RESPONSE TO NATIONAL INFRASTRUCTURE ASSESSMENT CALL FOR EVIDENCE

The Anaerobic Digestion and Bioresources Association (ADBA) is the trade association that represents the range of interests and matters related to the anaerobic digestion of organic materials (AD) across the UK, including the collection of waste for use as feedstock. ADBA understands the complex range of skills required by developers of new AD plants, from feedstock management through technology to energy production, markets and resource to land.

The organisation has over 400 members from across the AD industry, including plant operators and developers, farmers, local authorities, waste management companies, supermarkets, food processors, energy and water companies, equipment manufacturers and suppliers, consultants, financiers and supporting service companies. Anaerobic digestion can make a significant contribution to renewable energy, climate change, and critical resource preservation targets, and many of the UN Sustainable Development Goals, subject to the right policies being in place.

Why should the government invest in AD?

Following strong growth in recent years the UK's AD sector now has a capacity of almost 750MW electrical-equivalent. This is more than double the capacity of the Uskmouth coal plant – enough power for 850,000 homes.

AD produces biogas which can be used to generate baseload electricity or green gas 24 hours a day. AD offers an excellent return on the government's investment. This return includes:

1. Energy security from domestic green electricity or gas

Biogas is good for UK energy security. It is generated in the UK and supplies are constant and reliable. AD is already delivering significant amounts of home-grown green electricity and gas now and has the potential to deliver around 30% of domestic electricity or gas demand, while also reducing imports, curbing carbon emissions and improving the UK's Balance of Payments.

2. Cost-effective carbon abatement

Supporting AD could reduce the UK's carbon emissions by 4%. Our calculations suggest that continuing to support the technology would reduce government expenditure by £755m from 2017 to 2040 in GHG abatement, compared to the average renewable heat technology.

3. Economic productivity and global competitiveness

A sector already employing 3,500 people, with the potential to employ over 30,000 more, many in rural areas and manufacturing jobs, is worth protecting. A thriving UK sector can export to the world – the global AD market is worth £1 trillion. Exporting UK good practice in energy generation, agricultural and sewage waste treatment can deliver growth to British businesses whilst also supporting at least nine of the UN's Sustainable Development Goals.

4. Strengthening the Rural Economy

Recycling digestate also improves Britain's soils, the poor quality of which is costing the UK £1.4bn a year according to a recent Parliamentary Office of Science and Technology estimate. Integrated into farming, AD also helps stabilise farming businesses, improving their ability to withstand fluctuations in global commodity markets.

5. Meeting recycling targets

The government will not be able to meet its recycling targets without separate food waste collections, which will require more food waste AD capacity to treat and recycle the resulting separated food waste.

Cross-cutting issues

Question 1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

We have identified three essential infrastructure investments to support sustainable growth throughout the UK. We set these out below.

Building 200 new anaerobic plants, supported by mandatory separate food waste collection services

We urge the NIC to recommend to government an infrastructure investment in **200 new anaerobic plants, supported by separate food waste collection services**. Throughout the UK there are around 100 AD plants processing around 2 million tonnes of food waste from households and businesses each year. Constructing 200 new facilities would triple the current energy generation from food waste processed by anaerobic digestion to 9TWh of green gas per year – enough baseload energy to power around 800,000 homes. This ambitious infrastructure investment would transform the UK from its linear economy to a circular economy and provide what Defra has called the "best environmental option"[1] for the UK's inedible food waste. As sending a tonne of food waste to AD instead of landfill saves 500kgCO_2, if the entirety of this resource was sent to AD each year around 3.85 million tonnes of CO_2e would be saved.[2]

AD is the natural breakdown of organic material such as municipal solid waste, farm wastes, purpose-grown crops and sewage sludge in the absence of oxygen. Biogas (approximately 60% methane and 40% carbon dioxide) can be used for electricity and heat, or it can be upgraded to biomethane – almost pure methane – by removing the impurities and the renewable CO_2, which can itself be used commercially. Biomethane can then be used locally to fuel vehicles or injected into the gas grid for use as a transport fuel elsewhere.

AD currently produces approximately 9TWh of biogas in the UK. 2.6TWh of this is used for biomethane production, while 6.3TWh is used to produce 2.5TWh of electricity as baseload generation. Biomethane from AD provides home-grown energy and supplies are constant and reliable. Biomethane can be used as a transport fuel, helping government achieve its renewable energy transport target of 10% by 2020, or it can be used via the gas grid to heat homes, reduce carbon emissions in line with UK Carbon Budgets to 2050 and meet international agreements on climate change mitigation. With the UK currently importing two thirds of its natural gas supply, growing the total capacity of biomethane generated through the AD process would help reduce imports, in turn reducing the UK's trade deficit, and strengthening the UK economy.

AD is cheaper than hydrogen and requires no change for consumers

AD provides heat when biogas generated from food and agricultural wastes, slurries and residues is used to fuel a Combined Heat and Power (CHP) engine, or if the gas is upgraded to biomethane, via the gas grid. AD is a baseload generator and can deliver a constant supply of heat.

The AD industry already has the capacity to generate almost half of the UK's renewable heat output, largely thanks to Renewable Heat Incentive (RHI) support for biomethane for grid injection. Biomethane produced from AD replaces natural gas in our heating supplies with no need for consumers to change technology or behaviour.

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/406928/pb14019-anaerobic-digestion-annual-report-2013-14.pdf 1.

[2] https://documents.theccc.org.uk/wp-content/uploads/2015/11/Committee-on-Climate-Change-Fifth-Carbon-Budget-Report.pdf

With more than 500 plants in operation this already presents the potential for millions of people to use renewable heat generated through AD.

KPMG has estimated that using green gas and existing infrastructure is 2-3 times cheaper than other scenarios for delivering heat such as hydrogen.[3]

- The Energy and Climate Change Committee identified "biomethane as critical to the 2020 [12% heat sub-target]."[4]
- Policy Exchange encourages expansion in biomethane for grid injection, noting that biomethane "goes with the grain of consumer preferences and minimises costs to the consumer."[5]

It is for these reasons that the Committee on Climate Change recognises increasing the volume of biomethane injection into the gas grid as a "low-regret opportunity".[6]

With the right policies in place to support research and development of new feedstocks we estimate that by 2030 the AD industry could generate around 35TWh by 2020-25 and around 80TWh by 2030-35.[7] This could provide **30% of the UK domestic gas demand**.

Supporting local, low-carbon heat networks

AD is a baseload generator and can deliver a constant supply of heat, making it the perfect energy source for heat networks. Heating buildings and homes using electricity is incredibly inefficient. Using heat produced by AD plants reduces energy consumption and increases efficiency, therefore providing a higher return on investment. AD plants are distributed throughout the UK and operate on a local level - with government infrastructure support they could supply heat for district heating systems.

The generation of heat from AD plants may be supported by the RHI for the fossil fuel natural gas that is displaced and there are significant opportunities to build on this by integrating heat networks with both existing and new sites. However, the RHI does not provide support for network infrastructure to deliver heat to the end user and the cost of infrastructure to deliver low-carbon heat has proved prohibitively high for the vast majority of AD plants. We estimate that 3.8TWhth is co-generated from existing AD plants and that the majority of this heat is vented.

Refuelling infrastructure for biomethane biofuel

Over the short to mid-term time frame biomethane presents the only practical means of decarbonising heavy goods vehicles (HGVs), buses and non-road mobile machinery. Over the last five years GHG emissions from HGVs have been rising – HGVs represent 21% of overall transport emissions, so large gains can be made with relatively small effort: biomethane as a transport fuel will be crucial to decarbonise this most polluting of sectors.[8]

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[3] http://www.energynetworks.org/assets/files/gas/futures/KPMG%20Future%20of%20Gas%20Main%20report%20plus%20appendices%20FINAL.pdf 7.

[4] http://www.publications.parliament.uk/pa/cm201617/cmselect/cmenergy/173/173.pdf 3.

[5] http://www.policyexchange.org.uk/images/publications/too%20hot%20to%20handle%20-%20sept%2016.pdf 10-11.

[6] https://www.theccc.org.uk/wp-content/uploads/2016/10/Next-steps-for-UK-heat-policy-Committee-on-Climate-Change-October-2016.pdf 7.

[7] Our projections are discussed further in our response to question 4, below.

[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/567900/env0201.ods

Crucial to realising this goal and decarbonising the HGV sector is the development of a robust and integrated refuelling network. NIC should recommend government support for investment in a refuelling network to give commercial freight operators the confidence to operate biomethane-fuelled HGVs across all routes. We discuss the benefits of transport further in our response to questions 13 and 14, below.

Question 2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

The UK is a world leader in biogas – especially sewage treatment, food waste and on farm AD - with UK companies already exporting over £100m-worth of biogas-related expertise and equipment per year. Infrastructure investment in AD could put the UK at the heart of the growing, global biogas industry, now estimated to be worth £1 trillion. With the right support from government, DIT and the Commonwealth Secretariat, and with investment in our proposed Centre for Anaerobic Biotechnology and Bioresources Research (CABB) – building on the UK's excellent academic expertise in this area - the UK AD sector could grow to export to the international market at least £5bn per year, sustain around 60,000 UK jobs, while also making a significant contribution to achieving the UN's Sustainable Development Goals (SDGs).[9]

The AD industry has already transformed the UK energy sector, with commissioned plants currently delivering 708MWe-equivalent of renewable, indigenous power to UK homes and business – an increase of over 350% from where the industry was just ten years ago. There is significant potential for the AD industry to continue this economic growth with a pipeline of around 400 projects with planning permission. In our CABB proposal ADBA, along with the Universities of Oxford, Southampton, Reading, Newcastle and Cranfield, Imperial College and the Royal Botanic Gardens at Kew, call for an investment of £50 million over 5-7 years to develop a 'virtual' centre, with the core administrative function of distributing funds to the UK's existing world-leading research bases. Investment in research, development and commercialisation will ensure the UK can maintain its international competitiveness.

Question 3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

New cities around the world have taken advantage of advancing technology to embrace sustainability and ensure waste management, recycling and energy production are key aspects of their planning. Masdar City in Abu Dhabi, PlanIT Valley in Portugal and Tianjin Eco-city are ambitious examples, with the latter a low-carbon project the size of Manhattan that would provide sustainable living and working for 350,000 people. Around the world there are around 50 million anaerobic digesters, with this number growing 20-30% each year – cities of the future will look to AD for the end-to-end solution it provides.[10] In the future city:

- All organic waste can be sent to AD – removing the need for landfill;
- AD provides biogas which can be used to produce baseload electricity or green gas for HGVs or heating 24 hours a day – replacing fossil fuels with renewable energy;
- Digestate, a co-product of the AD process, improves soil quality, crop yields, the availability of nutrients and organic matter – this can be used instead of the expensive, carbon-intensive alternatives.
- AD will provide a waste management solution for sewage – it is already used by the majority of treatment facilities across the UK.[11]

[9] We discuss CABB in further detail in our responses to question 6, below. AD is contributing to at least nine of the 17 SDGs agreed by the countries of the United Nations to be achieved by 2030, http://www.worldbiogasassociation.org/wba-publications/

[10] Nathan Curry and Pragasen Pillay, 'Biogas prediction and design of a food waste to energy system for the urban environment' (2012) 41 Renewable Energy 200. Available at: http://www.sciencedirect.com/science/article/pii/S0960148111005957

[11] Ofwat reports AD treatment for 80% of UK sewage sludge. https://www.ofwat.gov.uk/wp-content/uploads/2015/12/pap_tec20150525w2020app2.pdf 3.

NIC should recommend to government the development of a clear and long-term waste strategy to ensure that all cities, towns and rural communities share in the benefits that AD delivers.

Question 4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

AD is inherently flexible and provides a low-carbon answer to 'rebound effects' of demand management and smart pricing – and AD does this without any behavioural change on the part of the end energy consumer or new technology in the home.

AD can provide **baseload or dispatchable electricity**. Plants may be operated so as to enter into a pulse mode to dispatch electricity when demand is high. In Germany, where there is extensive biogas infrastructure, this dynamic application arose following the amendment of their renewable energy regulations to introduce a 'flexibility tariff' for dispatchable electricity generation. Generation of this sort is further supported by priority connection rights to feed into the grid.[12] IEA Task 37 on biogas has undertaken significant research into the potential role of biogas in smart and flexible energy grids.[13]

AD can also provide **dispatchable energy and Demand Side Response**. With appropriate market incentives AD plants are able to alter electrical generation supply to meet consumer demand for both household and industry.

Biomethanation is the biorefining of excess electricity into methane using electrolysis. With renewable sources gaining market share in UK electricity composition, an increase is expected in grid imbalance due to the dispatchable nature of a large proportion of renewable energy.[14] Although AD plants are able to modulate their output to match supply and demand, other renewable plants that cannot, such as wind and solar, are forced to flare and waste their generation. Biomethanation mitigates this unsustainable practice and makes available vast quantities of renewable electricity, which will help UK infrastructure overcome possible rebound effects of demand management. Biomethanation delivers several important co-benefits:

- Uses an inexpensive and robust biological catalyst able to convert without inhibition from gaseous contaminants and at a fast rate;
- Energy conversion efficiency from electricity to green gas is currently approximately 80%;
- Allows future renewable energy sites (wind, PV, marine) to be installed without the requirement for capacity in the electricity network avoiding network restrictions and energy lost through curtailment;
- Allows flexibility in renewable energy use i.e. electricity, heat and transport fuel;
- Existing gas infrastructure is available to immediately accommodate the additional natural gas – this can be easily distributed throughout the UK; and,
- The biorefining requires a physically small infrastructure allowing uptake by the majority of existing energy generation sites.

Further R&D is necessary to bring lab-scale biomethanation technology to full-scale implementation. To this end the University of South Wales is working with industrial partners to develop a pilot-scale demonstration plant at a live industrial facility.[15]

[12] E.g. An operator of an AD plant with an installed capacity of 500kW is permitted to increase the capacity of its plant by 50% to 750kW. For the additional 250kW capacity the operator receives the additional flexibility rate. The flexibility rate is guaranteed for ten years.

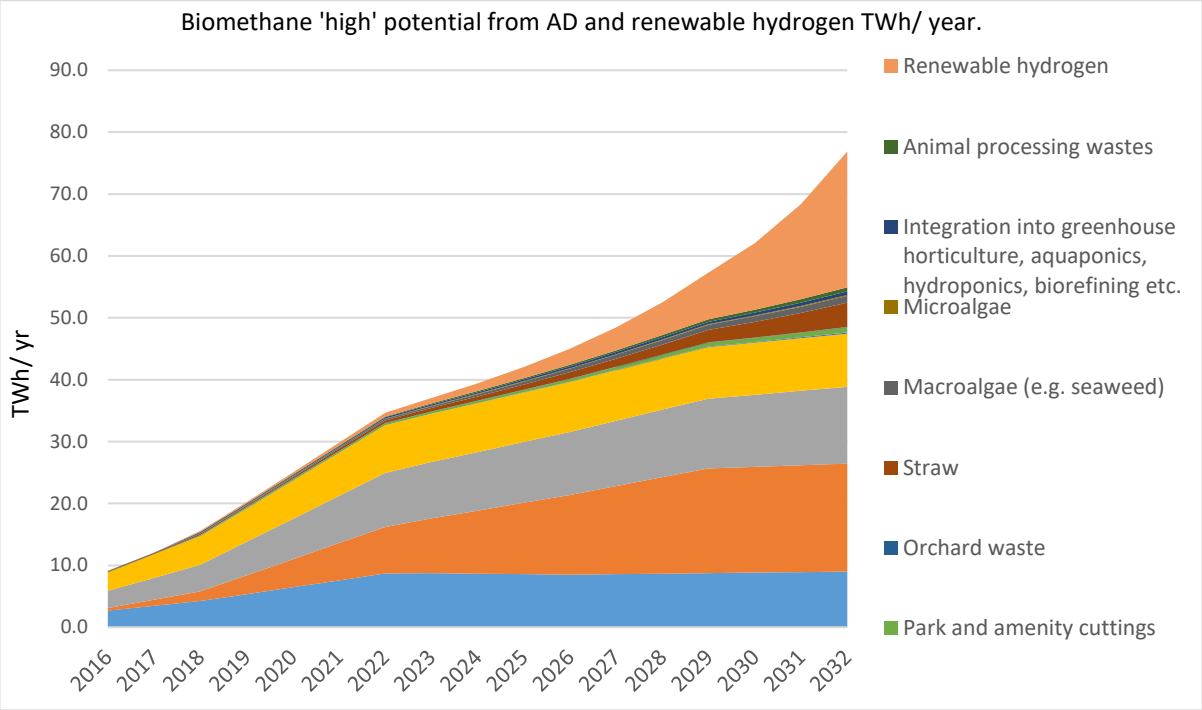
[13] http://www.iea-biogas.net/files/daten-redaktion/download/Technical%20Brochures/Smart_Grids_Final_web.pdf

[14] https://www.ofgem.gov.uk/publications-and-updates/ofgem-announces-%C2%A317-billion-new-investment-package-and-reduces-pressure-customer-bills

[15] http://www.wales.com/sites/default/files/page/files/aw78.pdf 23.

Energy potential from AD

AD can deliver around 30% of either UK domestic gas or electricity demand, helping the UK achieve energy security. As discussed in our response to question 1, with the right government support the AD industry could generate 80TWh by 2030, as the below graphs shows.



Evidence from Germany and the UK suggests that an all-renewable electricity supply 24/7, 52 weeks of the year, is achievable with around 80% of solar and wind power as long as it is backed up by between 15-20% of flexible bio-electric power.[16] The AD bio-electrical energy requirement is around 25%, comfortably below the currently projected 30% limit. This, the most secure of electricity scenarios, could have been achieved in the UK by 2025 had it not been for the drastic cuts to onshore wind, solar and AD subsidies.[17]

Question 5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

Support for AD as a means of decarbonising gas and heating throughout the UK would remove the need for constructing new grid infrastructure assets. Compared to other 2050 energy scenarios such as replacing the entire gas grid with electricity, evolution of gas poses the fewest infrastructure obstacles and the lowest incremental costs to the consumer.[18]

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[16] Daniel Nugent and Benjamin K. Sovacool '*Assessing the lifecycle greenhouse gas emissions from solar PV and wind energy: a critical meta-survey*' (20141) 65 Energy Policy 229. Available at: http://www.sciencedirect.com/science/article/pii/S0960148111005957

[17] ibid.

[18] http://www.energynetworks.org/assets/files/gas/futures/KPMG%20Future%20of%20Gas%20Main%20report%20plus%20appendices%20FINAL.pdf 7.

As discussed in our response to question 1, the AD industry already has the capacity to generate almost half of the UK's renewable heat output, largely thanks to government support for biomethane for grid injection. Biomethane produced from AD replaces natural gas in our heating supplies, meaning heat supplies are decarbonised without the need for consumers to change technology or behaviour. As KPMG's '2050 Energy Scenarios' report states, "customer preferences for how they want their heat is key"[19] and "getting people to make changes is one of the most difficult things to do. Changes to heating appliances [necessary if the grid contains a significant proportion of hydrogen] will inevitably result in a certain level of disruption to homes and businesses."[20]

Question 6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

As discussed in our response to question 2, above, investment in the proposed **Centre for Anaerobic Biotechnology and Bioresources Research (CABB)**, which is widely supported by academia and industry, would deliver the necessary step change required in the capability of the AD industry to deliver green energy at lower cost than coal and at a scale bigger than nuclear – potentially reducing global greenhouse gas emissions by 20%.[21] Facilitating competition and collaboration, CABB would oversee the development of new feedstocks, technological advancements and ensure these innovations achieve commercialisation. The objective of the proposed CABB would be to transform AD, which is currently often perceived solely as a waste-treatment technology, into a low-cost, multi-functional biotechnology. It would make AD a key ingredient in developing integrated processes to deliver future energy and resource provision. It would achieve this by bringing together and coordinating the research input of often disparate groups, to ensure the interdisciplinarity needed to rapidly achieve the full potential of anaerobic biotechnology.

CABB would facilitate a coordinated and cost-effective approach to taking new ideas and concepts and moving them through the technology readiness levels (TRLs) to demonstration and final implementation. It would work closely with government agencies such as Innovate UK and with trade associations to engage industrial participation at an early stage and would identify collaborative research opportunities to remove barriers to societal acceptance in both UK and overseas markets. Importantly, the Centre would aim to bring together the research teams that can rapidly progress core ideas through parallel rather than sequential research, thus 'fast-tracking' innovation to commercial reality. The Centre would thus play a key role in mapping pathways to successful translation of research to industry, dissemination of research findings, protecting intellectual property, and networking.

The research support by CABB would also aid the development of AD plant construction from job to flow production – ultimately delivering AD's low-carbon, waste-reducing energy infrastructure more quickly and cheaply.

[19] ibid 25.
[20] ibid.
[21] The potential for biogas generation, including from CAM crops, is 5.5 PWhe, and coal generation is 9.1 PWhe (i.e. 60% of coal) http://pubs.rsc.org/EN/content/articlelanding/2015/ee/c5ee00242g#!divAbstract. These figures are taken from the World Biogas Association's report on the 'Contribution of Anaerobic Digestion and Biogas towards achieving the UN Sustainable Development Goals' available at http://www.worldbiogasassociation.org/wba-publications/ . Fossil-fuel combustion for energy accounts for 68% of total greenhouse gas emissions. Coal is 45% of the fossil-fuel combustion for energy. So coal is over 30% of emissions given that coal has higher emissions per unit of energy produced than fuels such as natural gas. If biogas displaced 60% of coal emissions, it would reduce global emissions by 18%. Biogas also reduces methane emissions from waste and manure management.
https://www.iea.org/publications/freepublications/publication/CO2EmissionsFromFuelCombustionHighlights2015.pdf

Question 7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

There are a number of simple policy measures that could improve energy efficiency. While some incineration plants have the capability to capture some of the energy in food waste and composting is able to recycle the essential nutrients and organic matter back to our soils, only AD realises both of these benefits – maximising the value recovered from the resource.

AD is 60% more efficient than incineration and so to improve efficiency, clarity on the waste hierarchy should be provided – **all inedible organic waste should be sent to AD**.

Renewable financial incentives can also be revised to allow for efficient use of available resources in existing AD plants. Below we set out two instances where policy is preventing such efficiency:

- Under the Feed-in Tariff extending capacity for electrical generation is currently prohibited. There are a number of legitimate reasons to expand an operating AD plant. For example, it may be easier for some developers to create a smaller plant and add capacity once this is running and they have access to further finance. Operators also face risks in guaranteeing feedstock availability–once a plant is commissioned developers may decide to expand as once they have reduced these risks and demonstrated stable, profitable operation.
- Under the RHI, biogas CHP plants that commissioned before 5 December 2013 are not able to claim support for the renewable heat they generate. The RHI supports generation but does not provide support for network infrastructure to deliver heat to the end user and the cost of infrastructure to deliver low-carbon heat to end users has proved prohibitively high for the vast majority of AD plants. We estimate the number of AD plants currently generating heat and not making full use of it to be 130-160. The wasted thermal capacity of these plants is in the region of 135MWth, which if captured and used could abate 170,000 tonnes of carbon per year.

We urge NIC to recommend to government measures to address these inefficient policies. ADBA would be happy to work with government in designing carbon-cost-effective ways of addressing these issues, for example by creating a separate lower tariff or delaying the ability to extend after commissioning.

Question 8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

The rate of return developers and financiers seek to achieve for a given investment depends on the risk of policy change associated with that investment. Where that risk is perceived as being higher, the returns sought will also be higher. Degressing tariffs across all financial incentives that support AD also mean that at the point at which a developer commences a project, they have little certainty about what the eventual income stream may be when they reach pre-accreditation and commissioning.

AD plant developers are being left with few options for electricity generation with the closure of the Renewable Obligation (RO) to new applicants from 31 March 2017 and the Feed-in Tariff (FIT) so heavily constrained that it is not expected to receive new applications from 2018.

The situation with biomethane projects is more positive following the recent tariff reset under the RHI. The release of the government's intentions for the scheme going forward brought a degree of certainty to the AD industry, with many projects having been on hold for a year during the RHI consultation and awaiting this crucial decision. Although biogas heat tariffs have also received a reset in light of tariffs having fallen too low to stimulate new deployment, they are also reliant on electricity support which is low and awaiting further government decision.

Government interventions to improve financing

While we urge government to address the above concerns we have in relation to the FIT and the RHI, it is also important that measures are taken to address feedstock issues.

Government intervention on inedible food waste is necessary, which is why we have recommended infrastructure investment in **200 new anaerobic plants, supported by separate food waste collection services**. Generating biogas from AD depends on feedstocks such as food waste. Both existing and new plants rely on good availability of feedstocks in order to secure their future. National and local government policy plays a highly significant role in determining availability, possible contaminants and accurate collection and segregation: where councils are encouraged to offer dedicated food waste collection schemes, more feedstock is available for AD plants.

AD food waste capacity has grown dramatically in recent years, and is still growing. However, the rate of increase in the supply of food waste, especially in England, has not matched this increase, causing gate fees to tumble. Lower gate fees and throughputs mean any developer planning an AD project would need to have higher expected energy income to reach the same target internal rate of return, which therefore increases the necessary subsidy in the Department for Business, Energy and Industrial Strategy (BEIS)'s levelised cost calculations and translates to a higher forecast strike price.

Furthermore, when developers and financiers review AD projects, they review the landscape for food waste availability and whether any project is likely to have throughputs close to capacity, and whether this is likely to be achieved with high or low gate fees. Uncertainty and government inaction over food waste supply would therefore either reduce the likelihood of the project going ahead, or increase the 'hurdle rate' at which the financiers would invest in the project.

In total, food waste from households and from the manufacturing process and supply chain in England amounts to 12.5 million tonnes – equivalent to filling 25,000 Olympic-sized swimming pools.[22] Using all inedible food waste suitable for AD could produce 9TWh. If central government strategy set out an intention for all businesses producing food waste and all local authorities to send their inedible food waste to AD, as is the case in the devolved administrations, funders would step up to provide finance.

The Green Investment Bank (GIB) would provide a suitable institution through which to support and allocate funding for the 200 new AD plants that we propose. To this end, we are concerned over government plans to sell off the GIB as, under private hands, this fund would not have safeguarded support for renewable energy initiatives and such projects – which are critical to UK objectives – could be lost if other options prove more lucrative.

Question 9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

As discussed in our response to question 4, above, the inherent flexibility of AD provides resilience to the energy sector, enabling baseload or dispatchable power as required, as well as offering the prospect of biomethanation to support the gas grid of tomorrow.

An additional means of introducing resilience to the energy sector would be to revise Contracts for Difference (CfDs) so that AD projects sub 5MW are eligible. When the CfDs were designed, other support existed for sub 5MW - this is no longer the case with the RO completely closing to new capacity in March and the FIT heavily constrained. Removing the 5MW requirement would allow a greater number of plants to apply to the scheme, especially if a simplified application process were designed, and as a consequence more slurry, manure and food waste emissions

[22] http://www.wrap.org.uk/sites/files/wrap/UK%20Estimates%20October%2015%20(FINAL)_0.pdf 9.

could be processed. As it stands we envisage only a few AD plants greater than 5MW coming forward and applying to the scheme, but a greater number of plants would look to apply if the capacity restriction was removed or lowered.

AD can achieve negative carbon emissions, generating electricity from feedstocks such as manure or slurry that would otherwise emit methane. AD offers a simple, cheap option to ensure security of electricity supply during winter peak demand periods – with supportive policy we expect growth in the AD sector and around 250MW of new capacity by 2018. This constitutes approximately 10% of the 2.5GWe winter 2018 capacity margins in most projection scenarios.[23]

Question 10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

In the 2012 Anaerobic Digestion Strategy and Action Plan[24], government set out its intentions for planning and infrastructure support. Working closely with industry we call on the NIC to recommend to government a new strategy and action plan be agreed upon. This should recognise progress to date and set the UK on course to achieving the potential of the AD industry.

The 2012 AD Strategy and Action Plan sought to reform the planning system "to ensure that the sustainable development needed to support economic growth is able to proceed as easily as possible. This embraces a range of measures which should make it easier to obtain planning permission for appropriately sited AD plants." Reforms have not been sufficient and planning continues to delay projects or prevent them altogether.

To support on-farm AD in particular, restrictions to permitted development (PD) rights should be removed as they inhibit rural productivity and prevent farmers from diversification. The statutory regulations that restrict PD rights that are most pertinent to AD applications are the 465m^2 maximum development size[25] and the prohibition on storing fuel for or waste from a biomass boiler or an anaerobic digestion system not produced on the agricultural unit.[26] Clear guidance for local planning officers on how to interpret and apply PD rights remains remiss, despite it being one of the intended outcomes of the AD Strategy and Action Plan.[27] We encourage reform of planning and for these restrictions to be addressed.

Question 11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

The non-energy benefits of AD are numerous but as of yet they have not been linked to financial support mechanisms – support has only been provided for energy generated. We believe it is time for all the benefits of AD to be recognised, in particular its environmental benefits:

- Reducing emissions from rotting manure and farm wastes and slurries – abating significant amounts of carbon which helps mitigate the impacts of climate change;
- Recycling nutrients and organic matter back to soil to support food production and farmers through diversification;

[23] https://www.ofgem.gov.uk/sites/default/files/docs/2014/06/electricity_capacity_assessment_2014_-_full_report_final_for_publication.pdf
[24] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69400/anaerobic-digestion-strat-action-plan.pdf
[25] http://www.legislation.gov.uk/uksi/2015/596/schedule/2/made Part 6, A.1 (e)(ii).
[26] http://www.legislation.gov.uk/uksi/2015/596/schedule/2/made Part 6, A.1 (k).
[27] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69400/anaerobic-digestion-strat-action-plan.pdf 33.

- Strengthening the rural economy by creating jobs, with the industry currently employing 3,500 people and having the potential to employ a further 30,000 throughout the UK;
- Providing baseload, indigenous energy to improve UK energy security; and,
- Developing low-carbon technology and expertise to export to global markets
- AD also provides the best waste-management solution for food waste and sewage, and is used at the majority of waste-treatment facilities across the UK.[28]

Research and innovation undertaken throughout the AD industry has enabled novel feedstocks to be processed through AD. In the near future AD plants will be making genuinely advanced use of failed agricultural and horticultural crops and other low-input, high-diversity biomass. Innovations include:

- The Royal Society for the Protection of Birds (RSPB) study on use of wetland biomass for AD. According to the RSPB, unmanaged reed bed, wet grassland, fen, lowland heathland, upland heath and grassland provide a sustainable supply of bioenergy feedstock, and can have a positive impact on biodiversity; and,
- The Centre for Process Innovation (CPI) is conducting research into the financial viability and practicalities of using seaweed as a feedstock for biomethane generation from AD.
- Peakhill Associates is undertaking a study into the sustainability of Low-Impact High-Diversity road verge biomass as feedstock for use in AD plants. The study focuses on the Lincolnshire Local Highways Authority, which contracts for the mowing of 13,135km (1,445ha) of road verge, with all grass residue currently being left on site. In trials of verge harvesting undertaken by Montgomeryshire Wildlife Trust, average dry matter content was 29%, giving a total harvest fresh weight of 1,303kg/km – valuable feedstock that could be used to generate biomethane for use in transport.
- ADBA members Future Biogas and Rika Biogas Technologies are trialling pre-treatments for straw to enable it to be used as feedstock. Lignified biomass such as straw is widely available in certain parts of the UK and far more affordable than other feedstocks. However, in many parts of the country where slurry and manure is available, straw is not plentiful and therefore may not be a suitable feedstock to import due to increasing carbon miles. Use of this technology could improve plant sustainability as a fresh tonne of wheat straw can provide up to 2.7 times as much energy as a tonne of maize silage. Additionally, the digestate co-product is almost fibre-free, abating the nitrogen-intense composting of straw in its orthodox uses.

Question 12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

We have recommended an infrastructure investment in **200 new anaerobic plants, supported by separate food waste collection services**. The accompanying cost-benefit analysis into the energy and environmental benefits of this proposal should take into account all the associated wider economic, environmental and social benefits and put an appropriate value on them, including:

- Food waste reduction;
- Abatement of GHG emissions;
- Recycling of nutrients and organic matter/benefit to UK soils; and,
- Waste treatment of sewage.

[28] Ofwat reports AD treatment for 80% of UK sewage sludge. https://www.ofwat.gov.uk/wp-content/uploads/2015/12/pap_tec20150525w2020app2.pdf 3.

The economic damage caused by each tonne of carbon dioxide emitted to the atmosphere has been estimated at £70 per tonne of carbon dioxide-equivalent.[29] Recognition of this value will ensure that alternatives to using fossil fuels can be priced appropriately. Green Book guidance insists that such policy decisions consider environmental protection and climate change, with section 5.12 stating that these metrics may "often be more difficult to assess but are often important and should not be ignored simply because they cannot easily be costed" and section 5.23 stating, "indirect costs, such as environmental costs, need to be included in an appraisal".[30] Regrettably, the Green Book's "binding guidance" is not implemented satisfactorily, despite the obligatory wording of the document and its clauses, describing "how the economic, financial, social and environmental assessments of a policy, programme or project *should* be combined" in decision making.[31]

In addition to the non-energy benefits we have discussed in our response to question 11, above, we encourage stronger adherence to the Green Book to ensure due consideration is given to the carbon price and other long-term environmental impacts of fossil fuels that if taken into consideration would reveal AD to be a cost-effective option for the UK.

Transport

Question 13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

With GHG emissions from HGVs rising in recent years there are large gains to be made with relatively small effort and as a low-carbon fuel, biomethane will be crucial to decarbonise this most polluting of sectors.[32] The consensus of the industry is that by around 2025 under the right conditions (resolving vehicle availability, government support to buttress the customer business case, and biomethane supply) gas engines could account for 25-50% of the HGV vehicle market.

Question 14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

We believe it is vital that beyond transport access in and out of urban areas, other concerns such as emissions and air quality are also taken into consideration. As a transport fuel biomethane offers high GHG emissions savings compared to diesel and for this reason government should support measures to stimulate this growing market.

In addition to its GHG emissions credentials biomethane also delivers the following advantages over other fuels:

- Improved air quality from lower NO_x emissions and PM compared to Euro 5/V vehicles;
- Use of biomethane generated through the AD process reduces imports of fossil fuels whilst providing British jobs and strengthening the UK economy; and,
- Biomethane-fuelled vehicles are quieter, which could allow for night-time deliveries that are not disruptive, thereby helping to reduce congestion on Britain's roads.

29 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/42639/consult_carbon_price_support_condoc.pdf

30 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf

31 ibid (emphasis added)

32 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/567900/env0201.ods

Question 15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

We recommend investment in gas-refuelling infrastructure to ensure that the growing market can reach its potential of 25-50% HGV market penetration by 2025. Whereas electric vehicle infrastructure has received £80 million worth of investment, gas infrastructure has yet to receive any new investment – and yet the CO_2 benefits and speed of realising these emissions reductions are huge.[33]

Currently there are Euro 6 compliant gas engines in the UK market being trialled by both Iveco and Scania. Volvo will be launching a Euro 6 vehicle in 2018, and Iveco and Scania are developing further model extensions. There are a significant number of freight companies that are looking to invest in gas engines and in particular awaiting the range extensions expected in 2018 (to 6x2 axle units which represent 90% of the vehicle park in the UK). As these engines are all dedicated gas engines, there is also a requirement to develop a robust and integrated refuelling network, which does not exist today. Investment in a refuelling network would give commercial operators the confidence to invest in and, in turn, operate biomethane HGVs across all routes.

For buses, there is a steadily growing interest and uptake in low-carbon-emission buses, particularly biomethane-fuelled options. A number of policies have encouraged this uptake in England, implemented through the Bus Service Operators Grant (BSOG). This policy incentivises improvements in fleet fuel efficiency and provides a level playing field for low-carbon-emission buses. Buses are tested for their low-carbon credentials and certified accordingly. Additionally, the Low Carbon Emission Bus (BSOG LCEB) incentive offers bus operators an additional payment of six pence for each kilometre they operate with low-carbon buses. For HGVs and other vehicle types where this structured support is not available it remains a challenging environment for fleet operators that wish to increase their use of renewable and low-carbon fuels, hence the need for government investment in infrastructure.

Introducing such a scheme would send a signal to fleet operators that the UK is committed to decarbonising transport and increasing the volume of renewable fuels used in vehicles. If such signals are received fleet operators and funders would, in turn, be more willing to invest in refuelling infrastructure.

Question 16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

No comment.

Energy

Question 19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

ADBA modelling and analysis undertaken for the RHI 2016 consultation shows that AD can provide value for money below the average of the RHI payment for all technologies, per tonne of carbon abated. It is for this reason that the Committee on Climate Change, KPMG, Policy Exchange and the Energy and Select Committee have all urged further biomethane deployment, as we provided evidence to in our response to question 1, above. This is also why all four of National Grid's 'Future Energy Scenarios 2016' for 2040 presume significant growth in green gas.[34]

[33] https://www.gov.uk/government/news/government-pledges-290-million-boost-for-low-emission-vehicles
[34] National Grid 'Future Energy Scenarios 2016' 24.

AD applications to the CfD scheme present a number of ways of reducing emissions, helping improve the scheme's overall carbon cost-effectiveness. These include:

- Slurry and manure emissions abatement and avoided emissions used in the manufacture of chemical fertilisers. These emissions are significant – 9 million tonnes of CO_2e per year, which is around a third of UK agricultural emissions.[35]
- Sending unavoidable food waste to AD has a considerable environmental impact. If all 15 million tonnes of food waste arising in the UK were avoided, 21 million tonnes of CO_2e would be avoided each year.[36] Some of these emissions arise from the production, transportation and storage of food which is then wasted, but the vast proportion results from the decomposition of food at landfill sites, where methane is released.
- Use of crop feedstocks in AD plants also reduces on-farm emissions and generates energy in a cost-effective manner. ADBA analysis based on actual GHG emissions and calculated from the sustainability auditing of ADBA members with operational plants shows crop feedstock carbon-abatement costs of £200-£285 £/tCO_2e, making many crop feedstocks more cost-effective than other RHI-generating technologies.

AD achieves considerable carbon abatement–treating a tonne of waste through AD saves 500kg of CO_2e greenhouse gas emissions. Sending this waste to AD also reduces odours. **Each tonne of abated GHG emissions should be recognised, with the value recognised as being worth at least £70 per tonne of avoided CO_2e.**[37]

Question 20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

We encourage future energy scenarios to be balanced and make use of existing electricity and gas grids as this will ensure a zero-carbon power sector can be achieved with the cost to consumers remaining as low as possible. As has been discussed in our response to question 1, above, an evolution of the gas grid provides the cheapest incremental cost to consumers and has the fewest practical obstacles.[38] 2050 energy scenarios must take into consideration technological advancements that would decarbonise both grids, to which end biogas and biomethane must figure – **without AD a zero-carbon power sector cannot be achieved by 2050**.

AD from certain feedstocks can provide negative carbon emissions: GHG emissions are avoided by using organic wastes and residues in the biogas process and not letting those emissions reach the open air, which accounts for the negative emissions value presented below for wet manure.[39]

Comparison on GHG factors (gCO_2e/mj) from different AD feedstocks[40]

Municipal organic waste	Wet manure	Maize	Double cropping maize / barley
14.8	-69.9	40.8	26.8

35 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/496942/2014_Final_Emissions_Statistics_Release.pdf 12.

36 http://www.wrap.org.uk/sites/files/wrap/UK%20Estimates%20October%2015%20(FINAL)_0.pdf 15.

37 www.researchbriefings.files.parliament.uk/documents/SN05927/SN05927.pdf 9.

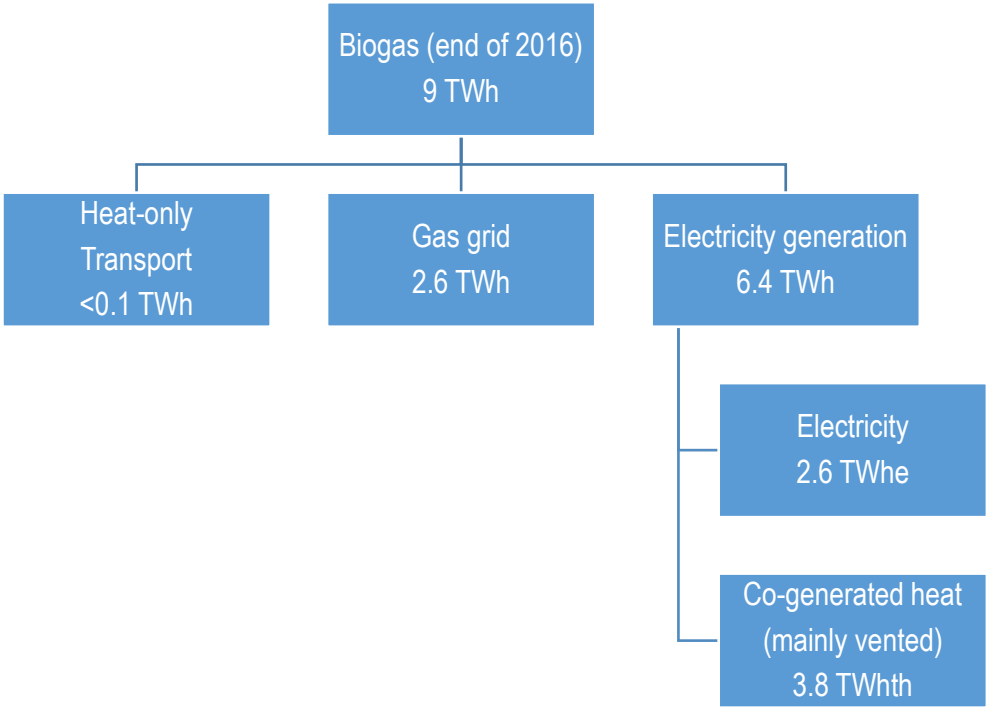
38 http://www.energynetworks.org/assets/files/gas/futures/KPMG%20Future%20of%20Gas%20Main%20report%20plus%20appendices%20FINAL.pdf 7.

39 http://iet.jrc.ec.europa.eu/about-jec/sites/iet.jrc.ec.europa.eu.about-jec/files/documents/wtw_report_v4a_march_2014_final.pdf 33.

40 http://iet.jrc.ec.europa.eu/sites/about-jec/files/documents/report_2013/wtt_v4_pathways_2-cbg_july_2013.xlsx

To meet the UK's 2050 target, emissions must reduce from 2015 levels by 100% in the electricity sector, 65% in the heat sector and 70% in the transport sector.[41] Of National Grid's four scenarios in the Future Energy Scenarios 2016 report only the 'Gone Green' scenario meets this target on time, and within that scenario full use is made of all feedstocks suitable for AD, which by our estimates could deliver 80TWh by 2030-35.[42]

As the below breakdown shows, current energy generation from AD predominantly goes to electricity generation – AD is unusual among renewables in that it can be used to generate electricity, heat or be used for transport purposes depending on government certainty and support and the business case.



Question 21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Biomethane as a transport fuel is the only practical means of decarbonising HGVs particularly in the short term and the NIC should join us in supporting measures to stimulate the HGV and light duty vehicle markets and increase their uptake. Importantly, biomethane produced from AD can be transported throughout the UK using the existing gas grid before it is then taken off the gird and compressed (to form bio-CNG) or liquefied (to form bio-LNG). In addition to the significant carbon savings, improved air quality and reduced noise that use of biomethane as a transport fuel delivers, a further advantage is that these benefits are achieved within existing infrastructure.

While we note that uptake of biomethane as a transport fuel could use the existing gas grid it remains important for government support for gas refuelling infrastructure to match that provided for electrification. Technology parity should be maintained: whereas electric vehicle infrastructure has received £80 million of investment, gas infrastructure has

[41] National Grid 'Future Energy Scenarios 2016' 136.
[42] See our response to question 4, above.

yet to receive any new investment – and yet the CO_2 benefits and speed of realising these emissions reductions are huge.[43]

We believe that when considering possible implications of low-carbon vehicles, the NIC and government should distinguish between different vehicles sectors and the appropriate transport fuels for each. While we support the introduction of electric vehicles, this technology would not be appropriate for HGVs and buses, even with the developments expected in battery storage by 2050 – this has been recognised by the Committee on Climate Change (CCC).[44] It is important that suitability in one vehicle sector is not interpreted as suitability across all sectors per se. Although the CCC recognise that "[l]arge, long-distance HGVs are not suitable for conventional electrification as they would require an excessively large battery for long-distance movement of goods", they note that Highways England is funding research into wireless power transfer for in-transit recharge, despite estimated infrastructure costs of around £5m per km of motorway.[45] Indeed the Energy and Climate Change Select Committee heard evidence on 7 June 2016 that "[electrification of] long distance freight trucks would be very difficult … biomethane trucks would be much more suitable".[46]

To date transport decarbonisation has underperformed when compared to the power sector, where savings and reductions are easier to achieve. Efforts to decarbonise the transport sector directly should be prioritised instead of relying on efforts made in the power sector i.e. low-carbon electricity generated for transport purposes. According to Energy UK's Pathways for the GB electricity sector to 2030, "the majority of carbon savings have been achieved in the power sector, and forecasts by DECC and the CCC estimate significant continued decarbonisation of the sector up to 2030."

Water and wastewater (drainage and sewerage)

Question 22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?
No comment.

Question 23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?
We encourage comprehensive cost-benefit analysis be undertaken into having all new sewerage piping and processing facilities able to handle both wastewater and food waste. AD already provides a waste-management solution to sewage and is used at more than 80% of waste-treatment facilities across the UK.[47] If households were able to dispose of food waste through AD, recycling rates would be expected to increase and maximum energy potential could be recovered.

[43] https://www.gov.uk/government/news/government-pledges-290-million-boost-for-low-emission-vehicles
[44] https://www.theccc.org.uk/wp-content/uploads/2015/11/Sectoral-scenarios-for-the-fifth-carbon-budget-Committee-on-Climate-Change.pdf 142.
[45] ibid.
[46] http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/energy-and-climate-change-committee/2020-renewable-heat-and-transport-targets/oral/34288.html
[47] Ofwat reports AD treatment for 80% of UK sewage sludge. https://www.ofwat.gov.uk/wp-content/uploads/2015/12/pap_tec20150525w2020app2.pdf 3.

ADBA is working with OfWat, the Environment Agency and Natural Resources Wales to explore better regulations for the co-digestion of sewage sludge and other organic wastes. In the US, co-digestion of food waste with wastewater sludge at wastewater treatment plants is driving up both methane yield and profitability for the early adopters. According to the American Biogas Council, some systems are reporting double the biogas yield from adding just 10% food waste, thus turning food waste from municipalities, restaurants, cafés, food processing facilities and agriculture from a liability into an asset.[48]

Question 24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?
No comment.

Solid waste

Question 27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

No they are not.

We support the development and introduction of measures across the entire waste hierarchy to tackle all aspects of food waste: waste should be minimised with edible food waste being redirected first for human consumption and second for animal consumption wherever possible, with all remaining and inedible waste being sent to AD.

Enforcement of the waste hierarchy is required and to support this we call for a revised government- and industry-designed AD strategy and action plan, along with **200 new anaerobic plants, supported by separate food waste collection services**. Such a strategy, long-term plan and explicit duty on the part of the Environment Agency would signal to industry that government support is firmly behind AD – investment in new AD facilities would naturally follow. Until this or a similar strategy and action plan are proposed funders are likely to remain concerned over falling tariffs and government uncertainty.

With supportive policy and recognition of the numerous benefits that AD delivers the industry could have continued to deploy at the rate seen in 2014, when around three times as many plants were commissioned than the year before. At that time, the industry received supportive tariffs and policy was relatively stable. Since then, tariffs on both the RHI and the FIT have halved, leading to a decline in applications for new plants: many of the current pipeline of around 400 AD projects with planning permission are now unlikely to proceed.

Falling financial incentives

AD delivers value for money for the tax-payer, with performance continually improving due to industry investment and opportunities to reduce costs being pursued from within the industry, including investment in R&D and the introduction of the ADBA Best Practice Scheme. AD is delivering home-grown green gas now and can continue to do so with government support. AD is on the path to becoming the most cost-effective form of low-carbon baseload power.

With government support, the industry could be on a trajectory to a cost of generating power of £100 per MWhe in 2020 and could have greater electrical capacity than Hinkley Point C, sooner and at less risk (without the creation of toxic waste).[49] When taking AD's carbon abatement contribution into account alongside the value derived from

[48] http://www.worldbiogasassociation.org/wba-publications/
[49] ADBA July 2016 Market Report.

baseload energy generation, AD offers exceptional value for money compared to renewable and non-renewable alternatives – and that's before assessing the technology's contribution to rural communities, food security and waste resource management.

Although AD is now an established technology, it still requires support to reach the industry's significant potential. However, supportive policy is no longer apparent and recent legislative proposals are eroding what support there is and at too quick a pace: there will soon be no electrical generation support for small-scale and sub-5MW AD:

- The Renewables Obligation closes to new applicants on 31 March 2017;
- The Feed-in Tariff is capped to just 5MW per quarter; and,
- Contracts for Difference exclude all sub-5MW AD plants.

Where there is support for AD, it is heavily constrained. The recent FIT consultation failed to address the restrictive 20MW annual deployment cap for AD, despite data from the Office of Budget Responsibility showing a reduction in spending predictions for environmental levies by 2020-21 of £0.9 billion, bringing into question the £100 million Levy Control Framework budget that determines FIT support.[50] Some of this saving has resulted from reform implemented following the 2015 FIT review but this significant reduction in spending is primarily due to the early closure of the Renewables Obligation and changes to Contracts for Difference and the Carbon Reduction Commitment.

Deployment of biogas heat under the RHI is inextricably linked to deployment of biogas power. With the RO closing in spring and with the FIT constrained and tariffs continuing to degress, the ambitions set out by government for biogas heat plants may be unrealistic.

Biomethane production is a clear success story for the RHI and we welcome the recent tariff reset that will lead to further investment in new capacity for green gas, though this may not be sufficient to reach the 20 biomethane plants per year (by 2021) as was originally proposed at time of consultation.[51]

Question 28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

The primary barrier to achieving a circular economy is weak enforcement of the waste hierarchy and glacial progress in England in introducing mandatory food waste collections.

Enforcement of the waste hierarchy

England must follow the lead of the devolved nations which adopt a circular economy approach whereby local authorities and businesses have a statutory duty to collect food waste and redirect it, ensuring its maximum economic and energy value can be extracted. Wales, Scotland and Northern Ireland have each implemented command and control regulation to ensure strict permissions, prohibitions, and enforcement of measures to reduce food waste. Such measures are in stark contrast to the system of voluntary initiatives pertaining in England where the primary tool to reduce food waste remains the financial driver that stems from the high level of the landfill tax – this is holding back growth in the AD sector where waste is a highly-prized resource, not something to be sent to landfill.

In Wales every household has a form of food waste collection, indeed 95% of Welsh households have food-waste-only collections. This was achieved through regulation, with local authorities now having a duty to prevent

[50] http://cdn.budgetresponsibility.org.uk/March2016EFO.pdf [4.74].

[51] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/505972/The_Renewable_Heat_Incentive_-_A_reformed_and_refocussed_scheme.pdf 17.

biodegradable municipal waste from ending up in landfill. In addition, communication resources were developed to inform the public on food waste arisings from households and from the food and drink sector. Such information communicated to the public that, "If we don't treat your food waste by collecting it from you, we are throwing away a valuable resource that can be made into a good quality soil improver or fertiliser and even generate electricity that can be fed back into the national grid."[52]

In Scotland and Northern Ireland three quarters of households have some form of food waste collection service as part of their respective programmes to reduce food waste, manage collections in the most cost-effective manner and ensure its resource value can be realised. This collection figure is growing rapidly in Scotland in particular as a result of the Zero Waste policy. Since 1 January 2016 it has been mandatory for food businesses producing more than 5kg per week of food waste in Scotland to separate out the waste for collection.[53] Businesses producing more than 50kg per week have been separating out their waste since 2014. At the start of the year it also became compulsory for local authorities in non-rural areas to collect separate food waste. As a result of the regulations, collection costs for waste controllers and accordingly for local authorities are reducing.[54] Northern Ireland has followed Scotland's successful scheme, with a 50kg mandatory food waste separation coming into effect from 1 April 2016.[55] These legislative changes are designed to reduce food waste throughout the supply chain and in households and should further commodify food waste.

The latest figures from WRAP show estimates for total and avoidable household food waste in the UK increased by 2.2% between 2012 and 2015, with the amount of avoidable food waste increasing by 2.8%.[56] AD food waste capacity has grown dramatically in recent years, but the supply of food waste, especially in England, has not matched this growth, causing gate fees to tumble. Lower gate fees and throughputs mean any developer planning an AD project would need to have higher expected energy income to reach the same target internal rate of return, which therefore increases the necessary subsidy in BEIS' levelised cost calculations and translates to a higher forecast strike price.

Furthermore, when developers and financiers review AD projects, they review the landscape for food waste availability and whether any project is likely to have throughputs close to capacity, and whether this is likely to be achieved with high or low gate fees. Uncertainty and government inaction over food waste supply would therefore either reduce the likelihood of the project going ahead, or increase the 'hurdle rate' at which the financiers would invest in the project.

The cost of food waste to households and businesses

The latest data from Defra shows that food waste from households in England amounted to 413 kg per person in [year], a 2.9% increase on the previous year.[57] This waste has a direct cost to each household of around £470 per year, or £700 per household with children.[58]

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[52] Recycle for Wales 'Food Waste' http://recycleforwales.org.uk/why-recycle/fascinating-facts/know-your-waste-more-facts/food-waste#.V6mgTPkrKUk
[53] The Waste (Scotland) Regulations 2012, ss2 (3) (b) 2F.
[54] Eunomia 'The Real Economic Benefit of Separate Biowaste Collections: A Business Case, http://www.r-e-a.net/resources/pdf/244/REA_Report_On_Separate_Biowaste_Collections_19-05-2016.pdf 10.
[55] The Food Waste Regulations (Northern Ireland) 2015, ss2 (3) (b) 2C, c, ii.
[56] http://www.wrap.org.uk/sites/files/wrap/Household_food_waste_in_the_UK_2015_Report.pdf 2.
[57] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/481771/Stats_Notice_Nov_2015.pdf 5.
[58] http://www.wrap.org.uk/sites/files/wrap/UK%20Estimates%20October%2015%20(FINAL)_0.pdf 9.

The cost also diverts local authority public spending from other areas.[59] Households pay for the costs of disposal through council tax. With a cost per tonne of £84.40 for any local authority to dispose of waste to landfill, collectively authorities in England are spending around £500 million to dispose of their household waste. Encouraging waste controllers to recycle food ensures that this weighty resource is extracted from general refuse collections, reducing the cost burden to local authorities and, in turn, rate payers. Further, the dry fractions of waste become more easily recyclable and have higher market value once the wet, contaminating food waste is eliminated from them.

As well as household food waste a considerable amount of waste results from the manufacturing sector and grocery supply chain. Food and drink wasted during the manufacturing process amounts to 3.3 Mt per year and products and ingredients wasted in England in the supply chain amount to 3.4 Mt. This costs businesses operating in England £2.6 billion a year: the labour cost to businesses constitutes close to £1 billion, and avoidable food-waste yield loss constitutes an average of 13.2% of labour costs across all hospitality and food service subsectors.[60]

The benefits of sending waste to AD

In addition to energy generation, as we have set out in our response to question 11, AD helps achieves several other government objectives including:

- Reducing emissions from rotting manure and farm wastes and slurries – abating significant amounts of carbon which helps mitigate the impacts of climate change;
- Recycling nutrients back to farmland to support food production and farmers through diversification;
- Strengthening the rural economy by creating jobs, with the industry currently employing 3,500 people and having the potential to employ a further 30,000 throughout the UK;
- Providing baseload, indigenous energy to improve UK energy security;
- Developing low-carbon technology and expertise to export to global markets; and,
- AD also provides a waste-management solution to sewage, and is used at the majority of waste-treatment facilities across the UK.

A co-product of the AD process is a biofertiliser called digestate, containing water, crop nutrients and organic carbon for soils. Digestate currently has a low or even negative commercial value but can replace artificial commercial fertilisers to provide crop nutrients, which would avoid 700,000 tonnes of GHG emissions per year.

Biofertiliser helps maintain pH and soil fertility and improves soil quality, crop yields and the availability of nutrients (principally nitrogen, potassium and phosphorus) whilst, significantly, also replacing the organic matter component. In this respect, growth in AD can lead to improved productivity in agriculture. Use of digestate and the development of digestate products for use in parks and gardens would also offer alternatives to the declining availability of peat fertilisers.

Peatlands function as important carbon sinks and as the Committee on Climate Change advocate in their UK Climate Change Risk Assessment 2017 report, "More action is needed to restore degraded carbon stores, particularly peatlands."[61] One such action that ADBA would support is the introduction of a ban on peat fertilisers throughout the UK with digestate providing a low-carbon, renewable alternative.

[59] http://www.wrap.org.uk/sites/files/wrap/hhfdw-2012-main.pdf.pdf 5. This is based on 2012 food prices.

[60] http://www.wrap.org.uk/sites/files/wrap/The%20True%20Cost%20of%20Food%20Waste%20within%20Hospitality%20and%20Food%20Service%20Sector%20FINAL.pdf 5.

[61] https://www.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Synthesis-Report-Appendix.pdf 7.

The Association for Decentralised Energy

Bringing Energy Together

Response to NIA Call for Evidence 10 February 2016

Context

We welcome the opportunity to respond to Ofgem's Draft Forward Work Programme 2017-18.

The ADE is the UK's leading decentralised energy advocate, focused on creating a more cost effective, efficient and user-orientated energy system. The ADE has more than 100 members active across a range of technologies, and they include both the providers and the users of energy. Our members have particular expertise in combined heat and power, district heating networks and demand side energy services, including demand response and storage.

Some key points which can be found in ADE's response to the questions below include:

- Enhancing the productivity of the UK's energy system through increased deployment of district heating could reduce energy infrastructure investment costs by around 10%.[1] The UK could also reduce the overall cost of heating and cooling for buildings by 15%.[2]
- The current non-cost reflective approach taken by electricity networks risks under-rewarding the network cost benefits of energy efficiency improvements and distributed generation. Modelling analysis by Imperial University, **available here,** has shown that the locational element could better reflect the long-run marginal cost of transmission network assets, from around 10% to around 60% of the total revenue recovered. By aligning costs with the users that impose those costs – also known as cost reflectivity – it will help incentivise users to change behaviour, through mechanisms such as distributed generation and demand side response, to help deliver a lower-cost, more productive energy network.
- The interplay of energy efficiency and changes in levels of activity effects on final energy consumption resulted in a net decrease of 13Mtoe (or 155TWh) in final energy used between 2010 and 2015. Final energy consumption in the domestic, service and industrial sectors amounted to 96Mtoe (1,116TWh) in 2010, compared to 83Mtoe (961TWh) in 2015. Based on these achieved savings, we are therefore unconvinced about whether rebound effects fully negate the benefits of efficiency.
- There is a DSR potential of 9.8 GW, which would represent 16% of the total winter peak demand and 33% of industrial, commercial, and public sector peak demand in 2020. Providing DSR during the 50 hours of the highest demand of the year would be equal to the yearly electricity consumption of over 115,000 households.
- Analysis by a number of research and Government bodies, including Stratego, the Energy Technologies Institute and DECC , show district heating is a key form of cost-effective network

[1] Heat Road Map Europe Pre-Study Fig 63

[2] Heat Road Map Europe Pre-Study Fig 63

infrastructure as part of the low carbon network transition. DECC has identified a cost-effective potential for heat networks to meet 18% of UK heating demands by 2030, a nine-fold increase from today.

- The high level of upfront capital investment required for district heating projects causes the cost of capital to be a vital factor in the heat bill. Limited existing heat network assets prevent a similar model from emerging in the district heating sector. We would propose that Government and regulators develop a mechanism that would create similar risk profiles for heat networks as new gas, water and power network investments and would attract institutional investors, allowing these projects to be financed. The Association is launching a District Heating Taskforce, made up of Government, Ofgem, the investor community, and consumer groups to develop an approach to reduce investment risk for this network infrastructure and secure larger, better-value schemes into development at low cost to taxpayers. The taskforce will issue a report in Autumn 2017, including recommendations for any legislative action required.

Responses to questions

1. What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

The ADE has no evidence on what the highest value infrastructure investments would be in each region. However, we would support the approach taken by Government in the Industrial Strategy Green Paper to better align central government infrastructure investment with local growth priorities.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

The role of infrastructure should be to increase the productivity of the UK, thereby increasing the UK's international competitiveness in a sustainable, market-led manner.

Energy markets and energy networks have an enormous opportunity to help achieve this aim.

Improving energy system productivity with new heat networks

Any time we make or use energy, we lose some of it as heat. Power stations, the industrial sector and cities like London all lose heat, and together they waste more heat than is used by every home in the UK. By building heat infrastructure, also known as district heating, in densely populated areas we can collect waste heat and move it to the points of use. It is by investing in this form of low carbon infrastructure that we can cut unnecessary waste from the energy system and reducing emissions at the same time.

The UK has a major opportunity to unlock the value of waste heat using district heating. Power stations, the industrial sector and cities like London together waste more heat than is used by every home in the UK.[3] Less than 10% of waste from thermal power stations is currently captured; just a third of the cost-effective potential.[4] The potential captured heat could be worth more than £2 billion a year[5]. Using waste heat sources creates a more productive energy system and a more competitive economy, by providing consumers with lower cost and lower carbon heat.

We are further exacerbating this issue by incentivising, through the Capacity Market, new power generation that is largely inefficient and does not capture its heat. The 2014, 2015 and 2016 Capacity Market auctions secured nearly 4 GW of new generation which included only a few examples of power stations that capture heat (known as Combined Heat and Power or CHP).

Enhancing the productivity of the UK's energy system through increased deployment of district heating could reduce energy infrastructure investment costs by around 10%.[6] The UK could also reduce the overall cost of heating and cooling for buildings by 15%.[7] Academic research shows the most cost-effective way to decarbonise heat is a combination of improving building efficiency and developing sustainable supply.[8]

The right balance can cut consumer costs, carbon emissions and increase the productivity of the wider energy system. Given the ongoing need for heating and hot water, long term heat infrastructure, in the right locations, is a future-proof investment which will help to enhance energy productivity whilst cutting both dependence on imported fuels and harmful emissions.

We set out in response to Question 19 how heat infrastructure could be delivered cost-effectively, and set out including the challenge of funded projects securing financing in Question 8.

Incentivising lower electricity network costs

UK transmission network costs are rising quickly, from £1.6 billion in 2010/11, to £2.5 billion in 2014/15 to £3.8 billion in 2020/21. This is 9% annualised growth in costs over 10 years, reflecting the significant cost of new transmission assets to transmit electricity from intermittent renewables in more rural locations, such as North Scotland. For half-hourly metered customers, which include most industrial and large businesses customers, the transmission network demand charge will increase from £20/kW in 2010/11 to £65/kW in 2021, representing a 14% annualised increase. However, these significant infrastructure costs are being born by businesses and householders and resulting in rising electricity bills.

Allocating transmission and distribution network costs to the users who cause those costs help to ensure robust market signals, driving long-term cost savings for all consumers. However, under the current electricity transmission network charging arrangements, only 10% of network costs are recovered from specific users (through the locational charge) and more than 90% of the costs are recovered from general consumers (through the demand residual charge), without regard for whether or not those consumers are driving increased network costs. This arrangement leads to

[3] ADE analysis using Digest of United Kingdom Energy Statistics 2014; Buro Happold, (for GLA), London's Zero Carbon Energy Report Secondary Energy, July 2013; Element Energy, (for DECC), The Potential for Recovering and Using Surplus Heat From Industry, March, 2014.
[4] Ricardo-AEA, Projections of CHP capacity and use to 2030, March, 2013; Cost effective potential based on a discount rate of 15% over 10 years
[5] See lesswastemoregrowth.co.uk/report
[6] Heat Road Map Europe Pre-Study Fig 63
[7] Heat Road Map Europe Pre-Study Fig 63
[8] Heat Road Map Europe

poor incentives for users to reduce use of the transmission network, as the cost signals are unclear, risking over-investment in transmission network infrastructure.

The current non-cost reflective approach risks under-rewarding the network cost benefits of energy efficiency improvements and distributed generation. Modelling analysis by Imperial University, **available here,** has shown that the locational element could better reflect the long-run marginal cost of transmission network assets, from around 10% to around 60% of the total revenue recovered. By aligning costs with the users that impose those costs – also known as cost reflectivity – it will help incentivise users to change behaviour, through mechanisms such as distributed generation and demand side response, to help deliver a lower-cost, more productive energy network.

Improving energy market productivity

By making energy markets more accessible, the Government can help make them more competitive, bringing down prices for consumers. Currently a number of smaller, non-traditional energy market participants are not able to secure fair value for their services in the electricity market.

We estimate that DSR providers currently miss out on hundreds of millions of pounds per year because they cannot access the full value of the Capacity Market, Balancing Mechanism and Balancing Services. At the same time, consumers are bearing higher costs than they would otherwise need to, because the tilted playing field prevents the lowest cost combination of supply and demand-side resources from being procured.

This problem manifests itself in the Balancing Services market, the Capacity Market, and the Balancing and Wholesale Markets. The Association for Decentralised Energy has set out how to improve the competitiveness of these markets by better facilitating non-traditional demand side and distributed participants in **our response to the Smart Energy Call for Evidence** (See page 17).

By allowing demand side response and energy efficiency to access fair value in these marketplaces, the UK will also benefit from improving the productivity of our network and generation assets, removing the need to build new infrastructure assets at high cost when existing assets are available to meet our needs more efficiently.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

It is by aligning infrastructure investment with local economic plans that these will be supported. In the case of energy investments, this involves close working with local planning authorities and local authorities, distribution network operators, and district heating network developers to ensure this is achieved.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower

prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

We have provided a response to this question considering within the context of both permanent demand reduction and flexible demand response.

Demand reduction

The past five years have seen reductions in energy demand as a result of energy efficiency improvements, as outlined in our recent Energy Productivity Audit report.

According to the ADE's analysis, the UK's final energy consumption decreased by 19 Mtoe between 2010 and 2015 (or 220 TWh) as a result of improved energy efficiency in the domestic, service and industrial sectors:

- 12 Mtoe reduction in the domestic sector,
- 5 Mtoe reduction in the service sector,
- 2 Mtoe reduction in the industrial sector.

These savings were balanced by changes in outputs, specifically economic activity in the industrial/service sectors and the growth in the number of households in the domestic sector. Therefore, the savings outlined above were mitigated by an increase in final energy consumption of 5.6 Mtoe between 2010 and 2015 (or 65 TWh) as a result of a growth of activity in the domestic and service sectors.

The interplay of energy efficiency and changes in levels of activity effects on final energy consumption resulted in a net decrease of 13Mtoe (or 155TWh) in final energy used between 2010 and 2015. Final energy consumption in the domestic, service and industrial sectors amounted to 96Mtoe (1,116TWh) in 2010, compared to 83Mtoe (961TWh) in 2015.

Based on these achieved savings, we are therefore unconvinced about whether rebound effects fully negate the benefits of efficiency.

Even if demand management results in increased demand, such as increased production from an industrial site, the overall productivity of the economy (amount of energy used per unit of production) remains improved, creating economic benefits that can be reinvested. Demand management is another term for demand productivity – doing more with less.

Furthermore, rebound effects are not an issue for just demand, but can just as easily apply to supply-based solutions. Increasing electricity generation capacity through the Capacity Market, for example, reduces electricity market peak prices in future years, reducing cost of electricity for consumers during peak demand periods, and allowing them to use more energy. Under this supply-based approach, there is an identical rebound effect, but unlike the demand-based approach, there is not a similar productivity improvement in the use of energy.

Demand response

In collaboration with the DSR industry and drawing on existing research, we undertook an industry-based assessment of the potential for industrial, commercial and public sector energy users to provide flexibility to the electricity system by 2020. The assumptions used in the analysis are based on average demand flexibility from previous research and consultancy work, supplemented with additional data based on industry input.

The ADE's analysis found that the total amount of potential DSR that could be secured across the industrial, commercial and public sectors, including highly efficient CHP assets and on-site back-up generation, can be conservatively estimated at 9.8 GW[9]. This estimate includes:

- **2.8 GW** from industrial demand flexibility
- **1.7 GW** from commercial and public sector demand flexibility
- **2.3 GW** in flexible availability from the 5.2 GW of current on-site CHP capacity
- **3 GW** of on-site back-up generation capacity (non-CHP)

This DSR potential of 9.8 GW would represent 16% of the total winter peak demand and 33% of industrial, commercial, and public sector peak demand in 2020. Providing DSR during the 50 hours of the highest demand of the year would be equal to the yearly electricity consumption of over 115,000 households[10].

The size of available DSR will likely grow further beyond 2020, as the electrification of heat and transport intensifies, and the industrial, commercial and eventually householder participation increases. Additional loads will offer flexibility to the system in different seasons and times of the day, for different periods of time.

Industrial demand opportunity

In 2014, approximately 97 TWh of electricity demand was used in the industrial sector. Many of the end uses are able to provide a considerable amount of flexibility and already contribute significantly to the operation of the electricity system[11].

An example of industrial flexibility is in the paper sector. The paper making process consists of three stages: pulp production, paper production and rewinding. Pulp production is stockpiled to allow some interruption without affecting overall site production. During such a period, the pulp stockpile is consumed by the papermaking process. Therefore the operation of large pulp making machinery can be delayed to a different time of day without affecting the plant's final output, but such a delay can help the grid enormously if a sudden surge of demand occurs or a traditional power station has a fault. The same principle can apply to electric arc furnaces or induction heaters in the steel industry.

The analysis considers the potential flexibility of each class of demand in different industrial sectors. A previous Frontier Economics study identified loads that offer potential for the provision of DSR in heating, ventilation and air conditioning, hot water, lighting, refrigeration, and water pumping[12].

Using data provided by DSR providers, we have also included potential flexibility from motors and high temperature processes, assuming a similar level of flexibility as the other demands. Motors include pumping, fans and machinery drives, while high temperature processes include coke ovens, blast furnaces, and other furnaces, kilns and glass tanks. The average flexibility assumption across these different demands is 33%.

[9] The calculation of the DSR potential is characterised by high levels of complexity and various decisions have to be made in the process. The total potential DSR capacity includes only existing electricity-consuming appliances and on-site generation owned by industries, businesses, and the public sector. This capacity may not be available all the time, but can provide DSR at least once a year.

[10] Based on 4,115 kWh of average annual domestic electricity consumption published by DECC in July 2015 (ECUK).

[11] DECC, *Digest of UK Energy Statistics*, 2015.

[12] Frontier Economics, *Future potential for DSR in GB*, 2015.

By estimating the peak demand of industrial customers and calculating the maximum potential size of the flexible demand, we estimate that industrial sector demand flexibility could provide up to 2.8 GW of DSR.

Commercial and public sector demand opportunity

The total commercial and public sector electricity consumption in 2014 was 93 TWh, and included an array of sub-sectors from retail and government to the leisure industry[13]. Many of these businesses are able to provide flexibility to the electricity system, with the greatest potential in the retail sector.

There is widespread experience of DSR from heating, ventilation and air conditioning of buildings by temporarily extending the automated temperature ranges permitted within a building without affecting the building user. For example, optimisation can be made to refrigerated and chilled stores to provide flexibility for limited periods by temporarily reducing or switching off chiller compressors. The period of time that flexibility can be provided depends on the type of product being stored. Storing fresh products is more sensitive compared to deep-frozen products in well-insulated environments that can reduce demand and provide flexibility for several hours.

Element Energy study report considered the technical potential for demand response in the non-domestic sector, including from heating, ventilation, and air conditioning (HVAC) of buildings, and food refrigeration[14]. Element Energy's most conservative scenario for the available commercial and public sector flexibility assumed an average 14% potential flexibility in the HVAC, hot water, lighting, and refrigeration loads during winter, when the demand associated with heating and lighting is high. Demands in catering and computing loads offer limited flexibility without changing operating patterns and so are not included.

Taking the peak electricity demand of the non-domestic sector and applying the weighted flexibility potential of electricity demand, the estimated total commercial and public sector DSR potential is 1.7 GW.

Highly efficient combined heat and power opportunity

There is a total of 5.2 GW of on-site CHP capacity installed in businesses across the UK. This excludes CHP capacity that is no longer connected to a main source of heat demand[15]. Combined heat and power integrates the production of electricity and the use of the resulting waste heat in one single, highly efficient process, reducing fuel use by about 30%. Combined heat and power is business-led energy generation that can help support the electricity system while delivering efficiency and cost savings to businesses and public sector organisations.

Large industrial sites tend to use gas and steam turbine CHP, which follow a production process, but some regularly operate below full load and so can turn up at short notice. Other forms of CHP in commercial sectors, often using reciprocating engines, can provide much needed flexibility during the critical period of demand in increase between 7am and 9am when they would otherwise be unused.

[13] DECC, Digest of UK Energy Statistics, 2015.

[14] Element Energy, Demand side response in the non-domestic sector, 2012.

[15] DECC, Digest of UK Energy Statistics, 2015.

Based on current CHP load factors, more than 48% of the current business-led CHP capacity is available for flexibility services and is not being taken advantage of – equivalent to 2.3 GW of the total capacity[16].

On-site back-up generation opportunity

The primary function of back-up generators is to power essential services, such as data centres, hospitals, sewage works and water supply works, during power failures.

By using existing back-up assets such as on-site diesel generators that are primarily reserved for emergency use, businesses and the public sector are able to secure additional revenue. As back-up diesel generation is necessary for emergency purposes, the engines must be tested regularly throughout the year to ensure they run efficiently and safely. Compared to diesel engine farms, which do not need to be tested as there is no back-up duty, on-site diesel back-up generation is an important element of a secure electricity system through the Capacity Market and National Grid's balancing services.

It is challenging to estimate the capacity of the UK's back-up generation fleet. The most recent work, by Frontier Economics, estimated the fleet at approximately 3 GW of installed capacity. Of this total capacity, some units are already routinely used to provide non-emergency services such as feeding power into the local electricity distribution system. Further potential exists in this sector from back-up generation geared towards emergency services.

The potential of 3 GW of on-site back-up generation is based on existing equipment. The advantage of using it is that it avoids the capital cost associated with new generation assets.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

The ADE has no comment.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

The ADE has no comment.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

The requirement that spending decisions for infrastructure investments are aligned with Spending Review periods creates significant uncertainty for projects and prevents the most cost-competitive delivery. Investment timescales do not operate according to Government budgeting periods. However, the restriction that Government cannot commit new spending beyond a Spending Review period restriction means policy instruments are restricted and large-scale

16 DECC, DUKES 2015, Chapter 7 on CHP, 2015.

projects must wait until the next Spending Review period to secure Government funding. The result is an increase in development and financing costs for such projects.

If the problem created by Spending Review periods is not addressed, Governments with five year terms risk being unable to design and deliver new infrastructure programmes. Five years is far too short to assign an infrastructure priority, secure competitive development interest, and deliver financing or funding. The result is that infrastructure spending programmes are designed and delivered in haste, or paused because the Spending Review period has ended and new political spending decisions are required.

A key to unlocking investment in infrastructure will be addressing this Parliamentary spending term limitation. One possible approach which could mitigate this issue is set out below, but we would welcome further discussion on alternative options.

Parliament could be enabled to assign spending from the current Spending Review budget into the following Spending Review period, akin to a budgeting provision. Such an arrangement would ensure that only existing funding, budgeted in the current Spending Review period, would be spent and there would be no financial commitment to future unbudgeted spend.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

We see a clear opportunity for productivity investments which can be funded, but which are unable to currently held back by their inability to secure financing.

Heat networks

As with other energy network infrastructure, heat networks are 40-year assets, with high up-front capital costs, and similar to other forms of network infrastructure, need to attract low-cost capital to deliver cost effective solutions. However, heat networks are unable to secure low-cost capital investment as they lack the investment certainty provided to regulated assets such as gas, electricity and water networks.

Unlike gas and power networks, heat networks do not have an investment and regulatory framework underpinning them. The absence of such a framework excludes potential investors as the risks around district heating investment are considered to be significantly higher than for other network infrastructure projects.

When considering the development of a heat network, potential heat users can be easily identified and some or all of these will be interested in connecting to the network. Of those who are interested, very few will be willing or able to sign a heat supply contract before network construction begins. A catch-22 situation is created in which a heat user expresses a desire to connect once the supply is available and the developer cannot develop without firm commitments in advance.

The result of uncertain heat demand increases the cost per user and/or the cost of capital for heat network projects as well as the cost of deployment. It prohibits many large-scale heat

networks, which often have the most promising economics and best value heat. As a result consumer bills are higher than they otherwise could be.

As infrastructure costs are a significant component of energy bills (up to a fifth for gas and electricity customers), the high level of upfront capital investment required for district heating projects causes the cost of capital to be a vital factor in the heat bill. In gas and electricity networks the investment risk is shared across millions of network customers. Limited existing heat network assets prevent a similar model from emerging in the district heating sector.

We would propose that Government and regulators develop a mechanism that would create similar risk profiles for heat networks as new gas, water and power network investments and would attract institutional investors. The Association is launching a District Heating Taskforce, made up of Government, Ofgem, the investor community, and consumer groups to develop an approach to reduce investment risk for this network infrastructure and secure larger, better-value schemes into development at low cost to taxpayers. The taskforce will issue a report in Autumn 2017, including recommendations for any legislative action required.

Industrial energy efficiency

Energy efficiency investments are often economic and offer a positive return on investment. However, these returns are generally not as attractive as those from investments in a company's core business. With paybacks that typically exceed the 3-4 years required for internal funding, energy efficiency investments lose a competition for capital within a business.

This internal funding shortfall can be addressed through third party financing, which may have different economic return criteria than the business, and can provide capital with longer investment horizons.

However, for third party investors, creditworthiness is a universal constraint. With many potential energy efficiency investments financed over an extended timeframe – sometimes up to 15 years – the third party investor or lender will need to consider the business' credit rating, as well as the sector's long-term outlook, and poor creditworthiness will increase the cost of capital or even prohibit an investment.

For a number of businesses, creditworthiness may be a fundamental obstacle to securing either traditional debt finance or an Energy Services Agreement, potentially making them prohibitively expensive. This is likely to be the case for a number of energy-intensive manufacturing businesses or sectors, and this is a particular issue stifling the industrial combined heat and power market.

With these constraints, an industrial businesses is going to be unlikely to invest in either their own long-term efficiency improvements or rely on third sector financing. In these instances, investment in energy efficiency is only likely to proceed through public sector support.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

In the case of the electricity system, there are clear resiliency benefits from the delivery of smaller generation sites and demand side response providers, instead of the historical use of large, centralised plant.

The benefits can be shown by considering the reliability factor of one large power plant in comparison with the reliability factors of many small power plants. Although a large power plant is likely to have a higher reliability factor than a small power plant (e.g. 95% vs 90%), by providing electricity from a number of small power plants and DSR sites, the overall probability rises. A worked example is below:

- 1,000 MW power plant = 95% reliability
- 100 x 10 MW power plant (each at 90% reliability) = 99.99999998% reliability

Therefore, by delivering the same electrical capacity from a larger number of power plants, the electricity system becomes significantly more reliable than having a single power plant. However, this increased system reliability is not reflected in any areas of the marketplace. For example, the Capacity Market discounts each power plant based on its site-specific reliability, rewarding a large 1,000 MW power plant more than a 10 MW power plant. However, the 1,000 MW power plant makes the overall system less reliable, making the economic incentive entirely incongruous.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

The ADE has no comment.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

As the National Infrastructure Commission recognises, the inefficient use of energy can result in the construction of unnecessary infrastructure, whether for the generation or the transportation of energy.

In 2015, the ADE worked alongside a coalition of industrial manufacturing groups and environmental advocates to show the value of energy waste to the UK economy. Our analysis showed that currently 54% of the energy used to produce electricity is lost by the time it arrives at a UK home or business, where further losses occur. This lost energy is worth more than half the average home's annual electricity bill. It also represents the annual carbon emissions equivalent to every car in the UK[17].

The energy waste across heat and electricity is equivalent to 37 nuclear power stations; An area the size of England covered in bioenergy crops; or energy from enough wind turbines to cover 40% of Scotland. All of this land use and infrastructure impacts the environment, affecting sensitive landscapes and wildlife habitats, such as our uplands and coastal areas.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

[17] The Association for Decentralised Energy, EEF, Greenpeace, et al., 2015. *Less Waste, More Growth: Boosting Energy Productivity*

Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs.

"Transparent" improvements are those that do not rely on 'black box' modelling and assumptions

Specifically on energy efficiency, there are three challenges to the current cost-benefit analysis techniques that prevent delivery of the most cost-effective solutions to some of our energy challenges.

Better measuring system value in Impact Assessments

Energy policy is approached in silos, separately addressing carbon and the environment, security, and cost, resulting in policies pulling against one another. For example:

- The Contracts for Difference mechanism aims to deliver renewable generation at least cost, but does not consider the impact on security of supply.
- The Capacity Market mechanism aims to deliver electricity security at least cost, but takes no interest in carbon emissions.
- Reliefs for energy intensive industries provide direct abatement of energy costs, but does not improve security of supply or reduce emissions from those industrial sites.

The result of all three of these policies is that we support intermittent renewables which create security of supply and cost challenges; we are building inefficient, highly polluting diesel generation, with winners' carbon emissions estimated to be 22% higher than the losing participants[18]; and we are relieving costs on industrial users without incentivising them to shift to long-term energy cost and carbon sustainability.

Each of these policies' Impact Assessments considered their impact in other areas, but their success was determined by how well they delivered one element of the trilemma. Solutions which deliver benefits across all of the areas in the trilemma, like energy efficiency, lose out, as their benefits are dispersed across the different policy areas.

To determine best value, policy makers should consider the energy system as a whole and measure the contribution of interventions on security of supply, economic productivity, energy affordability, and environmental impacts.

Better targeting cost-effective approaches in Impact Assessments

One of the key challenges in the existing Impact Assessment process is that Government often only intervenes to deliver some of the least cost-effective approaches.

More cost-effective energy efficiency approaches are given little support, leading to significant under deployment, while some generation technologies are supported at a cost of over £800 per tonne of CO_2[19]. This is because energy efficiency solutions are often economic but not investable – they provide businesses with a positive return, but the returns are insufficiently high to secure

[18] Agus, E, James, P, Loyd, S, Mansion, M, 2015. Conflicting Messages? – Investigating the Impacts of Legislation on the Future UK Electricity Generation Mix. Ramboll.

[19] The cost of carbon abated under the domestic RHI scheme from July to December 2014, based on data published by Ofgem, with gas as the counterfactual. The £800/tCO2 figure is for Ground Source Heat Pumps. Biomass is the least expensive technology and has a cost of £202/tCO2 abated.

an investment decisions. By being near-investible, it is difficult for Government to target support and guarantee all the funding will be to 'additional' schemes.

There are signs of improved approaches, such as the Contracts for Difference competitive allocation, which seeks the cheapest way to deliver a set policy aim. However, this auction is limited to renewable approaches, missing efficiency opportunities. If the most cost-effective approaches are to be supported, we should move away from supporting specific technologies and approaches, and instead look to deliver our energy objectives at best value for consumers and taxpayers.

We would also recommend all energy policy proposals are tested, as part of their Impact Assessments, against alternative options. Testing proposed supply-side solutions against demand-side solutions in Impact Assessment modelling will allow consumers to benefit from the best value approach.

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

Analysis by a number of research and Government bodies, including Stratego, the Energy Technologies Institute[20] and DECC[21], show district heating is a key form of cost-effective network infrastructure as part of the low carbon network transition. DECC has identified a cost-effective potential for heat networks to meet 18% of UK heating demands by 2030, a nine-fold increase from today.

With the support of the Government's Heat Network Deployment Unit (HNDU), more than 150 local authorities are now investigating local heat infrastructure investments, with a value of more than £2 billion. These innovative schemes capture waste heat from power stations, industrial sites, and tube stations to make our energy system more productive and alleviate fuel poverty.

Government has now committed £320m to heat network development over the course of this Parliament. This investment is welcome and will help bring a number of schemes forward. However, a longer-term regulatory and market framework will be necessary if the UK's full heat infrastructure potential is to be reached.

The benefits of district heating (and cooling) are well-established and central to the energy systems in a number of countries around the world, including Germany and the Netherlands. In some Scandinavian and Baltic countries, district heating accounts for 40-60% of the national heat market. In cities with mature district heating systems such as Copenhagen, 98% of space and water heating demand is met through a heat network.

Heat networks are recognised by the Energy Technologies Institute, Policy Exchange, and the Climate Change Committee as a 'no regrets' option for decarbonising heat while simultaneously lowering heating costs for both householders and businesses.

This is because heat networks' key benefit is their ability to take heat from a range of sources, and therefore enable new technologies and low carbon options to be adopted over time. In London, networks such as the Pimlico District Heating Undertaking have already moved from coal

[20] ETI, 2015. *Heat Insight – Decarbonising heat for UK homes*.

[21] DECC, 2012. *The future of heating: meeting the challenge*.

to oil boilers then on to gas combined heat and power. At each stage carbon and energy waste have been cut.

Across Europe, renewable energy sources are increasingly used. In 1980 91% of Swedish district heating was supplied by fossil fuels, but by 2014 this had reduced to just 8% with biofuels meeting 42% of demand. In Denmark, solar thermal is expected to supply 10% of heat network demand by 2030, further reducing reliance on coal. In the UK, heat networks could help to extract up to 6 GW of renewable heat from our waterways. Heat infrastructure is key to delivering this heat to homes and businesses. Without networks, this potential will go untapped.

Because of this 'no regrets' flexibility available to heat networks, decisions are able to be taken now to support this technology. If the heat pathway is determined to be either low carbon electricity or low carbon gas, heat networks will be a key transmission vehicle for heating solutions. For example, if hydrogen fuel is determined to be the most cost-effective heating fuel in a decarbonised economy, it will be far

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

The exact mix of the power sector in 2050 should not be pre-determined, as the solutions are likely to be a combination of generation assets in a variety of locations and commercial arrangements.

However, what is important is that the market provides sufficient signals to ensure the most cost-effective solutions are able to be delivered, reflecting scarcity value, flexibility value, long-term infrastructure impacts and carbon emissions. Therefore, while we do not know what the power sector will look like in 2050, it is vital that these two key principles are met:

- All generation and demand should be exposed to identical price signals for any given service, and able to access the same marketplaces at the same value.
- All generation and demand should be exposed to their full infrastructure and system costs or benefits, including transmission and distribution network costs, considering the long-run (40+ years) infrastructure impacts, and be able to secure the benefits of avoiding those impacts.

By meeting these principles, the market will find a variety of load-following, intermittent and peaking solutions that work in tandem with DSR and storage assets to arrive at the most cost-effective system solution.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

While there are benefits by increasing electric vehicle take-up, by increasing the availability of battery storage in domestic homes, the increased electricity demand from electric cars will also result in significant strains to electricity generation and distribution infrastructure.

Analysis by UK Power Networks found that both low and high uptake of electric vehicles would require 70 new primary substations and more than 4,800 secondary substations.

An expanded role for local, load-following generation and demand side response will be key to mitigate any increased strains. In fact, in a smart, flexible energy system, local CHP and DSR will respond directly to the activities of other generation on the network. For example, high solar PV output could result in a reduction in CHP generation through a choice of mechanisms: natural variation (CHPs run less on sunny days), automatic network management or ANM (the CHP senses voltage rising as a result of high PV output and low demand, and responds to it), demand response (the CHP is signalled to turn down, or load is signalled to turn on, as a service to the DNO when PV output is high), or price (CHP moves production into higher priced periods when PV output is low).

Unfortunately, the approach taken by DNOs at present does not facilitate this beneficial interaction. In order to address this challenge both BEIS and Ofgem need to ensure:

- DNOs take a more active role in managing new connections and explore alternative 'smart' mitigation options, such as active management approaches, or voltage limiting schemes, in accordance with their obligations under Section 16 of the Electricity Act and in discharge of their undertakings in the LCNF, NIC and NIA.
- The network security of supply standard (Engineering Recommendation P2/6) is updated to recognise non-build solutions such as DSR and storage.
- DNOs are required to offer flexible connection agreements on request from developers of all new generators or energy storage sites.

For further information please contact:
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AECOM is grateful to have the opportunity to the National Infrastructure Commission's Call for Evidence. With a global workforce of 100,000 people we have unparalleled access to expertise and knowledge regarding infrastructure which we are happy to share.

We believe that the Commission and many of the projects it promotes should not be led by sector specific Government Departments, instead treated as mulita-disciplinary projects. This will help with timely delivery, agglomeration of scope/efforts/efficiencies, fundability and private investment interest. It will also help to close the gap between construction and asset management.

For major infrastructure projects like High Speed 2 it would make more sense to second experts from relevant departments into a special government team.

AECOM has expertise globally in designing, building, operating and financing major linear infrastructure and we believe it is helpful to have a sequential test of:

- **resilience,**
- **compatibility,**
- **interoperability,**
- **cumulative impacts,**
- **inclusivity,**
- **with respect to incorporation of other linear utilities/transport systems.**

AECOM is multi-disciplinary, input into our response to the consultation comes from across the business including from specialists in; housing, transport, water, energy, economics and planning,

1. What are the highest value infrastructure investments that would support longterm sustainable growth in your city or region?

In terms of transportation and physical connectivity; value needs to be defined more clearly, and not just in Benefit Cost Ratio terms, it needs to take into account societal benefits and wider economic benefits - see for example the HS2 Design Vision and the HS2 Balanced Scorecard for evaluation of suppliers, a similar balanced scorecard should be developed for establishing relative values of different investments. Only once this is clearer will it actually be possible to determine which are the highest value investments.

We also need to focus on flexibility, adaptability and resilience in investments, to allow for the inevitable, disruptive changes which will occur over the lifetime of our assets.
Improved physical connectivity, carefully designed and implemented, is a vital support to long term sustainable growth and improved quality of life and it will also enable other vital developments for example infrastructure projects like Crossrail2, which can unlock vital housing.
Investment in more sustainable methods of transport will contribute to a more sustainable future
Strategically targeted investment in bottle necks, releases constraints in transportation efficiency

In terms of Communications and digital connectivity we believe the best way to support long-term growth is for future proofed digital strategies to accompany all major investment projects. Improved digital connectivity will reduce the need for transportation and hence improve sustainability and empower the rural economy.
A digital communications strategy for UK transportation, which is not mode specific, would improve utilisation of the transportation network – eg common "ticketless" ticketing, real-time information different modes

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

Infrastructure is a key driver of international competitiveness, as recognised in major global rankings by the World Economic Forum[1] and Institute for Management Development[2], and in the Government's recently published Industrial Strategy.

According to the World Economic Forum, competitiveness of the UK economy has, up to now, rested on highly efficient goods and labour markets; highly sophisticated business processes and a high level of digital readiness by both businesses and consumers. However, the Executive Opinion Survey conducted by WEF listed inadequate supply of infrastructure is 2nd highest problematic factors for doing business in the UK.

In order to remain competitive in a world facing major changes in terms of trade relations as well as the challenges of climate change and diminishing resources, the UK needs an open, resilient, sustainable, secure and flexible economy. This has core implications in terms of:

- **Transport**. Transport is the backbone of the UK's economy. A successful transport system enables businesses to have access to the labour they need, to establish efficient supply chains, to deliver their goods to customers, domestically and internationally, in a reliable and affordable manner. Investment in transport is a key driver of productivity growth by enabling the economy to operate more efficiently at all levels i.e. employee, business, area. This includes the agglomeration effects that can be generated by dense transport systems in cities and which have driven productivity growth in London. International gateways have a key role to play by enabling businesses and cities to participate in international production networks and global value chains (GVC). On the other hand, an inefficient transport system (whether in terms of cost, reliability or connectivity) can represent a major obstacle to productivity, to inward investment, to trade, and therefore competitiveness. Given transport's ability to shape the spatial distribution of people and jobs for the long-term, investment decisions need to carefully consider potential game-changers in this field in terms of new technologies, business models and consumer behaviours (including those driven by environmental and health concerns).

[1] World Economic Forum (2016) The Global Competitiveness Forum Report 2016-17
[2] International for Management Development (2016) World Competitiveness Scoreboard

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The Port of Southampton is the UK's biggest export port with £40 billion of manufactured goods exported each year and over 90% outside the EU. This includes over 901,000 cars.

Over 5 million cruise passengers use the port, making it the largest in Northern Europe. However the port's growth is constrained by:

- Finite land requiring the relocation of non-port activities and relocation of peripheral activities. The port needs to find actual capacity from its existing 700 acres of estate despite adding 30,000 car holding space over the last 10 years.
- While 40% of containers currently access the port by rail, this proportion number needs to increase as growth continues and the roads urgently need investment locally around the port and on more strategic routes to the Midlands (e.g. A34).
- Staff access to the port is affected by high levels of congestion at peak hours as the M27 is used as a local road due to the poor level of public transport provision. While there is a proposal for Phase 1 of a light rail or tram train scheme connecting Southampton airport to the port this was not funded by Government.
- The port will need to continue to develop berth capacity as ships increase in size (e.g. there are plans for cruise ships that are double the current 3,000 person capacity).

In conclusion, a whole range of mutually supportive place specific infrastructure investments are required for the Port of Southampton to continue to expand and support the UK's competitiveness.

- **Digital infrastructure**. With the advent of a Fourth Industrial Revolution based on digital platforms and characterized by a convergence of technologies that is blurring the lines between the physical, digital, and biological spheres, the widespread availability and likely regular upgrade of digital infrastructure will be critical to future competitiveness as an essential component of an innovative economy. This Fourth Industrial Revolution is not defined by any particular set of emerging technologies themselves, but rather by the transition to new systems that are being built on the infrastructure of the digital revolution. As these individual technologies become ubiquitous, they will fundamentally alter the way we produce, consume, communicate, move, generate energy, and interact with one another. They also offer an opportunity to increase the resource efficiency and reliability of all other forms of infrastructure (e.g. water management, transport etc).
- **Energy** to ensure that businesses can continue to produce goods and services while reducing reliance on imported fossil fuels and exposure to price changes.

Investment in these three strands of infrastructure will be critical to the UK's long-term competitiveness. However, as previously mentioned, it needs to fully take into account the challenges ahead in terms of technological change, climate change and demographic change in order to ensure it responds to future needs. In addition, it is important to consider it as part of an integrated, coherent offer from UK Plc and how it can enhance / or be hindered by other drivers of competitiveness such as access to qualified labour, regulations, political and social stability.

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3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

To create better places to live and work, infrastructure needs to be designed, planned and delivered on a more integrated and place specific basis. This is necessary to (a) tackle some of the persistent productivity challenges of the UK and (b) obtain more local buy-in into decisions and trade-offs. This remains a challenge if there are; for example, more centrally run road and rail organisations where the place element is an add-on that cuts across their current structures and operational approach. For example, there are 62 functional city areas, increasingly the main generators of economic wealth and growth in the UK.

Physical infrastructure should be integrated with housing and workplaces in such a way as to create open, welcoming environments and to avoid linear infrastructure dividing communities

Practically, there is a need to fully embed county and local level infrastructure studies and plans and ensure that all parties complete and own these, at both officer and political levels. These could be city based like the London 2050 Infrastructure Plan. While generally these will have a lead body pushing these forward, other partners can remain detached from the reality of securing the necessary funding for the infrastructure that is required for population growth.

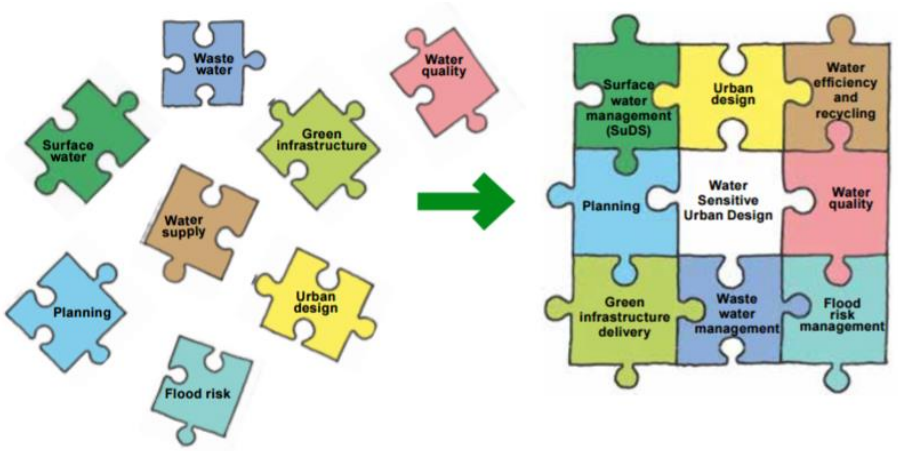
There is a danger that infrastructure providers (and their engineering advisors) start with the infrastructure and then see how it can create better places, rather than understanding the need for improved interconnected living spaces and designing the infrastructure to suit that requirement. Multi-modal transportation should be considered in all projects as appropriate and silo thinking from specific transportation companies should be avoided.

Housing, workplaces and infrastructure (both physical and communications) should be considered as a single integrated system, with planning designed to provide the best user friendly and sustainable solutions. They should be designed to unlock future development potential – particularly in those areas of the country where the housing crisis is the worst. Crossrail 2 is an example of housing being enabled by a transportation scheme, but even then the transportation and housing are being developed in parallel rather than as one integrated system. Authorities should also make better use of air rights spaces for housing above commuter stations.

From a water/wastewater perspective, water sensitive urban design (WSUD) has huge potential to unlock a wide range of societal benefits. To quote CIRIA,

''*WSUD is an integrated approach to managing flooding, droughts and water quality, which promotes a more rational and frugal use of water alongside the creation of beautiful and resilient places*''.

As well as the more obvious aspects of flood and drought management through natural and built capitals, this produces benefits in social and human capitals such as mental wellbeing and productivity through the creation of greenspace and biodiverse habitats.



The amount of hard standing in urban areas is increasing. The London Assembly estimated that around two-thirds of front gardens in the London area – equivalent to an area 22 times the size of Hyde Park – are already at least partially paved over, primarily to provide off-road parking spaces (Defra, 'Future Water' (2008): 2.5 Hyde Parks of green space are lost each year in London as a result.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

Water: The Commission's recognition of needing to balance expenditure, of asset creation and of asset maintenance, is very much in line with water sector developments in asset management planning over the last 15 years or so (e.g. the UK Water Industry Research (UKWIR) 'Common Framework for Expenditure Decision-Making'), and we agree that policies and priorities should feature among the range of recommendations. The water sector's experience in making these trade-offs is that it requires considerable thought on the metrics of risks and benefits to enable those to be made objectively. We expect that common metrics across the sectors would help to inform recommendations.

We note that although the Commission's remit is to look to a 30 year horizon, the water sector is working with Defra, Welsh government and its regulators to develop water resources planning to "at least a 50 year planning horizon", while Ofwat's 'Towards Resilience' states that "taking a long-term view is an essential element of planning for resilient systems and services… In the context of the water sector, 'long term' means looking 25 to 100 years ahead…" for both water and wastewater services.

We fully support the Commission's view that infrastructure assets includes natural assets like rivers and floodplains, as this aligns with water sector developments on assessing natural (along with social and human) capital in its decision making processes.

6. Do you agree that that the precise timing of reports and interim publications should be a matter for the commission in consultation with relevant departments?

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

8. **Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?**

9. **How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?**

The water sector's services are increasingly delivered by high rate, powered processes and using information flows from instrumentation via telecommunications. As seen in the effects of Hurricane Sandy, cascade effects across utilities (water, power, transport, telecoms) can exacerbate the consequences of shocks, be they natural or man made. Water companies have begun to move towards self-powered sites e.g. through energy generation on wastewater sites, which may mitigate some of the power outage consequences. This has implications in terms of regulatory constraints (transfer pricing) so it may be helpful to reassess this in the context of delivering resilient services.

Clearly, collaborative working across sectors in understanding risk pathways and effects, and potential joint solutions, would help to strengthen the resilience of the elements in the chain where effects cascade across sectors.

10. **What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?**

Projects should sit within a UK-wide infrastructure masterplan over a 50 year cycle. This would ensure identification of week points, upcoming pipeline of investment, prioritisation, cumulative impacts etc.

As noted above, multi-entity collaborations are cost beneficial and indeed may sometimes be the only way to resolve an issue with multiple causes which cut across jurisdictions. There is scope for a service (regional or national) which co-ordinates the proposed programmes of work across sectors using geographic information systems to show where there is scope to deliver integrated solutions.

11. **How should infrastructure most effectively contribute to protecting and enhancing the natural environment?**

From a water sector perspective, recent developments in making use of natural (and social and human) capital in informing expenditure decision making should be encouraged and extended more widely. The upshot is that a wider set of benefits of expenditure, to include the risks to / benefits for natural capital, is used in cost benefit analysis of expenditure options.

12. **What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?**

From past experience in assigning value to, and making trade-offs between, services in the water sector, we see the development of an agreed evaluation and appraisal methodology, and of risk and performance measures, as key in enabling cross-sectoral optimisation. It will be important to arrive at a common means of understanding and managing uncertainty in forecasts and appraisals, particularly given the long term nature of this planning.

The water sector has successfully developed portfolios of interventions through formal optimisation techniques since the early 2000s, to allow competing objectives to be optimised –

simple prioritisation can not achieve this. Similarly, multi-criteria analysis, while useful as an engagement tool, is open to the criticism that the weightings are not set objectively.

The sector makes use of performance measures (more recently including natural and social capital) which enable both an assignment of economic value (monetised benefit) to changes in risks and performance (up or down) as well as modelling to show the quantum of change of performance resulting from expenditure on interventions.

These are well established techniques and the Commission may find it helpful to engage with the sector and its supply chain on which may be appropriate to adopt and adapt for its own purposes.

Transport

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

With the pace of development, it is almost impossible to predict with any certainty the changes in travel patterns over the next 30 years. The advent of disruptive technologies will change things in ways that we cannot currently predict. We really only extrapolate current trends and make provision for disruptions. It is reasonable to expect continuing urbanisation and travel patterns will reflect this – increased metropolitan travel, greater need for safety, reliability and resilience.

We need to recognise the generational differences in transportation requirements, and to future proof based on current trends as well as societal trends like more leisure travel in future

The rate of traffic growth has slowed over the last two decades, and levels fell immediately after the 2008/09 economic downturn. At the individual level, car use fell in the 2000s, partly offset by the increase in population. In recent years traffic growth has recovered to pre-recession levels as growth in GDP has recovered. The average distance travelled per person increased to 2000, but then levelled off. Although the majority of all trips are for non-commuting purposes, provision of transport infrastructure is generally predicated on commute / peak hour travel patterns.

Over recent years there has been a change in how people work with more workers having the flexibility to work more remotely from their place of work, primarily as a consequence of improved connectivity and communication options. There are benefits for both the worker (commuting time and cost savings) and the employer (operational cost savings). It is a possibility that with broadband targets (superfast broadband for 95% of the UK by the end of 2017) and full national coverage in years to come, flexible / remote working options will become more commonplace as remote working becomes more efficient and can cover a wider geographical spread of people. Increased flexibility to work remotely also offers increased flexibility to work in multiple locations based on need. Consequently, travel patterns and the time of travel will become less fixed for an increasing number of people.

Remote working is not possible for all the sectors of the economy such as for those working in the care, education, retail and manufacturing sectors. However, more flexible working options for an increasing number of people will and are having an impact on these sectors, for example, retailers' increasing flexibility around shop opening times. Technology including automation, particularly in manufacturing, could result in displacement of workers who may have to become more flexible about when and for whom they work.

The impact of high housing prices on the ability to live close to a place of work, particularly in the south east, and the high cost of commuting means that with good broadband the pool of labour available to employers could widen. The benefits of agglomeration are well known, but the future trend may be to provide a pool of labour in satellite towns to service the jobs. This is being seen in high growth areas like Cambridge where the city cannot grow further so new towns are being built just outside the green belt. The medium to longer term impact may well be an increase in total travel demand, but moderated by the increase in remote working and scope to change travel times. This will necessitate continued investment in transport infrastructure, but also allow flexibility to make best use of existing assets, with technology and information provision allowing users to make more informed decisions on when and how to travel.

Infrastructure investment is often based on forecasts of conditions during peak hours. But demand for travel in some locations is so high that it is becoming increasingly costly to provide the infrastructure to meet that demand. Any trends that reduce demand should be welcomed and closely monitored so that new provision is delivered just in time.

Provision of essential services from other sectors is also changing over time, essentially because it offers greater efficiency. There is consolidation of healthcare centres and also the delivery of education. This leads to more efficient travel and changes in travel patterns to access services, but it could also result in longer journeys placing additional pressure on transport networks. Such changes can offer opportunities to public transport operators to consolidate services and help deliver a critical mass of fare paying passengers ensuring commercial viability that may not otherwise be possible.

Remote diagnosis from some GPs by telephone or Skype is impacting on travel patterns now, requiring patients to travel to the surgery only if deemed necessary. There is a similar change potentially taking place with consolidation of education facilities which could afford greater opportunities for sharing the school run.

These and other changes in land use have the potential to change travel patterns across society, but for the majority, it is unlikely to significantly affect the need to travel. Changes to land use have a long lead in time for both planning and implementation, and for their impacts to be felt across society. There is also the additional factor of a generational divide which influences the extent to which impacts are felt, and that needs greater understanding.

The impacts of technology on travel patterns are more difficult to predict – even five years ago could we have accurately predicted the advances being made in autonomous vehicles and, perhaps, how slowly the prevalence of lower emissions vehicles has materialised? There is an expectation that autonomous vehicles will allow new trips to take place, and potentially improve the access to essential services to sections of society who would not normally travel. For example, the elderly or mobility impaired, who cannot walk to a bus stop or who do not have a local or frequent bus service, could book a demand response autonomous vehicle offering a door-to-door service. There is a consequential impact on other providers such as bus services in rural areas if society sees a switch to autonomous vehicles. Increasing use of autonomous vehicles combined with a potential reduction in bus use could contribute to increasing congestion.

Within the freight industry technological advances have the potential to lead to more efficient deliveries. Freight platooning and connected vehicle trails are taking place in the UK supported by organisations such as Highways England so that the necessary infrastructure and technology can be provided to support vehicles of the future. DfT's Road Traffic Forecasts 2015 predicts that the greatest increase in vehicle types to 2040 will be from LGVs, albeit at a lower rate of increase than

seen in the past two decades. We are already seeing deliveries to local collection points so that the customer can pick-up a parcel at a convenient time, perhaps as part of another journey. It is this 'last mile' of delivery that appears to have the least impact from technological advances, although engine efficiency improvements continue and will have a positive impact on emissions.

The expectation is that the mix of trip types will change, but not the need for travel such as for commuting and the school run, but advances in technology and changes in land use may lead to a better / more efficient use of infrastructure. In 2050 we are likely to see:

- New travel patterns in which larger volumes of freight and greater numbers of travellers are carried to their destination by the most efficient (combination of) modes;
- Information technology provides for simpler and more reliable transfers; and
- Transport users pay for the full costs of transport in exchange for less congestion, more information, better services and increased safety.

There is a range of different trajectories as to what could happen with travel patterns to 2050 and it is difficult to predict accurately which of these will be borne out. Different factors will affect which trajectory travel patterns will follow and further research is needed to better understand the issues and their impact going forward. This presents an opportunity for policy makers, transport planners, and transport providers to influence behaviour and the infrastructure and services that are needed by society. This could be moving from providing peak capacity to providing new connections that give value all day for a more flexible population.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

There is much excitement regarding the development of Hyperloop, whilst this technology has not yet been proven, the UK should take this as a serious potential future disruptive technology and one that has the capacity to enhance the coherence of the UK by linking Edinburgh, London and Cardiff. Motorways with inductive loops for charging electric vehicles on the go, should be considered, to see whether this technology is viable and cost-effective. We should avoid overhead electrification on motorways as it would be a blight on the landscape.
The Government should also invest in infrastructure to support the use of autonomous cars and research into the use of autonomous cars which can link into continuous trains on motorways and then split to go to different destinations
Finally we would strongly encourage investment in improvements in reliability, capacity and interconnectivity of intercity rail – HS2 and others – provided that the links at either end are developed to provide seamless interconnection to other modes.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

Mobility as a Service (MaaS) has been defined by Transport Catapult as "using a digital interface to source and manage the provision of transport related service(s) which meets the mobility requirements of a customer". Theoretically, MaaS does offer the ability for road user charging to be applied, as part of the service offer charged on a per mile basis according to the time of travel and the journey undertaken. The prevalence of smart phone technology, GPS, and in vehicle trackers should allow for accurate monitoring and charging. It provides users with the opportunity to make an informed decision on when and where to travel based on their own needs and on the cost for

that journey, similar to the way airlines present ticket prices for different days and times over a longer time period.

However, there are a number of potential hurdles that would need to be overcome if road user charging was to be implemented using MaaS. These factors include, but are not limited to:

- Public acceptability – recent experience from local authorities, outside of London, who have tried to implement a system of road user charging, has shown that public acceptability of the principle is far from certain. Any system of road user charging under MaaS would need to be fully transparent.

- Privacy and data issues – there is reluctance amongst people to provide on-going personal information to organisations, for which location data would be a requirement for road user charging. While many people may appear to be reluctant in theory, in practice, most overcome this reluctance for the convenience offered by smartphones and apps, despite the volume of personal data harvested by such devices.

- Taxation – there is a difference between whether any scheme for road user charging is designed to be revenue neutral or congestion neutral. In a revenue neutral scheme, revenue from MaaS road user charging would replace all other travel or vehicle based taxation, then this tax revenue from MaaS would need to be sufficient to cover tax revenue lost from other sources. This in turn requires a critical mass of MaaS users if tax revenue is to be maintained at or above a particular level. It is currently unknown whether take-up of MaaS will be sufficient to allow this to take place, even though tax revenues are in decline as vehicle engines become more fuel efficient and the number of electric and hybrid cars increases. If the objective is to be congestion neutral, that is to ensure the growth in congestion would cease as a result of road user charging, then the level of charge required is likely to be higher than with a revenue neutral objective, and consequently unpopular.

- MaaS usage – if MaaS is more cost effective than car ownership and public transport, then it has to be assumed that take-up will be high. However, if this leads to increasing levels of congestion then achieving critical mass may become problematic.

- Regulatory framework – there is no regulatory or policy framework specific to MaaS and there is insufficient evidence to understand the potential impact of MaaS on economic, social and environmental factors. Furthermore, what would be the impact of MaaS on the provision of transport infrastructure and on public transport providers if, for example, it resulted in increased car use? How would the profits of private MaaS providers be harnessed to improve services and infrastructure?

Digital communications

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

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Energy

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Waste and Wastewater

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

Historically, most effort by water companies on the demand side has been put into leakage management e.g. active leakage control, pressure management. In the background, advances in the water efficiency of household appliances (e.g. washing machines, toilet cisterns) have resulted in significant demand reductions [see Oz examples in links above]. More recently, behavioural economics interventions or 'nudges' have been seen to be highly effective in changing consumers' behaviours e.g. education / influencing campaigns, albeit as with any other intervention these need to be maintained to continue to be effective. There is also scope for innovative tariffs to influence behaviours such as through incentives for uptake of water efficient appliances for poorer households.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

As outlined in Q4, implementing WSUD in the planning phases of development brings multiple benefits in terms of not just demand management for both water and wastewater services, but also environmental and societal through augmenting natural and social capitals. Adoption of this as a requirement for new developments would be highly effective in managing future demand.

As noted in Q6+Q10, collaborative interventions involving several entities, often making use of natural and social capital, are proving to be highly cost beneficial, while recognising that this is a new way of working for the sector and requiring different skills from the traditional standalone capital asset options.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

Applying approaches such as WSUD at a catchment level would identify and plan for the cross-sector effects of development against a backdrop of enabling resilience in an uncertain future.

Specific elements of WSUD such as SuDS provides communities with their own localised water resources to reduce the demand on centrally provided services e.g. meeting non-potable water consumption through rainwater harvesting facilities being provided in new builds or as retrofit, which at the same time reduces load on sewer networks and attenuates surface water flows to alleviate flooding from rainwater runoff.

Flood risk management

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

Resilience within the coastal context will be the most difficult to achieve. Development along the coast needs to be set back sufficiently to allow for reducing standards of protection as sea level rise and storminess increases. Planning needs to be taking account and reshaping the infrastructure to increase resilience of the community.

The assumption people will just vacate their homes to avoid risk is not the case as the recent east coast surge showed. More people are willing to put themselves at risk in large events.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

Government policy promotes the use of natural flood risk management within flooding and coastal erosion risk management (FCERM), and this is backed up by Defra's commitment to invest £15 million on NFM projects using funds allocated as part of the 2016 Autumn Statement. However, the current mechanisms for securing Government funding for flood risk management schemes (FCERM Grant in Aid (GiA)) are not aligned to these policies.

To attract FCERM-GiA, a business case must be submitted, demonstrating the costs and benefits of a scheme. Three aspects of a project determine the amount of national funding available: the value of benefits for householders as a result of flood or coastal erosion risks being managed, (especially in high risk or deprived areas); the value of other benefits achieved, such as benefits to businesses, agricultural productivity and protection for national and local infrastructure, across the whole-life of the scheme; and the environmental benefits of the scheme, needed to maintain healthy ecosystems as well as offset any habitats lost when defences are built to protect people and property. The maximum amount of funding for a project is based on multiplying each of the aspects by a set of payment rates, which are fixed amounts of national funding per unit of outcome or benefit achieved.

The current approach to quantifying and valuing benefits within the Partnership Funding Calculator overlooks some important environmental and social outcomes. In particular, the case for adopting an ecosystem services approach (as currently being developed for expenditure planning in the water sector) to valuing environmental outcomes which has the potential to derive multiple benefits for natural, social and human capital including key priority areas such as carbon management and enhanced accessibility of local communities.

This information would support a more holistic, accurate representation of the nature and significance of environmental and societal benefits alongside WFD requirements (OM 4), thereby potentially increasing the likelihood of securing funding for NFM measures through GiA, and could potentially identify where there may be opportunities to leverage funding contributions from a wider group of ecosystem service beneficiaries through payments for ecosystem services schemes.

For flood management, although schemes such as the Pickering scheme which make use of natural upstream systems are potentially useful, they are usually small scale. I think that the next London Barrier should be a serious consideration, even though current plans envisage no new barrier before 2050. I further think it should be possible to combine this with a tidal scheme, and possibly a transport link. The latter could be part of an outer London orbital to supplement to M25 at a distance corresponding to the A34: Oxford to Newbury and possibly the planned Oxford to Cambridge expressway as far as the M1 (the section from M1 to Cambridge is not radial). Luton (airport) to Stansted is another missing link.

Solid Waste

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

The main financial incentive in the solid waste sector is the landfill tax. This has been very successful in incentivising the development of recycling and recovery infrastructure, and could be seen as an exemplar of using taxation to achieve environmental outcomes. The landfill tax rate increased rapidly under the "escalator" scheme, but has now stabilised. At present, the tax rate appears to be a sufficient incentive to recycling and recovery, but this should be kept under review as the costs of various waste management routes vary over time.

The availability of excess Energy-from-Waste capacity in Europe has incentivised export of UK waste in recent years (thereby reducing waste landfilled), at the expense of developing UK-based treatment capacity. Whether or not this situation persists is unclear, and depends on regulatory factors (particularly post-Brexit) as well as the capacity of the European market.

Most waste operators still see there to be a "capacity gap" in the UK, particularly for commercial/industrial waste treatment. Most municipal waste streams are already contracted, and the commercial/industrial market is less predictable, with fewer long-term contracts. This makes it more difficult to secure financing for new facilities.

The landfill tax incentivises innovative technologies, insofar as they represent alternatives to landfill, but does not explicitly support innovation as opposed to proven technologies. In most cases, the constraints on innovation are technical and financial (i.e. will it work and is it profitable), rather than regulatory.
Regulations need to permit innovation and allow alternatives to landfill, but at the same time manage the risk to the environment. The increased landfill tax has encouraged technical innovation (in term of new technologies), but may also lead to regulatory arbitrage, in terms of waste producers seeking to maximise the use of exemptions and other low-cost, non-landfill disposal and recycling routes.

Waste producers have a legal duty of care for ensuring their waste is managed lawfully, although formal "producer responsibility" schemes apply to only a limited number of sectors. Increasing the amount of waste falling within such schemes could improve recycling rates and also contribute to the circular economy, although this may impose additional costs on business and consumers.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

Barriers to the Circular Economy:
It can be challenging to articulate the Circular Economy concept to people who are unfamiliar with it and many of the current best practice examples from the manufacturing sector are still in the process of being 'translated' into infrastructure delivery

There are established ways of delivering key infrastructure when it comes to materials and resources and waste – many of these approaches are starting to accommodate CE models, for example, deploying innovative materials like cement free or low carbon concrete and redeploying cut-and-fill spoil etc across projects. However, making the transition from delivering a construction product to a construction service will take time as current commercial models perpetuate themselves and down-cycling (i.e. a material loses more value each time it comes to the end of its life and ends up in a lower value application) is still prevalent

A common refrain is that infrastructure lifecycles are too long (e.g. 120 years) to consider what happens at end of life, however, this is mispresenting as in fact many components of infrastructure have much shorter lifecycles (e.g. most modules may have a 20-30 year lifecycle, like an electric line or a steel barrier or a road surface pavement), which are easy to monitor and replace / recycle or refurbish when they reach that time, it is rather the infrastructure footprint that has the long life cycle and that can stretch to hundreds of years, though may have different applications over that time (think roman roads and viaducts etc).

One barrier to wider implementation and scaling up of circular economy approaches is the current lack of an effective programme or corporate-level measurement or metric of success – this is being worked on and is likely to incorporate some measure of overall consumption of resource for a given product, project, programme or organisation as a ratio against the turnover or value of that entity across its life, i.e. decoupling consumption from growth or continuity of service

An old chestnut is that statutory design guidelines are sometimes inflexible and procurement rules can inhibit innovation – this is true to some extent, but innovative approaches do get piloted. A more serious problem is corporate inertia and risk appetite preventing pilot scaling beyond project trial to programme, scheme, and then BAU.

Cost and Benefits:

Infrastructure-specific cost benefit models for deployment of the circular economy approach are still work-in-progress, however, the benefits are widely considered to include the following:

- Significant reduction in raw material extraction
- Better productivity from existing resources
- Only a tiny percentage of a project's overall waste to landfill
- Competitive advantage – those organisations that adopt a CE approach spend less on resources

- Avoidance of product availability and commodity price fluctuations linked to local or global resource security (e.g. water, scarce minerals etc)
- Decongestion of logistics pathways due to use of hubs and in-project / in-programme closed loop resource flows
- Avoidance of environmental impacts and the need for remediation / clean-up associated with resource extraction and processing – indeed, a circular economy approach can really help those organisations that have signed up to a Net Positive impact approach on the environment
- Granted, the initial transaction costs of developing a circular economy approach can be high as supply loops are worked through, for example, see the National Grid widely available case study material on their overhead line circular economy replacement approach, however, once established CE approaches bear significant dividends as per above

The societal benefits of a circular economy approach will include cleaner air and water, less land footprint lost to extractives work, less congested roads owing to reduced materials movements and multiple handling, lower overall cost of infrastructure delivery (therefore economy-wide efficiencies, that could result in a re-alignment of spending priorities to e.g. health and wellbeing) and concomitant benefits to natural environments that society benefits from accessing, e.g. biodiversity, pollination, recreation space etc

Airport Operators Association response to the National Infrastructure Assessment call for evidence

Introduction

1. The Airport Operators Association (AOA) is the trade association for UK airports. It is also an active member of Sustainable Aviation, the UK coalition of airports, airlines, aerospace manufacturers and air navigation service providers that sets out a collective and long-term strategy to ensure a future for UK aviation that is cleaner, quieter and smarter.

2. We welcome the National Infrastructure Commission's intention to draw up a National Infrastructure Assessment. This will be an opportunity to set out a long-term vision for UK infrastructure. Airports are a major component of the UK's transport and economic infrastructure and the National Infrastructure's assessment offers will be able to highlight the importance of aviation and its integration with other transport modes as a crucial element of the country's economic success.

3. In light of the Government's focus on an Industrial Strategy for the UK, we believe that the NIA is an opportunity to provide the necessary infrastructure to underpin this work. For example, the Government's intention to rebalance the economy and its support for initiatives like the Northern Powerhouse and the Midlands Engine will require significant infrastructure to support the intended outcomes, including improved strategic connections between major cities themselves and between those cities and international connections served by airports.

4. The Government intends to draw up an Aviation Strategy for the coming decade, in line with the Industrial Strategy. The NIA's analysis of the sector's infrastructure needs over the next 10 years, both in terms of terminal, runway and surface access capacity and how investment in these can allow airports to better serve their regions through boosting connectivity, economic and productivity growth, would be an important independent cornerstone of the Government's work on this Aviation Strategy. The NIA should, however, also look further into the future by assessing infrastructure needs and passenger demand in the period up to 2050 and set out the long-term view on this, enabling all levels of Government to plan for this. It should base this work on the valuable work the Airports Commission did around identifying some of the trends in aviation, including the continuously diversifying airline sector that is now seeing the rise of low-cost long haul services, and technological improvements.

5. The right investment in infrastructure at and connecting to airports will drive greater competition across the aviation market. The Competitions and Markets Authority has been clear that the break-up of BAA has been beneficial to consumers and the UK economy. Continuing to support this competition by levelling the playing field through targeted infrastructure investment would ensure the continuation of that dynamic.

The role of aviation for the UK

6. As the Commission indicates, international gateways for passengers and freight contribute significantly to the UK's international competitiveness. This is supported by economic indicators: the aviation sector is a crucial driver of economic growth, contributing over £52 billion to the UK economy and employing around a million people[1]. Aviation connectivity is vital in facilitating trade in goods and services (more important than ever for a post-Brexit UK), tourism, business investment, innovation and productivity improvements.

7. Demand for air travel is forecast to increase 1-3% a year to 2050 and passenger numbers are predicted to increase to 315 million in 2030 and 445 million by 2050. We are encouraged by the Government's commitment to an additional runway at Heathrow Airport, but note that these forecasts suggest that there is a looming capacity crunch in many other parts of the UK by 2030 and unless action is taken to address this there will be severe knock on effects for the UK economy.

8. For aviation to grow, people and businesses need to be better connected to airports. Our central plea to the Commission is that it should make the case that **airport development and surface access should not be considered independently from one another, but should instead form part of an integrated transport strategy covering the whole of the UK.** The Commission is ideally placed to advise the Government on how best to deliver transformative infrastructure over a long-term horizon.

Infrastructure capacity

9. With the Government having taken a decision on additional runway capacity in the South East, there is now an opportunity for the National Infrastructure Commission to appraise aviation capacity across the UK. In the last few years, passenger growth has gone beyond even the most optimistic growth scenarios: the 251 million passengers travelling through UK airports in 2015 were 17 million more than the highest growth scenario in 2013 suggested. Under the 2013 forecasts, passenger increases were expected to lead to a capacity crunch at London airports by 2030 and a capacity crunch at airports like Birmingham, Manchester and Bristol by 2040. This may now come sooner than expected.

10. While the Government is intending to draw up a new Aviation Strategy White Paper by the end of 2018, they have indicated that this will not go into the detail of assessing where new infrastructure will be needed but merely provide an overall framework for growth, designed to enable market-led development. It is, however, important to safeguard areas of strategic opportunity where in ten or fifteen years it will be necessary to build new terminals or runways.

11. To support national and local government, as well as airports seeking to safeguard their future growth potential, the National Infrastructure Assessment would be the ideal opportunity to give an overview of expected future passenger demand and capacity need up to 2050, based on new passenger growth forecasts and in close cooperation with individual airports. This work can build on the Airports Commission's reports, which specifically did not

[1] Oxford Economics, on behalf of the AOA and partners, *Economic Benefits from Air Transport in the UK* (2014): http://www.aoa.org.uk/wp-content/uploads/2014/11/Economic-Benefits-from-Air-Transport-in-the-UK.pdf.pdf

consider demand beyond 2030 but did model it and made clear that by 2050 there would be around 35 million passengers per annum in unmet demand. This will then enable national and local government to make decisions that safeguard areas of future strategic opportunities for enhanced aviation connectivity.

Surface access to airports

12. Airport growth across the UK is contingent on good surface access and inadequate transport links can prevent airports from delivering their full economic potential. Improved transport links can boost catchment areas, make new journeys viable and are instrumental in ensuring an airport's ability to service a greater number of destinations at higher frequencies. Better access to airports provides greater inward growth and investment and creates economic benefits for the local, regional and national economy.

13. Surface access also defines the market in terms of competition, in that airports with better surface access connections have larger catchment areas that enable them to more easily attract airline investment in new and existing routes. Investment in surface access is an important component of levelling the playing field in terms of catchment.

14. Investment in airport growth, including enhanced surface access, will tend to be exactly the kind of high-value transport investment that allows people and freight to get into, out of and around major urban areas. Many airports are at the centre of "agglomeration economies" that are characterised by firms locating close to one another and thereby increasing productivity. Investment in improved surface access widens the area, both in terms of numbers of people as well the geographic reach of economic regions, that are able to enjoy the benefits of (international) connectivity provided by airports within easy reach. This facilitates improved economic integration and furthers the likelihood of investment and skills development as well as offering greater choice to consumers and businesses alike.

15. Looking at surface access, modelling commissioned by the AOA and published in our policy report *Connecting the UK's economy: how better access to airports can boost growth*[2] shows that (including direct, indirect, induced and catalytic effects) a 5% improvement in average journey times to and from airports could deliver a 2.7% increase in passenger numbers, generating an additional £1.9 billion per annum for the UK economy and supporting an additional 32,000 jobs. Around a third of these benefits are likely to accrue to the local economy surrounding an airport.

16. The Commission's infrastructure assessment provides the opportunity to assess the level of public transport infrastructure connecting UK airports and to identify where there are gaps in present and future demand. While the Airports Commission made recommendations on surface access improvements in the short term in its Interim Report, this did not consider the full picture across the UK. Furthermore, progress on implementation of those recommendations has not been as the sector had hoped. The NIA could build on this work by looking at how airports to serve their regions better. The Assessment could then encourage Government to insist that rail capacity assessments and Highways England route studies should include airport access and compare passenger growth assessments and their

[2] Airport Operators Association, *Connecting the UK's economy: how better access to airports can boost growth* (November 2016) http://www.aoa.org.uk/wp-content/uploads/2016/11/AOA-Connecting-the-UK-Economy.pdf

impact on transport infrastructure. This practice could be mandated in Government policy at national level to improve delivery of a more integrated transport system.

17. Improved surface access to airports would have substantial benefits for the economy, but better rail links and better use of roads also make a positive contribution to protecting the environment. This has been set out in Sustainable Aviation's recent report on emissions and air quality at airports.[3]

Airspace modernisation

18. The airspace structures across the UK have changed little since the 1950s. If we are to handle the forecasted growth in air traffic across the whole of the UK, we need to modernise that infrastructure. Our airspace was never designed to handle the more than two million aircraft that it did in 2015. The challenge is already being felt at peak periods. Modernising airspace is timely and complex. It takes many years and we are already behind schedule.

19. Principally, airspace modernisation moves the UK away from relying on ground-based beacons to satellite navigation. This brings clear benefits. Through better operating procedures there is a potential carbon saving to UK aviation by 2050 of between 9% and 14% and, alongside the introduction of quieter aircraft, 'the potential to reduce UK aviation noise output by 2050 compared to 2010' according to Sustainable Aviation.[4]

20. This is because aircraft would be able to fly more directly as aircraft are not constrained by ground-based aids. It will also mean greater use of Continuous Descent and Climb Operations, which reduce noise and CO_2 emissions. And it will reduce the need for conventional orbital holding; instead aircraft can be readied for landing higher and thereby reduce noise and CO_2 emissions. Routes could also be designed to avoid noise-sensitive areas or provide a more equitable spread of noise. In essence, aircraft would be able to fly quieter and more efficient routes, increasing the sky's capacity for growth.

21. This brings clear economic benefits too, because of reduced journey times and fewer delays. According to research by the International Air Transport Association (IATA), airspace modernisation across Europe will deliver over £29bn to UK GDP and 116,000 jobs by 2035.

22. If we do not act on this, there are clear disadvantages. Without modernising airspace, analysis commissioned by the DfT and carried out by NATS, predicts total delays due to air traffic management could reach 4.4 million minutes by 2030 – that's 3,100 days of delay, 72 times more than 2015.

23. Despite the clear case for modernisation, plans developed through the Future Airspace Strategy have been delayed due in large part to the negative reaction from some local communities who have been sensitised to aircraft noise by airspace trials and the on-going debate about the future of airport capacity in the South East. The views of these very vocal groups have dominated the public debate and led to the Government to reduce support for

[3] Sustainable Aviation, *UK Aviation and Air Quality Report* (January 2017) http://www.sustainableaviation.co.uk/uk-aviation-and-air-quality

[4] Sustainable Aviation, *CO_2 Road-Map* (December 2016) http://www.sustainableaviation.co.uk/wp-content/uploads/2016/12/FINAL_SA_Roadmap_2016.pdf

airspace modernisation and undertake a review of its airspace and noise policy. As a result, proposals to modernise airspace have been delayed.

24. The modernisation of airspace is largely funded by the aviation industry but it requires long-term strategic decision-making and Government support and commitment to ensure it can continue to benefit the UK. The Government's recent consultation on airspace policy is welcome but some of the complex changes require further leadership, particularly those where change have system-wide impacts or regional impacts for other airports, e.g. any changes for one airport in the London airspace impact all the others. The National Infrastructure Commission is the leading advocate of this type of decision-making and the process of modernising airspace would greatly benefit from the Commission setting out the case for change and the necessary steps to achieve this. This would help move the debate away from the pressures of short-term political need. We believe that the National Infrastructure Commission provides a once in a generation opportunity to achieve this.

Wider economic impacts of investment in airports

25. Recognising the full range of economic benefits strengthens the case for investing in airports. Although the benefits from improving surface access, for example, are widely known, this has not prevented underinvestment in recent decades. It is imperative that when improvements to airports surface access, airspace, terminals or runways are under consideration there should be a holistic analysis of all the economic effects, particularly the catalytic effects. The benefits will be particularly prevalent for schemes that improve international connectivity and we would foresee these being amongst the highest value infrastructure investments that would support long-term sustainable growth in important cities and regions.

26. **The National Infrastructure Commission could play a key role in promoting new thinking on transport appraisal guidance to better capture the catalytic impacts of investment.** Existing methodology often understates the benefits from improvements to, for example, surface access by missing out the gains from trade, tourism, foreign investment and migration. Capturing the full range of benefits would help to ensure that scarce resources are allocated to projects with the greatest returns. The effect of airports should be embedded into transport appraisals.

For further information, please contact AOA Policy Manager or

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Light Rail & Trams, Affordable & Sustainable Transport

"The past we inherit, the future we build ourselves"

"TramTrain does it Greener and Cheaper on lightly used railway lines and in the streets"

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APPLRG Submission to National Infrastructure Commission

Call for Evidence for the National Infrastructure Assessment

1. All Party Parliamentary Light Rail Group

The All Party Parliamentary Light Rail Group is an independent forum for MPs and Peers from all political parties and Industry to come together and raise awareness of matters concerning Light Rail & Tramways best practice and sustainable development.

The All Party Parliamentary Light Rail Group holds regular inquiry sessions in order to to provide a holistic package of policy proposals that will drive forward best practice, leading to affordable light rail & tramways with resultant physical and economic regeneration, carbon reduction, improved air quality, congestion relief, affordable transport. to the UK and its' citizens.

2. The problem facing our cities

The APPLRG is concerned that too much emphasis in current major infrastructure planning is being placed on better connections between cities whilst there is a significant problem with transport within cities and other urban areas.

A major factor in improving the economic performance of our major cities is by improving the access by businesses to a high-skilled workforce. This can be achieved by a better local transport infrastructure giving better connectivity between the city, its suburbs and the surrounding areas. A recent Centre for Cities report has highlighted this:

"The UK's biggest cities are currently punching well below their weight. To change this policy needs to improve their two key advantages – their ability to create new ideas and spread information, and the access they give businesses to many highly-skilled workers. This requires … investment in transport within cities and their wider areas to better link jobs in city centres in particular to residential areas in suburbs and hinterlands." [1]

Another report in comparing the North of England with the Rhine-Ruhr (Germany) and Randstad (Netherlands) conurbations came to a similar conclusions that intra-city connectivity is more important than inter-city in stimulating economic development:

"An argument often put forward about both the Randstad and Rhine-Ruhr area is that their transport links allow people to live in one city but work in another, suggesting that there would be benefits for the North of England in strengthening transport links between cities. But the data suggests that people don't use the transport links in this way."

"Highly skilled workers do tend to commute further. But they tend to commute from the rural hinterlands of the cities they work in, rather than from other cities." [2]
The problem with many of our larger cities is that, while they may have had efficient public transport systems in their industrial heyday much of this has been lost by closure of local railways and of tramway systems.

Subsequent reliance on the private car has led to congestion and gridlock, while the bus-based public transport systems have not been able to maintain their efficiency on the congested roads. There have been more recent improvements resulting from the electrification of local rail lines (such as the cross-city line in Birmingham) and the development of light rail systems (most notably Metrolink in Manchester). By and large, however, our cities still lack comprehensive efficient public transport.

Some of our smaller cities and towns have prospered, notably Cambridge, Oxford, Milton Keynes, Swindon and Norwich. They are now, , however, becoming victims of their own success and are suffering from high property prices which forces workers to live further from the city centre and from congestion as these same workers struggle to reach their places of work. These places, too, are sorely in need of improved and efficient public transport.

3. An answer

The APPLRG believes that the problems of urban connectivity are best solved by the provision of a high quality public transport network. While heavy rail and bus must play their part at opposite ends of the passenger loading spectrum, the backbone of such networks should be light rail and trams. The essential requirement in any network is the full integration of modes, in terms of interchange and through ticketing, allowing seamless journeys into and within the city.

4. Benefits of trams

Trams are an efficient way of moving large numbers of people in urban areas, typically 2,000-18,000 passengers per hour. They have a proven record in attracting people out of cars; the rate of modal transfer from car to tram at peak times is typically around 20%. This compares with estimates of between 4% and 6.5% for quality bus investment. Levels of traffic reduction from trams are typically around six times greater than with bus schemes. Reductions of road traffic of up to 14% after introduction of tram schemes have been recorded.

A tramway improves the city's image and assists urban regeneration. Shiny rails on the street instil confidence. All UK schemes have had positive effects on the image of the city in which they have been built, which has brought benefits in terms of attracting inward investment as well as business and tourist visitors. This is supported by the examples from overseas, where tangible improvements to a city's image are made obvious through numerous travel documentaries.

There are also beneficial effects on property values, both commercial and residential, from the introduction of trams. Tram schemes can encourage regeneration of run-down urban areas. Trams increase labour force mobility between job opportunities and residential areas, including deprived areas, , and give better access to community and shopping opportunities

Being electrically powered, trams are largely pollution-free at point of use, avoiding both the tail pipe pollution of the internal combustion engine as well as the particulate pollution generated by wear of tyres and road surface. The carbon footprint is also lower than other modes, particularly if they are powered by electricity generated by renewables.

5. Response to specific questions

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region? Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects? Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered? Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets? Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors? Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent? Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies? Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas? Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area? Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

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[2] Building the Northern Powerhouse Lessons from the Rhine-Ruhr and Randstad / Paul Swinney Centre for Cities. June 2016
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This report has been compiled in conjunction with Mr James Harkins FCILT, Chair, ERG, TramForward

On behalf of the All Party Parliamentary Light Rail Group,

Yours aye,

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Submission to the National Infrastructure Commission
National Infrastructure Assessment Call for Evidence

Angel Trains Ltd

1. Introduction

1.1 Angel Trains is the largest of the UK's three Rolling Stock Owning Companies (ROSCOs). We own and maintain over 4,300 passenger vehicles, representing around 34% of the nation's rolling stock, which we lease to all 21 franchised and open access operators.

1.2 Angel Trains plays an integral role in the UK's rail infrastructure. We act as a bridge between the operational railway and investors by attracting and securing the necessary private finance to procure, refurbish and enhance UK passenger rolling stock. Since 1994 we have invested over £4.7 billion in new rolling stock and refurbishment programmes, including our recent £900 million contract with Derby-based Bombardier to procure 665 new Aventra vehicles as part of Abellio's winning East Anglia rail franchise. This makes us one of the largest private investors in the UK's rail infrastructure.

1.3 We are supportive of the aims of the National Infrastructure Commission (NIC) and are grateful for the opportunity to inform the development of the National Infrastructure Assessment (NIA).

2. Long-term planning to ensure policy certainty

2.1 Angel Trains warmly welcomes the introduction of the NIA to analyse the UK's long-term economic infrastructure needs and provide a strategic vision over a 30-year period. Policy certainty and long-term planning from government are necessary to help ROSCOs attract and secure the private investment needed (in our case through pension and infrastructure funds) to plan and deliver rolling stock that meets passenger demand and expectations now and in the future.

2.2 ROSCOs take a long-term strategic view of the rail industry given the 30-35 year life-span of the trains we buy. We work with industry colleagues to produce an annual forecast of the likely size and mix of the national rolling stock to accommodate future passenger numbers over 30 years[1]. We use this strategy to assess and manage the optimum cascade options for our fleets and coordinate the major upgrades required to improve transport connectivity and enhance the passenger experience.

2.3 We would encourage the NIC to engage with Angel Trains to ensure that the UK's rolling stock requirements over a 30-year horizon are considered and reflected in each NIA. We strongly support the Government's commitment to market-led rolling stock procurement, and urge the NIC to ensure ROSCO representatives are able to contribute to expert panels and workshops in the future.

3. Whole life asset management to deliver high value transport investments

3.1 Angel Trains' engineers and financial experts have the necessary skills to manage our rolling stock at every stage of its life cycle. It is this long-term approach to infrastructure management that enables us to continue to optimise and enhance our high speed, regional and commuter fleets – both with new trains and through high quality refurbishment programmes.

3.2 As the Department for Transport outlined in its *Rolling Stock Perspective*, high quality refurbishment of trains can deliver a passenger experience comparable with new rolling stock but for a fraction of the cost of buying new vehicles[2]. This ensures we deliver long-term value for both the industry (beyond current franchising terms) and passengers. As such, this approach often represents a higher value transport investment for taxpayers compared with procurement of new trains. Notably, it also provides significant economic benefits for the domestic rail supply

[1] Long-Term Passenger Rolling Stock Strategy for the Rail Industry, Forth Edition, March 2016. Link.
[2] Rolling Stock Perspective. Department for Transport. May 2016. Link.

chain, as all this refurbishment work is carried out by UK-based manufacturers. For example, Angel Trains is investing a further £35 million across our 500 vehicles which we are leasing to Arriva Rail North as part of the Northern franchise. This accounts for over a tenth of our current portfolio. Every year we channel over £60 million through our supply chain, who range from large companies to specialist SMEs, supporting highly skilled jobs in depots across the UK and contributing to regional economic growth.

4. Further information

4.1 For further information, please contact:

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National Infrastructure Assessment: Call for Evidence

Response from Anglian Water Services Limited

Infrastructure investment priorities for the Anglian Water region (Question 1)

Providing safe, clean water is at the heart of what water companies do. Since privatisation, the industry has invested billions of pounds in securing the nation's precious water resources. However, as this detailed report suggests, mains water cannot be guaranteed even today, and this is a problem that will become more severe.

Earlier this year, the Government challenged the industry to understand more fully the future challenges and solutions in terms of our resilience to the risk of drought. The industry has enthusiastically responded with what we believe to be the fullest study of national water resource availability and pressures ever undertaken in this country.

Through this work, led by Water UK and chaired by Jean Spencer from Anglian Water, it is clear that the problem is even more pronounced than initially thought. The conclusions from this work are that action is required now, at a national and sub-national level, to build our resilience to this risk. If we carry on with 'business as usual', the impacts of severe droughts, which will become both more frequent and geographically widespread than previously understood, will be felt much more severely. This is a risk that is evident across England, but is particularly pronounced in our operational region and in the south east.

To address this challenge we will need to continue work to drive more efficient use of water in the home, in business and in agriculture. We will also need to reduce leakage further. These approaches have been central to our Love Every Drop approach over the past 7 years, which has transformed how we do business and how we engage with customers and stakeholders. However, given the evidence before us, it is likely that we will now need to go beyond the approaches currently deployed to take forward new approaches that may increase interconnectivity and sharing of water across regions, and the related need for additional storage facilities for water.

When looking at vital infrastructure, we must be careful about looing at regions; increasing (or allowing a decrease in) resilience in one area may very well affect the level of resilience in another. We will need new sources of supply and new storage. We need to make the most of tried and tested techniques whilst also focussing on new and emerging technologies such as smart meters.

Customers, as always, need to be at the heart of our response. The industry is exploring how best to engage customers on long-term issues, such as resilience. While the scale of ambition will be considerable, increasing resilience in this way should not require unaffordable changes in bills if we take this work forward on a collective and timely basis. Taking sensible steps now can help to ensure that water can remain available and affordable for customers today and in the future.

Ultimately, how we respond to the prospect of more frequent and more severe water shortages depends on how policy makers assess the level of risk that people and businesses should be exposed to.. The prospect of drought cannot be eliminated entirely, and so it is important for Government, in considering the evidence from the NIC, to establish what it considers acceptable in terms of levels of resilience to drought.

Using infrastructure to create better places to live and work (Question 3)

Infrastructure providers have a vital role to play in shaping the communities and economies within their operational areas. We believe that, by working with local planning authorities and developers for example, we can inform the spatial planning of our region – ensuring resource availability, existing infrastructure and flood risk is carefully considered and incorporated in local plans.

We are piloting even greater involvement in this space, playing a leading role within the Wisbech Garden City Vision, an ambitious project that aims to build 10,000 new homes, and improve transport infrastructure in the town.

Much of this development would be on land vulnerable to flooding. We have therefore sought to explore how this can be overcome through design solutions that have been successfully deployed in flood risk areas in developments in Europe, and through collaborative planning and innovative flood risk management practices like sustainable drainage (SuDS) and better surface water management.

SuDS and green space will do more than just reduce flood risk; they will enhance the environment and benefit the community – our customers – who live in and around Wisbech. This scheme, if successful, will be a great example of using infrastructure to create better spaces, as well as showcasing how collaboration and innovation can unlock large scale, sustainable developments.

Getting the balance right: maintenance and repair of existing assets vs. replacement (Question 5)

When looking at asset management versus replacement, it is our view that the whole life value of an asset should be considered, as well as its performance. This whole life cost should take into consideration the full cost of replacement, refurbishment, ongoing maintenance and also the associated costs incurred due to loss of service to customers over the lifespan of the asset.

Using this whole life measure allows a point in time to be determined where it becomes truly cost beneficial to construct a new asset, and removes any inherent bias towards choosing capital expenditure solutions.

The other key factor that must be considered when balancing our own asset maintenance and replacement is whether an asset may need replacing or upgrading to meet the capacity demands from growth.

Improving competition and collaboration of supply of infrastructure services (Question 6)

Competition

Anglian Water adopts a pro-markets approach and is in support of competition where there are genuinely contestable markets which can generate benefits for customers. We believe that, in the water sector, there is potential to introduce competitive markets in the areas of sludge management and upstream water resources.

We support the principle of water trading and have carried out in-depth work about lessons that can be learned from water trading in Australia. It is our belief that trading can add real value and allows for the most efficient and appropriate allocation of scare water resources.

Collaboration

We see collaboration as the best approach to understanding the needs of all stakeholders, and fully considering all options. From our experience, pooling resources helped to improve the understanding of how the needs for water supply and water recycling services may change in the future.

The NIC is familiar with the Water UK Water Resources Long-Term Planning Framework, in which Anglian Water played a leading role. This collaborative piece of work is the first national (England and Wales) assessment of vulnerability to more severe droughts than those experienced historically. The work also identified a number of supply options that could increase resilience, all of which require collaboration to be successful.

Through Water UK, Anglian Water is also playing a leading role in the 21st Century Drainage Project, which looks to identify future risks the drainage networks and provide options for policy makers based on sound research and evidence. The project aims to ensure the future resilience of drainage

infrastructure through dialogue facilitation, the development a framework to complement the national drainage strategy, and changing behaviours of customers with regards to what should and should not be put into the sewer network. A healthy and fit for purpose drainage network is vital in the face of the challenges posed by population growth, climate change, and increasing flood risk, and this can only be achieved through a collaborative project like this.

Regionally, Anglian Water has been central to the establishment of Water Resources East (WRE). WRE is a collaborative initiative which brings together stakeholders from a wide range of industries, including water, energy, retail, the environment, land management and agriculture. The innovative partnership aims to safeguard a sustainable water supply, which is resilient to future challenges presented by growth and climate change, and realise the East of England's full potential through the development of a long term, multi-sector water resource management strategy.

Flood partnerships offer one of the most high profile examples of collaborative working. Following heavy surface water flooding on Canvey Island, Essex, Anglian Water, along with three other partner authorities, formed a pioneering Multi-Agency Partnership (MAP) to raise awareness of flood risk and resilience in the community and to improve the island's drainage infrastructure. To date, the MAP has produced a manifesto and a six point plan outlining £24million of investment needed to protect Canvey from future surface water flood risk. The plans have been twice endorsed by the UK Government, and have been accompanied by over £3million of immediate remedial works and a high profile public awareness campaign to increase flood risk awareness have been funded by the MAP. We believe that this approach is something that should be recommended and encouraged across the broader industry and with other infrastructure providers.

Funding policy to improve the efficiency of infrastructure service delivery? (Question 7)

We note that almost all infrastructure in the water sector is funded by private investors and paid for through customer bills, rather than by taxpayers. Given that context, it is imperative that wider policy and regulatory environment provides the stability that investors require, but is flexible enough to enable innovative approaches to be taken. One example of this is whether assets may be developed which would meet needs wider than public water supply, and which would suggest that multi-sector investors could come together to fund new assets of this type. Some changes to current legislative and regulatory systems may be needed to facilitate such approaches, and we examined this issue with FTI consulting in a recent report into multi-sector water supply assets.[1]

What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time? (Question 10)

We believe that the creation of more adaptive, risk based approaches to planning would better support the efficient delivery of infrastructure.

Through the better sharing of information between utilities and local authorities on the likely progress of developments utilities can understand the timing, build out rates and occupation of new development. This will allow the effective, timely management of necessary supporting infrastructure.

We adopt a proactive approach to the development industry, and working more collaboratively with developers, house builders, other utilities and local authorities. In this regard we would support improvements to the exchange of information and intelligence between these groups, and a greater

[1] http://www.fticonsulting.com/insights/reports/financing-multi-sector-water-supply-assets

recognition of the interdependency between certain utility provision. Consistent and accessible data, including spatial information, would assist all providers form more credible investment plans.

Infrastructure providers need to ensure the efficient use of customer and taxpayer money, which means making the right investment at the right time. This includes working with the development industry to ensure that fair contributions are made towards the infrastructure needed to support growth. Improved intelligence of site progress, phasing and understanding of site requirements will help to achieve this.

There is also the potential for improvements to the current system of building regulations to recognise the increasing risk of drought. Higher standards for water efficiency within building regulations for new housing are currently a matter of choice for the local planning authority. In areas of water stress, such as the East of England, we would argue that an automatic higher standard could be adopted. A recent Water Resources East paper on these issues reviews a range of issues related to planning and infrastructure, and is appended below. We believe that improvements could also be made to how regulators consider growth within price review processes, to ensure that the right investments can be made at the right time to support growth. Local and sub-regional plans, national policy and high growth areas including garden villages and towns, and strategic growth corridors like Oxford-Milton Keynes-Cambridge should be taken into consideration by regulators when considering their responses to price review business plans so that growth is not blocked by insufficiency of supporting infrastructure. This should include allowing flexibility to changing circumstances, such as acceleration (or slowing) of housing delivery.

We think there is value in the used water network and water recycling facilities being considered as strategic infrastructure. It is intrinsically linked to the natural environment, particularly water quality, and its timely expansion is essential to enabling sustainable housing growth.

The planning system has rightly shifted towards being more flexible to increase the pace of housing and economic development. Whilst we are unashamedly pro-growth and see our organisation as an enabler of growth, we do have to consider that this approach will see an increase in sites coming forward outside of the Local Plan process where there is not a sufficient supply of land. It is also likely that we will see a reduction in the time taken for schemes to obtain planning consent through permission in principle. These flexibilities create additional challenges for infrastructure providers who work within 5-year price review periods.

We would like to see consideration given to the introduction of equal flexibility that would aid infrastructure providers to meet the needs of housing and economic growth. This could be, for example, in the form of extended permitted development rights or permissions that allow for modular build solutions.

Striking the balance between supply and demand for water (Question 22)

We face challenges from a combination of climate change, growth, the reductions needed to restore abstraction to sustainable levels. All of these factors combine to increase the risks of severe to extreme drought in our region.

Droughts and meeting the needs of the environment will result in large water deficits in the short to medium term. Although subject to some uncertainty, growth and climate change are likely to also result in significant water deficits in the medium to long-term.

To manage these risks we need to adopt a portfolio of resilience schemes that perform robustly in most plausible future scenarios. This portfolio will need to be flexible, adaptable and able to meet changing or unexpected conditions. The portfolio also needs to strike a balance, making sure it isn't under-utilised (too big) or insufficient to meet demand (too small).

We are currently using advanced decision making under uncertainty (DMUU) methods, such as Robust Decision Making and Multi-Criteria Search, to develop our preferred portfolio of schemes. Through stress-testing and scenario discovery, such techniques will allow supply system vulnerabilities to be quantified. The outputs of this work will also empower decision-makers to make trade-offs between the different portfolios that are available for meeting target levels of services.

Our preferred resilience portfolio will include measures to both reduce demand and increase supply. The demand management options we are considering include metering of unmeasured domestic customers and switching them to measured supplies, leakage reduction and measures to increase water efficiency, including grey water reuse.

The main options to increase supply include winter storage, aquifer storage and recovery, transfers and trading, desalination and water reuse.

In selecting our preferred supply-side schemes, there is an opportunity to align our needs with those of other water companies in the region and other abstractors and users of water. These opportunities are being pursued via the Water Resources East project. The purpose of the WRE is to develop an affordable long-term regional water strategy, which meets the needs of the environment and is resilient to the effects of climate change, growth and severe drought.

Building capacity for the future: how do we ensure drainage and sewerage capacity is fit for the future? (Question 23)

We strongly believe that there needs to be more transparency and better collaboration between utilities, local authorities and regulators on long term growth strategies. This will ensure that water companies (and other utility providers) are equipped with:

- 'real-time' forecasts for housing and economic growth;
- Up-to-date assessment of confidence in each five year planning forecast;
- a consistent format and ability to comment on spatial plans;
- robust and up-to-date data that can be relied upon and used with confidence.

This would then need to be supported by economic regulators finding ways in which they can appropriately take these plans into account (including considering the interdependency between critical infrastructure to support growth and resilience) when assessing companies' business plans and making decisions on price controls.

Beyond this, Anglian Water strongly advocates policy intervention to promote sustainable surface water management and surface water reduction strategies. One of the most effective ways of maintaining capacity is by keeping surface water out of the sewers in the first place. These reduction

strategies should be used as a first choice approach to improving capacity as they are most cost effective and sustainable when compared to capital investment, asset heavy solutions.

We are also of the view that partnership working has a greater role to play in this area and, if delivered correctly, can lead to the delivery of more effective solutions that have been designed in collaboration with local stakeholders and those benefitting from the schemes. In creating the operational environment for this to take place, policy should reflect a preference to partnership solutions and partnership funding methods should be simpler to access and administer.

Greater transparency and partnership working is an approach we are already promoting in the Anglian Water region with events such as the Water Resources East initiative, and our regional Growth Forum meetings. We believe they are the key to successful delivery of effective long term strategic plans that facilitate the management of any impacts of growth on our sewerage infrastructure and receiving water recycling centres.

Our interventions are currently phased, according to our confidence in local growth projections. These interventions include surface water management, partnership working, extensions and new assets. We also monitor key indicators, such as flows and new connections, to ensure the optimal timing of any intervention.

Utilising a holistic catchment approach to effectively manage water supply, water recycling and flood risk management (Question 24)

The Anglian Water region faces a number of significant risks to its future water supply and water recycling (wastewater) services. We operate in the driest region in the UK and want to ensure we are doing all we can facilitate sustainable growth. In the East of England we are forecast to experience the highest levels of growth outside London. This growing pressure on resources from population growth must be balanced with the demands of being the UK's most productive agricultural region (which may face even more demands if a consequence of Brexit is that more supply switches to UK produce away from import), and home to a significantly high number of internationally important environmental areas.

We must also consider that more than 1million people live at risk from flooding within the region; 645,000 people from surface water sources, 550,000 from river or coastal flooding, and 170,000 from reservoir flooding. Climate change and more frequent cases of extreme weather events mean that these risks are increasing.

Currently, water supply and water recycling catchments are often broken down into separate, unaligned geographical areas. For water supply catchments, the current approach looks at the geology of an area and the make-up of ground and surface water systems. Water recycling catchments are designated based on the extent of the sewerage network they contain. Flood risk infrastructure however aligns with the risk of flooding from the multiple sources outlined above, including coastal and river defences, and surface water management measures – thus straddling water resource catchments. Finding a way to align catchments would allow greater collaboration and transparency on both water and water recycling infrastructure.

Looking at the holistic catchment approach, we are working with partners to carefully explore opportunities for the creation of multiple-benefit infrastructure solutions. A prime example of this a project that is being led through the Water Resources East collaboration, looking at utilising the

Black Sluice catchment to provide both water supply resilience as well as flood risk management benefit. A detailed case study of this project is included as an appendix.

We believe that, with more properties at risk from surface water flooding across our region than any other source, urgent consideration is needed regarding the interaction between the underground sewer network and above ground drainage features. We are looking at how Sustainable Drainage Systems (SuDS) can be sued to help recharge groundwater, to stop excess surface water from entering the sewerage system, and to delivering additional societal and environmental benefits such as improved biodiversity, amenity value and water quality benefits.

The Cam and Ely Ouse Catchment Partnership (CamEO) is a good example of a holistic catchment approach in the Anglian Water region. This initiative sees utilities working together with local businesses, landowners, environmental professionals and communities to create a strategy for sustainable catchment management for the Cam and Ely Ouse rivers. It unites the interests of local individuals and organisations to influence national management plans and deliver a shared vision of sustainable management of water resources and the ecosystem benefits they provide.

Resilience to flooding: striking the right balance (Question 25)

We believe that there is work to be done to ensure resilience to all types of flooding across the country. We have played an active part in the National Flood Resilience Review, and the EFRA Select Committee hearing into Future Flood Prevention and were pleased to see additional funding for flood resilience.

However, we believe that the greatest risk has not yet been addressed by Government, and this is the risk of flooding from surface water. More properties are at risk to this form of flooding than all other sources combined, and yet there is little policy guidance to allow for resilience measures to be taken.

We believe greater guidance should be given on this area, as well as simplification of funding processes to allow for greater partnership funding to build resilience to surface water flooding.

The role of innovation and sustainability in flood risk management (Question 26)

Green infrastructure, including natural flood management schemes and innovative practice and technologies, should be deployed as widely as feasibly possible through development and growth, as well as asset management and maintenance, in order to provide resilience and encourage responsible flood risk management across the country. Their merits are only confined by the frameworks within which they work.

Sustainable Drainage Systems

We strongly support the use of sustainable drainage systems. We believe SuDS provide effective surface water drainage whilst also ensuring the greatest degree of flood risk protection over the long term. There are also a range of associated benefits of using SuDS schemes, such as increasing amenity value and improving productivity within communities, creating habitats and improving natural biodiversity.

SuDS also provide a greater degree of environmental protection by managing the quality and quantity of surface water run-off, reducing pressure on existing water recycling infrastructure.

Although there are many practical benefits to SuDS, there are a number of challenges faced in their widespread implementation. There is a void in the delivery and adoption of SuDS, which has meant a

lack of leadership, responsibility and incentivisation to include the schemes in housing developments. This could be rectified if Schedule 3 of the Flood and Water Management Act 2010 were enacted.

As it stands, Lead Local Flood Authorities are expected to comment on surface water drainage matters in planning applications, but few actually adopt SuDS. This often leaves the local sewerage undertaker as the only viable, long term, adopting authority.

This is a role that Anglian Water has embraced for a number of years, and will continue to do so. However, there is no duty on the water industry to adopt SuDS on new developments, which in turn leaves developers in a position of risk, and which could stifle future growth.

Partnership Funding

There is great value in infrastructure providers working together in partnership wherever possible. As part of the Anglian Water AMP6 business plan, we allocated £8million to our innovative Partnership Funding Programme. This fund was included to allow local authorities and other bodies to apply for a portion of funding towards flood defence schemes that meet a set of criteria. This collaborative, innovative approach to funding has been a real success and we strongly encourage approaches like this to be promoted and incentivised by policy makers.

Removing the barriers to achieving a more circular economy (Question 28)

In our view, the key to achieving a Circular Economy is the success with which organisations (or sectors) are able to effectively function in synergy. Any regulatory or other barriers to multi-sector working in this area should be removed .

One area where we have made significant progress in relation to circular economy approaches is in biosolids. The biosolids produced from the water recycling process are a valuable product which underpins sustainable agricultural growth and contributes to the circular economy. However, it is important for farmers and consumers to have total confidence in the quality of the biosolids that help produce their food.

In response, the UK Water Industry developed a quality assurance scheme for sludge treatment and its subsequent recycling as biosolids to agricultural land. The primary objective of the scheme was to promote the acceptance of recycling biosolids through a process of risk assessment, operational controls, third party audit and stakeholder reassurance.

The Biosolids Assurance Scheme (BAS) Standard is based on regulations and best practice, and is audited by a third-party certification body to demonstrate that members of the scheme are conforming to its requirements. The resulting certified biosolids aim to instil reassurance to food chain stakeholders and the public that biosolids are safely and sustainably recycled to agricultural land.

As a whole, the scheme is currently being implemented by all water and sewerage providers, and it will apply to all sewage sludge destined for agricultural land. By February 2017, around 83% - 700,000 tonnes dry solids a year - will be certified for treatment, storage and application to land with a target of 100% certification by the end of 2017.

The UK Water Industry and Assured Biosolids Limited (ABL), which was incorporated in 2015, are currently in discussion with the UK Government to explore how the BAS can be used to facilitate free market trading in sludge, whilst maintaining quality standards that will continue to provide food safety assurance and protect the environment.

One potential barrier in other areas is the categorisation of useful materials as 'waste' by regulations. By deeming materials as waste, permits are required to transport or utilise it. This adds an additional layer of workload and can make the utilisation of these materials far less attractive in many cases.

We strongly support the formation and use of upstream partnerships to ensure that product development and use does not have unintended negative consequences for the circular economy that have not been foreseen. Examples of this are cosmetic and cleaning products that are labelled as 'flushable'. The negative impacts of these wipes entering the water recycling process is vast and can only be tackled through relationships, such as those we have developed with the British Retail Consortium and individual retailers, where we can work in partnership to identify win-win solutions. Anglian Water is leading work in this area through Water UK and is working with retailers to develop wipes and products that are truly flushable. We would then like to see the introduction of a regulatory standard, ensuring products marketed as flushable adhered to a set of criteria that meant they caused no damage to drainage infrastructure.

Equally important is the recognition that downstream markets could be opened up for circular economy purposes through an overhaul of the definition of waste. Currently Waste remains waste no matter what processes it enters until the 'end of waste' criteria is met, which is now harder than ever to demonstrate. It should be considered that a 'Secondary Resource' classification could remove items from waste regulation but still encourage recycled products into the market where End of waste is not achievable or demonstrable to the standards currently being laid out by the regulators. We are exploring opportunities to work with all regulators involved in this area to develop innovative ways to develop alternatives to waste and the associated regulations.

Anglian Water

February 2017

Arnold White Estates
LIMITED

February
2017

National Infrastructure Assessment

Call for Evidence

Response by Arnold White Estates Ltd

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“The National Infrastructure Assessment together with the new Modern Industrial Strategy can stimulate prosperity and strengthen Britain as a global trading nation. But grasping the opportunities of Brexit in full will require real change that harnesses the development process as a catalyst for growth; for quality homes and jobs, for a green and pleasant environment and for a fantastic quality of life.

“The moment is urgent and tinkering under the bonnet will not be enough. Instead, the NIA must be spear-headed by radical thinking on how the development process can be re-engineered to add maximum value to taxpayer investment that is coordinated across sectors, scales and institutions.

“Infrastructure planning is the golden thread running through individual and national prosperity. Brexit and the Modern Industrial Strategy are a once in a generation opportunity to add some real grist to how we plan to deliver this.”

[Name redacted]

[Job title redacted]

1.0 INTRODUCTION | THE NIA AND AN INDUSTRIAL STRATEGY FIT FOR BREXIT

1.1 Arnold White Estates Limited (AWEL) strongly welcomes the establishment of the National Infrastructure Commission (NIC) as a permanent executive agency, as well as the remit and ambition of the National Infrastructure Assessment (NIA) programme. There has long been a need for comprehensive long term infrastructure planning in the UK. The new arrangements, beginning with this Call for Evidence (CfE), are a once in a generation opportunity to **pull together strategic planning across governance levels to leverage real development outcomes**.

1.2 The NIA will become an indispensable tool for the Government as it grasps the opportunities of Brexit through its new Modern Industrial Strategy, securing our future as a global, competitive nation.[1] Current NIC streams of work address particular topics, including: our preparedness for 5G and telecommunication technology; and the Oxford-Cambridgeshire Corridor as a knowledge intensive cluster that competes on the global stage.[2][3] AWEL views the more comprehensive nature of the NIA, framed by Brexit and the new Modern Industrial Strategy, **as an invitation for a more fundamental review of the processes of the planning and development industry**.

1.3 The primary motivation for AWEL contributing to this CfE is to ensure that an opportunity for fresh thinking around the development process is not missed between a broad new industrial strategy and regional/sector specific proposals. **Ignoring or tinkering with planning policy and guidance will not secure maximum value from infrastructure investment.** Rather, a commitment is required, across Government departments, to strain every legislative sinew to shape an industrial strategy that delivers homes, jobs, prosperity and quality of life; that makes the very most of Brexit.

1.4 Leaving the EU provides broad scope for a far-reaching review of how we plan and build Britain. Our sights must range from the apparently quotidian (the infamous Great Crested Newt is omnipresent in the UK, but scarce on the continent and thereby protected by EU legislation), to the more radical (such as smoothing the path to planning consent for regeneration of former mineral extraction sites). **Brexit and the Great Repeal Bill are a watershed moment and should prompt a thorough review national planning policy and guidance.** A recent report by the Home Builders Federation argues powerfully that the Government should use the 18 months following the Brexit vote to "identify the areas of EU regulation that could be reformed, reduced or removed to help create the conditions for housebuilders to thrive and for the industry to deliver more homes in areas where they are

[1] *Building our Industrial Strategy*, Green Paper, Department for Business, Energy and Industrial Strategy, January 2017.
[2] *Cambridge-Milton Keynes-Oxford Corridor: Interim Report*, National Infrastructure Commission, November 2016.
[3] *5G Call for Evidence*, National Infrastructure Commission, May 2016.

needed."[4] We endorse this approach wholeheartedly and are strongly of the view that the NIA must be thoroughly involved in this grand task if the opportunities of Brexit are to be seized.

1.5 It is obvious, but important, to state that the NIA will reflect the priorities of the Government of the day, alongside its broader purpose to support sustainable economic growth, competitiveness and quality of life. In this respect, whilst planning the delivery of homes is not within the remit of the NIC, nor addressed by questions in this Call for Evidence (CfE), **a cross-sector approach to infrastructure cannot in practice be separated from Government policy to transform housing delivery and build new Garden Settlements.**[5] Indeed, failing to join up strategic planning of homes and infrastructure would both diminish the value of taxpayer investment and hamstring efforts to transform housing delivery; it would mean fewer homes and poor planning.

1.6 The CfE is clear that the various infrastructure sectors need to be tackled in a coordinated way, including; transport; energy; and communications, amongst others. In order to make the most of the opportunity that the NIA represents, long term planning across these sectors also needs to be plugged into the strategic question of where new settlements will be delivered. Indeed, this is strongly implied by Question 3 of the CfE; "*How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?*"

1.7 In line with the expertise AWEL has in promoting strategic housing and infrastructure, responses offered to the various CfE questions return repeatedly to this key question of how to join-up planning for homes and infrastructure. Arising from these responses is a series of suggestions for how a joined-up approach be achieved, including **suggestions for updating planning processes to derive maximum value from infrastructure planning and investment**:

1.7.1 Placing **Garden Villages** more strongly under the remit of the NIC or a regional proxy;

1.7.2 Creating **new streamlined regional governance arrangements and spatial planning powers**, bringing together everyone with a contribution to make.

1.7.3 Making **interventions in the planning system to unlock land value** and enable delivery of infrastructure, excellent communities and ecological benefits.

1.8 The following sections of this document respond to the question of the CfE (Section 2.0) before expanding on these answers through reflections on AWEL's experience of promoting land holdings in the Cambridge-Milton Keynes-Oxford Corridor ("The Corridor") (Section 3.0).

[4] *Reversing the decline of small housebuilders*, Home Builders Federation, January 2017.
[5] *Locally-led Garden Villages, Towns and Cities*, Department for Communities and Local Government, March 2016.

2.0 RESPONSES TO NIA CALL FOR EVIDENCE QUESTIONS

2.1 **CfE Question 1**: *What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?*

2.2 AWEL has a number of land holdings in the south Midlands, primarily in Bedfordshire and Buckinghamshire, along the southern part of the Cambridge-Milton Keynes-Oxford Corridor. Currently this area is the focus of attention from the NIC and is also subject to plans for significant infrastructure investment, including:

- East-West Rail, linking Cambridge, Bedford, Milton Keynes and Oxford: planning and funding of western section between Bedford and Milton Keynes is moving forward;
- Oxford to Cambridge Expressway: Highways England is preparing a study for the Department for Transport that will consider options to improve East-West connectivity by creating an Expressway standard route between Oxford, Milton Keynes and Cambridge;
- An A5/M1 link road (cost £162m[6]) is now being built, allowing a major urban extension at Houghton Regis North to be allocated;
- A large urban extension to the North of Luton is being proposed which requires a 2km major link road/northern bypass between the M1 and A6 (then on to the A505).

The region that AWEL is most familiar with therefore has a lot of infrastructure investment planned or in the pipeline. In a nutshell, the experience of AWEL is that opportunities are being missed to coordinate these investments to support sound strategic development decisions. For example: Garden Settlements recently announced by the Government at Aylesbury and West Oxfordshire seem somewhat disconnected from the planned infrastructure improvements; and the HS2 line crosses East-West Rail close to the Cambridge-Milton Keynes-Oxford Corridor, but no station is planned to make the most of this. Further comment is provided later in this document regarding the need for greater coordination of these various projects.

2.3 **CfE Question 2**: *How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?*

2.4 The NIC vision for the Cambridge-Milton Keynes-Oxford Corridor as a single, knowledge intensive cluster, illustrates how regional infrastructure planning will be essential in underpinning many of the 'pillars' identified in the new national industrial strategy, including:

[6] Highways England web site.

- Investing in science, research and innovation;
- Upgrading infrastructure;
- Developing skills;
- Cultivating world leading sectors, and;
- Supporting business to start and grow.

The various infrastructure projects in the pipeline in the South Midlands, as listed in response to CfE Question 1, will undoubtedly make the Corridor an even more attractive location for knowledge intensive businesses and thereby boost the UK's international competitiveness. Nonetheless, the chronic shortage of housing in the region is a very real threat to this ambition, compounded by the failure of local authorities to grasp the nettle and agree Local Development Plans that meet a robust OAN and satisfy the Duty to Cooperate.

World class businesses need world class places for clever, discerning employees to live in: excellent transport links, high quality homes and strong ecological credentials are all a must. The Corridor does not provide anywhere near enough in this respect and the planned Garden Settlements at Aylesbury and West Oxfordshire do not resolve the problem. At the moment, taxpayer value from planned infrastructure investments risks being diminished because the dots are not being joined between infrastructure and locally-led strategic housing planning.

2.5 **CfE Question 3**: *How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?*

2.6 Major infrastructure providers (e.g. Highways England, Network Rail, HS2, National Grid, the power providers and the Environment Agency) too often operate in parallel trammels to the town and country planning system. As a result, around the country infrastructure is either provided reactively, catching up with existing needs, or planning authorities use new infrastructure (a road, a railway line) to allocate new development. For example, the new A421 (part of a link between Cambridge and the M1) opened in 2010 and has led to housing growth proposals in the Marston Vale. It strikes us that there must be a better way to coordinate strategic housing provision and infrastructure, hand-in-hand, from the outset.

There never has been a 'national spatial plan' and, since the demise of Regional Spatial Strategies (RSS) in 2012/13, there is no longer a framework at that level. The RSS system did include infrastructure provision, even if this mainly featured the road system. **Appendix B** attached is an extract of the main transportation content of the 2008 Adopted East of England Adopted RSS. This is

a good example of how strategic spatial planning was previously used to integrate development and infrastructure.

So planning has always been a patchwork job, but with the advent of localism and the latest generation of local plans, the patches have got smaller and the threads holding it all together are more sorely tested. The current planning system is based on the local plans of individual LPAs - some 326 in England[7]. A small number of Authorities are producing joint Plans and there is a "Duty to Cooperate"[8] (original emphasis):

> *Public bodies have a Duty to Cooperate on planning issues that cross administrative boundaries, particularly those which relate to the **strategic priorities** set out in paragraph 156. The Government expects joint working on areas of common interest to be diligently undertaken for the mutual benefit of neighbouring authorities.*

The "strategic priorities"[9] include infrastructure:

> *the provision of infrastructure for transport, telecommunications, waste management, water supply, wastewater, flood risk and coastal change management, and the provision of minerals and energy (including heat).*

In practice, the Duty to Cooperate deals mainly with shared housing need in 'housing market areas', including accommodating unmet need in neighbouring urban areas where there is insufficient land available and no 'room to grow'. Importantly, it does not address the supporting infrastructure that must come with housing and it is clear to AWEL from its own experiences that this is a serious problem in the current planning system. A good example is how the two Local Plans of Luton and Central Bedfordshire are seeking to accommodate Luton's unmet needs, where there has been considerable disagreement between the two Authorities over many years.

Against this background, and as a result of the limitations of the Duty to Cooperate, the following are examples where infrastructure provision in the region has been fragmented:

- An A5/M1 link road was eventually agreed (cost is £162m[10]) and is now being built, which allowed a major urban extension at Houghton Regis North to be allocated - but there is little evidence that this was a coordinated exercise;

[7] LGiU data.
[8] NPPF 2012 para 178.
[9] NPPF 2012 para 156.
[10] Highways England web site.

- A large urban extension to the North of Luton is being proposed which requires a 2km major link road/northern bypass between the M1 and A6 (then on to the A505), for which there are no published proposals or known sources of funding;
- East-West Rail linking Cambridge, Bedford, Milton Keynes and Oxford is essential to serve new development. It has been under consideration for many years and the planning and funding of western section between Bedford and Milton Keynes is moving forward, albeit with little regard for proposed Garden Settlements at Aylesbury and West Oxfordshire;
- Oxford to Cambridge Expressway: Highways England is preparing a study for the Department for Transport which will consider options for improving and/or providing new road links within the study area that improve East-West connectivity to create an Expressway standard route between Oxford, Milton Keynes and Cambridge.

These infrastructure components seem not yet to be 'joined up' – not with each other and not with emerging Garden Settlement proposals - and there seems to be little coordination with the Local Plan process. That process for the Corridor is already grappling with finding locations and sites for some 100,000 new homes[11] and infrastructure provision is an essential component.

A parallel system between infrastructure and town and country planning is precisely the situation in the South Midlands; a gap in coordination has opened between regionally/nationally led intensive planning for infrastructure and locally-led planning for homes. This lack of coordination is compounded where the town and country planning system suffers from a lack of effective joint working between Local Planning Authorities. Respect for the Duty to Cooperate is patchy, as can be seen in the South Midlands where Luton, Central Beds and Aylesbury continue a game of pass-the-parcel regarding housing numbers. It should therefore be no surprise that a lack of coordination persists where LPAs are asked to lead on proposals for Garden Villages. Only a few generic references to East-West Rail, the Oxford Expressway or the Cambridge-Milton Keynes-Oxford Corridor are found in the Expression of Interest documents for the West Oxfordshire and Aylesbury Garden Settlements, giving the impression that coordination is embryonic at best.[12] [13]

Through the NIA, the NIC is uniquely positioned to improve coordination of infrastructure and development planning. It should assume new powers to bring infrastructure planners and providers together with of Local Plan makers and commercial promoters. In particular, the strong LPA lead required in proposing Garden Villages to the Government needs to reimagined, potentially via a new regional tier of inclusive plan making with a strong role for the NIC or a regional proxy.

[11] See appendices, AWEL response to *Cambridge-Milton Keynes-Oxford Corridor Call for Evidence*, May 2016.
[12] *West Oxfordshire Garden Village, Expression of Interest*, West Oxfordshire District Council.
[13] *Aylesbury Garden Town, Expression of interest*, Aylesbury Vale District Council.

2.7 **CfE Question 5**: *How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?*

2.8 In short, provision of new infrastructure assets has a broader, galvanising effect by encouraging private investment in redundant or tired assets. For example, delivery of the Liverpool Superport has transformed how the development industry views the Liverpool City Region and the corridor between Manchester and Liverpool, with boroughs such as St Helens now seeing huge interest from developers. Improvements to important link roads such as the M62 and A580 are following through the town and country planning system as part of the bargain.

This process can help communities forge an identity and grow organically, as seen with Milton Keynes, which benefits from an excellent location and saw its growth take off during a period when both the public and private sector "could get on with the job."

2.9 **CfE Question 6**: *What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?*

2.10 Regarding collaboration, the response to CfE Question 3 frames areas where greater collaboration would benefit the planning and delivery of infrastructure: better coordination between LPA-led development planning and national/regional infrastructure planning; and more effective cooperation between LPAs who too often seem preoccupied with minimising the number of homes required on their patch.

From the perspective of land promoters, including AWEL, decision making processes regarding planning large settlements and infrastructure can be frustratingly opaque and inaccessible; information is submitted in response to calls for evidence or consultations, and an answer emerges months later from a black box, with few opportunities for dialogue in the meantime. As a result, potentially excellent locations for new settlements, roads and energy projects are failing to make the LPA sift and it is hard for the commercial sector to understand why. In such cases the suspicion is usually that the process led by LPA officers is bogged down in the parochial and the political and as a result fails to have proper regard for regional strategic context.

It may be that new and streamlined regional governance arrangements, and possibly spatial planning powers, will be required to ensure that opportunities are not missed. Questions AWEL would like the NIC to consider include: What new forums could be set up to coordinate LPA and infrastructure planning? How can the development industry be positively engaged outwith the stale, opaque and politically burdened iterative process of local plan making?

2.11 **CfE Question 7:** *What changes in funding policy could improve the efficiency with which infrastructure services are delivered?*

New development can fund infrastructure provision through well-established mechanisms such as a Community Infrastructure Levy[14] or a 'Section 106' obligation[15]. In this way, development can provide sites and/or contributions towards delivering railway stations, roads, transport interchanges, schools, open space, community facilities, etc. In turn, repeated rounds of Growth Fund opportunities are channelled through LEPs to help bring forward projects that will specifically boost local economies and create jobs. Mitigation funding can also be requested from organisations such as HS2 Ltd where a proposed infrastructure development will impact a local area.

For example, AWEL is promoting land for development in Waddesdon, near Aylesbury. A bypass around the village, which would probably require AWEL land, has been identified as a priority by the LEP and features in the locally agreed Blueprint for HS2 mitigation. In response to the latter, AWEL has sought mitigation funding for the road from HS2, which will see a huge amount of construction traffic pass through the village. AWEL is also willing to invest in the new road as part of a wider development scheme. The site is also close to Westcott Venture Park, a major strategic employment site that has received Government support to establish itself as a major national and international centre of excellence for space technology, very much in keeping with the NIC vision for the Cambridge-Milton Keynes-Oxford Corridor.

Growth at Westcott is severely constrained by capacity issues on the adjacent A41, which runs between Bicester and Aylesbury and through Waddesdon. A Waddesdon relief road, wholly or partly funded by the AWEL development, would release the potential of Westcott Venture Park and facilitate linkages to the proposed Oxford Cambridge Expressway.

Despite the obvious synergies with regional and national priorities, all options for funding a relief road run via the County Council and District Council. The Growth Fund, HS2 mitigation funding and S106 contributions from a development partner are all being dismissed on the basis of political prejudice, without any proper scrutiny from people with a wider responsibility for planning and delivering regional infrastructure. Strong interventions and proper scrutiny from the NIC, or a regional proxy, would be required in this situation to derive maximum value from investment in the Corridor and prevent tax payers being cheated of value by parish politics.

[14] The Community Infrastructure Levy is a planning charge, introduced by the Planning Act 2008 as a tool for local authorities in England and Wales to help deliver infrastructure to support the development of their area. It came into force on 6 April 2010 through the Community Infrastructure Levy Regulations 2010.

[15] Section 106 of the Town and Country Planning Act 1990 (as amended), commonly known as s106 agreements, are a mechanism which make a development proposal acceptable in planning terms, that would not otherwise be acceptable.

In short, it can be the case that the money is there, and the mechanisms are in place, but a lack of sound regional planning diminishes return on infrastructure investment.

2.12 **CfE Question 8**: *Are there circumstances where projects that can be funded will not be financed? What Government interventions might improve financing without distorting well-functioning markets?*

2.13 With reference to the response given to CfE Question 7, there will be many circumstances across the country where infrastructure projects that could be funded by the private sector, to the benefit of local people and the taxpayer, are frustrated by political prejudice or inertia on the part of LPAs. Addressing this may require interventions by Government in governance arrangements that tie together locally-led development planning and regional-led infrastructure planning. Where significant capital investment in a region is promised, as is the case in the Corridor, taxpayers would benefit from a new regional form of inclusive plan making, with a strong lead from the NIC or a regional proxy and proper dialogue with commercial partners.

2.14 **CfE Question 10:** *What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered efficiently and on time?*

The response to Question 7 refers to existing funding arrangements for infrastructure, including by way of Section 106 undertakings or through the Community Infrastructure Levy. AWEL's experience has been that Highways Authorities and other providers of infrastructure often get entangled in a myriad of regulations (e.g. Section 278 Agreements and similar instruments) which not only slow down the provision of infrastructure but often also increase the cost of delivery to the extent that it becomes unaffordable.

Broadly speaking, developers should be encouraged to take on the task themselves rather than relying on Statutory Authorities (and their consultants) frustrating provision with increasing levels of bureaucracy and cost. Developers should have 'step-in rights' to deliver infrastructure and then 'sell' the completed works to Authorities at cost plus interest. Allied to this, and to ensure that infrastructure schemes are not frustrated by delays in the planning process, deemed consents should be available where schemes are approved at a higher strategic level. LPAs would need to start building or face the prospect of others doing it for them. Needless to say, this would require a new regional arrangement for planning strategic settlements and infrastructure, the need for which is asserted throughout this document.

In addition, development that facilitates infrastructure, such as the example at Waddesdon described above, should be recognised as being of significant importance in the 'planning balance' and significant weight afforded to it so as to encourage the granting of planning permission.

2.15 **CfE Question 11**: *How should infrastructure most effectively contribute to protecting and enhancing the natural environment?*

CfE Question 12: *What improvements could be made to protecting and enhancing the natural environment?*

2.16 Answers to previous questions in this CfE explore the relationship between strategic settlement planning and strategic infrastructure planning. Government support for Garden Settlements envisages self-sustaining places with quality and good design hardwired in from the outset.[16] Also at the heart of the Garden Village agenda is the creation of green and pleasant places with real ecological benefits.

Against this background, Brexit and the forthcoming Great Repeal Bill offer an opportunity for a fresh look at the planning process as a means of leveraging excellent development outcomes. We need to look again at all of the pettifogging rules that stop development happening, or happening well, or happening quickly. For example, Great Crested Newts are rampant in the UK, but protected nonetheless on the basis that they are scarce on the continent; lessening the protection given to them will speed up many schemes. This is one example, but there are many more, from badgers to bats. We suspect that most figures involved in planning and building in the UK are familiar with these issues and will agree that the planning balance needs to be interpreted differently than it currently is.

Nonetheless, it would be easy, but wrong, to buy-into a false choice between ecological benefits and loosening red tape; instead, there is an opportunity to replace pre-Brexit legislation with smart legislation that will unleash development *and* significant ecological benefits. Engineering new communities brings innumerable opportunities to enrich the environment and boost biological diversity; for example, low grade farmland may look pleasant but is often ecologically poorer, and much less accessible to the public, than lakes, forests and meadows featured in a well-designed green community. In this respect Garden Villages are a big step forward in the tasks of marrying development to ecological value and public enjoyment of the countryside and wildlife.

AWEL therefore agrees wholeheartedly that Garden Villages should be encouraged. Responses to previous questions have covered how coordinating the location of Garden Villages with infrastructure planning will benefit communities, businesses and the new Modern Industrial Strategy. AWEL also

[16] *Locally-led Garden Villages, Towns and Cities*, Department for Communities and Local Government, March 2016.

recommends that consideration is given to making better use of mineral extraction sites as locations for Garden Villages. Appendix D of this report includes a briefing note on this matter that has been shared with DCLG previously and discussed at a meeting with Mr Nico Heslop and Mr Ben Llewellyn.

Precedent exists for former mineral extraction sites being reinvented as new settlements (for example, Chafford Hundred in Thurrock, Ebbsfleet in Kent and St Austell in Cornwall). Making use of manufactured and disrupted landscapes has the double ecological benefit of reducing the pressure to build on untouched landscapes, whilst also bringing opportunities to manufacture ecologically rich environments that are accessible to the public. As an experienced quarry operator, AWEL can attest to numerous examples in the South Midlands of former, current or planned extraction sites that could accommodate Garden Village style and scale settlements, whilst plugging into the massive investment in infrastructure being planned for the area.

As argued in response to previous questions, in the event that the Government was minded to smooth the path to planning consent for new settlements on extraction sites, the sort of strategic vision needed to make the most of this opportunity would arise only from renewed spatial planning governance arrangements and powers.

2.17 **CfE Question 13**: *How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?*

2.18 As Garden Settlements mature, the vision set out by the Government suggests that they should become self-sufficient communities rather than dormitory towns. This will be more successful in some cases than in others; proposed new settlements near strong urban centres will unavoidably have a dormitory function; for example, see recent of expressions of interest for Garden Villages at Dissington, near Newcastle, and Handforth, near Manchester. In other areas, such as the Cambridge-Milton Keynes-Oxford Corridor, more of a balance may emerge; new Garden Settlements would help meet the need for housing in, say, Luton; and new technologies will allow employees of knowledge intensive industries to work from home more effectively, or in smaller premises in village and town centres.

2.19 Despite the self-sufficient vision of Garden Settlement communities, and the progress of mobile and virtual working practices, it will surely remain important well into the future for new communities to be served by strong transport infrastructure connecting to wider regional economies; roads, railways, fibre-optic cables. The ability to commute into urban centres will remain particularly important for manual, often lower paid roles, making good transport infrastructure essential to supporting mixed and inclusive communities.

2.20 As an example, in developing proposals for a Garden Village settlement at Checkley Wood in Central Bedfordshire, AWEL has retained a strong regard for the existing links between resident workforces and employment areas. It is also cognisant of the unmet housing need in Luton, which Checkley Wood is ideally positioned to meet as part of the Luton HMA. AWEL proposals for Checkley Wood are developed to complement ongoing infrastructure development, such as the A5-M1 Link Road, and plug into public transport initiatives such as the Luton Guided Bus Service. In short, the vision of self-sufficient Garden Settlements and the ongoing evolution of new technologies should not be blind to such practical strategic planning considerations.

2.21 **CfE Question 14**: *What are the highest value transport investments to allow people and freight to get into out of and around major urban areas?*

CfE Question 15: *What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?*

2.22 Provision of a variety of quality transport links should be an essential part of dynamic, joined up planning from the outset, otherwise opportunities to build in greater connectivity will continue to be missed. One example is the missed opportunity to make provision for an interchange between HS2 and East-West Rail, located in the Cambridge-Milton Keynes-Oxford Corridor. National infrastructure processes such as the evolution of HS2 and localised planning processes should also be plugged together, for example; a broader view could be taken of mitigation funding to seek opportunities to unlock other infrastructure projects; and regional plans such as the Greater Manchester Spatial Framework should co-evolve with proposals such as HS2 and Northern Powerhouse Rail.

2.23 **CfE Question 19:** *What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?*

CfE Question 20: *What does the most effective zero carbon power sector look like in 2050? How would this be achieved?*

2.24 Many developments incorporate ‘green energy’ features such as ‘solar panels’ on roofs but these are often inconsequential when viewed against the more pressing needs to reduce carbon emissions. Large scale development should be encouraged to incorporate power generation infrastructure as a fully funded component of the overall scheme.

Such an approach, however, needs bold decision making and an acceptance that such radical and necessary provision may need Authorities to have a different view on the “planning balance”. There should be a presumption in favour of significant energy generation schemes – say over 1.5Mw - particularly so where these are designed as “emission offsets” in an integrated approach.

The present system does not work, bogged down as it is in tenuous objections, often judgemental and contrived, on visual, ecology, landscape, archaeology and other grounds. By moral force these arguments assume a 'planning weight' of their own that provides the decision makers with little alternative other than to refuse applications. A presumption in favour of granting consent would address this imbalance and encourage promoters to advance full integrated schemes.

Incorporating significant energy generation schemes in new Garden Settlement proposals would greatly complement the better coordination of housing planning and infrastructure planning championed in this document. AWEL has already adopted this approach by seeking to link large scale wind turbine energy output to proposed development at sites at Aylesbury[17] and at Heath and Reach near Leighton Buzzard where all the energy feeds directly into the local 11kV grid thereby ensuring that 100% of the renewable energy generated is consumed locally[18]. Needless to say, it would be more efficient and effective if the development of these energy schemes and new communities were mutually integrated from the outset, rather than proceeding in a piecemeal and retrospective fashion as a result of the failure of the relevant Local Plans.

AWEL is promoting development at a proposed 'Checkley Wood Garden Village' north of Leighton Linslade in Central Bedfordshire. A second turbine is likely to feature as part of an integrated proposal that will provide a new settlement of some 4500 new homes, supporting infrastructure and the real possibility of a biomass-fired neighbourhood heating network.

2.25 **CfE Question 27**: *Are financial and regulatory incentives correctly aligned to provide sufficient long term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?*

2.26 Rapid changes to Government initiatives, such as feed-in tariffs, stifle innovation and do not address some of the historic landfill legacies. Greater certainty and clarity of responsibility is needed if these issues are to be addressed. The technology and engineering solutions are there, but what is lacking is innovation in the governing statutory processes. This can only be addressed through pro-active, bold and determined government action. There are many anecdotes of where a lack of clear responsibility and direction is detrimental; in one case an old industrial building, containing both bats and asbestos, collapsed after various controlling authorities refused to act until appropriate consents were required. Bats died and asbestos pores were spread far and wide.

[17] Planning Appeal allowed 19.3.12 APP/J0405/A/11/2155043, AVDC ref 10/00136/APP.
[18] Planning permission 30.3.11: CB/10/03034/FULL, Double Arches Quarry, Eastern Way, Heath and Reach, Leighton Buzzard, LU7 9LF. Erection of a 2.3 MW wind turbine.

3.0 CASE STUDY | LESSONS FROM THE CAMBRIDGE-MILTON KEYNES-OXFORD CORRIDOR

3.1 AWEL is a development company with land interests in the Cambridge-Milton Keynes-Oxford Corridor, which have the capacity for some 10,000 homes and other development and the potential to make a substantial contribution '*to meet existing and expected housing needs'* and *'spread the benefits of economic growth along and beyond the corridor*'.[19] Details of these land holdings are not listed in detail here but can be found appended to this report, as part of the AWEL response to the Cambridge-Milton Keynes-Oxford Corridor Call for Evidence. It provides context for a case study that expands upon the responses to the CfE Questions.

3.2 The Interim Report into the Corridor by NIC makes compelling reading and provides a very welcome clear direction for how this 'growth corridor' should be planned with NIC/Government involvement. It is also heartening to see it give significant emphasis upon Garden Villages, as well as upon the need for urgent and substantial additional housing as key, alongside infrastructure provision, to realising the potential of this English 'Silicon Valley'.

3.3 The DCLG prospectus for Locally Led Garden Villages, Towns and Cities (first published in March 2015) has resulted in many expressions of interest from local authorities, with 14 successful bids announced in January 2016 and further rounds anticipated in 2017. The Interim Report into the Corridor is a useful case study of the importance of connecting the **locally-led** Garden Village agenda to the **national/regional remit of the NIA**.

3.4 The NIC has published the **Interim Report on the Cambridge-Milton Keynes-Oxford Corridor** with a strong and positive message about future housing/development/infrastructure strategic planning for this important corridor, which covers an extensive area between these cities including Local Authority areas of Aylesbury Vale, Bedford, Central Bedfordshire and Luton.[20] In its Interim Report, the NIC responds in many respects to its own questions in the current call for evidence, in a manner that supports many of the arguments presented in this document. Rather than quote at length here, relevant extracts are appended to this document.

3.5 The NIC view that infrastructure investment must be "properly aligned with a strategy for new homes and communities" is strongly welcomed by AWEL, as is the recognition that "current governance mechanisms are not sufficient to deliver the step-change in strategic leadership and collaboration needed." There is currently a spatial planning void regarding strategic housing that has insufficient

[19] *Cambridge-Milton Keynes-Oxford Corridor Call for Evidence*, National Infrastructure Commission, May 2016.
[20] *Cambridge-Milton Keynes-Oxford Corridor: Interim Report*, National Infrastructure Commission, November 2016, paras 1.3, 1.5, Fig 1 and Fig 9.

regard to a broader context of major infrastructure. The NIA should be viewed as an opportunity to make progress on this point, recommending new ways to bring together local authorities, commercial voices and regional actors to plug strategic housing planning into infrastructure planning and thereby leverage real development outcomes.

3.6 In turn, the NIC Interim Report indicates that more housing, in addition to that identified by Local Authorities, is required to meet the rapid acceleration of housing need that will result from investment in the Corridor. The AWEL response to the NIC consultation on the Corridor (see appendix) includes a table showing the scale of the housing shortage in the area. Whilst there are 'commitments' for some 106,000 homes, Local Plans must make provision for some 110,000 more. In short, much more house building is needed in the Corridor, well beyond what the local authorities are allowing in begrudged and belated acceptance.

3.7 An essential message of the Interim Report seems to be that, if the Corridor is to be a success, much more housing is required. Given the direction of Government policy it seems appropriate that this delivery is through urban extensions and new settlements; AWEL's long experience in the area reveals opportunities for such schemes. Given the historic reluctance of authorities to build enough homes, and particularly to accommodate additional housing need arising from Luton, it is hard to see how enough homes can be planned in the Corridor under current spatial planning arrangements. AWEL considers that the required new homes must be co-promoted and integrated with major infrastructure, via new and streamlined regional governance and spatial planning arrangements, drawing together: the NIC and other Government Agencies; Local Enterprise Partnerships (LEPs): land promoters and house builders; and Local Government.

3.8 Garden Villages are an opportunity to provide the glue that brings together LPA planning and national infrastructure planning, delivering the coordinated strategy that the NIA seeks to promote. Whilst Garden Villages are self-contained communities that come with their own infrastructure, the Interim Report also makes clear the obvious point that they also sit within, and will enrich, a regional economic context and thereby multiply the value of major infrastructure investments. As such, it is impossible to realise the maximum value of investments in transport, energy and the rest, without **locating new settlements strategically** with respect to these planned investments. In the experience of AWEL, if this process is left to LPAs, it will result in missed opportunities to get the most value from investments in the Corridor.

3.9 The Localism Act and NPPF have re-engaged communities in planning and prompted LPAs to plan for the future. Whilst progress in this respect is uneven and unpredictable, in many cases it is resulting in ambitious local plans being agreed with growing community consent. Nonetheless, at the margins and in some instances, another consequence of the new localism has been that strategic economic

planning fails across governance boundaries. Indeed, some safeguards in this respect are variously put in place by the activities of LEPs, Combined Authorities and the NIC itself, for example in the Cambridge-Milton Keynes-Oxfordshire Corridor.

3.10 Overall, the AWEL experience of promoting strategic land in the South Midlands highlights the risk that regional infrastructure planning will be disconnected from local plan making, resulting in missed opportunities to deliver new settlements and compounded by failures of the Duty to Cooperate and delays in agreeing local plans. The Corridor is at risk of being an example of taxpayer value being circumscribed by overlapping governance arrangements and a **lack of coherent spatial planning**.

3.11 The duty for LPAs to cooperate with one another, even when successful, does not cover infrastructure planning and does not therefore extend to the sort of long-sighted, pro-active planning needed to unlock transformational development. It may be that a more strategic approach emerges in some cases across the country, but it is only tending to happen where a centralised and stable city region takes a lead on a unifying spatial plan. Where there is no clear urban centre, or where party politics is livelier, this will be more difficult; but no less important, particularly in areas such as the Cambridge-Milton Keynes-Oxford Corridor that are in line for huge investment. The NIA is an opportunity to provide focus and leadership in such instances.

3.12 Crucial to making this work will be how the recommendations of an NIA come to life at levels of local government where strategic decisions are made regarding economic development. LPAs will continue to assess and allocate housing growth within (and to a degree across) their administrative boundaries, as is proper and democratic. Nonetheless, decisions with strategic consequences must tie in properly with infrastructure decisions made at a national and regional level, otherwise opportunities to link infrastructure to strategic housing will be lost.

3.13 AWEL is liaising with the Department for Communities and Local Government (DCLG) on proposals to give sites with existing mineral extraction consents, in strategically significant locations, preferential consideration as locations for Garden Villages in the planning system. The Cambridge-Milton Keynes-Oxford Corridor provides examples (which will be replicated across the country) of opportunities to deliver new Garden Villages, in strategic infrastructure locations, on land that has previously been disturbed and which cannot therefore be considered greenfield in the common sense way as generally understood. A report prepared by DCLG by AWEL, in conjunction with the Home Builders Federation (HBF).

3.14 Prioritising Garden Villages on well-connected, manufactured landscapes, will create new opportunities to link up strategic housing and infrastructure planning, whilst reducing the pressure to develop untouched Green Belt land. It will also bring a further host of ecological benefits by making

use of the frequent abundance of water at such sites to develop rich and varied habitats, as well as efficient use and recycling of local water resources.

3.15 Smoothing the path to planning consent for regenerating former quarries is just one example of how changes to planning policy or guidance can unlock land value and investment in infrastructure. There will be many others. For the purpose of this report, the main point is that to gain the benefit of any such change, current spatial planning arrangements in the Corridor, and potentially elsewhere, are wholly inadequate and in need of reinvention.

4.0 SUMMARY AND RECOMMENDATIONS

4.1 The confluence of the NIA, Brexit and the forthcoming Great Repeal Bill provides a clean slate for Government to **revisit regional governance arrangements and national planning practice and guidance** as **tools for enabling excellent development**. In particular, in this unique moment the NIA should seek practical solutions for strengthening the relationship between *locally-led* planning for new homes and settlements and *regional-led* planning for infrastructure.

4.2 Tinkering with planning governance arrangements will be no more than moving the furniture unless we also review planning policy and guidance. A new approach to regional spatial planning without a refreshed policy context would have the same limited toolkit as before. In turn, new planning powers and freedoms for LPAs could lie idle and opportunities be missed unless a new role is found for regional planning and the NIC. The ultimate aim must be to build quality communities in the right locations to make the most of infrastructure investment.

4.3 AWEL offers the following specific recommendations:

4.3.1 **Garden Villages** are the glue holding together *locally-led* planning for homes and *regional-led* planning for infrastructure and should therefore fall under the remit of the NIA. The 'locally-led' element of the Garden Village programme should be reinvented to give a stronger role for the NIC or a regional proxy;

4.3.2 Successful infrastructure investment requires **new and streamlined regional governance arrangements and spatial planning powers**, bringing together: Government Agencies such as the NIC; LEPs; commercial voices; and Local Government.

4.3.3 Following the Great Repeal Bill **interventions in the planning system should be made to unlock land value and enable delivery of infrastructure, excellent communities and ecological benefits.** One example promoted by AWEL is to smooth the planning path to regenerating mineral sites as new Garden Settlement communities.

The National Infrastructure Assessment – Call for Evidence

About Arqiva

Arqiva is a communications infrastructure and media services company operating at the heart of the mobile and broadcast communications industry. Arqiva provides infrastructure for television, radio, mobile and other wireless communication in the UK.

Arqiva operates shared radio site assets throughout the UK working with the mobile industry for over two decades and with a significant presence in suburban and rural areas. Our portfolio includes over 8,000 active mobile, radio and television sites.

Arqiva worked with DCMS to build new shared sites in ‘not-spots’ as part of the Mobile Infrastructure Programme (MIP). We also extend the MNOs’ coverage and capacity into challenging environments such as Canary Wharf and the ExCel Centre.

Arqiva is building a national Internet of Things (“IoT”) network, starting with 10 of the UK’s largest cities. Our smart metering service, connecting 10 million homes using long-range radio technology, will be one of the UK’s largest machine-to-machine deployments.

Arqiva is a founder member and shareholder of Freeview. We broadcast all eight Freeview multiplexes, are the licensed operator of four of them. Arqiva is the licensed operator of both national commercial DAB digital radio multiplexes.

Arqiva is a major player in the UK’s satellite industry, and is a major provider of permanent satellite services to both Freesat and Sky customers. Arqiva also provides global satellite based services to the security, oil & gas and exploration sectors.

Arqiva is owned by a consortium of long-term investors and has its headquarters in Hampshire, with major UK offices in London, Buckinghamshire and Yorkshire.

Response to questions

Arqiva welcomes the opportunity to respond the National Infrastructure Commission's (NIC's) call for evidence to provide input into the development of National Infrastructure Assessment. We responded in detail to the NIC's consultation on 5G and many of the points we made, and the evidence that we provided, are also relevant to this all for evidence. We have not sought to repeat them in full here and so we include our earlier response as Annex 1. Instead we have sought to provide a focussed response on the questions in this call for evidence where we have particular experience.

Cross-cutting issues

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

In its *Connected future* report on 5G and telecommunication technology the NIC looked at the specific issue of the international competitiveness of the UK's mobile industry and made recommendations for what the UK needs to do. Those recommendations should be taken forward to help make the UK a world leader in 5G.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

Small cells already play an important role in the continued deployment of 4G networks and the increasing data capacity that is vital to mobile connectivity. In order to deliver 5G services to mobile users there will be a need to deploy small cells on a scale not previously seen in the UK. Hundreds of thousands of small cells are expected to be rolled out in London alone and over a million will be required across the country.

Small cell deployment in significant numbers will require the use of buildings or other structures, such as lamp posts and other suitable street furniture. As it stands there are challenges to businesses in getting the planning permission that they need in order to roll out small cells.

As the NIC noted in *Connected Future,* Local Authorities and LEPs should enable the deployment of small cells in urban centres (including prioritising digital infrastructure in local planning policy and looking at using local government assets). As part of this, the planning regulations in urban conservation areas should give the same freedom as in other area to allow the cabinets that allow the fibre that is critical to support 5G.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

In the mobile industry sharing passive infrastructure has been established for many years and it occurs across the world. Among the many benefits of sharing passive infrastructure is that it reduces the environmental impact. Specifically, the environmental impact of fewer masts in the same location means:

- Less energy used to run the infrastructure and deliver the service in that area
- Less material used to build the infrastructure
- Less visual impact for the local community

Importantly the benefits to the environment and the cost savings can be delivered through sharing at the *passive* infrastructure level while maintaining all of the benefits of competition between the mobile operators at the *active* infrastructure, and the spectrum, level.

Digital communications

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

In *Connected future* the NIC has already done a lot of work to look at what is needed to secure digital connectivity across the country. Key amongst this is ensuring that there is the fibre in place to support 5G and looking at coverage obligations.

When it comes to passive mobile infrastructure the specific technology roadmap for what will be deployed on that infrastructure is less relevant that ensuring that there is infrastructure in place to allow wireless technologies to be deployed. There is evidence from multiple sources (as the NIC previously identified) for rising demand for data being delivered wirelessly. This results in a need for more mobile infrastructure. There will need to be more masts in rural areas to extend the benefits of mobile to all, and there will also need to be additional infrastructure to improve coverage on transport routes such as road, rail and on the underground.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

In terms of delivering communications where it is needed the NIC has already identified that there needs to be better coverage of road and railway lines. In order to deliver this it will require the public sector to make it possible for industry to use the masts, poles, ducts, power supplies and the fibre beside motorways and railway lines.

Furthermore it will be important that the business rate regime supports the roll out of new mobile infrastructure including small cells and outdoor WiFi access points. The government has already announced 100% business rate relief for new fibre and this should be extended to mobile.

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National Infrastructure Assessment

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10 February 2017

NIC Consultation Team

National Infrastructure Assessment Call for Evidence

A contribution to the National Infrastructure Assessment Call for Evidence.

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

In general, it is important to a degree of understanding around regional circumstances, city challenges, and potential for competitive advantage. In the longer term to 2050, the question is extremely difficult to answer with any degree of specificity at all given the potential for technological advances to reshape local economies entirely.

However, we believe the best strategy for maximising value must be one that utilises investment to create a flexible framework for growth, innovation and placemaking, backed by the hard and soft infrastructure of property, mobility, skills and digital connectivity. London has demonstrated a good example of long-term thinking in this area in the London Infrastructure Plan [1]and the World Economic Forum [2]has completed a number of reports that illustrate the power of systems thinking in this area, eg the WEF Competitiveness of Cities Report[3].

[1] London Infrastructure Plan: https://www.london.gov.uk/file/22098/download?token=XZV8z8Az
[2] WEF Competitiveness of Cities Report: http://www3.weforum.org/docs/GAC/2014/WEF_GAC_CompetitivenessOfCities_Report_2014.pdf
[3] WEF Competitiveness of Cities Report: http://www3.weforum.org/docs/GAC/2014/WEF_GAC_CompetitivenessOfCities_Report_2014.pdf

At the global level, there are some more general principles that may be helpful in developing a regional framework for considering the long-term value of infrastructure. For example, we know that cities are competing for investment and talent against global competition, not just UK competitors. Therefore, an assessment of how particular investments will add to the attractiveness and liveability of a city will be critically important to successful and sustainable developments.

Equally, each region must consider the scope for developing potentially useful competitive advantages, whether that is drawing on heritage, geographic relationships with strategic supply chains or favourable skills and demographics. Skills are clearly vital for any kind of sustainable growth. This requires an understanding of the demographic potential the city or region and an assessment of the educational potential of a particular region, as well as creating the incentives and tools to bolster the skills base and long-term capacity for growth.

The key is to develop a coherent vision that considers the eco-system of the city or region as a holistic system to offer a clear strategic direction of travel that maximises the benefits from the available investment within an adaptable, economically and socially resilient region.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

Connectivity – both physical and virtual – is a key component in driving competitiveness for trade and services, but the link between the two elements has to be far better understood and this is an area that is ripe for further research. Given the broad range of potential benefits inherent in considering wider connectivity it is well worth exploring how broad a scope to draw for a transport project, for example, as a catalyst for regeneration as well as a means of driving increased supply chain efficiency.

What we do know is that poor infrastructure and issues such as congestion act as brakes on growth, e.g. by tying up goods and increasing the demands on working capital or reducing access to the available labour pool.

It is also clear that if the UK is to compete on the world stage, then global connectivity hubs are critical, both for freight and passenger transport, although it is important to note that a mode agnostic approach will provide a better foundation for exploring the optimal connectivity solution from the options available.

For a competitive UK, infrastructure has to provide accessible, affordable, convenient, resilient, and reliable links between producers, markets and services. It is also important to recognise this is just as true for local networks as it is for regional and international links. So again it is critical to look at challenges and infrastructure solutions on a network basis, understanding the co-dependencies and potential for mode shift as costs fluctuate.

The UK has the potential to exploit our technical ability in areas such as ITS (Intelligent Transport Systems) to boost competitiveness and policymakers can help by creating the appropriate data frameworks and protocols on sharing and security.

[Aspects of all these issues are covered in Arup's Cities Alive[4] series.]

[4] Cities Alive: http://publications.arup.com/publications/c/cities_alive_cards

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Too often, planners focus on outputs in the form of a new railway station, trunk road or interchange, rather than the opportunities to create positive outcomes such as improving health, fostering economic regeneration or creating resilient communities.

In a globally competitive world, cities and regions will have to find new ways to align infrastructure investment with the need to create attractive places where actively people choose to live, work and raise families, providing a sense of place and belonging alongside jobs and transactional economic benefits.

This means creating a secure, attractive environment that offers easy access to work and services. And if we start to address the wider issues at the concept stage, infrastructure investment can become a vehicle for addressing issues of health, social exclusion, safety, and environmental quality as well. Viewed through this lens, a new railway station becomes the driver for affordable housing provision or an opportunity to increase city density and reduce environmental impacts by encouraging walking and cycling.

Equally, we must recognise the importance of infrastructure in driving development and regeneration. Without the necessary energy or drainage systems, commercial and residential schemes will not progress, so it is critical to view infrastructure as a prerequisite to sustainable growth and look at investment and development issues in the round.

Fundamentally we need to plan for people in the broadest sense, not just planning for systems and outcomes that can – in the worst cases – act as a physical barrier between communities themselves. This means effective land-use policies that spur growth, and encourage lower carbon, higher density, development.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

The history of road pricing proposals in the UK and regular rows over peak rail fare pricing underline the practical and political sensitivities around demand management. The principle is important in reducing congestion across modes and making infrastructure more efficient. However, the limits will fluctuate with a more general sense of economic prosperity across the country and perceptions of unfairness and inequality.

Considered sensitively, demand management can be a useful tool in driving efficiency and maximising returns for operators, but systems have to be both flexible and adaptable to respond to economic and political shifts and this has implications for capital returns and risk.

Specifically on energy, demand management can play a critical role in enhancing system resilience and meeting the UK's climate change obligations. Here, the challenge is

providing incentives that prompt marginal demand reductions. Behavioural economics may present some useful insights in this area, but more work needs to be carried out to test the potential.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

There are a host of life-cycle capital and cost management techniques and tools readily available to asset managers to assess this issue. Every day, asset managers model the discounted cost of replacing a sewage pipe with re-lining the sewer, for example.

It is, however, important to understand the parameters and limitations of the tools in use. For example, any given total life cycle cost technique may be perfectly acceptable from a technical standpoint for one owner, but another may have view the stewardship of the same asset over a different timeframe and make a different decision, while a third party may be indirectly affected by disruption.

Despite the sophistication of the tools available, interdependencies between third parties and other externalities make it essential that this decision is based on a clear vision for how the broaden socio-economic environment will benefit.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Aside from the obvious and reasonable limits on anti-competitive behaviour, there is a view in the industry that collaboration on innovation across the supply chain is made more challenging by fairly rigid procurement processes that favour lowest cost ahead of arguably riskier approaches that promote innovation.

Similarly, taking a full life cycle approach to cost and value is made more challenging by the split between capital and maintenance budgets. So there is certainly scope to encourage and incentivise innovation, efficiency and value for money through the procurement process, assuming clients are willing to take on perceived higher investment risks against uncertain innovation gains. It is easy to understand why many are not given the scale, scope and high profile nature of so many of the projects where the potential gains are greatest.

That said, positive steps are being taken at an industry-wide level though in areas such as BIM, ITS and through the various Catapults and this is certainly to be encouraged. But clients – particularly in the public sector, but also private – have to be prepared to play their part in fostering early engagement with consultants, contractors and suppliers and sharing the benefits of true collaboration on innovation. This type of Total Design thinking is hardly new, but implementation requires close consideration of the balance between cost and long-term value in the procurement process.

In the meantime, encouraging ‘innovation exemplars’ and accepting a degree of additional risk on specific projects within larger client organisations could provide an acceptable route toward accelerating innovation, while managing reputational and financial risks.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

At present, there is a strong market appetite for operational infrastructure assets and a large number of funding organisations on the lookout for opportunities that provide long-term, relatively low risk income streams that match long-lived liabilities elsewhere.

This provides opportunities for government – and, theoretically at least, very large-scale institutional players – to take on larger pools of early stage feasibility, development and construction risk in return for a small share of returns on large-scale infrastructure assets that pass through the various challenges to operation.

Conversely, there is a degree of wariness around financial solutions that leave risk with the consumer / taxpayer while delivering secure returns to investors.

Encouraging the development of 'open book' pilot schemes that build the confidence of clients and the public while leaving room to share cost savings from innovation, for example, could provide the necessary momentum to shift the balance toward greater acceptance of innovative financing programmes, rehabilitate PPP (and similar) as a funding technique, and secure greater private sector involvement in long-term investment.

Handled well, approaches that recognise the power of pooling effects for the financially smaller, but higher risk, early stage tranches of pre-feasibility, feasibility phases, could also help make enhance the prospects of infrastructure as an asset class, as well as fostering a move toward whole life costing for infrastructure schemes that recognise the inherent design trade-offs between capital and lifetime maintenance costs.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

One reason for the disconnect between funding availability and project financing is that the pension funds and insurance groups that are often most interested in owning infrastructure assets to match against long-term dated liabilities are, quite rightly, somewhat risk averse.

The gap is widest at the early stages of project development – pre-feasibility and feasibility – but it can be bridged. Here is where government has a potential role to play, providing support and incentives at the riskier earlier stages of infrastructure pipeline. Achieving positive outcomes will require collaboration between government and major institutions to explore the potential for incentivising risk pools at scale in the early stages of infrastructure and green projects. However, we have seen the challenges posed in the development of the Green Infrastructure Bank, so there are ready lessons to learn.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

Infrastructure systems are often interdependent and recognising the need for resilience and redundancy is the hard edge where cost and value have to be balanced. It is true of transport networks, energy or water systems and it requires a rational and probably far better informed approach to risk, redundancy and resilience.

The best way to ensure that trade-off is rational and balanced is to develop and improve our understanding of risk, availability and performance, examining infrastructure failure scenarios and deriving resilience strategies that attract risk-adjusted investment. In building our understanding of these scenarios, we should be able to better value the costs and benefits of redundancies in the system.

Needless to say, any infrastructure chain is only as strong as its weakest link. Understanding this point will become more critical as infrastructure faces greater risks from extreme weather events and digital systems become more pervasive and potentially subject to cyber-attack and it will be up to the regulators to keep up as systems evolve.

Arup and others have developed the Resilience Index [5]to help surface many of these interdependencies and promote appropriate responses

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

As a general rule, the UK has been improving in terms of major infrastructure project delivery on time and on budget. Yet despite successes such as the London Olympics, Heathrow T5, or the Queensferry Crossing, development and construction remains a relatively high-risk endeavour and there is clearly room for improvement.

The factors that help ensure successful projects include strong governance, smarter clients, experienced project management teams, a clear and common understanding of scope, shared objectives and a learning environment that is flexible to accommodate the potential to evolve.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Generally speaking, current guidance and policy thinking is reasonably well developed. However, there are clearly instances where enforcement mechanisms are not functioning as they should and we are letting ourselves down on what we can do protect the natural environment. Fundamentally, an attitudinal shift is required whereby meeting policy standards becomes the norm, as opposed to a list of options for debate. For this to happen, mandatory requirements, potentially in the form of green space 'factor' schemes (such as are in place in Berlin and Malmo), could be developed and used with the support of ecological expertise within planning departments.

To encourage this shift in attitude, there must be an improvement in the manner in which industry players engage with compliance. Developers must be made to engage with qualified environmental professionals early in the development process to ensure policies are meaningfully translated into the final project. Industry should be more aware of detailed guidance that has been created explicitly to explain to developers what is expected

[5] Resilience Index: http://publications.arup.com/publications/c/city_resilience_index

of them and how they can achieve environmental compliance (for example, CIEEM/CIRIA emerging principles and guidance on achieving net gain in biodiversity).

The recently launched Wild West End initiative demonstrates a holistic approach to protecting and improving London's environment. This is an example of self-created and self-imposed environmental standards within infrastructure developments, based on local policy. Many of the West End's largest property owners are working together to protect and enhance the natural environment within the most iconic areas of central London, creating greater connections with nature for residents, visitors and workers to enjoy. Those property owners are already seeing the benefits of this initiative and this approach can be replicated and should be encouraged.

Too often, though, the balance between economic, social and environmental issues becomes tipped so as to reduce or eliminate any ecological commitments which are not mandatory or enforced.

Crucial to the success of policy delivery is the ability of planning departments to rigorously enforce, monitor, and adapt policies. This action requires the expertise of competent environmental professionals and thus the funding for those roles within planning departments. Currently the weak link is the significant lack of ecological expertise within planning departments across the country, as identified by the London Assembly Environment Committee and All Party Parliamentary Group for Biodiversity (APPGB, 'Protecting and enhancing biodiversity in London' letter to former Mayor of London Boris Johnson (26 March 2015). Without this in-house expertise, the assessment and enforcement of policies which concentrate on environmental protection is not sufficiently addressed.

Schemes such as BREEAM and Code for Sustainable Homes encourage the incorporation of ecological enhancements within developments. More often than not, the ecological aspirations of a project become diminished over time due to pressures cited elsewhere, with the environmental enhancements tending towards the lowest possible requirement. No such practical guidance exists for the far more impactful linear infrastructure schemes. There are many examples where infrastructure has delivered housing or transport links as well as in built ecological protection, climate change resilience, flood protection, hydroelectric power generation, but in the UK this is rarely targeted, let alone achieved.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

There is an unfortunate tendency for infrastructure schemes to be judged against rigid models that are woefully under-equipped to capture the potential benefits of development. For example, High Speed Rail schemes are still judged against a model that is perfectly suitable for deciding the cost-benefit balance between two similar route options, but cannot capture externalities such as the potential for land value gains or the scope for local regeneration.

A tidal barrage scheme might be judged against a Treasury model that specifies a discounted cash flow period well short of the likely functional payback period and fails to

capture the additional benefits such as the utility of the barrage as a flood defence barrier or the social utility of the new harbour as a tourist site.

Equally, models that are used to analyse housing retrofit schemes can measure heat savings, but don't fully capture the softer gains and benefits from reduced fuel poverty, social exclusion and NHS health cost savings.

The country clearly needs to develop more sophisticated models to analyse and capture the full scope of socio-economic gains that derive from infrastructure investment. This will be particularly important as cities compete for global investment and talent.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

Travel patterns will become far more complex as working patterns shift along with changes in the economy and as technology drives the evolution of various transport modes[6][7][8][9].

Today, there is an increasing dependency on various forms of transport that are required to support broader inter-regional economic growth, as well as supporting local business and housing development. Peoples' expectations of transport continue to grow more complex too as transport infrastructure evolves to support more than just a point-to-point service. This has become more important with new communication technologies and the future expectation of alternative fuels and autonomous vehicles.

New technologies are also expected to shift private ownership of vehicles more toward public/private access services. Potentially, this could drive higher returns for both city and rural areas. However, the solution for each area will differ substantially in form e.g. improved local bus/taxi service in rural areas and a far greater dependency on city mass transit networks in urban areas.

These changes will likely come alongside stronger control of planning policies to help reduce the need to travel. This will open up further opportunities for walking, cycling and short distance trips, offering a host of broader community benefits and environmental gains.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

[6] Potential for Modal Shift in the UK Rail Freight Market: http://publications.arup.com/publications/f/future_potential_for_modal_shift_in_the_uk_rail_freight_market
[7] Future of Air Travel: http://publications.arup.com/publications/f/future_of_air_travel
[8] The Future of Rail: http://publications.arup.com/publications/f/future_of_rail_2050
[9] The Future of Highways: http://publications.arup.com/publications/f/future_of_highways

Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

Investment scale will depend on the size of the urban area and their connections across the UK so context is critical. Investment areas could include everything from major public transport infrastructure to the development of walking and cycling facilities that would bring additional health benefits, for instance.

At the upper end of the scale, you might consider the ambitious plans and schemes in place for logistics tunnels and hubs in cities such as Zurich, Amsterdam and Dresden. Elsewhere, large-scale integrated transport operations include developing stations to support local communities and 24-hour lifestyles.

Commercial transport and passenger logistics will require a far greater amount of active management in future and this is an exciting area for infrastructure to make a really positive impact on people's lives.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

Connectivity is critical to long-term competitiveness and growth for modern economies. At the upper end of the scale, airport development with efficient networks of rail and highway connections between cities is, and will become, more vital to assist economic development.

At the same time, shorter journey connections through light rail, bus/coach operations, and shared ownership vehicles will be used to balance demand and support local communities.

The critical point of course is that the two ends of the scale have be viewed as part of a whole system. We have to examine mobility as an end-to-end journey concept that provides people and freight with easily accessible options across multiple modes, while reducing 'friction' at the interchange nodes between transport options.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

Road user charging by area and corridor can redistribute demand to ease areas of high congestion and support through cross-funding other transport operations. Hence this could support the local and wider mobility objectives.

Digital communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

There are a number of physical and technological investments that might be cited here, however, the greatest value investment is likely to be in enhancing the public's trust in

digital systems. Without a thoughtful approach to cyber-security, digital could be seen as a compromised and compromising medium.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Note: the existing "regime" refers to the current market, competition and planning frameworks. "Digital communications" includes both fixed and mobile connectivity.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

The Energy Research Partnership Project is currently working on exactly this question. Arup is represented on the body which has set a scope to build on techno-economic analyses of specific heating technologies to explore governance and timeframe aspects around issues such as implementation and retrofit practicalities, user acceptance of technologies, primary energy demand and infrastructure requirements. One issue already acknowledged by the group is that there will be no 'one size fits all' solution since geography, demographics and economic developments will all play a major part in determining potential solutions, to say nothing of the technological aspects.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

In 2050, a zero carbon power sector will be characterised by a highly interconnected system of networks of generation and storage. Sitting behind this will be a smart, flexible energy system with the ability to provide a range of benefits for the whole economy, combining control, security of supply, and a mix of integrated low carbon technologies.

It's likely the mix will still cover a broad spectrum of nuclear (including small modular reactors), gas, biomass, solar, wind, tidal, and hydrogen sources linked by advanced storage strategies to solve the energy trilemma.

Getting there will not be easy. It will require strategic long-term vision backed by a mix of directed R&D, pilot studies, policy incentives and mandatory actions to promote a positive mix across the various technologies available.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Electric vehicles will be able to play a positive role to play in supporting a smart grid, as well as bringing costs of storage down, driving consumer uptake of smart solutions and

facilitating demand reduction goals. However, with the technology still at an early stage, more work is needed to understand the full extent of this potential role.

A high uptake of electric vehicles will be crucial to meet both climate goals and ensure EVs can meet expectations in supporting a smart, flexible energy system. However, a great of work is required to understand economic incentives for suppliers, consumers and shared owners, as well as exploring how to reinvent the distribution network to cope with the additional capacity and network capabilities required.

Reinventing and developing these complex distribution networks at a scale that would demand very significant additional power demands and could act as a brake on EV market growth.

Water and wastewater (drainage and sewerage):

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

Note: "demand" includes domestic, commercial, power generation and other major sources of demand.

There are four key tools available for water utilities to manage any emerging deficit between supply and demand. On the supply side, there is a great deal of scope for developing new resources such a groundwater, desalination, indirect potable recharge and surface water reservoirs. Equally, interconnectors between areas with a supply surplus to those in deficit, eg from North to South, offer a number of possibilities.

On the demand side, there are a variety of options for enhancing demand management and leakage measures. The use of an integrated water management approach for dealing with growth areas – utilising non-potable water, green infrastructure, etc – is critical. These options should be tested against criteria such as resilience, STEEP and marginal cost to supply.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

Note: this can include, but is not necessarily limited to, governance frameworks across the country.

Much of this comes down to sensible frameworks for good modelling. With the right approach, it should be relatively straightforward to model networks to identify areas that are at, or nearing, capacity, as well as any existing areas of headroom.

Once understood, there will be opportunities to utilise headroom in the network for attenuation, so-called 'Active Control'. In addition, there are a number of principles that can be applied to ensure that water management is fit for purpose such as dealing with as much stormwater at source and ensuring that new developments are design to accommodate green infrastructure techniques, as well as retrofitting existing areas.

To do any of this, strong governance and leadership is required. Structures need to be in place to provide forums for all stakeholders to work in partnership across the public and the private realm.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

There are a number of key principles involved in making a success of a whole catchment approach:

(i) develop clear objectives / responsibilities

(ii) understand and value 'Natural Capital'

(iii) good modelling – hydraulic and economic

(iv) develop communication channels with key stakeholders and the public around risk, eg the '1 in 100 year event' is not well understood

(v) deploy a partnership approach with a clear business case – taking into account environmental, social, economic factors.

None of these are necessarily easy to deliver, but the ambition to make them is a prerequisite for successful outcome.

Flood risk management:

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

Resilience suggests a number of elements, but at core, it is the ability of a system to recover from shocks and stresses. In this context, it is critical to consider flood resilience as part of a holistic resilience planning framework that incorporates preparedness and the need to consider adaptation and recovery across wider economic impacts and social disruption.

This holistic view of flood resilience also has to be considered in the context of the likely transitional impacts of climate change, mapped against development scenarios. Developing resilience plans will inevitably involve taking a risk-based approach to costs and benefits. By understanding the shift in longer-term climate change risks, the country should be able to minimise the financial and social risks.

This implies a strong governance element to bring the macro scenarios into the realm of national and local level plans.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

Smart flood management involves employing technologies and tools to best effect within a well understood catchment framework. This suggests providing greater support to create

tools that help build data sets and offer a menu of options for creating more naturalistic and sympathetic approach to flood risk through habitat creation and restoration.

Building knowledge about catchment areas is one thing, but helping to disseminate the various ways that stakeholders large and small can help extend flood resilience could be a cost-effective and effective approach to promoting resilience across communities.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

Clear and consistent insistence that the polluter pays principle will be a firm policy constant will go a long way toward clarifying clear lines of responsibility for waste streams, as well as encouraging new approaches to recycling and circular economy solutions. This means regularly reviewing recycling policies and taxes on landfill and disposal to ensure they are effective in driving shifts to a responsible approach to waste across society.

Elements of the funds raised via the polluter pays principle should also be used to promote innovation on circular economy thinking, managed between government and sector supply chains.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

Note: A "circular economy" is an alternative to a traditional 'linear economy' (i.e. make, use, dispose) in which products are designed and packaged to minimise waste, and resources are kept in use for as long as possible, e.g. through re-use, recycling and greater recovery of materials through the waste management process.

In practice, governance, regulation and business models are potentially more important to achieving the transition to a circular economy than design and engineering. The very nature of the circular economy concept requires an integrated approach to systems thinking that allows both the ecosystem and its individual components to adapt and change to build and reinforce positive feedback loops.

To get there requires a dedicated roadmap for the built environment operating to a set of guiding principles for the design, engineering and construction sector. The roadmap will need to focus both on the economic business case and the opportunities to develop new ways to design and deliver projects. A framework of guiding principles will be crucial to drive innovation across the sector.

The six elements of the Ellen MacArthur Foundation's ReSOLVE framework provide a route to apply circular economy thinking to products, buildings, neighbourhoods, cities, regions, and even to entire economies. ReSOLVE outlines six actions:

1. Regenerate

2. Share

3. Optimise

4. Loop

5. Virtualise

6. Exchange

The Arup publication *'Circular Economy in the Built Environment'*[10] illustrates practical examples of this approach can be applied to the sector from keeping products and materials in cycles and prioritising loops to replacing product-centric delivery models with new service-centric models.

There are significant challenges to overcome in moving toward a circular economy model and we will need to understand a great deal more about how material flows through the value chain and how to optimise value loops to maximise benefits and reduce costs. We need to develop and share new business models and demonstrate the efficacy of transitioning to new ways of understanding innovation in this context. And we will need incentives to encourage the whole value chain to make the move toward capturing the full benefits of a circular economy approach, convincing partners to showcase success and seed future partnerships.

Yours faithfully,

[Name redacted]
[job title redacted]

[10] Circular Economy in the Built Environment:
http://publications.arup.com/publications/c/circular_economy_in_the_built_environment

ASPLEY GUISE PARISH COUNCIL

[Job title redacted]: [Name redacted], [Address redacted] Tel:
[Phone number redacted] [Email address redacted]

NIA Call for Evidence
National Infrastructure Commission
11 Philpot Lane
London
EC3M 8UD

10th February 2017,

Dear Sirs,

NATIONAL INFRASTRUCTURE ASSESSMENT CALL FOR EVIDENCE

While we recognise the importance of considering the long-term strategic improvements needed to the nation's infrastructure it should be recognised that a number of the schemes being considered face significant challenges to their implementation which may make them difficult to realise.

The problems that would be caused by the closure of the level crossing at Woburn Sands that would result from Phase II of the East West Rail Project being a case in point.

Against this background we believe that it is essential that all short term improvements to the nation's infrastructure that can be implemented relatively easily should we pursued with all urgency. The dualling of the A421 from M1 Junction 13 to the border between Milton Keynes and Central Bedfordshire is an essential improvement which should have been delivered when the Bedford to J13 section of the A421 was upgraded.

Ongoing developments on the eastern flank of Milton Keynes make this an urgent improvement to cope with the ever increasing levels of traffic accessing Milton Keynes and we urge you to do all you can to support it.

Yours faithfully,

[Name redacted]
[Job title redacted]

Associated British Ports (ABP) Response to National Infrastructure Assessment Call for Evidence [Future projections of Port of Southampton throughput redacted][Future projections of Port of Southampton trade forecasts redacted][Sentences with commercially sensitive commentary redacted in Q1 and Q2]

National Infrastructure Commission: Call for Evidence

ABP is the UK's leading ports operator, with a network of 21 ports around the country handling 92 million tonnes of cargo every year. Our ports are an integral part of supply chains across the country and serve as vital international gateways to British businesses. Together with our customers, ABP handles £150 billion worth of trade including £70 billion of exports[1]. Our ports include the Port of Southampton, which is home to the UK's second largest container terminal, and the Port of Immingham, the UK's largest port by tonnage. By facilitating trade and supporting industry and manufacturing our ports make a major contribution to the UK economy, generating £5.6 billion and supporting 84,000 jobs.

ABP's operates port facilities in Ayr, Barrow, Barry, Cardiff, Fleetwood, Garston, Goole, Grimsby, Hull, Immingham, Ipswich, King's Lynn, Lowestoft, Newport, Plymouth, Port Talbot, Silloth, Southampton, Swansea, Teignmouth and Troon. ABP also operates Hams Hall rail freight terminal in the Midlands.

Cross-Cutting Issues

Question 1. What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

1. Leaving the European Union presents a unique opportunity to build on Britain's history as an outward looking, free trading nation. The process of leaving the European Union undoubtedly presents the UK with some challenges, but there are also great opportunities. Outside of the, EU Britain can seek new trade deals with growing markets across the globe. At home, ports can play an important role as bases for new manufacturing, helping to drive exports and rebalance the economy.

2. Realising this ambition will depend on strategic, long-term investment in infrastructure in support of the UK's ports and maritime industries. We are committed to working with partners and Government to identify and deliver the opportunities that will result from the UK's new relationship with the EU and the rest of the world.

[1] MDS Transmodal: Value of goods through UK ports (2016)

3. It is important that decisions on infrastructure investment are calibrated to reflect the priorities of the Government's Industrial Strategy. In particular, the need to improve connectivity to international markets and boost UK exports will require long-term policies to support the UK's maritime and ports sector. To support this view we would draw attention to the fact that UK ports handle 95% of the UK's trade in goods. It is also worth noting that many of those ports play a role in helping British business export to overseas markets. For example, the Port of Southampton handles £40 billion of exports very year, making it the UK's leading export port.

Port of Southampton

4. The Port of Southampton is ideally located to meet this challenge. It is the closest major UK port to the international deep-sea shipping lanes – the global maritime highways. Deviation of vessels from these lanes results in time and cost implications for the entire supply chain. It is imperative that we as a nation look to deliver the most efficient logistics routes for our exporters in order to make British manufactured goods economically viable across global markets.

5. In 2009 we started work on our first Port Master Plan, the objective of which was to publish information on the port's vision for demand over a 20 year period in order that we could share such information with stakeholders at all levels. We have recently repeated this exercise and the table below illustrates the 2005 baseline position looking forward to the years 2020 and 2030 against the current position of 2016 throughputs. The Commission will note that in the automotive and cruise passenger sectors, we have already exceeded the projections for 2030 and we are well on the way for meeting our 2020 projections for dry bulk tonnages.

Table 1: ABP Southampton Throughput figures for 2005 and 2016; 2020 and 2030 Projections

.	2005	2020	2030	2016
Cruise (000 passengers)	702			
Automotive (000 units)	724			
Dry Bulks (000 tonnes)	1,357			

Containers (TEU 000)	1,382			
% containers departing by train	25%			

6. Southampton is at an interesting time in its history and evolution. The fact is that we are chronically short of operational land in which to accommodate the predicted future demand from UK businesses. In meeting the spatial challenge, we have undertaken a number of tasks in order to make the most effective use of infrastructure. We have -
    a. Removed non-core port related activities
    b. Relocated peripheral activities where possible
    c. Acquired Marchwood Industrial Estate (£100M) in 2015 to ensure we can safeguard maritime related businesses in close proximity to the port
    d. Constructed 7 multi-storey car parks to support the UK automotive section creating 30,000 spaces.

7. The construction of our multi-storey facilities has been a great success. Each structure creates 10 acres of effective storage from a footprint of just two acres. Aside from the significant cost of constructing the car parks, there are consequences of constructing these facilities. A port thrives on its ability to deliver flexible handling space to the customer so that it can accommodate changes in the flows and nature of cargoes – a static structure removes this flexibility.

8. Even with these constraints both ABP and the vehicle manufacturers have chosen this space saving solution in order to benefit from the strategic locational advantage of Southampton as part of an effective supply chain.

9. We are, however, now running out of options on our current footprint. The table below has been replicated from our consultation document, the Port of Southampton Port Master Plan 2016 -2035, and illustrates growth forecasts for Southampton unconstrained by land and berth availability. Our challenge going forward is how to deliver additional space and berth capacity in order to connect customers with their markets in an efficient, cost effective and resilient way.

Table 2: 2016 Trade Forecasts to 2020, 2025 and 2030

	2016	2020	2025	2035	Shortfall
Cruise (000 passengers)	1,776				
Automotive (000 units)	919				
Dry Bulks (000 tonnes)	1,379				
Containers (TEU 000)[2]	1,895				
% containers departing by train	34%				
General Cargo (000 tonnes)	54				
IoW Ferry (000 vehicles)	857				

10. This predicted growth generates challenges. Principally the main challenges are requirements to extend the current footprints of existing trades and customer spatial allocation to allow their businesses to grow.

11. In a similar way to Heathrow airport, the Port of Southampton acts as a hub port and as a cluster for the wider maritime sector. The port attracts maritime businesses to the area creating a 'maritime cluster'. This allows smaller manufacturers to more easily access global markets in a more cost effective way than having to tranship their goods to another hub port.

12. By seeking to accommodate the predicted growth in sectors currently served by Southampton through a range of measures that includes implementing productivity gains and operational management measures as well as increasing the footprint it is inevitable that shortly there will be insufficient space to accommodate all of the Port's existing cargo sectors and customers.

13. Significant investment programmes at UK production plants will fuel this increase in numbers. The manufacturers

[2] Conservative annual throughput estimate

require an established and efficient logistics chain to deliver the vehicles to the global market. Southampton is a critical part of that process.

14. The Cruise sector for example, will shortly deliver new build >6,000 passenger vessels requiring 3,000 crew members. Our existing cruise terminals – voted as being some of the best in Europe – were designed for 3,000 (+1,500) passenger capacity leading to operational challenges in the operational management flows of people. In addition the change in design of the vessels mean that the distance between vessel and terminal buildings presents technical challenges. We therefore need to look at re-designing our cruise terminals for the new generation of vessels currently under construction - we believe this will be achieved by a need to increase the current footprint of cruise operations.

15. We believe we have practically exhausted all productivity and efficiency measures set out above and, therefore, we are left with the options of 'do nothing' or expand.

Question 2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

16. In answering this question, we have included the potential scenario of not taking proactive steps to effectively contribute to the UK's international competiveness. If we, and the nation, decide that the current area and berth layout of the Port of Southampton are sufficient or that expansion proposals are not commercially viable i.e. the 'do nothing' scenario', we believe a number of matters will arise:

a. Berth congestion will increase. As vessels increase in size there will be less space for vessels alongside and in manoeuvring operations. A reduction in available berths for the shipping lines may mean that Southampton remains a desirable location but becomes increasingly limited in capacity. This is not in the best interests of manufacturers, cargo owners or customers who would suffer from inefficient supply chain solutions with higher overheads and reduced service delivery times.

b. Operational land availability will become scarce. The consequence of this factor will mean that sectors cannot be handled efficiently or at a price point that results in a competitive end of point sale price. In the global market in which we all operate such

actors will simply look to overseas solutions to manufacture or transfer goods. In simple terms we will be becoming inefficient and losing trade to our international competitors.

17. Having exhausted all current spatial productivity initiatives we believe we are now in the position where we need to plan for the future; not only for the long term prosperity of the port but also to support the local, regional and national economies.

18. Expansion will also create regeneration opportunities. For example, relocation of the existing aggregate wharfs (outside the ABP owned port) to a new port area will free up land within the City of Southampton to enable to provision of much needed residential opportunities. A new facility could provide a state of the art aggregates hub able to serve the south east of England, accommodating larger deep sea vessels that will deliver economies of scale to benefit the construction sector and removing the need for land based extraction. Similarly a new port facility could unlock opportunities for marine related services, high quality office accommodation providing opportunities for locally based employment as well as facilities that would benefit the local population.

19. The port sector does, of course, have a National Policy Statement that sets out planning policy in relation to applications for port developments meeting the criteria of a nationally significant infrastructure project. We will work towards meeting the objectives in the NPS as we embark on master planning for port expansion.

20. Delivering the spatial requirement for operational port land is only part of the national infrastructure that is required to serve the nation in the future. In order to make the supply chain effective, a port requires effective marine, road and rail connectivity.

21. Marine connectivity takes the form of a dredged channel linking the port to the open sea. It is in many ways similar in importance to an airport's runway. Without it the port cannot operate efficiently. As a nation, we must therefore ensure that the UK is resilient and has sufficient marine capacity to connect the rest of the world with the UK. In Southampton, we

have delivered this marine infrastructure in the form of a capital dredge completed in 2015 which ensures excellent tidal access for the deepest draughted vessels afloat.

22. Road connectivity to the existing port is at times causing peak hour delays and we are concerned that this will, if not already, impact on manufacturer's supply chains. We need to ensure that funding is made available to Southampton City Council and Highways England for the ongoing maintenance of roads leading to the Port. In addition we all need to consider additional capacity to ensure that our transport infrastructure can accommodate the predicted increase in trade to Southampton, particularly the M27 and the A34 strategic routes.

23. Rail connectivity to the Port has been greatly enhanced by the delivery of the upgrade of the Midlands – Southampton mainline to W10 standard. The Port currently achieves around 40% of container transfers and around 20% of export vehicles. Ongoing success of rail transfer requires a partnership approach between the freight owner inland rail freight terminals and the end delivery point and the ability of Network Rail to deliver additional capacity achieving a balance between passenger and freight demand. If these requirements can be met, then we believe that these figures could be surpassed.

Question 8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

24. Port infrastructure, including associated off site infrastructure, comprises major design, assessment and engineering capability. As we embark on working out the precise nature of port expansion requirements in Southampton, we are aware that the economic viability for customers and users will be critical. The relative values of any cargoes likely to be handled at the port will require long term investments of GBP billions, however, revenues may not be sufficient to support investment criteria. Off-site infrastructure is likely to add to that financial commitment that may prove to be outside the reach of ABP - this is a topic that we would like to explore with central government so that this maritime gateway can best serve the future requirements of the nation.

Question 14. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

25. As demonstrated above, investment in road and rail infrastructure to facilitate the movement of goods around ports can yield long-term economic benefits. Where capacity issues restrict the movement of goods this also restrains the ability of the port to grow in line with demand. For example, improvements to the A63 Castle Street in Hull are much need if trade through the port is to continue to grow.

26. Gauge enhancement on important rail routes would increase the capacity for freight on the line and allow high cube container to be carried on conventional wagons. This would unlock the potential to increase freight connectivity along the line and encourages the modal shift of road to rail, with consequent environmental benefits. This is evidenced by the success of other ports which have benefited from gauge enhancement, such as the Port of Southampton.

27. An area that could provide high gain at low cost is upgrading rail gauge capacity for freight across the North, particularly on the Trans-Pennine route. Upgrading and standardising the gauge of the existing East-West rail corridor could be achieved at cost of approximately £100 million[3]. Upgrading the gauge across the East-West corridor would develop the capability of the line, increasing the size of containers that could be carried.

Energy

Question 20. What does the most effective zero carbon power sector look like in 2050?

28. ABP's ports play an important role in the energy supply chain, particularly on the Humber where ABP operates the ports of Hull, Goole, Grimsby and Immingham. The Humber is the UK's busiest trading estuary and the ports are fundamental to accommodating this trade. In doing so the ports also make a significant contribution to the local economy, generating £1.56 billion annually and supporting 23,000 jobs across the region.

29. In recent years ABP has invest £160 million in purpose-built biomass handling facilities in Hull and Immingham. This infrastructure investment has supported Drax Power Station in converting half its previously coal-burning units to sustainable biomass. The wood pellets which flow

[3] IPPR North: A Northern Ports Strategy (2016)

through the ports to Drax generate enough electricity for 6 million homes, equivalent to around 8% of the UK's energy supply. Biomass has an important role to play in the zero carbon energy sector and ABP is well-placed to continue to support this growing industry. A 2016 study shows that the industry is also making an important economic impact in the region, producing £12 billion for the economy and supporting 14,100 jobs.

30. Following a £310 million investment, the Green Port Hull project with Siemens at ABP's Port of Hull has produced a world class advanced manufacturing facility making blades for the nearby offshore wind sites in the North Sea. At the Port of Grimsby, port infrastructure is also being repurposed to accommodate global energy firms Dong and Centrica, and ABP is investing to ensure the port continues to serve these growing offshore industries in future.

31. The Humber has demonstrate illustrates how proper investment in energy infrastructure can pave the way to a zero carbon energy future. The continued development of this sector will require infrastructure which supports the growth of the ports on the Humber and elsewhere. Investment decisions should take into account the critical role of the Humber to national energy security and support the growing renewable energy sector already well established on the estuary.

Flood Risk Management

Question 26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

32. Flooding poses a significant risk to port infrastructure, particularly on the Humber Estuary which has a tidal range of up to six metres near its mouth. In addition, the City of Southampton is protected from surface water flood events by two pumping stations located on the port estate. In many instances we maintain flood protection measures at our own cost; however, pressure on existing defences is likely to increase between now and 2050 and funding decisions should properly reflect the critical role of ports to trade, economic growth and energy security.

33. As well as investing in the physical resilience of assets at our ports, over the last year ABP has been working in collaboration with the Environment Agency looking at the front line sea

defences along the frontages of our ports. Specifically we have assisted the Environment Agency and our various local authorities in establishing innovative public/private partnerships to improve flood defence infrastructure at our ports of Goole, Grimsby, Hull and Immingham. It is worth bearing in mind that our ports contain business interests which are much more than just those owned by ABP – the Port of Immingham in particular provides a home for some 70 separate businesses, with many more commercial operations being based in hinterland areas.

34. The Ports of Southampton, Grimsby, Goole and Hull also provide flood protection to numerous residential areas. Whilst our work with the EA tends to focus on the need to improve and raise the height (known as Standard of Protection) of flood defence infrastructure in the realisation that Sea Level Rise is a known and well-calculated phenomenon, it is also worth mentioning that existing flood defences are maintained by ABP along our port frontages with considerable maintenance expenditure requirements every year.

35. ABP would encourage further consideration of how flood defence decisions are reached and where the current funding formulas do not sufficiently recognise the benefits of protecting nationally critical assets and infrastructure such as ports.

Conclusion

36. We would welcome further opportunities to discuss the role of ports as part of the network of national critical infrastructure through the Commission's studies. We would be pleased to host the Commission in a visit to any of our ports where we can outline our role in more detail. Please contact me if you believe we can assist the Commission further.

consultancy engineering business environment

ACE Evidence: National Infrastructure Assessment

ACE response to the:

National Infrastructure Commission Call for Evidence

10/02/2017

Association for Consultancy and Engineering Alliance House 12 Caxton Street London SW1H 0QL
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About ACE

As the leading business association in the sector, ACE represents the interests of professional consultancy and engineering companies large and small in the UK. Many of our member companies have gained international recognition and acclaim and employ over 250,000 staff worldwide.

ACE members are at the heart of delivering, maintaining and upgrading our buildings, structures and infrastructure. They provide specialist services to a diverse range of sectors including water, transportation, housing and energy.

The ACE membership acts as the bridge between consultants, engineers and the wider construction sector who make an estimated contribution of £15bn to the nation's economy with the wider construction market contributing a further £90bn.

ACE's powerful representation and lobbying to government, major clients, the media and other key stakeholders, enables it to promote the critical contribution that engineers and consultants make to the nation's developing infrastructure.

Through our publications, market intelligence, events and networking, business guidance and personal contact, we provide a cohesive approach and direction for our members and the wider industry. In recognising the dynamics of our industry, we support and encourage our members in all aspects of their business, helping them to optimise performance and embrace opportunity.

Our fundamental purposes are to promote the worth of our industry and to give voice to our members. We do so with passion and vision, support and commitment, integrity and professionalism.

Further information

For further details about this publication please contact

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www.acenet.co.uk

Q1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

While ACE does operate in all the regions of the UK, including the devolved nations, in this response it is taking a more national overview of the infrastructure investments that can be made. This is because the National Infrastructure Assessment should seek to take a strategic overview across the whole country, and what would provide benefits on that basis rather than looking at the narrowly regional or city-based infrastructure.

That being said, many of the investments we would propose are geographically very localised. For instance, in London, Crossrail 2 is the next stage in the development of the London Underground network, one that will bring benefits estimated to be between £6bn and £8bn per annum.[1] This obviously represents a significant increase, and will result in the project quickly paying back the initial investments made by government and others through increased tax revenues.

Similarly, a new runway in the South East, which government has finally decided will be at Heathrow Airport, will also lead to a significant increase in economic levels for the region, but also the country as a whole. It is estimated that over its life the project will see over £200bn in nationwide benefits and create almost 180,000 jobs.[2]

Elsewhere in the country, the Northern Powerhouse scheme represents a real opportunity to provide the North of the UK with an integrated transport network that will mean it can compete globally and bring more jobs and prosperity to the region, and the UK. IPPR North estimates that if the region were able to halve the gap between its own economic output per head and the national level, its economy would be £34bn bigger.[3]

Across the whole nation, the biggest piece of infrastructure that promises to support long-term sustainable growth is the new High Speed Rail line, linking all the major cities along the north-south axis of the UK. One challenge, however, is to ensure that we do not stop at Manchester or York but press on to Scotland. In addition, we should also begin considering the possibility of developing further parts of the high speed network, for instance down to the West Country or across from Liverpool to Hull through the Pennines.

Finally, the UK needs to ensure that its energy supply meets the demand, as well as the need to meet climate change commitments, and be secure in nature to ensure the UK is not as subject to price spikes. This means the new generation of nuclear power stations, beginning with Hinkley Point C and continuing with Wylfa and others, must be built over the next two decades. In addition, other projects designed to ensure an adequate energy mix should be considered, such as the new Tidal Lagoon project in the Swansea Bay.

[1] Transport for London (TfL), *Crossrail 2: regional and national benefits* (2015)
[2] QUOD, *Regional Distribution of Employment and Economic Impacts* (2015)
[3] IPPR North, *Rhetoric to reality: A business agenda for the northern powerhouse* (2015)

Q2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight, and data in ensuring this?

Infrastructure is key to the UK's international competitiveness, both in terms of how foreign investors and companies are able to enter the country, and how they subsequently get around between the various economic centres. It is, therefore, vitally important to ensure our networks are the best in the world. This is even more the case now that the UK has decided to leave the European Union.

As already stated, one of the most important infrastructure projects that will be coming on line in the next decade stands to be the third runway at Heathrow Airport. This is a chance for the UK to state its intentions in terms of how it presents itself to travellers at what is usually the first experience they have of the country. This is also equally true of our other airports and the future National Infrastructure Assessment must not assume the job is complete. There will be need for further capacity around the country in time, and the document should seek to prepare government for the need to decide on this.

Our ports should also not be neglected, responsible as they are for all the imported goods being able to get into the UK. This ties in neatly with our airports too as, in addition to handling passengers, much also comes into the country via air routes. Indeed, Heathrow is actually one of our largest freight ports, handling 1.54m metric tonnes each year.[4]

The likes of Felixstowe and London Gateway will also contribute significantly to the ease with which goods can enter and exit the country and therefore must not be neglected in the conversations around the National Infrastructure Assessment. Without them, and without them being able to handle the various types of containers efficiently the UK will not be as attractive as a destination for trade and business, hampering our collective prosperity.

Q3. How should infrastructure be designed, planned, and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

The first point to be made in this case is to ensure that proper considerations as to the design and function of the infrastructure in question be given at the earliest possible stages in its development. This will ensure that the most appropriate designs and innovative solutions can be incorporated into the project, with the best minds that the engineering consultancy sector has contributing to it. This will ensure better outcomes, lower costs, and smoother delivery as changes at later, more costly and difficult stages are minimised.

Secondly, there remains a need to ensure that infrastructure is viewed in a more holistic way, with new transport networks taking linkages with other forms of infrastructure into account. For instance, there is much work being carried out now in cities where HS2 will call at to integrate it with existing or

[4] Heathrow, *Facts and figures* webpage (2016)

upgraded local networks. Again, this is something that needs to be considered at the earliest possible stage to ensure seamless delivery within timely and cost-efficient fashions.

Procurement is a third vital area that must be in the best possible shape to ensure infrastructure is designed, planned, and delivered. Too often, especially at local and regional level where cost-constraints are a significant issue, but also at national level, procurement function is viewed a secondary one. ACE thinks this is mistaken and procurement actually constitutes a strategic investment function that should be taken at the highest levels.

Procuring bodies should, therefore, be encouraged and even mandated to ensure they have the requisite skills within their workforce to ensure infrastructure plans meet the required outcomes. There will be major disbenefits if this is not the case, as a lack of experience or expertise leads to delay, extra cost, and potentially inadequate delivery.

Q4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

ACE is not in a position to provide an answer to this question.

Q5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

ACE is not in a position to provide an answer to this question.

Q5. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

ACE feels that the big opportunity in terms of improving the role of competition and collaboration in the delivery of the UK's infrastructure assets is in how SMEs are better able to access and take part in the supply chain. Very often these smaller businesses can bring a different approach to the project, while they are also much more likely to be local in nature, therefore ensuring that the project being delivered also benefits the area in which it is situated in other ways.

These benefits will not only mean more in terms of jobs and wealth creation that remains in the local area, but will also give the opportunity for the creation of good quality apprenticeships with the engineering and construction supply chain, for instance. It will also help to make the case for large scale infrastructure projects more acceptable to local stakeholders who will see the benefits earlier, and not just the disruption caused by construction.

Future procurement of large infrastructure projects should see the increased participation of SMEs as a key performance metric, either as a direct part of the supply chain or as part of a joint-venture with other SMEs or larger companies. This will mean that the procuring authority will have to take a smarter, more expert approach to ensuring issues such as liability and other legal terms and conditions are neutralised. ACE and its members realise that these are fundamental parts of any project delivery, however we feel they can be better managed so as to not exclude SMEs.

Q6. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

ACE believes that is little room to make changes in funding policy that could improve the efficiency with which infrastructure services are delivered. In essence, there are only two ways in which infrastructure services can be funded, that is paid for: either through general taxation (as the National Health Service is, for instance); or through user charges (as energy infrastructure is, through billing.)

There might be the possibility of funding new infrastructure services through a hybrid method of the two mentioned above, such as that which funds the UK's rail network at the present time, i.e. a mixture of government subsidies (out of general taxation) and revenue raised through ticketing (user charges). ACE believes this is the only opportunity to vary funding options.

In addition, however, future governments should be encouraged to take an innovative view when it comes to funding the provision of infrastructure services. It should also consider these approaches on a case-by-case basis, as what is appropriate for one project would not necessarily be so for another and will be dependent on the financing required to ensure delivery.

Q7. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

This is a highly complex area and one that is worthy of a separate review to determine the issues involved. ACE's members and wider stakeholders have continually identified issues with projects that cannot be financed. We would urge the NIC to hold a separate investigation on this topic.

In a general sense, there is an issue with the way local authorities are able to finance the projects that they determine necessary for their areas as they do not have the financial powers to put the appropriate deals together. London is the area that is most affected by this with projects like Crossrail 2 struggling to meet the financial hurdle necessary for project approval.

London government has access to the capital it needs to fund the projects identified to promote growth in the city but it lacks the financing powers to be able to properly pay for them. ACE would like to see London and other Metro cities to be able to issue local infrastructure bonds as a way of meeting this challenge.

Likewise, local infrastructure financing through CIL and Section 106 is not working as well as it should, as has been highlighted in the new report "A New Approach to Developer Contributions"[5] that shows that CILS are only collecting between 5-20% of estimated revenue leaving local authorities with considerable funding black holes. ACE supports the report's recommendations for the creation of Strategic Infrastructure Tariffs and Local Infrastructure Tariffs as a way to solve this issue.

[5] The CIL Review Team, *A New Approach to Developer Contributions*, 2016

Q8. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

In general, ACE sees the increasing interdependence across sectors as an opportunity for infrastructure providers and should produce more efficiency across the transport and utilities networks in the longer term.

However, there is concern that capital expenditure is often prioritised in government planning on infrastructure while maintenance of our complex and interdependent networks can be put to one side. Engineers should be as involved in the process of ensuring that assets are used effectively throughout the entirety of their lifecycle as they are in designing new infrastructure.

The UK's infrastructure is indeed becoming more interdependent but the risks associated with this issue should be considered in conjunction with the antiquated nature of our infrastructure in some parts of the country. This issue is especially relevant in much of the rail network and the sewerage systems of the country's cities. However, the UK has developed a national expertise in conducting improvements on aging infrastructure, such as the London Underground, while keeping the rest of the system running. This expertise has become relevant in the UK comparatively early because Britain was the first country to industrialise, but, as mass transit systems age in Asian and European cities, this expertise could represent a real comparative advantage and export opportunity for the UK.

Q9. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

ACE is not in a position to provide an answer to this question.

Q10. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

ACE recognises the matter of ensuring the protection of natural environments while expanding infrastructure is an important one. ACE has briefly consulted our membership on this issue and some initial thoughts were pointed out and are referred to below:

- Biodiversity offsetting and the effectiveness of the methodology used in the UK (https://www.gov.uk/government/collections/biodiversity-offsetting). We are not convinced the current system works and the opportunities for creating habitats are effective.
- The impact of habitat severance with linear infrastructure – roads cutting through habitats etc. and how this is mitigated.
- Further clarity is needed with regards to ancient woodlands, PAWS and veteran trees. We are encouraged to note that the government is planning to consult for clearer rules on this issue in the Housing White Paper.
- Infrastructure's ability to improve the public's access to natural capital should be taken into account.

These ideas represent 'food for thought' and we would welcome further work with the NIC going forward to establish some more concrete suggestions for the government.

Q11. What improvements could be made to our current cost-benefit analysis techniques that are credible, tractable, and transparent?

ACE does not necessarily contain the expertise to delve down into the detail of how cost-benefit analyses are arrived at, however there is one area in which the organisation and its members feel that improvements could be made. This is from the government side of things where, too often infrastructure projects are at the whim and mercy of HM Treasury's 'Green Book', the manual for deciding if something meets spending guidelines and value for money tests.

ACE and its members are not against ensuring that value for money is extracted from each project that is proposed, and robust business plans should obviously make this element clear. In fact, too often those involved in the construction of infrastructure are not mindful enough of the need to present decision-makers with believable figures regarding the project they are proposing. This is a short-coming that we hope is being addressed.

It is true to say, however, that in many cases the adherence to the criteria outlined in the 'Green Book' is too strict, or indeed the criteria themselves are too strict, especially around the timelines that are being used to judge whether a project provides value for money. In the case of infrastructure, especially large scale projects that are long in development and construction, this can lead to a skewed view of how much the project will cost and how much money it will generate.

Take the example of the Tidal Lagoon Project in the Swansea Bay, which is being unfavourably compared to the Hinkley Point C (HPC) nuclear power station. The latter has a guaranteed strike price of £92.50 per MWh, while the former's is being presented as more than £160 per MWh over a 35 year period. This is clearly unsatisfactory until the 120-year life cycle of the Tidal Lagoon array is taken into consideration, which drops this to almost half that of HPC.

If a more realistic approach to costing long term infrastructure projects were taken by Treasury, the case for such schemes would be more straightforward and the true cost of them could be presented to the public. ACE would, therefore, urge the NIC to take a view on proposing this change or a more flexible approach to estimating value for money.

Transport

Q12. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Three considerations need to be taken into account when examining travel patterns: when, where, and how, while these are affected by two factors, namely demography and economics. With the population of the UK set to continue to grow, possibly as high as 77m by 2050, demand overall is clearly going to increase.[6] In addition, as the population grows so too will the economic activity, with higher numbers of jobs, increased demand for consumer goods, and therefore more movement.

Most of this growth is forecast to occur within cities and towns of the UK, meaning consideration of future travel needs should be focussed in these areas, while obviously not ignoring the countryside and more peripheral areas of the UK. We must also consider the fact that as the population grows, it

[6] Office for National Statistics (ONS), *National Population Projections* (2015)

will also be aging as life expectancy increases, meaning travel patterns will change accordingly, as more travel outside of the peaks takes place, for instance.[7]

How people will travel is also expected to change during the next thirty years, especially as government policy around climate change and air pollution, public health more broadly, and spending change. Those cycling, for instance, have increased significantly over the past decade, with those commuting in London on bikes increasing threefold between 2000 and 2014. This is in the context of a halving of car use over the same timeframe.[8]

It is clear that while car ownership is increasing, the trend in trip rates is downward, with 13% fewer trips in 2015 than in 2002, while the proportion of young adults holding driving licences has decreased since the 1990s.[9] This is also at a time when public transport, particularly in London, is seeing record passenger numbers, meaning future policy decisions will need to be made in this context.

The impact of new technologies on travel patterns is hard to gauge, given the inherent uncertainties around predicting what will be forthcoming in the years ahead. A lot of attention is being devoted to driverless cars, for instance, and they promise much in terms of making more efficient use of road space and time, however there is still a lot of development that is needed.

That being said, we can expect the next three decades to bring forward improvements in digital technology, much as we have done in recent years, as well as more flexible approaches to many working practices. This could lead to more people taking advantage of the option to 'work from home' or in remote offices closer to home, for instance, meaning travel patterns especially during traditional peaks will change.

Q13. What are the highest value transport investments to allow people and freight to get into, out of, and around major urban areas?

Major urban areas rely on their transport infrastructure networks enormously, with the ability to move people and goods around vital for their economies, leisure activities, and other functions. Public transport networks such as the London Underground and the UK's bus network, as well as private cars provide the bulk of this transport and rely on significant amounts of investment, maintenance, and upgrading if they are to continue to thrive.

Arguably the most efficient forms of transport that allow people and freight to get into, out of, and travel around major urban areas are those that can carry the most people in the quickest time. In London's case we see this with the underground, rail, and bus networks, and Manchester's tram network. These types of investment would, in the view of ACE, provide the best solution to the question posed.

In the next decade, we will see further discussions about the need for further expansion of tram systems across the UK, as well as the need for Crossrail 2 in London. These are just examples of what is

[7] ONS, *ibid.*
[8] Transport for London (TfL), *Travel in London 8* (2015)
[9] Department for Transport (DfT), *National Transport Survey* (2016)

needed but they represent the best possible solutions we have to ensure those who need to travel into our urban areas for them to function and provide benefits for the whole country, can do so.

In addition, there is a case to be made that a proper, integrated freight pathway should be constructed, that will allow transportation of cargo across the country from ports to our major urban centres, without need to put more lorries on the road. This will be especially important if the UK is to become a major global trading centre in the wake of the UK's exit from the European Union, as is the government's ambition.

Finally, however, we must not neglect the road network, which is equally important when travelling around our cities. They are important to ensure delivery of goods in the final journey from warehouse to store. As in other cities, the vast majority of London's journeys on public transport still take place on surface level roads.

Q14. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside a single urban area?

In this regard, roads often play the biggest role and thus provide the highest value transport investment in terms of connecting people, places, and goods outside a single urban area. Public transport networks rarely extend out to serve these parts of the country and so people have to rely on their own cars or other vehicles to get around, do business, and live their day-to-day lives.

In the National Infrastructure Assessment, ACE would expect this view to continue on the whole, with roads playing the major part in connecting people. Specifically, there is need of better road connectivity in the more rural areas such as East Anglia, Wales, the South West, and in the North. Our members would expect to see much of these types of proposals in the final document when it is issued in due course.

This document does, however, present a significant opportunity for the NIC, the government, and the whole country. It is a chance to propose new thinking on our infrastructure and how we utilise it. We can continue to do things the same way, especially in rural areas, and provide more road capacity, better surfaces, etc. Or we could use this as a chance to think more innovatively and ask the question of how would we want to be getting around in 2050 if we did not live in a major town or city?

ACE and its members would like to see the NIA begin to ask these questions. Is there a way that we can provide good transport links for people without necessarily needing them to resort to their cars? Too often the rural areas of the UK are left to feel like they are being left behind, with all the focus on investment and infrastructure being on the towns and cities. Perhaps this is a chance to show these places that this is not to be the case in the future, government will seek solutions to these types of questions. A National Infratructure Assessment that is truly strategic and innovative should not shy away from posing these sorts of questions.

Q15. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

'Mobility as a service' (MaaS) could present a significant opportunity to instigate a system of road user charging as a means of collecting revenue to be spent on the road network, especially in light of declining levels of fuel duty and Vehicle Excise Duty (VED). A system could be established where technology is fitted to vehicles hired under the MaaS scheme records the time, distance, and roads travelled on in journeys. Users are then charged accordingly when they return the vehicles at the end of their hire period.

Care must be taken, however, that the potential negative consequences of this are taken into consideration, and mitigated as far as possible, otherwise the policy could be undermined from the start. This would have the knock on effect of also undermining efforts to establish a broader road user charging model, which ACE has argued is the logical next step in motoring tax policy, most recently in its report *Funding Roads.*[10]

Forcing companies to install this kind of technology and asking them to take payment under the road user charging scheme which they then pass on to HM Revenue and Customs could add a layer of cost that makes MaaS schemes uneconomic, for instance. Existing car clubs such as Zip Car would therefore be reluctant to take part, or even downright hostile to the new system.

Government would also need to provide reassurance to the public that any future revenue generated via a road user charging scheme (or at least a significant proportion of it) would be spent on the upkeep of the local, major, and strategic roads. Currently, the lack of confidence that monies raised through motoring duties is a key stumbling block among public acceptance of a road user charging scheme.

All that being said, were the policy to be implemented effectively and the negative aspects successfully avoided, it could have major implications for road usage. Vehicle ownership could decline as users do not need to purchase and maintain a significant asset such as a car, meaning trips would decrease as users were more likely to take short journeys on foot or bike. It would also potentially make better use of existing road space, as more journeys took place at cheaper times of day or on less expensive routes.

Digital Communications

Q16. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

Much of the investment into the UK's digital connectivity takes place via the private sector and in a very piecemeal way, with private operators seeking to open markets where they see value. This has obviously left many areas less well served than others when it comes to connection to the superfast broadband network, hampering businesses, preventing better consumer choices, and leaving parts of the UK lagging behind.

[10] Association for Consultancy and Engineering (ACE), *Funding Roads: Reducing inefficiency and securing investment in roads for future generations*, (2013)

Government efforts to redress this through organisations such as Broadband Delivery UK and targets such as those seeking to provide access to broadband speeds of at least 20Mbps by 2017 for 95 per cent of the country, have seen some success. Further detail on this is given below. The key question to answer is whether this is enough, both in the short term and in the long term. ACE is of the opinion that it is not and that a stronger steer needs to be given to the sector by the government and investment brought forward in a more strategic fashion.

A much-mooted idea during the early stages of the development of High Speed 2 was to use the opportunity of constructing a rail line through the centre of the UK was to use the opportunity to embed a high speed fibre optic broadband cabling network. This could then have branched off to various parts to provide a central spine. This is obviously not going ahead, however it displays the issue, that there is not enough of a strategic view on how we provide what is fast becoming an essential utility, similar to water or power.

Had greater consideration been given to this possibility at the earliest possible stage, the UK could be looking forward to taking a big step forward in the provision of superfast broadband to the whole country. This is the key point, however, that this major potential investment should, firstly, be one considered by government, secondly, that to do so in the context of an overall, high level broadband connectivity strategy would be most beneficial.

Additionally, a project such as this would need to be planned well in advance, allowing time for plans to be developed, resources collected and allocated, and delivery to be achieved. This is the case for all large scale infrastructure projects.

Q17. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

ACE and its members are fully supportive of the recent report published by the NIC on the subject of 5G digital connectivity, *Connected Future.*[11] The findings that, despite the importance of mobile digital telephony to everyday life, with 93 per cent of adults owning a mobile phone, the UK still has large areas of 'digital deserts' are concerning. In addition, that the UK lags behind the likes of Albania, Panama, and Peru is equally worrying, especially at a time when the UK's infrastructure should be a key advantage when it comes to attracting investment.

The work in recent years to ensure that coverage of high speed broadband services in the UK improves has been welcome, and ACE is pleased that significant sums have been spent. This has seen the UK achieve the highest levels of superfast broadband coverage of the EU5 (Germany, Spain, France, and Italy), and speeds of up to 30Mbps now available in 83 per cent of UK premises.[12]

It is not all good news, however, with a 2015 EFRA Committee report suggesting that the government target of ensuring 95 per cent of premises receive superfast broadband by 2017 'may slip'.[13] In addition, Ofcom estimates that by 2017 almost one-fifth of SMEs will still not have access to superfast

[11] National Infrastructure Commission (NIC), *Connected Future* (2016)
[12] House of Commons, *Superfast Broadband Coverage in the UK,* (2016)
[13] Environment, Food, and Rural Affairs (EFRA) Committee, *Rural Broadband and digital only services* (2015)

broadband. This is in the context of an FSB survey taken in 2014 that found that 14 per cent of small businesses felt the lack of a reliable and fast broadband connection was their main barrier to growth.[14]

One major limiting factor in the deployment of improved infrastructure that allows for faster internet connectivity has historically been a reluctance by the owner, BT, to install and/or upgrade existing lines. This has hampered other providers of broadband services such as Virgin Media who have been unable to open up new markets and connect new customers. ACE is hopeful that recent announcements around the establishment of 'Chinese walls' between BT and BT Openreach will see this problem disappear. Government should, however, stand ready to intervene quickly and effectively should this prove not to be the case.

Energy:

Q18. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

Energy efficiency measures, micro-generation and renewable energy.

Q19. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

The most effective zero carbon power sector must take into account the other two corners of the 'energy trilemma'. This means that the UK must develop an energy sector that, as well as being zero carbon, must also be affordable for consumers and be reliably secure. To achieve this, the UK must adopt a complimentary set of renewables that can generate capacity regardless of weather conditions – nuclear, wind, solar and tidal power – subject to cost effectiveness. The government could also take measures to ensure that individuals and businesses take responsibility for their own energy generation and develop strategies to see more renewable microgeneration.

To achieve a zero carbon power sector as quickly as possible, we need to ensure that there is as energy efficient consumption of heat and power as possible, as soon as possible. In recent years, the government has taken steps to place less emphasis on the kinds of measures, such as the roll back of the Green Deal, that would deliver savings in energy use. Furthermore, reports like EIC's *Driving Energy Efficiency in Commercial Property Portfolios*[15] highlight the need for policy consistency post-Brexit as schemes such as ESOS and EPCs originate in the European Union and may be subject to deregulation. This report also makes the case for the government to focus its efforts on organisations that own/manage larger numbers of properties rather than on creating behaviour change among individual home owners, which would be must more piecemeal.

[14] Federation of Small Businesses (FSB), *The fourth utility: Delivering universal broadband connectivity for small businesses across the UK* (2014)
[15] EIC *Driving Energy Efficiency in Commercial Property Portfolios* (2015)

Q20. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage, and new infrastructure requirements?

ULEV present a huge opportunity to the energy sector, but infrastructure for ULEV should be targeted and precise. As electric cars' range increases, there will be less need for charging points on every street corner and we should do all we can to encourage charging at home, in the first instance. Charging at home would mean that the energy required would come at a lower cost to the consumer and avoid peak usage times, taking pressure off the grid and balancing energy use.

Thus, the government is faced with a dilemma – provide more charging infrastructure now so stimulate the market for electric vehicles or hold off on a roll-out of charging points to secure the maximum benefits from ULEV, by creating the conditions for consumers to rely primarily on charging points based in the home.

Water and wastewater (drainage and sewerage):

Q21. What are the most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

ACE is not in a position to provide an answer to this question.

Q22. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

ACE is not in a position to provide an answer to this question.

Q23. How can we most effectively manage our water supply, wastewater, and flood risk management systems using a whole catchment approach?

ACE is not in a position to provide an answer to this question.

Flood risk management:

Q24. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

The UK should seek to achieve the highest flood resilience level it can balancing costs, development pressure and long-term risks.

If we accept that the government will need to make trade-offs because there is clearly a limit to the flood defence budget (welcome recent increases notwithstanding), the government must be transparent and clear with the public and business about the decisions it makes. As such, what is

missing from this question is an opportunity to discuss the government's relative priorities for flood resilience. The questions about whether flood resilience should prioritise homes vs businesses, deprived areas vs areas that are economically significant, the North vs the South East, people vs the environment, societal assets vs critical infrastructure.

Stories such as this imply that the government is making these decisions without public oversight. As a result, this presents a risk that the government will lack credibility on flood resilience when the next flood event does happen, unless its priorities are clearly communicated.

Climate change is clearly set to have a severe impact on flood risk management over the coming decades. The Committee on Climate Change's recently published Climate Change Risk Assessment, published every 5 years, points to evidence that highlights action and adaptation that needs to be taken immediately, to stall the seemingly inevitable rise in global sea levels that the CCC's report highlights for the rest of the 21st century and beyond.

Below is a synopsis of a recent presentation by Daniel Johns, the Head of Adaptation for the Committee on Climate Change. It highlights four clear areas where reform is required:

A) Infrastructure: The National Flood Resilience Review looked at the infrastructure assets within the extreme flood outline and identified more than 500 energy, water, communications, health clinics and other kind of infrastructure assets within that extreme flood outline, but there has been no published action plan about how those risks and vulnerabilities are going to be addressed. Within the Autumn Statement we had more money for road and for rail infrastructure resilience projects, but so far there has been no published account about how we're going to address, over the long term, the assets that are probably in the wrong place. The December 2013 tidal surge reminded us how much of the coastline is vulnerable to storms and tidal surge. We will see more examples like this where homes cannot be saved and need to be demolished.

B) We are halfway through the first planning epoch within shoreline management plans and at the end of the planning epoch, many policies are due to turn from "hold the line", to policies which are about managed alignment, and realignment, and no active intervention; this is a problem we are storing up, and at the moment we are not gearing up to engage those communities who in the past have seen people protect and maintain defences, where the implication of these shoreline management plans is that there will be people stepping back.

C) Soil erosion: Increasingly people are recognising the role that land management can play in helping to avoid flood risk, but it is clear that farming is part of the problem - poor land management practice is leading to and causing muddy floods and we're losing rich fertile soils off the hillsides, because we're planting things like maize and not winter cover crops that avoid these kind of muddy floods taking place. So we need to use farmland as a resource and recognise that much of it is actually part of the flood plain, to help manage the flood risk to avoid and try to reduce as far as possible the overall economic damages of these events.

D) New developments: new development is continuing and we're planning to build a million new homes in this country over the next five years, and stats from DCLG published in early December showed that one in ten new properties in recent years has been built in the 1% flood plain, in flood zone three, essentially so that means that we are still adding to the problem. At least there's the

national planning guidance which means those properties should be built in ways which minimise the residual risk, but when you're building that quantity of housing in different parts of the country it has to have consequences for the risks and the costs of flood management in future.

Q25. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

SuDs (sustainable drainage systems):

The government missed a major opportunity to limit flood risk and deliver a series of other benefits in its Housing and Planning Act when Schedule 3, the clause in the Water Management Act 2010 that calls for SuDS Approval Bodies that would approve new drainage systems for new and redeveloped sites, was determined to remain unimplemented. The result is that there is very little oversight of SuDS projects that can lead to poor designs and maintenance. Ultimately, this misleads the public into thinking they are protected when they are not.

Despite this, when designed, constructed and maintained correctly, the benefits of SuDS are clear and multidimensional. To name just a few, SuDS enable decreased flood risk, improved water quality, greater amenity/liveability and rainwater harvesting – for a full list and case studies, see here.

Property Level Resilience:

Property level resilience has often been overlooked by reviews of national flood resilience capacity, so we are encouraged that the technology is explicitly referred to in this document.

The property level resilience (or property level protection[16] - PLP) market is relatively young and there is a need for stricter standards both in terms of training and products to ensure that once a consumer believes they are protected, they truly are. At the moment, faulty products installed incorrectly by untrained (or, in some cases, opportunistic) providers mean that the certified companies in the sector are being denigrated while the two remain indistinguishable to consumers.

Furthermore, government initiatives, like the Repair and Renew Grant, are deployed in the wake of flood events rather than making subsidy available to consumers before floods to encourage members of the public to take a long term view of protecting their property. The grant also failed to ensure that the taxpayers' money spent on improvements to properties were credible products[17] installed by qualified professionals[18]. This meant that in some cases, the government has directly funded malpractice. These issues around training and standards are the risks to be considered when deploying

[16] There is some debate in the flood protection sector about whether flood 'resistance' or 'resilience' should be aspired to. The Flood Advisory Service has found that when explained to the public what flood resistance and flood resilience meant, 90% of respondents expressed a preference for resistance (water exclusion strategy) to resilience (letting the water in, but adapting a home so it recovers more quickly).

[17] 72% of respondents to a Flood Advisory Service survey said that choosing Kitemark over non Kitemark flood products was important or very important

[18] 78% of respondents to the Flood Advisory Service survey said that they felt it was important or very important to choose Kitemark installation for their PLP products

PLP solutions as government policy, but could be relatively easily abated by action from the government.

Whilst we accept the need to build more homes in the UK, ACE believes that the CCC's warnings on the urgent need for adaptation must be taken into account. This will require a change to building regulations, there is a need for Part C to be adapted for new homes to include passive measures to prevent water ingress via doorways, airbricks and drainage. It is currently all too easy for developers to push through plans (with few checks and balances in some cases), and, coupled with the lack of building regulations, the absence of accountability on developers' post-sale needs to be changed. Evidence from DCLG (as outlined in point D in our response to the previous question) points to potentially 100,000 new homes being built in flood zone 3 over the next 5 years. PLP has been proven to reduce residual risk to a property, so it would be a sensible solution to require developers to incorporate flood doors, non-return valves and anti-flood airbricks to these new homes as a "belt and braces" measure. The cost of taking such measures at the "build stage" is significantly reduced compared to retro-fit. In addition, developers should take responsibility for the cost of insurance for a period of, say, 10 years for all new build homes, and this could be administered via the existing NHBC warranty. Flood insurance is not covered by Flood Re, so this would be a twin incentive for all buyers of new build property. Finally, we should be aiming to build in resistance measures as outlined here to a 1/100-year event if possible.

The benefits to PLP products are as follows:

- It allows individual homeowners to take responsibility for their own flood risk, alleviating some responsibility of the government;
- PLP products can be installed in a bespoke way, allowing homeowners and experts to come to a solution that can be agreed based on personal priorities and risk appetite;
- PLP products can be quickly and easily installed and require limited maintenance;
- PLP could provide opportunity for developments on otherwise unfeasible plots (i.e. flood plains, which are increasingly relied upon for housebuilding)

Solid waste:

Q26. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

There is a well-documented need for increased treatment capacity in the waste management sector. A 2014 Defra report[19] stated the following:

> *estimating around 22 million tonnes capacity gap (per annum) between residual waste arisings and the amount of treatment infrastructure capacity either 'operating' or 'under construction'. The report also suggests that this capacity gap will decrease to just under 11 million tonnes (per*

[19] Defra, *Energy from Waste: A Guide to the debate* (2014)

annum) by 2020 if the waste treatment capacity that has planning consent (around 12 million tonnes) reaches financial close and begins construction.

However, the question above fails to clarify which *type* of waste treatment infrastructure the UK requires – more landfill, recycling or energy from waste (EfW) capacity. Principally, the government needs to decide on this question so that investment opportunities can be taken by private companies.

For now, recycling levels have plateaued for several reasons:

i. Recycling efforts in the UK have reached a point where the less challenging waste has been process responsibly. This means that further investment in recycling infrastructure is likely to suffer from diminishing returns;
ii. Local authorities, who still retain much control over domestic and commercial collection, are suffering from diminished budgets and therefore lack capacity to invest in more behaviour change campaigns which have proved successful in the past;
iii. There has been an historical strategic reliance on the European Union to take the lead on recycling/resource policy. This has meant that the government has broadly failed to provide a vision for recycling in the UK.

Thus, if further intensive investments in recycling infrastructure were to come about, much of the capacity may go unused.

If recycling is becoming more difficult, however, that does not mean that we endorse more capacity in landfilling. The UK has come a long way in decreasing its willingness to landfill and this should not be reversed for environmental reasons. We believe the Landfill Tax has reached the right level. Any further increase in the tax would result in an even worse rate of waste crime and avoidance[20], instead much better enforcement must be a priority, but it is important that it be maintained at its current level to encourage better overall environmental options.

With high levels of tax on landfill, waste companies have resorted to exporting waste. The UK has become more dependent on RDF exports since 2010 to Northern European countries such as Germany, the Netherlands and Scandinavia, as a means of managing waste in a reasonably environmentally sound way. The export of RDF has drastically increased in recent years. In 2010, the UK did not export and RDF, now exports are estimated to be around 3 million tonnes. In theory, increasing the level of RDF export is a good solution to the problem, but the risk of changing demand on the continent or regulatory de-synchronisation in a post-Brexit market might mean that relying on European markets is a risky strategy.

Instead, the government should consider incentivising an increase in domestic EfW capacity. This would enable the UK to have reasonably environmentally sound and self-sufficient systems to manage waste. Though EfW capacity increases are the best solution to the lack of infrastructure in the waste sector, there are important challenges that need to be addressed by government. Energy from waste plants take 10 years to develop, have a lifespan of 20-30 years and require significant financing, normally from a range of sources.

[20] See CIWM Journal Online, *£150 Million Landfill Tax Gap Reported by HMRC* (2016)

This climate of risk often leads to companies opting for proven technologies and the services of traditionally successful companies, thereby preventing new market entries and innovation. This means that innovation in the waste sector can be difficult. However, attempts by the industry to learn from other sectors, such as oil and gas, could be a way forward. There is more capital available now than any time in history but the lack of good, dependable projects in EfW is a clear barrier. Government action to make investment more likely would be encouraged.

Q27. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

One major barrier to achieving the circular economy is low virgin commodity prices. For example, if oil is cheap to buy, it is less economically viable to recycle plastics and can be cheaper to simply use more raw material to manufacture new products. This price disparity undermines the business case for recycling.

Another is the lack of national regulatory instruments to push materials up the waste hierarchy. Instead, European Union targets have been the main driver for change in the sector. As noted above, preventing landfilling has been a major policy success in the UK, especially considering the country's historic habit for the practice, but the best environmental outcomes have not been attained.

Further, there are little in the way of incentives to encourage circular use of resources. Sweden has recently proposed tax reform to decrease VAT on repairs from 25% to 12%. This type of initiative would disincentivise throwing away difficult to recycle white goods and electrical goods and stimulate a domestic repairs industry at the detriment to foreign goods imports. Similar financial incentives could be a useful mechanism to deliver a meaningful transition up the waste hierarchy.

Products are also routinely produced with a linear mind set. European Union eco-design standards are encouraging and enable evermore products to be reused. The government needs to ensure that the legislative framework for product design continues to push towards more sustainable consumer goods. The European Commission's new Circular Economy Package, for example, has further standards and requirements for eco-design and we would encourage the government to adopt these standards regardless of the UK's future relationship with the EU.

Finally, there is a need to change consumer behaviour. This starts with changing the public's ideas about the merits of buying new goods and encouraging consumers to reuse, share or donate products. This is certainly a challenge for any government because the interests of product businesses, whose aim is to sell as many units as possible, do not obviously align with a change in consumption culture that would inhibit purchases. However, government can support the repairs sector, provide ample infrastructure for donation (clothes banks etc) and raise public awareness about the social benefits of a more circular approach to consumption.

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Ref: National Infrastructure Assessment call for evidence

10 February 2017

Dear colleagues

Please find below a submission of evidence on behalf of the Association for Project Management (APM) in response to your recent call for evidence.

If any further information is required, or if we could be of further assistance, please do not hesitate to contact me.

Yours sincerely

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National Infrastructure Assessment: Call for evidence

Response by Association for Project Management

The Association for Project Management (APM) is a registered charity with over 21,000 individual and 550 corporate members making it the largest professional body its kind in Europe. APM is committed to developing and promoting project and programme management through a wide range of activities including membership, qualifications, events and enhancing standards and knowledge in the profession.

APM held an online survey between December 2016 and February 2017 which was open to members and the wider project management community. Responses came from a wide variety of business sectors most notably aerospace and defence, consultancy and construction as well as a broad spectrum of roles including project managers, academics and company directors. This document presents an informal synthesis of responses received, rather than a formal statement of APM policy.

The submission builds on APM submissions of evidence for the National Infrastructure Commission Strategy in January 2016 and the National Infrastructure Assessment consultation in August 2016.

i) Cross-cutting issues

1) What are the highest value infrastructure investments that would support long term growth in your city or region?

2) How should infrastructure most effectively contribute to the UK's international competitiveness and what is the role of international gateways for passengers, freight and data in ensuring this?

3) How should infrastructure be designed, planned and delivered to create better places to live and work and how should the interaction between infrastructure and housing be incorporated into this?

A number of respondents felt that in terms of designing, planning and delivering infrastructure, there needs to be more top-down drive based on a clear vision and strategy at government (national and local) translated into an architecture or blueprint of the future. Project, programme and portfolio management capabilities, coupled with other techniques such as systems thinking and enterprise architecture can help develop a blueprint for the future that spans multiple sectors and integrates them this could include transport, energy and the built environment amongst others. The benefits, e.g. financial, social, and economic, should be at the heart of this 'design'. It was felt this would create fully integrated transport solutions.

Respondents felt that infrastructure and transport linkages between Cambridge, London and Oxford would have significant benefits.

4) What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

A number of respondents felt the potential for demand management was highly limited in that it adds a massive amount of complexity into the system, allowing for better gaming (as noted). It remains likely that any significant focus on demand management would lead to a less manageable system overall. In addition it was believed that demand management is just one mechanism to enable supply of services to be matched to demand within a more sustainable system. Demand management should not be looked at in isolation and must be designed as an integrated range of

policies or system capabilities needed in a sustainable economy. Rebound effects can be countered by other behavioural and cultural levers - e.g. more community based generation gives more ownership and connects people with the source of their energy supply and has been shown to make people less wasteful. A 'whole system' view of these various initiatives is needed.

5) **How should the maintenance and repair of existing assets be effectively balanced with the construction of new assets?**
6) **How can the UK improve the role of competition and/or collaboration in different areas of the supply of infrastructure services?**
7) **What changes in funding policy could improve the efficiency with which infrastructure services are delivered?**

Respondents highlighted that maintenance and repair should be balanced with new construction based on a meaningful (without performance metrics that distort behaviours) cost benefit analysis. It was noted that whole life costs and benefits should inform these decisions this would create a longer term, more sustainable view being applied.

8) **Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?**

Respondents believed that the government needed to adopt a whole system/whole portfolio view (top-down). This will mean that interventions are only made where they are needed to enable the whole system and whole portfolio to achieve the required outcomes at that level - where otherwise market forces might drive a 'solution' that is not in the national interest or is not coherent when viewed across sectors/projects. This could aid in cutting out duplication, focusing limited investment and resources on the most beneficial projects and ensuring all projects are correctly ordered and prioritised so they form a coherent whole.

9) **How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?**
10) **What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?**
11) **How should infrastructure most effectively contribute to protecting and enhancing the natural environment?**

There are good practice techniques to identify and mitigate these risks and dependencies. However, this is not possible without taking a whole portfolio, whole system view of the 'top-down' system as outlined in addressing question 8. Dependencies and risks at this level can only be identified and mitigated if the whole system, whole portfolio view is established and maintained. Another activity that could be employed is improved and meaningful Programme Leadership.

Skills

The APM believes that skills are crucial to the successful implementation of a whole range of major infrastructure challenges over the next few years. This includes a proper overview of the need for 1) the client skills capability and 2) future skills required for both specific projects and the national infrastructure as a whole.

We believe that as the 'pipeline' develops there is a need to anticipate future skills requirements both for major projects and at a systemic level. The APM and its membership is well placed to view this and we have major concerns that current and future 'bottlenecks' in project management and related skills could have a major constraint on the successful delivery of these projects. We believe it is essential that the skills required – both in Higher and Further Education but also at a vocational level within the current workforce is assessed and built into the National Assessment process.

12) What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

In terms of improvements respondents felt that decision making needs to be less focus on academically defined metrics and more on a true understand of the balance in play. This requires Programme Leaders to move beyond the metrics to an understanding of the complex interplay of competing benefits in order to make informed decisions with minimised unforeseen consequences. Benefits in particular need to be mapped at portfolio, programme and project level as a coherent set. They must be clearly aligned with strategy and vision, and properly quantified and profiled with uncertainty and sensitivity analysis. These benefit maps must be validated by a whole system model of the 'system of interest'. In terms of cost, this potentially could be done by starting to level the playing field. For example renewable Contract for Difference (CFD) projects have to make all costs transparent, including subsidies, disposal, etc. Other energy schemes do not and many subsidies are hidden with whole life costs (e.g. nuclear disposal) not included or understated. Carbon emitting energy forms should also have to include the carbon impact and climate change costs in their cost benefit analysis.

ii) Transport

13) How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Respondents identified a number of changes to travel plans between now and 2050 these included: self-driving and automated cars, automated technology may lead to more coordinated travel and "road trains" of driverless goods vehicles on long distance journeys and the possibility of less personal and commercial travel due to technology advancements. 'Smart cities' and big data has the potential to revolutionise current thinking alongside agile approaches and agile working.

14) What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Respondents felt the highest value transport investment could come from smart city technology including phased traffic lights; parking coordination, traffic jam avoidance, and vehicle to vehicle communication for smart routing.

15) What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

There was no one particular investment highlighted by respondents with answers given ranging from rail to connect smaller hubs to self-driving vehicles and direct routing from point-to-point to bypass known areas of congestion.

16) What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

Respondents differed in how best to address this question. Some felt that mobility as a service will allow the true cost of mobility to be applied to the user. However, the distortion to a global market that is not applying mobility as a service may mean applying the full cost to the user may be counter-productive. Others took a different perspective in that they believed road charging is a solution looking for a problem. Smart vehicles and the rise of driverless vehicles could lead to a sharing economy and an increase in ride sharing which could drive down vehicle ownership and volumes. If this came to fruition it would solve many of the existing traffic congestion issues.

iii) Digital communications

17) What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends) and when would these need to be completed?

Contributors believed that wide area wireless and other 5G technologies could drive more Internet of Things (IoT) development and reduce the time to market and fixed capital investment. Software defined networking will also speed the development cycle and allow much more flexibility in mesh networks and reconfiguration to adjust to peak loading. In terms of timescales it was felt that this would need to be introduced around the early 2020s.

Digital technological change has the capacity to act as a major catalyst through its disruptive capability and radically alter current costing assumptions.

18) Will the existing digital communications regime deliver what is needed, when, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

It was felt by respondents that the UK's existing digital infrastructure is not sufficient. Reasons given to counter this included focusing on nationwide connectivity including rural areas as well as having a national approach to define the standards to be used and adopted.

iv) Energy

19) What is the highest value solution for decarbonising heat, for both commercial and domestic consumers and when should this be carried out?

20) What does the most effective zero carbon power sector look like in 2050 and how would this be achieved?

Respondents felt that a whole system, whole portfolio approach needs to be taken across the energy sector with the approach government led and ensuring that all stakeholders are engaged in the decision-making process. Developing a target whole energy system and analysing roadmaps and pathways to achieve this in a way which is transparent with stakeholders and consistent across the whole sector is the key. This will make it apparent where the market can lead and where government needs to intervene. The work of the Energy Systems Catapult is important in this regard. In addition it was felt that for true decarbonisation to occur then the renewables sector would need to be able to sustain baseload requirements. This requires solutions such as tidal energy, which is not subject to variable weather conditions. Transmission and distribution also requires a step change to reduce

inherent losses, which requires a new medium of transmission and storage, such as battery storage and non-peak recharge to maintain and smooth peak supply.

21) What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Respondents believed that clearly there are infrastructure implications from low carbon vehicles.. Start-ups and entrepreneurs should be actively encouraged and government should understand where it needs to intervene so the low carbon vehicle market can reach a critical mass that can compete with fossil fuel cars. In addition it was felt that self-driving vehicles may not have the effect some consider they will in that they remove the requirement for users to own their own vehicles but will significantly increase the use of each vehicle which in turn will require more electricity generation and distribution than is currently produced. Current best practice public urban vehicles use capacitors for short journeys, which are around 30% more efficient than battery storage.

v) Water and wastewater

No responses were offered by APM members or the wider Project management community to this section.

vi) Flood risk management

No responses were offered by APM members or the wider Project management community to this section. However, we believe it is important to factor in the impact of both 1) short-term mitigation activity as well as 2) long-term climate change adaption.

vii) Solid waste

28) What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

Respondents noted that the barriers are the ease of the dispose stage and the non-mandatory recycling responsibility of the OEM. The current cycle generally absolves the manufacturer of any obligation once the product has left the factory. More recycling responsibility will drive the design of recyclable products through own interest cost reduction pressure. How this works given global supplies chains is the issue, whereby the responsibility should be transferred to the point of import.

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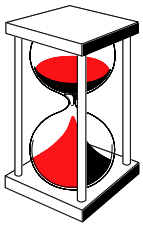

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10th February 2017

National Infrastructure Commission call for evidence:

response from the Association for the Conservation of Energy

Introduction

The Association for the Conservation of Energy (ACE) represents the energy efficiency sector in the UK. It works to enable the UK to become energy efficient, driving productivity and business competitiveness, providing warm and healthy homes, delivering a secure energy future and a vibrant low carbon economy.

This response focuses on question 19 of the call for evidence: *what is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?*

The highest value solution for decarbonising heat

Heat demand reduction offers significant potential to reduce carbon emissions at lower cost than decarbonising supply options. The potential has been estimated by various independent bodies including the Committee on Climate Change.

However, it is important to note that demand reduction delivers a range of other benefits, in addition to carbon emissions reductions, that increase its value to households, businesses, the energy system and the UK as a whole.

A recent study by the ACE research team, working with Dr Jan Rosenow of the Regulatory Assistance Project, explored the multiple benefits of energy efficiency improvements. If the benefits considered are restricted only to those quantified for formal impact assessments, the benefit-cost ratio of energy efficiency investments is in the region of 1.5. But this excludes significant employment, energy system and GDP benefits that are not as easy to quantify.

The full report can be found here: http://www.ukace.org/wp-content/uploads/2016/09/ACE-RAP-report-2016-10-Buildings-and-the-5th-Carbon-Budget.pdf

When should decisions be made?

The cost-effectiveness of many energy efficiency investments suggests that 'no-regrets' decisions to invest in them can be taken early. Prioritising demand reduction will avoid investment in supply assets that could at a later date become unnecessary as demand falls. It will also help the UK to meet its carbon budgets in the short term whilst more difficult decisions on choice of low carbon supply options are taken.

The Association would be happy to discuss further any of the details in our report, should the Commission wish to.

Yours sincerely

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ADEPT
Association of Directors of
Environment, Economy, Planning & Transport

National infrastructure assessment call for evidence: Submission from ADEPT

10th February 2017

Introduction

The Association of Directors of Environment, Economy, Planning and Transport (ADEPT) represents 'Place' Directors from upper tier (county, unitary and metropolitan) authorities. ADEPT members are at the very heart of maximising sustainable growth in communities throughout the UK. We are delivering the projects that are critical to unlocking broader economic success and creating more resilient communities, economies and infrastructure.

ADEPT is a membership based, voluntary organisation with 70 authority, 15 Local Enterprise Partnership (LEP) and 10 corporate partner members across England. We represent members' interests by proactively engaging central Government on emerging policy and issues, and promoting initiatives aimed at influencing Government policy. We represent public sector interests across all our key areas.

Responses to questions: cross-cutting issues

Q1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

As a national body ADEPT seeks to support sustainable and high quality growth through appropriate policies and investment. Prioritisation should be given to areas where marginal / modest growth in GVA can have a marked and substantial impact in lifting areas out of poverty. This not only seeks to re-balance the economy but it supports the Government ambition of creating an '*economy that works for everyone*'. Many local economies have need for investment to tackle current and forecast increases in highway congestion and rail overcrowding, however schemes that help re-balance the economy should play a bigger role.

ADEPT notes the new Housing Strategy as set out by the Government and we are very supportive of the ambition to deliver a step change in numbers of homes delivered. The need for quality homes in the right location is essential in meeting the basic needs of society. However ADEPT does not feel the current planning system, especially the National Planning Policy Framework (NPPF), will bring about the necessary quality of development i.e. energy efficiency, traffic mitigation measures or help tackle air quality.

Future infrastructure across the public realm must become more resilient to change. This includes the impacts of climate change and ever more intensive winter flooding. Equally, technology is demanding greater flexibility in the use of current and future infrastructure and reflecting the lifespan of major investment it is essential that such 'high value' assets maintain their value and purpose in to the future.

Q2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

Global markets play a significant role in meeting the UK's day to day needs. Equally our ability to trade competitively across national boundaries will become an even greater priority in the coming years. The UK has historically been a trading nation and with it has grown a complex and

comprehensive range of ports and airports interconnected with a range of inland waterways, rail and road connections. The extent to which infrastructure constraints act as a barrier, or additional cost pressure, on global supply chain logistics is perhaps 'lost' within the broadly acceptable figure an annual cost in excess of £21bn per annum and rising. By 2030 this represents a loss to the UK of more than £300bn.

Notwithstanding understandable concerns associated with runway location, it is clear that development and delivery of major infrastructure remains slow and protracted. Such long lead times militate against early gains to GVA and itself represents a bottleneck as major schemes (e.g. HS2, Heathrow, and Hinckley) vie for Ministerial time. However the choice of UK ports and airports, and the role of the Channel Tunnel, represent critical assets that only when nearing capacity does a policy response from Government seem forthcoming (e.g. Bathside Bay). Only at that point do long standing issues associated with freight gauge and capacity i.e. Felixstowe to Nuneaton or air quality at Heathrow become the subject of discussion. ADEPT believes that certain critical enabling infrastructure should be developed as part of a long term strategy.

Q3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

A rebalanced economy *should*, over the longer term, ensure more homes are built outside London and the South East. This would help measures to reduce the GVA gap and create positive economic multipliers within the economies of the Northern Powerhouse and Midlands Engine. Any new major infrastructure should be focussed around achieving this structural shift.

Local government when properly supported and given appropriate freedoms is then able to support the delivery of critical local and reginal infrastructure. Whilst each major development might not be relevant to the National Infrastructure Commission (NIC), the framework for having this does have relevance. The National Planning Policy Guidance (NPPG) is not achieving the volume of development nor the quality desired. NIC support for reform of the NPPG might usefully support local Government in delivering the ambition for truly sustainable communities.

ADEPT endorses maximising the development potential of brownfield sites – especially where this forms part of the existing built environment. This is crucial in mitigating the needs for car borne trips and supports enhanced bus and rail services and non-motorised trips. Indeed cycling and walking must play an ever greater role in our thinking given the obesity issues affecting the UK. Existing best practice and case studies exist but owing to NPPG and the desire to increase the volume of housing ADEPT is unsure that these homes and communities will be in the right place and create a sustainable and positive legacy for decades to come.

Q4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

ADEPT has undertaken considerable research on demand management and we are ideally placed to share this with the NIC in more detailed discussions.

In our experience it is the reduction of peak demand that has the greatest immediate opportunity to reduce peak loading – be this on roads, trains, energy or water supplies. Smoothing of demand through market segmentation and crucially informed customers making appropriate choices (with incentives) has a significant and immediate role to play. Certain industrial users of electricity have

'Peak Load Pricing' whilst the National Grid continues to incentivise 'demand side response' programmes including reduced activity at times of critical energy demand from elsewhere in the system.

Train operators already operate advanced fare systems to price people into the off peak periods. However we feel this is more likely about yield management and managing contractual payments associated with their franchise than genuine attempts to bring about demand management across the entirety of their capacity during the off peak.

It is highly likely that people can be encouraged to change habits and this could be informed by the roll out of smart meters and connected devices (e.g. freezers that turn on at specified off peak slots and development of 'Economy 7' type products). It is notable that the roll out of LED's and low energy bulbs domestically, allied with LED TV screens are starting to reduce domestic demand. However home insulation has had a piecemeal and stop start interventions; highly relevant (and neglected) given the role this simple investment in reducing the overall baseload.

On demand management for transport, ADEPT notes recent discussion regarding TfL and the London Mayor's regarding potential road pricing instead of congestion charging. At present road space is managed through congestion which simply adds to pollution and energy demands (from whatever source of propulsion). With the rise of connected vehicles it can only be a matter time as to when a mileage and time based approach to manging demand for road space is implemented. An informed motorist can then make choices in light of full information on the direct and externalised cost of their travel. This could readily be priced at a point where it was fiscally neutral to the motorist and exchequer but would make more transparent choice of modes or times of day.

Q5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

ADEPT recognises the significant backlog in road maintenance and deficiencies in renewal of bus fleets and train rolling stock (Britain having its highest ever average age). In a mixed funding envelope it is understandable that there are calls to prioritise renewal of life expired carriageway, failing bridges, streetlights and structures. Equally many existing rail corridors are life expired or at capacity. Business parks and residential roads are often not on the classified road network and create an unattractive place to work or live.

However, new infrastructure is essential in order to bring about an economic shift at the heart of 'rebalancing the economy'. In some locations it is essential that new rail lines (i.e. HS2 and HS3) and certain road connections provide distinct and discrete incremental capacity to bring about wider ambition and change. Major new inter urban road capacity however is recognised as having been tried (i.e. M25) and shown to consistently fill up with generated trips and increased mobility.

Renewal of gas and water infrastructure installed 100- 150 years ago is resulting in many councils experiencing significant issues of 3rd party works impacting their networks, albeit there is recognition this investment is critical. Long term investment in roads maintenance has occurred in a few areas associated with PFI projects. That model is not necessarily one that would benefit all areas, but it is clear that even when funding exists over a 5-10 year period new or different thinking is required to provide immediate investment leveraged against future funding beyond a narrow local council time scale. A 10 year leveraged approach with front loaded funded would provide greater immediate impact and would be efficient within the new approach to Asset Management Planning.

Q6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Across the UK there are already a number of examples of local councils operating at a regional or shared service approach. This includes the Greater Manchester waste disposal arrangements or the substantial Energy from Waste projects (i.e. South Wales). It is notable that there is over 400 district or borough councils but only 153 highway authorities.

Collaboration in procurement of goods and services is occurring but many councils are not participating; through either inertia or resistance to change. This is evidenced by the lower than expected take up of the DfT 'HMEP' programme (Highways Efficiency Maintenance Programme). It is clear that a political geography rarely mirrors the appropriate scale to provide major maintenance as with the piecemeal renewal the £££ billions of street lighting asset, or conversely winter maintenance that is not joined up across boundaries. This raises issues as to whether the public sector is able to approach the market at the scale and quantum that provides the best outcome.

Q7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

It is recognised that having funding certainty through multi-year settlements – as operated by DfT - is beneficial. This can facilitate investment in maintenance and wider transport enhancements.

ADEPT has undertaken research that shows that access to capital investment is not the issue but rather the repayment mechanism. Local councils have considerable experience and operate diverse mechanisms i.e. the UK's first Local Authority PFI - the Essex A130 which operates shadow tolls.

As already mentioned, pricing also sends a signal on the direct cost of consuming a service and differential pricing occurs in consumption of energy but not for transport. A fiscally neutral method that does not penalise the average motorist would provide a significant signal that direct cost – plus externalities such as air quality impacts – varies according to when people choose to travel.

These price signals are crucial to making most efficient use of precious assets. Equally given the advent of new services such as 'Uber' and developments including autonomous vehicles, there could be a marked shift in what and where infrastructure is required and who might pay for this.

Q8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

Local government is already accessing substantial funds through prudential borrowing. ADEPT notes the government decision to close the public works loan board, but with alternative loan arrangements being put in place, that appears to represent no major issue to accessing capital. Councils have become very skilful at 'invest to save' initiatives with major investment secured on the back of savings achieved over the life of projects.

Local councils are however increasingly reporting a reducing amount of revenue funding which can and will affect the ability to 'seed corn' investment in capital projects. Moreover the long run revenue implications of step change in infrastructure will increasingly affect the viability of otherwise sound investments. There needs to be far greater freedoms and flexibilities as to how

local public bodies make investment choices. This requires more funding to be delegated to the local level by Whitehall, plus an acceptance of the need to relax revenue versus capital issues.

In many local economies there is not a well-functioning mechanism to secure necessary investment. Councils have a long and successful record of land remediation and working with commercial partners. However the long lead time and scale of historic issues (i.e. contamination in former coking works) requires consideration of more specialist funding arrangements if ambitions associated with brownfield development can be swiftly achieved.

Q9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

A rebalanced economy will spread the benefits of what is currently, largely London and the South East, centric growth. This presents major risks in terms of unbalance in labour markets, materials and potential 'boom and bust' and resultant historic impacts that affect wider programming across major projects and the efficiencies that can flow from these.

ADEPT continues to work with councils and government departments on improving resilience, including the severe flooding that has hit many regions of the UK over recent winters. The interconnected nature of supplies and communications systems (including broadband and 3G) continues to be tested in ways that, not until recently, had been found to be lacking.

ADEPT has previously submitted (May 2014) evidence to the DfT resilience review. Following the major flooding of Storms Desmond and Eva, the Government commissioned the National Critical Resilience Review. ADEPT remains seriously concerned that sufficient understanding is still not being given to 'weak points' in national and international communication / infrastructure systems associated with natural or potential deliberate acts.

Q10.What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

ADEPT believes that local government can provide a suitable democratic basis on which to develop and deliver sustainable growth. The credentials of local councils in balancing sustainability and speed of growth are essential to ensure that new communities provide a positive long term legacy. The Local Plan and Local Transport Plan approach is well established and broadly effective; although there are areas where a more strategic approach to spatial planning would be beneficial.

The concept of 'efficiency' must consider the long run impacts of locational choice, especially where sites are being delivered in areas known to be at higher risk of flooding. Equally it is hardly efficient to continue to build homes that create a higher demand for energy and water than envisaged in the previous Level 5 & 6 of the Code for Sustainable Homes and ambition for Zero Carbon homes.

At present the NPPF presents councils with a threat that if they reject development then Developers nullify all conditions on Appeal. This creates a significant concern in the planning process and when developers do succeed at appeal, it means development is proceeding without essential infrastructure.

Q11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

The land use planning system recognises the degree of 'harm' in changing land use. ADEPT members have for many years sought to balance the need to protect local environments with development pressures.

New approaches and interventions can bring about offsetting impacts that restore balance over a large area. Indeed ADEPT has examples of how water quality can be improved through innovation and engagement with water companies, to bring about a positive system-wide change and 'raising the bar' for future development.

Equally we note that from a low point of less than 5%, UK tree cover and forest now exceed 11% and continues to be enhanced. Trees have a critical role in providing attractive places to live but equally through Defra funded programmes they are now again contributing to positively to flood management in upper catchment areas. It is of concern that good practice associated with sustainable drainage systems (including porous parking surfaces), and the related aspects of creating space for wildlife at the heart of developments, has been weakened by not having a statutory basis.

ADEPT believes that enhancing the natural environment is about maintaining and enhancing green spaces to benefit wildlife diversity, offer public (physical and mental) health opportunities, improve air and water quality, tackle surface water flooding and ensure greater resilience to future climate change. We do not support growth at any cost; protecting and enhancing natural capital is essential to making local places attractive places to live and work. The role of Local Nature Partnerships (LNPs) needs to be reinvigorated with proper funding. LNPs should have a seat around the LEP table to ensure the benefits of natural capital towards sustainable growth are properly considered. The environment is not a block to growth but is a way of providing great places to live and work. We need to move away from this outdated view and ensure that the environment is built into our growth decisions.

Q12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

ADEPT is aware that contemporary evidence gathering by the House of Commons Transport Select Committee has generated considerable input from the Chartered Institute of Highways and Transportation (CIHT) and other national bodies such as the local government technical advisory group (TAG).

It is recognised that the cumulative impact of relatively modest journey time savings might overplay the need for road improvements. Conversely rail forecasting is consistently failing to predict the real latent demand for travel such as experience by unprecedented growth on the Borders rail re-opening in Scotland.

We are also highly mindful that future developments might increasingly be out with traditional models presenting a major risk associated with substantial infrastructure change beyond that committed. We note the extensive work currently underway by Transport for the North on such issues within their Trans-Pennine road considerations and we would guide the NIC to that work.

Transport

Q13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

As referred to above, the ability to predict the impact of fast changing technologies undermines traditional modelling and prediction. It is essential that our systems can be made to accommodate change through more flexible approaches.

It is highly likely that developments will create opportunity in the heart of town centres but equally this change may result in loss of some types of activity. Just as 'out of town' development from the mid-1980s brought significant change, large distribution hubs and 'Amazon' deliveries are creating a new scale to logistics.

The fact that driverless cars might increasingly impact on marginal bus services might represent a significant reduction in access to education, jobs and health care. Conversely such technology might instead create a blended approach of core routes and much wider and more attractive 'feeder / distributor' approaches to public transport. Equally driverless deliveries, especially overnight logistics, might make best use of available capacity and help reduce peak time activity.

ADEPT is mindful that there is considerable material already being produced on this matter. The degree and extent to which these will feature across the public realm is the subject of debate; indeed reaching a consensus might be better achieved through dialogue with ADEPT (and others) as to what we should actively plan for and what we might additionally safeguard for.

Q14.What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

The Eddington Review over a decade ago identified the value of targeted and relatively modest investments. The DfT has in recent years continued to support occasional tranches of 'pinch point' projects. Equally the development of park and ride systems in specific locations can bring about major change, even in very traditional car based communities (e.g. Essex County Council, Chelmsford).

ADEPT note the protracted issues associated with modest enhancement to existing rail station projects and new stations on the approach to major conurbations (i.e. Elland Station in West Yorkshire). Equally the long term planning process for light rail mitigates against their development and delivery as they are out with Parliamentary and planning cycles.

Given ever tighter budget pressures in local Government, the age of traffic signals has resulted in many key junctions and arteries at the heart of town centres now being served by systems that are approaching two decades old. They are analogue / clock face systems in a world that is increasingly 'Bluetooth' '3G, 4G, 5G'. Such systems are actually creating congestion, delay and increases to air pollution as they have not been synchronised in many years and fail to be ready for a connected world. A major investment in proven systems would create immediate improvement and would accommodate forecast traffic levels but crucially would allow greater differentiation of higher value trips – be these buses or certain freight that could be platooned through or into towns.

Q15.What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

There is a need to better understand the nature and function of trips in order to better support different policy choices. Travel between rural centres, or adjacent urban areas, are distinct from inter-urban travel. It is recognised that increased accessibility and choice will broaden the demand for travel to access certain services and does create choice and opportunity.

However additional trips are rarely without impact and the full externalities of additional trips, especially in the peak periods, create a cost on other users and, through pollution, wider society. Such inter-urban trips should be encouraged onto public transport modes and the creation of park and ride as well as freight hubs should be more extensively developed as a priority to create choice where currently choice is limited.

Q16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

As set out in Question 13 there is a considerable debate on future transport opportunities. It is recognised that some scenarios include fewer vehicles that are more extensively used over the course of the day. This contrasts with current car use that is perhaps only 5-10 hours a week. The fiscal impact to the Exchequer could be significant but equally there could be impact on the lower demand for town centre parking. A scenario exists where cars are instead owned by a number of fleet providers that arrive when required. It would be those fleet providers who would then have a financial (tax) relationship nationally and it is likely that a local charge or toll would then be more acceptable.

It is also worth noting that consumers would then be using such vehicles in a manner that would remove their desire / interest in the fuel source, power, marque etc. Instead they would be more interested in assurances around the guarantee of a specified 'slot' into a given destination and the user experience within the vehicle.

At a policy level, with known times and destinations it is possible that MaaS could seek to defer or bring forward certain trips as capacity consideration are calculated by the mobility operator. This could markedly reduce the highest morning and evening peak demand and smooth demand through careful programming into the shoulders and off peak periods. It is conceivable certain trips might be actively converged with car-pooling or perhaps para transit / mini-van arrangements. Public bodies could actively influence this so long as a pricing tool exists.

Digital communications

Q17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

Mobile connectivity is a modern necessity – both for the public and also public and private services - and should be treated as such with availability of service the norm. At the current time, because infrastructure investment has been too little and too slow (mainly, but by no means exclusively, in rural counties), there exist too many 'not-spots' and very intermittent coverage. Clearly this is not conducive to today's ways of doing business via multi-function smartphones. Good 4G coverage

must be secured now, via legislation if necessary, using the concept of the Broadband Universal Service Obligation based on a measure of the service consumers actually receive wherever they need it. The UK must become well placed to take advantage of 5G capacity when it becomes available but cannot wait until this begins to replace 4G in the 2020s. Good digital capacity is needed to complement transport demand measures. As more people and organisations apply flexible working access to digital connectivity becomes a vital component economic growth.

There has been significant change in the market, with a number of mergers between operators. This has resulted in some deterioration of service locally where mergers have led to rationalisation of infrastructure (e.g. decommissioning of masts). In addition, central government manage the license process for 3/4/5G, and operators bid in. Local authorities have little / no influence over any improvements or investments being made into areas to improve the situation.

Q18.Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Many existing initiatives, including the Government's Superfast Broadband project and to a certain extent the now defunct Mobile Infrastructure Project, have gone a long way to delivering what is needed. However, due to large housing numbers coming forward over coming this will not be enough as locations continue to grow homes and businesses. The Government must establish deployment of digital infrastructure – both fixed and mobile – as a priority in national policy and work with local planning authorities to encourage prioritisation in local planning policy.

In Gloucestershire County Council the roll-out of broadband provision has aimed to deliver speeds of 30mbps in line with EU targets. This will ensure that the area does not fall below EU targets, but we are aware that other areas may be aiming e.g. for 24mbps minimum.

Energy

Q19.What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

The highest value solution would be a combination of district heating networks (urban and commercial) and individual electric heat (rural) alongside thermal storage. These will need to be combined with efficiency measures. The main issue is not having a clear national energy pathway, which is creating a lack of confidence in the market development of the necessary networks, technology and investments. A transition away from gas will also be a significant challenge, and again will require clear policy that encourages certainty and investment. Decisions need to be made immediately in order to achieve any 2050 targets. Key to success will be public engagement and leadership through a clear policy framework.

Q20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

The third UK Carbon Budget, which runs from 2018-2022, is a 35% reduction from the 1990 base year by 2020. The 35% target was achieved in 2014 and national carbon emissions continue to show a downward trend. In 2015, 17% of the UK's electricity generation came from renewable sources.

An effective zero carbon power sector should be flexible and on-demand. It will have at its heart, energy efficiency technologies such as co-generation, and would be using predominantly low carbon and renewable energy technologies to generate electricity.

This would be achieved by putting in place a well-resourced phased strategy. This would include adequately funded research and development to enable new technologies to be developed. It would also include a supported route to market particularly for technologies that are already being used in other countries.

Q21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Although the electric vehicle (EV) market has more than doubled in the last three years, the uptake of EVs and the demand for charge points was initially lower than expected. However, it is expected that as the price of EVs drop, its uptake will continue to increase.

This could lead to an increased variance in the demand of electricity, as at any point in time a number of EVs could be charging and therefore increase the load. Both the DfT and the Royal Academy of Engineering estimated that if the UK switched to EVs, electricity demand could rise by 16%. However, if as intended, most EVs are charged at home during the night then the demand will be predominantly at night time and easier to manage in relation to destination site charging. DfT and the Royal Academy also noted that this could present an opportunity for utility companies to take advantage of this increased demand by offering incentives such as lower cost electricity for off-peak use and EV owners feeding unused energy back into the grid at peak times.

Energy storage will need to provide a balancing effect for additional charging loads coupled with smart tariff arrangement to reduce energy peak loads. Phasing of overnight charging loads using smart grid technology would be essential in removing night time charging peaks and balancing demand.

Ideally new housing and commercial construction projects should include charging points as the cost of the charge point is relatively small during construction and the inclusion of an on and off street EV charging strategy should feature in development plans. This would remove any negative perception of charging point availability for potential EV buyers and increase the rate of change to EV vehicle adoption.

Water and wastewater (drainage and sewerage)

Q22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

Demand management relies in large part on behavioural change, and is clearly challenging to achieve. The most effective intervention in this context is metering.

New resources are affected by (land use) planning and various consenting requirements which lead to long lead-in times. It would be for the water companies to address this matter through effective long-term planning within their Business Plans.

Intercompany transfers are not without their financial and environmental costs. However, it may be that this is the preferred element of a suite of measures to manage the demand supply balance.

Planning for water resources needs to be considered more thoroughly as part of the development process. Currently there are various documents that all try to achieve the same outcome i.e. Water Cycle Studies / Strategies, Business Plans, Abstraction Plans etc. There is a need for one holistic plan including multi-agency / partner requirements and aspirations. The absence of a strategic framework and the prevalence of 'jigsaw' planning have led to greater difficulties for infrastructure providers of all types to keep in step with growth. The re-introduction of formalised strategic planning to allow a planned approach to growth across the country would be an effective intervention. We are firmly of the view that current strategic planning arrangements, primarily through the requirement to comply with the Duty to Co-operate, are not an effective way of addressing the strategic demand and supply of infrastructure, which includes water resources. The complexities of the planning system in relation to infrastructure planning i.e. Community Infrastructure Levy / Section 106 also need addressing.

Q23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

The revised emphasis on strategic planning is necessary to ensure that foul sewerage provision is in step with development needs. It should be made mandatory that every strategic plan is accompanied by a sound evidence base when planning for drainage and sewerage capacity. This could easily be achieved through the requirement of a document such as a Water Cycle Study, which are often completed in partnership and set out new infrastructure requirements or upgrades needed to protect existing development.

The current inadequacies of drainage systems are of concern. The question suggests that the only problem is with meeting future development pressures, and that current systems are up to the job.

Historical under-investment means systems are 'just about managing' in many centres of population and are often easily tipped into crisis. The management of systems is often reactive, not pre-emptive. There is a legacy of changes in roles and responsibilities over time whereby assets haven't been transferred or identified in specific maintenance regimes. This had led to huge numbers of flood and drainage related assets being un-owned and maintained – leading to increased flood risk and costly legal challenges.

Ofwat sets the criteria against which the water companies are judged. The current regime allows the public realm to be flooded by surface and foul water as water companies are not judged on their performance in this area. A review of the Regulator's priorities with regard to flooding, and by implication the adequacy of sewerage capacity, is necessary.

Schedule 3 of the Flood and Water Management Act introduced Sustainable Drainage Approval Bodies (SAB). This role would be performed by the upper tier local authorities, also known as the Lead Local Flood Authorities (LLFAs). These would have effectively regulated and maintained

drainage (non-foul) as part of new development. However, the government considered this to be a brake on growth and did not commence this aspect of the Act.

In its place the government designated LLFAs as statutory consultees to the (land use) planning system. However, their advice is not binding and developments can, and are, being approved despite concerns / objections being raised by the LLFAs. Furthermore, the adoption and subsequent maintenance of new drainage infrastructure is not effectively addressed under this new arrangement. This leaves a potential legacy of widespread surface water problems for future generations.

The introduction of a body regulating drainage designs at a local level (i.e. the SAB) would ensure the effective implementation of robust and appropriate drainage systems which would be maintained for the lifetime of the development.

Q24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

Taking a whole catchment approach is not new; it is a long standing concept which is easy to understand but less easy to implement.

It is important to reconcile the competing priorities of the very many and different agencies, authorities and private sector organisations who are essential to the delivery of a whole catchment approach. However, there is no single legal mechanism available for an organisation to achieve this. Instead, reliance is placed upon pro-active partnership working and issues can arise around self-interest.

However, we do not think new primary legislation is appropriate as it may place too much power in one agency and it would have profound implications for allied legislation. It may be that existing legislation and regulatory priorities are re-oriented towards a whole catchment approach. This could be achieved through strengthening the catchment based flood risk management plan (FRMP) process.

The maintenance of existing systems should not be forgotten. Whilst accommodating growth is important, it is essential that the infrastructure we already have is fit for purpose, attributed to an owner, and effectively inspected and maintained.

Flood risk management

Q25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

The summer floods of 2007 cost the UK economy £3.5bn; and the recently published climate change risk assessment identities that the risk of flooding will increase. The public health costs are often underestimated; in addition the mental health impacts on affected communities of flooding can last many years. There is no simple answer to the question but it must be an aspiration to ensure flood resilience and adaptation.

Q26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

We should be managing risk at the strategic level, and utilising property level resilience as a means of last resort. This strategic risk management, much like the catchment approach, relies upon a variety of interested parties coordinating their actions to minimise risk. There are a vast number of merits including environment, biodiversity, water quality, aesthetic and health improvements linked to natural flood management. There is a vast amount of available evidence to suggest the effectiveness of natural interventions and this work should be promoted and hard defences challenged more often through existing regimes such at the Regional Flood and Coastal Committees. The limitations result from the inability of the current assessment and funding regimes to adequately assess these types of schemes against the traditional approach. There is an urgent need for the current flood & coastal erosion risk management (FCERM) process to improve the cost-benefit arrangements for not only surface water projects, but also natural flood management schemes.

Solid waste

Q27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

The joining together of waste collection and disposal functions in areas where currently there is separation will generate efficiencies and provide opportunities to increase recycling rates. We should be aiming to move away from landfill; whilst and investment in energy recovery facilities could contribute to localised district heating schemes. PFI type schemes have been successful in securing new facilities which are cleaner and provide the capacity to dispose of our waste.

Q28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

We should ensure a stronger regulatory framework which places greater responsibility on the producer to incorporate reuse/recycling or end disposal costs within their manufacturing and pricing structure.

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ALERC
Association of Local Environmental Records Centres

www.alerc.org.uk

Evidence to the National Infrastructure Commission

Formed in 2009, ALERC is an association between Local Environmental Records Centres (LERCs) in Great Britain. The Association aims to provide a central voice for the views and concerns of the Records Centre community, whilst building a support-based network of knowledge and advice to meet the needs of its members.

Local Environmental Records Centres (LERCs) are not-for-profit organisations that collect, collate and manage information on the natural environment for a defined geographic area. LERCs support and collaborate with a network of experts to ensure information is robust, and make information products and services accessible to a range of audiences including decision-makers, the public, and researchers.

ALERC considers it has relevant evidence to submit in relation to the following question:

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

ALERC would encourage changes to the planning system and infrastructure governance arrangements which ensure that biodiversity constraints and the need for site-specific ecological surveys are taken into consideration at the earliest possible stage in the infrastructure development process.

We would draw the Commission's attention to the British Standards Publication, *Biodiversity – Code of practice for planning and development* (BS42020:2013), which states:

"Where available, Local Environmental Record Centres should be approached initially for species and habitat information to inform desk studies."

It is straight forward to find the record centre in your area of interest, using the map on the ALERC website, here: http://www.alerc.org.uk/find-an-lerc-map.html

The British Standards Publication also states that, "Ecological surveys should be carefully programmed into the early phases of the pre-application process. They should also, ideally, be carried out sufficiently in advance of detailed design work to enable the results to be taken fully into account in the design process." It goes on to note that, "the cost of incorporating biodiversity into the development could be higher if surveys are not conducted until after designs are well advanced."

LERCs are often the authoritative source for local biodiversity information, including protected species and priority habitats. It is therefore essential that they are approached as early as possible to ensure infrastructure is delivered as efficiently as possible and on time.

9 February 2017

Black Country Local Enterprise Partnership (LEP) Response

NIC - Infrastructure Assessment Call for Evidence

Key Points from Black Country Local Enterprise Partnership

1. For the UK to prosper in the future global economy, the Black Country, wider West Midlands, and the UKs other city regions must have high performing economies, which are underpinned by attractive, liveable urban environments. Achieving this will require a per capita spend on urban transport solutions which is closer to that of London and European cities.
2. City region high performing economies and attractive, liveable urban environments need high performing city region transport systems and effective inter-urban links, especially when growth and increased population are factored in.
3. Investment planning for these links needs to be less siloed with more scope for investment in strategic (heavy and light) rail capacity to directly accommodate demand for additional road capacity constraints that might otherwise occur.
4. Smart mobility has a key role to play in assisting the development of effective city region and inter urban transport systems - strategic planning and investment needs to make better account of changes in models of car ownership and technology with a greater emphasis on enabling investment to support emergent technologies like Connected and Autonomous Vehicles.
5. The UK needs to significantly enhance the offering of existing inter-urban infrastructure, including rail rolling stock capacity and technology. There is a need to explore and implement new technology for capacity utilisation, network resilience, improving air quality and next generation infrastructure operation.
6. The Black Country is keen to explore this aspect of future transport requirements with the Commission.

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

Connectivity across the Midlands is essential for supporting people and businesses, as well as highly skilled workers. To fully deliver on their potential - areas such as the Black Country need efficient and effective local transport networks as well as good connectivity with each other and the wider world. Connectivity with other cities, and with the wider world, attracts investment and skills and enables access to domestic and international markets.

Cities need to be smart and embrace and facilitate transformative social and technological change like the electrification of transport, the growth in cycling and the way in which open data, smart devices and Connected/Autonomous Vehicles can revolutionise transport information, access and planning. This in turn will draw in investment and skills whilst also, improving air quality and making cities more attractive and dynamic places to be.

The Black Country LEP is playing a major role in strategic and devolved approaches to pan regional infrastructure like better east-west transport connections – through its strategic economic plan, the West Midlands Combined Authority and Midlands Connect, as well as on planning and development of regional rail services through West Midlands Rail.

The Black Country area has a clearly defined strategy for growth, aligned to a robust and deliverable transport strategy. This is summarised in 'Movement for Growth' and is articulated in the ambition and subsequent delivery plans of stakeholders across the region.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

It is crucial that Government continues to back the Midlands and Black Country in promoting jobs and growth, boosting productivity and attracting inward investment whilst recognising the importance of improving infrastructure to increase connectivity. The Midlands Engine region has an economy of £222 billion each year and is home to over 11.5 million people.

Across the West Midlands the population is forecast to grow by 444,000 people by 2035 (Office of National Statistics). The number of new homes which will need to be built to help accommodate this growth over 20 years is in the order of 165,000.

The West Midlands lies at the heart of the UK's road and rail networks, the mix of long-distance, regional and local travel needs is placing heavy demands upon them. There are connectivity challenges that will constrain the ability of the West Midlands to realise its ambitions for growth.

Road

The West Midlands motorway network is subject to heavy congestion, with traffic delays and poor journey reliability, meaning that businesses, commuters and leisure travellers have to schedule additional time into the journey to give confidence that they can arrive at destinations on time.

The analysis completed to date as part of Midlands Connect highlights that we will need to tackle congestion and resilience and quality of journeys provided by the Strategic Road Network. Particular pressures include the South East of the West Midlands, the M6 between M54, usage of the M6 Toll and Birmingham Central (A38M). There needs to be targeted strategic highway capacity to support connectivity to modal interchanges and network resilience to the A5 to rail-freight, A46 to support Birmingham Motorway Box, wider HS2 access, long term M5 Capacity and Strategic Park and Ride.

Rail

There are fast, frequent rail links connecting large parts of the Midlands to the north and south, via the West Coast, Midland and East Coast Main Lines. However, there are major challenges travelling by rail between the Midlands cities and there is an increasing problem of capacity and crowding on services entering and crossing Birmingham. This will cause problems both in accommodating growth in Birmingham and in improving rail connections across the whole Midlands.

To ensure that our transport network provides the future capacity it needs, Government needs to work more collaboratively with TfWM, West Midlands Rail and Midlands Connect. Future service improvements and infrastructure enhancements such as the Midlands Rail Hub need to be delivered faster to cope with the existing increase in rail patronage, unlock early benefits of HS2 and to offer credible alternatives to the private car.

HS2

The importance of integrating growth plans and transport plans should be also recognised. Improving sustainable connectivity across the West Midlands will create investment opportunities but will also tackle development viability and issues such as poor air quality.

HS2 will transform north-south travel and will also significantly improve connections between East and West Midlands. However, it is critical that the Commission fully support the WMCA in delivering HS2 Local Connectivity Package to fully capitalise on the opportunities provided by new stations serving the West Midlands.

Aviation

Enhanced global aviation connectivity will help grow our export led economy further, securing extra benefits and opportunities for the region. HS2 will see Birmingham Interchange station built in close proximity to Birmingham Airport.

Birmingham Airport is a local, regional and national economic asset, a gateway for our businesses to export their services around the world. In the long term, Birmingham Airport has the ability to provide a wider national and global function. Birmingham Airport is well placed to support the UK aviation capacity needs up to 2043.

HS2 brings Birmingham Airport closer to the rest of the country and can provide immediate capacity up to 27 million passengers.

CAV and Technology

The UK and Midlands based automotive industry is a significant part of our overall economy, but is intrinsically global in nature. CAV initiatives can offer opportunities for the Midlands transport system and economy as well as continuing to raise the already established West Midlands profile and UK leadership in the field.

CAV technology will and is entering the system irrespective of any action by Government or a local authority. Failure to support and nurture emerging automotive technology as part of the Midlands and UK transport system will lead to inevitable global investment migration.

The UK and Midlands specifically would benefit from putting in place a coordinated programme of support working closely with those Authorities and companies which have already established activity in order. The Commission may be required to investigate the upgrading of intelligent infrastructure and energy supply capacity to support CAVs and wider advanced manufacturing development.

Freight

Freight and logistics are vital to our economic activity and development. They support people and businesses in their daily activities, ranging from deliveries to homes and shops through transferring goods to and from factories or getting supplies to offices.

The Black Country LEP through the WMCA would like to work with the Commission to explore planning for major strategic rail freight capacity enhancement to central Birmingham rail capacity above and beyond the Midlands Rail Hub. As well as providing extra strategic freight capacity including autonomous platooning freight which are being explored in main land Europe.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Infrastructure should be delivered at the outset for new developments, with sustainable transport capacity completed and public transport operational when new housing becomes occupied. Best practice from the Netherlands should be considered for sustainable urban extensions in relation to this.

Much of the future housing and employment stock within the West Midlands is situated on brownfield land, which has remained derelict for years due to the abnormal costs associated with site remediation. With this in mind consideration should also be given to innovative financial vehicles where key infrastructure and services is delivered to unlock development and costs there are then paid back once occupied. There are examples where this has been successful, such as the Birmingham City Centre Enterprise Zone and Bond financing in the US.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

There needs to be extensive market research exploring views of different demographic groups of the extent of their "love of the car" and the potential role of demand management of some private car and road freight demand for urban and for inter urban journeys, allied to improvements to different models of car use and ownership and to public transport, cycling and walking.

Consideration of what demand management has achieved in other comparable industrial countries would also be of value. The role of technology and information on travel choices available has much potential in relation to deploying demand management measures.

Thought also needs to be given to planning for demographic changes which is seeing significant changes in travel behaviours. For example, fewer younger people are driving but the level of over 65s driving has increases significantly.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

A useful overarching principle is to make best use of existing capacity and create new sustainable transport capacity. Making best use of existing capacity includes effective planned asset management of highways, footways, cycle paths and street lighting.

The condition of the road network for example can have an impact on congestion in terms of traffic speeds, the impacts of remedial or emergency maintenance work and the knock-on effects for congestion of damage to vehicles as well as road accidents. Research in the West Midlands suggests that an accelerated maintenance programme would generate economic returns of £6.50 for every £1 of public funding invested[1].

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

[1] CH2m Hill, (2015), Highways Maintenance Challenge Fund - West Midlands Road Condition Maintenance Improvements

The WMCA, the design consortium of Egis, Tony Gee and Pell Frischmann and contractor Colas Rail have come together in the form of the Midland Metro Alliance. The Alliance will implement a 10-year programme of tram system enhancement works to deliver a lasting legacy for the Black Country and wider West Midlands that will enable social & economic regeneration, and deliver local jobs and training. These longer-term partnerships will help to address skills shortages – enabling consultants and contractors to plan and grow more strategically rather to than to cycle through shorter term contracts.

Alliancing is a form of relationship contracting often used for complex projects or programmes which require speed of delivery and cost certainty. Pure Alliances include the owner, designer and contractor as alliance members who collectively seek outstanding outcomes through an integrated team, characterized by aligned goals, innovative thinking and collaborative behaviours.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

The greater certainty that has been brought to national rail and road spending through five year funding periods and investment programmes as well as Devolution Deals is welcome, as is the creation of the National Infrastructure Commission.

The availability of capital funding for Combined Authorities to tackle transport problems fluctuates and there is a strong case for capital spending to be agreed over a long term (10-20 year) period. We would like to see the widening of the devolved Single Pot funding approach to the WMCA.

In addition, the proliferation of competition funding creates additional pressures on declining resource funding in terms of uncertainty around when such funding competitions will emerge. Bidding for grant funding have non-negligible cost (Urban Transport Group estimates the amount of up to 1.8% of total costs for a £5 million scheme), and creates unpredictable peaks and troughs in workloads which are difficult to plan for efficiently.

To help improve the efficiency of planning, financing, developing and delivering infrastructure, Government and the Commission must commit to fiscal devolution and avoid competitive bidding processes.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

An area to consider with this issue is how an active state can quickly increase diesel rolling stock capacity much more effectively than that provided by existing mechanisms in the rail industry.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

There is a growing awareness of the scale and timing of a series of major infrastructure works which particularly impact the Strategic Road Network and West Midlands Key Route Network (WM-KRN) across the West Midlands. This includes:

- HS2 Phase 1: with significant rail, local road and motorway interfaces and diversion works;
- Network Rail and Highways England investment programmes;
- WMCA investment as well investment in major maintenance and utilities works; and
- Major developments across the Black Country geography.

The infrastructure investment will bring many significant direct benefits and unlock further regeneration and growth opportunities. However, during the delivery period there is a risk that un-coordinated delivery undertaken by different agencies working in siloes could generate significant short-term adverse construction disruption impacts, as well as negatively impacting upon air quality. If poorly handled, as well as impacting the ability for labour market to move freely around the area, it has the potential to impact on manufacturing and logistics operations that underpin the regional economy (many of which use 'Just in Time' operating models).

TfWM and the HS2 Growth Strategy Board commissioned a study and the headline preliminary findings identify the probable loss of 1 or 2 lanes (approximately 12.5 to 25%) capacity from the SRN at multiple locations during the same period, with potential for 20 mins plus delays for each vehicle for extended periods across significant elements of the network.

Based on the consultant's findings and the most impactful mitigation options are likely to focus on (but should not be limited to):

- **Making use of empty seat capacity in cars:** There is a high proportion of single occupancy car trip making over the local and strategic highway network, with significant level of short distance motorway travel (often referred to as junction hoping);
- **Shifting the time of travel and mode choice**: Through a mixture of technology enabled incentives (easy payment systems and public transport pricing; traveller information; and Mobility as a Service solutions) and intelligent management of parking supply and pricing. These would be most effectively implemented through targeted engagement with main traffic generating areas and organisations, and at pinch point hot spots;
- **Traffic management** - Physical and enforcement measures: Introduction of temporary measures such as High Occupancy Vehicle Lanes; Clearways (or Red Routes) and making best use of underutilised highway capacity such as the M6 Toll; and rigorous traffic enforcement (including moving traffic offences); and
- **Communications, data, technology and intelligence**: The use of optimised Urban Traffic Control systems and systems performance monitoring within an environment of open data shared between agencies and published openly. This would be used to optimise construction planning and scheduling; as well as to drive joined up public information through multiple communications channels.

The issue has been raised as part of the Devolution Deal 2 discussions. This has been with a view to securing Central Government support for the strategic response, recognising that the scale and importance of the issue has impacts which are beyond the Black Country.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

The role of elected Mayors for city regions is critical to any changes to the planning system and infrastructure governance arrangements to improve the delivery of infrastructure. Please see points raised in question 3.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Creating city region transport systems with much lower private car modal share and much greater use of low emission or emission free power sources will be a great contributor to protecting and enhancing the natural environment.

The Black Country region also benefits from a diverse range of environmental assets. The road, rail, canal and river networks within the Black Country provide excellent connections between the existing environmental infrastructure, as well as linking to housing and employment centres. Therefore, the building, enhancement and connecting of transport infrastructure can also create opportunities for environmental uplift and habitat creation, leading to better air quality, increased biodiversity and in turn more attractive areas for the local community to engage with. This could be through schemes promoting tree lined streets, grass meadow verges or green walls and roofs within the built environment. New management regimes can also be explored to maintain this infrastructure. For example, reduced grass cutting on road verges, through public sector maintenance cuts, has led in some areas to flower meadow habitat creation in the Spring and Summer.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

The ability to capture more effectively the wider economic benefits of transport schemes and the economic public health benefits of transport schemes would be very positive improvements.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies? Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport

Within the urban environment travel will have to cope with increased density as the populations surge both from growth and agglomeration. The key aim will be to maximise asset efficiency to best utilise road, cycle, rail, tram, air, etc. in terms of the number of passengers, the frequency of services, the delivery of goods and the "always on" transport system. Tailored personal services for transport are seen to be the ultimate approach to mobility, this will have to be balanced with mass-transit although mode choice may affect this. The use of information, location, incentivisation and machines understanding our daily life patterns will be the enablers that will encourage uptake of new technology and increasing mode choice, all combining to make movement easier as a result of convenient transport based on personal preference.

The opportunities that platooning of autonomous vehicles bring to rapidly enabling transport systems to develop will lead to changes in inequalities within the urban environment. There will be opportunities to enable people with mobility problems to move around more freely with mobility on demand. Potentially tackling isolation for the elderly or access to jobs for deprived areas. The important aspect of this will be to manage private sector business models with public policy to develop solutions that work for the city-region.

The impact of a more digitally aware citizen, as the millennials grow older, combined with improved communication technologies via the internet will be a major factor in altering travel behaviours – the impact however is difficult to predict. The current unreliability of communications, the desire for face to face interactions and the ability to keep in touch with people more often over wider distances has in fact led to greater travel demand and movement.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Significantly enhancing the offering of existing inter-urban infrastructure through exploring and implementing new technology for capacity utilisation, network resilience, improving air quality and next generation infrastructure operation is one aspect. The second is to invest in city region rail and rapid transit networks, integrated with local bus networks, alongside high quality cycling infrastructure and decent conditions for walking.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

Initiatives to improve the Black Country and wider West Midlands economy, air quality and quality of life all need to be supported by transport improvements. This is in the context of the - still valid - strategic economic priorities for transport policy identified in the Eddington Review:

- Supporting the UKs successful agglomerated urban areas and their catchments;
- Maintaining or improving the performance of the UKs key international gateways; and
- The key inter-urban corridors between these places.

In line with the above, there is a need for a successful integrated transport network supporting the growth and development of the West Midlands. Support to deliver the HS2 Local Connectivity Package will maximise the benefits for the West Midlands.

A key infrastructure challenge for the Black Country is ensuring the effective and reliable operation of the Strategic Road Network in the West Midlands. This is to serve the West Midlands regional and national needs whilst simultaneously serving movement of people and goods traversing the West Midlands. Wider use of the M6 Toll is required as part of the solution to this challenge. This also improves our issues around Network Resilience, as highlighted in Question 9.

Better utilisation of the M6 Toll is of importance to the Black Country and WMCA area and the Commission should acknowledge that the M6 Toll has a critical role to play nationally.

As part of overall corridor approaches, the role of national and regional rail, including HS2 and rail freight, also need to be considered as priorities, including the Midlands Rail Hub improvement which is the main rail passenger and freight bottleneck of the Midlands and national network.

The Midlands Rail Hub will bring national, regional and local benefits to the rail network and help support the economy and reduce air quality.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

MaaS removes the consumer traveller from directly paying the transport operator or infrastructure provider (i.e. car parking charges or indeed tolls). It is a single payment for the end to end activity with the incentive to minimise the costs against the experience received with the MaaS service provider.

Once a MaaS platform is established and the MaaS service provider can call on transport services as the consumer needs, to get them from where they are to where they really want to go. This has the potential over time to remove some inefficiencies in the transport network.

The other dimension for MaaS is disruptive providers such as Uber, who enter the market and provide a customized service that can be priced on demand. When the network is very busy Uber prices are higher. This could allow for demand pricing on road charging. We will also see more disruptive service like Uber such as Slide in Bristol starting up across our urban networks that could take advantage of road user charging by providing a tailored ride sharing service.

Digital communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

We believe that fibre connectivity to the premise offers the most stable, secure and superfast speeds for both residents and businesses across the Country. We believe that internet bandwidth speed is key for digital connectivity, and agree with 'Nielsen's Law of Internet Bandwidth', which predicts increasing demand for faster internet speeds over the coming years. Much investment has already taken place across the Black Country in developing fibre broadband connectivity, namely through the Government Broadband Delivery UK (BDUK) project, which is predicted to take fibre connectivity across the Black Country to over 99% of premises in 2017.

We feel that that whilst the BDUK project is currently being delivered, further funding from Government to provide 100% superfast broadband coverage across the Black Country (Including Wolverhampton City Centre), would be sensible, as it will be cost effective and easier to inject further Government funding into a current Government programmes.

Finally, we feel that the Government needs to look into the contractual rules for the BDUK project, which currently does not allow BDUK investment to take place in City Centres across the UK. We encourage Government to relax / remove legislation which prohibits the BDUK programme being deployed across City Centres. Further funding, or the allowance of gain share to be reinvested into increasing fibre broadband deployment in City Centres is an action that Government can take immediately.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Note: the existing "regime" refers to the current market, competition and planning frameworks. "Digital communications" includes both fixed and mobile connectivity.

With the advent of cloud technology, 4K quality streaming, and increase in smartphone technology, we believe that there will be an increasing demand for faster broadband speeds over the coming years. There could be the possibility of meeting this demand using existing broadband technology (Fibre to the Cabinet – FTTC), as some recent trails of ultrafast broadband by BT has shown. In any case, further investment in Fibre to the Premise (FTTP), along with ultrafast speeds by Government / Utility companies is encouraged.

We welcome the recent recommendations from Ofcom which ordered BT to separate legally from its Openreach division. We believe this recommendation will offer fair and equal access to the country's telecoms infrastructure to BT's competitors, which ultimately will benefit customers. We would also welcome further Government investment / intervention in Broadband provision, if it will help deliver faster broadband speeds for competitive prices.

Finally, we believe the Government could further facilitate development of 5G mobile phone connectivity by investing in the development of the technology so that it is accessible for all.

The resulting uplift in economic activity, allied with the benefits of a wider use of digital infrastructure in traditional infrastructure would be directly reflected in the national economy.

Energy:

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

The Black Country asks the Commission and Government to accelerate and relax the rules around the adoption and roll out of alternative fuels such as Hydrogen.

Bournemouth BOROUGH COUNCIL

Building a Better Bournemouth

This matter is being dealt with by: [redacted] [name redacted]

Email: [redacted] [e-mail address redacted]

Direct line: [redacted] [phone number redacted]

Address:
Development Services
Town Hall Annexe
St Stephen's Road
Bournemouth
BH2 6EA

Date: 10th February 2017

Dear National Infrastructure Commission,

Please find below the submission from Bournemouth Borough Council to the National Infrastructure Assessment call for evidence.

Cross Cutting Themes

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

The wider Bournemouth conurbation is the second largest settlement in the south west and needs to be considered as a city region in terms of its infrastructure demands. It is an area of high growth. When considering national infrastructure, we must ensure that local infrastructure is able to cope with the required demand and growth.

The following response is based upon public investment in infrastructure.

- Rail: (External links) – Faster journey times between Bournemouth & London; Rail: (Internal links) – 'Dorset Metro' – new and frequent cross-SE Dorset conurbation commuter train services, including new branch lines to Wimborne and Ferndown;
- Rail connections from the south west to the wider Bournemouth Conurbation are weak. For example, no direct line to Exeter from Bournemouth or Bristol to Bournemouth
- Built Environment: Investment in high quality public realm within city and town centres and business areas;
- Public/Low Carbon Transport (Internal Links) – Greater investment in sustainable travel – bus infrastructure, electric buses; cycling infrastructure; multi-purpose transport hubs;
- Road (External links) – Improvements to A31 between Ashley Heath and M27 (Southampton);
- Road (External links) – Provision of new link road between Poole and A31;
- Transport: Air (External links) – Improve capacity and facilities at Bournemouth Airport with a view to increasing flights to and from key trading destinations to enhance export opportunities and the attraction of customers/visitors;
- Transport: Sea (External links) – Increase capacity and capability at the Port of Poole to enhance export opportunities and the attraction of customers/visitors;

- Built Environment: Investment in regeneration of socially deprived areas to include new house building;
- Affordable Housing – provision of suitable [redacted]ng to attract talent to an otherwise relatively expensive area;
- Digital [redacted]s – capability and capacity [redacted]ial models to drive revenue
- Digital communications – the creation of an Office of Data Analytics will enable cities to become more efficient in service delivery
- Other supporting infrastructure, such as energy, waste, healthcare, education, telecoms, leisure, retail etc.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

It is important to identify the key building blocks of world class successful economic regions to inform the prioritisation of investment in infrastructure (which is the purpose of this call for evidence).

Bournemouth has been identified as the fifth-fastest growing area for jobs in the UK over the past 10 years by Centre for Cities. It has particularly strong financial and digital sectors as well as large service and advanced manufacturing sectors. Based upon successful city regions elsewhere in the world the key economic building blocks for Bournemouth and the SE Dorset conurbation are considered to be:

- Accessibility to markets – good international, national and internal connectivity by road, rail, air and sea;
- Availability of talent – high quality universities and further education colleges providing courses tailored towards key local sectors such as finance, digital/media and advance manufacturing;
- Attractive – ensuring that the area provides a world class environment in which to do business and to attract new business and talent;
- Well connected physically – enabling people, businesses and customers to not only move efficiently into and out of the area but also within the urban area in order to increase productivity and competitiveness;
- Well connected digitally – ensuring the area has access to the latest digital technology and data communication systems to enable it to have a competitive edge;
- Supporting infrastructure – good quality housing and schools, proper provision of healthcare, retail, recreation, energy and utilities.

Infrastructure, or rather investment in infrastructure needs to be analytically and strategically applied to a mix of solutions across a wider range of regional areas to provide the optimum return on investment and contribution to the UK's international competitiveness.

There is a sense that investment is currently focused in too few regional areas and only on a handful of significant major projects meaning that other areas with great potential for growth are not realising that potential. Investment could be more effectively dispersed across less large but nonetheless key enabling projects in order to unlock greater economic growth. In the recently published Green Paper 'Building our Industrial Strategy' government has acknowledged the need to "better align central government infrastructure investment with local growth priorities".

Gateways for passengers, freight and data is really important for Bournemouth.

Bournemouth is one of the fastest growing digital/media economies in the country with excellent prospects for further growth. It is therefore important that the latest technology is available and that there is access to the fastest available data transfer services. The recent DCMS contract awarded to Ordnance Survey, commissioning the creation and trial of 5G mapping software in Bournemouth

recognises the importance of Bournemouth's potential and is typical of the high-tech investment that is needed if it is to compete on the world stage.

Bournemouth is home to a number of major financial institutions including JP Morgan which has its UK headquarters and international technology and operations situated in the town. Due to the international nature of these financial institutions it is vital that there are good quality international connections.

For many years Bournemouth has attracted a considerable number of overseas students to its numerous language schools. Overseas student numbers have increased significantly over recent years with the exponential growth of Bournemouth University and the Arts University Bournemouth. Having effective international gateways into and out of Bournemouth not only supports the schools and universities but brings considerable income into the local economy. Further-more due to the attractiveness of the area many students often elect to remain in the town using their talents to not only support local businesses but also to establish new businesses.

Another key business sector is the tourism industry. Bournemouth and Dorset has an exceptional natural environment, including the World Heritage Jurassic Coast. The area attracts millions of visitors each year, both from home and overseas bringing significant benefits to the economy.
In order to support current business sectors and future growth prospects and in order to make the most of potential international markets it is therefore vital that Bournemouth airport and the Port of Poole is able to provide connections to key international markets and customers.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?
Despite the duty to cooperate and there being some good examples of this in practice there is also a notable silo approach to planning amongst some authorities. The solution should be to create a national plan to set a clear planning framework for sustainable growth and investment.
The quality of the local environment plays a vital role in the ability to attract customers and talent. Future urban infrastructure therefore needs to be designed around people, movement and place, reflecting the priority given to the most successful, attractive and inspiring towns and cities in the world.

Bournemouth began life as a Victorian town that was designed around people. The beautiful parks and architecture that were created then provided a legacy that still attracts people to the area. Unfortunately, in the post war era, like many towns in the UK, too much emphasis has been placed upon function rather than place. Typical of this has been the overemphasis on the provision for cars which has led to unwelcoming major roads, blighting the urban landscape and severing communities. Whilst the strategic road infrastructure between and into and out of towns remains critical for economic success, there is the need to fundamentally reimagine our urban areas with the emphasis being on providing inspiring, attractive and sustainable places for people to live and move around.

Increasingly people are more aware of how their actions and choices impact upon the environment and therefore would actively seek out to live in places which support a more sustainable lifestyle. Bournemouth's age demographic is changing (it has an average age of 34 for the next twenty years) and these generational individuals can catalyse green economic growth in the area. Bournemouth is seeking to become one of the UK's leading 'green' cities and is looking to emulate other 'Green Economy Leaders' such as Vancouver, Stockholm and Copenhagen. For Copenhagen, the title of Green Economy Leader is expected to lead to more than 100,000 people migrating to the city by 2025.

To help attract growth town and city centres need to have a very high quality public realm supported by sustainable, convenient, clean and attractive transport systems. In the future this would typically

involve a mix between the provision of excellent walking and cycling facilities and a modern public transport system, possibly with electric buses, trains and/or trams.

Housing should also be designed with green credentials in mind and located to minimise the need to travel and therefore the need for additional infrastructure. Facilities and utilities need to be provided to new build housing to encourage remote working where possible. Business hubs should also be provided as part of new developments or within existing infrastructure so that employees of different businesses can set down and work remotely whilst still enjoying the interaction and sharing of ideas with others.

For those that do need to travel to work by car there is the need to provide much higher quality, attractive, multi-functional travel exchange hubs (rather than simple and uninviting park and ride sites). This would enable and encourage commuters to switch to more sustainable transport modes for their onward journeys into city and town centres.

Housing again needs to be designed with the need to attract talent in mind. Fast data communication hardware needs to be installed into new housing (for as long as hard wired networks are still required). Access to leisure is also a key requirement for most people therefore sustainable access to parks, shopping, sports facilities and entertainment also needs to be considered.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

In regards to transport there are two aspects to demand management. Firstly, the avoidance of the need to travel and secondly, if there is a need to travel, the need to restrict travel by car. Within Bournemouth there is the potential to reduce demand significantly. In regards to avoiding the need to travel a typical intervention would be the encouragement of home or remote working. For this to be successful the right digital infrastructure needs to be in place and there would need to be a greater take up amongst employers, who often can be resistant due to the perceived lack of control of remote working staff.

In regards to reducing the demand for car travel there are considerable opportunities. Many people are willing to change their travel behaviour but the greatest barrier is the current lack of safe, convenient and affordable alternatives. Addressing this issue requires urgent attention and significant investment.

Where investment is made into alternative, sustainable transport and this leads to modal shift, surplus highway space may be reallocated to provide improved public realm, further sustainable travel networks or space for redevelopment, thereby helping to avoid any rebound effect.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

Initially there is a need to identify what infrastructure is required both now and in the future. This assessment needs to be based upon both function and form i.e. does the asset serve an important purpose? does the asset have any heritage/place making value? For those assets that pass this test generally it is more cost effective to carry out maintenance. However, an assessment needs to be made as to whether continued maintenance of the asset is cost-effective or whether it should be replaced or whether a completely new and alternative asset should be provided.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

There is significant potential to improve collaboration between different client agencies that provide infrastructure. The absence of an overarching local infrastructure planning framework often means that agencies operate in isolation. The result can be the inefficient and uncoordinated provision of infrastructure, e.g. the location of a hospital or university facility with poor transport access will require additional and potentially avoidable investment in transport infrastructure.

The current local planning system neither has sufficient scope nor sufficient powers to ensure that all agencies work together to optimise key infrastructure investment. Consideration should therefore be given to the establishment of formal 'local infrastructure bodies' which would require key agencies to identify, co-ordinate and plan future infrastructure helping to ensure that the right infrastructure is brought forward and is delivered as cost-effectively as possible.

In the Green Paper 'Building our Industrial Strategy' government has acknowledged the need to create "... the right institutions to bring together sectors and places" and local infrastructure bodies could fulfil that role for infrastructure provision. These bodies could form part of an extended role for either Local Enterprise Partnerships or Combined Authorities and include expert representation typically from each of the following agencies: -

- Key local businesses;
- Political leaders;
- Local planning authorities;
- Urban designers;
- Local transport and highway authorities;
- Local clinical commissioning groups;
- Healthcare providers – GPs/Hospitals etc;
- Environmental bodies;
- Universities and FE Colleges;
- Education authorities/bodies;
- Network rail;
- Train operators;
- Bus and other public transport operators;
- Air and sea port operators;
- Energy providers;
- Water and waste water companies;
- Digital communications companies;
- Agriculture and fishing bodies;
- Waste management authorities;
- Flood risk authorities;
- Housing authorities/providers;
- Landowners;
- Housing developers;
- Other developers;
- Leisure providers;
- Contractors (e.g. Constructing Excellence)

Collaboration between key agencies is the most critical factor in delivering the right infrastructure effectively.

In regards to the role of competition this can be applied to both client agencies and contractors building the assets. Whilst competition at the client level, e.g. energy companies and train operating companies, can be beneficial there is also concern that commercial interests have the potential to impede wider benefits. The creation of a 'local infrastructure body' with appropriate powers could help to mitigate this risk. In regard to contractors delivering the physical assets, provided that appropriate procurement options are followed competition is usually beneficial in securing better value for money.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

At present investment in road infrastructure is catered for through LTP and other DfT grant settlements. However other infrastructure, important for creating attractive places to live and work is not directly or adequately catered for. Typically, urban realm and regeneration schemes either have to be funded through developer contributions, which are becoming increasingly difficult to secure to

the levels of funding required, or through local authorities' own budgets which are already under considerable pressure. The identification of funding streams to support the development of both the built and natural environment would therefore be welcomed.

The creation of a funding/grant system that supports a broader infrastructure spectrum, rather than the current systems which primarily focuses on road construction, would be beneficial, and could help deliver the wider aspirations of 'local infrastructure bodies' if such bodies were to be created.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?
Raising capital for upfront funding of projects, particularly those requiring significant advance investment, is extremely difficult for local authorities. In some cases, upfront investment could be partially reimbursed through the charging of fares or fees or through the franchising of assets – e.g. the creation of a Dorset Metro rail system. However, it should be borne in mind that benefits from assets are not always realised directly and even if a project may not be self-financing the wider economic and social benefits also need to be taken into account – e.g. increased tax revenue; reduced health or social care costs. When these indirect benefits are factored in the case for government intervention becomes much stronger.

At present local authorities would find it politically very challenging to introduce road–user charging to help fund projects as for many people there are not convenient alternative transport options in place. The provision of much better rail, cycling and bus infrastructure would make the case for road-charging considerably stronger and the income from this could then be used to offset some of the upfront infrastructure costs for these alternative modes.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?
As stated previously (refer to response to Q.6) the fundamental problem with current arrangements is that many key agents develop their future infrastructure plans in isolation which can lead to inadequate overall outcomes. A co-ordinated approach through a formal 'local infrastructure body' should help to address this problem as well as helping to ensure that interdependencies are properly identified and catered for.

A formal local infrastructure body could also take on the explicit responsibility for ensuring resilience is accounted for in the design and construction of infrastructure as well as the ongoing management of resilience risk i.e. need for maintenance or other interventions.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?
(Refer also to responses to Q.6 and Q.9)
There needs to be suitable investment in the planning system throughout from local to national level. The value of good planning need to be fully recognised and supported – see RTPI 2016 report - http://www.rtpi.org.uk/valueofplanning

The Town and Country Planning Association Publication 'Planning 4 People' also highlights the associations flaws in the current system and the planning of national infrastructure provides some opportunities to respond to these issues- https://www.tcpa.org.uk/planning4people

It is considered that the existing National Infrastructure Planning process for projects such as large renewable energy schemes is effective and helps to negate issues of local interest being an obstacle to the wider public interest at a national level. The existing system should be sustained unless there is a coherent national planning framework in place which will enable Local authorities to make planning decision accounting for clearly stated national priorities.

At present the planning system does not have sufficient scope, powers or resources to be able to fulfil governance effectively. In many respects the planning system can appear to be adversarial. Planners set planning rules and seek to obtain contributions from developers in order to provide supporting infrastructure necessary to offset the impacts of the development, whereas developers seek to minimise any contributions in order to maximise returns on investment. The result is often a piecemeal, short term, reactional approach to the provision of infrastructure, rather than the strategic, co-ordinated approach that is required.

Again the provision of a formal local infrastructure body, with wider powers and resources would help to address this issue, enabling strategic infrastructure to be properly planned in advance so that all parties are clear about what is required in terms of the infrastructure necessary to support any development. This upfront approach would make a significant contribution to 'fast-tracking' development through the planning system helping it to be delivered far more efficiently and on time. Other measures that could be taken to speed up the delivery process would be increasing CPO powers over land which has no current intrinsic value.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

It should be part of a wider national plan which includes national environmental designations. Bournemouth and Dorset's natural environment is a unique and major asset and makes a significant contribution to attracting businesses, customers and talent to the area.

As well as the Jurassic Coast World Heritage Site, it is also has wide areas of very important heathland and wetland that is home to rare protected species, birds, flora and fora. As a result many of these areas are subject to international environmental habitat designations. It is therefore paramount that the provision of infrastructure should respect Dorset's natural environment, contributing towards its protection whilst enabling appropriate access for its enjoyment. Access roads, car parks, visitor centres, disability friendly footpaths etc. all need to be carefully set out to strike the right balance between protection and access.

The Dorset coastline is particularly vulnerable to erosion. Coast protections and flood defence works can therefore help to protect the coastline as well as important habitats. However great care is required in the design to ensure that the infrastructure provided is sympathetic to the natural environment.

Roads, structures, renewable energy infrastructure, telecoms masts and pylons also all need to be sensitive to their setting within the landscape and should therefore be appropriately located.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

There is an urgent need to review cost-benefit analysis associated with infrastructure. The Growth Deal initiative has highlighted the inadequacy of current cost benefit analyses. Typically, for transport schemes designed to unlock employment land the main economic benefit is treated as the saving in journey times rather than the considerable GVA generated from the creations of jobs. Current cost-benefit approaches can therefore lead to the wrong outcomes being measured, potentially leading to perverse outcomes with investment being directed into the wrong infrastructure. This issue has been partially recognised but a far better approach is needed. Cost-benefit analyses should be targeted at a wider range of economic and quality of life 'building blocks' that will deliver the optimum outcomes and return on investment.
Greater focus therefore needs to be given to the ability of any scheme to deliver against key overarching outcomes such as:

Creation and protection of jobs;

- construction of offices, business units, research/innovation centres; factories etc;
- enhancement in agriculture and fishing facilities;

- facilities to improve access to markets (local, national and international);
- facilities to improve access to employment;

Developing skills;

- construction of university buildings; FE colleges, training centres; new schools etc;
- facilities to improve access to education;

Enhancing the built-environment;

- construction of attractive public realm infrastructure in business, town, and neighbourhood centres;
- construction of modern transport hubs;
- regeneration initiatives;
- creation of public open space and parks

Healthier lifestyles;

- construction of leisure, recreational and sports facilities,
- creation of better walking and cycling environments;
- facilities to improve access to leisure, recreation and sport;

Improved Healthcare;

- construction of hospital and healthcare facilities;
- facilities to improve access to healthcare;

Protection of the environment;

- construction of sustainable travel networks e.g. rail, bus, cycling and walking;
- provision of renewable energy;
- Provision of flood and coastal defences.

Underpinning the above key outcomes is 'enabling infrastructure'. This enabling infrastructure should be assessed to the degree in which it contributes to the delivery of the above outcomes – rather than in its own right which currently can be a particular issue with road schemes. Typical enabling infrastructure may be considered to be: -

Transport links (external and internal);

- enhancement and construction of rail, road, bus, cycling and walking infrastructure;
- enhancement of airports and sea ports.

Utilities;

- construction of water and waste water treatment facilities;
- provision of affordable energy;
- provision of digital and telecommunications hardware;
- provision of waste management facilities

Mineral extraction;

- quarries, processing plants etc;
-

Only a few infrastructure schemes will contribute to all of the outcomes. It is therefore necessary to devise a cost-benefit mechanism that appropriately weighs the various outcomes so that differing schemes can be assessed and compared in terms of which deliver the best overall value for money. Although it may be difficult to develop credible, tractable or transparent cost-benefit analysis techniques capable of analysing and comparing differing schemes' ability to deliver such key outcomes this should not be a reason for analysing more simple alternative non-critical outcomes. The focus should always remain on assessing the key outcomes not the degree of difficulty involved in the assessment.

As well as pre-project cost-benefit analysis greater consideration needs to be given to post-project analysis. Post-project analyses are seldom properly carried out on infrastructure schemes and yet they are very important in answering two key questions – were the intended benefits/outcomes realised? If the benefits/outcomes did not align with what was intended what adjustments need to be made to future cost-benefit assessments? Further-more and importantly evidence from post-project analyses also helps to build up a picture of what constitutes successful infrastructure interventions to help inform future investment decisions.

Investment in data infrastructure and data analytics capacity will enable better, shared reporting

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

The answer to this question is highly dependent upon where investment in transport infrastructure and technology is directed. Over the past sixty years the focus has been primarily on road building, which has inevitably led to the significant increase in car use. Similarly, the future will be dictated by where transport investment is targeted.

Whilst inter-urban transport is likely to continue to be dominated by roads and cars to move people and freight around, land pressures within urban areas and the inability to continually widen roads, coupled with increasing congestion and air quality issues means a different transport regime is inevitable in our towns and cities. Infrastructure targeted at buses, rail, cycling and walking make much better use of available land and assets. With step changes also taking place in travel planning technology there is significant scope to improve sustainable travel making it far more attractive and easier to use. Therefore, within our town and cities, with the right investment in the future far more journeys will be undertaken by bus, rail, bike or on foot.

With the provision of genuinely viable sustainable travel alternatives, demand for car use will be considerably less with towns and cities. This will be reinforced should car-use charging be introduced by which time most cars are likely to be electric vehicles.

Again with the advance in technology, increasingly people will be electing to work from home, further reducing demands on the transport network. Currently daytime travel is dominated by peak hour commuter travel. Over the next 30 years there is likely to be a significant shift towards leisure travel and away from commuter travel. This will also deliver journey time benefits avoiding the need for any further major investment in road building for cars within urban areas.

Advances in autonomous vehicles raises the question of how traffic could be managed in the future. Coupled with advances in technology there is potential for both personal use and freight vehicles to be remotely 'orchestrated' to optimise journeys, although the advent of unforeseen incidents (e.g. potholes, severe and sudden weather events) and how to manage these represents significant difficulties.

In regards to Bournemouth its diverse population, coupled with its significant predicted growth will inevitably place a greater demand on air travel and rail travel.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Movement of people into and out of major urban areas

- Investment in new link road between Poole and A31 trunk road.
- Investment in 'Dorset Metro' commuter train service;
- Reopen key rail branch lines to Wimborne and Ferndown;

Movement of freight into and out of major urban areas

- Investment in new link road between Poole (including Port of Poole) and A31 trunk road;
- Investment in rail freight handling facilities.

Movement of people within major urban areas

- Investment in sustainable transport infrastructure for buses, rail metro, cycling and walking, including travel hubs;
- Investment in 'Dorset Metro' commuter train service;
- Investment in travel information technology.

Movement of freight within major urban areas

- Investment in sustainable transport infrastructure to reduce congestion and help free up internal strategic road network for freight.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

Movement of people outside of major urban areas

- Investment in infrastructure to reduce train journey times to London;
- Investment in improving strategic road network – A31 trunk road between Ringwood and Southampton;
- Enhance facilities at Bournemouth Airport
- Enhance facilities at Port of Poole

Movement of freight into outside of major urban areas

- Investment in improving strategic road network – A31 trunk road between Ringwood and Southampton;
- Investment in rail freight handling facilities.
- Enhance facilities at Bournemouth Airport
- Enhance facilities at Port of Poole

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

There is considerable scope to use 'mobility as a service' not only for road user charging but for helping people to access real-time public transport information and buy tickets online. A fully integrated travel information network has the potential to vastly change travel behaviour and digital Apps are already being developed with this capability.

Mobile technology has tremendous potential to reduce the amount of infrastructure necessary on street such as real-time bus travel information displays. The ability to use phones to geo-spatially track drivers has obvious cost-saving implications on delivering future road user charging regimes, however the greatest potential is with sustainable travel.

Digital communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

We fully support the NIC's Connected Future Report (Jan 2017)) and recommendations.
In addition to the 6 identified areas (1. Putting digital infrastructure at the heart of the Uk's industrial strategy 2. Motorways with mobile telecommunication networks fit for the future 3. Rail passengers should have high capacity wireless connectivity 4. Local government should actively facilitate the employment of mobile telecoms infrastructure 5. Meaningful metrics on coverage 6. Review the sharing of telecoms infrastructure 7. Regulatory review of mobile communications market) significant investment is needed in data and cloud infrastructure to enable a city's interoperability. A civic intelligence centre, similar to that of the Mayor's Office of Data Analytics in New York, would enable all city stakeholders to build capacity and capability to collect, analyse and visualise data across departments and fully realise the potential for a Smart City. Business intelligence teams in local authorities need investment in specific skill sets such as data analysts that will unlock the potential of how local authority data can be used to cut costs, enabling them to become more efficient in their delivery of services, resulting in a data-driven approach to business decisions. Talent attraction into local authorities in this area remains difficult due to perceived and real uncompetitive salary levels, coupled with poor awareness of the opportunities on offer within the public sector.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming

a utility? If not, how can we facilitate this?
We fully support the NIC's Connected Future Report and recommendations. With regard to 'Engaging Local Government as a partner' we would add for central government to mandate the need for all fixed broadband service providers and MNO's to be fully transparent on where their existing networks are positioned and current coverage so we are able to have the most accurate view of existing infrastructure and connectivity and use this to inform future plans.

Drawing on case studies from Stokab and Bristol, Bournemouth has ambitions to own and commercialise ducting. Support is needed from central government and knowledge sharing from key cities who have built this capability to develop this concept and investment to realise this ambition. The local authority would then be able to manage its own network and provide mobile (5G and wifi) and fixed network coverage for residents, utilities and businesses.

Identifying pilot cities will be important to share knowledge and frameworks with other local authorities. Bournemouth is well placed to be a pilot for two important reasons. Firstly, that our recent partnership with Ordnance Survey means by April we will already have an 3D model informing where 5G sensors should be positioned. Secondly we have key different types of area (urban, rural, coastal) that are seen as core to testing different deployment models. Situated close to the Jurassic Coast, we would seek to see how high quality design can minimise the visual impact of this kind of infrastructure on an area of outstanding natural beauty.

We would also add that it should be compulsory for each local authority to employ a Chief Digital Officer that reports into the CEO, oversees the digital infrastructure, the digitalisation of local authority services, implementation of data strategy. This role should demonstrate strong digital leadership and drive cultural change across the business.

Energy:
19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?
There are too many different scenarios with varying factors associated with the cost of heat decarbonisation to be able to define the single highest value solution nationally. Factors that affect the cost of heat decarbonisation include:

- Type of current heating system
- Thermal insulation qualities of building fabric
- Pressure on local electricity infrastructure
- Proximity to gas network
- Presence of on-site renewable generation
- Wholesale energy costs
- Density of local heat demand

The emphasis should be put on providing training and education to people to ensure that the right skills and knowledge exist to identify highest value solution in each scenario. Additionally, it is thought that local authorities are better placed to identify the highest value solutions for heat decarbonisation. This is because the highest value solution will vary nationally, however it is envisaged that there will be a highest value solution at the city / regional scale. Therefore, national government should encourage local authorities to set local heat policies that tackle heat decarbonisation. A similar model to follow could be to that of the Heat Network Distribution Unit, whereby local authorities are given grant to identify areas for where it is economic to build heat networks. The government could create a team to support the formulation of local heat plans. Policies to support the decarbonisation need to be implemented as soon as possible because it is likely that this will save businesses and households money which will improve the economy. For example, emphasis should be put on the heat decarbonisation of new domestic and commercial properties. Whilst it will likely increase upfront build costs, it will probably significantly decrease the lifecycle cost of heat and if the UK is realistically going to decrease heat by 80% by 2050, then the heating system of today's new builds will have to be retrofitted before then.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?
The most effective zero carbon network will rely on a mixture of different energy generation technologies (e.g. solar, wind, nuclear, tidal) with storage. Additionally, it is foreseen that many new energy generation technologies in 2050 will likely be invented / improved by then (e.g. large-scale nuclear fusion plants?). Therefore, emphasis should be put on providing training and education to people to ensure that the right skills and knowledge exist to identify the most effective solution in each scenario. Likewise, funding for research to improve all energy generation and storage technologies should be increased to ensure that UK remains / becomes a global leader in energy technologies because this will no doubt have positive consequences for the economy. It is acknowledged that the government has taken positive action already by significantly increasing funding for research into energy innovation this parliament, it is thought that further investment will yield higher return on investment for the national economy. Another example of positive action is the building of the Swansea Bay tidal power plant that puts the UK as the leader in this market in the world and creates potential opportunities for export.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?
Nil response

Water and wastewater (drainage and sewerage):
22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?
Nil response

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?
Nil response

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?
Nil response

Flood risk management:
25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?
Joint response to 25 and 26 under 26

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?
The biggest flood risk in Bournemouth is currently Surface Water flooding. In terms of numbers of properties at risk this considerably exceeds those at risks from Coastal, Fluvial or Ground Water Flooding combinedThis is partly because of the natural topography of the area and the density of urban development but also somewhat counter intuitively because the ground is generally free draining. This has over many years lead to development in what were assumed to be dry valleys. There is now very little natural drainage in the Borough with much of the urban drainage is almost entirely dependent on the public sewerage system or individual property soakaways. Any "piped" drainage network only has finite capacity but when the drainage is overwhelmed in intense (usually summer thunderstorms) rainfall, flow returns to these natural valleys. It is simply not economically viable to make the drainage system capable of handling every storm no matter how big. This flooding often occurs quickly with little "targeted" warning, it is relatively localised and is over quickly but doing a lot of damage while it lasts. There is no time to raise temporary defences even if they were available.

This situation is expected to get worse with the results of Climate change.

Ideally any opportunity should be taken to remove these inappropriate developments with the creation of "Blue Corridors" as per the Government report "Making space for Water" but as most of these sites are in private ownership or already extensively developed, this is very unlikely to occur. There may be a very small opportunity for more natural flood management but much of the run off is generated within the urban area and contributes to flooding in the urban area. Further it is very unlikely that funding will be available for major flood relief schemes so the most successful approach is likely to be increasing the resilience / resistance of the current properties (property level protection) and ensuring any new developments are resilient / resistant. This has to be largely done through the planning process so that must be robust. It also relies on having accurate, reliable, data to identify at risk areas. While improvements in advance warning will help, the Bournemouth Conurbation is relatively small and Chaos theory dictates that in[redacted]ised thunderstorms are always going to be difficult to accurately predict.

Finally, all new developments must be required to do everything to reduce their impact on the environment so Sustainable Urban Drainage (SuDs) is vital but again this is largely enforced through the planning process.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

Bournemouth's Municipal Waste Management Strategy 2011-2026 (http://www.bournemouth.gov.uk/BinsRecycling/GoGreen/BournemouthsWasteStrategy.aspx) outlines how the Council proposes to face the challenges of reducing the amount of waste we generate, how we expect to reuse and recycle the waste we do create and then extract as much benefit as possible from the residual waste left before we resort to landfill.

We believe it is in everyone's interests to manage our waste more efficiently and to do this we may require new technologies to treat waste as a resource. Thanks to the fantastic resident participation in our re-use and recycling schemes we achieved exceptional results for our recycling last year, recycling or composting 63.9% of all waste, an increase from 50% in the previous year. Bournemouth now has the 4th best recycling record in the whole country and is the clear leader in the South of England but we are striving to build upon this success.

To fully consider and reflect the rapidly changing environment relating to waste management, work will continue on the set of action plans published in conjunction with this strategy and as such, the strategy may need periodic review and refinement. These action plans have incorporated input from stakeholder consultation.

The action plans
- Waste Prevention Action Plan 2011-2016
- Recycling and Composting Action Plan 2011-2026
- Commercial Waste Action Plan 2011-2026

Ensuring sustainable waste management must be a key objective for the future and Bournemouth Borough Council, informed by whole life-cycle thinking, will continually promote, encourage and enforce the delivery of the waste hierarchy, particularly in the light of the current fiscal constraints. Using this strategy as a route map for the effective management of Bournemouth's municipal waste the Council have emphasised waste prevention, re-use and stopping waste at its source, together with continuing to increase recycling rates when considered the best option. The strategy also recognises the potential and cost effectiveness of generating renewable energy from residual waste

and encourage community and commercial participation, vital in working towards a zero waste economy.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?
This fits well with Bournemouth's ambition to become a Green Economy Leader, helping to minimise waste, re-use goods and services and reduce carbon emissions. This in turn can lead to attracting the best people, growing responsible and profitable businesses, and developing an even more inclusive community. Some of the barriers are outlined in the Council's Municipal Waste Management Strategy outlined in 27.

Yours sincerely,

[redacted] [signature redacted]

[redacted] [name redacted]
Bournemouth Borough Council [job title redacted]

HM Treasury

NATIONAL INFRASTRUCTURE COMMISSION

National Infrastructure Commission Studies – Call for ideas response form

Name/Organisation: BRAMPTON A14 CAMPAIGN GROUP – A RESIDENTS ASSOCIATION

*You have **up to 500 words** to outline the problem for a NIC study to focus on, and if you wish, to explain why this should be a priority. You must demonstrate how your suggestions fulfil the criteria outlined in this 'Call for Ideas'.*

Suggestion:

THE NEW DEFRA AIR QUALITY PLAN (DEC 2015), DfT ROADS INVESTMENT STRATEGY AND DfT NEW RAIL FREIGHT STRATEGY SHOULD BE EXAMINED IN THE LIGHT OF ENVIRONMENT AND HEALTH POLICY, DfT MODAL SHIFT POLICY (FROM ROAD TO RAIL), AND SUSTAINABLE DEVELOPMENT GUIDANCE (ESPECIALLY THE PRECAUTIONARY PRINCIPLE) TO ACHIEVE THE REDUCTION IN ROAD TRAFFIC AIR POLLUTION REQUIRED BY THE SUPREME COURT IN APRIL 2015.

Rationale:

Does the suggestion deal with a nationally significant issue?

YES: UK ROAD TRAFFIC AIR POLLUTION CRISIS.

MORTALITY RATES ATTRIBUTABLE TO ROAD TRAFFIC AIR POLLUTION ARE CURRENTLY ASSESSED AS 40,000 PER ANNUM. MEDICAL PROFESSIONAL BODIES – ROYAL COLLEGE OF PHYSICIANS (RCP) AND ROYAL COLLEGE OF PAEDIATRICS AND CHILD HEALTH (RCPCH) – AS WELL AS ENVIRONMENT EXPERTS AND URBAN AND RURAL COMMUNITIES UP AND DOWN THE COUNTRY, ARE DEEPLY CONCERNED.

Does the suggestion need to be considered now?

YES: IMMEDIATE MORATORIUM ON ALL NEW ROAD SCHEMES NEEDED (INCLUDING A14 SCHEME).

HIGHWAYS ENGLAND IS POISED TO START WORK IMMEDIATELY ON HUNTINGDON SOUTHERN BYPASS (ESTIMATED COST £600 MILLION) – PART OF A14 SCHEME TO BE CANCELLED IN BCG ALTERNATIVE SCHEME. BCG SCHEME INCLUDES A **REPLACEMENT RAIL FREIGHT ELEMENT (FELIXSTOWE-NUNEATON)** TOGETHER WITH IMPROVEMENTS TO **A428 -A421 ROUTE FROM A14 TO M1** (NOW ALSO PART OF THE NEW CAMBRIDGE-OXFORD EXPRESSWAY STUDY).

Does the study deal with a challenging issue?

YES: THIS IS A HIGH PRIORITY, MULTI-FACETED, CROSS-PARTY, CROSS- DEPARTMENTAL ISSUE THAT AFFECTS BOTH RURAL AND URBAN COMMUNITIES THROUGHOUT THE UK.

Would any potential recommendations be realistic in terms of cost?

YES: SIGNIFICANT COST SAVINGS POSSIBLE WITH ALTERNATIVE (BCG) A14 SCHEME

BCG A14 SCHEME IS MUCH LESS COSTLY IN FINANCIAL AND ENVIRONMENTAL TERMS. RAIL FREIGHT ROUTE (FELIXSTOWE-NUNEATON) ALREADY PART-FUNDED IN CP5. RAIL IS SAFER, CLEANER, LOW-CARBON FREIGHT OPTION. BCG SCHEME WOULD REDUCE ROAD TRAFFIC ALONG WHOLE LENGTH OF A14 – NOT JUST FROM CAMBRIDGE TO HUNTINGDON AND HELP TO MEET CARBON REDUCTION TARGETS.

Would the NIC add value by considering this issue?

YES: SUPREME COURT RULING (APRIL 2015) REQUIRED URGENT ACTION BY UK TO REDUCE ROAD TRAFFIC AIR POLLUTION – FAILURE TO COMPLY WITH THIS RULING COULD RESULT IN CONSIDERABLE EU FINES. CURRENT LEVELS OF POLLUTION ALSO IMPACT ON COSTS TO THE NHS.

ENVIRONMENT & HEALTH: THE GOVERNMENT HAS A DUTY OF CARE TO THE POPULATION AND EVERY EFFORT MUST BE MADE TO PROTECT LIVES AND IMPROVE HEALTH AND WELL-BEING.

LATEST SCIENTIFIC EVIDENCE FROM AIRBORNE RESEARCH LABORATORY OF THE NATIONAL ENVIRONMENT RESEARCH COUNCIL (NERC) SHOWS SCALE OF PROBLEM EVEN LARGER THAN PREVIOUSLY KNOWN – EVIDENCE TODAY (26 OCT) WIDELY COVERED ON BBC & SKY NEWS BULLETINS

POTENTIAL COST SAVINGS TO NHS IF ROAD TRAFFIC AIR POLLUTION REDUCED. COSTS TO THE NHS DUE TO ROAD TRAFFIC AIR POLLUTION IN 2009 WERE ASSESSED AT **£11BILLION PER ANNUM.**

[Name redacted] – Brampton A14 Campaign Group
(BCG) [Phone number redacted]

Please e-mail this form to: NationalInfrastructureCommissionSpecificStudy@HMTreasury.gsi.gov.uk

Letter to Chancellor – Sustainable Development and Roads Investment Strategy – 16 Nov 2016

KEY POINTS

1.SUSTAINABLE DEVELOPMENT – PRECAUTIONARY PRINCIPLE

The UK Infrastructure Strategy is set within the over-arching UN Sustainable Development goals and the guiding principles of UK Sustainable Development policy (Annex A appx1). All guiding principles must be followed if a project/scheme is to be deemed sustainable, notably the Precautionary Principle, which states that if an action or policy might cause severe or irreversible harm to the public, in the absence of a scientific consensus that harm would not ensue, the burden of proof falls on those who advocate taking the action – see Gauderman report on the impact of road traffic air pollution on children's lung development (Annex A appx2).

2.SCIENTIFIC CONSENSUS ON HEALTH IMPACTS OF ROAD TRAFFIC AIR POLLUTION

The Gauderman report was discounted by the A14 Planning Inspectors (PINS) as a single study, even though the WHO Review of the Health Aspects of Air Pollution (REVIHAAP) - which includes the Gauderman report - was also provided as evidence. SofS/DfT was subsequently advised by PINS to approve the A14 scheme, which he did on 11 May 2015. Further peer-reviewed evidence of harm to public health (Annex B) was subsequently provided by the Royal College of Physicians and the Royal College of Paediatrics and Child Care (Sep 2015). Additionally, expert medical evidence (Annex C) to the Parliamentary Office of Science and Technology (POST) Dec 2015 states that there are similar health risks to communities living alongside busy roads in rural areas, which would be further exacerbated by higher levels of ozone in the countryside.

3.DEFRA AIR QUALITY PLAN & ROADS INVESTMENT STRATEGY

The Supreme Court recently quashed the latest DEFRA Air Quality Plan, which is based on Clean Air Zones in cities but does not address road traffic air pollution in rural areas. The consensus of scientific evidence of harm to human health is now irrefutable and DEFRA agree that urgent action is needed (Ministerial response by Therese Coffey MP to an Urgent Question from the EFRA Select Committee in Parliament last week). But this issue is not restricted to existing roads and the environment and health impacts of planned new roads/road schemes (such as the A14 scheme) in the Highways England £multi-billion Roads Investment Strategy(RIS) need to be addressed and action taken to avoid future harm. There is committed funding for these schemes but that does not mean that the plans (approved or not) are set in stone. The RIS states clearly:
Section 3: Key Investments on the Strategic Road Network (Annex D p27):
"In some instances, the development of schemes over the course of the road period may bring unexpected issues to light. This could mean that in limited cases individual commitments may need to change or adjust. If this happens Ministers will be required to confirm that the revised proposals continue to meet the overall objectives of the scheme, or that they provide an alternative way of tackling the problems targeted."

4. UK INDUSTRIAL STRATEGY & NEW RAIL FREIGHT STRATEGY

The UK Industrial Strategy now includes a new Rail Freight Strategy which will presumably include DfT modal shift policy and also comply with the EU TEN-T freight routes strategy and the CEF. Additional investment in the Felixstowe – Nuneaton rail freight route (as per the BCG multi-modal alternative scheme) would reduce A14 congestion, road traffic air pollution and carbon emissions

along the whole length of the A14 corridor not just from Cambridge to Huntingdon. Please also see my response to the DECC/BERR online consultation in March 2009 on low-carbon transport strategy (Annex A appx3) advocating rail as the optimum low-carbon transport option. This proposal won support and funding from the EU vice-President for Transport and is reflected in the current EU TEN-T freight routes strategy (Annex A appx5) and the Connecting Europe Facility (CEF) which provides funding for EU freight routes based on rail, ports and multi-modal platforms (including HS2, Felixstowe, Liverpool and Northern Hub and the BCG multi-modal scheme). TEN-T road only schemes (such as the HE A14 scheme) are not included in the CEF.

5.SPENDING REVIEW – POTENTIAL COST SAVINGS

The HE A14 scheme was initially conceived in 2001, lost a judicial review in 2005, was re-submitted and cancelled in 2010 and again re-submitted in its current form in 2015. It is largely unchanged from the 2010 version - except that the Brampton Interchange is now some 100 metres closer to family homes (now only 200 metres from the ten-lane Brampton Interchange). It has not been updated in line with Government policy changes in the intervening years.

The A14 scheme as currently configured should be re-assessed in the light of current Government environment and health policy, sustainable development criteria, Treasury Green Book 'value for money' rules (including valuing environment and health impacts for transport scheme appraisals) and carbon emissions reduction targets (Climate Change). The BCG alternative scheme should also be drawn up and evaluated for possible cost savings and reduced risks to public health. This has been proposed as possible cost saving option in the 2016 Spending Review (Annex E). There are further developments that suggest that the need for the A14 scheme should be re-assessed. Peel Ports Liverpool has recently opened a new freight facility with large cranes capable of servicing the largest container ships. This could result in reduced levels of container freight traffic at Felixstowe, together with associated reductions in A14 road congestion, road traffic air pollution and carbon emissions.

6.CONSTRUCTION OF A14 SCHEME IMMINENT – URGENT MORATORIUM NEEDED

Highways England have issued 'at risk' contracts to proceed with the A14 scheme and contractors are poised to start work imminently on huge quarries on both sides of the existing A1 at Brampton for the extraction of some 2 million tonnes of sand and gravel for the scheme (Annex F). This would result in thousands of truck movements 6 days a week during the construction period (2016-2020) close to family homes and not far from the village school. The quarry site on Park Farm abuts the former RAF Brampton site where some 250 service personnel still live and where 700 new homes are being built, together with a nursing home for the elderly. A cement works is also planned for one of the quarry sites. In the operational phase (2020 onwards), traffic levels on the ten-lane Brampton Interchange are expected to be as high as those on the busiest parts of the M25. Clearly an urgent moratorium on this scheme is required to allow time to assess alternative options. A moratorium on the A14 scheme, and all new roads in the HE pipeline, would not only allow time to consider alternative options (including the BCG alternative scheme) but also the opportunity to take account of potential post-Brexit trade issues which could affect industrial freight routes.

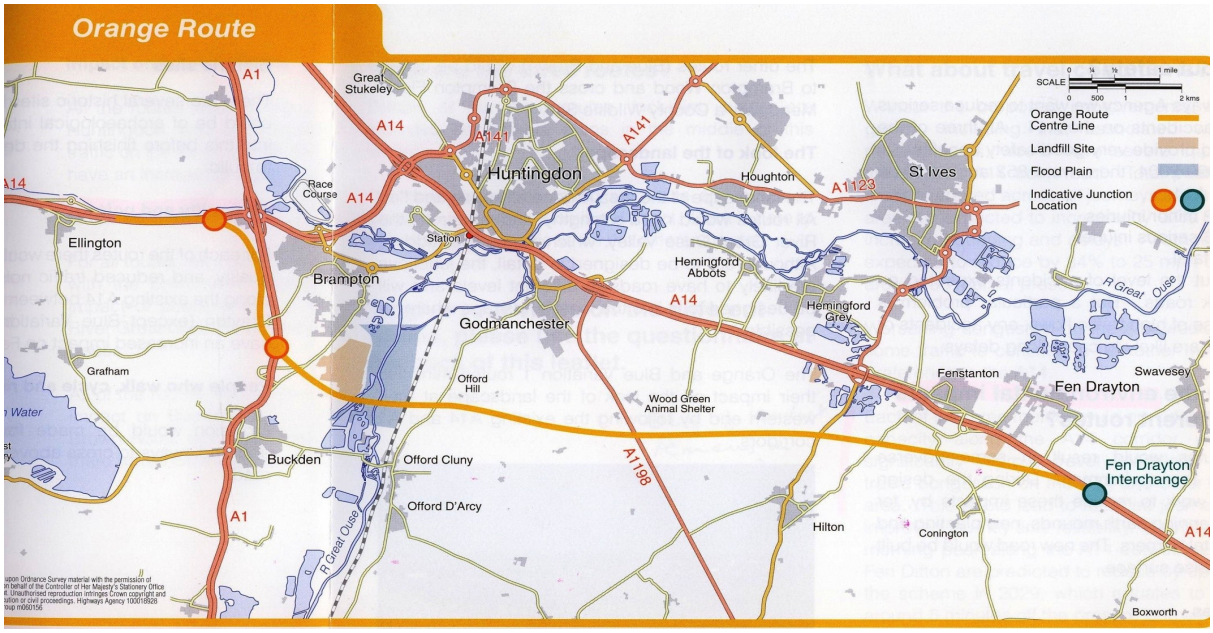
[Name redacted]– Brampton Campaign Group (BCG) – a residents association.

Letter to Chancellor – Sustainable Development and Roads Investment Strategy – 16 Nov 2016

16Nov2016

HIGHWAYS AGENCY A14 SCHEME 2010-2014

BRAMPTON A14 CAMPAIGN GROUP



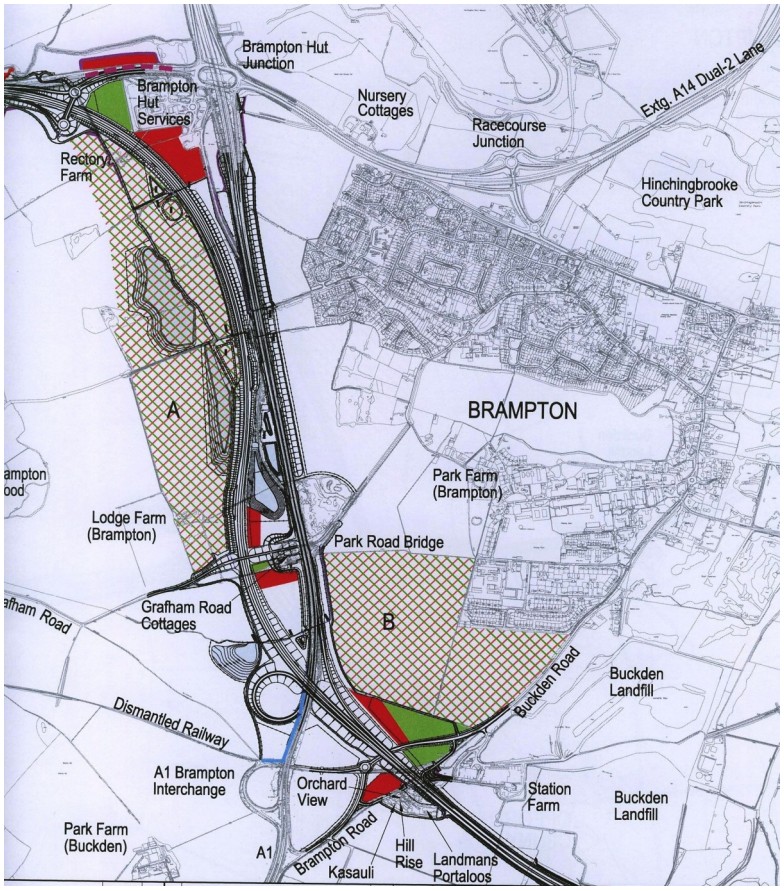
2010 ORANGE ROUTE NOW KNOWN AS HUNTINGDON SOUTHERN BYPASS

BRAMPTON A14 CAMPAIGN GROUP

ENVIRONMENT AGENCY FLOOD MAP – BRAMPTON – BUCKDEN – OFFORDS

BRAMPTON IS IN A FLOOD ZONE AND THE A1/A14 AREA REGULARLY FLOODS RESILIENCE OF TRANSPORT INFRASTRUCTURE WILL BE AT RISK

HIGHWAYS AGENCY A14 SCHEME—BRAMPTON INTERCHANGE

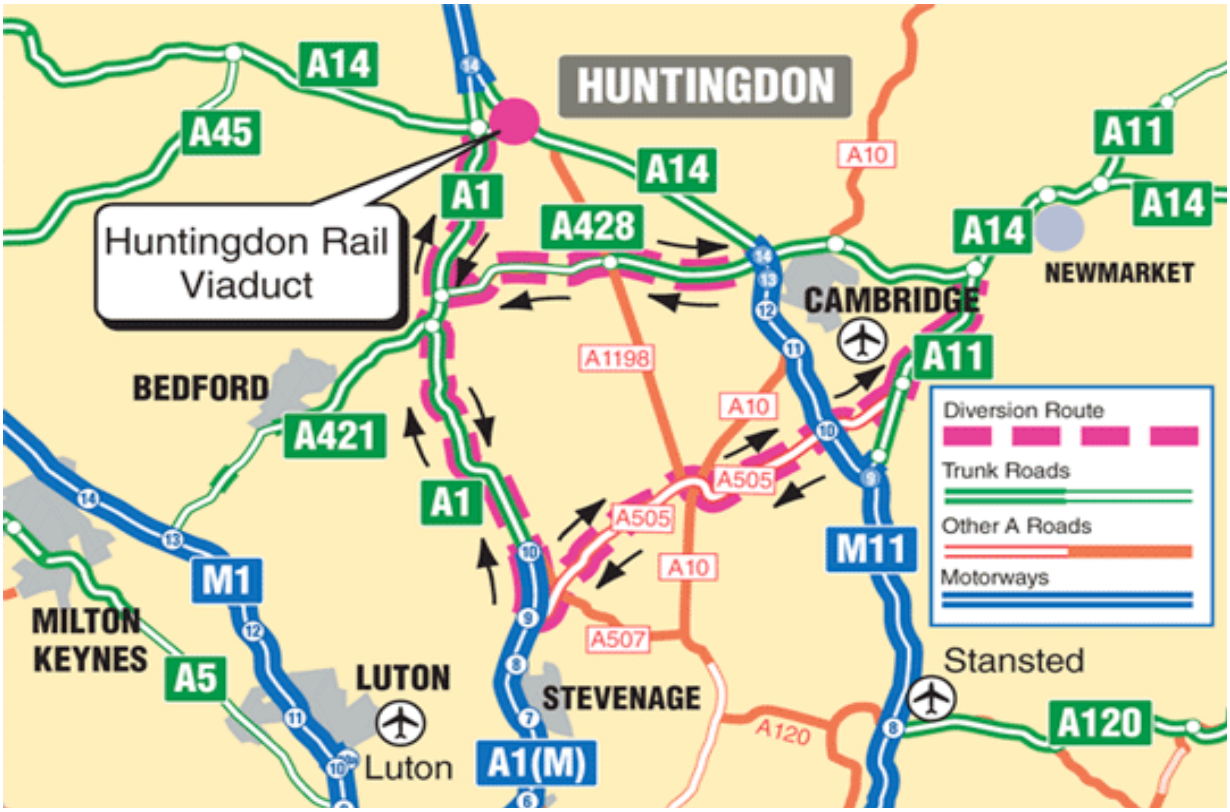


The new scheme is largely the same as the previous one cancelled in 2010 except that widening a stretch of the A1 from Alconbury to Brampton Hut has been added to the original scheme. The line of the two roads (A1 & A14) has also been altered and shows the A14 nearer to family homes in Brampton (because the A1 traffic is now predicted to be heavier—but will still run alongside the A14!).

The areas marked A & B indicate quarries for extracting up to 3million tons of sand and gravel. A cement-processing facility is also planned. This will compound the air pollution problems of road traffic diesel particulates and the harmful effects on the lung development of children living within 500 metres of the Brampton A1/A14 Interchange.

Highways Agency A1/A14 Interchange as at October 2010

HIGHWAYS AGENCY ALTERNATIVE MAINTENANCE ROUTES ALTERNATIVE SOUTHERN ROUTE A14/M11—A428-A421—M1 SHOWN



Map - Highways Agency (HA) alternative routes during A14 rail viaduct works

BRAMPTON A14 CAMPAIGN GROUP ALTERNATIVE SCHEME

The current HA scheme – cost £1.5billion (£60million per mile)
The current A14 scheme is based on the Cambridge to Huntingdon Multi-Modal Scheme (CHUMMS) developed in 2001. The main problem for A14 villages is that it seeks demolition of the A14 rail viaduct as a key aim and the proposed 'Huntingdon Southern Bypass' - the new road from the existing A14 to Brampton Interchange - has disproportionately adverse environmental effects on neighbouring villages and the Ouse Valley.

There is no rational justification for demolishing the A14 rail viaduct and destroying the existing strategic trunk route when increased road capacity is being sought. The rail viaduct should be retained. Result: no ned for new roads on Huntingdon commons, no Southern Bypass, no Brampton Interchange, no widening of the A1. Costs would be significantly reduced and leave the Highways Agency free to reconfigure the A14 scheme as an improved International TEN-T Freight Route and Strategic Trunk Road. Brampton A14 Campaign Group's alternative scheme - first submitted in January 2010 - is based on an M11 –M1 link road via the A428 and A421 (including completing widening of the A428). This would effectively be a 'Huntingdon Southern Bypass' whichIt would benefit local and international road hauliers and motorists alike and save A14 towns and villages from the harmful effects of road traffic air pollution.

Brampton A14 Campaign Group Alternative (Multi-Modal) Scheme - Key Points

- **Retain Huntingdon rail viaduct** and existing A14 capacity.

- **Upgrade A14 to motorway standard (A14(M))** from Cambridge (M11-J14) to Huntingdon. The rail viaduct could be rebuilt to a higher standard at a later date. Recent repairs have assured the safety of the viaduct 'for the foreseeable future'.

- **Upgrade the route from M11(J14) to the M1 to motorway standard A n**ew road could be built from M11(J14) [or from the A428 Caxton Gibbet roundabout] direct to the Black Cat roundabout on the A1. A new A1/A421 interchange would ease traffic congestion at the Black Cat and reduce travelling times for traffic bound for Birmingham and beyond.

- **Retain the existing A428** as a local road which links the A1 and the A1198.

- **Active Traffic Management** systems should be installed on both roads and Highways Agency 'managed motorways' practices adopted – traffic running on the hard shoulder during peak hours. This has already been successfully introduced on the M42.

- **A Park & Ride site at Brampton Racecourse (or Brampton Hut) -**The Guided Bus route could be extended to the site from Huntingdon rail station. A shuttle bus between the Park & Ride, Brampton village, the rail station and Hinchingbrooke hospital would relieve congestion on local roads and car parking problems at the station and hospital.

- **Rail freight route – Felixstowe–Nuneaton:**This is effectively an **eastern bypass of Huntingdon**. DfT policy is to encourage the shift of freight from road to rail.

- **The EU Transport Commissioner** has already provided some 20 million euros for two elements of the old BCG scheme - ie (1) upgraded signalling on the Felixstowe rail freight route and (2) installation of Active Traffic Management systems along the whole length of the A14 (section within the A14 scheme area was excepted).

- **Motorways of the Sea:** whereby freight is transferred at deep sea ports to coastal shipping for onward transmission - removes freight from roads and reduces road traffic congestion and air and noise pollution.

[Name redacted] ([job title redacted] Brampton A14 Campaign Group 19 Oct 2013

Heavy traffic on the existing A14

Right - 6 lanes
Left - 4 Lanes

NEW A428-A421 ALLIANCE

Brampton A14 Campaign Group (BCG) welcomes the new East Anglia-wide alliance of MPs, County and District Councillors pressing for the upgrade of the existing A428-A421 route. This route has been advocated by BCG since 2008 as a less costly and more easily achievable solution to A14 congestion problems than the vastly expensive **new** 'Huntingdon Southern Bypass' proposed by the Highways Agency (HA). The A428-A421 link route between the A14, M11 and M1 is effectively an **existing** 'Huntingdon Southern Bypass' which could provide a fast freight route between East and South Coast ports, the industrial Midlands and beyond—see p11.

The HA report of the outcome of their A14 public consultation on route proposals in October 2013 states that: "There is a lack of support for the Huntingdon Southern Bypass...". yet this is not taken into account in the HA A14 route proposals. BCG believes that the new Alliance should press for funding for the bypass be switched to the A428-A421 route so that this much-needed (and wanted) improvement can be brought about quickly—construction of the proposed HA A14 route is due to start in 2016.

The biggest threat to residents of Brampton is the public health risk of road traffic air pollution. The bypass would result in 10 lanes of heavy traffic within **300** metres of family homes - up to 150,000 vehicles a day not far from the village primary school - see 2010 scheme drawing (p11). The road traffic air pollution would be compounded by sand and dust particles from large quarries next to the road to extract up to 3 million tons of sand and gravel for road construction plus dust particles from a cement-processing plant. Studies have shown that the lung function development of children has been significantly impaired when living within **500** metres of similar road schemes. This A14 proposal clearly contravenes the social and environmental elements of sustainable development and ignores the environmental Precautionary Principle in respect of causing harm to public health. .

The current A14 scheme is estimated to cost some £1.5 billion (ie £1.5 **thousand million** - over £60million per mile). To this cost should be added costs to the NHS deriving from damage to public health from road traffic air pollution. In 2009 this was estimated at £11 billion per annum in the UK. Air pollution is currently rising to the top of the Government's environmental agenda and is currently the focus of a parliamentary inquiry by the Environmental Audit Select Committee owing to increases in mortality statistics. Additionally, the UK government is facing EU fines for breaching Air Quality standards and failing to protect public health.

The Planning Inspector at the previous A14 Public Inquiry pre-meeting in May 2010 instructed the Highways Agency to draw up and evaluate alternative schemes submitted (including the BCG scheme) and to consult affected communities. The Highways Agency is required to do this under Treasury value for money rules. This was not done and the whole scheme was cancelled in October 2010 on cost grounds.

Surely the time has come for the HA to draw up and cost the BCG alternative solution and properly assess its impact on public health compared with that of the HA Huntingdon Southern Bypass so that sensible choices can be made as to the way forward.

Where damage to children's health is at stake, we believe that prevention is better than cure. Plans for the 'Huntingdon Southern Bypass' should be scrapped and the A428-A421 route upgraded instead.

Eileen Collier - Chair/Brampton A14 Campaign Group

HOUSES OF PARLIAMENT
PARLIAMENTARY OFFICE OF SCIENCE & TECHNOLOGY

Air Quality – an integrated understanding of health risks
– closed POST breakfast event

0830-1000 on Tuesday 27th October 2015 in Room P, Portcullis House

The aim of the event was to discuss the science and resulting policy issues relating to new knowledge on the interconnections and pathways between air pollutants and interacting stressors, exposure routes and health effects in humans. In 2014, the Supreme Court ruled that the government must develop air quality plans for the 38 of the 43 UK air quality zones failing to meet the EU limit values for nitrogen dioxide by the 31st December 2015. The event was chaired by the Lady Manningham-Buller, and attendees, including MPs, peers and parliamentary staff, heard briefly from seven speakers during general discussion of the issues:

- **Professor Paul Wilkinson, Public and Environmental Health Research Unit, London School of Hygiene and Tropical Medicine, member of the Committee on the Medical effects of Air Pollution (COMEAP)**
- **Professor Martin Williams, Environmental Research Group, King's College London**
- **Professor Michael Depledge, Chair of Environment and Human Health, University of Exeter; and Chair of the Board of the European Centre for Environment and Human Health**
- **Dr Sotiris Vardoulakis, Head of Environmental Change, Public Health England**
- **Professor Ian Boyd, Chief Scientific Adviser, Defra**
- **Andrea Lee, Health and Environment Adviser, Client Earth**
- **Ruth Calderwood, Environmental Policy Officer at City of London.**

Air Quality Breakfast Briefing Meeting Summary

- **Professor Paul Wilkinson***:* Overall mass of air pollution has decreased since 1950 by two orders of magnitude, but air pollution is still having detrimental health effects. Scientific evidence of effects is strongest for particles, but there is increasing debate over other pollutants such as nitrogen dioxide and Ozone. There is no evidence to suggest that there is a threshold for air pollution under which effects level out, with further improvements in health outcomes if air pollution is decreased below a threshold. The lower the air pollution is the further improvements we see in health outcomes. Globally, 3.7 million deaths can be attributed to air pollution, with the Committee on the Medical Effects of Air Pollution (COMEAP) estimating an effect on mortality equivalent to 29,000 deaths annually as a result of particulate air pollution. There is increasing evidence that air pollution is contributing to illnesses such as cardiovascular and respiratory diseases – on average each person in the UK is losing 6 months off their lifespan because of particulate air pollution, although actual effects will vary greatly between individuals. The source of air pollution is not only traffic in the urban environment, but other sectors such as heating of housing, energy production and agriculture. With agriculture the major source of secondary particulate pollution, which contributes to the long range transport of other particulate air pollutants with greater toxicity. It is very difficult to set emission controls and achieve them, but the move away from fossil fuels and a low carbon economy may be a pathway to achieving a step change in levels of air pollutants. Accelerating the transition to a low carbon

economy and tightening controls surrounding emissions are needed, with emissions from the heating systems of housing an important target

- **Professor Martin Williams:** It is important to emphasise that single studies on health effects of air pollutants do not inform policy, which requires reviews of evidence. The World Health Organization (WHO) undertook a large scale review which found substantial evidence for the effects of particles at lower concentrations than regulatory thresholds and provided stronger evidence for health effects of nitrogen dioxide (previously evidence was weak). Effects of nitrogen dioxide could be as big as particles at high concentrations. WHO also concluded that there were significant adverse health effects from living near heavily trafficked roads, but it is difficult to determine what the most dangerous component of pollutants from traffic were. There is evidence that not only exhaust emissions are harmful, but also non-exhaust from tyre wear, clutch control etc. that produce abraded metal particles that are not subject to any specific regulatory controls. There are short term correlations between air pollution and mortality, particularly myocardium infarction exacerbated by exposure to pollution. The transition to a low carbon and reduced use of fossil fuels will not necessarily equal low pollution; there are clean ways and dirty ways of low carbon transition, some low carbon technologies using biomass have the potential to increase air pollution. Policies to encourage use of electric vehicles will deliver air quality benefits, but the extent of these depend on the generation source for the electricity.

DISCUSSION

Socio-economic Gradients

- People with lower incomes are more likely to be exposed to air pollution and to have underlying health issues that will be exacerbated by this exposure.
- However there is not a strong gradient between effects of air pollution and wealth, and it varies between different parts of the country and within cities.

Indoor Air

- Need to minimise outdoor air pollutants entering buildings and increase levels of indoor air pollutants removed – there are potential dangers of implementing indoor air ventilation badly.
- Improving energy efficiency of housing, e.g. using more insulation, may reduce infiltration of outdoor air.
- However there are particles generated from inside (burning food, tobacco smoke etc.) and the concentrations of these particles could increase due reduced ventilation
- Need to include careful natural ventilation which minimises pollution getting in
- In policy terms indoor air is different to outdoor air and isn't regulated by the same policy

Information for Local Authorities (Hope Street, Glasgow and Bath)

- Local Authorities are generally good at monitoring air pollution levels but have been less effective in implementing measures to reduce traffic emissions.
- Retrofitting public transport – retrofitting buses and taxis with filters and traps to reduce particle and NOx emissions.
- In the longer term, completely overhauling the public transport to run on electricity or compressed gas

- Cutting traffic – Edinburgh have a policy where they close some streets an hour before and after school hours, called school street.
- Do low emission zones actually work? – A recent review has suggested there is a lack of evidence that they do.
- Pollution may not necessarily be produced where concentrations accumulate, some of the pollution in London originates in continental Europe.

Air Quality inside Cars

- The performance of air filters in cars is limited and the air quality inside cars reflects the emissions of the exhausts of the cars in front. However, the level of exposure is no worse than that of pedestrians on busy roads.

Association between Air Pollution and Health

- Can we disaggregate other factors driving trends in health from the effects of pollution on health?
- Current health impacts are assessed by comparing populations around the country with different levels of exposure – could possibly use epidemiological models to tease out the effects of the legacy of previous air pollution but these aren't likely to be substantial compared to current exposure.

- **Professor Michael Depledge:** The population of the UK is concentrated in cities, around 85% of the population live in urban environments. However, cities are highly heterogeneous and the issues with air pollutants vary accordingly. Some of these issues have not yet been well characterised; for example, nanoparticles, smaller than the particulates of current policy concern, which are emitted by combustion, wear and tear of vehicles and in vehicle exhaust may be problematic. Nanoparticles, such as Cerium Oxide, are added to transport fuels to increase fuel efficiency and decrease greenhouse gas emissions. However, the environmental fate and effects of these nanoparticles are uncertain. It has been shown that very high levels of iron nanoparticles can have toxic effects, but information about nanoparticle persistence, toxicity and interaction with the environment remains limited. There is a lack of evidence of how to manage nanoparticles as there no agreed methods for measuring concentrations of nanoparticles in the environment, determining their fate or their toxicity. Current approaches are focussed on the effects of air pollutants on humans but there should be more consideration of the extensive impacts on plants and animals.

- **Dr Sotiris Vardoulakis**: Health effects occur both from long-term exposure to ambient pollution levels, and from short-term episodes of elevated air pollution. Health impacts from air pollution include effects on cardiovascular and respiratory conditions and increased risk of lung cancer. About 5.3% of adult all-cause mortality in England each year can be attributed to particulate air pollution. There is evidence associating exposure to air pollutants with a worsening of asthma symptoms. Traffic-related air pollution may play a role in inducing asthma in some individuals, particularly those who live near busy roads carrying high numbers of heavy goods vehicles. Traffic has a big contribution to air pollution; around 80% of emissions of nitrogen oxides (NO_x) in areas where the UK is exceeding nitrogen dioxide (NO_2) limit values are due to road transport, although urban and regional background non-transport sources are still considerable. Everyone has the right to clean air and air pollution needs to be reduced at a local level. Modal shift from

cars to walking, cycling and public transport encouraged through promotion of the multiple health benefits of active travel can help reduce local emissions. For instance, through businesses giving incentives to walk, cycle, carpool and work from home. Implementation and regulation of EURO vehicle standards and vehicle emissions tests to reflect real world driving emissions are crucial, as well as promoting electric vehicles and implementing a national framework for clean air zones.

- **Professor Ian Boyd:** At the moment in the UK, national measurements of pollutants are supplied by a sparse networks of monitoring stations. This data is used in the Pollution Climate Mapping (PCM) model which estimates distribution of pollutants. The model outputs for different areas corresponds with the observed measurements made by local authority monitoring networks, providing confidence that the outputs are accurate. The UK approach is one of the most effective monitoring system in the EU, but these monitoring systems only provide a limited picture, when air pollution is often a detailed local issue down to the street level. In the future, monitoring could be more focused on areas of air pollution within which the general public are exposed to peaks and troughs of pollution. There has been rapid innovation in personal pollution measuring instrumentation which individuals could buy; for example, car manufacturers could fit cars with pollution monitoring systems that would tell the occupants the levels of pollution outside and inside the car. Members of the public can then make informed decisions, which would rapidly change the tenor of the air pollution debate. Air pollution has decreased from the 1970s to the present day, but we need to ask why it has taken so long. There are a few systemic reasons such as public behaviour, capital investment, vehicle turnover, depreciation and replacement. Putting information in the hands of the consumer alone will not solve the issue; a multitude of policies working together will be required. Policies should stimulate and drive change and should be driven by public behaviour, such as individual measurements of the environment.

DISCUSSION

Measuring pollution through devices fitted to cars

- The characteristics of air pollution have changed and will go on changing, requiring new policy responses.
- People who buy vehicles typically don't look at low emission data on cars, far more likely to look at other factors such as price, fuel efficiency etc.
- General public will adopt alternative technologies if given easy choices, such as appropriately priced electric cars with good performance, but there would need to be a transition to energy generation that does not contribute to air pollution. Some polluting aspects of the transport system will be less easy to replace, including freight vehicles and public transport. .

Contribution of Aviation to Pollution

- The biggest contributor to pollution is transportation of passengers to the airport, via cars and public transport, rather than the planes themselves.
- Planes have large emissions of nitrogen dioxide, but this only contributes to air pollution at ground level during take-off and landing. The emissions scale up with the number of aircraft taking off.

- Aviation and shipping are growing sources of emissions when compared to other transport sectors.
- Persuasive alternative transport choices will be needed to influence individual behaviour to limit emissions if Heathrow airport is to be expanded, but these are unlikely to be enough and a no traffic buffer zone may have to be created around Heathrow airport to limit exposure to air pollutants**.**

Low Emission Zones

- When the congestion charge was introduced to central London a lot of money was invested in public transport before the charge was brought in, which enabled a smooth transition. If other low emissions zones were brought in around the country there would need to be both carrot and stick, including viable alternative transportation available beforehand.
- Implementation of ultra-low emission zones in London, although they may prove to be ineffective, are better than nothing.
- Low emission zones require investment in transport infrastructure along with systemic change to address pollution sources from different sectors to create more liveable sustainable cities. Without this pollution levels may not decrease.

Agriculture

- Emission from the agricultural sector remains one of the unsolved problems in air quality policy, with existing EU policies in effective.
- Ammonia emissions from agriculture are one of the major components in the formation of secondary particulates in the atmosphere that transport toxic components long distances, and methane is one of the precursor gases involved in the formation of ground level ozone pollution.
- There has been no reductions in ammonia levels over the past three decades and the agricultural sector is resisting any regulatory measures to reduce emissions.
- Agriculture is the biggest contributor to secondary particle pollution (PM 2.5).

- **Andrea Lee:** Action is needed at all levels and everybody has their role to play, but no significant progress can be made without national leadership from governments to provide and facilitate policy solutions at a local, national and European level. Individual behaviour change cannot be relied upon to deliver effective control of air pollution, and putting the onus on individuals who are not in a position to change behaviours and have many other factors such as cost to consider. It will also makes little difference if an individual reduces their contribution to air pollution if the majority of their neighbours don't. Measures should also be available to allow individuals to protect themselves from air pollution. Transport is the main contributor of NOx pollution, about 80%, in towns and cities that do not comply with thresholds, but other sectors, such as agriculture, also need to contribute to reductions. MEPs will be voting on revisions to the National Emission Ceiling Directive tomorrow, but controls are unlikely to be placed on the agriculture sector. There is concern that current UK plans are not informed by a clear cross-departmental national approach to tackling air pollution, with responsibility devolved to local authorities with little additional resource and no new powers. A letter has been sent to local authorities reminding them they are responsible for EU air quality fines under the localism, despite local authorities being under resourced. There is also concern what the Comprehensive Spending Review will mean for the implementation of the air quality plans. A nationally designed

network of low emission zones might be effective in encouraging people to change behaviour, as called for by the Healthy Air Campaign, but the current voluntary approach to their implementation is unlikely to deliver results. National government needs to provide policy framework and investment to facilitate low emission lifestyles. If overall levels of motor traffic are to be reduced, it will require a step increase in walking and cycling levels as well as public transport use, and the public need to be properly informed about the risks so they can reduce their contribution and exposure and buy into the tough political measurer that will have to happen.

- **Ruth Calderwood:** There have been lots of measures introduce to improve air quality in London but there has overall been no real improvement of air quality within the City of London. Evidence recently published by Kings College London showing the mortality effects of nitrogen dioxide has increased the will of the City Corporation to take local action. City Corporation has already done quite a lot of community engagement work to nudge behaviour. Businesses have changed the way they operate and local residents are being helped to understand the impacts of air quality. This approach does work but is time consuming and resource intensive. A national campaign is needed for air quality giving the general public simple and consistent messages about what they can to reduce their exposure and too increase willingness to support air pollution policies. More reliable data is needed including on vehicle emissions, with tighter emission control of diesel cars.

DISCUSSION –

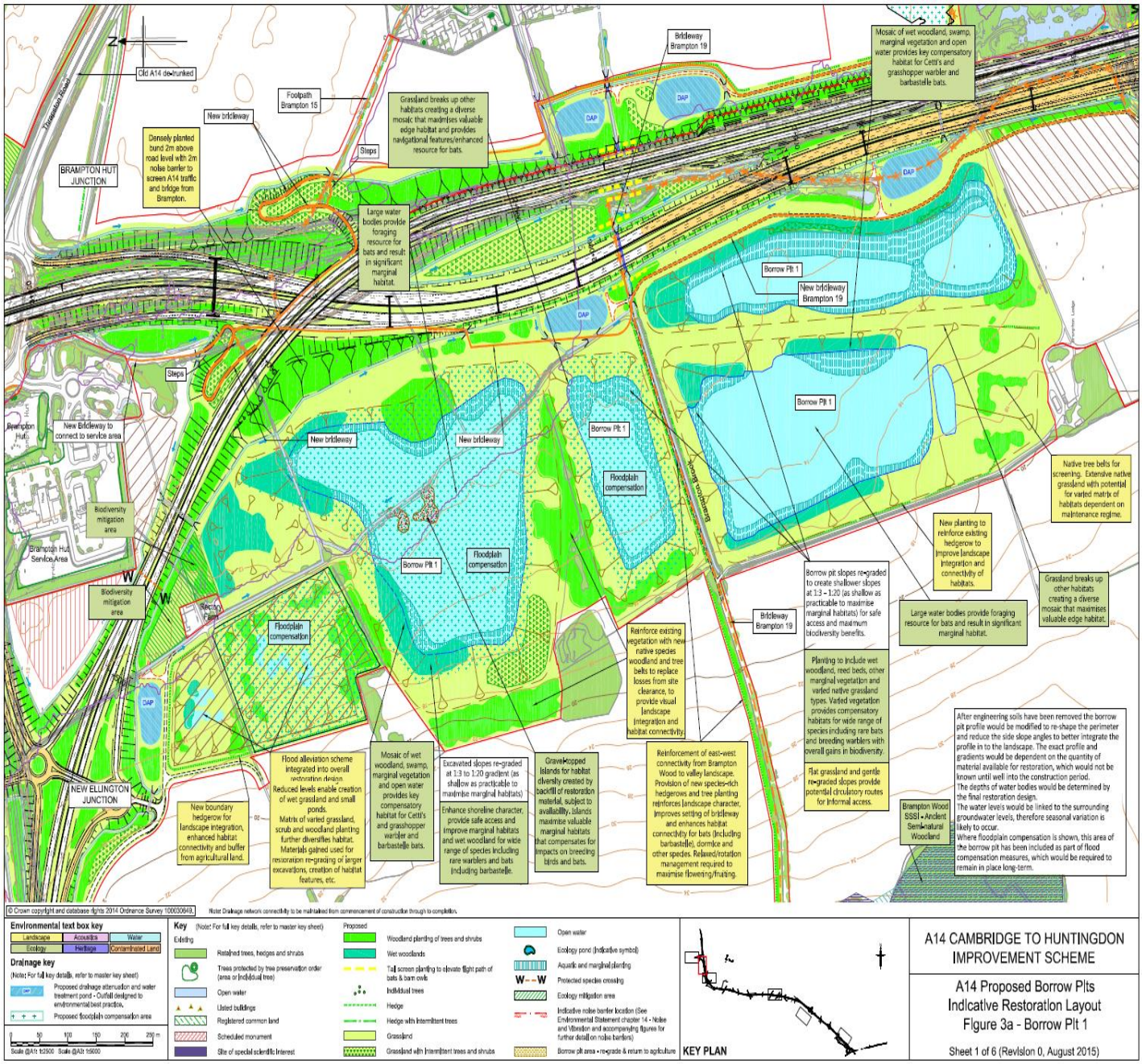
- Some pollutants still have health effects when levels are low.
- A strategic approach will be needed to considering how to address the totality of air quality and greenhouse gas emissions.
- This will include looking at the integrated impacts of air quality and looking at life course exposures and lifestyle choices. Current approaches need to be re-evaluated in the light of social science research, with better integration of social and environmental sciences.
- There are three big issues, climate change, air pollution and health which we can begin to mitigate by moving away from fossil fuels and low activity lifestyles.
- A low carbon economy can also be good for health, but in order for these changes to take place our policy has to be bolder and happening at a greater pace.
- We need a step change in transport system, agriculture and housing.
- Around 20% of all car journeys in the UK are less than 1 mile in length, so there are opportunities to replace some of these car journeys with walking and cycling
- There are other cities in Western Europe that have invested in and implemented sustainable city planning.
- Natural resource depletion is also an important issue that should be added to the other big three challenges.
- This relates to control and demand at a global scale and countries need to act in unison through mechanisms, such as the G7.
- What is the correlations between environment improvement vs. life expectancy and medical technology vs. life expectancy? Clean water, housing and reductions in coal burning have all improved life expectancy but so have medical advances such as immunisation. Life expectancy

will keep improving through medical technology, but improvements in quality of life will require changes in the relationship between humans and the environment, not just reductions in pollutants but also in terms of use of natural resources.

- Towns and cities need to be redesigned to help implement new technology in communities.
- The centralisation of economic activity in particular areas results in higher house prices and people have to travel further to work creating more air pollution.
- Health inequalities are related to environmental inequalities, often causally.
- Air pollution should be considered together with other threats from the environment to health and wellbeing (climate change, microbial pathogens, chemical pollution, etc.) as it is the integrated impact of all of these factors that influence health outcomes.
- A step change is required in communicating the intimate relationship between environmental quality (which includes air quality) and human health (and wellbeing), so that this is more broadly appreciated by politicians and policymakers across the spectrum of government. This strongly relates to debates regarding healthier lifestyles in sustainable environments.
- Tackling air pollution requires a deeper understanding of how the changing climate, weather, heat island effects, and vulnerability of the ageing population interact, and how adverse effects might be mitigated through the provision of green and blue spaces, and building infrastructure to promote walking, cycling, the use of electric vehicles and smart buildings which offer numerous co-benefits for health and the environment.

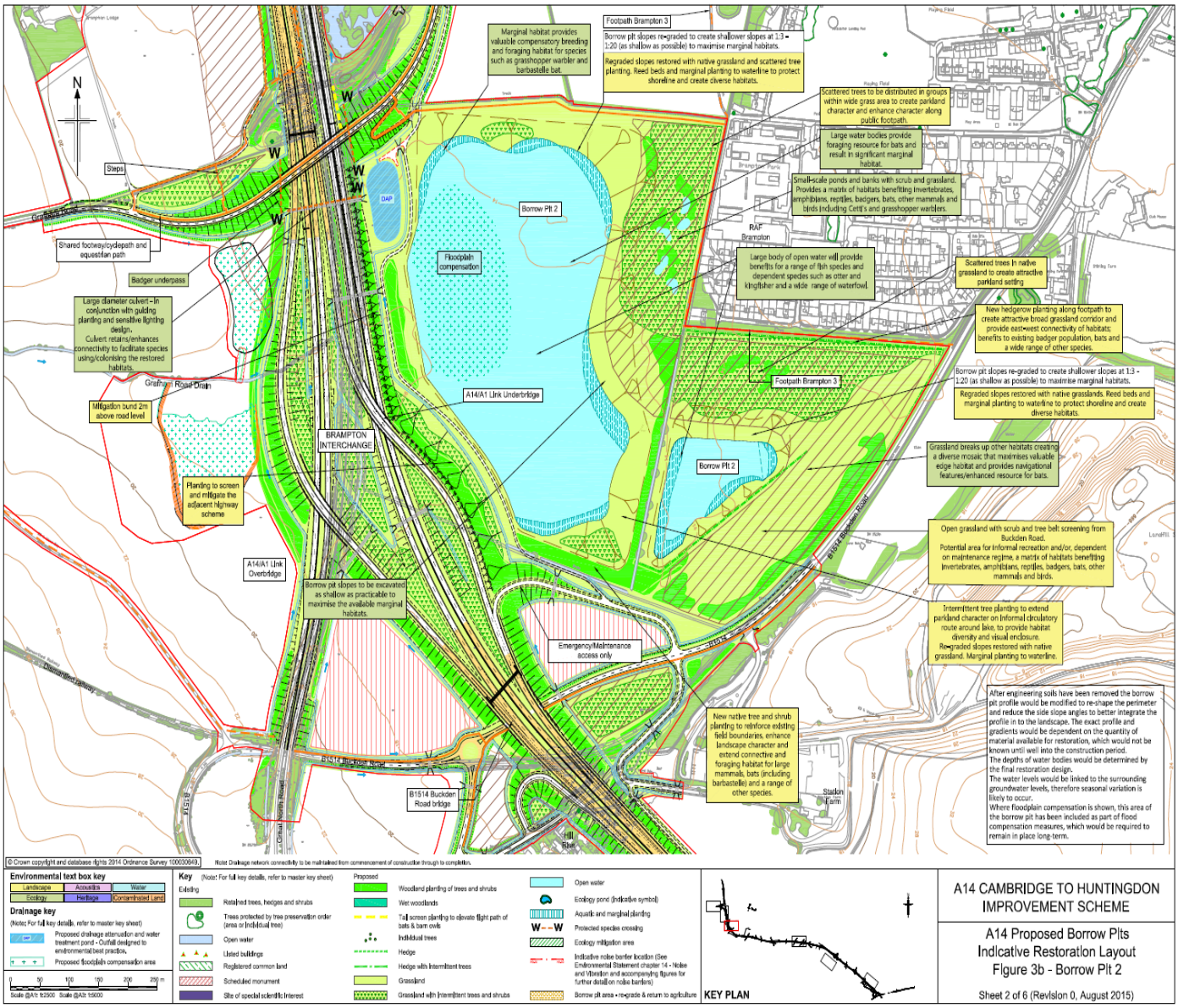
A14 scheme Borrow pits (sand and gravel quarries) – BP1 & BP2 at Brampton

Borrow Pit 1 – Nr Brampton Hut & Rectory Farm (four excavation sites) plus ten-lane Brampton Interchange - widened A1 + 'new A14' – key part of new 'Huntingdon Southern Bypass'



A14 scheme Borrow pits (sand and gravel quarries) – BP1 & BP2 at Brampton

Borrow Pit 2 – Park Farm (two excavation sites). Realigned Footpath Park Road to Buckden Road marked in red.



ENVIRONMENTAL AUDIT INQUIRY – SUSTAINABLE DEVELOPMENT
See also my written evidence to the EAC Climate Change Adaptation Inquiry – Feb 2015

NB: The responses below relate to the A14 Huntingdon to Cambridge improvement scheme (NSIP):

- **What key policies are needed over the course of this Parliament to adequately protect the environment, promote growth in the low carbon sector and improve wellbeing?**
  - Current sustainable development guiding principles should be reinforced and implementation monitored – see DEFRA definition of sustainable development below (1).
  -
  - The Precautionary Principle applies to impact assessments. Where scientific evidence conflicts, the burden of proof lies with the party advocating taking the action – usually a project/scheme promoter. In the case of road traffic air pollution Highways England would presumably have to prove that harm to public health would not be caused by air pollution from the road traffic using the NSIP. See Gauderman report below (2).
  -
  - Land-use Planning - including Nationally Significant Infrastructure Projects (NSIP) and safe-guarding high quality arable farmland as part of the national Food Security strategy - should be reviewed for compliance with sustainable development principles and wider environmental policy/law – eg building on flood plains.
  -
  - Road transport is a large carbon emitter and road schemes should be individually assessed for carbon emissions. Transport policy should be reviewed in the light of the new EU TEN-T policy – Connecting Europe and the DfT policy of modal shift of freight from road to rail (a cleaner, safer low carbon option) . See also my contribution to a previous DECC/BERR consultation on low carbon transport below (3) and BCG dossier (5).
  -
- **Does the Government's current fiscal and legislative agenda accord with the action required and, if not, why not and where might it be improved?**
  - Current Treasury funding proposals for NSIPs should be reviewed – see current East of England road scheme funding table below (4). The funding announcement lacks coherence and proper justification. A holistic overview of alternative transport modes should be undertaken for all major projects to ensure value for money as well as compliance with sustainable development policy.
  -
  - Green Book value for money rules could explicitly include the Polluter Pays Principle so that NSIP project cost estimates include costs to other Government Departments (eg NHS – road traffic air pollution; DEFRA – flooding mitigation). See my earlier recommendations to EAC (Climate Change Adaptation – Feb 2015).
  -
- **Where should responsibility lie in Government for ensuring the sustainable development approach is adopted by all Government departments?**
  - The Cabinet Office has a powerful central role in Government and could ensure compliance by all Departments and subordinate organisations (eg Highways England) with Government sustainable development policy and principles and oversee proper implementation.
  -
- **What metrics could the Committee use to monitor the Government's performance on sustainable development over the course of the Parliament?**
  - I am a firm believer in the KISS principle – Keep It Simple.... a sustainable development checklist for each major project as well as NSIPs would be a good start and help to focus minds on environmental issues. The list could include the carbon emissions for each infrastructure project during construction and during operation.
  -
  - The checklist could also include a Health Impact Statement with an assessment of costs to other Government Departments resulting from the scheme – for example the annual cost to the NHS of road traffic air pollution in 2009 was assessed as £11billion. I am sure that clever Government economists can devise a metric to apportion this to individual projects.

[Name redacted] [Job title redacted] Brampton A14 Campaign Group – 29 July 2015

Appendices

1. DEFRA definition of sustainable development
2. Gauderman Report 2007
3. DECC/BERR consultation on low carbon transport – Mar 2009
4. East of England road scheme funding – Dec 2014
5. BCG alternative scheme - dossier 2009 - 2015

Appendix 1

Extract from information on DEFRA website:
http://www.defra.gov.uk/sustainable/government/what/principles.htm

What is sustainable development?

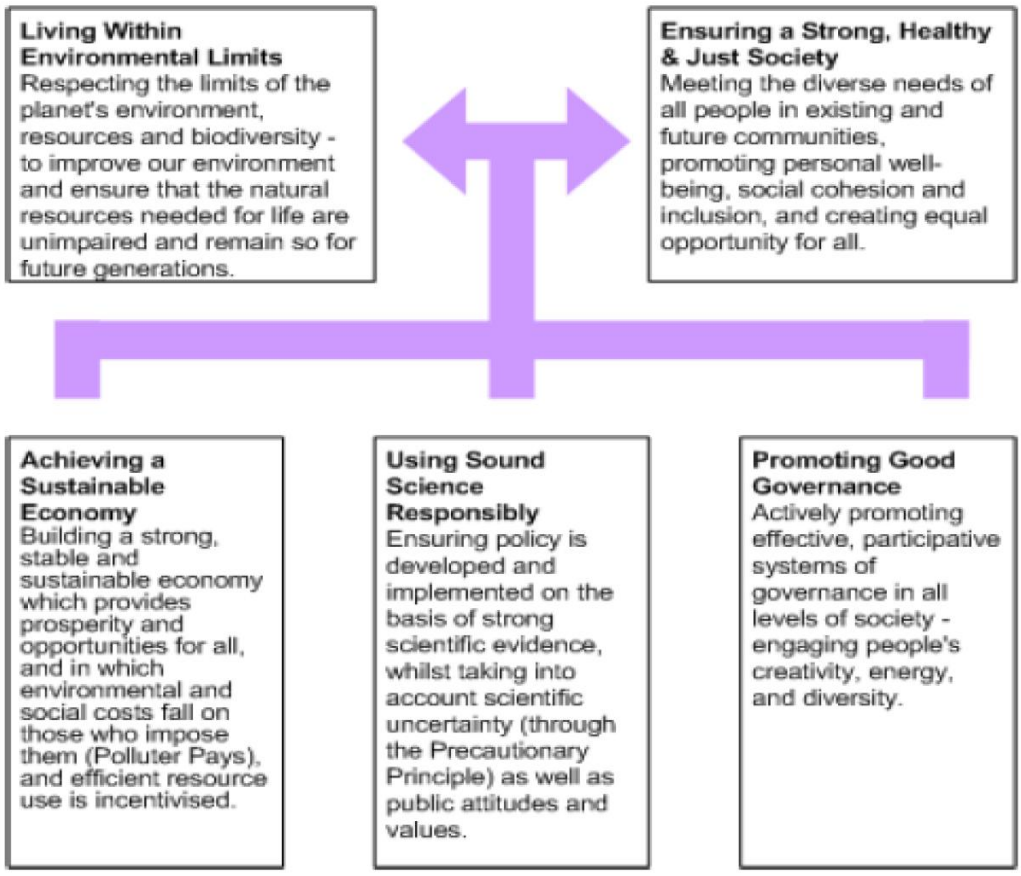
A widely-used and accepted international definition of sustainable development is: ***'development which meets the needs of the present without compromising the ability of future generations to meet their own needs'*** - Globally we are not even meeting the needs of the present let alone considering the needs of future generations.

Guiding principles of sustainable development

The UK Government, Scottish Executive, Welsh Assembly Government and the Northern Ireland Administration have agreed upon a set of principles that provide a basis for sustainable development policy in the UK. For a policy to be sustainable, it must respect all five principles.

Shared UK principles of sustainable development

This page sets out the shared UK principles of sustainable development in the UK. They apply to the UK Government, Scottish Executive, Welsh Assembly Government and the Northern Ireland Administration. For a policy to be sustainable, it must respect all five principles. We want to live within environmental limits and achieve a just society, and we will do so by means of sustainable economy, good governance, and sound science.



Appendix 2

HEALTH ISSUES—GAUDERMAN REPORT

THE LANCET.com

The Lancet 2007; **369**:571-577

DOI:10.1016/S0140-6736(07)60037-3

Articles

Effect of exposure to traffic on lung development from 10 to 18 years of age: a cohort study

Dr W James GaudermanPhD [a], Hita VoraMS [a], Prof Rob McConnellMD [a], Kiros BerhanePhD [a], Prof Frank GillilandMD [a], Prof Duncan ThomasPhD [a], Fred LurmannMS [b], Edward AvolMS [a], Nino KunzliMD [c], Michael JerrettPhD [d] and Prof John PetersMD [a]

Summary

Background

Whether local exposure to major roadways adversely affects lung-function growth during the period of rapid lung development that takes place between 10 and 18 years of age is unknown. This study investigated the association between residential exposure to traffic and 8-year lung-function growth.

Methods

In this prospective study, 3677 children (mean age 10 years [SD 0·44]) participated from 12 southern California communities that represent a wide range in regional air quality. Children were followed up for 8 years, with yearly lung-function measurements recorded. For each child, we identified several indicators of residential exposure to traffic from large roads. Regression analysis was used to establish whether 8-year growth in lung function was associated with local traffic exposure, and whether local traffic effects were independent of regional air quality.

Findings

Children who lived within 500 m of a freeway (motorway) had substantial deficits in 8-year growth of forced expiratory volume in 1 s (FEV_1, −81 mL, p=0·01 [95% CI −143 to −18]) and maximum midexpiratory flow rate (MMEF, −127 mL/s, p=0·03 [−243 to −11), compared with children who lived at least 1500 m from a freeway. Joint models showed that both local exposure to freeways and regional air pollution had detrimental, and independent, effects on lung-function growth. Pronounced deficits in attained lung function at age 18 years were recorded for those living within 500 m of a freeway, with mean percent-predicted 97·0% for FEV_1 (p=0·013, relative to >1500 m [95% CI 94·6–99·4]) and 93·4% for MMEF (p=0·006 [95% CI 89·1–97·7]).

Interpretation

Local exposure to traffic on a freeway has adverse effects on children's lung development, which are independent of regional air quality, and which could result in important deficits in attained lung function in later life.

Comment:

1. I have discussed Brampton's situation with the lead author of this report, Dr James Gauderman. He assures me that if the 'new A14' goes ahead (ie the proposed 6-lane highway from Fen Drayton to Ellington via Brampton) , Brampton would fall well within the criteria for this study based on size of highway (combined A1 + A14), volume of traffic and proximity of housing.

2. The Precautionary Principle is a moral and political principle which states that if an action or policy might cause severe or irreversible harm to the public, in the absence of a scientific consensus that harm would not ensue, the burden of proof falls on those who would advocate taking the action. ***EC***

Appendix 3

DECC/BERR LOW CARBON TRANSPORT CONSULTATION - MARCH 2009

Our Low Carbon Industrial Strategy will set out how, working with the private sector, we can coordinate public sector activity to ensure the UK is a global leader in developing, demonstrating and manufacturing ultra-low emission vehicles and vehicle components.

- **What is the best way for Government and business to work together to secure a world leading position for the UK in low carbon transport?**

1. *Eileen Collier* says: 9 March 2009 at 9:41 am

   1. To adopt a multi-faceted and multi-modal cross-Government strategy, aimed at achieving carbon emissions reduction targets, which offers scope for developing cutting-edge technology while, at the same time, funding the Skills Academies and College and University courses required to optimise the talents of the workforce needed by industry.

   2. To recognise that a low carbon industry – the railways – already exists which offers enormous scope for technological development. In the EU the aim is to achieve interoperability of rail (both passenger and freight); dedicated international rail freight lines are being constructed and Intelligent Transport Systems (ITS) seem to be the way forward. Britain should play a key role in this.

   3. To ensure that rail transport is specifically included in low –carbon plans and transport sector carbon budgets by the Climate Change Committee, who seem to be focused on future innovations in road transport whilst ignoring the current benefits of rail. The Department for Energy and Climate Change, the Department for Transport and the Climate Change Committee should recognise that road and rail solutions to cutting carbon emissions are not mutually exclusive but complementary. For instance, a strategic rail freight network servicing deep-sea ports and airports would still require low-carbon road transport for local deliveries of goods.

   4. To explore the potential of technological advances in river and coastal water transport to help reduce carbon emissions. The EU Motorways of the Sea concept currently being considered, whereby cargo arriving at deep-sea ports can be transferred to river or coastal shipping for the next stage of its journey, is also exciting. It would be an excellent way to reduce the harmful pollution of heavy goods traffic and would, for example, benefit regional economies with smaller port facilities. Again, innovative low-carbon road transport would be required for final journeys to end-users.

   5. To ensure that the strategic infrastructure for rail freight (which is usually shared with passenger traffic so benefits both services) is properly funded to the level required to achieve the modal shift from road to rail needed to meet the Government's ambitious carbon emissions reduction targets. This work should start immediately (Stern) if we are to play our part in reducing the risks of Climate Change in the timescale required.

   EC 9Mar09

Appendix 4

ROAD SCHEMES FUNDING ANNOUNCED AUTUMN STATEMENT DEC 2014

NOTE: BCG notes shown in red

East of England (extract): A14/A1 scheme and A428-A421-M1 route to M1

Links to infographics and images will be available to download from 09.00am on Monday December 2014

Scheme name	Scheme Description	Announced
A14 Cambridge to Huntingdon	A14 Junction 20 (Ellington) to Junction 33 (Milton): major upgrade between the A1 and A10 at Milton, widening to dual three lanes, creating a bypass for Huntingdon and new distributor roads for local traffic and remodelling key junctions.	2013 Estimated cost £1.5billion (c. £60 million per mile)
A428 Black Cat to Caxton Gibbet (part of A428-A421-M1 alternative Huntingdon southern bypass)	A428: dualling of remaining single carriageway section between Caxton Gibbet west of Cambridge and the M1, including a grade separated junction at the A1 Black Cat roundabout.	Autumn Statement 2014 Estimated cost?
Oxford to Cambridge Expressway Study A428-A421 route to M1 and beyond	Study of the potential to link Oxford, Milton Keynes and Cambridge, making use of existing roads where possible and considering the case for filling missing links.	Autumn Statement 2014 Estimated cost of study? Cost limit for scheme?
A1 East of England Feasibility Study A14 scheme now includes widening the A1 between Alconbury and Brampton to **six lanes**.	Study of how to improve the safety and performance of the A1 between Peterborough and the M25, including the possibility of upgrading the road to motorway standard.	Autumn Statement 2014 Estimated cost of study? Cost limit for scheme? Not part of A14 scheme -why now included?

Note: All the comments above are made in relation to the A14 Cambridge to Huntingdon improvement scheme – see my written evidence to the Climate Change Adaptation consultation (Feb 2015) for more detailed information. The Planning Inspectorate (PINS) Examination in Public is now well under way and there are many documents now in the public domain on the PINS website for the project. If you wish to see all our evidence to the Inspectors, which is focused on environmental issues, you can select it from the Examination library by filtering using our name – ie **Brampton A14 Campaign Group**.

Appendix 5

Brampton A14 Campaign Group (BCG) scheme - dossier 2009-2015
BCG: low carbon transport; EU support & funding; EU TEN-T policy
BCG ALTERNATIVE A14 SCHEME – EU TRANSPORT COMMISSIONER SUPPORT (2009)

SUPPORT FROM THE EUROPEAN COMMISSION

EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR ENERGY AND TRANSPORT

DIRECTORATE A - Internal market & Sustainability
Economic analysis, impact assessment, evaluation & climate change

Brussels, 2 1 OCT. 2009
TREN/A1 CAC D(2009) 69139

Dear Ms Collier,

Vice-President Tajani has asked me to thank you for your e-mail of 30 September.

We share your opinion that the impact of transport activities on citizens' health and on the environment should be properly taken into account and that balance has to be found between the costs and the benefits of transport. We also support your view that traffic growth should not be merely accommodated through the extension of the transport networks; instead, a comprehensive approach should be adopted, coupling the provision of new infrastructure with innovative solutions for the optimization of the existing networks and their use.

As to the environmental aspect, achieving a sustainable mobility which is respectful of the environment and of public health is set very high on the priorities list of the European Commission. Disconnecting mobility from its adverse effects is a necessary step in a sector which showed strong growth in the past – and that might continue on this trend in the future.

I am happy to confirm that the letter and the attachments you addressed to Vice-President Tajani will be included in the list of contributions that were submitted in the framework of the public consultation on the Commission Communication "*A sustainable future for transport: Towards an integrated, technology-led and user-friendly system*".

Best regards,

Sandro Santamato
Head of Unit

EUROPEAN COMMISSION PRESS RELEASE: TEN-T DAYS NAPLES 21OCT09

The European Commission has today announced the first group of projects that will benefit from a total of €500 million worth of investment in vital transport infrastructure projects across the EU. The grants will be allocated under the Trans-European Transport Network (TEN-T) programme, which helps to fund works to build missing transport links or remove bottlenecks in order to enable people and goods to circulate quickly and easily between Member States. The €500 million package constitutes a vital part of the Commission's response to the economic crisis. The funding announced today will go towards projects in Austria, Belgium, Germany, Spain, France, Hungary, Italy, the Netherlands, Portugal, Sweden and the United Kingdom.

European Commission Vice-President Antonio Tajani in charge of transport, commented: "I am pleased to be signing these funding decisions today. It is my conviction that the EU's capacity to grow depends on the quality of its transport infrastructure and the TEN-T programme plays an essential role in ensuring its progress. Unlocking this funding shows the Commission is serious about tackling the economic crisis as it is targeted to encourage further economic growth. This funding released under the TEN-T programme plays a crucial role in keeping Europe moving forward."

Comment: The funding allocated to the UK was for the A14 Traffic Management Scheme (ATM) and for works on the Felixstowe-Nuneaton rail freight route as advocated in the Brampton A14 Campaign Group alternative solution. EC

Brampton A14 Campaign Group (BCG) scheme - dossier 2009-2015
BCG: low carbon transport; EU support & funding; EU TEN-T policy
BCG ALTERNATIVE SCHEME – PORTS RAIL FREIGHT OPTION (2009)

TEN-T EA
Trans-European Transport Network Executive Agency

European Economic Recovery Plan

Member States involved:
United Kingdom

Implementation schedule
Start date: July 2009
End date: December 2011

Implementing body:
Network Rail Limited

Budget:

National budget: €36,937,928

Total project cost covered by this Decision: €46,171,928

EU contribution: €9,234,000

Percentage of EU support:
Works: 20%

Additional information:

European Commission, DG TREN
http://ec.europa.eu/transport/index_en.html

Trans-European Transport Network Executive Agency (TEN-T EA)
http://ec.europa.eu/tentea

Beneficiary:
United Kingdom of Great Britain and Northern Ireland
www.dft.gov.uk

Implementing body:
Network Rail (infrastructure) Ltd
www.networkrail.co.uk

Felixstowe-Nuneaton Route Work

2009-UK-26029-E

Part of Priority Project 26

Source: TEN-T Executive Agency

This project aims to upgrade the Priority Axis 26 (railway/road axis Ireland/United Kingdom/continental Europe) from the port of Felixstowe to the West Midlands and connections with Priority Axis 14 (West Coast Main Line) at Nuneaton. This will facilitate the movement of international traffic by rail between the port and other UK regional distribution centres in the Midlands, North East, North West and Central Scotland.

The route work, which involves 29 sub-activities, will upgrade loading gauge capability specifically to enable the movement of 9' 6" containers on one metre high flat bed wagons - the most economical means of moving containers by rail within the UK. It will also provide increased capacity for intermodal freight services (to meet port forecasts up to 2030, and for a better loading/utilisation of intermodal services to 85% loading per train).

This increased capacity will:

- improve the network resilience for the movement of containers by rail from the port of Felixstowe
- increase rail mode share
- avoid additional intermodal services being routed via London (with consequential passenger benefits in the London area)
- support environmental sustainability
- reduce road congestion on the A14 corridor
- support regional policy objectives for transport, economic vibrancy and employment

Brampton A14 Campaign Group (BCG) scheme - dossier 2009-2015
BCG: low carbon transport; EU support & funding; EU TEN-T policy
BCG ALTERNATIVE A14 SCHEME – ACTIVE TRAFFIC MANAGEMENT SYSTEM (2009)

TEN-T EA
Trans-European Transport Network Executive Agency

A14 Corridor Traffic Management Scheme

2009-UK-13027-E

Part of Priority Project 13

European Economic Recovery Plan

Member States involved:

United Kingdom

Implementation schedule
Start date: May 2009
End date: December 2010

Implementing body:
Highways Agency

Budget:

National budget: €46,687,800

Total project cost covered by this Decision: €58,357,800

EU contribution: €11,670,000

Percentage of EU support:
Works: 20%

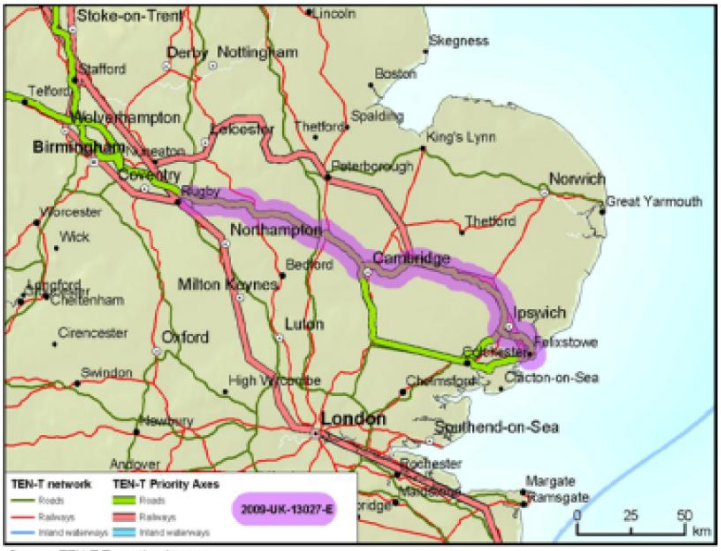
Additional information:

European Commission, DG TREN
http://ec.europa.eu/transport/index_en.html

Trans-European Transport Network Executive Agency (TEN-T EA)
http://ec.europa.eu/tentea

Beneficiary:
United Kingdom of Great Britain and Northern Ireland
www.dft.gov.uk

Implementing body:
Highways Agency
www.highways.gov.uk



Source: TEN-T Executive Agency

This project is part of Priority Project 13 (United Kingdom/Ireland/Benelux road axis).

The proposal will improve traffic conditions along 3 heavily congested sections of the A14. This will be achieved by installation of:

- Incident detection and automatic signing, traffic detection system and queue protection using variable message signs on cantilever structures.
- Strategic diversionary message sign information at specific junctions
- Extensive close circuit television (CCTV) coverage for improved incident response

Through wider dissemination of the data collected, significant accident reduction and delays saving will be achieved by warning drivers of upcoming accidents and advising them of preferred diversionary routes.

The project will also contribute to the ongoing EU ITS initiatives including Easyway and the ITS Action Plan.

DISCLAIMER
Individual financing Decisions will be adopted by the Commission only after all pending issues related to EC legislation, notably environmental law, have been resolved.

Total Funding - United Kingdom

- Thames Estuary dredge and reclamation works to support the integrated multi-modal London Gateway port and logistics development (€14,174,000)
- A14 Corridor Traffic Management Scheme (€11,670,000)
- Felixstowe-Nuneaton Route Work (€9,234,000)

For more details on a particular project please visit:

http://ec.europa.eu/transport/infrastructure/events/2009_10_21_naples_en.htm

ENVIRONMENTAL AUDIT INQUIRY – SUSTAINABLE DEVELOPMENT
See also my written evidence to the EAC Climate Change Adaptation Inquiry – Feb 2015

Brampton A14 Campaign Group (BCG) scheme - dossier 2009-2015
BCG: low carbon transport; EU support & funding; EU TEN-T policy

European Commission | Trans European Transport Network
Connecting UNITED KINGDOM

Extract from European Commission TEN-T website –Connecting Europe Facility

UNITED KINGDOM

United Kingdom has 1 Core Network Corridor crossing its country:

The **North Sea-Mediterranean Corridor** stretches from Belfast and the Irish ports of Cork and Dublin, as well as from the northern UK ports Glasgow and Edinburgh through Belgium, with a branch from Amsterdam and Rotterdam, via Luxembourg to Strasbourg and Basel and via Lyon to the southern French ports of Fos/Marseille. It covers rail, road, airports, ports, RRT's and the Dutch-Belgian inland waterway system as well as the Rhône river. The key project is the Seine-Escaut inland waterway.
The corridors and key projects which contribute to completing them are shown above.

What are the key benefits?

The multimodal TEN-T Core Network with the Core Network Corridors will strongly contribute to European cohesion and strengthen the internal market. A more competitive economy will produce higher employment. Enhanced multimodality on a better rail, inland waterways and maritime infrastructure within the multimodal TEN-T, as well as innovative technologies in the field of transport, will induce modal shift, reduce congestion on road, cut emissions of greenhouse and polluting gases and boost transport safety and security.

ENVIRONMENTAL AUDIT INQUIRY – SUSTAINABLE DEVELOPMENT
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BCG: low carbon transport; EU support & funding; EU TEN-T policy

Projects that could receive financing from the "Connecting Europe Facility" (CEF):

Taking into account the long-distance benefits of improvements in a corridor, the following tables comprise, apart from projects in the country concerned, also measures in corridor sections beyond its borders.

North Sea – Mediterranean

Cork - Dublin - Belfast	Rail	Studies and works; Dublin Interconnector (DART);
Belfast	Port, multimodal connections	upgrading
Glasgow - Edinburgh	Rail	Upgrading
Manchester – Liverpool	Rail	Upgrading and electrification, including Northern Hub
Birmingham – Reading – Southampton	Rail	Upgrading of the freight line
Dublin, Cork, Southampton	Ports, Rail	Studies and works on port capacity, MoS and interconnections
Felixstowe – Midlands	Rail, port, multimodal platforms	rail upgrading, interconnections port and multimodal platforms

Other

Milford Haven – Swansea – Cardiff	Other Core Network	Rail	Upgrading
Rail connection Shannon Foynes - Limerick junction	Other Core Network	Rail	studies
High Speed 2	Other Core Network	Rail	Studies & works for a high speed line London – Midlands
Cardiff - Bristol - London	Other Core Network	Rail	Upgrading, including Crossrail

NOTE: BCG ALTERNATIVE A14 SCHEME 2015
The BCG multi-modal alternative scheme is based on sound environmental principles (including the Precautionary Principle). It also complies with the new EU TEN-T policy and DfT modal shift policy. It has been further updated since the 2013 version to incorporate subsequent DfT policies viz: the new Expressway standard for trunk roads and the DfT 'Green Retrofit' scheme for roads without noise mitigation such as the A1 at Brampton.

Eileen Collier (Cllr) – Brampton A14 Campaign Group - 29 July 2015

Federation House, Station Road, Stoke-on-Trent. ST4 2SA
Tel: [telephone redacted]
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8th February 2017

Gas Storage Briefing for the National Infrastructure Commission

About the British Ceramic Confederation and Ceramic Sector

As a trade association, the British Ceramic Confederation (BCC) represents the collective interests of all facets of the UK ceramic manufacturing industry. Our 100 member companies operate 160 sites. Our sector (including materials suppliers) generates annual sales of around £2bn, employs 20,000 people directly and is an active exporter, with over £400m in export sales. Around 75% of our member companies are SMEs.

The ceramic sector is diverse, going beyond typical perceptions, spanning foundation industries through to advanced manufacturing / materials and comprises: heavy clay construction products (bricks, roof tiles and drainage pipes); whitewares (tableware, giftware, wall tiles and sanitaryware); refractories (vital in all high-temperature process industries) and technical ceramics (for many electronic, medical, aerospace, environmental, military and structural applications).

Energy Consumption in the Sector

On a consumption basis, around 85% of the energy mix used in the ceramics industry is provided by natural gas, with the industry consuming around 4,400 GWh in 2015. Consequently, issues around gas supply security and costs are of critical concern to our members. The fuel is principally used in dryers, spray dryers and kilns to dry and then fire the raw materials to produce a ceramic product.

Although less than 15% of total energy usage in the industry, around 650 GWh in 2015, is provided by electricity it as vital as gas because all kilns and other parts of the manufacturing process (such as grinding, conveying of semi-finished product, abatement of industrial emissions etc) are controlled or powered by electricity. Thus issues around electricity supply security and cost are equally important. This also links back to gas given gas-fired power stations, principally CCGTs, generate around a third of the UK's electricity and are able to respond to demand changes relatively quickly.

The ceramic industry is energy-intensive (but not energy-inefficient); with energy costs and taxes making up to 30 to 35% of total production costs. By virtue of the importance of energy to their overall costs, our members (and energy-intensive industries in general) have been driven to maximise the efficiency of their operations over several decades.

The firing temperatures in a gas fired kiln range from 1,000 ^{o}C to 1,700 ^{o}C. While some members that require higher firing temperatures (up to 2,750^{o}C) use electricity rather than gas through electric arc, resistance or induction heating.

UK Gas Supplies

Following the discovery of natural gas in the North Sea (UK Continental Shelf), the UK enjoyed plentiful natural gas supplies for several decades. The construction of the UK to Belgium interconnector also enabled gas to be exported to the European market. However, domestic conventional gas reserves are now in long-term decline, such that since 2004 the UK has been a net importer of gas. In response the market has increased import capacity but this doesn't necessarily guarantee enough supply at any specific time particularly during times of demand or supply stress.

The UK faces several potential causes of high demand or disruption to supply:

- Cold weather: UK winter demand variability is driven by temperature and domestic heating.
- Infrastructure: failure of interconnectors, pipelines and processing terminals.
- Geo-political events.
- LNG: deliveries are not guaranteed and can be diverted to other countries at very short-notice.

As a result of being a net importer the UK must attract gas supplies through higher prices and competes for gas on a global basis. Gas held in storage is located physically close to the UK transmission system and so is able to respond quickly to situations of high demand or supply disruption. However, gas storage levels in the UK are lower than in many other parts of Europe.

Security of supply

In the event of a gas supply shortage, the largest industrial consumers are the first to be instructed to cease consuming gas, i.e. domestic consumers are given precedence over industrial consumers. A limited number of non-domestic consumers are treated as priority customers and exempt from this instruction, including hospitals, care homes and consumers operating major items of capital plant which require time to be safely shut down and would sustain damage in excess of £50 million if gas supplies ceased suddenly. Unfortunately, whilst our members are exposed to major structural damage risks, they do not meet the £50m threshold (an absolute rather than relative threshold) and therefore are not on the "priority consumers" list.

In the ceramic sector, the physical loss of gas or electricity in an unplanned manner (i.e. without several days' notice to allow fully controlled cooling to take place) can cause severe damage to continuous kilns, their refractories and kiln cars; as well as loss of product being fired and any further production being suspended. This would usually require a factory shutdown for repairs, resulting in £ multimillion of losses. This would be especially damaging to the SMEs in the sector.

Price volatility

Gas wholesale prices are more variable in the UK than in some other competitor economies. This results in unstable operating conditions (variable costs and hence variable profitability) for gas-intensive industrial users, such as ceramic manufacturers. There is a growing need to protect all consumers from price volatility.

Members are responsible for their own individual energy contract arrangements. On one hand some may fix their prices for several years ahead, but usually pay a risk premium to achieve this. While at the other end of the scale gas might be purchased a day ahead, and in between, members may gradually fix their prices over time. In the event of high demand or shortfall of supply those members on day-ahead contracts would be exposed to higher prices and face the market's reaction to the risk of disruption. In addition, members on fixed contracts could be affected through higher market prices in the longer-term. This is especially important given the proportion of costs that are energy related.

In March 2013 the UK experienced a late cold spell which combined with reduced supply availability due to a compressor failure at Bacton and low gas storage levels. During this episode the day-ahead gas price spiked to 150 p/therm. At least one member suspended operation during the high prices and more widely the Unions were briefed in case of the need for redundancies. In addition, at the time many of our members received calls from their gas transporter to confirm emergency contact details in the event of being required to switch off supplies. This created significant uncertainty and concerns for our members.

Need for more UK gas storage

With no significant new gas storage capacity constructed in recent years coupled with Centrica Storage's ongoing testing programme at its ageing Rough facility (which accounts for around 70% of total UK gas storage capacity), we feel Government urgently needs to reconsider the case for supporting new and existing gas storage facilities. One option, as the Prime Minister said, is using "more Treasury-backed project bonds for new infrastructure projects" as the market is not delivering the necessary investment. We have calculated that doubling our gas storage capacity would result in additional costs to all consumers of ~ 1p / therm. Our members and Board recognise this as an acceptable "insurance" cost to improve supply security and reduce price volatility. We want to keep manufacturing businesses, jobs and investments in the UK.

Please feel free to contact one of us if you require any further information.

[name redacted]	[name redacted]
[job title redacted]	[job title redacted]
[email redacted]	[email redacted]
[telephone redacted]	[telephone redacted]

NATIONAL INFRASTRCTURE ASSESSMENT CALL FOR EVIDENCE

BRITISH CHAMBERS OF COMMERCE SUBMISSION

The British Chambers of Commerce (BCC) sits at the heart of a network comprising 52 accredited Chambers of Commerce in the UK, plus a fast-growing Global Business Network.

In the UK, our network brings together over 75,000 member businesses, and engages with a further 200,000 non-member companies each year. Overseas, our Global Business Network offers practical, on-the-ground help to UK exporters, and supports two-way trade between the UK and the rest of the world.

INTRODUCTION

UK Accredited Chambers of Commerce help businesses connect locally, have a deep knowledge of local business requirements and connect local businesses to global opportunities. Chambers of Commerce bring together business communities rooted in places. Our Network's depth and strength at a local and regional level sets us apart from other business organisations. The focus on place – both in government and business – is increasing, driven by devolution and decision making moving from Whitehall to the regions and nations. Against this background, Chambers' remain the pre-eminent champions of local and regional business communities and are key players in local economic development.

Investment in economic infrastructure is critical to the success of business and local economies. In responding to this call for evidence for the National Infrastructure Assessment, the BCC has identified key principles against which investment needs to be assessed. We have also highlighted key infrastructure investment priorities for cities and regions across the country.

In addition, individual chambers of commerce from across the BCC Accredited Network will be submitting to you their own detailed responses. The BCC offers its support and assistance to the NIC to bring together businesses and stakeholders to identify nationally significant infrastructure investment priorities.

UNLOCK ECONOMIC AND HOUSING GROWTH

- Chambers of Commerce in every town, city and region of the UK will have be able to identify transport infrastructure investment needed to stimulate sustainable economic growth and unlock land for housing and employment uses. A list of priority schemes is presented at Annex A
- Infrastructure investment must be directed towards those areas and projects which can generate the greatest levels of economic, social and environmental returns.
- Effective and efficient transport infrastructure is critical for the movement of people, freight, products and services. Improving road and rail transport connectivity and capacity, within and between urban centres, including more east -west road and rail links, is key to this goal.
- Improved road and rail links between Tier 2 and Tier 3 cities and neighbouring core cities is required to facilitate the flow of skilled labour and enable businesses to access the talent they need to grow.
- Improved 'first mile/last mile' links from key growth locations to transport hubs and network access points are required to extend labour markets and facilitate linkages between firms and suppliers.

- National agencies, such as Highways England and Network Rail, must be better aligned with LEPs and local government to ensure that investment in local, regional and national transport infrastructure is properly integrated and that local economies can maximise economic development opportunities arising from national infrastructure investment. The formation of regional transport authorities, such as Transport for The North, to improve the planning and coordination of investment is supported.
- The growth of too many SMEs is constrained by the lack of access to digital infrastructure. All businesses in towns, cities and rural areas across the nation must be able to access the highest speeds and most reliable broadband and mobile connectivity at a competitive price. Digital infrastructure must be future-proofed to provide, at the very least, the speed and capacity enjoyed by our leading international competitors.
- Businesses require security of energy supply and stability of prices. More investment in infrastructure for local district heat networks, energy from waste and other renewable energy initiatives would provide greater certainty and confidence, as well as stimulating economic growth through local supply chain development.

Examples:

East of England: Dualing of the A47 will help deliver journey time reliability and development in key economic growth areas, including the Enterprise Zone at Great Yarmouth and Lowestoft.

North Midlands: East-West Connectivity: To boost trade and access to skills, there is a need for upgraded rolling stock and signalling which would improve capacity and frequency of rail services between Crewe, Stoke and Derby.

Milton Keynes & Northamptonshire: The Oxford & Cambridge Expressway, together with electrification of the rail infrastructure, would provide significant enhancements to strategic connectivity and benefit economies and communities well beyond the immediate corridor.

ENABLE INTERNATIONAL TRADE

- To remain internationally competitive, businesses need fast, reliable and efficient transport connections to customers and markets around the globe. This requires improved connectivity to ports and airports, including better east-west road and rail links, as well as increased capacity at these international gateways.
- A national aviation strategy is required to ensure airport infrastructure in the South East can meet the future needs of the economy and that the economic potential of regional airports throughout the UK is maximised.
- More investment is required to improve road and rail connectivity to airports, including the full integration of HS2 services.
- The UK's ports enable trade and tourism with Europe and the wider global economy. To facilitate the movement of freight to ports, and to support international trade, there is a requirement for enhanced east-west road and rail connectivity.
- To increase freight capacity at ports, improve ease of access, and minimise undesirable heavy goods vehicle movements into cities and other sensitive areas, there must be improved connectivity to major multimodal hubs.
- Investment in smart technology is required to help regulate traffic flows at ports. This would facilitate introduction of virtual queuing at lorry parks to enable timed arrival of vehicles and increase capacity for customs clearance.
- A national network of quality freight parking facilities is required to serve ports, airports and urban areas. As well as facilitating freight movements, this would also improve safety and reduce crime.

- Exporting firms need access to ultra-fast, reliable and competitively priced broadband to facilitate e-commerce and digital communications with customers in export markets.
- The international competitiveness of intensive energy using firms, such as those in the ceramics sector, is jeopardised by the risk of interruption to energy supply which can restrict operations, increase costs and damage expensive machinery. In the short to medium term, while such firms transition to lower carbon solutions, the NIA needs to re-assess the infrastructure capacity of the UK's gas storage facilities to ensure it can meet the needs of industry.

Examples:

Kent Ports: To facilitate traffic to and from the Channel Port, invest in the new Lower Thames Crossing and enhancements of the M2/A2 corridor to enable the bifurcation (splitting) of traffic between the M2/A2 and M20/A20 corridors which would provide resilience on this international corridor and create a new strategic route from the Port of Dover to the Midlands and the North.

North East Ports: Promote use of coastal feedering and electrify and establish W12 gauge clearance on the rail line between Northallerton and Teesport.

MANAGE DEMAND

- Businesses are experiencing worsening journey times on the roads network within cities and between cities. Delays impact on fuel consumption, increase business costs and restrict growth and competitiveness. Investment in technology is needed to enable the densification of roads and improve management of traffic flows.
- Roll tolling and congestion charging initiatives are regarded as stealth taxes and generally lack support from the business community. This stems from the perception that road tolling schemes are often poorly planned and coordinated, leading to unintended consequences, especially for hauliers. Businesses are concerned that charging schemes create boundary issues. Moreover, there is a lack of confidence that taxes raised from congestion charging will be directly hypothecated for local road infrastructure improvements. Whatever the intrinsic benefits of a pricing approach to demand management, business confidence and support will be undermined unless these issues are resolved.
- Demand management measures, and the sensible roll-out of smart motorways, need to be balanced with greater investment in road upgrades and new road building, to meet the long-term capacity needs of the UK economy. The number of miles of roads and motorways per head of population in the UK is still less than half of the European average.
- Greater investment is needed in local sustainable transport infrastructure, to encourage modal shift and release road capacity. Infrastructure to enable bus priority in urban centres, and light rail solutions, would help to maximise the potential of these modes to reduce road traffic congestion.
- A quality and affordable alternative to the private car must be available before any restrictions are imposed on businesses or commuters.
- A blunt tax on businesses based on traffic generation would damage growth and competitiveness. A mechanism to identify business sensitive traffic and protect from excessive costs and constraints would be required.

REFORM PLANNING

- Action is needed to remove blockages in the planning system which impact on the viability and pace of delivery of economic infrastructure.

- The planning system must be speeded up at the local level through increased staff resources, training of planning committee members and streamlining of conditions. Delays introduced at the level of the Planning Inspectorate and the length of time allowed for judicial review must also be curtailed.
- More must be done to consult businesses, provide strategic certainty and boost confidence in the planning system. There must be an up-to-date spatial plan in every council area and the timescales and stages for the preparation of such plans needs to be reviewed to help this process.
- The failure of the Duty To Cooperate must be addressed. Strategic Economic Plans set by LEPs and the local plans set by councils must be properly aligned.
- Government must reduce the complexity, duplication, layering and contradictory nature of plan making across the emerging economic geographies. Combined authorities need stronger powers over spatial planning to prevent fragmentation and enable the delivery of ambitious growth and major infrastructure. To be effective, these combined authority spatial plans should be given development plan status.
- To bring forward new housing and infrastructure development, the undue weight given to neighbourhood plans, especially in the early stages, needs to be revised.
- There is a need to address concerns about the operation of the Community Infrastructure Levy regime in certain parts of the North and the Midlands arising from the limited viability of some forms of development. The government needs to review this one-size-fits-all policy to ensure that infrastructure is delivered in all parts of the country. Businesses need to be consulted and involved.
- The correct balance of land and infrastructure for jobs and homes must be maintained. Councils need to objectively plan for employment land to ensure that the imperative to meet demand for housing does not force out other uses and create greater demands on transport and infrastructure networks.

The British Chambers of Commerce remain keen to engage further as this consultation progresses.

For further information, please contact:

[name redacted] | [email redacted] | [direct telephone line redacted]

LONDON of CHAMBER
COMMERCE AND INDUSTRY

CONNECT. INFLUENCE. SUPPORT.

National Infrastructure Assessment

Submission from London Chamber of Commerce and Industry to BCC

2nd February 2017

London faces two significant, related challenges. The first is the acute undersupply of housing in the capital. The second is the need for sustained investment in London's transport system, in order to service London's rapidly increasing population – heading towards 10 million by 2030.[1]

Research undertaken by ComRes on behalf of LCCI in May 2015 found that housing was the top infrastructure priority for London.[2] In helping address this challenge, LCCI believes it is essential that the role that investment in London's transport infrastructure can play in boosting the capital's housing supply is recognised.

Crossrail 2

This is why LCCI strongly supports the development and construction of Crossrail 2. It represents a strategic investment in London's future infrastructure needs, with successful delivery of the project anticipated to make significant inroads towards addressing both the capital's transport capacity crunch and its chronic housing undersupply.

Crossrail 2 has the potential to enable and accelerate the development of 200,000 new homes across the region, particularly in the Upper Lee Valley and even the Stansted Corridor.[3] The project would deliver jobs to the area by releasing and adding to capacity on longer distance main lines. It can also improve productivity by bringing a greater number of individuals' journey times to central London below 45 minutes. LCCI believes that the project should be viewed as an essential component of overall efforts to reach the capital's housing targets, and towards keeping the UK's capital globally competitive.

It is essential to recognise that the economic benefits of Crossrail 2 reach far beyond London and the South East. It is a vital piece of national infrastructure that will benefit the UK as a whole. For example, central government will benefit from Crossrail 2 through the increased tax receipts that will result from the economic growth it generates and the new homes built. The Crossrail project's supply chain also illustrates how large scale infrastructure projects can benefit the UK as a whole.[4]

River crossings

LCCI recognises that there are also other, smaller scale infrastructure projects in London that need to be taken forward. The wider South East of London is experiencing rapid population growth and the regeneration of East London has seen increased investment by the business community. However, road connectivity in the area is poor, especially in comparison to West London. Within the M25 there are 23 fixed road crossings across the River Thames west of Tower Bridge (not including

[1] It is expected that the population will grow to 10 million by 2030 (https://tfl.gov.uk/info-for/media/press-releases/2015/june/-tfl-annual-report-published)
[2] ComRes survey of 1,016 members of the London public, 156 London councilors and 510 London business decision makers for London Tomorrow *London's future infrastructure: Who pays and how do we deliver?* May 2015
[3] Crossrail 2: regional and national benefits September 2015
[4] http://www.crossrail.co.uk/supply-chain/

Tower Bridge itself)[5] but just two to the east.[6] This is detrimental for businesses in East London who are disadvantaged in comparison to their competitors on the other side of the capital.

Whilst LCCI supports the current proposals for the Silvertown Tunnel, we believe that new, fixed river crossings should also be constructed at Gallions Reach and Belvedere.

Aviation capacity

International trade has long been a critical component of Britain's economic well-being. Following the UK's vote to leave the EU, there is a pressing need to encourage and support British businesses to engage in international commerce and help build a strong and prosperous UK economy. For Britain, as an island economy, the ability to do this relies on frequent and direct air links to high-growth international markets. Addressing airport capacity constraints is essential for the future competitiveness of London and the whole of the country. Yet, the announced new runway at Heathrow will take several years to be operational.

LCCI welcomed the Government's decision on Heathrow, the announced new runway at Heathrow will take several years to be operational. Whilst we wait for the runway to be built, there is a pressing need to maximise London and the South East's airports system as a whole including City, Luton and Stansted airports in order to maximisie and develop international trade opportunities.

Existing terminals need to be enhanced with smoother check-in, security processing and border controls. Wherever possible airfields need to be improved to shorten turnaround times and rail links need to be reliable and frequent. Additionally, we need to significantly improve transport links to Stansted which is currently only operating at around 50% of its capacity. If we can press on with the planned improvements at London City Airport whilst driving forward enhanced links to Stansted and maintaining the case for another runway at Gatwick, then London and the rest of the UK can truly futureproof this vital aspect of our economy.

For further information, please contact:

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33 Queen Street
London EC4R 1AP
[email redacted]

[name redacted]
[position redacted]
33 Queen Street
London EC4R 1AP
[email redacted]

[5] East of Tower Bridge but east of M25 crossing of River Thames at Egham, there are the following fixed road crossings of the River Thames: A308 (at Staines), M3 (at Chertsey), B375 (at Chertsey), A244 (at Walton), A309 (at Hampton Court), A308 (at Kingston), A505 (at Richmond), A316 (at Richmond), South Circular Road (at Kew), A316 (at Mortlake), A306 (at Hammersmith), A219 (at Putney), A217 (at Wandsworth), A3220 (at Battersea), A3031 (Albert Bridge), A3216 (Chelsea Bridge), A202 (Vauxhall Bridge), A3203 (Lambeth Bridge), A302 (Westminster Bridge), A301 (Waterloo Bridge), A201 (Blackfriars Bridge), A300 (Southwark Bridge) and A3 (London Bridge).

[6] West of Tower Bridge but east of Queen Elizabeth II Bridge/M25 crossing of River Thames at Dartford, there are the following fixed road crossings of the River Thames: A101 (Rotherhithe Tunnel), A102 (Blackwall Tunnel). In addition to the above fixed road crossings, there is also the Woolwich Ferry.

North East England
Chamber of Commerce

BCC Input – National Infrastructure Assessment

North East England Infrastructure Investment Priorities

Introduction

This document outlines the key infrastructure priorities for North East England, as identified by Chamber members in the region, and detailed in our Chamber Manifesto 2017 and related policy documents, which are attached to this submission.

Several of the region's key infrastructure priorities would fit within multiple categories below, but have been placed in the category considered most applicable.

1 Unlocking economic and housing growth

Each and every infrastructure investment should help move the region towards unlocking its economic potential, and should have enabling development at its core.

There are two key gateway infrastructure projects in the region which have the potential to unlock economic growth, at Newcastle Central Station and Darlington Station.

Ambitious plans for Newcastle Central Station will see accessibility improved, platform capacity increased to prepare the station for High Speed Rail, and a new southern entrance, opening up an entire section of the city – alongside the historic Stephenson Quarter – to regeneration. Newcastle Central is a gateway to the north of the region, acting as the primary link between Tyne and Wear and the rest of the country via the East Coast Mainline.

Similarly, Darlington Station acts as the gateway to Tees Valley. For that part of the region to flourish, Darlington Station requires redevelopment and realignment, to allow greater capacity for trains to pass through and prepare the station for High Speed Rail, while preserving a key access point to Middlesbrough and Teesport.

Digital connectivity is also crucial to a region with a diverse geography, combining the rural and urban, and many parts of the region still struggle with broadband access. The region needs continued support, both for the roll out of existing fibre broadband technology and for the delivery of the next generation of digital communication technologies like 5G.

North East England has long played a significant role in the UK's energy generation, with the correct investment in infrastructure – and the certainty of policy which would unlock private investment – the region could continue to play that role, with expertise in advanced manufacturing, subsea oil and gas, and renewable energy.

Summary:

- Investment in Newcastle Central Gateway project
- Realignment of Darlington Station
- Investment in digital connectivity
- Certainty in energy policy and support for private investment

2 Enabling international trade

North East England
Chamber of Commerce

North East England is a region with a global outlook, and is the only region in the UK with a consistently positive balance of trade. To maintain this successful global foothold in an increasingly competitive environment, the region needs investment both on a local and a national level.

The Government's commitment to expand London's Heathrow Airport is a welcome one, securing the region's current links via Newcastle International Airport to the UK's international hub, and opening up the potential for a new link between Heathrow and Durham Tees Valley Airport. However, now the expansion of runway capacity is out to consultation, it is important the project continues to gather support and continues to move along the process towards delivery as quickly as possible.

To ensure that the region continues to benefit from the excellent connectivity it currently enjoys, and with the room for growth, it is important that surface access to our ports and airports is improved. This includes improvement sin road access across the region, and ensuring the correct loading gauge and capacity for rail lines is available linking Teesport and Port of Tyne to logistics centres across the country.

Summary:

- Continued support for a swift delivery of airport expansion at Heathrow
- Improved surface access to ports and airports
- Improved rail connectivity to Port of Tyne and Teesport

3 Improving connectivity

North East England is in a unique position within the UK, with strong existing links to London and Edinburgh, and strong international links via our ports and airports.

Where the region's connectivity must improve is in strengthening links with our neighbours in the north.

Improvements are needed on the East Coast Mainline, not only to enable planned improvements to passenger services, but also to relieve bottlenecks and open up new freight paths.

Improvements to the existing national rail network in North East England are also vital to allow HS2 trains to run on and into the region before high speed track arrives, adding additional capacity and opening up links to new connections across the country.

The timely delivery of HS2, and its swift progression into North East England, should be viewed as part of improving connectivity to the region's neighbours, including to across the Pennines. Providing these links, via the A66 and A69 on the road, and also via trans-Pennine rail services, will play a significant role in enabling the north of England as a whole to achieve its aims for economic growth and sectoral development.

Summary:

- Upgrades to the East Coast Mainline, especially to improve capacity from Northallerton to Newcastle
- Swift delivery of High Speed Rail to North East England, initially as run-on services, leading to new track in the future
- Improvement to trans-Pennine connectivity, including delivery on commitments on A66, further upgrades on A69 and improvements to trans-Pennine rail

4 Increasing capacity

North East England has long suffered from underinvestment in its road network, and although this has begun to be rebalanced, it is important that the region's road network continues to see investment to ensure it is able to meet the demands on capacity as our economy continues to grow.

To the north of the region, the recent commitment of the Secretary of State for Transport to dual the A1 in Northumberland all the way to the Scottish Border is to be welcomed, but this commitment must become reality as soon as possible.

The planned improvements on the A19 – particularly at Testos and Down Hill Lane junctions – will help the region's road network enable expansion in our key sectors, and link Nissan and the proposed International Advanced Manufacturing Park (IAMP) to the Port of Tyne.

In the south of the region, the Tees Valley's local road network is hampered by a lack of capacity for crossing the River Tees, and the Tees Valley Combined Authority is currently examining the case for a new Tees Crossing. This additional capacity on the local network can enable Teesside's businesses to better reach the A19 and the A66, and continue to create jobs and drive economic growth.

Summary:

- Dual the A1 in Northumberland into Scotland
- Deliver planned upgrades to the A19
- Move forward case for a new Tees crossing

5 Improving reliability of networks

In addition to the projects already outlined, the region has one key ask to improve the reliability of its transport networks – new rolling stock for the Tyne & Wear Metro.

The current Metro fleet is approaching 40 years old, and has operated since the service opened. It is beyond the end of its operational life, and reliability issues mean that without a new fleet, the Metro will not be able to expand and improve the service to meet the growing needs of Newcastle, Gateshead, North Tyneside, South Tyneside and Sunderland.

Expansion plans, linked to the delivery of new trains, include expanding the network onto the national rail system, potentially linking currently isolated parts of Northumberland and Co. Durham in particular to the system and to the East Coast Mainline.

The Tyne & Wear Metro is a tremendous asset for the region, but needs substantial investment in order to continue to play this vital role in the regional economy.

Summary:

- Delivery of a new rolling stock fleet for the Tyne & Wear Metro

6 Managing demand

In addition to above concerns around capacity and connectivity, there are two key areas where the UK is currently, or will soon need to, manage demand.

North East England
Chamber of Commerce

The first is on rail freight capacity, where the region is rapidly approaching the limits of what the current network and current methods can provide. Work is needed to unlock capacity, both through investment in physical infrastructure, and also investment in new approaches to identify where efficiencies can be found to open up new paths to the region's manufacturers, energy generators and logistics firms.

Secondly, the nation's energy capacity. North East England has long been at the forefront of energy generation in the UK, and has the natural assets, skilled workforce and industrial expertise to remain so. Not only is the region a leader in the renewables sector, it also enjoys the presence of many energy-intensive industries, whose competitiveness is linked to the cost and reliability of their energy supply.

Efforts should be made to support industrial investment in new technologies around energy generation – including industrial Carbon Capture and Storage – and help reduce costs for high-intensity users. This must include long term certainty around the energy sector, offering clear sight for investors as they plan and deliver schemes over the medium to long term.

Summary:

- Open up additional rail freight paths, better linking North East England with the rest of the UK
- Support access to cheap, reliable energy for industrial users – including by generation on site

[name redacted]
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North East England Chamber of Commerce
February 2017

West & North Yorkshire Chamber of Commerce
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National Infrastructure Commission

The West and North Yorkshire Chamber of Commerce is one of the largest Chambers, in geographical terms in the country. It includes the main economic centres of Bradford, Leeds and York and also towns such as Harrogate and Scarborough. Consequently the input provided by this Chamber includes national, cross-boundary and local infrastructure and investment needs.

The responses reflect the order in which the questions were asked in the original message about providing input to the Commission's National Infrastructure Commission:

Unblocking economic and housing growth

In many ways these two issues are very closely linked i.e. if the local economy is growing it will require additional workers who, in turn will require housing. However the development and adoption of Local Plans is an essential document to ensure that the two issues are identified and also sites allocated for economic and housing growth. Unfortunately in both Bradford and York no plans have yet been approved and consequently unplanned development continues with the local authorities frequently losing appeals by developers because of the lack of a local plan. Local Plans are essential for the structured, long-term development of cities and towns and it is a considerable concern to the Chamber that two of major cities in our area do not have such plans in place.

The lack of Local Plans is to some extent increasing pressure on the availability of land for residential development because little if any development is taking place is taking place outside the existing green belt. Therefore land within the green belt which could be used to support economic development and business growth is coming under pressure to have a changer of use to residential development. In addition, particularly in York, the increasing pressure for residential development is having an impact upon the price of land which is on the rise and consequently being too costly for commercial development. The Chamber would want to see the safeguarding of certain commercial sites in our cities and towns thereby ensuring the availability of land for future business activity.

Enabling international trade

The recent Brexit referendum result will undoubtedly impact on where, in the future the UK trades internationally. The Chamber of Commerce network is in a very unique position, because of its worldwide links to support businesses that may be looking to trade overseas for the first time or looking to expand their overseas activities. There is no other business representative organisation which is in such a position and consequently the Chamber network should be engaging now with central government to ensure the Chamber's unique position is acknowledged and understood. Chamber's need to work closer with the relevant government departments to offer a seamless offer of assistance to business rather than competing which has, sometimes been the case in the past. In addition reductions in staff numbers in many overseas embassies mean that they are often not now able to provide the economic information, etc that business is looking for about local markets and, again Chamber are often in a position to offer this service.

AS the UK moves forward to exiting the EU there is a significant opportunity for the Chambers to establish themselves as the pre-eminent business support organisation for overseas trade and the Chamber network needs to undertake the necessary work to ensure this happens.

Improving connectivity

One of the two main barriers to growth which members mention is poor connectivity. This frequently refers to transport infrastructure but can also include broadband and mobile 'phone connectivity. Investment in the North's transport infrastructure has, disappointingly lagged far behind that in London and the South East and consequently the north is playing "catch-up". Increased investment is required across all modes of transport and whilst the Chamber welcomes the investment that is taking place, and planned in public transport networks, for the majority of Chamber members, car is still their chosen mode of transport.

The Chamber's comments about connectivity reflect the way business is done i.e. across boundaries and therefore it is essential for investment to reflect this. Localised investment should integrate with that at city-region level which in turn should integrate with investment at regional and inter-regional levels which should then reflect national priorities. Establishing Transport for the North (TfN) is step in the right direction towards more coordination of investment in transport infrastructure and this Chamber is supportive of its ambitions.

As mentioned above there are national and inter-regional transport projects that the Chamber would want to see delivered and these include:

Rail

- HS2 arriving in Leeds and York within the proposed timescales and that local and regional rail services are also increased/improved to maximise the economic impact of the new high-speed services,
- Leeds rail station is redeveloped into a piece of inspirational, national transport infrastructure which integrates not only high-speed services but also Northern Powerhouse Rail (NPR) services, and increased local and regional services. Passenger footfall is estimated to double to over 60m per year and so the rail station needs redeveloping to effectively accommodate the significant growth in passenger numbers as well as rail services,
- The Chamber would want to see some high-speed services travel through Leeds and onto York, the north of England and Scotland (and the return journeys) and believes that a connection (a "hook") needs to be built from the HS2 lines coming into the city directly into the rail station thereby providing the through connection. In addition the Chamber would also want to see the existing 2 rail lines between Leeds rail station and York increased to 4 lines thereby facilitating higher speed journeys and contributing towards the conditional outputs for NPR.
- The Chamber is supportive of the proposals to have an intermediate station sited in Bradford city centre on the proposed NPR network and is actively contributing towards

- collecting economic evidence, as well as working with the city of Bradford Metropolitan Council to support the case for NPR to come to the city.
- The City of York will also have a significant role to play, primarily because of its location with both HS2 and NPR services using the city's rail station. It will need a certain amount of redevelopment to accommodate the additional services but this appears dependent upon the development of the nearby York Central site. The Chamber would want to see this site opened up (there are significant access problems) as soon as possible and plans produced to adequately accommodate the additional rail services.
- Uncertainty remains about the timescales for the commencement and completion of the proposed Trans-Pennine electrification project and the Chamber would like the Government to re-affirm its commitment to the project and for Network rail to clarify when it will start and end.
- As well as HS and NPR rail projects investment need to be continued in local rail services and whilst the announcements by Virgin Rail, Trans-Pennine Express and Northern are welcome, the Chamber would want to see a firm commitment to continued investment.
- The supporting infrastructure for rail services should not be overlooked and whilst the Chamber welcomes recent announcements to upgrade facilities, including increased car parking at many rail stations in the Leeds City Region, this investment should be expanded to cover all stations in our Chamber's geography.
- The Chamber welcomes the change to franchise agreements for Train Operating Companies and also the focus upon growth within those agreements. However if the franchise holders fail to deliver on the commitments for new rolling stock, reducing overcrowding and punctuality then the Chamber would want to see powers in place to replace the existing franchise holders.

Road

- As previously mentioned road is the chosen mode of transport for many of our members and the ever increasing levels of traffic and also congestion are mentioned by many as a barrier to growth. The Chamber's geographic area includes motorways, strategic "A" roads and the local road network and with traffic levels in the area forecast to increase by around 23% (DfT'S figures) by 2030 there is considerable concern that congestion levels will further increase and thereby all the associated problems. The Chamber welcomes TfN's proposals to produce a road strategy in the spring for the North and will be looking for a clear commitment to increase capacity and reduce congestion. In particular the Chamber wants to see proposals for:
- Upgrading the existing A1 dual carriageway between the M18 and M62 motorways to full motorway status,
- Upgrading the A64 road to dual carriageway along its full length from York to Scarborough,
- Upgrading the northern ring road around York to dual carriageway,
- Full approval by DfT for the proposed transport investment programme in Leeds,

- A further upgrade to the Lofthouse interchange on the M62 with its junction with the M1, this is a regular source of severe congestion and a major interchange on the North's motorway network,
- Completion of the upgrade to the trans-Pennine section of the M62 to Smart motorway status however further consideration will need to be given to increase capacity for road travel across the Pennines. One possibility could be an extension (possibly dual carriageway) of the M65 motorway into Yorkshire to the A1/M1.
- The introduction of more park and ride schemes across the Chamber's region which then properly integrate with local bus and rail services,
- Introduction of a comprehensive electric charging network for vehicles.
- Improved surface access to Leeds Bradford Airport. Whilst the Chamber welcomes the recent proposals for a park and ride facility near to the east of airport, this doesn't improve access from the west and south west and in particular Bradford.

Air

- The Chamber is supportive of plans to redevelop parts of Leeds Bradford Airport and the surrounding area including a link road and park and ride facility. However the Chamber would want to see an increase in flights to London Heathrow, especially earlier in the morning and later in the evening. A direct connection to North America would also support increased trade with that part of the world.

Increased Capacity

- As mentioned previously much of the area's supporting infrastructure is nearing or at capacity particularly at peak hours. Without significant investment and cross-boundary panning and integration the situation will only worsen. The Chamber welcomes the more joined up approach that the two LEPs (Leeds City Region and York, North Yorkshire and East Riding) have brought but this needs to continue.
- Current broadband speeds in many parts of the Chamber's geography, particularly outside the main urban areas are insufficient to meet the needs of modern business activity and a firm commitment from government to improve this situation is required.
- Similar to the comments above about broadband, in even more parts of our area mobile connectivity is patchy or even non-existent! This situation is intolerable for many of those affected and is certainly a barrier to business activity in the affected areas. The Chamber wants to see a concrete commitment from government for this situation to be resolved and quickly.

Improving reliability of networks

- The poor reliability and resilience of much of the supporting networks, particularly road and rail is a serious concern to the Chamber. There is concern that there is too much emphasis on getting projects built and not on maintaining them once they are in place. All projects should have accurate costings built into them for in-going maintenance.

- The Chamber wants to see funding "ring-fenced" for repairs to pot-holes experienced by many on the area's road network. The recent cuts in local authority budgets have resulted in reductions in funding for pot-hole repairs whilst the funding requirement escalates.

Managing Demand

- With the country's population increasing and a continuing rise in city/town living and working there will be ever increasing demand upon supporting services, facilities and infrastructure. The Chamber does not want to see the introduction of charges for these services however, particularly on the road network some form of charging may have to be considered to reduce congestion and/or pollution. The Chamber would not want to see the introduction of charging without an effective alternative being in place and nor for charging to be perceived as a barrier to economic growth. If charging was to be introduced the Chamber would want to see the funds raised "ring-fenced" for investment in the local transport network.

National Infrastructure Assessment – Call for Evidence

Introduction to the BPF

The BPF is the voice of the real estate industry in the UK. We represent organisations with an interest in real estate in the UK – owners, developers, funders (equity and debt), agents and advisers.

Our vision is for a vibrant and successful real estate industry, working in partnership with national and local governments, to deliver:

1. **Economic growth**: real estate represents £1,667bn of UK assets and contributes £95.6bn GVA to the economy each year.

2. **Essential infrastructure**: the boundary between real estate and infrastructure is increasingly meaningless and both are essential. The sector is also intrinsic to the development of social infrastructure, such as hospitals, GP practices and schools.

3. **Great places:** our members make great places for people to live, work and relax. Doing this well can make a huge contribution to building sustainable communities and increasing social cohesion as well as increasing productivity through promoting well-being**.**

The BPF's contribution to building the UK's essential infrastructure – real estate and infrastructure have a symbiotic relationship, and it is crucial that the industry be seen as a part of the UK's essential infrastructure. The property industry is increasingly required to fund wider infrastructure investment against a background of continued public spending restraint. The industry also has a responsibility to ensure that it invests in resource -efficient, resilient buildings for the future.

The BPF promotes the timely delivery of necessary infrastructure with the financial and practical support of the sector where appropriate.

The National Infrastructure Assessment Call for Evidence – The BPF's Response

The BPF has examined the key questions provided by the National Infrastructure Commission and will be providing a cross-cutting and general response for the NIA call for evidence with a few references to specific questions. This response will cover how the NIA should address infrastructure prioritisation and how a strategic spatial plan for growth will address the country's infrastructure needs. The BPF would also add that clarity must be provided in the NIA for how the Commission plans to consider housing and infrastructure together.

The BPF believes that in light of the current infrastructure challenges facing the UK, the extent of infrastructure prioritisation should be reliant on the location of jobs and housing. Balancing the maintenance and repair of existing infrastructure assets against the construction of new infrastructure assets should be done on a case-by-case basis. While there is no doubt that a larger and aging population will require more infrastructure, improving the effectiveness of what is already available is crucial as well.

For BPF members, core infrastructure priorities are those that can facilitate the UK's need for new houses and provide the population with greater connectivity in relation to their work – roads, rail and statutory

services. In relation to Q1, the highest value infrastructure investments that would support long-term sustainable growth include improving the resilience and capacity of the power network and the ability of statutory undertakers to manage connections in a timely and effective manner. Other high value investments include the improvement of transport into East and Southeast London in order to bolster interest from residential developers and unlock the poorly connected parts of London. To that end, the BPF would urge the Commission to consider in its NIA that it is necessary to build infrastructure before housing, not the other way round. Despite the difficulty in convincing government to build infrastructure where there is no current demand, doing so would create the certainty required for residential developers to invest in building new homes. This would in turn lead to more infrastructure financing from the private sector. The BPF would also urge the Commission to work with central and local government on establishing clarity in the planning process so that unnecessary delays to the building of infrastructure can be avoided. It should therefore include in its NIA a proposal for simplifying the planning process (Q10).

While effective infrastructure prioritisation is crucial to its delivery over the next 30 years, the NIC should have a strategic spatial plan and vision for growth in the UK at a local and national level. The NIC should engage in conversations with Local Enterprise Partnerships (LEPs) on spatial strategies and should facilitate a co-creation approach to effect change. The Commission's NIA should therefore include a spatial plan and vision to address the UK's infrastructure needs. Without such long term plans, we cannot see where the infrastructure priorities lie. Strategic plans would further make infrastructure attractive to institutional investors and take pressure off HM Treasury. While infrastructure support for existing growth is already happening, the NIC needs to look at the other end of the spectrum and provide infrastructure support for places that have the potential for future growth but are not currently doing so. To that end, the Commission should include in its NIA the need for two types of infrastructure support: existing need and future need. In summary, the NIC should include in its NIA a spatial framework for growth in Britain – the NIC must have a visionary role that can demonstrate progression leading up to 2050. This vision and strategy should be the basis for all infrastructure decisions over the next 30 years and this vision can be reviewed during each subsequent NIA in order to remain on course. In doing so, the NIC will be able to quantify its progress and successfully address the country's infrastructure needs.

The NIC and housing – real estate and infrastructure are increasingly interdependent. Accessible housing supply is inextricably linked with delivering essential infrastructure and the two must be taken together to ensure a holistic approach is adopted to create great places, for urban generation and to create sustainable communities for attracting and retaining talent. While previous consultations by the NIC have addressed that the Commission will look closely at the relationship between the two, the Commission's remit ultimately does not include housing and cannot be changed without a subsequent remit letter from the Chancellor. In light of this, the BPF would urge the NIC to clarify in its NIA how it plans to look at infrastructure and housing together.

BRUFMA's response to the National Infrastructure Assessment Call for Evidence

Response submitted by: [name redacted], [job title redacted], BRUFMA

About British Rigid Urethane Foam Manufacturers Association (BRUFMA)

The British Rigid Urethane Foam Manufacturers Association (BRUFMA), formed in 1967, represents the Rigid Polyisocyanurate (PIR) and Polyurethane (PUR) Insulation Industry in the United Kingdom which accounts for around 50% of the total insulation market in the UK. BRUFMA's membership comprises all major companies in the sector including manufacturers of finished PIR and PUR insulation products, suppliers of raw materials and associated services.

PIR and PUR insulation is one of the most thermally efficient insulation materials available, which means that a relatively thin layer of PIR/PUR can provide very high energy efficiency in a building envelope. PIR insulation products are widely used in construction in a variety of applications not only because of their high thermal performance but also because they are resistant to moisture and are lightweight and easy to install. In-situ applied products have the ability to bond to most materials.

Answers to questions

Answers have been provided to questions 1, 4, 5, 19, 25 and 26.

General	
The UK Building stock is at the heart of our infrastructure and improvements in both new build and existing stock contribute on a number of levels, including: • employment and economic growth • comfort, well being and cost reduction for building occupants • carbon emission reductions • energy security • flood resilience	
Cross Cutting Issues	
1.	What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

Improved energy efficiency of UK buildings is one of the highest value infrastructure investments as this provides a more sustainable environment for the UK. BRUFMA promotes a 'fabric first' approach to improve the building stock, as this ensures that, with the use of high performance insulating products, the building envelope delivers high performance, low maintenance and long term energy efficiency, which in turn enables the use of low operating temperature, efficient heating systems. Materials such as rigid insulation are cost-effective to install and provide long-term benefits for the building occupants, including financially through lower fuel bills, greater comfort and improved health from warmer buildings, as well as lower CO2 emissions. In addition, the reduction of energy usage will lower energy supply demand and thereby have a positive impact on UK energy security.

4.	What is the maximum potential for demand management, recognising behavioural constraints and rebound effects? *Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.*

Installation of energy efficiency measures such as rigid insulation is one of the most effective ways to reduce demand for heat in the UK's buildings. Achieving well-built, thermally efficient, air tight buildings for the life of the building should be the overarching objective of government and the construction industry – in line with the UK's emissions reduction targets.

Installing insulation alongside other measures such as smart meters can help avoid rebound effects as consumers will be better able to understand and manage their energy usage. Improving the thermal performance of the building offers a simple, cost effective and efficient means of providing long-term energy savings and lower carbon emissions.

5.	How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

Building performance standards are significant drivers for the uptake of energy efficiency measures and the installation of thermal insulation, which as outlined, is one of the highest value infrastructure investments to support sustainable long-term growth in the UK. As such the UK needs a continuing strengthening of the building performance standards, to ensure building performance increases and emissions from buildings are reduced. Maintenance and repair of existing assets should include incentives and regulation to drive up the energy efficiency of all existing buildings. Construction of new buildings should have adequate targets for energy efficiency alongside monitoring and inspection to ensure these targets are met. Regular reviews of energy efficiency targets balanced against cost can ensure these are tightened at regular intervals.

Energy	
19.	What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?
When seeking solutions to decarbonise heat in both commercial and domestic sectors, first and foremost should be measures to reduce demand for heat. BRUFMA promotes a 'fabric first' approach to the whole building stock which ensures that the building envelope delivers high performance, low maintenance and long term energy efficiency through high quality insulation products. Energy efficiency measures in buildings, such as improved insulation, can efficiently lower heat demand and therefore reduce carbon. Installed today this can reduce demand from existing gas and oil boilers helping to lower carbon as we transition to renewable technologies. Improved insulation also prepares a building for the installation of low carbon and renewable technologies because many of these technologies operate more effectively in well insulated buildings. Thus, improved energy efficiency should be one of the first measures considered on the road towards decarbonising heat. BRUFMA members support the decarbonisation of heat. In order to deliver this the market needs clear signals to invest in delivery of demand reduction and to consistently innovate with new products. Therefore decisions on an approach would be welcomed at the earliest opportunity.	
Flood Risk Management	
25.	What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?
Rigid PUR and PUR insulation is not only one of the most thermally efficient insulation materials available but it also includes water resistant properties. As such it has been recognised as a solution when seeking to improve the flood resilience of buildings. In the 2016 Property Flood Resilience Action Plan[1] recommendations were made to "explore whether Building Regulations can be used to encourage flood resistant and resilient construction in a way that is tailored to meet the needs of properties in areas at risk of flooding". BRUFMA supports this approach. Flood resilient construction of buildings should be part of the over-arching approach for flood risk management. This approach can support with balancing costs and development pressures in areas where other types of flood resistance and resilience schemes are not viable.	
26.	What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk? *Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.*
As outlined in answer to question 25, flood resilient construction of buildings can be an effective solution to flood risk in some cases. The merits of this are that it can be delivered in individual properties to increase resilience in areas where a larger flood management scheme (such as a flood defence) is not viable. As a result, there is potential to improve the resilience of more homes	

[1] Defra (2016) The Property Flood Resilience Action Plan

to flooding and to speed recovery from flooding. Alongside this the occupant will also experience the benefits of improved thermal insulation in the property.

For more information on this call for evidence response please contact [name redacted], [job title redacted], BRUFMA: [email redacted]

National Infrastructure Assessment call for evidence

BT's response

February 2017

National Infrastructure Assessment call for evidence, BT's response

General comments

BT welcomes the opportunity to contribute to this call for evidence to inform the UK vision and priorities for national infrastructure. We recognise the importance of Infrastructure in delivering sustainable economic growth, improved competiveness and improved quality of life.

Given the focus of BT's business on digital infrastructure and connectivity, we have responded specifically to Questions 17 and 18 on digital communications, as well as cross-cutting questions where we believe our views are relevant. However, we also recognise the huge potential for digital infrastructure to impact all types of infrastructure across the UK, particularly its ability to deliver more efficient, and more interconnected sectors across the economy. To that end we would also highlight that delivering the full benefits of digital infrastructure integration across other UK infrastructures does not automatically result in benefits to the infrastructure provider. As a result it will be necessary to carefully assess how best to ensure investment in digital infrastructure occurs to best serve the total UK infrastructure when the benefits are not realisable by the digital investors.

Leveraging benefits of key infrastructure into other areas of the economy

Digital infrastructure, like many other infrastructures, incurs high capital costs due to the physical networks on which it is based and that these are built to last decades. Barriers to entry can be high, thus regulation to provide effective access and service competition is common not just in the UK but throughout Europe and, to various extents, across the globe.

Digital infrastructure and the services it enables to run 'over the top' make for huge savings and additional benefits across the economy and various industries. However, these savings and benefits are currently unlikely to flow to digital infrastructure providers. For example, recent work by Accenture for the world Economic Forum, presented at Davos early in 2017[1] highlighted that digital transformation could:

> *"…create more than **$10 trillion value over the next decade** for five key external industries alone (automotive, consumer industries, electricity, logistics and media)."*

However, it cautioned that:-

> *"…the Telecoms sector has not yet been able to capture significant value from this transformation."*

Therefore, although there is much evidence to support the case of huge benefits to society and industry due to digital transformation, for these benefits to be realised, further investment in the underlying infrastructure and systems that make digital transformation and trusted, capable, resilient and secure connectivity will be required. The benefits that could underwrite such investments are not currently flowing to the infrastructure investors, but rather the wider digital economy.

[1] https://www.accenture.com/t20170116T084450__w__/us-en/_acnmedia/Accenture/Conversion-Assets/WEF/PDF/Accenture-DTI-executive-summary.pdf

Need to ensure alignment of investments and returns

Clear industry and societal benefits need to be recognised by regulators and policy makers when making policy decisions on digital infrastructure investment. There needs to be sufficient return to investors to ensure the infrastructure needed to deliver these benefits is delivered.

BT considers that the holistic, long-term and cross-sectoral approach proposed by the NIC in this discussion paper is well placed to ensure that UK policy decisions take account of this and that sufficient benefits flow to digital infrastructure investors to ensure the right investments are made.

Cross-cutting issues

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?
Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

See BT Response to Q 17.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

The UK's digital infrastructure is already a huge driver of UK international competiveness. This is underpinned by the highest level of superfast broadband availability in the EU big economies, very high levels of mobile availability, coupled with high levels of take up, use and trust in digital services by the UK population and businesses.

This has helped enable the UK to leapfrog other countries up the digital leader board in the eyes of global experts:

- the World Economic Forum now ranks the UK 3rd globally on 'technology readiness'
- the ITU (**the United Nations agency for information and communication technologies)** ranks the UK 4th globally overall on connectivity
- the Huawei Global Connectivity Index ranks UK in the top five along with the US, Singapore, Sweden, and Switzerland.

And not surprisingly, today the UK has the world's most internet-intensive economy, with 10% of economic output driven by the internet, (with the UK having the highest percentage of its GDP driven by digital of any country in the G20) and the highest ecommerce per capita at £1,600, almost twice the US in 2nd place.

However, more can be done, for example by ensuring the completion of the superfast broadband delivery programmes to as close to 100% of UK premises as possible, continuing to push mobile broadband capability towards 100% of the UK landmass, and ensuring everyone in the UK has the skills, confidence and trust in digital services to use and exploit them in their everyday lives. Take up of fixed broadband in the UK has been effectively static at circa 80% of UK households for a number of years, and although Superfast service take-up is still increasing, this is still only 30% of the total number of broadband connections, meaning investment cases for more and faster coverage and capability are more difficult than they should be.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

It is clear from the experience of the UK and many other countries that commercial investment in fibre broadband infrastructure networks can deliver extensive coverage and very high speeds. Enabling this digital infrastructure across the entirety of the UK is also clearly beneficial to end users and the UK economy. Indeed the UK has a higher percentage of its GDP driven by the digital economy than any other G20 nation. The potential for digital Infrastructure to deliver better places to live and work across the UK is therefore clear.

It is also clear that the industry and its investors are continuing to innovate and invest in ensuring as many customers as possible can access the services and speeds they need at prices that they can afford. Such commercial approaches need to be encouraged to ensure the maximum deployment achievable by the market.

However, there will be areas of the UK where the limits of commercial investment and return are such that some form of Government intervention will be required to deliver the benefits of these services to all that want them. In these areas, given the undoubted overall societal and general economic benefits, it is appropriate for the Government to assist with the costs of deployment via focussed interventions that minimise competitive distortions and help deliver competitive benefits to all.

There is also real scope for improving deployment of digital infrastructure by ensuring it is integrated into other infrastructure projects. Digital is often an afterthought, when the difficulty and cost of deployment is likely to increase significantly. Local and national governments can play a key role in building in digital connectivity requirements at the earliest possible stage of other infrastructure investments (eg, high speed rail links).

The complexity and variety of civil infrastructure build in and across the UK (eg, population density, premises type, access to assets, etc) is such that innovation in solution delivery will also be key in delivering ultrafast capability to as many people as possible in as short a time as possible.

Investment in this infrastructure will be assisted by high levels of take-up and use of the services once they are available, along with continued revenues on the services over time to ensure pay back on the long-term commitments necessary for such infrastructure investment, and such take-up can be assisted by the actions of the Government.

People's evolving expectations are that ubiquitous coverage and connectivity of digital networks are taken for granted; they are largely not concerned what the technology is behind their services. So fixed, mobile (3G/4G) as well as future 5G and Wi-Fi networks will seamlessly work together and act as resilient supports for each other.

The Government delivery model for digital networks must therefore seek to ensure:

- regulatory and policy stability to give investors confidence that UK telecommunications is the right place to invest
- a regulatory framework that shifts the balance towards encouraging investment
- a regulatory model that encourages transition to the new services and technologies of a fibre future, for example, supporting the withdrawal of older technology or services

- a regulatory environment that provides certainty for infrastructure investors and encourages long term investment in ultrafast infrastructure with clear long term regulatory goals that provide clarity beyond the normal market review periods
- acceptance that the journey to FTTP will be long and the UK cannot just wait for its arrival. Other technologies such as VDSL, G.fast and cable broadband, as well as mobile networks and evolving 5G networks have important roles to play over the coming decade and investment in them should be supported and encouraged
- focused Government funding (state aid) targeted at those areas that will benefit from full fibre but where the economic case for wholesale infrastructure investment is not currently viable.

Specifically on the interaction of digital infrastructure and housing we would highlight that since summer 2015, Openreach has worked with the Government, the House Builders Federation (HBF) and property developers to build a strategy to support the delivery of a fibre infrastructure to the vast majority of new build homes in the UK. This strategy is designed to ensure that new-build properties will always benefit from high speed fibre broadband from day one.

By working with the Government and developers, we have created a proposal where Openreach would fund the building of the fibre infrastructure if commercially viable. Where it is not, Openreach will seek a contribution from the developer that bridges the gap to deliver the infrastructure needed. This approach is completely voluntary and developers can continue to have a copper infrastructure should they choose. The current offer means that all developers of sites of 30 units or more can have FTTP installed by BT at no cost, subject to them providing sufficient advance notice of the development to Openreach. FTTP connectivity is also available for sub-30 plots development subject to a developer contribution.

This advance notice allows Openreach to plan and build the necessary duct and civil infrastructure as part of the development works on the site, thus significantly reducing the cost of retrospective civils deployment.

This scheme will have the capability to ensure that nine out of ten new home developments come with full fibre at day one. However, it is important that developers ensure Openreach is engaged early in the process to enable suitable low-cost planning and deployment, and that ISPs will buy full-fibre wholesale products made available over this infrastructure. It is therefore important that developers engage with Openreach early in the development process to ensure the fibre infrastructure can be deployed cost effectively.

This approach intended to ensure that new-build sites have access to FTTP services at day one. However, we are dependent on the support and cooperation of developers for this to happen in practice. Currently, a large proportion of all new-build registrations with Openreach occur late in the planning process and as a result there are a significant number of customer orders which cannot be progressed due to incomplete on-site work by developers. This delays the connection of new home owners and increases the cost and complexity of the fibre build even at new development sites where FTTP is the logical commercial solution.

We propose that it should be mandatory for developers to register their communications infrastructure requirements at the same time as for all other utilities. In particular we would recommend that the Department for Communities and Local government (DCLG) should ensure that on-site and in-building work conforms to the guidelines for fibre cabling and connectivity which was set out in PAS 2016 guidelines.

Mobile specific

Though we expect mobile and fixed infrastructure to interwork seamlessly as far as users are concerned, there are a number of fundamental future mobile infrastructure needs, mainly driven by huge increases in mobile data usage and expectations of ubiquitous coverage, but also the evolution to an integrated fixed/mobile "5G" network. This will mean a small increase in base stations in rural and suburban areas to extend networks and considerable cell 'densification' in urban areas and in-building for further capacity. Future spectrum bands for capacity enhancements are almost all higher frequency than current mobile spectrum bands, needing very dense 5G infrastructure, requiring small cells indoors and out. As a rough estimate, this could require an additional 10,000 to 50,000 small cells per operator between 2020 and 2030.

Improving the economics of network investment, particularly to support extensive small cell deployment, should be a major focus for legislator and regulator activity, and an area where the NIC could have significant influence. Planning regimes and legislation underpinning access to land must also reflect the growing importance of digital connectivity. Recent changes to the English planning regime for mobile infrastructure are welcome and we hope that devolved administrations follow this. It is vital that planning law ensures that small cell deployment is not hampered; public authorities should be obliged to set out how they will promote the deployment of dense digital infrastructure from competing providers on a technology neutral basis, eg, on street furniture. It is very unhelpful when infrastructure is auctioned off to one supplier, for one technology, such as WiFi, for short-term financial gain.

For high performance 5G services to be provided in-building or inside vehicles, for example, there is likely to be a need for indoor solutions, and a requirement for densification of existing 4G or WiFi deployments. This will require collaboration between construction companies, manufacturers, building owners, and in some cases tenants to ensure the infrastructure is built.

Spectrum availability and management

Access to large bandwidths will be needed in the future Over time, 5G will probably be deployed in a mix of frequencies new to mobile use and frequencies re-farmed from the retirement of 2G and 3G. However, in order to enable the early launch of 5G, operators will need early access to new, European or internationally harmonised spectrum. It will be important to proceed with implementation of Ofcom's mobile data strategy to release new bands to the market by auction and to continue to ensure there are no impediments in licences to prevent existing licensees deploying 5G within the spectrum already assigned to them. Ofcom should issue a clear timetable for further spectrum awards as soon as possible. The UK generally awards indefinite spectrum licences, which is helpful in incentivising long-term investments. It is important that where annual fees are applied, these are only used to the extent necessary to incentivise efficient use of spectrum and are not set at excessive levels. By contrast, we consider the Ofcom decision following the 2010 Government Direction regarding revised Annual Licence Fees for 1800 MHz and 900 MHz to have been entirely unhelpful, with the resulting trebling of existing fees harmful to the promotion of investment and the best interests of consumers.

It will be important to encourage global harmonisation of new spectrum bands to support 5G services. Government policy should continue to support this and Ofcom should continue to pursue this on a European and a global basis. Licence-exempt spectrum will have a complementary role to licensed spectrum in 5G service delivery, for uses without stretching KPIs and SLAs, supporting 'network slicing' to optimise the experience for a range of different user groups. Ensuring a technology-neutral approach (while ensuring equitable access to such shared spectrum) is appropriate.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?
Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

Given the prevalence of 'unlimited download' packages in the UK broadband market, the signals of or ability to utilise demand management on digital infrastructure is currently low. Indeed, the effect of this can be seen in particular with file downloads for software device and games updates. Such updates are generally not time critical, and could be spread over relatively long time periods or even via automated/overnight updates, but with unlimited download there is little if any incentive for the providers of such file download services to manage their load. With games file updates typically being multigigabyte sized files at start-up/purchase, such files have the ability to generate very high peak speed demand over a very short period, or alternatively negligible speed impact over a more managed period.

Currently the key drivers of bandwidth for most digital infrastructure users in the UK are video and file download. With even 4K video streaming requiring only 15-20Mbs and improved coding algorithms set to reduce this down to sub 10Mbs over time, the potential for peak bandwidth needs to be driven by file download is significant. However, appropriate management of these downloads could significantly impact this demand profile going forward, resulting in potentially very significant savings and benefits for all users.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

For digital infrastructure the issue of re-use or new construction is specifically addressed via the EU State aid guidelines for NGA networks. These state a clear preference for re-using existing assets wherever possible, in order to minimise costs/maximise benefits. Typically this will be at the 'passive layer'. However, existing duct/civil infrastructure should be re-used or repaired wherever possible in order to deliver new fibre or equivalent infrastructure. Similarly with commercial investment in digital infrastructure, the strictures of a commercial investment will drive to reuse existing infrastructure where is sensible to do so.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Again, in the area of digital infrastructure the EU State-aid guidelines should provide significant steer. There are risks to commercial investments, both existing and future, and to the competitive market if Government intervention in the supply of infrastructure is not done carefully. Although assistance, both financial and otherwise, in the provision of infrastructure is likely to be welcome in creating new or improved infrastructure, caution is required in how and where this assistance is provided if the existing competitive market is not to be adversely impacted.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?
Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

BT has experience and understanding of a range of different approaches to stimulating the market and seeking to improve the investment case and thus the efficiency with which infrastructure services can be delivered for fibre solutions across the UK and internationally. We would highlight a number of key points and themes from this experience we consider to be very important considerations to take into account when assessing a way forward.

The investment case for digital infrastructure is dependent on a number of key factors that vary significantly from market to market, therefore it is realistic to expect different market outcomes and different 'mixes' of solutions, coverage rates and take-up rates across markets.

The key variables on the cost side of the investment case are:

- availability or otherwise of high-quality civil infrastructure (ducts/poles). 'High quality' means effectively unblocked, available, predictable and easily visible, low-cost infrastructure capable of being used to deploy low-cost fibre cables from a logical concentration point all the way to a customer premises
- costs of civil infrastructure deployment beyond the cabinet
- concentration of target premises into MDUs, effectively the ability to target large numbers of customers at a single location without further civil infrastructure
- relative density of single dwelling units, particularly impact of 'recent build' developments with new and high-quality civil infrastructure with high availability of duct infrastructure all the way to the end user
- concentration of premises of all forms, urban/suburban/rural but also disperse nature of premises within categories especially within rural.

On the revenue side of the case key variables are:

- regulatory pricing flexibility
- number of competing networks (eg, cable TV, wholesale access to superfast fibre, etc) thus expected and achievable market share
- impact of competing services and existing broadband; relatively good existing broadband will impact the willingness of customers to upgrade to full-fibre options and thus impact take-up
- willingness of the market to pay a premium for higher speed services over and above capability of existing superfast and ultrafast options. For example, in Australia the majority of customers on the NBNco FTTP network buy 50Mbps or lower packages
- availability of alternative revenue sources including 'anchor tenant' revenue, eg, from Government services or co-investors committing revenue up front
- availability of direct grant costs/ tax reliefs/investment incentives, etc, in lieu of revenue, effectively state aid in EU terms but approaches vary from country to country.

A more detailed analysis of these various factors and in particular their relevance to ultrafast and full fibre digital infrastructure networks has been recently conducted by Communications Chambers for BT, Virgin Media and also by Ovum for NBNco in Australia.[2]

To date, these various economic factors have led to a concentration of fibre deployment in the UK based on FTTC and cable TV/DOCSIS solutions. In the case of BT and Openreach this approach has resulted in fibre being deployed to over 80,000 separate cabinet locations across the UK serving some 26 million customer premises via FTTC plus direct FTTP services to some 350,000 premises. This focus on FTTC has enabled the investment case to minimise its exposure to the highest cost and risk aspects of the cost variables above (lack of duct to premises, lack of clear demand/willingness to pay from majority of customers, long timescales for civils work, etc) whilst maximising the potential revenue opportunity.

Similarly, Virgin Media has sought to reuse its existing cable TV infrastructure, upgrading it using DOCSIS3.0 electronics over the existing copper access network and supported via fibre into the cable TV street cabinets. This has delivered an alternative superfast and now ultrafast broadband network across some 45% of the UK. More recently Virgin has been investing to expand this footprint towards 60% of the UK, again using a mixture of cable TV/DOCSIS infrastructure and FTTP according to local financial drivers.

In order for a more FTTP-focused investment case to be made it will be necessary to significantly change a number of the key business case factors above. BT is pursuing ways to deliver on this, including various trials and live deployments, of potentially lower cost/higher revenue options. In addition we have been working extensively with partners and suppliers on improvements to technology and deployment techniques to further enhance the fibre deployment case.

However, if the commercial case is not made for a particular type of infrastructure to be deployed then some form of Government assistance/State aid would be required, as indicated in our list of revenue side impacts above.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets? Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

In the particular case of digital Infrastructure where BT has expertise, these issues of lack of finance/investment case are addressed effectively via the State-aid guideline son NGA investment form the EU commission. These generally address two types of 'funding failure' as follows:

- in the event of 'market failure' where there is no effective commercial case for investment in parts of the market to deliver services enjoyed elsewhere in the market the EU rules set out

[2] http://static1.1.sqspcdn.com/static/f/1321365/27318459/1478201664463/BT_RK_Report_2016.pdf?token=WHVWBnZn3%2Fq83%2FIfXTsD9o%2Bd65w%3D
http://static1.1.sqspcdn.com/static/f/1321365/27367645/1481127793677/Liberty-Global-Policy-Series-Connectivity-for-the-Gigabit-Society.pdf?token=OtaSNzs7fiGPzW009iyKkHr1MQw%3D
http://www.nbnco.com.au/content/dam/nbnco2/documents/Gigabit%20Networks%20-%20G%20Fast%20%20XG%20FAST.pdf

various forms of assistance that can be applied by Government, along with various safeguards and limitations in order to protect the commercial investments and competition across the market.

- in the event of lack of funding at an appropriate rate for an otherwise commercial investment, again aid rules allow for the availability of lower cost funding schemes, eg, for smaller providers who cannot access normal market financing rates to be made available by Government, again subject to aid rules and minimising impact on the commercial market.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?
Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

The increasing reliance on the digital networks for 'critical' services will mean that resilience will be an increasingly essential feature for end users. Although increased resilience can be delivered by having fixed and mobile networks covering the country with effectively seamless handover between the two, this will likely require additional investment to deliver the increasingly high levels of quality, security and resilience. The availability, capacity, reliability, low latency, jitter and noise levels requirements for 'critical' compared to 'best efforts' service will have a cost and will need to be reflected in the prices for the services. These costs will need to be reflected in the regulatory and policy approach to these increasingly critical networks. Thus a wider group of Quality of Service metrics will need to replace the current emphasis on speed of digital networks and be regularly updated. Networks will be more scalable and able to respond more rapidly to demand through virtual network management.

The increasing linkage and interdependence of ICT networks and utility networks, particularly the electricity network, mean that resilient supplies of power to the ICT network will become more important.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

There a number of key cost items that impact the full fibre investment case that are focussed on access to and costs of effective civil infrastructure suitable for deployment of fibre all the way to the customer premise. The Government has already taken some specific actions to remove or lower some of the barriers to utilising and improving the civil infrastructure for fibre deployment such as enabling new pole infrastructures, assisting with access to joint use electricity poles etc. but more can be done.

We suggest the Government could focus its activities in this area on the core issues below:-

Traffic management

There are no legislative timescales for any traffic management activity, apart from road closures, associated with major works. As a result lead times vary across different Highways areas, for example, portable traffic signals vary from 1-30 days and footpath closures 3-84 days. This variability and uncertainty increases the time required for planning and deployment leading to difficulty in setting and delivering on customer expectations.

We propose the introduction of statutory timescales for review and approval of temporary traffic management via a review of the 'Road Traffic (Temporary) Restrictions Procedure Regulation'. Alternatively, a statutory guidance document could be issued by the Government.

Classification of "works" on the highways

By classifying the deployment of fibre infrastructure in highways as major works means increased costs, extended time to deliver and additional complexity. Major works have a three-month notice period instead of 10 days and average additional cost of £215 per permit.

We propose a statutory revision of the works categories such that works that do not impact on traffic flows are removed from the major works category.

Permit and lane rental

There is evidence that permit and lane-rental schemes may be being used to raise revenue by local authorities. This additional cost is borne by fibre deployment projects, at odds with Government deployment targets or commercial investment plans of network investors. Furthermore, there is significant variability in how the permit schemes are applied across the UK and this increases complexity for planning and street works teams.

This complexity and the charges for the relevant permits can add considerable cost to any fibre deployment project that must be reflected in the investment case. In addition it will increase time to deploy and increase the difficulty in setting and complying with customer expectations.

We would propose that the Government seeks to standardise across the various UK schemes along the following lines; zero charges for cat 3 and 4 (non-traffic sensitive) roads; zero charges for work during non-traffic sensitive times; automatic acceptance if refusal is not in accordance with permit scheme.

Permit and Lane Rental – new legislation

The proposals contained in the Private Members Bill to legislate for work sites on 'local A roads' left unattended at weekends or if temporary traffic lights are not promptly removed, were well intentioned in seeking to minimise traffic delays, but will impact on fibre deployment. It would have significant cost implications, with daily charges proposed on a sliding scale between £250 and £10k a day, that would lead to significant risk and cost escalation for fibre deployment.

We would propose that this Bill is not reflected in new legislation at all.

Pre-noticing of poles

The DCMS code of practice requires BT to affix a notice at the site of a proposed pole installation. This requirement to pre-notify is resource hungry and time consuming, again impacting delivery cost and timescales.

We would therefore propose a revision to the CoP such that pre-noticing is limited to sensitive areas such as a conservation area and areas of outstanding natural beauty. In all other areas we would propose that we continue with our current practice of affixing notices to all poles following installation, giving details of rights of appeal.

Wayleaves

Wayleave negotiations are time consuming and the resultant terms can be onerous and seriously impact both time and cost of infrastructure delivery.

We propose an agreed standard wayleave template, recognised across industry. This should be supported by clear direction from the Government on the importance of communications infrastructure and encouragement of landowners to engage constructively.

New build

We set out in our answer to question 1 details of our current offer to developers at new build sites. This is intended to ensure that new-build sites have access to FTTP services at day one. However, we are dependent on the support and cooperation of developers for this to happen in practice. Currently, a large proportion of all new-build registrations with Openreach occur late in the planning process and as a result there are a significant number of customer orders which cannot be progressed due to incomplete on-site work by developers. This delays the connection of new home owners and increases the cost and complexity of the fibre build even at new development sites where FTTP is the logical commercial solution.

We propose that it should be mandatory for developers to register their communications infrastructure requirements at the same time as for all other utilities. In particular we would recommend that the Department for Communities and Local government (DCLG) should ensure that on-site and in-building work conforms to the guidelines for fibre cabling and connectivity which was set out in PAS 2016 guidelines.

Specific questions on digital communications

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

There is a belief from some commentators that for digital infrastructure in the UK (or elsewhere) only fibre all the way to every premise will deliver 'value' as it is seen as the ultimate future proof infrastructure investment. Indeed we note the Government's belief that 'full-fibre' networks are the future. BT is committed to investing further in the UK network to ensure we continue to expand the footprint and capability of our broadband network to as much of the UK as we can. However, we would highlight that a range of technologies are capable of delivering equivalent capabilities and benefits, many of which are lower cost to deliver and much faster to deploy at scale, meaning that many of the benefits and value an FTTP network can deliver could be made available earlier, to a wider group of UK consumers, and at lower cost if there is continued flexibility in the technology choice. It is therefore important that these alternative routes to delivering the capabilities of fibre are not ruled out or made more difficult, as to do so would put at risk rapid delivery of value and benefits.

BT has the experience and understanding of UK civil infrastructure and topography, gained from building the largest FTTP and FTTC networks in the country. BT already operates the UK's largest FTTP network with coverage of over 350,000 premises and we have plans to take this to up to 2 million premises by 2020. We have also delivered over 220,000 Ethernet links to businesses across the UK, capable of running at multiple Gigabit speeds, and of course we have delivered fibre to over 80,000 FTTC cabinets, delivering fibre-based services to some 26 million UK premises.

The UK market needs to be capable of delivering any benefits that may come from the ultrafast services provided by fibre across as much of the UK as is feasible and to make these services available in advance of the market needing them. As a result of our experience building fibre networks we know that a journey to national coverage of FTTP would be a long one, perhaps 15-20 years to build, with significant investment recovery periods. That is why we are also deploying ultrafast services through means other than FTTP that can make these speeds available across a much wider area in very short timescales and at a significantly lower level of initial investment. We believe the UK's infrastructure strategy should reflect this need to deliver ultrafast services across as

much of the UK as possible, in relatively short timescales, in order to deliver the benefits of ultrafast to the economy quickly. This is something that FTTP on its own will struggle to do. The industry will need an environment that supports commercial investment by reducing uncertainty, by encouraging transition to and use of new technology and services and removing barriers to their deployment, operation and use.

The most effective and efficient approach to build telecommunications access networks is through large-scale deployments that share assets and costs and can aggregate demand. The UK's strategy should start by encouraging this large-scale deployment approach to provide coverage to most premises and then consider local approaches to fill any gaps, as has been successfully done with the superfast fibre deployment to date. However, delivering FTTP in very remote areas is likely to come at considerable cost and thus may need to be subject to limitations. The alternative is an inefficient build that results in a patchwork network with local variability on providers and services.

A few other countries (eg, New Zealand, Australia, Japan and South Korea) have delivered relatively widespread FTTP, although none has delivered solely FTTP but various levels of a 'mixed economy' through combinations of heavy public funding and/or with the benefit of local topography such as a high density of multi-dwelling units that serve to lower local fibre-deployment costs. However, many of these, after an initial focus on FTTP have sought to change their plans to a more flexible technology approach to reduce cost and increase speed of deployment. This change of focus reflects not just the very high cost to deploy FTTP in some areas but also the recent major advances in capability of alternative technologies. For example, New Zealand is using FTTC and radio in rural areas, NBNco in Australia is looking to G.Fast to complete urban and suburban deployments, as are Swisscom and others given its lower cost and rapid deployment potential.

Although the exact levels of Government investment or FTTP cost in many of these countries are difficult to determine, there have been industry level independent studies into the cost of such an FTTP network in the UK. For example, in 2008 at the start of the UK fibre investment programmes the Broadband Stakeholder Group commissioned industry analysts Analysys Mason to cost both FTTC and FTTP deployment across the UK. This concluded that an FTTP deployment would cost some £29Bn pounds[3]. This Analysys Mason work was subsequently refreshed in 2010 and again in 2016 further confirming both the scale of the investment required for FTTP and the timescale to deliver this across the UK.

We believe that Government funding is best spent supporting those areas that are beyond commercial reach. This brings immediate benefit to those impacted and minimises the risk that Government intervention skews market development. Continuing the BDUK programme to take superfast fibre broadband as close to 100% as possible would be a worthwhile use of public funds. As this programme reaches the most rural and dispersed areas of the UK, the 'final 5%', it is increasingly the case that FTTP is the most cost-effective means of delivering a service that meets the contract requirements due to the nature of these locations. However, it is unlikely to ever be commercially viable at current or anticipated market rates in these areas.

The commercial market in the UK is already deploying FTTP and other ultrafast solutions, and will continue to do so in accordance with market economics. To support and enhance this commercial deployment of ultrafast solutions across the UK the Government needs to recognise the significant variation in the cost and speed of deployment and the suitability of different technologies to different situations. For example urban vs rural, or multi-dwelling units vs individual or isolated houses. Any Government support therefore needs to enable the rapid delivery of ultrafast services across as much of the UK as possible.

[3] http://www.broadbanduk.org/wp-content/uploads/2012/08/http___www-broadbanduk6.pdf

To the specific point of "When would decision need to be made?" we would highlight that BT has already committed to investing in this infrastructure and is continuing to deploy ultrafast fibre networks across the UK. By enabling a flexible technology approach as we are currently pursuing also enables flexibility in the timing of infrastructure investment decisions. None of the deployments we are pursuing rules out a future move to FTTP should it be required or considered necessary for the UK by the Government, but by delivering ultrafast capability and benefits in a flexible manner it is possible to ensure the investment timing can remain flexible and able to respond to market needs as they emerge and develop.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this? ***Note: the existing "regime" refers to the current market, competition and planning frameworks. "Digital communications" includes both fixed and mobile connectivity.***

It is clear from the experience of the UK and many other countries that commercial investment in fibre broadband networks can deliver extensive coverage and very high speeds. It is also clear that the industry and its investors are continuing to innovate and invest in ensuring as many customers as possible can access the services and speeds they need at prices that they can afford. Such commercial approaches need to be encouraged to ensure the maximum deployment achievable by the market.

However, there will be areas of the UK where the limits of commercial investment and return are such that some form of Government intervention will be required to deliver the benefits of these services to all that want them. In these areas, given the undoubted overall societal and general economic benefits, it is appropriate for the Government to assist with the costs of deployment via focussed interventions that minimise competitive distortions and help deliver competitive benefits to all.

The complexity and variety of civil infrastructure build in and across the UK (eg, population density, premises type, access to assets, etc) is such that innovation in solution delivery will also be key in delivering ultrafast capability to as many people as possible in as short a time as possible.

The investments in this infrastructure will be assisted by high levels of take-up and use of the services once available, along with continued revenues on the services over time to ensure pay back on the long-term commitments necessary for such infrastructure investment, and such take-up can be assisted by the actions of the Government.

The digital communications regime in the UK must therefore seek to ensure:

- regulatory and policy stability to give investors confidence that UK telecommunications is the right place to invest
- a regulatory framework that shifts the balance towards encouraging investment
- a regulatory model that encourages transition to the new services and technologies of a fibre future, for example, supporting the withdrawal of older technology or services
- a regulatory environment that provides certainty for infrastructure investors and encourages long term investment in ultrafast infrastructure with clear long-term regulatory goals that provide clarity beyond the normal market review periods
- acceptance that the journey to FTTP will be long and the UK cannot just wait for its arrival. Other technologies such as VDSL, G.fast and cable broadband have important roles to play over the coming decade and investment in them should be supported and encouraged

- focused Government funding (State aid) targeted at those areas that will benefit from fibre but where the economic case for wholesale infrastructure investment is not currently viable.

We would be happy to discuss these issues further. Further enquiries can be directed to

[name redacted], [job title redacted], BT Group plc

[phone number redacted]/[email address redacted]

Buckinghamshire County Council response to National Infrastructure Assessment Consultation

Buckinghamshire County Council welcomes the opportunity to respond to the consultation and has used its extensive experience of national, regional and local infrastructure planning, financing and delivery to inform its response. The range of national infrastructure projects which will directly impact the County – committed and potential – which either have been recently constructed or are planned is significant.

These include HS2, M4 Smart Motorway, Western Rail Access to Heathrow, Crossrail, Heathrow expansion third runway, East West Rail (Western and Central sections), Oxford-Cambridge Expressway, potential reservoir location near Chinnor, and a completed Energy to Waste plant at Greatmoor, near Calvert.

Our role in each of these schemes has been varied. We have been a key promoter of East-West Rail and are one of the leading local authorities within the consortium. We have also led and successfully opened a £180 million Energy to Waste plant. Our teams are leading the construction of multi-million pound road building programmes to enable housing and economic growth in the County. We have first-hand knowledge of the costs and requirements of building a business case for infrastructure and the barriers that must be overcome to secure infrastructure investment.

Where we have not been the promoter we again have first-hand experience of managing the impacts of infrastructure schemes on our communities and failings of existing stakeholder management arrangements. As an observer/recipient we see the damage that the existing fragmented approach to infrastructure planning is having, not only on public finances, but also on public perception of all levels of government and government agencies and on our environment and communities.

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

In terms of infrastructure needs our priorities would be:

Digital Connectivity – to support the concept of the Cambridge – Milton Keynes – Oxford " brain belt". If this concept is to succeed then the digital connectivity needs to be globally competitive. Currently the UK average broadband speed is 13 MB/sec, which compares unfavourably with the global leader – South Korea – of 26.7Mb/sec. This however pales beside Google Fiber which provides Silicon Valley residents with connection speeds up to 1,000 MB/sec as part of an experiment to

see what innovation will develop with ultra-ultra fast broadband. Upload speeds are of vital importance to some businesses – so this should be built into any plans for digital connectivity.

Oxford – Cambridge Expressway and East West Rail

The cases for these infrastructure projects have already been covered by the NIC Study into the Cambridge – Milton Keynes – Oxford corridor and supported in the Interim Report. The Expressway project needs to include improvements to the existing road network to ensure that there are good links to existing towns as well as the implementation of access strategies for existing congested built up areas. For Buckinghamshire the inter-relationship between Oxford – Cambridge Expressway, growth at Aylesbury and to the south west of Milton Keynes and how the expressway will enable that growth are key.

East West Rail needs to include the western and central sections, as well as twin tracking on the Princes Risborough branch line to High Wycombe and the case for this has already been considered by NIC.

Aylesbury – Ring Road

Aylesbury is one of the fastest growing towns in the UK and is planning for a further 15,000 homes by 2033. Recently it was designated a Garden Town. A key element of the transport strategy to enable the growth of the town is the building of a complete ring road. Currently this is being undertaken on a piecemeal basis as developments and funding opportunities via Bucks Thames Valley LEP come forward. However, this is providing uncertainty on the deliverability of the complete ring of link roads which is delaying development as the sections are interdependent. Having certainty that the Ring Road would be funded and delivered in its entirety (together with other complementary aspects of the Aylesbury Transport Strategy) would create an environment of certainty for developers, allowing for an acceleration of housing and employment delivery. Link to Aylesbury Transport Strategy is here

Infrastructure to support access to Heathrow and Luton International Gateways. The package of measures needed to improve access to these locations, is yet to be developed. The case for supporting increase in airport capacity in the SE has comprehensively been set out and consultation is underway on the National Policy Statement associated with the possible third runway at Heathrow. Increases in airport capacity in the south east will require investment in the supporting transport network to cater for growth in passenger, freight and private business travel. For Buckinghamshire, surface access arrangements to Heathrow and access to Luton from the west of the A5 would be a priority. In particular, improvements to the **A418**, by providing a by-pass at Wing and upgrading the quality of the road so that the corridor can effectively join into the A505 and the new A5-M1 link to provide better access to Luton should be a key element of improving access to Luton, as well as possible providing Dunstable/Luton a widened labour market.

High Wycombe Single Track Access to Old Oak Common (supported by Chiltern Railways and in the draft West Midlands and Chiltern Route Utilisation Study) to be followed by **re-instatement of High Wycombe to Bourne End railway** to allow a link between East West rail and the Marlow/Maidenhead branch line. These rail improvements are likely to feature in any surface access strategy **to Heathrow**, to allow rail access from multiple locations and ensure workforce and passenger accessibility is not limited to road transport from locations to the north, west and south of Heathrow. Whilst the case for this route has yet to made – it is a candidate for consideration in the package of measures that would be needed to achieve Heathrow's targets in terms of maintaining existing levels of access by car and reducing air quality impacts associated with increased vehicular journeys to Heathrow. These schemes would also assist with the expansion of the Slough and Heathrow Travel to Work area which will be needed to ensure that the additional workforce requirements of an expanded Heathrow can be met.

Capacity improvements to A404 Corridor – including junctions 8/9 on M4, Bisham roundabout, Westhorpe junction and Handy Cross (junction 4 of M40). Improvements to this corridor are seen as a priority by Highways England for this region. It is complementary to the M25 SW Quadrant Study (in that it facilitates orbital movement between the M4 and M40 without the need to use the M25). It is also seen as key to providing capacity prior to improvements to the A34 and implementation of Oxford – Cambridge Expressway. The corridor provides a key link in the Thames Valley, one of the most productive areas in the UK, which is currently heavily congested in the peak hours. Highways England have produced options for improving access to Wycombe, including improvements to junction 4 (Handy Cross) or a potential new junction 3a. These options are currently being assessed.

M40 resilience – there is regular congestion from Stokenchurch southbound to Handy Cross in the am peak – which can be expected to worsen with no investment in the next 30 years – despite the growth and potential in the Oxford – Cambridge arc. The M40 will remain a key piece of infrastructure in the "arc" – and new or expanded junctions either for Bicester or Oxford-Cambridge Expressway will draw in additional traffic. Therefore the capacity of the M40 will need to be looked at in detail as the implications of the construction and completion of the Expressway become more defined.

Upgrades to Major Road Network in Bucks. As well as investment in the Strategic Road Network, there is a Major Road Network which is also critical for freight movement and longer commuting journeys. This has been defined in work supported by the Rees Jeffreys Foundation – on the need to consider this as a single network requiring investment. The study can be found here - Major Roads for the Future.

Energy

There is some uncertainty about the adequacy of the planned investment in energy capacity to accommodate the planned growth in Buckinghamshire. Energy investment decisions do not seem to be taking account of potential growth in electric

vehicles. This reflects a further lack of integration – between low carbon/air quality actions with energy infrastructure.

Wastewater

There is clearly insufficient capacity of some of the existing sewerage works in Buckinghamshire and Oxfordshire. Thames Water was fined last year for allowing sewerage from its Princes Risborough STW to pollute a local river. The firm is currently being prosecuted for allowing sewerage to pollute several rivers, including the River Thames due to capacity problems at Aylesbury, Little Marlow and Didcot. Capacity problems at the Aylesbury STW was one of the reasons identified for the problems occurring. The recent Court Case is covered here Thames Water faces 'biggest ever fine' after dumping litres of sewage in Thames (From Bucks Free Press)

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passenger, freight and data in ensuring this?

To support the economic growth of the country we need to ensure that the infrastructure in the UK is able to accommodate the growth in traffic, digital or transport. This is particularly true of our international gateways which not only need to provide efficient entry and exit from the country but also set an impression for those visiting the UK. However, we need to also remember that some of the smaller airports across the country also act as a gateway for some of the most influential decision makers in the world who will arrive by private jet at places such as Biggin Hill. These locations must not be forgotten in the consideration of our gateways.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

In terms of the electricity distribution and transmission development there is scope for DNO's to work more effectively and directly with local authorities. This is from a regional planning and economic development perspective. DNO's already hold "surgeries" which are effective however there is room for more collaborative working between local authorities and DNO's in terms of understanding and overcoming issues arising from the Second Cover Rule. Current practise is that secondary developers wait for the five year timeline to lapse so that they do not have to pay the primary developer any proportioned costs in upgrading the local distribution network. This waiting game can delay development within areas and have a negative impact on large scale schemes where cooperation is required such as district heat networks on new build developments.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?
Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

We consider that the potential for demand management, when combined with infrastructure investment is considerable and has not been fully exploited. There are several aspects to this.

Firstly, there continues to be inadequate revenue funding or long term application of behaviour change programmes to achieve ongoing results. London may be the only example where there has been ongoing significant investment in transport behaviour change alongside capital investment to achieve modal shift patterns. Another example would be the use of demand management techniques during the Olympics to ensure infrastructure functioned during peak demand.

Secondly, the assessment of the potential of behaviour change to reduce the need for infrastructure is reliant on evidence from a small range of interventions.

Thirdly, the amount of funding available for behaviour change is miniscule compared to the amount of capital investment available. The Highways England RIS1 funding is £15 billion. There is no mention of specific amounts of funding for behaviour change to complement that investment.

Fourthly, professionals working on behaviour change and infrastructure are not integrated. For behaviour change to be effective it needs to be considered from the start of the infrastructure planning process (i.e. how much infrastructure is needed if we can achieve behaviour change) and then built into the feasibility, planning and delivery. We rely on engineers for infrastructure planning and delivery – but their training and skills do not currently embrace behaviour change. We need to be thinking about the skill sets needed that would ensure behaviour change is integrated into infrastructure planning at all stages.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

The maintenance of the existing asset needs to be properly funded. Whilst a significant proportion of traffic travels on the Strategic Road Network very few journeys do not make use of the local highways. The development of the Major Roads Network will only be of value if it enables further additional funding to be directed at maintaining these critical roads to an appropriate standard. Failure to maintain the network is resulting in significant congestion despite the good work of the Highways Maintenance Efficiency Programme. Consideration needs to be given

to the opportunities to maintain and repair existing assets as part of the delivery of major new infrastructure projects where they tie into the existing network and clearer commitments to long term maintenance funding for Local Highway Authorities needs to be provided to enable sensible planning.

In addition, recognising the true impact of the construction phase of major projects on the local highway network and properly funding remedial measures would not only assist in the maintenance of the existing asset but would help compensate local communities for the disruption they experience, often with no significant or direct benefit to themselves from the new infrastructure.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Whilst clients have spent a significant amount of time encouraging providers to work collaboratively they still struggle to do it themselves. This can be as a result of the types of contracts let to managing agents or similar but inevitably results in significant amounts of money being wasted on either checking designs or in having to co-ordinate multiple providers on site. The relationships between Highways England, Local Highway Authorities and Utility Companies have to improve if this challenge is to be addressed. Examples of this include Highways England managing agents placing onerous requirements on Local Highway Authority schemes even when the Highways England element of the site is the responsibility of the Local Highway Authority for the duration of works and Utility companies not allowing the use of a Local Highway Authority Provider to deliver their diversion works despite the fact that the provider was on the Utility Company approved list and it would have saved time and money.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?
Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

The significant challenge is finding a way to address the cash flow requirements. Current approaches, such as Enterprise Zones enable some support of local infrastructure needs but unlocking housing and economic growth needs forward funding of infrastructure with some means of recovering the investment from those who then develop the associated opportunities. In addition the funding policy needs to be embedded within the overall strategy for infrastructure delivery and needs to be considered on a larger geographic area. Work needs to be done with England's Economic Heartland, Transport for the North and Midlands Connect to develop appropriate transport strategies and associated funding vehicles.

Network Rail have recently been applying a "value capture" approach to seeking payments where alterations to their assets are required as part of an infrastructure package to enable developments. This is having a significant effect on the viability of developments, where these have already been based on the infrastructure requirements identified by the local authorities. For example, in relation to Princes Risborough, where 2500 homes are proposed, Network Rail are looking for a payment equivalent to 50% of the land value uplift, even though the proposed

changes to their infrastructure (the construction of a tunnel underneath the railway line) is a relatively minor part of the required infrastructure needed overall for the development – for example the development needs a relief road with estimated cost of £48m, whilst the tunnel has an estimated cost of £2m. If this applies to all schemes where there is an interface with Network Rail – then this will effectively make any development close to Network Rail assets unattractive and more risky.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?
Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

The cost of building a business case for transport schemes is in the region of £0.5m. This is a significant investment for local authorities where there is no guarantee that the scheme will go ahead. With austerity measures and continuing pressures on local authority budgets it is not surprising that relatively few transport schemes are being developed and there is a limited pipeline of new schemes available to be considered when DfT opens a bidding round for transport investment, invariably with a very quick turn round time.

Longer funding timescales, funding to develop business cases and funding to develop a range of schemes – even if these do not proceed – is needed to ensure that there is a pipeline of infrastructure projects.

The reliance on development to progress infrastructure leads to a piecemeal approach and uncertainty. Proposed development around Aylesbury and at Princes Risborough are all being delayed due to the need to resolve certainty of delivery of transport infrastructure, where there are multiple developers involved and lack of a comprehensive funding package. The local authorities are having to intervene to try to create the certainty to enable local plans to be "sound" and to ensure that developments can proceed.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?
Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

The planning, funding and delivery of all types of infrastructure needs to be brought together.

a) Planning of all types of infrastructure should be co-ordinated to the same planning timescales say 20 years – to coincide with local plans as well as a

longer term horizon. Currently, there are different planning horizons for different types of infrastructure – for example

Infrastructure and provider	**Planning type/name**	**Planning time period**
Rail - Network Rail	CP5 CP6 CP7	2014- 2019 2019 – 2024 2024 – 2029
Strategic Roads - Highways England	RIS 1 RIS 2	2015-2020 2020 – 2025
Gas – National Grid	10 year planning period	2013 – 2023
Electricity - DNO	8 year planning cycle	2015 – 2023

This makes co-ordination of infrastructure extremely difficult – as each industry will use different planning assumptions in terms of predicting demand.

Every local planning authority is required to produce an Infrastructure Delivery Plan to support its Local Plan – which normally have a 20 year horizon. This quite often does not coincide with utility infrastructure planning timescales and there is no requirement on the utility companies to engage in the plan making process. Either this requirement on local authorities should be relaxed, or utility companies and other infrastructure providers should be required to provide the necessary inputs to allow local Infrastructure Delivery Plans to be produced.

For areas such as Buckinghamshire, which have a key relationship with London, the planning of energy infrastructure should not be undertaken at the local level, but needs to be considered at a sub-regional level

b) Planning needs to be better co-ordinated between different types of transport infrastructure to move towards the creation of an integrated transport network. Currently, planning for a range of national transport infrastructure projects are happening in isolation. Buckinghamshire has first-hand experience of this lack of integration in terms of railway investment planning on HS2, East-West Rail, Heathrow Express, Western Access to Heathrow and Crossrail.

The existing structure within DfT based on modes of travel does not assist planning, funding and delivery of an integrated transport network. Neither does it allow for maximising the potential for behaviour change nor technology. We do not have an alternative proposition but observe that that the structure leads to funding streams for different modes and purposes, which make planning and delivery ineffective.

c) Where several infrastructure projects impact on a geographical area, there needs to better co-ordination as well as assessment of cumulative impacts – rather than each project only having to consider its own impact. In future for Buckinghamshire this will be Heathrow, M40 (junc 4 upgrade, new junction to serve Bicester are both possible in RIS2), East West Rail, HS2 and Oxford-Cambridge Expressway.

There is a lack of co-ordination between sponsors of national infrastructure schemes and this is leading to duplication of work, conflicting designs and wasted time and effort. For example, in the Iver area, where there are multiple NSIPS, proposals by Western Rail Access to Heathrow team and the HS2 teams are in conflict, with each proposing a design which impacts significantly on the other project. Each NSIP will have had to invest over £500,000 in surveys, modelling, business case development, yet the cumulative impact of these on a local area (in this case South Bucks around Iver) have been ignored. In particular, with each scheme assessing only their impacts, this disregards the cumulative congestion impacts as well as the cumulative impact on the environment and local settlements.

At a recent meeting in Iver it became apparent that neither project would be able to progress their preferred design as it did not allow for the other project's design. We had asked DfT to ensure that where these schemes converged or had a cumulative impact on an area, that there was DfT co-ordination between the projects but unfortunately this does not appear to have happened. The burden placed on the local authority to work with the local communities to assess the cumulative impact and develop solutions is significant and the funding support provided by the major projects inadequate. A topic paper setting the impacts of several infrastructure schemes in Iver can be seen here – page 8 sets out a table of the different NSIPs.

Although external perception of integration between the railways schemes of High Speed 2 and with East West Rail has improved since 2013 with the publication of the initial integration report. However, it is only now, some four years later, that the integration is being communicated to the relevant local authorities and the impacted communities. There are similar issues with HS2 (HEx) and WRAtH join up (both DfT projects) which are also being experienced.

Stakeholder engagement

We have found that the vacuum of communication on HS2/EWR integration, and other aspects of HS2, has led to information voids being filled with misinformation which is resource intensive to later correct.

It is clear that Government needs to improve its understanding is of how local government communicates with its communities and engage better in this area. We have a wealth of experience of doing this work but it is not being utilised. The majority of people look to their district/county council for information and we seek to provide that wherever possible. Our earlier

comments regarding collaborative work are relevant to this issue. This would seem to lead to the conclusion that due to the impact of national infrastructure projects on local authorities, project costs should include appropriate stakeholder management funds directed to local authorities and the development of a closer working relationship between the major project teams and the relevant local authoririte s.

The lack of transparency on the scope of the local government new burden created by delivering HS2 and the emphasis of focusing efforts on individual local authority negotiations seems resource intensive and inconsistent.

The focus is always on protecting the programme of the national infrastructure scheme – which is quite understandable. However, this is not the only public money that can be adversely impacted. At a local level there can be impacts on the council's forward programme of work and development in terms of S106. Much of this work is fundamental to the growth aspirations of the local area. The wider impacts of the national infrastructure scheme and its costs to other projects and local growth also need to be taken into account.

There needs to be greater understanding by Government of local government structure (county, district, parish) and the nuances between them.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?
Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

Transport:
13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?
Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?
Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?
Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

Digital communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?
Note: the existing "regime" refers to the current market, competition and planning frameworks. "Digital communications" includes both fixed and mobile connectivity.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

There is a need to change public perception regarding zero carbon technologies and lifestyle. This could be done either by direct central government campaigns delivered on national television or by encouraging energy providers to reference renewable energy and decentralized energy systems in their national advertising. Many people in the UK still consider solar panels as "ugly" for example. This is less of the case in countries like Germany. Encourage the design of new build areas with core transportation modes as public transport available on a 24/7 basis and communal car ownership available when needed as luxury rather than being seen as a necessity. Full closed loop designs such as waste systems already in place in Europe where waste in apartment blocks is transported from the apartment via a network of tunnels directly to landfill without the use of on-road vehicles.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Use of electric vehicles will increase demand on the electricity distribution and transmission network within the region. The implications of which is something that Buckinghamshire County Council (BCC) are seeking to understand to ensure that the county is effectively prepared in embracing forthcoming changes in consumer energy use. Future proofing the county is key. BCC are already aware that failure to embrace the forthcoming electric vehicle evolution could negatively impact economic development within the region.

BCC are particularly aware that as a home county increasingly absorbing London's commuter population we need to embrace city thinking and developmental concepts. Recent local area plans indicate that the region is due to rapidly develop by 2033 with a large number of houses and associated community buildings. A large proportion of this development will undoubtedly entail domestic electric vehicle use. Buckinghamshire has two key towns, High Wycombe and Aylesbury, that are increasingly represented in national press as places for people with a capital city focus to live in. It is vital that these key towns remain competitive and desirable places for people to live.

Current projects changing the energy vehicle landscape are ones where local authorities invest in battery schemes which draw electricity from the national grid when electricity rates are lowest and sell onto consumers for their electric vehicles.

Moving beyond this, BCC need to provide electric vehicle infrastructure as electric vehicles will become a normal part of consumer demand. If BCC do not provide electric vehicle charging infrastructure then consumers will simply visit and live in the next county or region that does. Here then, BCC recommends that the NIC and government look at Buckinghamshire's regional energy infrastructure development from a national context. If ensuring that regions such as Buckinghamshire are critical in keeping the capital city buoyant then their energy infrastructure development must be considered a national issue.

BCC are keen to ensure that the region's energy infrastructure development is viewed within this light and receives appropriate support from government where necessary. One such example is where costs for upgrading the distribution network to meet electric vehicle demand specifically are supported centrally helping battery/electric vehicle projects to meet attractive return on investment criteria. We note the OLEV ORC scheme which should provide support for the implementation of residential car charging points.

Costs for upgrading the distribution network on specific projects are usually within the £500,000 to £2,000,000 range. BCC are also particularly keen to receive central support and funding for costs on upgrading the transmission network which as previously detailed, can run into the tens of millions of pounds. BCC understand a quotation for £25 million in grid infrastructure upgrades / reinforcement for a key development within the region has recently been received.

Water and wastewater (drainage and sewerage):

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?
Note: "demand" includes domestic, commercial, power generation and other major sources of demand.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?
Note: this can include, but is not necessarily limited to, governance frameworks across the country.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

For each catchment there needs to be an agreed approach which addresses flood risk from fluvial, surface water, groundwater and sewer flooding. All parties (EA, LLFAs, LPAs, IDBs, Water utility companies) need to contribute to these catchment plans which should be at the correct scale to correspond and to be aligned in time and scale with the Local Plans, SFRAs.

Flood risk management:

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

Currently then standard in 100 year plus Climate Change (CC). This does feel the correct level but the variable in the CC allowance which has recently been raised and is only likely to be raised further. This flexibility needs to be kept in to make allowance for CC changes. The fluvial, surface water and groundwater risk all need to be aligned to avoid confusion. At present the surface water is classified as High which is 1 in 30 year to 1 in 100 year which is consistent with the Fluvial 1 in 100 year but expressed differently.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?
Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

There are clearly some merits in considering natural flood management in the upper catchment as part of the suite of tools to address flood management. This suite of tools should include natural flood management, flood resilience and warning, engineered solutions such as banks and walls and temporary defences. Natural flood management are likely to be useful at lower return period events. Their merits are that they are cheaper than more traditional hard engineering solutions. Natural flood management seeks to work with the environment and natural processes and are therefore more ecologically acceptable, enhancing rather than damaging the

environment. The maintenance regime would be required but this would be less costly than more traditional methods and could be undertaken by NGOs or communities.

The limitations are that it is unlikely that natural flood management could "solve" the flooding issues in a downstream community completely especially for higher events and more likely that it would need to be used alongside and in addition to other solutions. There needs to be greater understanding of the level and scope of these methods especially for catchments in lowland situations. Other limitations could be that by holding back or slowing down flow on a sub-catchment(s) could mean that the sub-catchment flow would then coincide with the main catchment flows rather than passing through earlier. Any measures need to be addressed in the context of the whole catchment. In the majority of situations, NFM requires land take so this needs to be factored into the cost for compensating landowners for land take or reduced land viability or productivity.

Solid waste:

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

Buckinghamshire response: There isn't a clear enough long term strategic commitment from the government on waste management including treatment capacity. Councils find themselves developing localised solutions which then do not benefit from any national plan. For any council the commitment to developing local collection, sorting, transfer and treatment capacity is a major financial undertaking which can take years to deliver.

Buckinghamshire County Council has invested in its own energy from waste (EfW) power station at Greatmoor, near Calvert, in northern Buckinghamshire. The plant generates electricity from waste that cannot be recycled. The investment is the single biggest investment ever made by the County Council standing at £181 million as PFI credits were removed. This project has taken considerable time to deliver (10 years), due to various challenges through planning and procurement regimes. We were only able to move forward the delivery of the infrastructure following a successful outcome through the judicial system.

Local authorities have committed many hundreds of millions of pounds to underpin the delivery of waste treatment infrastructure to radically reduce landfill by 2020. Nationally England has stagnated in terms of recycling performance, which would suggest the indication of a 70% recycling target in the future as unachievable.

Local Authorities pay significant sums towards landfill tax, these receipts can provide investment capital that would contribute towards increased recycling levels and help councils to deliver infrastructure that would not otherwise be affordable.

Local authorities meet a significant proportion of cost from collect to treatment and disposal. Producers of waste do not meet full costs of their products at the end of their life; to date we have the lowest level of contribution from producers amongst all other EU member states. Full due consideration should be given around the implementation of extended producer responsibility (EPR), rather than tax payers being the default positon to meet financial burdens.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

Note: A "circular economy" is an alternative to a traditional 'linear economy' (i.e. make, use, dispose) in which products are designed and packaged to minimise waste, and resources are kept in use for as long as possible, e.g. through re-use, recycling and greater recovery of materials through the waste management process.

Where possible the basic principal of the waste hierarchy should be applied with prevention and reuse/repair before a large proportion of material finds its way into the waste stream. The materials used during the design are really key and important, Once a product is in the waste stream it is becoming increasingly challenging to find cost effective ways to extract the resource. This is in addition to creating financially viable markets for secondary material. While innovative techniques continue to be developed to disassemble, refurbish, repair and recycle different products it remains financially challenging.

There is a gap between the secondary reprocessor materials competing in a volatile market which is often undermined by lower cost virgin materials. To drive demand for secondary materials and improve the financial viability of recycling collection the Government should consider further product and material specific requirements to use recycled content in product manufacture. Full due consideration should be given around the implementation of extended producer responsibility (EPR). There should be a minimum level of producer contribution based on the costs of collection and subsequent reuse, recycling or disposal of their products.

Please direct any queries concerning this response to [name redacted], [email address redacted]

NATIONAL INFRASTRUCTURE ASSESSMENT

Response by the Campaign to Protect Rural England to the National Infrastructure Commission's call for evidence

February 2017

Introduction

1. The Campaign to Protect Rural England (CPRE) greatly welcomes this opportunity to feed into this important work by the National Infrastructure Commission ('the Commission') to prepare the first ever National Infrastructure Assessment ('the Assessment'). CPRE works locally and nationally to protect, shape and enhance a beautiful, thriving countryside for everyone to value and enjoy.

2. We are a charity with about 60,000 members, a branch in every county, over 200 district groups and more than 2,000 parish council members, which has been actively engaged in infrastructure issues since 1926 at the local and national levels. We recognise that the scale of the infrastructure transition that England is facing is at least as great as at any time of our ninety years of existence, whether the interwar creation of the National Grid, post-war reconstruction or construction of the motorway network[1] and the increase in the capacity of the Grid in the 1960s to early 1970s.

3. In our 2015 election manifesto, we called for 'the right infrastructure for the right reasons', stating that '[w]e need to make better use of existing transport and energy infrastructure and smarter decisions on new investment – to reduce demand rather than drive it.' To address challenges such as climate change and minimising land take for development, we recognise the importance of major investment in our infrastructure systems, for example to deliver a major shift towards rail and electricity away from private motor transport and fossil fuels.

Overview

4. Renewing aged infrastructure and tackling climate change are imperatives which mean that we could not afford to 'do nothing', even if we did not need to improve productivity and quality of life. Infrastructure debates in this country too often manifest themselves as an adversarial parody. On the one hand are those that are obsessed with building huge 'vanity projects' that can be seen from the moon. On the other are the Luddites fighting against progress down to the last blade of grass. A slight less crude version of this debate involves those arguing for major infrastructure to be designed with appropriate mitigation to reduce environmental impacts, versus those arguing that greater efficiency and small scale measures mean nothing big ever needs to be built again.

1 *Where motor car is master - how the Department of Transport became bewitched by roads* (CPRE, 1993)

Restructuring our infrastructure systems

5. The growing evidence from infrastructure systems theory[2] is that the only affordable and sustainable approach in the long term is to invest in restructuring our infrastructure while implementing policies to secure smarter use of it. While it might be possible to get by through doing the minimum, expanding capacity to meet predicted demands or trying to maximise efficiency of existing infrastructure, all those approaches would lead to major problems by 2050, whether in terms of costs, reliability or environmental impacts. In addition, greater synergies between infrastructure systems will be driven by requirements of climate change mitigation and adaptation. The former requiring electrification using increasingly zero carbon energy, the latter requiring infrastructure networks to work better to increase resilience and natural capital.

6. CPRE accepts these arguments for restructuring, which run like a golden thread throughout this submission. Our case is informed by two major reports on transport and energy we are publishing this spring that add considerably to this evidence base. In relation to transport, our research demonstrates that road-building is not delivering the expected congestion and economic benefits, while leading to worse environmental outcomes[3]. On energy, our evidence suggests that if we are to have affordable power that does not damage the landscape, we need to radically change our relationship with the power system. In both these two sectors, which are perhaps the most challenging areas of infrastructure, we will need to invest more in decentralised systems[4] as well as adopt ambitious policies. There will still nonetheless need to be some major infrastructure, such as major new rail lines and interconnectors, forming the backbone of new sustainable systems.

Future landscapes

7. All these changes, even those that are small scale, will cumulatively change the appearance of our country and its countryside for generations. The European Landscape Convention provides important guidance and our energy report is perhaps the first time it has sought to be applied, at least in the UK, at such a strategic level. It is critical that the public is engaged pro-actively and explicitly as the Assessment is developed in relation to potential landscape impacts. Landscapes are the product of generations of change, whether due to the impact of nature, humans or the combination of the two, and will continue to change. The Assessment offers major opportunities to enhance them and make them more multi-functional[5]. The next stages of planning will require will require cross-disciplinary input at an early stage[6] plus commitments to multi-functional infrastructure and world-class design.

8. Some may see such an approach as slowing down or even putting a brake on progress, thereby damaging our international competitiveness. After all good design and attractive landscapes do not tend to be visible through the narrow lenses of Marginal Abatement Cost Curves and Benefit Cost Ratios. The most competitive countries in the world, led by Switzerland and Singapore[7], have exemplary design standards and strong

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2 *The Future of National Infrastructure* (Hall, Tran, Hickford and Nichols, 2016)
3 *The Impact of Road Projects in England* (Sloman L, Hopkinson L and Taylor I for CPRE, 2017)
4 *Title tbc* (Regen SW & The Landmark Practice for CPRE, 2017)
5 For an outstanding landscape, this might mean improving its capacity to offer ecosystem services such as flood control and carbon storage, for a more everyday landscape this could mean integrating solar PV on buildings and fruit trees into new cycling and walking paths.
6 In 2015 the Farrell Review, which was commissioned by DCMS, called for PLACE reviews, bringing together Planning, Landscape, Architecture, Conservation and Engineering professionals.
7 The USA is an outlier in the top ten countries in that it has neither excellent infrastructure nor strong environmental regulations. Its size and soft power are likely to be factors that offset some of its disadvantages.

environmental policies, however. If the UK is to catch up, whether in terms of quality of life or competitiveness, a smarter approach to infrastructure will be essential.

Consultation questions

Q1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

9. The highest value investments are the measures to unlock greater efficiencies in existing infrastructure and ensure that new or modified infrastructure is planned and used efficiently. These measures require the integration of policies to encourage making better use of infrastructure capacity with enabling capital investment, such as in smart ticketing, smart road charging and smart meters for energy use. Without such measures, the benefits of investment in further infrastructure will become ever more marginal. *The Eddington Transport Study* (DfT, 2006) found that without a system of road charging in place, benefits from expanding road capacity after 2015 would quickly be eroded by induced traffic. Our evidence (see response to Q15) suggests the problem of induced traffic is even greater than Eddington feared. In any event, given increasing uncertainty from technological change, smarter use policies are the 'no regrets' option that should be chosen first.

10. The power sector is starting to show the success of such a model, having taken initial steps towards it: through greater efficiency of consumer goods and demand side response measures to discourage use during peak periods, the fear of blackouts is now readily dismissed[8]. The rail network has adopted variable pricing with similar success. By contrast the road network has not and is facing growing challenges from congestion due to traffic increases. The effective abolition of the Fuel Duty Escalator, which was one of the only policies at national level to manage demand, has led to fuel costs plummeting by almost 20% over the last three years[9]. Introducing smart charging on roads, initially for HGVs and LGVs (vans), would bring major benefits.

11. More detail is set out as to the best infrastructure investments for transport, energy and waste in later sections of this response. In terms of prioritising investment, arguments about 'lowest hanging fruit' will often be made, leading to major urban areas often being first in the queue for funding and rural areas at the back. Particularly in relation to transport and digital infrastructure, there are certain network effects from universal coverage that are not easily captured by current methods of appraisal. Broadband notspots and gaps in Electric Vehicle (EV) chargers, public transport and cycle route networks can hold back behaviour change and productivity gains. Despite its small size, variability in service provision seems more of a problem in England than many other countries. Greater innovation and collaboration between broadband service providers is needed to improve connectivity in rural areas, so that it is both affordable and sensitive to local landscape character.

Q2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

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8 *UK need not fear blackouts says ex-National Grid boss* (BBC News, 2017)
9 *Provisional road traffic estimates, Great Britain: January 2016 to December 2016* (DfT, 2017) shows a clear relationship between fuel prices and traffic growth.

12. Improved digital infrastructure offers the best economic and indeed environmental benefits. Data should also be considered as part of digital infrastructure; further comment is provided regarding the potential of better infrastructure data in response to Q10.

13. HS1 and the Channel Tunnel is the only international gateway that offers zero emission (whether in terms of carbon or air pollution) travel, so its use should be encouraged. At present it is chronically underused, in terms of services per hour and the failure to use double decker passenger trains, despite being built to continental gauge. That said St Pancras is already bursting at peak times, even before the impact of Brexit may change immigration and customs controls. Even if they do not run further for the foreseeable future, an HS1-HS2 link would enable European services to reach Old Oak Common. Besides relieving the pressure on St Pancras, this would enable step-free access to a much wider swathe of the UK as well as to Heathrow.

14. Investment in improved rail access to air hubs should aim to improve public transport networks for the 50% of the population who do not fly regularly, such as by developing orbital rail routes around city centres. It should be done carefully so as to not encourage sprawl on Green Belt sites around airports, which can hinder urban regeneration. Wider high speed rail improvements, a mixture of new lines and upgraded sections to Scotland for example, are needed to minimise domestic aviation and free up rail capacity for more freight and local services.

15. Better sustainable freight access to new export markets is urgently needed. China's One Belt One Road policy is opening up new markets in the former Silk Road and has led to Chinese freight trains reaching the UK. As the UK exports tend to be higher value, they would benefit particularly from the cheap, relatively fast connectivity offered by rail. Chinese and continental freight trains cannot proceed beyond HS1 at Barking due to the size constraints of our Victorian infrastructure, meaning such trains are likely to return largely empty. A continental gauge freight link to the north would help tackle this. Better rail links to ports – electrified and with larger loading gauges – are likewise critical to minimise HGVs traffic.

16. Besides better connectivity (in terms of better capacity management as well as infrastructure) to international gateways, improved local rail networks would make the UK more competitive. As we noted in our response to the Commission's consultation on Northern Connectivity, the highly productive Mittlestand area of Germany has dense S-bahn rail networks that generate agglomeration benefits between smaller cities and towns. This enables global players to be found outside major urban areas, The range of these public transport networks are extended through cycle networks, giving young people the chance to access a range of training opportunities with low transport costs. The role of local transport in improving skills must not be overlooked.

17. According to 2014 figures from Visit Britain, 54% of all inbound tourism spending in the UK was in London. The rest of the country has a tourism deficit and we urgently need to tackle this. Investment in smart ticketing and regional rail is needed to make our tourist offer more competitive, for example reopening under six miles of the Shakespeare Line would transform rail access to Stratford-upon-Avon, not to mention regional rail connectivity and resilience.

18. Some will seek to argue that road-building is the answer to this question. Often said our road networks are bad. True there are issues with surface quality, particularly of local roads, but main issue is lack of management. The UK has some of the widest motorways in Europe but also some of the most congested. What we do not have however,

are the tools to manage use of that capacity such as through tolling and variable lorry charging. Our response to Q15 provides more detail.

Q3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

19. For nationally strategic infrastructure projects, early engagement with a wide range of professional disciplines beyond engineering is key. The use of design panels for design review from the early stages of projects is an important means to do this and move from a 'design as mitigation' approach to one where better design processes unlock wider benefits. Early design panel input for HS2 phase 2 led to route changes and, although the input was relatively later for phase 1, it was much earlier than for other schemes such as Crossrail and has had major benefits for procurement.

20. Investment in smaller-scale infrastructure, such as energy storage, Combined Heat & Power (CHP), rapid transit and cycle networks, can take pressure off major infrastructure networks, such as the National Grid and Strategic Road Network. Through high quality design, especially the integration of multiple objectives, these types of infrastructure can also offer exciting opportunities to add to local character and improve quality of life. In Demark, for example, attractively designed, municipally owned district heating plants can be a source of local pride. A significant degree of local involvement if not ownership of infrastructure and house-building appears important. Large housebuilders are often wedded to standard designs while national infrastructure bodies can be focused in an engineering silo. This can make it harder to secure multi-functional infrastructure and highly sustainable housing with aesthetics that enhance local character.

Transport and place-making

21. Getting transport right is of critical importance to securing good quality of life, whether in terms of ease of travel and the impact of travel and infrastructure on places. Air and noise pollution from major transport infrastructure blights swathes of our cities. Green walls and green bridges can help tackle impacts and even, for example the green decks being constructed over motorways in Hamburg and Paris, create new space. Nonetheless even with high environmental standards, additional road capacity is likely to choke towns and cities with ever more traffic and congestion.

22. As leading architect Sunad Prasad told the House of Lords Built Environment Committee: 'Drop anyone from a helicopter almost anywhere on the outskirts of any town in the UK and they will see only highway-dominated spaces, poor spaces, business parks and retail outlets. Those are terrible; they are just not for people. They are there for the hermetic idea of arriving by car.' Road investment is very likely to lead to these lower density, lower quality developments on greenfield sites.

23. The alternative approach of Public Transport Oriented Development (PTOD) is focused in towns, around new and existing rail stations, with density and urban form to make walking and cycling the modes of choice. It is important to prioritise development on brownfield too, in order to secure regeneration and minimise the need for land. Inspired by continental examples such as Vauban, in the German city of Freiburg, CPRE has

called for measures including multi-variable measures of density, participatory planning, custom- and self-build housing and car limited housing[10].

24. It will be difficult for some types of infrastructure to avoid passing through the Green Belt, which is an important resource for recreation on the edge of major cities. Beyond seeking to minimise its impacts on openness through better design, consideration should be given for compensation to offset impacts on purposes of the Green Belt, such as through improving recreational opportunities and protecting openness. CPRE has secured a formal assurance from the DfT that the HS2 Community and Environmental Fund will be available for such purposes.

Q4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

25. The sectors that have harnessed the potential of demand management the least should learn from those that have. Although variable pricing has taken off in the rail and commercial power sectors, there is significant potential for such pricing on roads and domestic power.

26. High peak prices are features of the rail and power sectors and intensive public engagement is needed to communicate the potential long-term cost savings and seek views on how this might work most fairly in other sectors. In a freezing windless winter week, would it be acceptable to suggest people avoid higher charges by accepting the cold, putting extra layers on or choosing say to watch a movie in the cinema rather than at home? How might special consideration be given to those with particular needs, for example by capping peak charges for the disabled or those recovering from serious illness? As Travel Demand Management at the 2012 Olympics demonstrated, there is great potential for improvement to road freight, such as through consolidation, night time deliveries and providing pick-up points near homes as an alternative to receiving internet shopping at work places.

27. Rebound effects may be more significant in rural areas, where home temperatures are lower (see answer to Q19) and congestion, at least outside market towns, less of a dampening factor of traffic growth. Rebound effects in the power sector should not be an issue if spare power from renewables can be used, such as by relying on storage. By contrast, 'peak spreading' on the road network has negative impacts on air quality and noise pollution, damaging productivity by affecting sleep, for example.

Q5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

28. Because of the lifespan of infrastructure, it is important to invest in existing infrastructure. Besides maintenance and repair, retrofitting of existing assets is important, whether to improve environmental outcomes or indeed restructure an infrastructure system to optimise its operation. As part of the roads reform agenda that led to the creation of Highways England, CPRE developed the idea of a 'roads retrofit', to secure better environmental outcomes from older roads designed before modern environmental standards. Together with other environmental NGOs, we secured £500m towards the

10 For a list of recommendations, see *Better Brownfield: Ensuring Responsive Development on Previously Developed Land* (CPRE, 2015)

Environmental Designated Funds within the Road Investment Strategy, which are starting to addressing issues such as noise and air pollution, severance of communities, habitats and landscapes.

29. HS2 is potentially an example of a new asset enabling a wider restructuring of existing infrastructure: by removing the fastest trains from the West Coast Main Line, the existing infrastructure can better serve freight and local passenger markets. It will be important to ensure that investing in HS2 can go hand in hand with investment to repurpose these lines, for example reopening stations closed in the 1960s when the needs of long distance traffic were prioritised over local.

30. Almost all infrastructure reaches the end of its design life at some point. Consideration is needed about how to maximise subsequent opportunities when overhauling existing infrastructure or constructing new assets. For instance much energy infrastructure is coming to end of its life. While London benefits from the redevelopment of former power stations, such as what is now the Tate, King's Cross Gasholders and soon to be Battersea redevelopment, rural areas have not. Indeed some forms of infrastructure, such as nuclear power stations, pose their own challenges. An even longer term perspective should be adopted when planning infrastructure, one that considers not just the whole lifetime of the infrastructure but also beyond.

Q6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

31. There are opportunities for better collaboration in respect of construction of infrastructure and provision of services.

32. The way that responsibility for construction of infrastructure is divided up into different national bodies in the UK is hindering synergies. Although a National Grid overhead line runs through the Chilterns AONB and would have to be moved to make way for HS2, the two infrastructure bodies proved unable to work with each other to take the opportunity to bury the power line during HS2's construction. This is in sharp contrast to Switzerland and the plans for the Grimsel tunnel, which would combine a 22km new strategic rail link and a 380KV electric line. This would cost effectively remove the existing line, which was in need of strengthening, from a protected landscape.

33. In some sectors, competition is being encouraged for provision of infrastructure. Proposals contained in the draft Energy Bill laid before Parliament in 2016 would have enabled competitive tendering for onshore transmission. CPRE recognises the efforts made by the incumbent, National Grid, to improve its public engagement and reduce its impacts on the landscape in response to our campaigning over the years. The original proposals failed in any way to consider the landscape impacts of transmission networks and so may well have miscalculated the potential savings that new entrants might be able to offer.

34. It is critical that the UK considers future opportunities for multi-functional infrastructure not just at a national scale, such as further phases of HS2, but for local infrastructure too. Municipal bodies provided the first gas and electricity in many areas a century ago and they may be appropriate to turn to again to break down sectoral silos. Expanding the role of Sub-national Transport Bodies to cover other forms of infrastructure would provide a co-ordinating role. At the local level multi-utility trenching would enable more cost effective infrastructure system refits, such as the roll out of district heating, grey water recycling, Fibre-to-the-Premises, followed by rebuilding the roads dug up, so that space is reallocated for cycling and walking.

35. Regarding services, better collaboration is more appropriate in a number of sectors than competition. Competition may still be possible, such as through concessions or franchising, however. The provision of public transport networks and district heating are good examples where economies of scale are needed to provide a competitive service at affordable cost. Van traffic is increasing sharply on rural roads. Different supermarket and delivery companies will frequently send a van to the same village on the same day, each only delivering one package. New models are needed to tackle such transport inefficiencies, whether by creating a larger network of pick-up points or collaboration between delivery companies.

Q7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

36. User charging should become smarter and there should be a greater contribution to infrastructure from uplifts to land values (see answer to Q10).

37. There are three principles to making user charges smarter that should be applied:
- Pay full costs to reflect externalities: for example charging HGVs more to reflect their impact to road surfaces and cost to health from of road noise, which is over £10bn per year (Defra, 2014);
- Vary charges by time to reflect service cost: large amounts of capacity are only used for a small proportion of the year, for example mid-winter, something Time of Use Tariffs could address.
- Sliding charges: in order to be socially equitable, those using a small amount of energy or water, or only flying once per year, for example, should pay less per unit consumed, with higher users paying more per unit after consuming more than a certain level.

38. Charges for essential services should not be higher in rural areas, for example the cost of public transport (where it still exists) is often higher due to the lack of travel card systems outside major urban areas.

Q8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

39. Greater support should be given for Tax Incremental Financing[11] as well as capturing increased values of land through encouraging use of the Community Infrastructure Levy. These forms of financing have particular potential not just for public transport schemes but also for the removal of intrusive highway infrastructure. Part of the justification of the removal of the gyratory in Elephant & Castle in London for example was to unlock higher land values.

40. There is a severe funding shortfall for cycling and walking schemes, so new measures, such as social impact bonds, should be investigated. Although all developers should be aiming for infrastructure schemes to result in a net gain in biodiversity and promote local character, some schemes may unlock wider opportunities, where enhancements to the scheme would be cheaper than procuring stand-alone schemes for

[11] *Making the link - Integrating land use and transport planning through Public Transport Oriented Development* (CPRE, 2016)

green infrastructure. The potential of new financial measures, such as natural capital allowances and environmental impact bonds, to unlock such synergies should be investigated.

Q9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

41. Long-term assessment at the national level is important, for example the work of the UK Infrastructure Transitions Research Consortium in highlighting water requirements for energy and energy requirements for transport. At the local level, better planning is needed. The Planning Inspectorate has given limited consideration to transport and energy aspects of local plans[12] compared to the delivery of housing. As part of its review of the National Planning Policy Framework (NPPF) announced in February 2017, CLG is reviewing which elements of policy are most relevant to assessing soundness of local plans. It is critical that local plans that fail to minimise impacts on constrained infrastructure, in particular those posed by growing interdependence, are not signed off as sound. Stronger national policy as well as training for planning professionals is required.

42. The more multi-functional infrastructure becomes, the greater the potential for different elements to assist if something else fails, for example through transport infrastructure designed to generate electricity and mitigate flooding. A balance of scale is important too: just as cycle networks in London help take the strain when there is a tube strike, so smaller scale renewables could help if there is a gas shortage.

Q10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

43. Cumbersome hybrid bills should be consigned to the history book and new legal tools are created to integrate infrastructure better into its surroundings (see answer to Q11 regarding conservation covenants for more details). Changes are also needed to the form of National Policy Statements (NPSs) and development consent applications to bring them into the 21st century, to make them more user-friendly.

44. Hybrid bills are not only a cumbersome means to consent to development, they are rooted in a 19th century mindset that focuses on private rather than public interests. This is wholly inappropriate in the 21st century for infrastructure that should last into the 22nd. Major issues such as climate change were not mentioned in the Commons committee report and barely mentioned, only to be brushed away by the Lords. With Parliamentary time increasingly taken up with Brexit and then updating legislation we previously imported from the EU, simple changes to the Planning Act 2008 are needed to enable that process to deal with more types of rail scheme.

Harnessing open data for infrastructure planning

45. Proposals in the Housing White Paper – *Fixing our broken housing market* (CLG, 2017) to digitalise the local planning system risk leaving the national planning of major infrastructure in the slow lane. At present, both planning applications and applications for development consent involve cumbersome PDF files. Although the volume of material has

12 See *Planning for the Climate Challenge? Understanding the performance of English Local Plans* (TCPA, 2016)

grown – to over 56,000 pages for HS2 phase 1 – the format has been unchanged for half a generation and has been classed as the least scoring only one out of five stars in open data standards. Five star 'linked data' could be searched intelligently, enabling spatial data to be found or computers to know from markup that figures in a table relate to traffic counts at a particular location in a particular year.

46. Similarly modifying NPSs so that they are set out in sections on web pages, as the NPPF is, would make it easier to amend and update individual sections, rather than having to amend all subsequent paragraph numbers.

47. Bodies undertaking public functions (so including privately owned utilities) are increasingly required to publish environmental open data, pursuant to legislation such as the INSPIRE Regulations, this is not enough to the benefits of so doing, such as by miminising misunderstanding about the impacts of complex schemes and enabling reuse of survey data by developers and in local plans.

48. Despite first publishing the route for phase 2 in January 2014, for example, HS2 Ltd still has not updated its public interactive map to show where phase 2 would run: only complex engineering drawings are publicly available. CPRE published interactive mapping, the most advanced for any infrastructure project in the world, but due to funding constraints has been unable to carry out all the updates to keep it current, not least as missing metadata made the process challenging. The INSPIRE Regulations set out requirements public authorities to provide 'view services' for open data; consistent approaches to rendering schemes would be helpful to aid public understanding of different sectors.

Q11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

49. The right overarching principles are needed for infrastructure systems to maximise benefits for the environment as well as detailed practical processes.

50. In terms of overarching principles, the European Landscape Convention (ELC) provides useful guidance and stresses that all landscapes should be considered, not just the most special. The word landscape in this context is used in an inclusive sense here, covering townscape as well as ecosystems. The main principles are:

- Protect, enhance and restore landscapes: protect the special qualities of designated landscapes, take opportunities to improve everyday landscapes, particularly through regenerating degraded landscapes, such as through regenerating brownfield sites;
- Improve public understanding of landscape, including landscape change: landscape is much more than just the view out of the window but the whole multi-sensory experience of places. Most landscape is the product of interaction between humans and nature;
- Encourage multi-functional landscapes: such as to maximise the value of ecosystem services.

51. A system restructuring strategy for infrastructure services can assist this by reducing the need for new infrastructure and ensuring that which is built is done so sensitively. Although green infrastructure (other than flood control) is not explicitly within scope of the Commission at present, the Assessment is a crucial opportunity to build in consideration of green infrastructure and natural capital into long-term planning. The mitigation hierarchy should be applied within this strategy; the first priority should be

avoiding harm to the environment, whether by minimising the need for new infrastructure, locating it away from sensitive places or minimising its scale.

52. In terms of practical processes to achieve these objectives, a range of approaches is needed, including:

- Plan for multi-functional infrastructure: this will require creativity with funding streams and innovative collaboration between different infrastructure sectors, such as through joint ventures;
- Harness the input of multiple professions, such as through design panels that supportively challenge engineers to think outside the box;
- Integrate infrastructure into the wider landscape, rather than having a defined boundary, use new approaches and tools such as conservation covenants (see below);
- Offset impacts to ensure net environmental gains – where harm cannot be reasonably avoided, take wider opportunities to secure benefits;
- Apply better systems of appraisal: intangible and long-term factors may be best assessed through qualitative systems (see answer to Q12);
- Maintain ring-fenced funding for improved environmental outcomes from existing infrastructure, such as the Environmental Designated Funds for Highways England and Visual Improvement Provisions project for the National Grid within RIIO;
- Better monitoring and evaluation: expert evaluation and monitoring is needed both to learn from infrastructure schemes as well as to ensure that environmental mitigation is actually delivered and maintained.

Conservation covenants

53. In the past the land required to build infrastructure was simply that to enable it to be physically supported, such as by embankments and cuttings. This led to a defined 'red line', i.e. the area required for compulsory purchase, being drawn around sites. Modern environmental standards, such as the ambition in the Natural Environment White Paper (Defra, 2011) for a net gain, require a different approach, where infrastructure is integrated into the wider landscape. Recent schemes are being hamstrung by trying to meet 21st environmental standards using 19th century legal tools for compulsory purchase.

54. Unlike many other jurisdictions, the English legal system does not have any form of conservation covenant[13], a tool enabling environmental obligations to be permanently placed on land, so as to secure benefits for nature, landscape, communities and cultural heritage. This has meant, for example, that HS2 Ltd has had to buy land right next to the route, rather than being able to negotiate with landowners to impose environmental obligations away from the route, such as providing new woodland or wetland to screen views of the route and provide 'stepping stones' for wildlife. In other words this has led to higher costs for the project, greater disruption to landowners (including for viability of farm holdings) plus worse environmental outcomes.

55. The Law Commission published its recommendations in favour of legislation creating conservation covenants in 2014, which were supported by environmental, farming and landowner groups. Defra responded initially in 2015, 'finally' in 2016 but over a year later nothing has moved forward and with Brexit taking up most of the department's time, progress appears to have slowed further. CPRE has highlighted the potential of this measure with DfT and HS2 Ltd officials, who were not aware of it nor its potential benefits.

[13] *The Potential of Conservation Covenants* (Green Balance for National Trust, 2008)

Q12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

56. Although cost-benefit analysis (CBA) has been developed the most in relation to transport, its credibility has never been under greater question. According to the 2015 Highways England Post Opening Project Evaluation (POPE) meta-analysis, journey time savings accounted for 85% of average scheme benefits in ex-ante CBA and 79% ex-post. There is an extensive literature critiquing the use of small notional time savings aggregated over long periods, indeed CPRE's roads research highlights the lack of demonstrable evidence of any economic benefit that these could be a proxy for. The modelling of land use change from transport investment is challenging to make tractable.

57. The potential of disruptive technologies in the energy and transport sectors is such that the forecasting of Benefit Cost Ratios over sixty year appraisal periods is no longer tenable for anything other than short-term infrastructure. Although Monte Carlo techniques can improve the modelling of uncertainty, potentially including some of the uncertainty around climate change adaptation, they do not alter this key challenge, as a disruption to a market is of a fundamentally different order to a simple variable change.

58. A more credible approach is to adopt Multi-Criteria Decision Analysis, supplemented by CBA in discrete areas but without the fiction that every factor can be reduced to figures, let alone then be commensurable to enable reporting through a single ratio. Although quantitative methods are emerging to value the benefits of green infrastructure, many aspects, such as the potential for endangered species to survive in a changing climate are hard to predict. Assessing compliance with criteria of improving ecosystem resilience can be more useful than trying to quantify this, for example.

59. Valuing intangible impacts, such as to landscape, is particularly challenging, even though this is ever more important given the growing appreciation about how infrastructure can lead to wider land value changes. The DfT went cold on applying Willingness to Pay (WTP) approaches after a 2009 study on valuing transport impacts on landscape suggested that the average household in the Chilterns would be willing to pay £14.32 to avoid having a high speed railway run nearby. The alternative approach of valuing landscapes by the type of land use makes as much sense as valuing paintings by means of identifying the types of paint used.

60. WTP has reared its head again in relation to the A303 Stonehenge scheme, which would add about the same amount of new road into the World Heritage Site that it would remove. The assertion that a WTP survey carried out at a single point in time could be valid across a 60 year appraisal case for a scheme that would permanently change a landscape thousands of years old borders on the farcical.

Transport

Q13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

61. The interaction between social and technological changes makes it challenging to predict future travel patterns in the long term. Even five years ago predicted what the impact of Uber would be, not least due to uncertainty about how the public and regulatory frameworks would respond. While electrification offers potential to tackle carbon emissions from smaller vehicles, provided there is sufficient zero carbon power, technology cannot be expected to solve many of the problems caused by inefficient

transport infrastructure systems: Uber has not solved congestion, AVs are unlikely to step-change efficient use of capacity unless there is widespread sharing of journeys and EVs appear to reduce the most deadly form of air pollution by just 1-3% compared to modern Internal Combustion Engines[14].

62. It is the interaction between technology and society leading to behaviour change that has the most potential and that is the most difficult to model, whether in terms of how the public responds or indeed forms of regulation and taxation.

Q14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

63. Please see our response to Q15 – we believe that the principles for major urban areas will be more similar with those for other cities and towns. It is rural areas, particularly those that are more sparsely populated where the issues indeed challenges are most significant, whether due to demand being spread out or funding.

Q15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

64. The reference to 'highest value' in this question should mean solutions that lead to real, long-term improvements in productivity and quality of life, in particular by unlocking higher density, mixed development that is key to delivering successful places. It should not mean those that may appear to solve congestion in the short-term or be easiest to calculate scores from.

A strong case for road-building?

65. Some will want to suggest that road-building is the best option or at the very least one that should be a significant part of the policy mix. This is on the basis that transport appraisal, which the UK is a world leader on, suggests road schemes have the highest Benefit Cost Ratios or that surveys show business leaders believe such schemes have strong economic benefits. According to Highways England, its Post Opening Project Evaluation (POPE) programme is the largest evaluation process for roads in Europe. Surely, if there is strong evidence for the benefits of road-building, it could be found there?

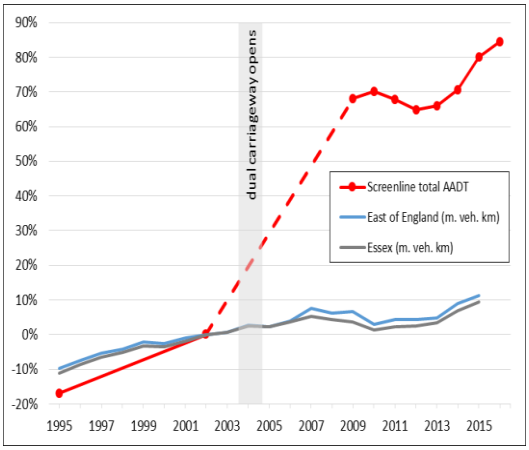
66. CPRE commissioned a leading consultancy that has undertaken evaluation for DfT of its programmes for over a decade to review the evidence. The study examined over 80 POPEs for major road schemes, the POPE meta-analyses (focusing on 2015, the latest) and then dived down into four long-term case studies, to enable a longer-term view to be taken, as despite appraisal periods being sixty years, POPEs currently only evaluate schemes for a maximum of five years after opening. The research supplemented POPE data through obtaining additional traffic and economic data, such as from the Census and registrations of new business.

67. The 2015 meta-POPE claimed that induced traffic was not a problem but acknowledged that evidence of economic benefits was 'at best anecdotal'. By using screenline data and revalidating against traffic flow outturns, our research found strong evidence that adding road capacity induces traffic, as traffic on additional road capacity

[14] *Non-exhaust PM emissions from electric vehicles* (Timmers & Achten in Atmospheric Environment, 2016)

grew faster than background rates. Worse still, rather than solving congestion, this additional traffic quickly created new pinch-points. Of the 25 road schemes were promoted on the basis they would benefit the local economy, only six had evidence of any economic effects. For those six schemes, there was no evidence that economic effects were directly attributable to the road scheme, were genuinely additional, and were not displacement of economic activity from elsewhere. Of schemes that claimed journey time savings would increase workforce accessibility and hence attractiveness of sites to business, none of the POPEs showed increased employment rates or newly located firms.

68. Environmental impacts from road-building were found to be severe. Well over half the schemes examined had adverse impacts on sites designated for landscape, biodiversity or heritage. Besides those serious impacts on the natural environment, the development unlocked by these schemes has been of poor quality, often characterised by soulless sprawl, in some cases sucking life out of existing town centres. While there is limited evidence on impacts on cycling and walking, the road safety impacts are at best neutral and likely to be negative in the long-term due to traffic growth. Based on a conservative methodology, the schemes increased carbon emissions from roads nationally by over 3%, again becoming worse as traffic grows further. This model of road-building → car-based development → traffic growth → road-building is flawed and has not even delivered on its own terms.



69. One of the case studies, the offline dualling of the A120 Stansted-Braintree is typical. After opening, traffic rose 84% (see chart), far above regional comparators. The old road quickly became busy again due to low-density car-dependent housing, which attracted dormitory use by commuters as it was unaffordable for locals. Job growth in the corridor was less than the remainder of Essex, with no significant provision of employment sites, indeed jobs at the Stansted airport site (used to justify the road) fell. Precious countryside, including ancient woodland and SSSIs were destroyed, with compensatory planting and translocation failing. There is now pressure for more of the same to dual sections of the rest of the A120 that have become congested.

Smarter solutions

70. Does this research mean 'no more roads', in other words there should be an end to road-building? The Eddington Transport Study suggested in 2006 that even with road pricing, which is strongly recommended, there might still be a case for some increases in inter-urban road capacity. This research suggests otherwise, whether in terms of the wider costs or the lack of benefits. There may still be a need for some road-building, albeit in terms of transport system restructuring, such as priority lanes for shared vehicles and safe paths for cycling and walking, rather than capacity enhancement for general motor traffic, which in the medium term would simply induce more traffic and more congestion.

71. Small scale bypasses – wide two lane roads that can be adapted in future for AVs, rather than dual carriageways – could be considered where:

- Significant intensification of development is proposed, such as a Sustainable Urban Extension or new town supported by the local community and local plan;

- The majority of traffic is through traffic that does not have an origin or destination in a built up area;
- Measures to secure modal shift, such as rail enhancements, have already been taken first (or would be operational before changes to the road network are completed);
- Measures would be put in place to lock in the benefits of freed-up capacity, such as point closures for private through motor traffic and transformed public realm.

72. Some cities have turned to Park & Ride (P&R), though research into the impact of Cambridge's P&R system suggests it increases overall vehicle mileage and carbon emissions, in particular by discouraging rural bus use and visits to smaller towns, rather than reduces them. While Oxford is struggling with congestion around its P&R sites, many other cities are cutting back as they no longer have the funding to subsidise bus services. Besides having a very small sweet spot – between overpopularity leading to congestion and insufficient demand leading to cost pressures – P&R may not fit well with a future of AVs. It also eats up large sections of Green Belt, the countryside on urban dwellers doorsteps, damaging the setting of our cities.

73. A better approach is one that supports existing bus services while paving the way for widespread MaaS. 'Link & Ride' involves a more distributed system of parking at bus stops across an area, supporting the development of more intensive bus and local rail services, rather than requiring a separate dedicated service. The word link is used because there is much greater integration with other forms of transport, such as improved cycling and walking routes and Demand Responsive Transport. Such a system would evolve far more effectively into a future of MaaS.

74. Just as more distributed solutions make sense for moving people, so too for freight. Indeed potentially more so given the challenges of decarbonising freight vehicles. The model of Strategic Rail Freight Interchanges assumes huge terminals in Green Belt and long transhipment distances by HGV. The DfT is still relying on an evidence base for its National Policy Statement in National Networks. There have been huge changes in the way we shop since then but the changes for freight with 3D printing on the horizon are likely to be even greater. Smaller-scale networks of consolidation hubs and pick-up points (such as Doddle) can be expected to have better environmental outcomes at less cost and deliverability issues.

Q16. What opportunities does 'mobility as a service' [MaaS] create for road user charging? How would this affect road usage?

75. CPRE supports the principle of well-designed road user charging, so long as it is carefully designed to benefit rural areas economically, socially and environmentally: traffic is growing fastest on rural roads and a system of charging that increases this growth rate would further decimate bus services, while making cycling and walking less safe.

76. Millennials are displaying fundamentally different attitudes to car ownership. There is great potential for MaaS to shift attitudes even more fundamentally, so long as it is not simply limited to major urban areas. It weakens the argument that there is no or inadequate public transport, that one has no choice but to drive (one's own car alone). As noted earlier, we believe there is potential for road user charging to be introduced sooner for freight vehicles than for cars.

77. The big challenge is how areas where MaaS has conveniences of scale – in terms of having a realistic chance of being able to share much of a journey or even have a competitive public transport option - interface with those, perhaps due to sparsity of

demand, where it is not. The boundary between such areas will not only change progressively – as technology and social acceptance become more widespread – but also dynamically, for example at night or also during holiday periods when areas like National Parks may become more viable for it. How might road users coming from areas without MaaS accept charging on the basis that it is generally available, albeit perhaps not for their particular journey?

Energy

Q19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

78. The highest value solution is increased efficiency, through zero carbon home standards and similar measures for new non-residential buildings plus a national retrofit programme. Increased efficiency is required for other technological improvements such as low-temperature district heating. Rural areas have benefitted less from previous subsidies and incentives – just 1% of subsidies compared to 18% of population – even though rural homes have worse insulation standards[15]. There may be greater rebound effects in rural areas where internal temperatures are often lower than average, as some energy savings from insulation improvements will be consumed by users choosing higher temperatures.

79. Heat storage offers the potential to reduce winter peak electricity demand, yet there has been very little research in the UK into its potential and even less implementation. The Danish approach of using heat storage to manage variability in supply from renewable electricity and demand from households should be piloted here, such as through integrating electric boilers and heat storage into CHP and other forms of district heating. Seasonal Thermal Energy Storage, such as Thermal Banks, could permit longer-term storage whether helping cope during windless periods in winter or even storing energy from summer. By being underground, these forms of storage minimise landscape impacts of the energy system and have minimal maintenance.

80. A national retrofit programme would take many years, while every home built with inadequate efficiency standards will cost more to put right: arguably decisions should have already been taken. A clear policy pathway is needed beyond the 5th Carbon Budget to provide certainty for investment, backed up by state funding whether for mainstream measures and piloting new approaches such as heat storage. Better regulation of district heating and legislation to make provision for domestic connections is also urgently required to fill the gap between predicted emissions and carbon targets. While stronger planning policy might help build on better regulation, it is unclear whether a National Planning Statement for heat is actually needed, as unless the relevant threshold under the Planning Act 2008 is set very low, most infrastructure consented could fall beneath it. In addition, provision of heat networks is likely to be achieved most effectively if integrated into local plans.

Q20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

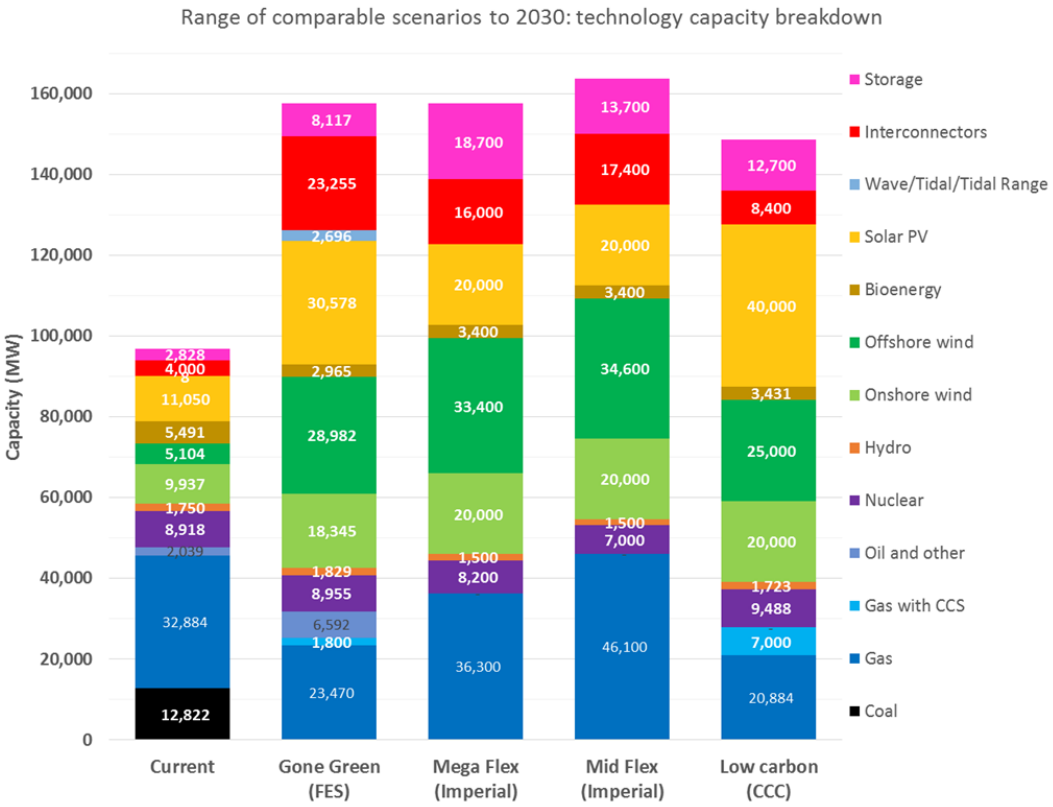
81. Many of the potential landscapes associated with a low-carbon transition are highly contested. This provides a challenge to policy makers not to leave this complex issue to

[15] *Warm and Green: Achieving affordable, low carbon energy while reducing impacts on the countryside* (Cambridge Architectural Research and Anglia Ruskin University for CPRE, 2015)

local planning authorities to unpick but to support the transition with a clear policy framework for local decision making. In relation to the local level, last year CPRE commissioned the Centre for Sustainable Energy to produce the *Future Energy Landscapes* toolkit, to enable communities to produce bottom up energy plans that they feel they have ownership of. Empowering communities in this way is important to increase energy literacy and behaviour change.

82. Nonetheless the lack of a clear national trajectory and planning at the sub-regional level has left a major gap that makes it difficult for communities to assess what degree of transition they ought to plan for and at what pace. CPRE commissioned research from Regen SW and the Landmark Practice to scope long-term power scenarios that are compliant with the Paris Agreement and their potential landscape impacts. The research involved the following steps:

- Five different energy scenarios were reconstructed to compare how they varied in their composition of electricity generating capacity at 2030, a critical point on the pathway to decarbonisation by 2050.
- The slow progress in carbon reduction from other sectors of the economy to date led to the assumption that the power sector needs to achieve net zero carbon emissions by 2050 and, to achieve this, the lower end of the current carbon budgets of 50-100gC02/Kwh by 2030.
- Scenarios that would not enable the achievement of this objective were dismissed and then the two most contrasting approaches were then chosen for further examination, namely Gone Green and Mega Flex.
- Spatial implications of these scenarios were assessed based upon existing sector knowledge, drawing on what could be assumed about the locations of development and which landscapes these would most likely effect, for example coastal, inland or seascape, rural or urban.



	Gone Green	Mega Flex
Annual demand	346 TWh	355 TWh
Peak demand	61 GW	52 Wh

83. Findings from the research included that unless measures to significantly reduce peak demand are adopted, there will be major requirements for excessive peak demand capacity. Such assets would operate at very low capacity factors, with resulting landscape not to mention consumer cost impacts. Besides being important to minimise cumulative environmental impacts, larger scale spatial planning is needed so that renewable capacity, in particular wind, is distributed across the UK and its territorial waters to benefit from different weather systems, enabling reduced derating factors.

84. Given the considerable uncertainties around factors such as nuclear (not least the unsolved issue of waste storage), tidal power, consumer preferences and storage, it is not sensible to make detailed recommendations on the power mix in 2050. Instead a carefully considered process is needed to take us in the direction needed, involving:

- Increase understanding and acceptance of need for change: we have been talking about low carbon for a generation, with 2050 almost just a generation away, we need to talk about zero carbon
- Minimise power demand: although there has been steady progress, we are missing many opportunities to reduce demand through cost-effective, higher standards and smarter planning, whether for transport and heating.
- Manage peak demand: such as through adoption of Time of Use Tariffs and storage.
- Re-purpose existing infrastructure: innovative re-use of existing sites and network connections and promotion of multi-functional landscapes
- Drive innovation for 2050 net zero carbon energy: such as through greater R&D investment for emerging solutions like CCS, marine energy and integration of gas and electricity networks for improved balancing.

Relocalising the Grid

85. Since the era of the Electricity Supply Act 1926 and the resulting development of the National Grid, local energy markets have been viewed as inefficient and antiquated. The increase in locally generated, intermittent electricity means such markets could have a new lease of life. Not in the sense of completely disconnecting local areas but at least reducing the need large amounts of electricity over short periods. The Energy Local scheme in Wales, for example, encourages supply and use of locally sourced electricity by producers and consumers not having to pay Grid costs. Assuming that the draft Energy Bill that was given pre-legislative scrutiny in 2016 will return shortly, this could be amended to include the power to make regulations to set up local electricity markets. In the same way that people who incorporate local food into their diets are more aware of seasonality of food, potentially those who use local electricity will be more sensitive to intermittency.

86. Even before the current electrification programme is complete, Network Rail is the National Grid's biggest single customer. HS2 alone could use up to the equivalent of 0.5% of current electricity demand once completed. Peak demand for electricity coincides with peak rail travel hours, meaning that as road transport becomes electrified and relies primarily on cheaper overnight electricity for charging, some of rail's energy efficiency benefits could be eroded. Although the sector has considered on-train electricity storage as a means to reduce the need for electrification, up to now it is not considered integrating storage with its power network. At the end of 2016, CPRE secured a formal

assurance from DfT that energy storage solutions would be considered within post-Royal Assent detailed design.

Q21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

87. Although electricity distribution networks in rural areas are more likely to be able to cope with the increased power requirements of EVs[16], the need for a comprehensive network of charge points remains a challenge. In order to encourage adoption of EVs and tackle range anxiety, subsidies will be needed to make sure charge points are available at convenient places in rural areas. In one of its final reports[17], the Energy and Climate Change Committee flagged up CPRE's concerns in relation to this as an example of Government's failure to rural-proof policy.

88. On-street charging points for EVs are set to become ubiquitous. While they can be integrated into some street lights in urban areas, many villages and smaller towns are unlit. Rather than be as ugly as broadband cabinets, which have provoked understandable reactions where they have been imposed on intimate streets, they could become new, cherished icons if designed well. In the introduction to *Icons of England* (CPRE, 2008), our former president Bill Bryson explains his fascination with red phone boxes. Where is the ambition for charging points to become as much as a distinctive design classic as our post or phone boxes?

89. Flash charging for buses, a technology with great promise that the UK has not yet explored, poses particular issues for the local electricity grid due to requirements for a 400KW draw for very short periods. Overhead gantries have potential for high quality design. This is a good example about why integrating energy and transport into local planning is essential.

Waste

Q27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

90. The current financial and regulatory incentives are not adequate in attracting investment for long-term waste management capacity, such as reprocessing plants. Our waste management systems are not providing enough good quality material to encourage this, as they are not incentivised to do so by stretching targets or the risk of financial penalties. The same approach is also preventing innovation, in that there is no incentive to change the status quo. It is encouraging to see the current landfill tax regulations remaining firm but these too could be developed further, to incentivise waste managers and packaging producers to develop new systems for extracting materials from the waste stream. With regard to recycling, the targets are far too low and there is not enough focus on re-use or reduction, both of which are higher in the waste hierarchy.

91. Responsibility for funding waste management is largely borne by the taxpayer and again this is an approach that does nothing to promote improvement or innovation. The

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[16] *Managing Heat System Decarbonisation: Comparing the impacts and costs of transitions in heat infrastructure* (MacLean, Sansom, Watson & Gross, Imperial College, 2016)
17 *2020 renewable heat and transport targets* (House of Commons ECC Committee, 2016)

success of interventions such as the 5p charge on plastic bags, which led to an 85% drop in usage in England in its first six months, shows that regulatory interventions can be used to great success. It is encouraging that the Government is now considering the next logical step in this type of approach – a deposit return system for drinks containers. Currently less than 50% of the 24 billion drinks containers being sold in the UK every year are recycled. This type of system could deliver a 90% return rate, whilst delivering significant savings to local authorities and creating new jobs within the waste and resource management sector[18].

CPRE
February 2017

[18] *Have we got the bottle?* (Eunomia for CPRE, 2010)

Julie Sharman
Director of Asset Management

10 February 2017

National Infrastructure Commission
Email: enquiries@nic.gsi.gov.uk

Our Ref NIC response_10.02.17
Your Ref

Dear Sir/Madam,

Canal & River Trust response to National Infrastructure Commission "call for evidence"

The Canal & River Trust is the charity entrusted with the care of 2000 miles of waterways in England & Wales. Its abstractions of water support the canal environment and the wildlife which lives there, provide an attractive place for people to visit and enjoy as well as to work and live alongside and of course allows for boats to navigate the waterways. We believe that our canals and rivers are a national treasure and a local haven for people and wildlife. It is our job to care for this wonderful legacy – holding it in trust for the nation in perpetuity and giving people a greater role in the running of their local waterways.

The Trust believes that its waterways and associated assets can have an enhanced role in supporting wider UK infrastructure development, helping to deliver a low carbon, resilient and sustainable water sector and achieve a wide range of other positive outcomes to benefit society, the economy and the environment. The Trusts waterways are uniquely placed to provide connections across river catchments and political boundaries, and in fact already provide transfer routes for public water supply and high-speed fibre-optic data networks as part of existing infrastructure.

Our response to this call for evidence focusses primarily on the water and energy aspects of UK infrastructure and the opportunities the inland waterway network can provide. We would be grateful for the opportunity to provide more detailed information and copies of specific reports and studies in support of the views we have outlined below, and welcome the invitation to provide our input to the development of the UKs first National Infrastructure Assessment.

Yours faithfully,

Julie Sharman
Director of Asset Management

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

The Trust has a national role, with over 2000 miles of inland waterways in England and Wales, so cannot make specific comments in response to this question.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

The Trust, as a charity and navigation authority, does not have a specific viewpoint on this topic.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

As an example of influencing the design and deliver of large scale infrastructure, the input that the Trust has provided to HS2 has generally had a positive influence on the design, sense of place and character where the route alignment has the potential to impact the inland waterway network in our care.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

The Trust, as a charity and navigation authority, does not have a specific viewpoint on this topic.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

When considering our own assets, many of which are over 200 years old, we undertake a risk based assessment of the condition, serviceability and consequence of failure of each asset, allowing us to make informed, prioritised decisions as to the relative benefit or value of repair and renewal, as well as creation of new assets. The ongoing operating and maintenance requirements of existing assets are a paramount consideration, and need to be factored into the whole-life cost benefit analysis of any new infrastructure construction.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

In terms of changes to the regulation of public water supply through recent changes in legislation (Water Act 2014), the Trust believes that competition is an important intervention to ensure that our waterways can play a full part in solving problems with both water supply and sustainable drainage.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

The Trust, as a charity and navigation authority, does not have a specific viewpoint on this topic.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

The Trust does have some concerns on this aspect of infrastructure development, particularly in relation to the funding of collaborative schemes (such as water transfers via canals, between two or more water companies) and the viewpoint of the economic regulator is not fully developed in this area. To date, our recent work on collaborative canal transfers has focussed on the technical challenges, but the funding and regulatory aspects are becoming more critical to the successful progress of these options within the current Water Resources Management Plan (WRMP'19) work being undertaken by the water companies in England and Wales.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?
The Trust believes that the innovative and adaptive use of the inland waterway network can provide increased resilience (e.g. in bulk water transfer via canals) to the water sector, and in turn this can benefit the energy, industrial and agricultural sectors too.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?
In our experience, the current planning process sometimes limits the opportunity afforded by canal restorations and new canals, as these projects can take time to deliver, due to the time constraints it imposes on developments. We can provide examples of this to illustrate our viewpoint.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?
By its very existence, the inland waterway network that the trust cares for simultaneously provides important national infrastructure and valuable ecosystems and biodiversity, as well as preserving and enriching heritage. Our work ensures that the waterways continue to provide this benefit for UK society and the economy, now and for the future.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?
The Trust, as a charity and navigation authority, does not have a specific viewpoint on this topic.

Transport:
13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?
The Trust, as a charity and navigation authority, does not have a specific viewpoint on this topic at the scale of UK national infrastructure development. We would state that historically the inland waterway network provided the major freight arterial routes across many areas of the UK, prior to the development of the rail network. Whilst most canals are generally used for recreational navigation, there are still a number of significant freight opportunities on our inland waterways which can provide the UK with alternative options to allow the movement of bulk goods.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

The Trusts network of towpaths already provides a significant service for commuting and other modes of personal transport, in addition to the waterborne opportunities, in major urban areas such as London, Birmingham, Manchester and elsewhere.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?
Please see comment above, about the role that the inland waterways already play in providing transport routes across the 2000 mile network. There have been significant investments in improving the accessibility and condition of our towpaths in recent years, some of it funded by third parties.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?
The Trust, as a charity and navigation authority, does not have a specific viewpoint on this topic.

Digital communications:
17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?
The Trust, as a charity and navigation authority, does not have a specific viewpoint on this topic.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming
a utility? If not, how can we facilitate this?
The Trust, as a charity and navigation authority, does not have a specific viewpoint on this topic.

Energy:
19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?
The inland waterway network has the potential to provide local and regional scale solutions to heating and cooling, using the thermal energy (or dissipation capacity) within the canals we manage. The Trust already has a number of customers for heating and cooling applications, reducing energy consumption and carbon footprint. Case studies of these can be provided on request.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?
The Trust, as a charity and navigation authority, does not have a specific viewpoint on this topic.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?
The Trust, as a charity and navigation authority, does not have a specific viewpoint on this topic.

Water and wastewater (drainage and sewerage):

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country
where the difference will become most acute?
The Trust already provides bulk water transfer routes for a number of UK water companies, and these have been operating effectively for many years. The Trust is very positive about developing new transfer routes, and has procured a consultant study (part funded by five water companies) to assess the technical feasibility and costings (capital and operational) of a range of collaborative canal transfer route options. Further detail on this was submitted to the NIC in the call for ideas (October 2016) and a copy of the study can be made available to the Commission on request. The outputs from the study are currently being evaluated by the respective water companies as part of their options appraisal for WMRP'19 development. Key contacts within the Environment Agency and Ofwat are aware of the study and its aims.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?
One area of particular concern to the Trust has been the failure to implement the provisions set out within the Flood & Water Management Act 2010, in relation to Sustainable Drainage Systems (SuDs). The Trust believes that the current arrangements, introduced in the past couple of years, do not go far enough in requiring SuDs to be implemented for new developments, and hence this is an important intervention. In addition, the Trust is developing its own Flood Risk Management Strategy at present, which will set out the role and responsibilities we have in relation to flood risk, and how we will work with other stakeholders to try to effectively manage the risk of flooding both to and from our network.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?
The Trust considers itself to be well placed to provide local, development scale solutions to help address the challenges of water supply, wastewater and flood risk. In many locations, our waterways already form an integral part of the catchment system, taking surface water runoff (and occasionally treated effluent) from developments and other infrastructure owners (e.g. water companies), as well as providing the bulk water supply options discussed elsewhere in this response.

Flood risk management:
25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?
The Trusts view is that a single national level of resilience to flooding is inappropriate, and instead the resilience ought to be informed by the diligent and objective assessment of costs and benefits (monetary and non-monetary) of schemes and flood risk management practices and interventions.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?
The Trust has had limited experience of natural flood management schemes, but following the December 2015 flood events, which led to around £15 million of damage to our waterways assets

(principally in the north) we have been working with other stakeholders to consider the role the canals can play in wider natural flood risk management solutions.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

Through its varied activities of maintenance and repair and renewal of our waterway assets, along with the customer service role provided to boaters, the Trust does have a significant challenge with solid waste disposal. Much of our effort in recent years has been working with our main waste contractors to maximise diversion of waste from landfill, but there is still further work in this area to improve recycling rates, both of our own activities and our customers and contractors. Our experience of working with a single main national waste contractor has highlighted some issues with the local provision of waste segregation, as well as the common issues of fly-tipping and cross-contamination of the waste services we provide across our 2000 mile network of waterways.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

The Trust, it its capacity as a charity and navigation authority, does not have a specific viewpoint on this topic.

NATIONAL INFRASTRUCTURE ASSESSMENT call for evidence: October 2016

Canary Wharf Group is the owner, developer and manager of the Canary Wharf estate in east London. The success of the Canary Wharf district has demonstrated the close interrelationship between infrastructure provision, principally transport but not exclusively, and economic regeneration, and we believe that our experience is unsurpassed. As far as the UK is concerned the need for more infrastructure to support regional growth is accepted however all indications suggest growth in London will remain dominant. Government has rightly focused on the desperate need for more housing nevertheless sustainable communities also need access to jobs and amenities.

The NIA ask **"What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?"** and while we accept that east London has benefitted from major transport improvements over the last two decades it has developed from a very low base. Historically public transport accessibility north and south of the river east of Tower Bridge has been poor (or non-existent) and if London is going to accommodate the growth expected in the next ten years additional transport capacity will be necessary. However much of the brownfield land available for London's growth is in east and south-east London in areas currently poorly served by public transport.

This submission is based on Canary Wharf Group's submission to the Thames Estuary Commission "Call For Ideas". We believe that the very high growth potential of the Thames Estuary justifies it as a specific area of interest for the provision of new infrastructure. Canary Wharf is one of the key economic hubs of the Thames Estuary and we believe that a plan to accommodate much of the anticipated growth of London and the south-east of England in the Thames Estuary should be based on these economic hubs and the clusters that may form around them together with the infrastructure required to support that growth. The primary hubs are already established: Canary Wharf, Stratford, London City Airport, Excel, Lakeside and DP World London Gateway port on the north side and Greenwich, The O2, Bluewater and Ebbsfleet on the south side. These hubs would be a stable or growing location employing more than [2,000] people.

Canary Wharf is the economic apex of the Estuary with about 120,000 employees today, eventually reaching 180,000, with up to 50,00 more jobs elsewhere on the Isle of Dogs. With transport links from north and south of the river converging at, or close to Canary Wharf, it is effectively the Gateway to London which makes it the most significant hub. Additionally there is both physical and economic space for additional hubs, in particular in Barking & Dagenham and in North Bexley – two sites capable of supporting significant further development. Interestingly these two large opportunity areas would fill the gap between the clusters of activity in Docklands and those either side of the Dartford Crossing. Once these new hubs are identified, transport connections will be necessary to link them, together with links to nearby areas of residential development.

While transport infrastructure is an important determinant of where people choose to live the viability and sustainability of new communities relies on more than transport; jobs and access to amenities and facilities are crucial. Consequentially improving the connectivity between the hubs in east London and the Thames Estuary, linking homes with jobs, is vital.

INCREASING CONNECTIVITY: THE BAKERLOO LINE EXTENSION

Canary Wharf Group has recently discussed with Transport for London the enhancement of the Mayor of London's proposal to extend the Bakerloo line to Lewisham, the viability of which was previously questioned by the NIC[1]. By introducing an additional branch from Old Kent Road to Charlton via the Isle of Dogs, four more Major Opportunity Areas can be served. This would help facilitate additional housing in the areas of east and south-east London identified in the London Plan for accommodating growth and up to [100,000] new homes could follow so dramatically enhancing the viability of the Mayor's proposal. It would also provide relief for the North Kent Line with passengers disembarking at Charlton to travel into Canary Wharf and central London, and for the Jubilee line by reducing the numbers arriving at London Bridge. It would also relieve pressure on the DLR at Greenwich and Lewisham. Furthermore the link to Charlton would improve connectivity for the whole of North Kent and future extensions could bring the Underground to north Bexley.

Benefits of the Bakerloo Line extension to Charlton via Canary Wharf:

- Old Kent Road station facilitates regeneration of planned homes and jobs in the Old Kent Road Opportunity Area
- Interchange at Surrey Quays will relieve congestion at Canada Water station on the Jubilee line giving choice to transfer passengers from London Overground
- Surrey Quays station supports regeneration of planned homes and jobs in the Canada Water Opportunity Area
- Charlton station facilitates regeneration of planned homes and jobs in the Charlton Riverside Opportunity Area
- Provides the O2 Arena with alternative access/egress necessary to optimise the venue's potential.
- East Greenwich station supports planned increase of new homes in the Greenwich Peninsula Opportunity Area
- By complementing Jubilee line and Crossrail stations a new South Quay station would increase the 10 minute walk catchment area on the Isle of Dogs from between 10,000 and 30,000 new homes (approximately)
- Overall the proposed extension would support approximately [25,000] additional new homes along the corridor.

INCREASING CONNECTIVITY: CROSSRAIL TO EBBSFLEET

Canary Wharf Group has always promoted Ebbsfleet as the terminus of the southern branch of the Elizabeth line/Crossrail 1. While Abbey Wood provides a good link to the North Kent Line, Ebbsfleet opens the possibility of connections to High Speed One and the rest of Kent. The intermediate stop (or stops) between Abbey Wood and Ebbsfleet at Erith, Belvedere, Slade Green and Dartford would then become potential major development sites with relatively low land and house prices. We would suggest that Crossrail be extended at least to Slade Green, and for work be done to identify potential major development opportunities there.

INCREASING CONNECTIVITY: CROSSRAIL LINE 2 TAKES OVER SHENFIELD BRANCH OF CROSSRAIL 1

We would suggest that consideration be given to linking the Shenfield branch of Crossrail 1 into the Crossrail 2 route, leaving the main line of Crossrail from Whitechapel to go to Abbey Wood / Ebbsfleet via Canary Wharf. The connection from Crossrail 2 to the Shenfield Branch could be from Hackney into Stratford and then on to Shenfield, a relatively short link. This would double the capacity on the Abbey Wood branch from 12 to 24 trains per hour, allowing its extension to

[1] "Transport for a World City", National; Infrastructure Commission, March 2016

Ebbsfleet and dramatically improving capacity for Canary Wharf, Excel, Woolwich and Abbey Wood. It would provide the capacity and connectivity needed for major developments including new hubs at Slade Green and Ebbsfleet.

INCREASING CONNECTIVITY: ADDITIONAL RIVER CROSSINGS

Despite some reservations due to the design and the impact on already congested roads, we support the proposed Silvertown tunnel. We believe that this should be only the first of a series of new crossings. There are 27 road bridges within the M25 west of Tower Bridge and just two tunnels and a ferry to the east of Tower Bridge. While this reflects east London's history as a port accommodating large ships, the future of the Estuary must be in closer co-operation north and south of the river. A cross-river journey for people in west London is simply taken for granted with many people traveling to work or school on the other side of the river. For anyone living east of Tower Hill, a cross-river journey is often a long detour. Canary Wharf Group through its ELBP initiative has succeeded in placing contracts worth more than £1.4bn with businesses in east London but to date these have predominantly been located north of the river. Businesses in south-east London have been at a serious disadvantage due to access difficulties via the Blackwall Tunnel. The Silvertown Tunnel will therefore open up opportunities in Canary Wharf for small and medium size companies in south-east London, which will widen the reach of prosperity, generated by the Canary Wharf economy. However if areas of the Thames Gateway further east are to prosper, further road crossings will be essential to complement the development of radial rail improvements north and south of the river. For example it is no surprise that the two shopping centres at Lakeside and Bluewater are situated either side of the M25 bridge at Dartford – having a river crossing doubles the potential catchment area. So we also strongly support potential bridges or tunnels at Gallions Reach, Belvedere, and the proposal for a lower Thames Crossing.

SECURING INVESTMENT: USING NEW FORMS OF PARTNERSHIP

We would suggest that the Government look at the mechanisms used to fund Crossrail, and the principles behind them, as part of the funding packages for new infrastructure investment. In particular we suggest that consideration be given to:

- Tax Incremental Financing (TIFs) – borrowing against future tax revenue generated by developments
- Land Value Capture mechanisms – identifying landowners who are likely to see significant value increases and capturing a small part of that increase, including doing individual bespoke deals like those involving Canary Wharf Group and Berkeley Homes in the case of Crossrail
- Using the Mayoral Community Infrastructure Levy (CIL) or a new CIL levied by an Estuary Agency
- Bonds – borrowing secured against perhaps a basket of different income streams
- Local authorities should be allowed to keep taxes generated from new developments for a period of years. The Government has stepped gingerly in this direction but should be bolder. If local authorities get a windfall from new housing or commercial development they are much more likely to create the conditions in which development can be brought forward. It would also help facilitate TIFs, tax incentives and other mechanisms.
- Brexit may, conceivably, create opportunities to avoid EU State Aid rules – which currently prevent significant tax advantages being offered as incentives – although this will depend on the deal eventually struck with the EU.

Crossrail has proved that mechanisms for capturing the value of land – however crudely implemented so far – are realistic propositions. We think that there is real

scope for the Estuary to be the lead in developing innovative funding mechanisms.

FURTHER INFRATRUCTURE REQUIREMENTS: FIXING THE ROADS
The roads network between central London and the Thames estuary has been severely compromised by the former Mayor's decision to remove road capacity on the most important east-west arterial road in order to provide segregated cycleways. While Canary Wharf Group strongly supports cycling, this decision has reduced the capacity of the main road north of the river linking Docklands to the City and the West End. Recent studies have suggested that journey times on this route are up to 4 times worse that Transport for London predicted. This in turn has adversely impacted on air quality contrary to the Mayor of London's "Healthy Streets" initiative. Urgent work should be done to identify solutions to the current and worsening congestion on east-west roads including how to improve capacity on these crucial routes or even to build new capacity.

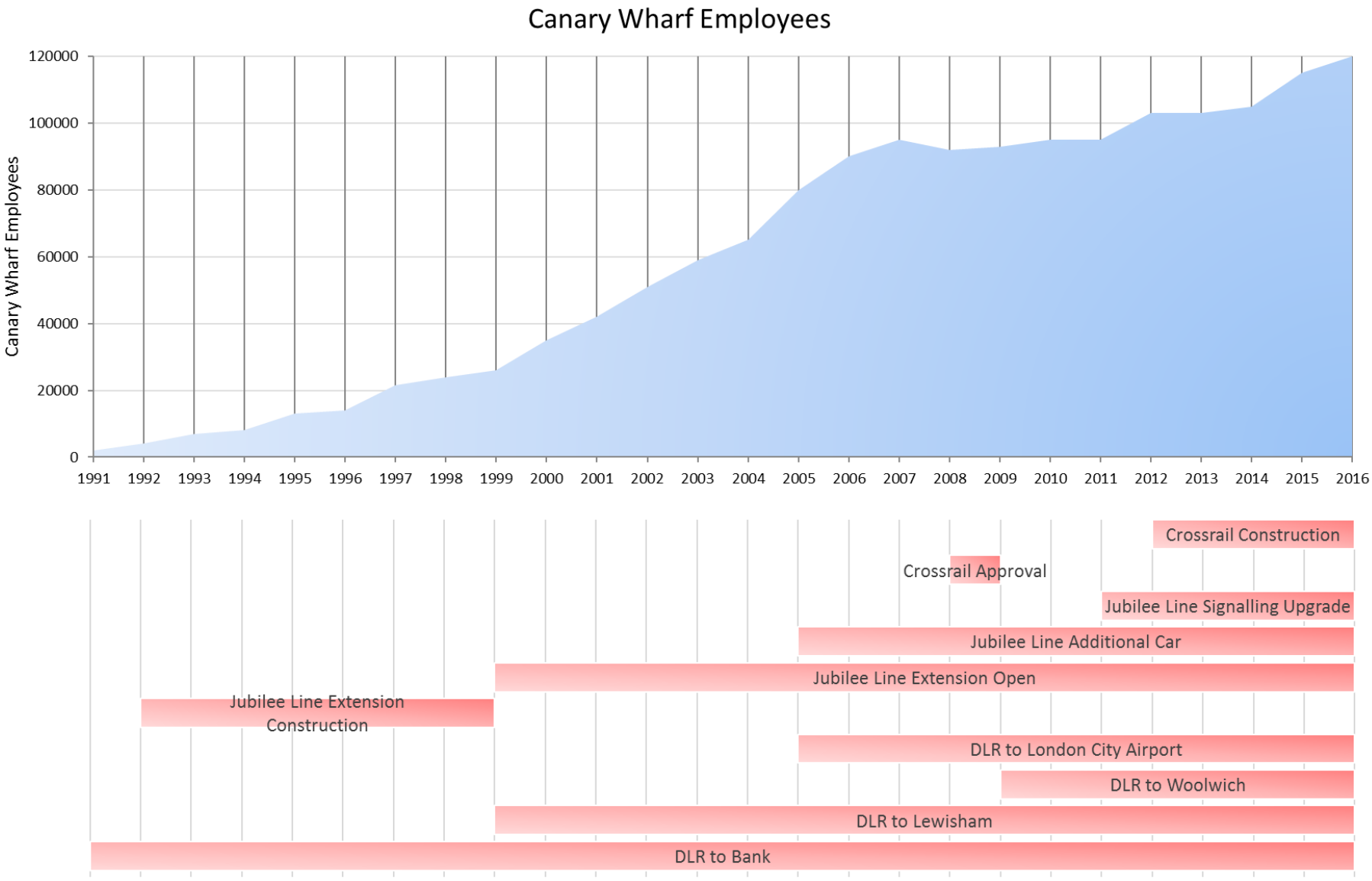
Now that there has been a positive shift in public opinion towards road pricing following the introduction of toll roads, congestion charging and the Ultra Low Emission Zone, also with the application of new technology, it might be possible to look at commercial only routes, where service/delivery vehicles and buses could be separated from other traffic to ensure arterial commercial routes are maintained. There is also a need to review the medium-distance traffic travelling to and through London to determine whether it could be better routed and managed. The Estuary should not be congested with traffic trying to get to the other side of London.

ADDITIONAL EVIDENCE;
Canary Wharf Group has amassed a considerable amount of information over more than 20 years, which includes the changing travel patterns and the home locations of employees on Canary Wharf linked to infrastructure enhancements such as the DLR and Jubilee line and we would be pleased to share our knowledge and experience. The attached graph shows how the introduction of new transport infrastructure related to the increased number of jobs at Canary Wharf. Employment on Canary Wharf and the Isle of Dogs has the real potential to grow much more but will be constrained without additional transport capacity.

In addition, the improvement of public transport capacity and the connectivity that it provides has increased the attractiveness of the Isle of Dogs for new housing with dramatic effect. In the early 1990s the population of the Isle of Dogs was around 12,000 and as more housing was built with the opening of the Jubilee line extension in 1999 it grew to 27,500 by 2007. It continued to grow reaching 40,251 by the time of the national census in 2011[2]. The opportunity for growth originally identified in the London Plan indicated an additional 10,000 homes. The GLA now expect a minimum of 30,000 extra homes[3]. The current population is estimated to be about 54,000, which would more than double by 2021 if development plans in the pipeline are implemented. But this will be constrained by infrastructure, as the capacity of the Jubilee line and the DLR, even with the Elizabeth line/Crossrail 1 and other improvements currently planned by TfL, will be insufficient. Furthermore without a step change in capacity the lack of transport will constrain development over a much wider area of east and south-east London.

Submissions by Friday 10 February 2017 by email to; NIAEvidence@nic.gsi.gov.uk

[2] http://www.towerhamlets.gov.uk/Documents/Planning-and-building-control/Strategic-Planning/Neighbourhood-Planning/Options%20appraisal%20related%20to%20the%20area%20boundaries%20IOD%20NPF.pdf
[3] https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/opportunity-areas/opportunity-areas/isle-dogs-and-south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Crossrail Construction
Crossrail Approval
Jubilee Line Signalling Upgrade
Jubilee Line Additional Car
Jubilee Line Extension Open
Jubilee Line Extension Construction
DLR to London City Airport
DLR to Woolwich
DLR to Lewisham
DLR to Bank

carillion

Making tomorrow a better place

Carillion submission to the National Infrastructure Assessment Call for Evidence

It may be helpful in the first instance to outline some background information on Carillion. We are one of the UK's leading integrated support services companies, with extensive construction capabilities, a substantial portfolio of Public Private Partnership projects, and a sector-leading ability to deliver sustainable solutions. We employ 20,000 people in the UK, and over 46,000 people worldwide. We are also the country's largest private sector provider of construction apprenticeships, and we are proud of the work we do with our young learners across our network of 11 UK wide training centres.

Our services include: facilities management, energy services, road maintenance, rail services, remote site accommodation services and consultancy services. We also have expertise in delivering major Public Private Partnership (PPP) projects, including Government buildings and infrastructure mainly in the Defence, Health, Education and Transport sectors in the UK and Canada. Our construction services activity includes building and civil engineering activities in the Middle East.

In our response to the consultation, we have focussed on those areas where we have experience of delivery and where we feel we are able to add value with our comments.

Question 2: How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

For a number of countries, international competitiveness is linked to their ability to design and construct infrastructure abroad. This is often based on experience accrued in the home market.

In the case of High Speed Rail, our competitors from continental Europe have developed their High Speed Rail expertise largely from independent contracts (not JVs) in their home market. They are now seeking to deploy this expertise in the UK on HS2. UK contractors on the other hand, have considered it necessary to enter into consortia with these organisations to develop this expertise, rather than it being nurtured by the UK as a capability ready for export.

PPP was a UK invention and has delivered strong success, especially in the highways, education and health sectors. The home market for PPP has since declined, however UK companies have been able to take their PPP experience abroad, particularly to North America.

A consideration in the award of contracts in the home market should be the ability to export the experience gained, ultimately contributing to the UK's international competitiveness.

Question 3: How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

In our experience, the construction of infrastructure, and its subsequent maintenance and renewal, does offer the opportunity to provide a number of other benefits to society, regardless of the primary

function of the infrastructure. These subsidiary benefits are usually referred to under the title of "Sustainability" and cover the following areas:

- Employment opportunities for the local workforce, which will in turn boost the local economy. SMEs will benefit from supply chain spend.
- Training and development of employees and potential employees can be carried out for people working on the infrastructure.
- The infrastructure can form the background to local educational initiatives.
- The local environment can be enhanced - this is generally proposed as a mitigation for changes brought about by the new construction, but overall enhancement is also possible.
- Temporary measures, such as access and utility connections, can be reused by the local community once the infrastructure is complete.
- The infrastructure may facilitate other developments nearby.

Client organisations for infrastructure can encourage these activities via:

- Mandating these initiatives in construction contracts, to prevent work being bid on a cut price basis.
- Selection of delivery organisations on wider criteria, including skills in sustainable delivery.
- Providing contracts with sufficient continuity or aggregation to allow for skills development etc.

In terms of the design, planning and delivery of infrastructure projects, Carillion believe they should be done in a way that not only provides better places to live and work, but that they increase productivity and Gross Value Added (GVA) both at a local and national level.

Additionally, infrastructure plays a key role in improving the attractiveness of places to live and work, and for developers and businesses to invest. Carillion supports the £2.3bn Housing Infrastructure Fund announced by the Chancellor in last year's Autumn Statement and considers this a key enabler for the construction of 100,000 homes in areas where they are most needed.

Such is the importance of infrastructure as an enabler for housing and commerce, Carillion would encourage the National Infrastructure Commission to be bold in promoting infrastructure projects that stimulate regeneration and investment. Crossrail and the Jubilee Line/DLR are good examples of this, with both projects resulting in significant new housing and the regeneration of Docklands as a prosperous part of the City of London. Manchester's Metrolink extension to Media City has also boosted investment in Salford Quays.

The interaction between infrastructure and housing should be as seamless as possible, and should be completed where possible, without causing a nuisance or having a detrimental effect on air quality etc, specifically in relation to rail and road. In our experience, if the infrastructure is installed (or at least planned) in the first instance, housing can be configured in such a way that these impacts are reduced; there is a natural incentive for housing developers to do this in order to enhance the value of properties. In urban and inner city areas, we feel particular emphasis should be paid to the accessibility of public transport as a means of reducing congestion and improving air quality.

Question 5: How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

Before answering the above, it is perhaps worth outlining our understanding of the term 'existing assets'. Our experience shows that assets generally fall in to one of two wide categories:

- Generally records are available and, certainly since the 1950s where standards are approximate to those we use today.
- Those where records are frequently unavailable, a significant amount of unrecorded change will have occurred and where standards were used that a very different from what we use today.

There are obvious examples that do not follow this categorisation, however examples of older infrastructure include the railways, city streets, early sewers etc. Newer infrastructure would include airports, motorways and main utility networks.

Where existing infrastructure requires an upgrade there are two factors that will affect the ease/cost of upgrade - how run down it is, and how much it is being used. This is further complicated when the underlying condition of the asset is not properly understood. Lightly used, existing infrastructure is generally capable of being upgraded because adequate access can be arranged to carry out the work efficiently. This also applies where alternative arrangements (i.e. diversions) can be applied.
Taking transport as an example:

- Motorways, which are generally 20 to 50 years old, can be readily upgraded - with traffic restricted to narrow lanes and speed limits.
- Victorian railways, all more than 100 years old, are of poor underlying quality (which is not properly understood) and very busy – these are difficult to upgrade. This is made all the more difficult by upgrades being carried out with little attempt to provide appropriate access for the work.

It is Carillion's belief that more thought should be given to the construction of new (parallel) infrastructure to complement our aged infrastructure. The Thames Tideway is a good example of where this method has been utilised to good effect.

Question 6: What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Competition
Carillion feel that the complexity of tenders and the resulting costs are extremely high for UK infrastructure contracts - with at least four businesses tendering for any one project, a significant amount of money is spent on tendering. Complex tenders also require a lot of effort / cost to adjudicate, within the client team, which of course adds further expense.
Increased use open tendering procedures following changes to Public Contracts Regulations in 2015 are compounding things further, with prequalification processes often dispensed with leaving contractors competing against an undefined number of bidders.

More considered use of alternative procurement procedures (e.g. restricted procedure) would help to alleviate these problems, as well as a greater focus on tender deliverables, avoiding excessive tender costs where appropriate. We would draw reference to recommendations in the recent

Procurement Report developed by the Civil Engineering Contractors Association (CECA) which Carillion contributed to. The report is available here: http://www.ceca.co.uk/media/246624/ceca-procurement-report-2016-master-for-upload.pdf

Collaboration

UK infrastructure rightly places a lot of importance on collaboration; where this works Carillion feel it adds value to any project. In our experience successful collaboration will ensure that end users of infrastructure make their requirements clear and empower designers / contractors to provide efficient solutions to meet these requirements. Unfortunately, in practise we have found that:

- Collaboration occurs in pockets – there is a lack of connection between users and constructors; for example, in the Rail sector, there is collaboration between train operators and Network Rail maintenance and then disconnected collaboration between Network Rail's Infrastructure Projects Division and contractors. For successful delivery collaboration needs to become more seamless.
- Too much credence is often given to academic/abstract collaboration instead of teams properly working together.
- It is often used as an excuse for poor project management.

We have also found that some recent tenders have attached so much importance to collaboration that the ability of organisations to actually deliver the work has been overlooked.

Internal collaboration within customers and contractors is also important; a lot of opportunities for innovation and cost saving are lost via the internal divisions between engineering, programme and cost teams.

Question 7: What changes in funding policy could improve the efficiency with which infrastructure services are delivered? Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

The current funding policy of infrastructure projects encourages a stop/start approach to the delivery of new assets, as the funding is frequently allocated on a project by project basis. This has several negative effects on the delivery of projects:

1. It discourages training and development of staff – it is hard to complete training programmes on the back of short term projects. This is having both a long term and short term impact on the ability of UK companies to deliver infrastructure projects, and results in the well published skills shortages which the construction industry now faces.
2. Without continuity, there is less incentive to innovate.
3. Poor investment in plant and equipment.
4. Less efficiency, due to the lack of a "learning curve".

To counter these negative effects, Carillion believe that more work should be let on the basis of PPP, with a programme of work, followed by a period of maintenance. In our opinion this would counter

the negative aspects above and bring the benefits of knowledge about maintenance effort/costs, and in turn encourage innovation.

Although we have made reference to concerns regarding how infrastructure projects are funded, it is also perhaps worth saying that we are also concerned about the quality of the covenant of the funder.

For example, Carillion will be more comfortable if the customer is a central government department or central government agency, as opposed to a local authority with a poor financial history.

Question 8: Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets? Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

It is our understanding that projects which could be funded by government but might not be financed by private sector investment and borrowings, would include projects where the payment mechanism introduces a high level of risk that the private sector will not get its money back. In many areas such as demand risk transfer and toll roads. Other projects that fall within this category would be those where the risk is derived from a change in government policy, for example, solar projects where revenue is derived from feed-in-tariffs or immigration centres etc.

Question 9: How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors? Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

In our opinion, the most effective solution to increased resilience is having a diverse infrastructure network based on the various modes (road, rail, aviation, light rail, pedestrian, cycling) - Should use of one or more mode grow exponentially in the future as, say, technology begins to have a greater influence, then this diversity would give greater resilience.

Resilience for individual modes can be ensured by sustained investment in maintenance and development, supported by clear policy making and planning. The transition to a 5-year funding model in Highways through the Road Investment Strategy, is a good example which sets out how the Department for Transport and Highways England intend to deliver some £15 billion of investment through over 100 major projects on the Strategic Road Network between 2015 and 2020. This has parallels with others sectors such as Rail (Control Periods) and Water (Asset Management Periods).

However, we must be cognisant of the increased role technology and automation will have on infrastructure and begin to design and future-proof our networks as best we can to accommodate such changes. This includes the anticipated transition to driverless cars and the use of unmanned aerial vehicles. We must also take heed of increased threats from terrorism and cyber-attack and design our infrastructure in such a way that it provides sufficient physical and technological protection, thereby ensuring that users remain safe and satisfied.

Question 10: What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

In an effort to ensure infrastructure is delivered as efficiently as possible and on time, Carillion believe that government should urgently remove all planning restrictions on brownfield sites so there is a presumption in favour of development. Through incentives, government should also create a culture where UK pension funds are invested in infrastructure, in much the same way that Canadian pension

funds do. We would also like to see government departments and non-departmental public bodies, such as the Ministry of Defence and Network Rail, make under-utilised sites available for development immediately.

On a broader note, Carillion welcomes the National Infrastructure Commission's role in looking at infrastructure needs over a 30-year time horizon, supported by the National Infrastructure Planning regime (National Policy Statements, Nationally Significant Infrastructure Projects etc).

Question 11: How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

The planning and design of infrastructure projects needs to consider longer-term impacts of activities rather than short-term gains. It should not be more costly to deliver a low carbon design, however, to make this possible there needs to be better collaboration between all industry partners to make circular, low carbon, low impact possible.

Carillion believe that a more considered approach, with the environment at the core of any planned works, not just an afterthought to be compliant with legislation, is required to protect the natural environment. A behavioural change, with the adaptation of new low carbon and innovative technology that reduces/limits environmental impacts is also required.

It is our belief that low carbon targets cannot be met by operational savings alone. We need to consider a whole life cycle approach to carbon from raw material, processing, manufacture, in-use, re-use, and end of life (disposal). This drives a need for infrastructure design to specify low Embodied Carbon requirements (materials and process) and therefore more needs to be done by government in terms of legislation to drive further action.

Government should consider the development of internationally recognised standards to manage and reduce carbon and more should be done to implement PAS2050 and PAS2080 as standard across industry.

On a more general point, infrastructure projects should stipulate a number of the above mentioned solutions (design it in) from the outset – that way contractors would have to (all) deliver against it, thus levelling the playing field for all, and would have to develop skills to support that – both during construction and during the in-life phase. If the client does not ask for it, contractors will continue to struggle to offer it in fiercely competitive markets.

CAUSE

Infrastructure first

10 February 2017

Dear Sir

National Infrastructure Commission Call for Evidence

We welcome the opportunity to respond to this call for evidence and to assist in the identification of long term infrastructure challenges and in highlighting the priority areas for action in the medium term. We write in the context of proposed housing growth. It is essential that infrastructure planning, funding and delivery is better integrated into Local Plans and that infrastructure needs are identified and delivered before housing.

We would be pleased to participate in any relevant round-tables. As a volunteer-run lobbying group we believe that we offer a unique perspective.

About CAUSE www.cause4livingessex.com

CAUSE (Campaign Against Urban Sprawl in Essex) is a think tank lobbying for infrastructure to be planned and built before housing. CAUSE worked with Dr Nicholas Falk, Wolfson Economics prize winner, and appointed transport and planning consultants to conduct research and create a vision for north Essex. We concluded that transit-oriented development is the best way forward and launched our findings at a conference, "Visions For Growth", in November 2015. We are planning a follow-up networking event on what makes development successful, jointly with Essex University. CAUSE responded to the Local Plans Experts Group consultation and as a result we were invited to attend a round-table last year.

Our response to the call for evidence

We have chosen to answer questions 1-16 by way of a brief north Essex case study which brings together answers to many of the questions relating to transport and infrastructure requirements. Our perspective on infrastructure is that it must be the basis for decisions on housing locations and must be provided before new housing. Developer contributions must be used more effectively, and the various parties involved in infrastructure delivery and funding must work more closely together.

NORTH ESSEX CASE STUDY

Background & issues

For the purposes of this case study, we will use the North Essex Garden Communities project area of Tendring District, Colchester Borough and Braintree District as the area for discussion. The three local authorities must plan for around 45,000 homes over the next fifteen years.

Much of the long-term housing need is proposed in three garden communities of between 7,000 and 17,000 homes.

Infrastructure first

Colchester and Braintree are fast-growing towns and both export labour, much of it to London on the Great Eastern Main Line (GEML), which is approaching capacity. Much of Braintree's economic growth is focused to its west, towards Stansted and the M11 corridor. Much of Colchester's economic growth is focused around Essex University and its 'Knowledge Gateway'. In Tendring District there is employment at Harwich Port, but a significant number of Tendring's workers commute westwards into Colchester and beyond. Aside from London commuters on the GEML, all three districts are car-dependent. The flow of workers creates strain on the area's transport infrastructure.

Infrastructure funding and delivery is confused: local authorities have their transport provided by Essex County Council, the area falls into the South East LEP, and of course Network Rail/Abellio have responsibility for the railways/trains and Highways England for trunk roads. Infrastructure has not kept up with housing growth.

The missing link in the north Essex Local Plans is a regional transport and infrastructure strategy. In particular, the garden communities are being planned in isolation, and located without reference to the wider economic area. Opportunities to improve the region's infrastructure and economy have been missed in the rush to locate houses at all costs. Lack of vision is leading to the wrong decisions about where to locate housing.

This week's Housing White Paper makes some welcome references to the need to integrate infrastructure with new housing but does not go far enough. The £2.3bn infrastructure pot will barely scratch the surface and the thrust of the paper is still directed towards delivering housing at all cost. Land value capture is critical and the review of developer contributions which Government is carrying out is much needed and offers an excellent opportunity to do things better in the future. There must be a means of capturing land value from every new home to deliver infrastructure across a district, not just infrastructure associated with the development itself.

How could things be done better?

The Oxford-Cambridge National Infrastructure Commission case study cited in the Housing White Paper this week illustrates the approach which we believe is needed in North Essex, particularly the alignment of strategic infrastructure delivery with housing, to support the economy. It is exactly the strategy which is required to develop the regions around London, rather than the London-centric development we are seeing at 17,000 home 'West Tey' new town in north Essex. This is a proposed settlement which cannot be sustainable without huge infrastructure investment, particularly in the Great Eastern Main line.

We believe that our local authorities should look first at the economic opportunities afforded by the area, and the existing infrastructure constraints and opportunities. In conjunction with Government, the NIC, the SE LEP and Essex County Council, transport providers a plan for the area should be put in place and then decisions on housing growth should be made.

Instead, the opposite is happening. Land-owners have offered up their land for garden communities in three locations. The local authorities have accepted their offer and are trying to backfill the evidence and backfill the infrastructure to justify the locations.

CAUSE

Infrastructure first

What might a vision for north Essex look like?

1. METRO PLAN

CAUSE's Metro Plan is a truly 'infrastructure first' proposal which provides the opportunity to link jobs, housing and infrastructure. It makes use of the **underused transport asset of the Colchester-Clacton electrified railway which could provide a frequent local metro service**. The line offers a sustainable transport solution which will help to reduce car dependency and to generate economc growth. It could deliver 6-8,000 dwellings within a 10-minute walking catchment of high quality public transport. Each 'pearl' on the necklace would support low order services such as primary schools, doctor's surgeries and shops. High order services would be access in the urban centres.

Essex University and its Knowledge Gateway (**ideally with a new rail station**) could provide the focus for an eastward urban extension to Colchester providing up to 10,000 dwellings. This would support a high quality 10-minute express bus service linking to the town centre. The Metro Plan supports the local economy and is based around the jobs of the University, the Knowledge Gateway, Colchester Town Centre and the ports. A new railway station serving the university would bring additional economic growth.

Neither the potential of the Colchester-Clacton line nor the benefits of a new station at the University are being explored by our local authorities.

Brownfield land is not the focus of this call for evidence but it must be used first and infrastructure put in place as appropriate.

2. TRANSPORT STRATEGY

A transport strategy is needed for each district. Taking Colchester as an example, the historic fast growth (850 homes per annum) and the planned future growth (920 homes per annum) mean that the roads are congested. Colchester Borough Councillors and Essex County Councillors pass the buck on transport decisions. Local people want to see a realistic plan, implemented by the Borough, with developer contributions from new homes invested into infrastructure. All options must be on the table for discussion: Workplace Parking Charging (Colchester has a very high rate of private car spaces), road pricing/flexible congestion charging, Park & Ride times to suit commuters, Cycle-ways, better bus services, new road links, better rail services etc. This has not happened, resulting in opposition to the relentless growth of the town.

3. LONG-TERM VISION

The GEML is in need of substantial investment to deal with increase in demand due to population growth across the whole of Essex. Last year's Anglia Route Study set out a range of interventions needed to meet the forecast increase in passengers to 2043 and these need funding and scheduling in a control period. Until such a time as the number of trains per hour can be increased to the level set out in the Anglia Route Study, there should be an embargo on significant development along the line.

For a map illustrating the points above, please click here: CAUSE map

What might make a difference to delivery of infrastructure in north Essex?

There is no silver bullet. Perhaps leadership is the key one of the bullet points below, to bring them all together, but all these factors need to be taken into account to ensure that the right infrastructure actually gets delivered at the right time:

- Transport infrastructure investment – GEML, Colchester-Clacton line, new station at the University of Essex, dualled A120, A133 link.
- Improved methods for capturing land value uplift from every single home built.
- Pooling of developer contributions to benefit areas beyond the immediate area of impact of a development.
- A regional plan integrating the economy, housing and infrastructure and district level transport and infrastructure plans.
- Leadership.
- Better public / private communication and joined-up working between Local Authorities, Essex County Council, SE LEP, NIC, Network Rail, Highways England, Abellio.
- Awareness of all funding types available e.g borrowing against future tax receipts.

Thank you for the opportunity to comment.

Yours sincerely

[name redacted]

[position redacted]

CAUSE

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CBI response to the National Infrastructure Commissions' Call for Evidence to provide input into the development of its National Infrastructure Assessment

1. The Confederation of British Industry (CBI) welcomes the opportunity to respond to the National Infrastructure Commission's Call for Evidence to provide input into the development of the National Infrastructure Assessment. The CBI is the UK's leading business organisation, speaking for some 190,000 businesses that together employ around a third of the private sector workforce. With offices across the UK as well as representation in Brussels, Washington, Beijing, and Delhi, the CBI communicates the British business voice around the world.

2. From the roads, railways and airspace that connect the UK, the homes people live in, to the energy supply that powers homes and businesses, infrastructure provides the essential foundations business needs to deliver jobs, growth and prosperity for all. Indeed, according to CBI's latest research, 'Unlocking Regional Growth'[1], better-connected cities have increased productivity allowing businesses to draw on a larger pool of skills and talents, establish larger markets and supply chains, and stimulate knowledge spill over. Infrastructure enables higher regional productivity to be unlocked, with the potential to add £208 billion to the UK economy over the next decade.

3. The CBI firmly supports a long-term evidence-based approach to infrastructure and the proposals, originally made by Sir John Armitt, for a National Infrastructure Commission (NIC). This issue has been consistently highlighted as a top priority for CBI members which include investors, contractors, operators and users of UK infrastructure. According to the CBI's Infrastructure Survey 2016, over two thirds of all firms (68%) are of the opinion that setting out a long-term plan is a 'critical' function of the NIC with over half (54%) seeing the NIC playing an important role in joining up the UK's infrastructure networks.[2] As such, analysing the infrastructure needs facing the UK over a 30 year horizon through the National Infrastructure Assessment (NIA) is a positive step forward.

4. Future-proofing the UK's infrastructure by providing a holistic and strategic approach will also be critical to 'Brand Britain' and our long term prosperity. According to the CBI's Infrastructure Survey, 64% of respondents felt that the UK was unlikely to be more internationally competitive in 2050 than it is now.[3] With the UK currently ranked 24th in the world for the overall quality of its infrastructure,[4] an evidence-based assessment of longer term need is the most robust means of ensuring the policies of today are shaped by the infrastructure needed tomorrow. As the UK begins its withdrawal from the European Union, there will be a greater emphasis on the UK as a global trading nation, and high quality infrastructure will play a key role in underpinning this ambition. This will also be crucial for the success of a Industrial Strategy domestically, which should help to remove regional inequalities and build a modern economy as the foundation for a prosperous, fairer and more inclusive society.[5]

This response seeks to offer suggestions rather than recommendations for the NIC to consider as it sets out a vision for the NIA in 2017:

- **On the cross-cutting themes:**
  - **Understanding how the UK interacts with its infrastructure provides the best evidence on which to set out a long-term needs-based assessment.**
  - **Clarity and direction of infrastructure policy should be maintained over political cycles with plans across government departments and agencies better aligned.**
  - **Understanding the disruptive role technology can play in the development of infrastructure will be important in order to plan for the long-term.**

[1] *Unlocking Regional Growth*, CBI, November 2016
[2] *Thinking Globally, Delivering Locally: CBI / AECOM Infrastructure Survey 2016*, CBI, November 2016
[3] *Thinking Globally, Delivering Locally: CBI / AECOM Infrastructure Survey 2016*, CBI, November 2016
[4] *The Global Competitiveness Report, 2016-2017*, World Economic Forum, September 2016
[5] *Evidence for Business, Energy and Industrial Strategy Select Committee Inquiry on Industrial Strategy*, CBI, September 2016

- **In order for infrastructure providers to be able to deliver the UK's infrastructure needs for 2050, the industry business model will need to evolve**.

- **Future-proofing the skills the industry will need will be essential to delivering and maintaining infrastructure needed in 2050.**

- **<u>Energy</u>: In order to deliver low carbon, secure and affordable energy in 2050, a long-term and cross-government framework should be in place.**

- **<u>Transport</u>: Greater integration of wider transport plans that make better use of technology will help future proof the UK's infrastructure.**

- **<u>Digital communications</u>: In a fast-moving technological race for more efficient infrastructure services, the need for the UK to be on the front foot cannot be underestimated.**

- **<u>Water</u>: In order to provide safe, clean, reliable supply of water at affordable prices in 2050, decisions on resilience measures need to be taken today.**

- **<u>Waste</u>: Ensuring the UK has the correct infrastructure to deal with waste in 2050 will allow it to effectively recover the many valuable resources and uses from it.**

The first part of this response seeks to address the questions posed in the 'cross-cutting' themes section of the call for evidence.

Understanding how the UK interacts with its infrastructure provides the best evidence on which to set out a long-term needs-based assessment.

5. In order to account for the future needs of UK infrastructure, the NIC should seek to understand how the UK interacts with its infrastructure in the NIA. 'Demand drivers' set out by National Needs Assessment (NNA)[6] or 'Envisioned Future Scenarios' of infrastructure provide the best evidence base on which to undertake a long-term needs-based assessment. These could include changes in population growth and age, the economy, technology, society and the environment. 'Demand Drivers' that are identified by the NIC will have disruptive effects on UK infrastructure. Any forward looking approach to infrastructure will need to incorporate a degree of flexibility and resilience to such drivers. Studying these demand drivers should allow for potential system failures in 2050 to be identified now, allowing the NIA to propose measures that can ensure such problems do not occur.

6. The interactions between infrastructure sectors should also be considered by the NIC when developing its long-term strategy. Understanding the future needs of UK infrastructure will require setting out how different key sectors - transport, energy, digital communication, water, flood management, solid Waste and housing - will relate to one another beyond a 30 year outlook. Indeed, housing should be fully considered as part of the NIA not least because it shares links with other forms of infrastructure identified by the NIC. The recommendations set out in the NNA on housing should be considered in the development of the NIA.[7] These economic infrastructure sectors have historically been viewed in isolation which means the interdependencies between these sectors have not been properly accounted for and opportunities for mutual benefits lost. This is problematic as each sector makes significant demands upon the others – for example a lack of adequate transport infrastructure can act as an obstacle to delivering housing the UK currently needs. The NIA should seek to capitalise on the interdependent relationships and mutual benefits between sectors.

Clarity and direction of infrastructure policy should be maintained over political cycles with plans across government departments and agencies better aligned.

7. In order to effectively plan for 2050, policies concerning the investment and delivery of infrastructure need to be better integrated across government plans. Identifying the long-term needs of UK infrastructure does not fit in with the 5 year electoral cycle which makes it difficult for successive governments to work on a long-term basis. The NIA presents an opportunity to set out a framework which can align the plans of all government departments and agencies, across sectors and with major stakeholders. This will allow us to look beyond the political cycle and ensure the sitting government is committed to a long-term needs-based approach to infrastructure.

[6] *National Needs Assessment – A Vision for UK Infrastructure*, ICE, November 2016
[7] *No Place like Home: Delivering new homes for a more prosperous, Britain*, CBI, October 2016

8. Greater collaboration between the government, sub-national bodies and businesses will also help achieve the best outcomes for future infrastructure investments. Better understanding of government's future plans can allow the private sector to align them with its own approach. Collaboration between government, universities and business could also be vital for long- term infrastructure resilience and innovation. Greater focus should be placed on bringing together centres of excellence to enable links to form and flourish. Further clarity surrounding the role of sub-national groupings such as combined Local Authorities, LEPs and other 'super-structures' like the Northern Powerhouse could also have the potential to reinvigorate local and strategic planning initiatives. It would also enable partnerships between such bodies and central Government to help further identify infrastructure requirements.[8]

Understanding the disruptive role technology can play in the development of infrastructure will be important in order to plan for the long-term.

9. Future populations will dictate the way infrastructure will change, with technology becoming the main interface between people and infrastructure. Smartphones determine how populations travel and pay for its use, and household devices can help to optimise our energy consumption. While it is difficult to predict the scale and impact technology can have on infrastructure, it will continually present new challenges for regulation. These will exist in safety and security of data management for example as technology enables more automation and access to personal information on an unprecedented scale. Such challenges will need to be considered by the NIA to ensure that any safeguards put in place do not to hinder the positive potential changes technology can have.

10. Technology can also reduce costs, influence the design, and improve the maintenance and delivery of infrastructure. From its use to deliver smarter infrastructure through project management, to the maintenance of and operation of assets, technology will play a decisive role in the future. The importance of technology has already been highlighted in the NNA but also in the strategic studies undertaken by the NIC. With the increased use of technological and digital processes, more data can be collected and analysed to highlight the areas where the UK's infrastructure can be more effectively delivered. It can also provide a greater understanding of when to maintain current assets and when to build new ones. Future methods for delivering projects, as well as the project itself, will need to allow for developments in technology and opportunities to collect data to be applied to them. The NIA should seek to prioritise the development and use of technology in infrastructure in order to deepen our understanding and foresight. A greater understanding of how to deliver, maintain and operate infrastructure will future-proof the UK as well as save money in the long run.

In order for infrastructure providers to be able to deliver the UK's needs for 2050, the industry business model will need to evolve.

11. Construction companies and their supply chains currently operate on low margins with small balance sheets which means the industry often struggles to take on high levels of risk on large projects. This is because clients, government or from the private sector, often choose low cost and low technology solutions which have higher whole-life costs over higher quality, better resourced solutions that cost more in early stages but have significantly lower whole life costs overall. The current business model and customer practises could hinder the industry's ability to deliver the vision for 2050 as set out by the NIC in the NIA.

12. In order to be able to deliver the UK's infrastructure needs then a sustainable and innovative business model that makes greater use of technology should be proposed. Clients from both the private and public sector that base procurement on value for money and greater use of technology rather than lowest cost will allow for the best solutions to be provided, reducing the cost of building and operating infrastructure. For example, Building Information Modelling (BIM) can reduce construction costs and provide data packages that are shared across multiple projects[9] while sensor technology can also streamline new construction processes with significant cost savings and improve the whole life approach to maintenance and asset management. The NIA should therefore encourage changes in business and government practises and propose solutions that address weaknesses in the business model. This would allow the industry to adopt new technology, products and processes and ultimately improve the capacity to deliver the infrastructure the UK will need in 2050.

[8] *Rhetoric to Reality: A Business Agenda for the Northern Powerhouse*, KPMG /IPPR, September 2015
[9] *Submission to Construction Leadership Council's study on Labour Models in the Construction Industry*, CBI, January 2016

Future-proofing the skills the industry will need in the future will be essential to delivering and maintaining infrastructure needed in 2050.

13. The number and types of skills the UK will need to deliver and maintain its infrastructure for 2050 and beyond will vastly differ from those needed today. The UK is currently facing a skills shortage and the potential long terms effects that Brexit could have on the UK's access to the European labour market or skilled workers from the rest of the world cannot yet be quantified. The publication of the National Infrastructure Plan for Skills (NIPFS) last year highlighted the need for 100,000 new apprentices across all sectors, ramping up to some 250,000 additional workers in construction and over 150,000 engineers by 2020.[10] The NIPFS is a positive step forward in recognising the skills deficit the UK currently faces. However, the NIA should acknowledge that over time the skills challenges facing infrastructure will change as new technology is introduced or new pioneering projects are announced. Strategies and recommendations for future-proofing the UK's skills need should continually be reviewed to stay relevant.

14. Looking forward, there are a number of opportunities available to invest in skills development and provide the correct balance of skills needed in future years. The proposed Apprenticeship Levy presents such an opportunity but it is important that the levy is both fit for purpose for the present and future, and benefits the industry as a whole. However, alternative mechanisms for attracting young people and re-training skilled workers to meet the challenges of new technology and to deliver the ambitious infrastructure programme will also need to be explored. This could involve the creation of similar bodies such as the Strategic Transport Apprenticeship Taskforce (STAT) as such bodies allow for the skills challenge to be addressed in a co-ordinated and collaborative way.[11] It will be crucial that the UK is able to develop, train or re-train the correct type and number of skilled workers the industry will need in years to come. The NIA can play an important role by highlighting that unless steps are taken to tackle the skills deficit, the ability to delivery infrastructure over the next 30 years will be severely hampered.

The second part of this response will address the questions relating to the specific sectors as set out in the call for evidence.

<u>Energy</u>: In order to deliver low carbon, secure and affordable energy in 2050, a long-term and cross-government framework will need to be in place.

The UK's energy system is going through significant change, which is set to continue into the future; we are on a long-term path to decarbonisation, with more local generation and new technologies creating a dynamic system, while digitisation is driving greater interconnectivity between different sectors. A refreshed plan is therefore needed to drive investment and innovation in a low-carbon, secure and affordable energy system. As such, the National Infrastructure Assessment should consider the policy direction set out in the government's forthcoming Emissions Reduction Plan.

A smarter and more flexible power system can make energy cleaner, cheaper and secure.

15. The UK's power system is going through a major transformation. By 2030, we can expect to see two thirds of existing power stations shut down, including all coal power, with much of this capacity to be replaced by new nuclear, renewables and gas. This investment should be supported through Electricity Market Reform – primarily Contracts for Difference and the Capacity Market – while a strategy is needed to support the integration of Carbon Capture Storage (CCS) into power generational and industrial processes. Importantly, business will need long-term visibility of the framework beyond 2020, with a clear pipeline of auctions in order to build confidence to invest.

16. As well as significant investment in new generation, we are likely to see a smarter, more dynamic grid, which will support greater penetration of renewables and allow energy consumers – both domestic and business – to play a more active role through more flexible demand and local generation. This will require more energy storage – from both new pumps and batteries – as well as local network reinforcement and a greater role for distribution network operators in managing local grids. As such, regulation will need to evolve to reflect the range of innovative technologies and business models coming through, ensuring a level playing field.

[10] *National infrastructure plan for skills*, HM Treasury, September 2015
[11] *Infrastructure Skills Strategy: Building Sustainable Skills, Moving Britain Ahead,* Department for Transport, 2016

Greater energy efficiency is needed right across the economy, alongside low-carbon heat solutions.

17. Energy efficiency is one of the most cost effective ways of reducing emissions, energy demand and costs, and should therefore be seen as an important part of the UK's infrastructure within the NIA.

18. For energy-intensive industries where energy is a major cost, great strides have been made in improving processes and efficiency. The next step change will need to be through innovation and the development of new technologies and processes, such as industrial Carbon Capture Storage/Utilisation and Industry 4.0, underpinned by the right infrastructure. In commercial buildings, there needs to be a long-term trajectory for energy efficiency improvements. For example, maintaining the Minimum Energy Efficiency Standards will be important, as well as providing the right financial support to enable investment in projects that typically have long payback periods. The public sector can take a lead in improving building energy efficiency which will support the market, improving skills and driving down costs.

19. Improving the energy efficiency of the UK's housing stock will be crucial when considering the 2050 outlook. There should be a focus on ensuring that new homes are affordable to run as well as affordable to buy, meaning they should be "low-carbon ready" and future-proofed to integrate new technologies and demand management systems. In terms of retrofitting existing homes, as well as solid wall, cavity and loft installations, smart technology such as smart meters and appliances, could help manage household energy demand and give consumers more autonomy over their energy use and bills. A clear plan is therefore needed to drive energy efficiency uptake in the able-to-pay market.

20. Decarbonising our heat system across both our homes and businesses will require a range of solutions, including heat pumps, district heating, low carbon hydrogen, biomass and green gas. With a very heterogeneous housing stock, and different business needs, there is not a one size fits all solution. The NIA should therefore encourage Whitehall and local government to work together to develop the appropriate low-carbon heating solutions for different areas in the UK.

In addition, step changes in low-carbon transport can meet increasing consumer demand.

21. Government should establish a long-term plan for investment, skills and infrastructure to facilitate an increase in ultra-low emissions vehicle ownership, regardless of technology. The NIA could consider the infrastructure requirements that are associated with a greater uptake of ULEVs, including addressing potential challenges around greater electricity demand, distribution and access to charging points for electric vehicles, as well as refuelling requirements for alternative fuels such as hydrogen and biofuels. Furthermore, it's key that clarity is given to allow business to innovate, particularly in alternative fuels for Heavy Goods Vehicle (HGV).

<u>Transport</u>: Greater integration of transport plans that make better use of technology will help future proof the UK's infrastructure.

Demand for transport infrastructure has grown dramatically over the past 60 years. This has been driven by a variety of factors, including the increasing affordability of travel, population growth, and technological changes in society. Strategic investment will need to be partnered with better management of the network or the benefits of new capacity will be rapidly drowned out by increased demand in 2050.

Future transport plans need to ensure that projects are no longer considered in isolation and ensure the most value is derived from it.

22. It is important that a long-term approach to UK infrastructure ensures that the most value can be extracted from transformative projects such as the new runway at Heathrow or HS2. The National Infrastructure Delivery Plan[12] contains several nationally significant projects that sit not only across road and rail but aviation, energy, water and housing as well. Marrying future transport network strategies in roads and rail with a national aviation strategy for example can optimise the huge investments taking place into nationally significant projects that straddle both sectors. Better connectivity across the UK is an important priority for CBI members with 70% of firms calling faster road and rail access to the UK's airports 'critical' or 'important'. Looking to the second Road

[12] *National Infrastructure Delivery Plan, 2016 – 2021*, Infrastructure and Projects Authority, March 2016

Investment Strategy (RIS 2), businesses would also prioritise linking the road network up to other forms of transport, with 75% of respondents regarding it as 'important'.[13] Effectively integrating transport projects with one another will require further future proofing across the UK's transport network. The NIA should identify the most economically important road and rail routes to invest in to ensure that they can effectively be joined up with the rest of the transport network. Future transport strategies, in order to meet the needs of the UK in 2050, should ensure that no infrastructure project is considered in isolation in future.

23. A national aviation strategy can play a key role in maintaining the vast network of trade and tourism essential for the UK's long term prosperity. This strategy should seek to both modernise current airport infrastructure and airspace as well as assessing the UK's capacity needs as whole. Airspace modernisation would enable the greater utilisation of modern satellite navigation and so better manage the high demand for services without delays to passengers or cancelling flights. The number of passengers using UK airspace is set to grow from 250 million in 2015 to 350 million in 2030, but without airspace modernisation delays faced by passengers are likely to soar to 4 million minutes by 2030, up from 90,000 minutes in 2015.[14] Ensuring sufficient runway capacity as well as improved connections to airports by road and rail will require long-term strategic thinking in the NIA. With a the green light given to a new runway at Heathrow, upgrades being undertaken at London City and Dublin Airports, all of the UK's airports capacity need to be looked as whole in order to effectively plan for the capacity and resilience needed to benefit the UK in 2050.

24. Greater integration of transport projects will also need to support the UK's connectivity to international markets. Ports are the international gateways for UK plc but are currently hindered by 'pinch-points' across road and rail network. While in the South East, Operation Stack has alleviated some pressure, it is only a temporary measure. A more joined up approach is needed to increasing resilience not just in areas surrounding the UK's ports but country wide to ensure the UK can still trade with European and international partners alike. The UK ports handle 95% of the UK's trade in goods with many ports playing a role in helping British business export to overseas markets. In 2016, ports handled an estimated £511 billion worth of goods of which £228 billion were exports.[15] Improving connectivity to international markets to help boost UK exports will require long-term policies to support the UK's maritime and ports sector. The NIA should examine how UK trade and international connectivity could be boosted through a forward looking ports and maritime strategy.

Long-term certainty for tackling road congestion and increasing rail capacity will be critical network for industry and investor confidence.

25. Continued delivery of infrastructure investments will be essential to the UK's long-term needs. Increased certainty of infrastructure investment will go a long way to attracting private finance through different mechanisms as well as allow the industry to successfully deliver the pipeline of projects. A climate of certainty will entice investors as policy makers will have signalled their long-term policy goals to the market. This will also help the industry to predict levels of future activity and invest in their supply chains accordingly. The NIA should provide the long-term certainty needed for both continued investment and delivery of UK infrastructure for 2050. While in road and rail sectors, a pipeline of projects has begun to emerge (Road Investment Strategy and Control Period 5 with RIS2 and CP6 in early planning stages), investing in new capacity for a long-term outlook remains an issue for investors and providers who find it difficult to accurately forecast levels of activity. Government has done much to create pipelines with 3 to 5 years of foresight, however in order to plan long-term, an intended forward looking program of projects would be more beneficial.

26. With a large number of Nationally Significant Projects on the government's horizon – High Speed Rail 2, High Speed Rail 3 and Crossrail 2 – the UK will require alternate methods of raising capital from private sources. And as greater demands are placed on UK infrastructure, people are open to paying for infrastructure services in different ways and funding models should evolve accordingly. According the CBI's Infrastructure Survey 2016, 59% of all firms are open to more private financing models for the road and rail networks and 54% of respondents saying they would move to greater use of a 'user pays' model on the UK's roads if it led to increased resilience and improved journey times.[16] The CBI has previously called for a regulated asset based (RAB) model – in which an independent, price-setting regulator oversees investment from private operators for stable, capped returns. Implementing this kind of model is a way of securing a well-funded, high-performing network

[13] *Thinking Globally, Delivering Locally: CBI / AECOM Infrastructure Survey 2016*
[14] *The Sky is the Limit: Modernising UK Airspace*, AirlinesUK, November 2016
[15] *The Value of passing through UK ports*, MDS Transmodal, July 2016
[16] *Thinking Globally, Delivering Locally: CBI / AECOM Infrastructure Survey 2016*

that works for users and investors alike.[17] While, road user charging is rarely used across UK roads, the NIA should explore how greater use of user pay models such as road pricing can help provide greater funding, increase resilience and capacity in the long-term. More resources can then be put into new smart technologies in road and rail overall that can benefit new and current assets.

Better management of both the UK's road and rail networks through technology is crucial for greater productivity and competitiveness.

27. Technology can be used to increase capacity and resilience, monitor how people use infrastructure and therefore optimise networks and halt degradation of the UK's roads and rail. The UK's infrastructure industry is becoming more data driven and this digitalisation allows for data to be analysed more intelligently to optimise operations. CBI research has highlighted that 94% of businesses believe that digital technologies are a crucial driver of increased productivity.[18] Current examples range from the modernisation (digital signalling) and electrification of the UK's rail network to the implementation of 'Smart Motorways' and better demand management of road space. The NIA should identify where further use of technologies can applied to enhance the management of the network.

28. Integrating access to digital communications across the transport network can have a significant economic impact too. This can reduce the need for regular commuting and making business travel more flexible and further altering the way people interact with the UK's infrastructure. When asked what long-term upgrades should be prioritised for the UK's rail systems, businesses report that improved access to digital connectivity such as Wi-Fi or 3G/4G tops their list, with three quarters (75%) saying it is either critical or important to their future operations according to the CBI's Infrastructure Survey 2016.[19] The results indicate that 'productivity on the move' ranks highly in the minds of many businesses. With businesses rapidly digitising their operations and service provision, it is perhaps unsurprising that moving seamlessly from desk to train and vice versa tops the list of future priorities. The NIA should further explore how to enable digital connectivity and productivity on the move to become the norm, rather than the exception.

<u>Digital Communications</u>: In a fast-moving technological race for more efficient infrastructure services, the need for the UK to be on the front foot cannot be underestimated.

High speed connectivity is a necessary requirement for the digital economy. Innovation in fixed and mobile digital technologies will continue rapidly in a competitive global market. However, to stay ahead we will need to investigate the digital communications requirements of new and emerging infrastructure systems and ensuring that high quality access is available everywhere.

The UK will require robust and flexible digital infrastructure that can take account of future technology improvements.

29. Digital connectivity is essential for businesses and will be key driver of long-term productivity, prosperity and regional growth. The internet is no longer an optional extra – it powers almost everything populations do, and has become crucial for businesses and consumers alike. Due to rapid innovation, increasing demand and a changing economic landscape, it will be challenging to forecast how the UK's digital communications infrastructure system will meet our future connectivity needs. There will almost certainly be a mix of fixed, mobile, wireless and satellite connectivity. Future business requirements for data will continue to grow as technologies that require internet and data access will become increasingly ubiquitous, placing additional demands on the speed and reliability of the UK's digital infrastructure. It is vital that the NIA ensures sufficient digital connectivity for 2050 to avoid the potential detrimental effects on business operations and competitiveness in the global marketplace.

30. Government and businesses alike cannot afford to get complacent when it comes to digital connectivity. Despite a broadly positive picture, with three quarters of businesses (75%) believing that UK digital networks have improved in the last five years, many still see gaps in the availability and reliability of broadband. The CBI's Infrastructure Survey 2016 shows that for 58% of businesses, greater reliability and robustness along with wider geographical availability are the two most important outcomes that need to be secured in the long-term. With only a third (32%) of firms stating that their current fixed-line broadband meets their business needs and with three quarters of

[17] *Bold Thinking: A model to fund our future roads*, CBI, October 2012
[18] *Embracing Digital in Every Sector Survey, CBI, 2016*
[19] *Thinking Globally, Delivering Locally: CBI / AECOM Infrastructure Survey 2016*

businesses reporting a lack of speed as the primary concern, there is still a long way to go.[20] Continued improvement should remain a priority in the NIA as digitalisation is set to continue to be a key enabler of innovation, productivity and economic growth.

A long-term strategy for digital communications is needed for full connectivity and future-proofing.

31. The NIA should add a long-term strategy dimension to the current digital communications regime in order to allow business to plan and benefit accordingly. To meet demand for wider geographic availability, particularly in mobile, the UK needs to deliver the next generation services. Digital communications then needs to be increasingly treated as a utility. It is critical that the UK seizes the initiative with 5G technology in the coming decade, laying the foundations now for widespread rollout. Data is fast becoming the most important commodity in the digital age. By 2050, the main access points to data services through mobile devices and the internet of things could be grounded on widespread coverage of 5G (or other) mobile broadband. All industrial and commercial organisations will require reliable and secure access to high speed internet and wireless communications at globally leading speeds to be competitive. The UK should be at the forefront of delivering for the next generation of services.

32. Prioritising the roll out of quality, business-dedicated broadband, alongside consumer broadband should also be set out by the NIA. The government's recent announcements at Autumn Statement, which showed a renewed focus on business infrastructure are therefore welcome. Future physical infrastructure projects should also be 'built digital'. For example, the permitted erection of masts for mobile connectivity along major transport routes or enabling broadband providers to lay fibre in new rail construction projects could help to achieve this. Businesses need to be able to have continued connection to the internet while travelling on rail and road. Ensuring physical infrastructure is better linked up with digital networks would enable more effective working patterns. In the long run, it could save costs, increase connectivity and support the future development of smart transport networks. A key challenge for the digital sector is a persistent digital divide between those who have access to the latest technologies and those who do not. Setting out in the NIA how to secure digital connectivity will be critical to the UK's long-term prosperity in 2050 and beyond.

<u>Water</u>: In order to provide safe, clean, reliable supply of water at affordable prices in 2050, decisions on resilience measures need to be taken today.

The water sector in the UK has delivered good security of supply since privatisation but the risks of serious shortages in the future are now being recognised. Recent floods have illustrated the vulnerability of UK infrastructure to flooding and is estimated to cost the UK approximately £1bn per year in economic damage. Climate change threatens to increase this risk in the future. A 'whole systems' approach to managing risks from flooding as well as building greater resilience through water transfers, storage and re-use will be necessary in the coming years.

Having a better understanding of the future impacts upon water usage and certainty of supply will allow for a holistic approach to existing and upcoming water infrastructure.

33. Securing the nation's precious water resources in the future will be vitally important. The Water Resources Long-term Framework[21] found droughts of the future could be more severe and geographically widespread than previously thought. The potential economic impact of inaction could be £1.3 billion per day while the cost to increase resilience to this level is around £4 per household per year.[22] It demonstrates an example highlighted previously in this response where infrastructure planning can be based on best value for money, not merely lowest cost. Further investments will also be required to renew wastewater assets to deal with an increasing population and to meet improving standards of wastewater discharges. There is then a need for the NIA to consider how industry, government and regulators can work together to best respond to the risk of severe drought.

34. Future proofing our water supply for 2050 could require a number of different actions. Measures could range from the more efficient use of water at home, in business and in agriculture, to reducing leakage and finding new sources of supply and storage. Technology will also play an important role in smart metering or rainwater and greywater recycling. New ways of working across current company boundaries will also need to be developed to optimise the use of scarce water resources,

[20] *Thinking Globally, Delivering Locally: CBI / AECOM Infrastructure Survey 2016*
[21] *Resources Long-term Framework,* WaterUK, September 2016
[22] *National Needs Assessment – A Vision for UK Infrastructure*, ICE, November 2016

particularly through water transfers. The NIA should explore how a supportive policy and regulatory framework could enable this to a greater extent. Future plans set out in the NIA should also be based on potential scenarios as a long term needs based assessment should no longer rely on historic record or a 'worst case scenario' plan. Planning techniques for uncertainty and minimum standards of resilience should be looked into as well as a national level adaptive plan which can identify key "trigger points" for policy interventions or new infrastructure. Developing a forward looking approach that can effectively address the planning and supply of water resources will greatly benefit the UK in 2050.

<u>Waste</u>: Ensuring the UK has the correct infrastructure to deal with waste in 2050 will allow it to effectively recover the many valuable resources and uses from it.

Over the past two to three decades, waste management in the industrialised world has gradually shifted from providing safe disposal of unwanted materials, often by entombing the waste in a sophisticated, engineered landfill, to recovering materials and value through re-use, recycling, composting and energy recovery. UK waste has been decreasing over the years owing mainly to EU regulations and landfill taxes. However, opportunities for recovery of valuable resources from waste are still under-exploited in the UK.

Treating UK waste internally rather than abroad could have significant economic benefits.

35. The UK does not currently have sufficient waste treatment infrastructure to harness the potential benefits from it. Typically, Energy from Waste facilities (EfW) process the UK's residual waste which remains over from either domestic black bags or industry after recycling of useful materials such as paper, wood or plastics. However, without sufficient EfW infrastructure in place, much of this 'waste for fuel' (Refuse Derived Fuel or RDF) is shipped abroad, with the UK missing out on significant potential power and heat generation that can be gained from using it domestically. Waste can also be used in green construction materials used in building homes and transport infrastructure. The NIA should therefore consider how the UK's processing capacity might be increased so that we can take advantage of these opportunities. To that end, a long-term plan for waste infrastructure could provide the confidence needed for industry to invest in new EfW facilities within the UK, generating circular economic benefits and placing waste processing infrastructure on a long-term, competitive and sustainable footing.

CBI Infrastructure and Industries Directorate, February 2017

The National Infrastructure Assessment – Call for Evidence

A National Infrastructure Commission consultation paper

Consumer Council for Water

February 2017

Introduction

1. The Consumer Council for Water (CCWater) is the statutory consumer organisation representing water and sewerage consumers in England and Wales. We have four regional committees in England and a committee for Wales.
2. We welcome the opportunity to respond to this Call for Evidence from the National Infrastructure Commission. This response covers the questions relevant to water resources and wastewater services only.

General Comments

3. In research conducted by CCWater and water companies over many years, customers have consistently placed a safe, reliable water supply as their top priority, with the efficient collection and effective treatment of sewage as their next priority.
4. To meet customers' expectations, water-only and water and sewerage companies (companies) must take a long-term view about the reliability of their assets, individually and collectively, and the overall resilience of their systems. They do so via investment, maintenance and reinforcement.

Investment and maintenance

5. The past quarter of a century has seen companies invest heavily in building new, or upgrading existing, water and waste water treatment works to meet ever tightening drinking water and environmental standards. The results have been impressive: 99.97% compliance with drinking water standards, bathing water quality at an all time high, and a significant reduction in the number of pollution incidents.
6. At times this may, we believe, have been at the expense of maintenance of the mains and sewers networks. Previous price reviews, notably 1999, have provided insufficient funds to allow companies to effectively maintain their networks. We also suspect that some companies have attempted to make further cuts in their maintenance programme and to pass these off as efficiency savings. This we believe is a short-sighted view for companies to take. Reactive rather than active maintenance will inevitably lead to an increasing incidence of problems on the networks.

Resilience

7. Customers, quite rightly, expect companies to ensure that supplies and services are maintained (or, at worst, restored promptly) in the event of a failure elsewhere on the company's network. But company networks, especially in rural areas, can be linear – abstraction point to treatment works to service reservoir to distribution mains to customers' taps. This 'single source' approach puts customers at risk of a supply interruption in the event of a failure anywhere on that network. To improve resilience companies need to link up their water supply zones to create larger networks that enable rezoning of supplies in the event of a failure.

8. Sewerage networks can also be linear with some failures resulting in sewer discharges that can then flood properties. In some cases, the cause is insufficient capacity within the sewer to handle flows through them. We are supportive of companies restricting surface water - from roofs and paved areas – from sewers through the construction of Sustainable Drainage Systems (SuDS) as this is generally a more cost effective solution than building additional treatment facilities.

9. Of course, failures on companies' networks are not always due to a mains burst or sewer incapacity. Climate change is already placing strain on water resources and has led to widespread flooding in recent years. Companies, therefore, need to protect their assets and in some cases add additional sources to ensure they are resilient to these threats.

10. The recent Water UK Water Resources Long Term Planning Framework (2015-2065) project shows that different areas in England and Wales will be affected by different risks/circumstances; as a result, the report identified a number of strategic infrastructure developments that could contribute to the resilience of water resources.

11. Similarly, the Water UK-led 21st Century Drainage Programme is investigating how companies can make their networks more resilient. This includes protecting company sites against fluvial and pluvial flooding through, *inter alia*, landscaping, relocating electrical equipment, improved alarm systems, and installing stand-by generators in the event of a power outage.

12. In the latter case this demonstrates that companies can not be solely reliant on the services of other utilities, whether that is an energy or telecoms provider. Companies must find ways in which to maintain supplies and services even in the event of a major failure, including a dislocation of transport that might mean inability to reach or access a facility.

Metrics

13. To encourage companies to improve their services to customers, Ofwat established an Outcome Delivery Incentive (ODI) regime at the 2014 price review. This provides a financial reward or penalty for companies' out- or under-performance against a range of Performance Commitments, including operational activities such as supply interruptions and sewer flooding.

14. To complement these operational ODIs, it could be possible to develop a suite of metrics that reflect the resilience of companies' networks. These could include, but are not limited to, percentage of customers reliant on a single source, percentage of customers vulnerable to serious drought over time, percentage of customers served by assets without a back-up electrical supply, or percentage of customers served by assets not protected against storms. .

15. We suggest that these should be reputational metrics rather than attract rewards or penalties. This is because there may be a degree of cross-over with ODIs, and it would be inappropriate to reward or penalise a company twice for similar measures.

Cross-cutting issues

Q1. What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

16. The recent Water UK Water Resources Long Term Planning Framework (2015-2065) project[1] shows that different areas in England and Wales will be affected by different risks/circumstances. As a result, the report identified a number of strategic infrastructure developments and value added investments that could contribute to the resilience of water resources. These developments include infrastructure for water transfers, additional reservoir capacity and water re-use where there is increased water stress and risk of droughts.

17. One of the areas that will certainly require additional water resources, and therefore investment, is the South East of England which is already classified as being seriously water stressed. Water companies in the south and east of England already work collaboratively on water resources planning and further work is planned to bring different sectors together to consider more strategic water resource development and the optimisation of existing resources. This cross-sector collaboration needs to be encouraged and, where possible, facilitated.

18. As mentioned in CCWater's response to the National Infrastructure Assessment, we support the proposal that the National Infrastructure Commission (NIC) will 'have to identify solutions that are good value for money for those who rely on, and ultimately pay for, infrastructure'. We suggest that this should be expanded to include so called 'green' infrastructure. These measures, such as SuDS and land management practices, utilise natural resources and can be cheaper to build and/or more cost effective over the long-term than more traditional 'end of pipe' solutions as they aim to address the cause rather than the effect of problems within a catchment. It is crucial that infrastructure is built and paid for at a pace that customers find acceptable and affordable.

19. It is clear that water and sewerage infrastructure needs to be resilient to shocks and stresses, including (but not limited to) droughts, floods, climate change and population growth. The assessment of what investment is needed (and where) will probably be best placed with companies, and the sector regulators. This will form an output of the companies' Water Resources Management Plans 2020-45 (WRMPs) and Business Plans for Ofwat's 2019 Price Review.

20. Finally, in order to be able to determine the 'highest value' and most beneficial investments, further work is needed to understand how resilient the water industry currently is and where the greatest risks are. At present, there are no metrics to

[1] Water UK (2016). Water resources long-term planning framework 2015-2065. http://www.water.org.uk/water-resources-long-term-planning-framework

measure resilience. This is being considered by Ofwat who state in the consultation on the Outcomes Framework for PR19[2], that their preferred approach is to 'review and adjust the definition of the common performance commitments so that they better reflect resilience and to encourage the sector to develop a common resilience metric or metrics'.

Q2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

21. We are unable to comment.

Q3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

22. Infrastructure projects should always be subject to extensive options appraisal and Strategic Environmental Assessment (SEA). The opportunity should be taken to design and construct infrastructure in sympathy with the local environment and communities with an expectation that any resulting impacts are solved or mitigated against.

23. In the water sector, solutions need to balance the needs of water consumers, the environment, and local residents; this is more challenging in areas potentially bearing high levels of building development where local resources and infrastructure are already under stress. Water and sewerage companies need to be consulted early on when growth in housing is proposed. Any issues raised in relation to water supply and waste water (drainage) services must be addressed before planning consent is given. It is important to ensure that existing and future customers are not exposed to an increased risk of flooding because of housing developments.

24. Where water and sewerage networks and infrastructure are already reaching capacity and unlikely to be resilient to future pressures from growth, climate change or the need to address environmental impacts, investment should be planned over the longer term to allow costs to be spread and enable bills to remain affordable.

25. Water companies are now taking a longer-term view when planning their water resources strategies. We encourage a similar approach for wastewater management and expect to see more sustainable drainage systems being used to help reduce the amount of rainwater that enters the sewer network from buildings and roads. In doing so, this can reduce the risk of internal flooding in homes and reduce pollution of rivers and streams.

26. It would also help to set water efficiency requirements in building standards. In addition, new builds should incorporate a minimum standard for rain water management and where reasonable, re-use. (However, anecdotal evidence suggests that water re-use at a development level may be challenging to implement due to

[2] http://www.ofwat.gov.uk/wp-content/uploads/2016/11/Consultation-on-the-outcomes-framework-for-PR19.pdf

problems associated with equipment maintenance as well as negative customer perception).

Q4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

27. We do not know what the *maximum potential* for demand management is, but we consider, based on existing evidence such as the Water UK Water Resources Long Term Planning Framework and customer experience and views (see paragraph 29-30 below) that demand management (a mix of metering, leakage management and behaviour change to reduce water use) on its own will not solve the water resources deficit in the east and south of England.

28. We support a twin-track approach to water management that utilises demand management and resource development. Demand management is only *part* of the solution, and there is a lot more that can be done to address the supply/demand deficit of water resources. However, the case for more ambitious water efficiency will be more difficult to make in areas that are not water stressed, unless this is a means of increasing water available as 'headroom' and thereby facilitating water transfers to areas of water constraint.

29. Compulsory water metering is being rolled out in seriously water stressed parts of the south east of England. Early indications from Southern Water suggest that compulsory metering is reducing demand. Analysis suggest a reduction of 16.5% [3,4] of water going into distribution, equivalent to 27 million litres/day[5]. However, this is not only down to customers reducing their use, but also includes an element of leakage reduction from company pipes as well as customers' own pipes and plumbing. Although these results are encouraging, it is difficult to ascertain if this figure can be maintained (or improved) over the long-term, or replicated by other companies undergoing similar metering programmes.

30. It appears that customers who have chosen to switch to a meter change their behaviour around water use in order to control their bills. Our research[6] suggests that the most important factor encouraging customers to save water is saving money (42%). Saving water for environmental reasons was done by 22% of respondents, and was ranked third after 'it is common sense' (26%). These findings suggest that messages explaining why it is important to save water are not having a great impact.

[3] https://www.southernwater.co.uk/latest-news/metering-saves-27-million-litres-of-water-a-day
[4] http://www.southampton.ac.uk/news/2015/02/fitting-water-meters.page
[5] https://www.ice.org.uk/disciplines-and-resources/case-studies/southern-water-universal-metering-project
[6] BMG Research (2016). Customer attitudes to tap water and using water wisely. August. http://www.ccwater.org.uk/blog/2016/08/10/attitudes-to-tap-water-and-using-water-wisely/

31. Water companies must be seen to be doing all they can to minimise leakage as perceptions of poor performance in this area can act as a barrier to customers making more effort to use water efficiently. Our research[7] shows that 72% of customers say that water companies should spend more resources on addressing leakage, which amounts to over 3,000 mega litres per day in England and Wales. This is equivalent to an industry (weighted) average of almost 121 litres per property per day. In comparison, the average water use per person per day is 140 litres.[8] Customers' perception is that the amount that can be saved by people using less water in their homes is 'tiny' compared to what is lost through leakage is largely borne out by the facts. In short, customers *will do more if the company plays its part too*.

32. Water use is largely determined by lifestyle and habit and there is a question over the degree to which customers will respond to more complex price signals. Our research[9] suggests that customers are generally not in favour of 'smart' tariffs that seek to influence their water use. But when pressed, customers accept a rising block tariff. Because it would be easier to budget throughout the year. Respondents felt a seasonal tariff would penalise everyone because in the summer people generally tend to use more water regardless of how water efficient they are.

33. We agree with Water UK and Waterwise that more can be achieved in relation to water efficiency, but there must be a comprehensive approach involving awareness raising, practical help and advice to help and encourage customers to change their attitudes and behaviours towards water use.

Q5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

34. In order to achieve a resilient water industry, the rates of maintenance/repair and renewal rates of assets are likely to need to increase given their age and comparatively low rates of replacement/renewal. Historically, there has been a focus on maintaining serviceability of existing assets but on occasion not enough to solve issues. As a result, we expect that in order to increase the resilience of its assets, the water industry could find ways to look ahead and anticipate investment required for the future.

35. Greater resilience could be achieved by balancing the investment required to maintain existing assets to ensure they are in good condition and the investment needed to build new assets where required. Lack of maintenance can also hinder resilience.

36. Water companies need to be held accountable for what they have done (or not done). Maintenance should look backwards and forwards – to solve legacy issues but also plan for future challenges, as some solutions may solve an immediate problem but not be

[7] SPA Thinking (2013) CCWater leakage study. Research into customer perceptions of leakage: report. June.
[8] Consumer Council for Water (2016). Delving into Water 2016: Performance of the water companies in England and Wales 2011-12 to 2015-16 http://www.ccwater.org.uk/wp-content/uploads/2016/11/Delving-into-water-2016.pdf
[9] DJS Research (2013). Research into saving water – the experiences and perceptions of customers and their households. A report prepared for CCWater. March. http://www.ccwater.org.uk/wp-content/uploads/2013/12/Research-into-customer-water-saving.pdf

cost effective in the long term. The planning of this spend should take account of the bill impacts of this and other investment.

37. Ofwat's upcoming Price Review in 2019 for water companies in England and Wales will approve further investment in maintenance and enhancements so that companies can deliver their statutory duties for customers and the environment.

Q6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

38. The water sector is already exploring these opportunities and potential collaborations in relation to water resources planning and management. CCWater has encouraged inter-company and cross-sector collaboration as there are clear benefits to be gained from these primarily in making the best possible use of existing water resources and in developing new ones.

39. Given the uncertainties associated with the opening up of markets in water trading there is a danger that this may not deliver expected outcomes. For example, potential investors may be wary of investing in large, long-term assets (such as a reservoir) unless there is certainty that they will get a reasonable return on their investment.

40. In this context, collaboration will probably be about abstractors sharing resources by using markets for water resources or large scale, cross-company border projects that involve a variety of sectors (eg,. public water supply and agriculture).

Q7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

41. In the water sector, funding for infrastructure projects proposed by water companies is subject to scrutiny and challenge during Ofwat's five-yearly price reviews. The expenditure required is recovered through customers' bills. However, the cycle of five year price controls can lead to a lack of longer term planning. Similarly, the 'resetting' of revenue allowances and Ofwat's cost and financing assumptions every five years can lead to a 'stop/start' delivery of longer term infrastructure projects that could be inefficient.

42. We support the sector using the five year price control as a milestone towards a longer term strategy for achieving infrastructure resilience, to give customers, companies and investors greater certainty, in terms of:

    - costs and financing (and subsequent customer bill impacts); and
    - delivery of long term infrastructure projects and maintenance which can be delivered smoothly (over a number of AMPs) with a lower risk of disruption caused by the five-yearly price review cycle.

43. Significantly higher cost infrastructure projects in the water sector could be funded more transparently (and possibly at lower cost) by opening them up to competitive tender in a similar way to how the Thames Tideway Tunnel (TTT) has been financed (subject to a separate delivery body and cost of financing). Ofwat is looking for future £100m+ projects in the sector to be subject to competitive tender, as part of its Water 2020 proposals.

44. The assumed cost of financing such projects should not lead to consumers carrying a disproportionate level of risk through an over-inflated cost of capital. Risk should be carried by those best able to carry it. Risks associated with financing an infrastructure project, and any risk in its delivery, should be carried by the company (or companies) chosen to deliver the project. Consumers should not carry a high risk of paying further costs if the project fails to deliver, or the cost of financing it has been underestimated.

45. Separate financing of significant infrastructure projects could enable greater transparency to consumers in terms of who is delivering the project, its financing arrangements, the costs assumed, and how this translates to consumers' bills. Such transparency could enable scrutiny and accountability of the project.

Q8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

46. Any large infrastructure project that carries a relatively high risk of non-delivery or cost overruns may deter investors or inflate the equity/asset beta within the cost of capital.

47. In such circumstances, a government guarantee that protects against catastrophic events (as was the case with TTT) is likely to overcome concerns from investors and secure efficient financing.

Q9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

48. The impact of climate change is predicted to result in more extreme weather patterns (both drought and floods) and will directly impact our water and waste water infrastructure and service provision. These extreme events will also impact other water dependent sectors. At present there is joint/collaborative working across sectors looking at long term issues of water resources in relation to drought and water

resources planning already happening in the East and South East of England. This is a model that could be replicated elsewhere, given similar issues faced by different sectors.

49. Where assets are/could be shared between the water industry and other sectors, it is important that:

- water companies carry out appropriate risk assessments;
- there are sound governance and funding arrangements in place to ensure that water customers are not paying for more than their share of the costs; and
- these arrangements can take place within the specific planning and regulatory frameworks for the water industry.

The sustainability component will also be of importance, considering the environmental, social and economic commitments water companies need to meet.

50. In terms of increasing the resilience of the water sector, it would also be useful for it to look at lessons learned and potential risks deriving from failure in other sectors such as telecoms, energy and transport, and any interdependencies between them.

Q10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

51. As explained in our response to Question 7, price reviews (whether it remains as a five yearly cycle, or is lengthened in the future) and the Water Resources Management Plan framework should act as milestones within a longer term strategy. In addition, it could be useful if wastewater management had its own long-term planning framework. The Water UK led 21st Century Drainage Programme is looking at a range of longer term drainage issues. This will help customers, companies and investors alike have greater certainty as to how significant infrastructure projects are delivered and funded efficiently. Ofwat's new duties relating to resilience in the sector as well as the creation of the National Infrastructure Commission should help enable this.

Q11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

52. One way to protect and enhance the natural environment could be to ensure that investment in measures that utilise natural resources and systems is prioritised. These include SuDS, catchment management, the restoration of upland areas, planting trees or developing or restoring wetlands. These activities can be a more sustainable and much cheaper way to deal with problems in the water environment. They can also have multiple benefits. Planting trees, for example can help to improve the quality of water bodies and contribute towards flood management. In urban areas, SuDS can help reduce surface water flooding (and may enable customers who are connected to the systems to reduce their sewerage bills, depending on who owns them) as they do not discharge rainwater to the sewerage network. They can also enhance the local

environment and have an amenity value. Several water companies across England and Wales are involved with or have been involved with such schemes[10].

53. In general, the National Infrastructure Commission should aim to ensure that any infrastructure is as sustainable as possible, to avoid creating problems for future generations.

Q12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

54. Cost Benefit Analysis (CBA) can be improved by taking more account of wider societal and environmental risks, costs and benefits as well as inter-generational issues. Furthermore, and specifically for the water industry, there seems to be two issues with CBA: the robustness of the willingness to pay (wtp) methodologies and data, and the way they are used in the CBA.

55. Lastly, CBA for major utility infrastructure could also gain from giving more consideration/weight to the potential benefits (and risks) to the wider economy through collaboration on large infrastructure projects, for example the costs of a major flood or extreme drought affecting the city of London, should the level of resilience in the current infrastructure fail or become inadequate.

Water and wastewater (drainage and sewerage)

Q22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

Note: "demand" includes domestic, commercial, power generation and other major sources of demand.

56. The main considerations over the long-term (lifetime) of any new assets will have to be cost-effectiveness, sufficient provision for maintenance in the long-term, and appropriate cost-allocation to ensure affordable and acceptable water bills for present and future water customers. Given the uncertainties over climate change and the particular pressures from population growth in already water stressed areas, the levels of service water companies currently plan to (i.e frequency of water use restrictions) may need to change in the future.

57. As mentioned in the answer to Question 4, we support the 'twin track' approach recommended by Water UK's Water Resources Long-Term Planning Framework project. This approach includes supply enhancement (i.e. inter-regional transfers,

[10] Dwr Cymru – Welsh Water Rainscape in Llanelli, Northumbrian Water also has schemes in Killingworth, Jarrow and the Ouseburn.

reservoir development and more use of treated wastewater to supplement river abstractions), as well as continued efforts to increase demand management (interventions to reduce water use by households and businesses as well as better leakage management and control).

58. The effects of climate change and population growth will exacerbate the supply/demand deficit. Although per capita consumption may be reduced as a result of different interventions and behaviour change, more people will mean that the requirements for water will still increase over time.

Q23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

Note: this can include, but is not necessarily limited to, governance frameworks across the country.

59. Current sewerage and drainage systems will not cope with the more intense rainfall events forecast. As a result, there is a need to find new, more sustainable ways to deal with heavy rainfall. These could include sustainable drainage systems (SuDS), managed wetlands and river restoration.

60. One way to do this would be to require all new developments to have sustainable drainage systems that are fit for purpose. This would ensure that the sewers are used to transport sewage rather than for rainwater drainage thus reducing the likelihood of under capacity in the sewer network. Any known capacity issues should be addressed before planning permission is granted, allowing the development to proceed.

61. Sewerage companies need to have long-term wastewater management plans, analogous to water companies' water resources management plans. These would set out how future challenges are to be met and how current issues are being dealt with. These plans would require public consultation which would give all interested parties (commercial sector, planners, developers and local authorities) an opportunity to look for issues (and solutions) as well as opportunities of mutual interest.

Q24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

62. The catchment approach is a useful tool because it allows dealing with problems the source, at what usually is a lower cost than dealing with them further downstream. In addition, catchment management measures tend to be more sustainable, with a lower carbon impact than traditional concrete (infrastructure) measures. However, each catchment is different, and as such, problems might require a 'mix and match' of different solutions and approaches.

63. Having the right balance of measures can provide multiple benefits. For instance, some measures to slow the flow of rivers, to reduce the possibility of floods could also contribute to reducing pollution in water courses. In turn this would improve the ecology of the water course and increase bio-diversity. These types of schemes also

tend to involve partnership (collaborative) funding, where a number of stakeholders contribute to the cost and maybe even broaden the scope of the work. In turn, this improves the benefit to cost ratio.

64. Water companies have a statutory requirement to maintain and improve the resilience of their networks, so may benefit from considering natural flood measures. However, they and, hence, their customers, should only bear the costs of work that is necessary for them to meet their statutory obligations, within the limits of what customers find affordable and acceptable.

Flood risk management

Q25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

65. In terms of flooding, CCWater's remit is with sewer flooding. We monitor the number of properties flooded with sewage internally and externally, from information provided by water and sewerage companies and published in our annual *Delving into Water* report.

66. Although the number of properties affected by sewer flooding is relatively small[11], it is an event unacceptable to customers, as well as an environmental and health hazard. Investment to deal with this problem should be a priority for water companies, to reduce the number the number of properties that are flooded and to some extent the frequency at which this occurs.

67. We recognise that there are a number of properties where the solution required to protect them against sewer flooding is too expensive, but where mitigation measures (such as fitting a Non-Return Valve (NRV) in the drain, air brick covers and door guards) might be more appropriate, although they do not eliminate the risk completely.

68. CCWater is an observer of the Water UK-led 21st Century Drainage Programme Board[12]. In October 2016 the Board published a document setting out the challenges in this area over the next 25-50 years and how they should be dealt with. These recommendations will enable each sewerage company to determine what it needs to do to deliver the ambitions set out by the Programme Board and help to reduce the risk (and number) of flooding incidents attributed to failure of the sewerage network.

69. The risk of surface water and sewer flooding could be reduced if more sustainable methods of draining and storing surface water are adopted. As outlined in our response to question 11, measures that utilise natural resources and landscape can all have a useful, and relatively low cost, impact on flood resilience. This can be achieved through partnership working between sewerage companies, local authorities and other parties responsible for different aspects of drainage.

70. Where houses are built on flood plains, we consider that:

[11] Consumer Council for Water (2016). Delving into Water 2016: Performance of the water companies in England and Wales 2011-12 to 2015-16 http://www.ccwater.org.uk/wp-content/uploads/2016/11/Delving-into-water-2016.pdf

[12] More information available at: http://water.org.uk/policy/improving-resilience/21st-century-drainage

- Proposed purchasers should be given written information that the property has been built on a flood plain, about flooding mitigation measures in place on the property and across the development, and the potential consequences of altering the property (extensions or paving over grassed areas) without including additional mitigation measures; and
- There should be a requirement that the deeds of new build properties on flood plains contain a reference to the property's susceptibility to flooding because of its location.

71. In doing so, this could encourage developers to take greater care about the siting of houses, and build SuDS and other flood mitigation measures into the development. We made the same comments to consultants commissioned by Welsh Government to explore flooding issues.

72. In order to achieve flood resilience, water companies and other stakeholders will need to consult the public and where costs fall to water companies there needs to be good customer engagement to ensure that there is evidence of willingness to pay and that bill impacts are managed appropriately to ensure acceptance and affordability.

Q26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

73. In general, we expect water companies to invest in schemes that provide proven benefits to customers at a reasonable cost. For some natural flood risk management schemes, however, benefits can take many years to emerge. Any framework, therefore, needs to facilitate the right conditions for water companies to invest in catchment schemes based on the best available evidence. At the same time, however, they must be able to identify, and remedy, failing schemes quickly to reduce the scale of costs arising from failed investments which will ultimately be borne by customers.

Enquiries

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Submission to National Infrastructure Assessment Call for Evidence

<Name>

<Job title>, Centre for Progressive Capitalism

This submission purely focusses on question 7 in the call for evidence: What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

Overview

In recent months the housing white paper and the Scottish planning consultation have both centred on the importance of infrastructure to open up new areas of land for housing. Moreover, both governments are exploring the possibility of trying to find new ways of financing this much needed infrastructure. A recent damning report with regards to CIL suggests that the UK needs to fundamentally rethink how it finances infrastructure.

This is of particular importance as a recent McKinsey study estimated that the infrastructure stock to GDP of a country is on average around 70%. However, the figure for the UK is substantially lower at only 57% of GDP compared to 71% in Germany. One major factor why the rate of infrastructure investment in the UK is so low is that it tends to be paid for out of general public expenditure. When it comes to prioritising infrastructure against health, education and defence it is not surprising that it has been consistently at the bottom of the list. But financing local infrastructure from general government taxation is the exception rather than the rule internationally.

Most of Britain's competitors across Europe and Asia use land value capture which is a self-financing mechanism for infrastructure investment. This is also one reason why many of these countries have lower budget deficits and yet greater levels of infrastructure stock.

The self-financing mechanism of land value capture works as a result of the new infrastructure supplying the offices and houses to meet the pent-up demand. Once the scheme has been designed, a city region authority generally raises long term finance in the form of bonds from the capital market. The jump in value from the land's original use value to residential value provides the revenue stream to pay back the bondholders.

So why has Britain not been using this very effective mechanism to self-finance infrastructure and drive up the rate of housebuilding? The major obstacle is that the 1961 Land Compensation Act guarantees that the uplift in land values, as a result of public infrastructure investment, flows to the landowner instead. This means that landowners generate windfall profits in the region of £9.3bn per annum. This £9.3bn is calculated after public land sales and the various levies from section 106 agreement and the Community Infrastructure Levy (CIL) have been paid – which only amount to just over a fifth of the total uplift. Over a twenty year period, this would add an additional £185bn of infrastructure investment.

In the event where the infrastructure investor is the landowner this can still take place in the UK, however, this is the exception rather than the rule.

Case Studies:

The Hong Kong Metro: The ability of the Hong Kong metro system to capture revenues from the uplift in land values due to the network played a significant role in the financing of the network itself. Between 1996 and 2000, annual revenues generated from public land leasing were more than enough to cover the costs of all infrastructure. For the Hong Kong Metro System, land value capture represented a financial windfall. It facilitated an increase in the building of residential properties that were connected to places of employment through the metro links.

Hamburg's Hafen City, Germany: In 1996, Hamburg set out a plan to expand the city using adjacent brownfield sites in order to dramatically increase the housing supply in conjunction with a new container terminal. While around 70 per cent of the land to be developed was already under the ownership of the city-state, the agency responsible for the project, Hafen City Hamburg GmbH, was tasked with bringing the remainder of the privately owned land into public hands. The infrastructure for the project was financed by borrowing against the land assets and included building roads, bridges, public spaces and flood defences. The total public expenditure of €2.4bn was subsequently complemented by private investment totalling €8.4bn. Sales of land that have captured the uplift in land value due to the infrastructure investment has permitted the agency to finance its operations and also to pay back the loans needed for investment.

Amersfoot, Netherlands: The Vathorst Development Company (OBV) was set up in 1998 in Amersfoort to expand the housing supply. OBV was a 50:50 joint venture between the local authority and a consortium of private landowners and developers who had pooled their land holdings. The development company was responsible among other things for land acquisition and commissioning infrastructure. Financing the development of 11,000 homes, a shopping centre and business park amounted to €750m, of which half was used to fund infrastructure. Borrowings with a maturity of 15 years are to be repaid out of the proceeds from land sales.

The North West Cambridge Development, UK: Cambridge University has become increasingly concerned that the inexorable rise of house prices will make it much harder to attract the best lecturers and researchers from around the world to join the university staff. The university therefore decided to use its own land and raise money from the bond market to invest £70m in infrastructure in order for 3,000 homes to be built. The bond holders are to be paid back through the process of land value capture. The agricultural land that the university owned with a nominal book value of around £24,000 per hectare will jump to around £2.4m per hectare as a result of the strategic planning and infrastructure investment. Cambridge University expects to sell off half of the plots to developers and then keep half of them to rent out to staff. If the university had had to acquire the land at market rates, the project would most likely have failed at the viability stage. The value of residential land in Cambridge for 3,000 units is estimated at around £384m, which is considerably more than the £350m the university borrowed from the bond market to finance the entire project.

Increasing infrastructure investment by 25% pa

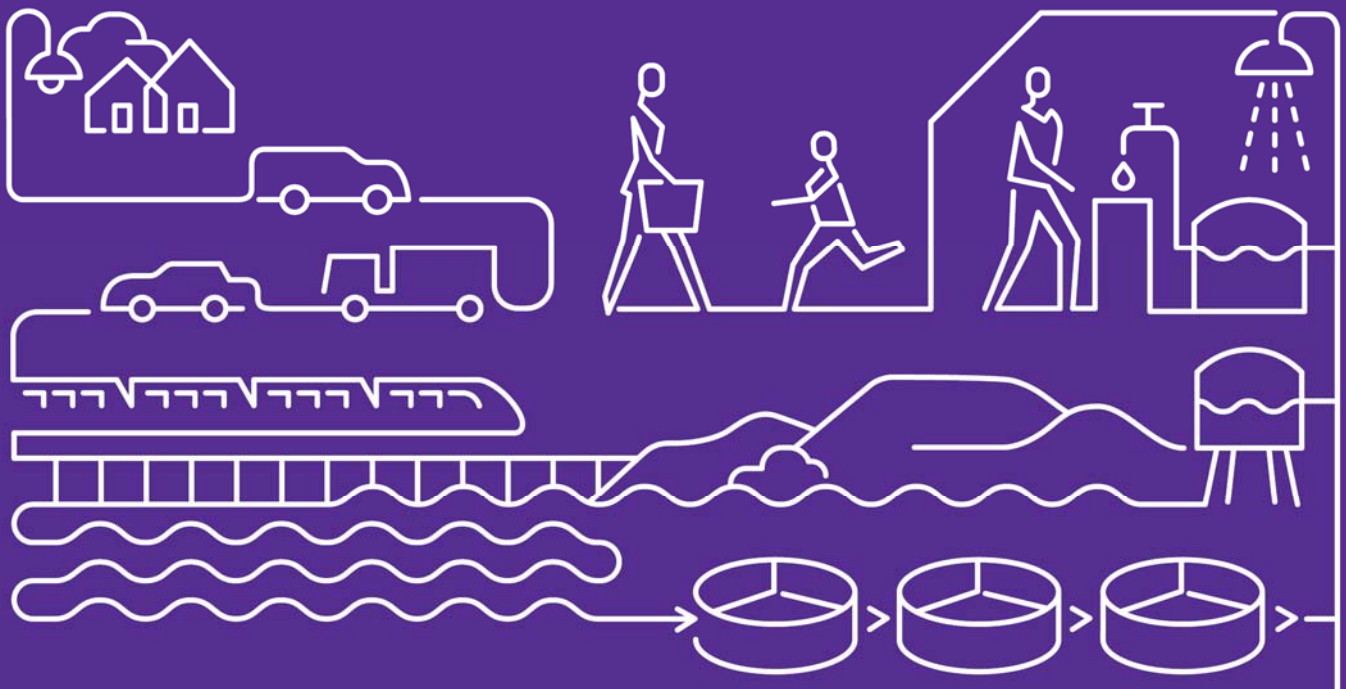
The Centre for Progressive Capitalism has developed a land value capture database at the local authority level which permits the assessment of the total potential uplift available to finance infrastructure investment. In Greater London, the value of industrial land is around £2.7m per hectare, however, land with planning permission for residential housing is on average around £26m per hectare. Utilising this mechanism for the proposed Crossrail II project – which aims to unlock 200,000 new houses – would generate an uplift in land values in the region of £69bn. This is more than enough to finance the entire project, and critically without any need for increased net government expenditure.

Land value capture is not just for London though. It can be used all over the country and raise much needed finance for the new Combined Authorities to deliver our necessary 21st century infrastructure. At current housebuilding rates this mechanism could generate more than £14bn of incremental financing for infrastructure in the West Midlands and nearly £14bn for the North West over the next 25 years.

If the 1961 Land Compensation Act were to be amended so that no account is taken of any prospective planning permission in land designated by combined authorities for infrastructure including housing, there would be a 25% jump in infrastructure investment. Based on 2016/17 figures this would take the UK's expected public sector net investment levels to 2.5% of GDP. While this is still short of the OECD's recommended target of 3.5%, this substantial improvement in investment can be made without negatively impacting the state of Britain's deteriorating public finances.

For further details see http://progressive-capitalism.net/2016/06/bridging-the-infrastructure-gap/

National Infrastructure Commission (NIC) – Call for Evidence



Submitted by

ch2m SM

February 2017

Introduction

Over the past decade, we have seen infrastructure creep up the agenda to a point that it is now firmly placed at the heart of the political debate. With investment in major transport, energy and utility projects increasing to record highs and the development of the National Infrastructure Plan to set out key Government priorities, we have reached a stage where infrastructure is a nationally significant issue that transcends party political ties.

The formation of the National Infrastructure Commission was greatly welcomed by the industry and provided a great level of confidence in the deliverability of major projects and enables the current Government and future administrations to speed up decision-making on vital transport, energy and housing programmes that Britain needs to continue to grow its economy.

CH2M is a global engineering and programme management company that works in the areas of water, transportation, environmental, energy, facilities and defence. With over 2,500 people employed in the UK, CH2M is currently working on some of the most iconic infrastructure programmes including Crossrail, High Speed 2, Thames Tideway Tunnel, Crossrail 2, the new Lower Thames Crossing and was one of the leading partners in CLM, Delivery Partner to the Olympic Delivery Authority for the London 2012 Olympic and Paralympic Games.

Given our experience of working on the development and delivery of major UK infrastructure projects, we felt it may be helpful to share some of our thoughts around the points laid out in the NIC's call for evidence in order to share the lessons learned for the efficient delivery of future infrastructure priorities. In particular, this document presents our view on the main infrastructure challenges facing the country over the coming decades.

[name redacted]
[job title redacted]

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

High quality infrastructure is essential for an economy as it enables businesses and consumers to buy and sell goods and services domestically and globally through international gateways. Increased infrastructure provision helps to reduce prices and contributes to the functioning of a successful and competitive economy. Transport networks provide connectivity both domestically and internationally by linking people to jobs, businesses to their supplies and customers and delivering products to domestic and international markets.

In terms of transport, the 2006 Eddington study argues that a better transport network increases Gross Domestic Product (GDP) by allowing greater access to markets and by stimulating productivity improvements. Improved access to labour markets could lead to higher employment and therefore higher GDP. In addition to this, improved transport links could lead to the creation of new firms, whilst also leading to efficiency improvements within firms and boosting productivity. Specifically, transport could change the growth rate of productivity either temporarily or permanently by boosting innovation through agglomeration economies, trade and foreign direct investment.

The 2006 Eddington study argues that an economy with an effective transport system could respond better to structural changes and lead to higher output and productivity gains. Also, transport improvements create new leisure opportunities and lifestyle choices, known as productivity of consumption, and therefore result in an improved economic welfare.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

The Transport Business Case guidance, whilst obviously only used for transport, could with some changes be reasonably applied to the design, planning and delivery of all infrastructure. This infrastructure business case guidance will be used to evaluate on a strategic level major infrastructure investment decisions in the long term adjusted to take into account specific industry and sector characteristics.

This guidance should take under consideration land use competition for housing, infrastructure and other spaces such as green spaces. The availability of jobs, the mobility of labour and the location of the industry should be taken under consideration when measuring the value of housing against infrastructure.

Stakeholder engagement is critical to the successful incorporation of infrastructure and housing at the design stage. Ideally, the sponsoring authority should work closely with the local authority to allocate enough space for housing and infrastructure and reassure that the design is in compliance with local authorities planning regulation in order to be commercially viable for the developer. In addition, in order to do this, planning should take under consideration the density and provision of green spaces. Transit Oriented Development (TOD), which refers to people living in a walking distance from stations, and resulting energy efficiency should also be incorporated in the Infrastructure Business Cases guidance.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

Demand management is about using prices to efficiently manage demand for infrastructure and this approach should be at the centre of UK infrastructure policy. From an economic perspective, the socially optimum price for the use of infrastructure assets should be set where social marginal costs equal social marginal revenue. This means that infrastructure pricing should take account of externalities such as congestion, accidents or pollution, as well as direct or private costs to users. However, it is clear that in many infrastructure sectors, over many decades, demand management has not and still is not at the heart of infrastructure policy and implementation. Some examples from the transport sector are the long history of predict and provide on the roads and the absence of road pricing – the same is true on the railways. Airports policy has largely suffered from planning hurdles and demand management has had little influence on the need for new airport capacity.

Whilst economic theory defines an optimal pricing approach which can be applied to the whole economy and to individual sectors such as infrastructure, its practical application is much more of a challenge. The reason for the lack of demand management in infrastructure is that its use is very politically sensitive, given that it favours people who can more easily afford to pay. Ultimately, the practical implementation of a pricing policy depends on how far decision makers think they can increase prices to manage demand without incurring too much political opposition.

In the United States, we have seen greater use of 'smart technology' for demand management since 2009 that has not been present in the UK. Integrated technology systems have seen benefits in areas such as energy reduction in public areas (use of street lighting) and grid based water management. By using sensored technology to manage infrastructure in real time in areas such as Bellevue, Washington, repeatable benefits were incurred such as lower energy consumption, increased rate of reaction to flooding incidents and a reduced cost of service. By managing demand in these ways, efficiency was increased by 10-15% and operational costs reduced by approximately 8%.

12 What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

The following improvements could be made to current cost-benefit analysis techniques:

- Continue to develop and improve methods for appraising the wider economic impacts of transport in order to better capture 'real economy' impacts such as increased GDP and jobs. CH2M, with Atkins, is currently advising DfT on how to improve agglomeration elasticities used in the appraisal of wider economic impacts.
- Carry out more research into the impacts of transport projects on land uses. Extensive evaluation evidence, which has looked at what happens to land uses after transport schemes have been built, has demonstrated that the current 'fixed land use' assumption in the vast majority of traffic models is not realistic.
- More appraisal guidance is needed on packages of transport interventions to understand the relationships and synergies between the different components in a package.
- The DfT should mandate the use of ranges of Benefit Cost Ratios, reflecting the uncertain nature of benefits over 60 years, to avoid the impression of spurious accuracy in appraisal results. This could be beneficial when comparing infrastructure investment decisions across sectors.

13 How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

Over the last 50 years, the average number of trips per person per year has increased marginally from 921 in 1965 to 945 trips in 2014, whilst the time spent travelling has remained stable at around an hour a day. However, there has been a big change in the average distance travelled per trip which has increased by 71% since 1965. This has been happening due to changes in the use of transport modes, as well as increased travel demand by particular social groups such as women and older people. In particular, ownership of cars has risen rapidly over the last 50 years, with 32% of households in 2014 owning two or more cars compared to only 5% of households in 1965.[1] These changes in travel patterns and car ownership have been driven by various economic, social and demographic factors such as population growth, living standards, attitudes and behavioural changes to car ownership. Furthermore, supply factors, such as transport capacity increases and declining costs of transport compared to incomes, have also influenced the current travel patterns and are likely to continue to influence future travel patterns.

The UK's population is expected to rise to 78 million by 2050 (ONS 2015[2]) and coupled with increasing life expectancy and female participation in the workforce, this is likely to increase travel demand. The Department for Transport estimates that road travel demand will grow by between 19% to 55% over the period from 2010 to 2040.

As this illustrates, there are a number of possible future scenarios with regards to how travel patterns might change. The key is to understand how the above factors will change but increasingly, forecasts also need to include factors such as technological advances in the automotive industry.

Technological advances are becoming an increasingly important factor driving travel patterns. There has been a significant rise in firms developing vehicles with greater levels of autonomous ability as governments across the world encourage and support such development for example Google driverless cars. Furthermore, changes to attitudes towards renewable energy and global warming have seen the increase of electric cars which produce fewer emissions and tend to allow individuals to travel distances similar to or even greater than the conventional combustion engine.

14 What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

An effective transport system enables people and freight to move into, out and around an urban area using a variety of different transport modes, but with high levels of public transport provision and usage, such as London. This is because the high population densities of urban areas require transport systems with a 'first-to-last mile' public transport provision to allow people to travel efficiently to a wide range of destinations within the urban area.

In terms of freight, rail tends to be cheaper for bulk haulage but is much less flexible for other types of freight and is not suitable for final delivery. Therefore, having a good road network is often the most effective method for freight transport.

One approach to the development of urban transport systems, which has been used in major cities such as New York, Berlin, London and Washington and is being increasingly implemented is Transit Orientated Development (TOD). This focuses on the provision of mixed land use developments that maximise the

[1] National Travel Survey: Change in travel since 1965
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/457732/nts2014-factsheet.pdf
[2] Office of National Statistics 2015; Table A1-1, Principal Projection – UK Summary
https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections#datasets

amount of residential, business and leisure space around and within walking distance of public transport stations or in linear transit corridors.

There are several synergies that can arise from TOD, transport synergies such as:

- faster travel to work times using public transport
- increasing passenger trips
- lower congestion levels
- reduced energy costs
- development impacts that give rise to more efficient high-rise developments which are more cost effective to service and reduces urban sprawl
- regional/city planning benefits in terms of encouraging development and expanding cities close to regional centres

Such an approach allows people and freight to move easily within an urban area and encourages agglomeration economies which increases productivity levels.

15 What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

For interurban projects, the direct economic benefits of road schemes typically outweigh the construction and maintenance costs by a ratio of around three to one. This compares to typical benefit to cost ratios of between one and two to one for passenger rail projects.

Further, the 2006 Eddington Report recognised that often small-scale road projects, seeking to address local congestion and improve connectivity through, for example, junction improvement schemes, have much higher benefit to cost ratios than larger, but more expensive, road projects. In addition, given the far higher use of road transport than rail (2015 mode shares were 90% for all types of road users and 9% for rail), more people tend to benefit from investment in road projects than rail projects.

However, there are strong cases for investment in rail infrastructure outside urban areas. To provide long distance connectivity, many countries have invested in high speed passenger rail infrastructure and services e.g. France, Spain, China. Often the cases are built upon the improvement in journey times and the wider economic benefits generated. However, evidence about the relative value of transport investments in terms of agglomeration benefits is limited. There is some evidence that the long-distance agglomeration has an impacts, but the magnitude of impact is small. Agglomeration/productivity benefits are highly dependent upon trade between urban regions and transport schemes that provide improved connectivity between urban areas that already trade should result in high levels of agglomeration benefits. However, it is often difficult, due to a lack of data, to distinguish whether a transport scheme helps to connect two existing clusters, or if the transport scheme has helped create clusters because transport investments in a particular area do not happen on a regular basis.

In terms of investment in infrastructure to support the transport of freight, rail tends to be cheaper and less environmentally damaging for bulk haulage and over long distances, but it is much less flexible for other types of freight and it is unsuitable for final delivery for the vast majority of products.

[1] Graham and Melo (2010): Advice on the assessment of wider economic impacts: a report for HS2

http://webarchive.nationalarchives.gov.uk/+/http:/www.dft.gov.uk/pgr/rail/pi/highspeedrail/hs2ltd/appraisalmaterial/pdf/widereconomicreport.pdf

16 What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

'Mobility as a service' (MaaS), involving the shift away from personally owned cars towards mobility solutions with public and private operators, and are consumed, managed and paid for through a single portal as a service. Currently, there are a number of existing technologies that can be used to implement road user charging systems such as toll tag, telematics insurance devices and smartphones. However, companies such as Uber and Zipcar, are starting to evolve MaaS services whose business models are based on the provision of smartphone centric services.

This approach could in the short term lead to a more efficient use of transport and a potential reduction in travel demand. However, over the longer term, the increasing use of technology will enable new MaaS services to be developed. These will encourage the move towards greater use of road user charging. For example, with the development of autonomous vehicles to deliver MaaS services, numerous opportunities will arise to develop more efficient charging systems that vary charges by distance, time and levels of congestion. This will allow MaaS companies and other transport providers to improve the distribution of trips spatially and over time. For example, prices can be used to ensure that only people that value peak travel highly will travel in peak times. The use of autonomous vehicles will mean that previously congested urban roads should also be able to accommodate far more trips with fewer vehicles as a single vehicle can be used to provide mobility for many people across the day. The development of these more efficient charging systems will enable major cities to more effectively address congestion, particularly if they integrate road pricing systems with public transport, enabling road charges to vary with demand for public transport, such as in Singapore.

Digital Communications

17 What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

Whilst this is not a core area for CH2M, we see value in ensuring the trunk road and national rail network are fully linked to the 4G network as a minimum. This would allow reliable digital connectivity, with associated productivity benefits.

This will become increasingly important as road vehicles become "smarter".

Water and wastewater (drainage and sewerage)

22 What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

Note: "demand" includes domestic, commercial, power generation and other major sources of demand.

There are two guiding principles to ensure water security:

1. Balance the water rich and water poor geographies, large and small scale, with the introduction of additional transfers
2. Plan for water use by conceptualising it in four different states: rainwater, raw water from river or groundwater abstraction, treated water and treated effluent. With this in mind, plan water use in terms of stages during which it belongs to one of these four states

The text below explains the benefits of each principle.

Achieving a geographical water balance via transfer:

In the United Kingdom, the Water Resources South East Group understands the pressing needs to provide adequate water in the future. Not only will this region need to respond to the largest growth in population, they may also need to deal with some very large sustainability reductions and therefore lose some of the

water they are currently used to abstracting. In order to evaluate how they can be most resilient to challenges to their future water security, they are exploring the impact of different futures and what investment can best help them provide adequate water. One scheme that can assist is the implementation of a strategic water transfer from the west which has a surplus of water when the southeast is in drought, therefore balancing the water rich and water poor geographies.

Additional transfers will make better use of abstraction licenses already in production and will optimise the use of future resource developments in one Water Resource Zone (WRZ) by making the water benefits available to additional WRZs. The Water Resources South East Group is also exploring the benefits local inter-zonal transfers to more efficiently share surplus water. In areas like the southeast which lack access to additional abstraction licenses, future water may be provided by strategically returning treated effluent back to the natural water systems to be available at strategic abstraction points for transfer and use and also for direct industrial use.

The additional network connectivity will also provide additional resilience for unexpected and more extreme outage events.

Multi-state and stage water planning:

Maximising the utility of captured water before it is returned to the natural system is a significant option when current abstraction is being limited to ensure environmental sustainability and future abstraction is harder to find. Multi-state and stage water planning will make it possible to reap the benefits of water more than once before it reaches the sea and as a result limit the need for additional abstractions from the natural environment. The following text offers a few examples.

If we examine the principles at the domestic scale, rainwater can be collected and stored for not only garden use, but also for showering and bathing or toilet flushing. Additionally, rainwater that has been used for showering or bathing can be again used for toilet flushing and/or garden and other outside use such as washing the car or the driveway. Australian legislation has dictated the creation of a triple pipe water system that conveys potable water, rainwater and treated waste water and have established plumbing guidance to manage these three streams with appropriate backflow protection. The practicality of this approach has helped them survive long term droughts and provided the technical infrastructure to enable strong legislation such as banning the use of potable water for gardening. This brave act also motivated a growth the economy in terms of different cistern products and pumps that monitor rainwater storage to top-up supply from a municipal pipe when needed. New housing developments are being marketed with beautiful lawns and garden space all compliant based on the rainwater and greywater systems.

At the local industrial scale, the benefit of treated effluent is promoting integrate business developments and network industrial complexes. The water treatment works in Tacoma, Washington, USA, offers a prime example of a treatment centre that is making a profit. They sell their treated effluent to the municipality and local businesses for street cleaning and industrial uses. They sell the sludge for home garden compost (at a profitable markup) after it has completed its time in the anaerobic digestor, and finally, they use a heat exchanger on the effluent and generate electricity to sell back to the grid. The industrial benefits of treated water and networked manufacturing productions are being promoted by Yorkshire Water who are seeking to develop industrial hubs around treatment works. The use of treated water can provide business growth in addition to maximising water use and limiting the need for additional abstraction.

At the regional scale, the concept of water reuse in larger volumes via aquifer storage and recovery has changed legislation in California. RAND Corporation, a California research group, worked with the Imperial Water District in California to explore their resilience to climate change. After evaluating thousands of potential futures to understand the vulnerabilities of existing planning practices, the collaborative team discovered that the most cost-effective method to achieve resilience to future droughts would be to capture stormwater and store it in underground aquifers. Because of the uncertainty of future climate patterns, it could not be defined when the infrastructure should be built, but the study did convince the regulators and water planners that there needed to be able to change the long term water plan to adjust to a change in climate and invest in this infrastructure development sooner than expected. This need for resilience changed legislation to allow for an adaptive management plan that could adjust to changing circumstance.

In the UK, Anglian Water and other companies in the southeast are evaluating the benefit of aquifer storage and recovery to extend the potential of groundwater aquifer storage and in this sense maximise the benefit of the natural system. There is a potential to link to source of this stored water to water captured during flood alleviation work. This is one of the examples of integrated whole catchment planning.

The multi-state and stage approach to water planning can accentuate our resilience to water deficit when we characterise the type of use required, understand the residency time and place of the different states and stages and maximise the different storage potentials to provide the different states of water at the right place and in the right time. It is a question of tracking the flow of water as it changes between the different states and leveraging its utility along the way.

23 What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

Note: this can include, but is not necessarily limited to, governance frameworks across the country.

Introduction

Current drainage and sewerage capacity is often a legacy of our Victorian past and the core infrastructure constructed in the 19th and early 20th centuries. Combined sewers (taking wastewater and stormwater) are especially vulnerable to capacity problems. Demand is increasing because of population increases in cities, 'urban creep' as green areas are paved over, and climate change which increases the frequency of problematic rainfall. When increases in demand (for drainage and sewerage service) exceed supply (the capacity of the buried infrastructure and assimilative capacity of receiving waters) communities, customers and the environment suffer because of the more frequent operation of combined sewer overflows (CSOs) and flooding.

The supply-demand in-balance for drainage and sewerage services is a growing challenge for UK water utilities and other flood risk management stakeholders. The consequences are very severe and represent amongst the worse service failures water utility customers can experience. A lack of capacity can also be a significant economic blight on an area where pollution or flooding concerns triggers planning embargos until infrastructure is enhanced. Intervention can be on the supply side or demand side. All increases in demand are characterised by significant uncertainty on timing and location; this makes effective planning a challenge.

Supply side

Supply side interventions are the most conventional and involve increasing capacity underground and hence at treatment facilities. The most notable example in the UK is the Thames Tideway Tunnel programme, designed to all but eliminate CSOs in London to the River Thames. The reference design for Thames Tideway Tunnel has been developed by CH2M as Programme Manager, and considerable attention has been paid to how sensitive the design is to future populations, urban creep and climate change. The solution is especially effectively because it will meet environmental objectives relatively quickly (by 2022).

Demand side

Demand side interventions focus on controlling the rate and volume of stormwater entering combined sewer networks through measures such as green roofs, downspout disconnections, rain barrels, rain gardens and surface attention ponds. In North America and parts of Europe, such 'stormwater green infrastructure' or 'sustainable drainage systems' (SuDS) have been successfully deployed to offset or augment conventional 'grey infrastructure' supply side measures. CH2M is active in implementing such interventions in US cities such as Philadelphia, Washington and New York.

In the UK, many of the water utilities are piloting such techniques, notably Welsh Water, Scottish Water and Thames Water. The creation of new green infrastructure is beneficial in other ways for cities too, improving biodiversity, protection against climate change and healthier, happier communities. Solutions are also lower in carbon and reduce the need for sewage pumping and treatment. Evidence for this is well

presented in the CH2M co-authored work for CIRIA on evaluating the benefits of SuDS. (http://www.ciria.org/News/CIRIA_news2/New-tool-assesses-the-benefits-of-SuDS.aspx).

A barrier to widespread use of these interventions is the institutional complexity of water utilities, local authorities and agencies such as the Environment Agency. Questions of financing, responsibility, maintenance and adoption continue to be raised as apparent of actual barriers to wide-spread city greening. CH2M authored a report for United Kingdom Water Industry Research (UKWIR) in 2014 on approaches for developing a stormwater green infrastructure business plan and negotiating some of these challenges. We concluded that stormwater green infrastructure can play its part alongside conventional grey infrastructure.

Most effective interventions

The most effective strategy for the future will be one that blends grey and green optimally to anticipate and meet future demands. Because of the uncertainties in the location and timing of demand, a 'managed adaptive' approach is required with a battery of 'low regrets' demand side interventions for the medium/long term and tactical supply side interventions in the short term. Computational optimisation techniques can be used to develop and plan a program of work like this. Some good examples are cited by CH2M partner Optimatics http://optimatics.com/use-cases/#wastewater

More innovative supply side interventions are possible through digital infrastructure and the implementation of smart water technologies. In sewerage this relates to improved monitoring and control of flows through networks to maximise use of storage that is already there but not used. So called 'real time control' systems are commonplace in North America and Europe but have struggled to become 'normal' in the UK. More flexible approaches to overflow permitting would help in this regard. UKWIR reported on the potential for these technologies in the UK in 2013 (https://www.ukwir.org/forefront-report-page?object=66922).

Water utilities certainly have the system planning and analysis tools to support this process. Sewerage management plans (SMP) and drainage strategies are both important. Both could be more effective if water utilities were statutory consultees for planning authorities with the ability to influence development consistent with the timely provision of new sewerage interventions. OFWAT/EA's Drainage Strategy Framework was developed by CH2M and is an excellent basis for future planning in this area (http://www.ofwat.gov.uk/wp-content/uploads/2015/12/rpt_com201305drainagestrategy1.pdf).

Water UK is now working on a 21st Century Drainage program which continues this work with a work stream focused on capacity and headroom. The industry is helpfully coalescing around this work and with support from important bodies such as CIWEM's Urban Drainage Group, the dissemination should enable a more consistent approach across the UK.

24 How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

The main principles guiding catchment management are:

1. Emulate the natural processes and make use of ecosystem services
2. Maximise the use of water
3. Minimise human impact to the natural environment

These principles respond to the key water issues the UK must address:

1. Managing floods and water quality for human needs in a denuded landscape
2. Providing adequate supply of water for domestic, business and industrial needs whilst ensuring the health of the ecosystem
3. Ensuring our activities don't further degrade the ecosystem we are working hard to protect

Benefitting from and regenerating the ecosystem:

Flood alleviation into water supply: The best manner in which to effectively manage water using a whole catchment approach is to use water where it lands and accentuate the natural circumstances that control its flow. For instance, there are proven technical methods developed by the University of British Columbia that use distributed rainfall/runoff modelling to identify which localised areas of a catchment are subject to the highest accumulation of water. These are the locations within a catchment that could benefit from a small-scale dam that could initially alleviate the flashiness of a flood and subsequently, via network connections, contribute to a larger scale water distribution network to accentuate supply.

Restoring nature and saving money: Upper catchment management can trap significant amounts of water, and if targeted correctly, it can also alleviate the treatment costs associated with unmoderated overland flow. South West Water has proven success in a research project with the University of Exeter that restored peat bogs and increased the downstream water quality.

Restoring nature and evading drought: Building up the natural vegetation on the landscape helps with water quality issues and it also helps increase infiltration to replenish groundwater supplies and safeguard longer term base flow into the local stream network. This enhanced base flow helps achieve summer time minimum flow requirements and as a result makes it easier to continue to supply water during the summer months and makes it less likely that periods of hot dry weather will result in temporary bans on certain types of water use.

Bringing natural benefits to the city: The slowing down of water to alleviate floods and benefit longer term water availability via additional storage and base flow is not limited to ground vegetation nor is it limited to rural environments. Trees capture the majority of precipitation very effectively and can retain considerable amounts of water that evaporate back to the atmosphere without ever touching the ground. This benefit can be utilised in the rural landscape and in a cityscape. There are studies conducted by the University of British Columbia and the University of Davis that quantify the ability of different tree species to capture rainfall. These studies also provide information on the second benefit of trees to channel flow down the branch and trunk network. In the urban environment, the foliage of trees can be used to trap water in the atmosphere and the root structure can be used to trap water that has run down the branches and trunk as well as water that has runoff the pavement into storm drains. There are underground tree root capture cells that can intercept pavement runoff and thus lessen the shock to a drainage system during a storm event. This slowdown in flow can help limit and lessen the impact of combined sewage overflows.

Optimising the use of water and reducing floods: The benefit of using water where it lands for whole catchment management can be utilised in a distributed and intelligent infrastructure design. It is evident that rainwater harvesting provides great benefit as a water supply. At the same time, rainwater harvesting has a large potential for flood abatement and moderation. Imagine a large network of rainwater collection systems that have a certain amount of storage. These types of systems can capture most of the impact from less extreme storms and can still alleviate the pressure of more extreme storms. If all these distributed collection systems were connected via intelligent release valves, then they could be emptied in advance of an upcoming storm to maximise their ability alleviate the storm impacts once they arrive. This type of technology is achievable.

Playing our part in moderating human impacts: All the examples of SuDS technology and innovative water management require the collaboration of the water utilities, local authorities, developers and regulators. Many of these techniques are well known, but are not implemented as part of routine development because the planning process does not interject their use at the right time, nor do the water providers and the local authorities collaborate at the essential stages. More discussion and more pressure from the regulations to adopt innovative techniques will increase their uptake. To reap the benefits of this type of technology, implementation on a large scale is required.

In discussion with water companies in the south east, many are eager to embark on more innovative demand side management programs related to new developments that include rainwater harvesting and greywater use. These types of demand management offer larger savings in natural abstraction than simple water

efficiency efforts. Additionally, there will be a plateau to how much water can be saved when more and more households have low flush toilets and other water efficient household appliances. But often the water companies are involved too late in the process to drive this innovation forward, and sometimes the local authorities and developers are not thinking with modern concepts of sustainable water use. The government needs to include innovative methods in the building code and require developers of larger sites to build with integrated and sustainable water supply systems as part of the core design principles.

Flood risk management

25 What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

Flood resilience needs to be provided to ensure the safety of the public and enable the sustainable development of the country. Currently, we do not appraise investment levels using a target level of safety criteria, and it may be useful to develop such an approach, particularly for appraising the appropriate level of investment for maintenance of existing flood defences. For example, the Netherlands are adopting a threshold based on a probability of an individual dying from flooding in any given year of 10^{-5}. In addition to criteria based on risk to life, we also need to continue to use appraisal criteria that include economic, environmental and other social impacts and look to optimise net present value. One weakness in the existing criteria is that they do not include assessment of potential shocks to the systems and widespread flood events that could result in negative impacts to the country felt far beyond the location of the flooding. The National Risk Register of Civil Emergencies (2015) ranks coastal flooding as a highest priority risk (impact rank 4) and inland flooding impact rank 3 – but it is not clear about how these risk rankings relate to required levels resilience.

Methods for including climate change scenarios are already embedded into the appraisal processes for flood management. Readily applicable guidance allows for ranges of potential climate change at future epochs to be assessed for rainfall, river flow, sea level rise, storm surge and wave climate. Extreme end (H++) scenarios are available for most of these variables. 'Limits of adaptation' studies can be undertaken, using the climate change scenario data, to help identify under what conditions it may be appropriate to switch from a response that is based on protecting infrastructure 'in-situ', to one which involves moving infrastructure to less susceptible locations.

CH2M has been helping the Environment Agency with their Long Term Investment Scenarios (LTIS) since 2008 and the scope of these assessments have continued to grow over the years. The current LTIS analysis that we are leading includes an initial assessment of potential shocks on the system, higher climate change scenarios, more development scenarios, impacts on infrastructure and a fuller range of flood responses. Within the constraints of the project, the LTIS analysis will provide new evidence to inform decisions on the appropriate investment levels for flood risk management in England.

26 What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

Natural flood management schemes seek to work with natural processes by taking action that will manage and reduce flood and coastal erosion risk. Such schemes may cover a wide range of interventions; ranging from very localised options such as debris dams, green roofs and permeable paving, through to larger scale upland catchment management and river restoration, or coastal projects which seek to restore foreshore environments to reduce coastal erosion. In 2010, we worked with the Environment Agency to compile a wide range of natural flood management case studies[3].

[3] (http://webarchive.nationalarchives.gov.uk/20140328084622/http:/cdn.environment-agency.gov.uk/geho0310bsfi-e-e.pdf)

- Merits of natural flood management schemes include:
  - Can be effective at reducing downstream flood risk. For example, the Sinderland Brook River Restoration in Altrincham reduced flood risk to a downstream development from a 1 in 35 year to 1 in 75 year flood risk.
  - Can unlock additional funding and contributions in kind (e.g. the River Quaggy project in South London had input from the Quaggy Waterways Action Group).
  - Creation of improved habitats can qualify towards Defra's Outcome Measure 4.
  - Working with natural processes is typically more sustainable, reducing the commitment to spend money on future maintenance. In some cases, schemes also enable landowners to qualify for agri-environment payments. River restoration schemes can also reduce asset maintenance costs by removing redundant assets such as culverts (the River Quaggy restoration being another good example here).

- Limitations include:
  - The scale of influence can be small, i.e. field or small catchment. As such, schemes such as upland catchment management and reforesting floodplains need to be applied at a large scale to have significant flood risk reduction impact downstream.
  - The success of natural flood management schemes can be difficult to monitor and evaluate, particularly in the short term. For example, it will take many years for new woodlands or peat bog restorations to become fully effective. This presents a risk in terms of not knowing exactly how the environment will react, and whether the scheme will work.

As natural flood management schemes are developed, it will be important to capture and collate long-term monitoring data. This data can then be used to develop and improve models to support planning and designing natural flood risk management, and will also provide more confidence in expected outcomes.

Innovative technologies and practices in reducing flood risk

Long term asset management investment over an asset lifecycle provides significant opportunity for substantial cost savings, improved resilience and lower residual flood risk. The current system of assessing the benefits of flood alleviation schemes leads you to maximise the risk before you solve the problem (ambulance chasing). A pro-active approach (like TEAM2100 Portfolio Asset Management) enables a long term investment profile that avoids any sudden reduction in flood protection, avoids emergency works and gains better confidence in an asset system. The use of new technology around smart sensors, drone surveying and BIM provides a huge opportunity to improve understanding and performance in managing flood risk assets. However, a change of culture, business planning and benefits capture will be required, to move away from the traditional fail then fix approach that is widely adopted across the industry.

Solid waste

27 Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

Progress to date:

Credit must go to what has been achieved through a sense of purpose installed through financial and regulatory incentives. There has been significant progress and speed in the transformation of the waste industry over the last 30 years through financial incentives and a dramatic increase in standards for waste treatment from source to destination. The industry is now well-regulated with responsible organisations and individuals acting appropriately and taking responsibility for waste.

This has been achieved through the landfill tax escalator, although regulation has helped guide the industry in the right directions to develop the right behaviours. It has provided the right environment for industry to invest: certainty around timings of tax escalator and tighter regulation to develop skills and technology. For example, anaerobic digestion, energy from waste (pyrolysis) and mechanical recovery stations.

What is working well:

Recycling rates in construction are well above other industries. It is not unheard of for zero waste on construction sites. London Olympics set the bar for the industry in waste recovery and the reuse of materials, new standards for remediation and new approaches to waste management. Glasgow 2014 Commonwealth Games built on lessons learned and hit 0% waste for most materials, and 95% recycling rates on others.

Regulation surrounding waste ownership has created responsible waste owners in the construction industry that are actively avoiding waste generation. This is partly achieved through much better waste segregation techniques being applied on site. Without the financial incentives however, it is suspected that the behaviours observed would be less apparent. Combined, both of these drivers create a positive pressure to innovate.

Some major projects have innovated in the destination of inert waste to create value as well as avoid cost. For example, both Crossrail and Tideway utilised the spoil created by the tunnel boring machines (tunnelled clay) to form a nature reserve and flood defence barrier providing huge social and natural capital value as well as avoiding filling landfill sites. Through this process, critical lessons were learnt about the transportation of such vast volumes of material. Transporting spoil by barge was the initial concept to avoid knock on consequences to the road network. However, in some sections the spoil was too water saturated, and therefore sloppy, to be loaded into the barge cleanly and efficiently. The initial decision was to revert back to road haulage rather than adapting the barges (which was a cost based decision), though eventually after road haulage caused delays to the programme, it was realised that adapting the barges to the spoil would have been a better and cheaper option.

This lesson has now been learned and will be applied on future major projects were water transportation of waste and materials is an option. This example, whilst in the bigger picture is positive, also demonstrates that the perception of cost can prohibit innovation, and therefore there is a need to help overcome the perception that doing things differently is more expensive. Further support could be provided, through grant funding for prototyping solutions or trialling innovations off line, to provide the industry with better insight in to the potential risks and to support change management processes.

What needs improving:

Progress is beginning to stall as the cost effectiveness of increasing waste recycling rates has reduced. This is partly due to the recession reducing investment in innovation in waste handling, and partly reflects that the low hanging fruits have been harvested (waste segregation on site can't go much further) as we are now entering an area of increased complexity to push recycling rates higher.

There are opportunities to lessen the burden of waste segregation costs on demolition and construction teams through designing for waste recovery and waste minimisation techniques. However, those benefits will not be realised until the sites now under construction have come to the end of their operational life.

In the short to medium term greater gains can be achieved by modifying regulation and how it is applied to facilitate inter project sharing of materials. Appropriately classifying inert site won materials should allow greater reuse of what would traditionally be called waste. This would reduce the cost of reusing this material and allow it to avoid the destination of landfill sites. Our experience has shown that this can be caused where standards are applied too rigidly. Should the regulating agencies and local authorities be given greater training and provided resource to share best practice better, cost could be avoided and rates increased.

There are often also logistical constraints that affect inter project sharing of material resource, especially between government agencies and authorities. This can partly be due to timing, projects are not temporally aligned to facilitate the ease of reuse of materials and waste, and partly due to how waste is classified and managed between sites, and partly due to lack of inter-agency communication and alignment of projects based on shared needs.

Things that need consideration for the future – ideas and potential solutions:

Targets are currently not high enough within the construction industry which is affecting innovation and meaning progress is beginning to stall. EU targets require recycling rates of 70% in construction and demolition waste by 2020. However, 90% and above is consistently achieved on many major projects meaning that these targets are not high enough for UK construction sector to drive further improvements. Maybe our exit from the European Union provides an opportunity to reconsider the targets and up the game of the industry to gain a globally competitive industry through greater innovation.

Complexity in the types of materials and how they are arranged within building products is also beginning to rise. For example, there is an increase in novel (e.g. nano non friction surfaces) and composite materials that could require new methods of handling, treatment and disposal. Incorporation of smart technologies, sensors, communications systems and batteries into materials such as concrete may also require attention as they will necessarily complicate demolition and waste management/recovery approaches.

Reuse and recovery of these materials requires consideration during the design and testing phase, i.e. now. Greater regulation on how these materials are incorporated into existing structures could require new approaches in design for recovery/reuse and stimulation of this market could help avoid future cost and create job opportunities. There are however costs and these issues will be discussed in the response of the question below.

28 What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

Note: A "circular economy" is an alternative to a traditional 'linear economy' (i.e. make, use, dispose) in which products are designed and packaged to minimise waste, and resources are kept in use for as long as possible, e.g. through re-use, recycling and greater recovery of materials through the waste management process.

The definition of the circular economy used above is partial. The original intention was to incorporate concepts such as restorative and regenerative aspects of the system level approach to the circular economy, and be guided by natural system limits. There is a risk that such a 'weak' definition of CE does not facilitate the optimal gains that can be achieved to switching to circular model. For example, much of the literature from the practitioner and public sector is simply rehashing 'design for reuse/recovery' literature and rebranding it as circular economy.

However, a 'strong' approach (much as different approaches to sustainability can be classified as 'weak or strong') may not be pragmatic or achievable in practice. There are several complexities associated with managing materials in a circular way that we might not be able to overcome. For example, the logistics of managing the vast quantities of material that can be generated or required by major projects; surplus generated might not be needed for years – where do you store it? How is it classified? Whose responsibility is it?

These issues need consideration and should demand that a carefully selected definition be agreed and used to prevent a subsequent barrier being created, that of confusion and resulting avoidance behaviour. Clarity and certainty will facilitate progress.

It is important to note that we are beginning to see the emergence of the CE already. The most poignant example is a company who is leasing materials (steel) to buildings over their lifecycle and aiming to recover the materials at the demolition phase. However, such examples are the exception rather than the norm. This is due to primarily to market failures and the costs associated with overcoming the existing barriers.

Barriers

There are many existing barriers which broadly reflect the industry as it currently is, compared to what it needs to be to achieve the circular economy.

Transitioning to a circular economy will involve doing things differently. Change in business practice and individual behaviours requires effort, and this produces a barrier in terms of cost. There are initial investments in technology and training that will need to be made but currently regulation does not provide the certainty and clarity to facilitate investment by industry.

External costs, or externalities, in other non-CE products are currently not internalised and therefore like for like comparison in economic terms is not balanced. This results in non-CE products and services having a competitive cost advantage constraining market growth in CE products and services.

Cost benefit analyses used in construction and engineering is slowly moving to a whole life cost, and whole life value, approach. Investment decisions based on capex does not demonstrate the true value of CE products and services. This acts as a barrier to investment in CE.

Other areas of regulation and legal frameworks in this area poorly define targets and objectives, which provides little clarity and certainty to an industry that might want to invest. The result is that investment is not coordinated or not made at all, resulting in a slow uptake and different outcomes being sought. Careful consideration and consensus of the required outcomes is recommended.

The regulation guiding waste was intended for the linear economy and as such is not fit for purpose for the circular economy. In a CE, what constitutes waste? Nothing should be classified as waste, rather materials going through different uses. In this context a more nuanced and mature definition of who is a waste producer and who is a waste carrier is required. For example, the WEEE Directive places the responsibility on the producer, which ensures that the life of products and the materials that they are made of is explicitly considered. A new framework for the classification of waste, waste carriers, and waste producers is recommended to give this embryonic industry the same impetus that the recycling industry has utilised.

Costs

The costs are typically associated with overcoming the existing structural market and regulatory barriers, as well as the investment required for new technology and training.

Economic costs will be affected through the incorporation of externalities in the pricing of materials and products. This will initially increase the costs of products and services and have an inflationary effect on the construction industry. Over time the lessening of external costs at a societal level, for example air pollution, will reduce the constraints on economic growth and prosperity. As the industry matures, innovation and competitive market forces will reduce this cost burden, but there may be a requirement to stimulate initial investment to overcome these barriers.

Changing regulatory barriers, switching a legal framework that was designed to work in a linear economy, will also have significant costs, directly in the production of new fit for purpose legislation, and indirectly as industry readjusts to the new structure and requirements. Certainty over timing and fiscal incentives will allow the industry to adapt.

Technical barriers also exist in the design and manufacture of products used in the industry and how they will incorporate materials that can liberated for reuse after their initial lifecycle. The move to modularisation and offsite manufacturing should assist in overcoming some issues associated with the complexity of recovering materials through demolition. It should also lend itself to the constant evolution of the design of products to better meet CE requirements, akin to many manufacturing processes of other industries leading to faster and faster evolution of better, more standardised products. However, procurement of such offsite or modular components is not standard and needs to be increased. The pace of this change could be assisted by regulation or through procurement rules.

Benefits

The benefits associated with moving to a CE are more than significant, systemic and critical should we want to avoid escalating cost and pollution associated with the consumption of finite resources and the environment's ability to absorb environmental pollution. This decoupling of economic development from finite resource consumption is absolutely imperative to maintain progress and as such the CE represents an avoidance of future problems which will dampen if not destroy economic growth potential.

The benefits are not just the avoidance of cost. There are significant profit opportunities through increased revenues from emerging circular activities, improved customer interaction and loyalty, job creation potential and substantial net material cost savings. A reduced pressure on resources, securing supply chains and reducing price volatility will stimulate further market development and facilitate the progression of technologies and services that increase the effectiveness of systems related to construction.

A reduction in the costs associated with industry should also allow UK Plc to benefit from trade and investment if we act now and get a head start on other countries.

Summary

There is a requirement to increase the pace of change as externalities creating costs in managing pollution and destabilising supply chains are beginning to be felt. The existing barriers will constrain progress and

prevent essential benefits from being realised. It is therefore suggested that fiscal incentives, such as grants/R&D funds/tax breaks, may be required to overcome initial costs and be more effective than the avoidance of tax burdens.

It is thought that the initial cost implication on the production of CE products may be too high for the market at this current time of turmoil created by Brexit. However, once mature, a CE in the UK could offer an exportable service if we get it right and are able to demonstrate societal and economic benefits.

For additional information,
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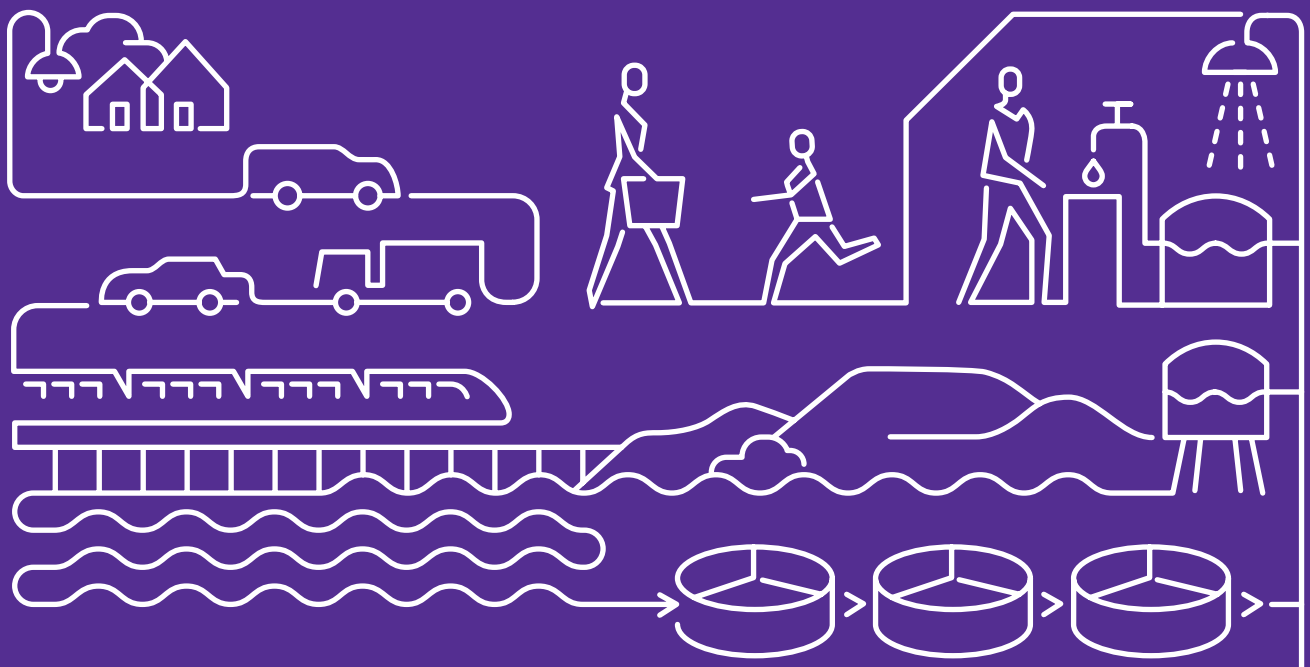

National Infrastructure Assessment Call for Evidence
Chartered Institute of Arbitrators Consultation Response

What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Introduction

1. The Chartered Institute of Arbitrators (CIArb) is a leading professional membership organisation representing the interests of alternative dispute resolution (ADR) practitioners worldwide. With 14,000 members located in 133 countries CIArb supports the global promotion, facilitation, and development of all forms of private dispute resolution.

2. CIArb has under its Royal Charter a duty in the public interest to promote and facilitate worldwide the determination of disputes by arbitration and alternative means of private dispute resolution other than resolution by the court (collectively called "private dispute resolution").

3. ADR mechanisms are a range of procedures that serve to resolve disputes generally involving the intercessions and assistance of a neutral third party to promote a binding settlement or decision. ADR mechanisms include:
    a. arbitration,
    b. mediation,
    c. adjudication,
    d. expert determination,
    e. Dispute Boards (DBs) also known as Conflict Avoidance Boards and
    f. online dispute resolution (ODR).

4. CIArb welcomed the establishment of a National Infrastructure Commission. The National Infrastructure Assessment (NIA) should explore how to improve contract design and approaches to procurement challenges to promote culture change through conflict avoidance. This collaborative approach will help ensure major projects are not hindered by protracted disputes. CIArb believes Conflict Avoidance Boards have a major role to play as part of a solution in relation to reducing project contingency and controlling dispute risk.

5. CIArb is a member of coalition of the UK's principal construction and engineering professional bodies; including Royal Institution of Chartered Surveyors, Royal Institute of British Architects, Institute of Civil Engineers, Dispute Resolution Board Foundation and International Chambers of Commerce UK, who have joined together in a ground-breaking coalition to help government and industry reduce the financial and reputational costs caused by disputes.[1]

Conflict Avoidance Boards

6. CIArb has asserted previously that the management and avoidance of disputes must be considered as the UK's strategic infrastructure needs and priorities are analysed over a long-term horizon. It is important that staff are trained and systems are in place to design good contracts, control dispute risk, and relieve tension within complex supply chains to preserve productive contractual relationships throughout the duration of major infrastructure projects.

7. A more collaborative, strategic approach to dispute management would encourage even further infrastructure investment, including a greater use of ADR procedures in addition to proposed planning courts to fast-track development disputes that impede construction projects.

8. The coalition that CIArb is a member of will seek to promote a Conflict Avoidance Pledge and we would urge the NIA to acknowledge this development and encourage those involved in the delivery of infrastructure services to take conflict avoidance seriously to ensure infrastructure is delivered as efficiently as possible and on time.

9. Conflict Avoidance Boards (also known as DBs) used with great success for domestic projects such as the London Olympics and overseas for the Copenhagen Metro and Hong Kong International Airport, reduce project contingency and risk. They typically consist of between one to three neutrals and exist throughout the duration of a contract to, firstly, and uniquely in ADR, prevent disputes from arising by encouraging informal discussions, and, secondly, if necessary, give enforceable decisions on disputes that may arise before the completion of the contractual arrangements. The neutrals will be familiar with the contract and its performance, and also be acquainted with the parties, making the board an effective dispute resolution mechanism with "real-time" value. Ideally, the neutrals become part of the project team and are trusted to be fair and impartial, so that their advice will be readily accepted by all parties. They would be an effective and efficient means for the Government to ensure it keeps costs down when embarking on long-term, multi-party infrastructure projects across all sectors: including major IT projects.[2]

10. For large scale infrastructure projects, Conflict Avoidance Boards have proved useful in resolving disputes before they crystallise into arbitrations. A typical cost of a standing Board on a project internationally is 0.06% to 0.30% of the final construction cost of a project. These are generally multi-million pound projects.[3]

Conclusion

11. CIArb believes that action in the area of dispute management and conflict avoidance to foster a culture of collaboration would contribute to a sustainable development of our national infrastructure. It would ensure contracts support projects rather than lead to protracted, costly disputes that damage the UK's international competitiveness and hinder economic growth. CIArb has implementation and advisory services, as well as contract avoidance training programmes that may be suitable for Government commercial staff responsible for contract design and delivery.[4]

Further information

12. If you would like further information on any of the points made above please contact:

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NIA Call for Evidence
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9th February 2017

Dear Sirs

National Infrastructure Commission: Call for Evidence

In connection with the National Infrastructure Commission Call for Evidence we felt that the Commission would appreciate a local authority perspective to assist in the process.

Local Context

Chelmsford is a forward thinking authority that is pro-growth. We have an adopted local plan in place to 2021 and will be publishing our preferred option local plan to 2036 next month. Growth in Chelmsford is at scale – we are delivering close to 1,000 new homes a year and about 700 new jobs, together with some of the supporting infrastructure needed. In north Chelmsford alone a development of over 4,000 new homes by Countryside Zest (Beaulieu), Bellway (Channels) and others is well advanced and our new Plan will be bringing forward a further 5,000 homes in this part of the City.

In delivering our growth to date we have built excellent relationships with key delivery partners, including Essex County Council, Highways England, the Environment Agency, Network Rail, Greater Anglia, our NHS partners and of course the development industry. Through development, S106 provisions and the Community Infrastructure Levy, we are able to raise fairly significant sums for infrastructure delivery, but there is a natural limit to this constrained by development viability. For the strategic interventions other funding mechanisms will need to be identified. So, for example the Countryside Zest development referred to above is delivering some £100m worth of infrastructure in total, including £22m

towards the cost of a new Beaulieu rail station, but the development itself can-not sustain the full delivery cost of the station.

Linking the Local to the National Context

Clearly the National Infrastructure Commission has a strategic national remit, focusing on the key national priorities to deliver a successful UK.

However, there is an important national-local dimension that we would hope the Commission can have regard to and shape national infrastructure projects which will also unlock the local growth that we as local authorities are charged to deliver.

So for example, in our part of Essex the widening of the A12 to 3 lanes, the new A120 and the Chelmsford North East Bypass will unlock thousands of new homes and business space that together will make a significant contribution to UK Plc in this part of Essex. We would hope therefore that the Infrastructure Commission is able to take into account this local dimension when considering strategic infrastructure projects. We have and are commissioning various strands of work which set out the economic case for such projects and would be happy to share these with you.

A local example would be Beaulieu Station – we have £34m secured, £22m from the developer and £12m from the South East LEP. The Station has wider economic benefits, will speed up housing and economic delivery and should be fully integrated with the wider strategic improvements on the Great Eastern Main Line. We wonder if there is therefore a role for the NIC to broker delivery in circumstances such as this where there is a clear local-national perspective. In addition we wonder if the Commission can broker closer working arrangements when needed – for example between DfT, Network Rail and the Train Operating Company.

Our challenges

Our challenges, like any local authority are significant in terms of infrastructure delivery and we don't profess to be unique. We have been relatively successful up to a point in raising local funding for significant infrastructure projects and will continue to do this into the future through our planning process. With this relatively successful background however there is a sense that for strategic infrastructure projects we are not getting the national investment that such growth warrants.

Our two key infrastructure priorities, Beaulieu Station and Chelmsford North East Bypass, will need central support and we would hope that the NIC may be able to work with us and support us in identifying alternative funding models to deliver these key schemes as we move forward. Both will accelerate housing and economic growth in this part of Chelmsford, which in turn will bring wider benefits to UK plc.

On a more detailed level we are also finding that where some schemes are funded and scheduled for delivery, for example the Chelmsford Flood Alleviation Scheme (a £13.5m scheme which his being jointly funded with the Environment Agency) and which will protect significant numbers of residential and commercial properties from flood risk, we are finding that the legal process can be used to delay delivery.

Speed of implementation and clarity of the various funding models available to us would also be of great assistance. So for example, the Housing White Paper flags up the Housing Infrastructure Fund and proposed changes to the Community Infrastructure Levy. As a local authority, having clarity on what is proposed and the timescales for change are of paramount importance to us in preparing our Infrastructure Delivery Programmes.

I trust that the above is of some interest to you in your gathering of evidence and we would of course be delighted to provide more information from a local perspective should that be required at some point in the future.

Yours faithfully,

[Signature redacted]

[Name redacted]
[Job title redacted]

Industry (with until recently government backing) has made huge strides over the last 15 years and the cost of zero carbon housing has come down from some 35% premium to less than 1.9%[3]

Lessons have been learned up and down the country in designing and constructing energy efficient homes which are still to be shared. BEIS could play a role in identifying, disseminating and encouraging them. Boilers are case in point: why does a modern home need a 32kW boiler / heating connection, when barely 20 years ago it was 12kW? We should be close to 1.5kW by now.

Industry can learn from elsewhere, for example installing PV panels in place of a traditional waterproof roof layer (not as an add-on component and add cost). Elon Musk may be exaggerating a little, but *this 'promise'* is that solar tiles will be as cheap, functionally efficient, long lasting and versatile as any other roofing material on the market within a few years.

We are not far away from an insulation sweet point where integral heat gains match heat losses so conventional heating can be completely omitted.

There are some big gains to be had on domestic hot water demands, given it is now becoming a large part of the heat demand, but is ignored by SAP.

Now we are getting our insulation and airtightness (at zero extra cost once skills are in place) together with enhanced insulation, this allows, for example, a 1.5kW exhaust air heat pump to meet all a dwelling's heating and hot water needs. This would eliminate the need for and cost of district heating for new build.

With half an eye on climate temperature change, the right configuration can give you free cooling from summer fresh air supply (using it as a heat source for creating hot water). The widespread take-up of heat pumps remains controversial. To obtain the best summer energy efficiencies there must be ways of using outside air directly to minimise the rise in internal temperature above the external. Openable rain and draught producing windows must take preference to architectural fashion and the consequent need for continuous "whole house ventilation" at a controllable but occasionally very high rate. This is likely to affect not just a building but where it can sensibly be built, so standards should cover this aspect as well.

There is an opportunity to restructure and greatly simplify the current 'process compliance' in Part L of the Building Regulations, and instead have an outcome performance based kWh/m^2 which tends to simplify designs and installed systems, and get the right (as NABERS experience shows). That approach also removes the fatal flaw of relying on SAP methodology development being funded by kit suppliers who simply push increase SAP complexity to allow their new gizmos

End-user lower energy bills mean improved mortgage affordability (less outgoings) and improved rent affordability, as well as improved comfort and amenity.

Zero-energy bill homes as a goal (user focused) are achievable now for up to 3 storeys with lower build densities, using on-site PV with enhanced passive efficiency measures. For higher build densities, a promising approach is UK customised Passivhaus, harnessing lower envelope areas and UK higher internal heat gains.

The point of all the foregoing is that the industry is on track being able to deliver very energy efficient homes at little or no extra cost. It can also be argued that in recent years new houses have

[3] David Lock Associates, 2016 Greater London Authority Housing Standards Review Viability Assessment

had higher sales price compared with their low construction cost increases, leaving a sufficient margin to pay for the above.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

No response provided

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

No response provided

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

No response provided

9 How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

The 2007 floods demonstrated that our infrastructure fails in a brittle manner, and that failure cascade from system to system. We need to take an integrated whole systems approach to the UK's *infrastructure*.

The old energy approach of concentrating on supply and distribution but ignoring consumers won't work anymore. Power systems today are undergoing a profound transformation, driven by the diversification and decentralization of power generation, coupled with the emergence of advanced power electronics which are capable of managing the increasing complexity and size of modern power systems. The technological changes are in turn driving changes in the way energy is bought and sold: the twentieth century model of centralized energy production and distribution by a limited number of actors is evolving into a dynamic, multi-directional, market-based platform where divisions between roles – producer, distributor, and consumer – are becoming blurred and overlapping.

This convergence of actors participating in a dynamic energy market is referred to as transactive energy (TE). TE is formally defined by the GridWise Architecture Council[4] as "A system of economic and control mechanisms that allows the dynamic balance of supply and demand across the entire electrical infrastructure using value as a key operational parameter."

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10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

No response provided

[4] The GridWise Architecture Council "was formed by the U.S. Department of Energy to promote and enable interoperability among the many entities that interact with the nation's electric power system." For further information see http://www.gridwiseac.org/

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Take an integrated whole systems approach to minimising waste, with particular emphasis on reducing GHG emissions and maximising biodiversity.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

A comprehensive Green Book analysis should in theory provide a sound basis for evaluating and prioritizing options for infrastructure investment. The system boundary of the analysis needs to be drawn widely enough that all important effects are properly accounted for, particularly where not all aspects to be considered can be expressed in monetary terms. The challenge still remains of the conflicting objectives and subconscious bias involved in complex decision making. An approach in which options are mathematically scored independently from each other and against an ideal scenario, previously determined, would mitigate to a large degree the subjectivity of the evaluation and also allow such process to be recorded for auditing purposes.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

There is no single simple answer to this. What works best will depend on local circumstances and timing. What is clear is that reducing consumption will be an important component of all solutions. For an example of the avoided cost attributable to reducing residential energy consumption, halving the energy consumed each year in the homes is equivalent to not needing the combined output of ten Hinkley Point Cs.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

No response provided

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

No response provided

Chartered Institution of Highways & Transportation response to the National Infrastructure Commission (NIC) - National Infrastructure Assessment call for evidence 10 February 2017

[Name redacted], [Job title redacted], Chartered Institution of Highways and Transportation (CIHT), [phone number redacted] Email: [email address redacted]

CIHT is a charity, learned society and membership body with over 14,000 members spread across 12 UK regions and a number of international groups. We represent and qualify professionals who plan, design, build, manage and operate transport and infrastructure networks. Part of our vision is to demonstrate transport infrastructure's contribution to a prosperous economy and a healthy and inclusive society. Our values are to be Professional, Inclusive, Collaborative and Progressive.

CIHT welcomes the opportunity to respond to the National Infrastructure Commission call for evidence on the National Infrastructure Assessment. CIHT has supported the National Infrastructure Commission's role in advising the Government on the identification of the UK's long-term infrastructure needs.

CIHT call for National Transport Strategy

CIHT has consistently called for an integrated national transport strategy[1] that sets a clear framework of requirements over a sustained period (20-30 years) for all elements of the UK transportation networks. This strategy should include the strategic and local road networks, rail, aviation and ports and set out how those networks integrate with one another. A strategy that addresses walking, cycling and public transport issues in the context of integration of planning, transport, health and well-being.

There should be a clear strategy, set nationally, for collaboration between different policy areas, including transport, digital, health, planning (including housing), utilities, education and social care in making inclusive and accessible environments, as all of these areas contribute to congested networks.

There have been a number of constraints for a long period of time preventing a co-ordinated, successful approach to the assessment and delivery of infrastructure need. These include:

- A continuing lack of commitment to long-term forward planning.
- Limited, if any coordination between government departments with ambiguity around roles and responsibilities. CIHT welcome the recent Industrial Strategy Green Paper and Airport Capacity National Policy Statement and Housing White Paper, however it is essential that these relate/co-ordinate with each other and are not once again individual silo'd statements.
- A reduction in client capability in the delivery of major programmes, a skills shortage in the supply chain combined with a lack of diversity and younger people being attracted into infrastructure planning and construction.
- The framework needs to be stable and simplified wherever possible. It will also have to recognise that need may be uncertain and subject to change and therefore the framework will need the ability to be flexible. This is discussed in the CIHT FUTURES report.

Other constraints include: resource availability, including finance, technical skills and land availability; local land use planning; lack of recognition of the importance of existing infrastructure maintenance and whole life management; and a lack of money, especially revenue, compared with capital.

[1] CIHT Manifesto

Supporting long-term economic growth in cities and regions

CIHT asked its regions to highlight the highest value infrastructure investments that would support long term growth in their region. Examples of these can be found in Annex A at the end of this submission.

Improved connectivity across all regions is essential to support and attract businesses and skilled workers, helping regions realise their economic potential and move towards a more balanced economy. With regards to the forms of governance which would most effectively deliver transformative infrastructure, CIHT support the devolution of powers. The overriding aim of devolution should be to ensure infrastructure provision meets the needs of all users, from a personal and business perspective. However the full benefit can only be realised if there is successful connectivity, policy and collaboration between all the cities, regions and LEPs. This requires a transparent share on funding and infrastructure.

There is an opportunity to build on the emergence of sub-national groupings to encourage a more strategic focus to decision making. The emergence of statutory Sub-national Transport Bodies offers new opportunities to feed local 'strategic' views into a wider national 'strategic' view of infrastructure. The National Infrastructure Assessment should take advantage of this by working closely with sub-national partnership bodies enabling an integrated/co-ordinated approach to infrastructure planning to meet local 'strategic needs'.

Further points include:

- Devolved governments in both Scotland and Wales have already demonstrated a more joined up approach in developing transport strategy. There is an opportunity to learn from their approach.
- London provides an example of how a mayoral approach, with executive powers, can deliver positive change in terms of transport. The 1999 Greater London Act transferred responsibility for multi-year budgets to the London Mayor[2] - which has allowed for long term planning (for schemes such as Crossrail) and for focus on local networks that help improve health and wellbeing through the support given to walking and cycling.
- The devolution deals currently underway present great opportunities for a greater response to local needs but the large number of transport authorities, with different delivery methods and procedures across the UK, does present challenges in terms of consistency of approach, ineffective use of resources and differing governance standards.

- The move to devolution of greater agglomeration of transport operations, if structured (through governance/executive powers and funded for multi-year periods) correctly could deliver real benefits.

  Total Transport Pilots

  Total Transport[3]: CIHT are currently working with Northamptonshire County Council and other organisations in their DfT support pilot, which is exploring bringing together transport provision across a range of sectors, education, NHS, the County Council and bus provider. This pilot project has potentially significant benefits in reducing the amount of trips made by transport providers, reducing both cost and congestion. The NIC should consider the success of these pilots in their assessment.

- More focus needs to be given on how we manage transport in all its forms across the country. The Rees Jeffrey Road Fund work on the Major Road network, combined with

[2] 'Can Devolved Transport Overcome the Black Spots, Guardian Newspaper (2015)
[3] https://www.gov.uk/government/publications/total-transport-pilot-fund

the developing approach of Highways England and the emergence of Sub-National Transport Bodies such as Transport for the North, Midlands Connect and England's Economic Heartland give the opportunity to consider carefully how strategic transport planning and delivery can be managed and delivered with other infrastructure areas.

- The availability of funding for transport, especially at a local level and for ongoing resilience and operation, will continue to be a concern moving forwards.

Planning and housing

A strong spatial strategy and attention to planning

CIHT believes that an infrastructure strategy (including digital infrastructure), linked to a high-level spatial strategy is essential when carrying out the Infrastructure Assessment. There needs to be an integrated approach from Government (national, sub-national and local) and its agencies. This should extend beyond the electoral cycle to produce a long-term spatial strategy that links the future transport needs of the country.

CIHT's response to the National Planning Policy Framework[4] highlighted the importance of effectively integrating planning and transport to ensure that the objective of delivering sustainable growth is realised. There is a need for changes to the National Planning Policy Framework in order to facilitate better/improved and timely delivery.

Questions such as how future housing requirements will be met must be clear in spatial terms. The Commission should recognise the challenges provided by the operation of the current housing market: the majority of housing availability sits within the current housing stock and locational choices are a trade-off between affordability and travel costs for households. This gives support to an argument for why a light touch spatial strategy is important (for example the devolved administrations have been preparing light touch spatial strategies)[5].

Infrastructure provision should consider the interaction between transport, digital, health and housing when developing the case for new transport schemes in the UK. CIHT notes that in recent times, the funders, professional advisers and users have tended to focus only on the direct economic benefits, without factoring in quantified health and wellbeing savings.

For example the current aim of an extra 1 million homes in this parliament, alongside provision of social infrastructure to support this extra provision will rely fundamentally on integrating spatial and transport planning. The aims of productivity and automatic planning permission for brownfield sites runs the risk of not fully considering how such schemes integrate with transport provision. This could miss opportunities for ensuring adequate public transport and particularly walking and cycling: important given the health challenges the UK faces.

The NIC should also consider when addressing the Infrastructure Assessment which existing corridors demand investment (particularly regarding public transport, including bus provision with walking and cycling).

Creating more inclusive environments

In order to create inclusive environments CIHT believes that there is a need for a strategy that sets street design in the overall context of the statutory requirements on local authorities (set out in the Equalities Act 2010) to create inclusive environments. This approach is set

[4] CIHT response to the National Planning Policy Framework
[5] CIHT response to the Transport Select Committee call for Evidence on Local Decision Making on Transport Expenditure.

out in Manual for Streets[6] about the need to place inclusive design at the heart of the design of better streets. Roads and streets are more than just routes for transport. They are about place as well as movement, creating places that people and goods can move to, from and within. Providing accessibility through travel choice is an essential component of place making, i.e. sustainable transport and development location. Accessibility should be assessed and encouraged on the basis of a hierarchy – reducing the need to travel, walking, cycling, public transport, private car - with priority given to the most sustainable means of travel first.

Demand Management, travel patterns and mobility as a service

It is important when assessing the national needs that the process recognises the wider benefits of (transport) infrastructure. Improved and integrated infrastructure will help tackle some of the big societal changes, including the ageing population, rise in obesity and social exclusion that we face. The benefits of investing in a long-term infrastructure plan will have a positive impact on accessibility, education, protecting the environment and enhancing the quality and functionality of existing places as well as improvement in quality of life and climate change.

There is a generational dimension with the priorities of younger people (significantly in major urban environments) likely to change demand for transport in the future. This is partly being driven by technology enabled by innovation and this is encouraging a shift from ownership of transport towards access to transport/connectivity: this is a fundamental shift in terms of attitude and expectations.

The NIC would be encouraged by CIHT to move away from a 'predict and provide' approach to one of more 'decide and provide'. When considering the Infrastructure Assessment, consideration should also be given to what society wants the future to look like. CIHT would be pleased to share the findings of its CIHT FUTURES[7] project that should provide more information and insight into issues such as uncertainty and forecasting.

CIHT would also encourage the Commission to look at the New Zealand Government's Future Demand project[8] which explored the uncertainty of demand for personal travel by developing four future scenarios looking at the possible impact on travel. These scenarios set out a range of plausible futures that will help us make better investment decisions.

Technology enabled solutions are making it possible for customers to have greater visibility of the cost of transport choices, in this sense the market will drive this trend in response to customers' expectations.

Considering new and emerging technologies and disruptive trends

New technology offers passengers potential for much improved journey planning and ticketing options and can assist in promoting modal shift, increase patronage and contribute to seamless connectivity. For example, Transport for London now offer contactless payment and have stopped using cash on buses thereby promoting the speed by which passengers get onto buses. One recent innovation in transport, Mobility as a Service (MaaS) focuses on providing a single platform for combining all transportation options and presenting them to the customer in a simple and completely integrated manner – the emphasis being on how to

[6] Manual for Streets
[7] CIHT FUTURES
[8] New Zealand Future Demand Project

get from A to B rather than the individual transport modes and services[9], MaaS has the potential to help reduce congestion greatly.

The public sector should act as an enabler/facilitator for technology enabled innovation as the market will respond in ways that might not be envisaged. The public sector should provide leadership and a vision on the kind of place we are looking to achieve. The NIC could look at ways in which the public sector might realise this potential.

There are a large range of emerging technologies – from increasingly autonomous and electric vehicles to wireless power technology. Print on demand (3D) and use of drones are just some examples of what might have a disruptive influence on supply chains and logistics. These initiatives are being led largely by the private sector, again the NIC might want to look at what the public sector needs to do to help accelerate this.

The way in which technology changes behaviour and demand is one of the uncertain elements faced today – rather than trying to predict, the opportunity is to embrace uncertainty so trying to predict what technology will do is unlikely to be the right approach. If the question is turned around to say – What do the users of our transport networks need? Then there is the opportunity to map which factors affect and influence those needs. They can then be assessed;

- Which of those factors can be controlled and which cannot?
- Where can technology play a part in controlling those factors and who manages that technology?

That approach will give a much clearer route to which areas of technology to focus on. Alongside that approach there is then a need to accept that there will be changes that were not predicted and how are these managed?

The commission should also ensure that technology is tested from a security-minded perspective.

Door-to-door journeys

Any assessment must include the Local Road Network (LRN) and set out how the Strategic Road Network (SRN), rail, aviation and ports networks integrate with one another. Nearly all journeys begin and end on the local highway network and therefore must be considered in any evaluation of connectivity. It should not just focus on the requirements for new infrastructure but the need to use existing infrastructure more effectively.

Connectivity

Improved connectivity is vital to enabling growth. Clarity and certainty in terms of strategic planning (and the assessment process) will produce greater confidence amongst investors, business and housing (developers). Cities, towns, villages and rural communities all contribute to the success of the UK economy, increasingly so as the implications of the new digital economy challenge the traditional 'agglomeration model' The CIHT FUTURES[10] project helps to set out the need to adopt a new approach to strategic planning, one that embraces a scenario based planning approach.

The weaknesses in connectivity is holding back much of the UKs regions in terms of jobs, enterprise creation, economic growth, and housing. It is therefore important that investment

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[9] **https://webcache.googleusercontent.com/search?q=cache:0f8pUphoQ44J:https://ts.catapult.org.uk/wp-content/uploads/2016/07/Mobility-as-a-Service_Exploring-the-Opportunity-for-MaaS-in-the-UK-**

[10] Future Uncertainty in Transport – Understanding and Responding to an Evolving Society, CIHT 2015 - 16

priorities in one area of the country are determined only having taken into account the relative benefit compared to investment made elsewhere.

Maintenance of existing assets, resilience, skills and funding

The Commission must not lose sight of the importance of maintaining existing infrastructure during the assessment

Maintenance and resilience of the existing asset, especially the Local Road Network, is too often overlooked with focus on the funding model for capital expenditure on highways maintenance given precedence. If existing assets are not adequately maintained then the entire network will not function correctly and will negate the benefits of capital investment in new infrastructure. It is vital to recognise that the highway maintenance service in local authorities is also dependent on revenue funding from Department for Communities and Local Government (DCLG) and other sources.

Revenue funding is subject to significant economic pressures that affect the ability of local authorities to deliver their highway services. A number of reports have highlighted the need to consider both revenue and capital funding together to ensure an effective and efficient service delivery (NAO[11], Transport Resilience Review[12]). Without considering the two elements together it is unclear how an effective and efficient service can be delivered.

Resilience - mitigate against disruption

Any assessment should review the resilience of the UKs infrastructure and move the consideration of resilience from events-driven reviews (Quarmby Review in 2010[13] and the further review on the causes of vulnerability in 2014) to regular review and planning by asset owners themselves, as a fundamental part of maintaining an integrated transport network. CIHT has previously recommended a formal review and commitment for asset and infrastructure resilience assessment to be made a statutory requirement in its response to the Transport Resilience Review[14] in 2014.

Resilience – invest to save

Resilient and reliable infrastructure is key to increasing confidence across the country and attracting private investment. Issues such as flood alleviation and asset maintenance are high profile across the country and highlight the need for funding certainty and commitment. Lack of both or this perception will stifle growth.

The Commission should ensure that Government takes an 'invest to save' approach as upfront investment will help reduce later costs from disruption. Such thinking should apply also to how transport networks support decarbonisation.

Skills – who will deliver infrastructure?

The Infrastructure Assessment requires a focus around the delivery of jobs and to address the skills shortage. This includes an understanding of who is responsible for tackling the shortage and how we are going to fill the jobs that will be required to deliver the proposed infrastructure. The development of skills is a key area of concern and one that should be careful considered when considering delivery of the national needs. The recruitment, development and retention of the next generation is vital to deliver these ambitious plans. In a recent survey of CIHT's

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[11] NAO report (2014) 'Maintaining strategic infrastructure: roads'
[12] Transport Resilience Review (2014)
[13] http://webarchive.nationalarchives.gov.uk/20111014014059/http://transportwinterresilience.independent.gov.uk/
[14] http://www.ciht.org.uk/en/document-summary/index.cfm/docid/FE7FEF4E-E237-45F7-8C526F39F890E407

Corporate Partners, 96% of respondents anticipated having a skills shortage in the next few years.[15]

CIHT has recently launched a suite of career materials and guidance as part of a programme to help the industry deal with the range of technical skills shortages. This includes a diversity and inclusion toolkit which provides practical guidance on data gathering, attracting and retaining a more diverse workforce and on changing culture and behaviour. It is the first toolkit of its kind for the highways and transportation sector and provides a route map to success through diversity and inclusion.

The National Infrastructure Plan for Skills[16], published by Infrastructure UK, sets out concerns in major sectors like roads, rail and energy. The report found that through growth in infrastructure investment, there would be a demand for over 250,000 construction and over 150,000 engineering workers by 2020, with a shortfall of nearly 100,000 additional workers by the end of the decade. Programmes like HS2 and increased investment in roads will put further stress on the industry's capacity to deliver, the report found. It noted that demand is forecast to outstrip supply over the next five years in all English regions.

The NIC has the ability to establish the certainty that would help industry invest in skills and secure the pipeline of skilled engineers and professionals for the future. CIHT welcomed the Department for Transport Skills strategy[17]. It is now crucial that the government works with industry very quickly to ensure the skills, capacity (e.g. timetabling of scheduled works to enable the necessary skilled professionals to be available) and capability to deliver these infrastructure projects are available.

To further exacerbate the issue, all of the above studies into the shortage of skilled workers do not take into account the potential effect of Brexit. There has perhaps traditionally been a reliance on migrant labour from the EU. It is, however, difficult to comment on the effect leaving the EU will have on the skill pool as we are still waiting to hear the type of Brexit that will be delivered and how the subsequent negotiations with former trade partners will conclude. Migrant workers from the EU play a huge role in the construction/engineering industries and their loss would impact greatly. The Office of National Statistics figures state that nearly 12 per cent of the 2.1 million construction workers come from abroad.

Security – the Commission needs to ensure that a security-minded approach is embedded across all Infrastructure Delivery

The Infrastructure Assessment should ensure that security and resilience issues are fully considered. The NIC should focus on the security aspects of infrastructure provision in terms of physical and cyber security. This is important when it comes to the potential security implications of moves towards open data and BIM models. It is recommended that PAS 119-5 2015[18]is strongly championed by the NIC to ensure such thinking is embedded within the infrastructure community.

Public and private sector roles

A significant amount of investment will be private sector led (a view that HMT has articulated in the National Infrastructure Plan) – so CIHT recommends the need to make sure that public sector takes ownership of the problems but enables the private sector to respond by being innovative with the solutions.

- Another potential solution is to move the road network to more of a utilities model: leading to more of a pay as you go i.e. road pricing approach.

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[15] Routes to Diversity & Inclusion, CIHT 2015
[16] The National Infrastructure Plan for Skills 2015
[17] Department for Transport Skills Strategy 2016
[18] http://bim-level2.org/en/standards/

- Ensure the procurement process allows for flexibility and innovation in delivery approaches

Sector needs certainty

Certainty, and continuity of investment over a sustained period is important if overall improvements to the network are to be delivered effectively and efficiently. This need for certainty applies both to the Government, "client" bodies and the wider supply chain of organisations working in the sector.

Certainty of investment will allow progress to be made in terms of developing and delivering a truly co-ordinated transport system, one that allows networks to be more resilient to disruption – both planned and unplanned. Examples such as the recent flooding in parts of Cumbria, Lancashire and Yorkshire have only served to highlight the importance of the UK's networks.

CIHT welcomed the establishment of Highways England and in particularly to the greater longer term certainty of funding provided. This similar level of certainty exists for the rail network and would be useful to implement across the UK – through devolved administrations and on the local road network.

Alternative funding mechanisms

Use of a new roads fund: In 2015 we welcomed the announcement of the creation of a new road fund which provided certainty in funding for the strategic road network. CIHT believe that the UK Government must also begin to address the funding of our local roads which make up over 97% of the network.

Road Pricing: In 2012 CIHT supported a report by the Institute for Fiscal Studies (IFS) commissioned by the RAC Foundation that argues that there is a compelling case for road charging in the UK. CIHT believe that road pricing at both the national and local level has potential to deliver social, environmental and economic benefits including a dedicated funding stream for transport infrastructure improvements and maintenance. For CIHT, the potential benefits of road pricing include a means of managing road space, which on many of our urban and inter-urban roads is currently congested. Analysts report that the London congestion charge has been successful and is working well. Congestion is lower, journey times quicker, and more predictable, public transport more effective and business has survived without a significant impact. In fact, the scheme has been far more effective than expected, and has removed far more cars from the road than was planned[19].

Workplace Parking Levy (WPL): Evidence from Nottingham reveals that their flagship city centre parking control scheme, 'Workplace Parking Levy (WPL)' has been highly successful at reducing car journeys significantly. WPL is a charge on employers who provide workplace parking, a type of congestion charging scheme. Nottingham City Council introduced this scheme to tackle problems associated with traffic congestion. Money raised from the WPL goes towards NET Phase Two (the extensions to the existing tram system), the redevelopment of Nottingham Rail Station and also supports the Link bus network. Employers, rather than employees, are responsible for paying any WPL charge, although employers can choose to reclaim part or all of the cost of the WPL from their employees[20]. The work in Nottingham has demonstrated the importance of integrating action to control car use with active provision of improvements to public transport to compensate and provide an effective alternative to the car.

Construction materials and equipment

[19] **http://www.nottingham.ac.uk/transportissues/cong_roadcharging.shtml**
[20] **http://www.nottinghamcity.gov.uk/transport-parking-and-streets/parking-and-permits/workplace-parking-levy/**

Recent investment in infrastructure such as the £15bn allocated to Highways England for the strategic road network, HS2 and other large programmes of work such as Crossrail, will impact on the availability of materials, plant and equipment in the sector. A 2010 study by BIS estimated that 64% of building materials were imported from the EU. With Brexit, importers may now face duties or limits on quantities, which could lead to further shortages of construction materials or an increase in costs.[21] Clarity is essential to provide the certainty required by the supply chain side of the sector, enabling them to invest in resource and capability to deliver the investment envisaged.

The environment

The commission's assessment must tackle sustainability and environment and is inadequate as currently stated. The NIC, in its assessment, needs to be more than reactive to climate change and recognise that infrastructure and everything that comes with it, is one of the drivers of climate change, and therefore we should be pro-active as well as reactive. Under the current remit it might conclude that the transport systems connecting to a coal fired power station should be resistant to flooding, without questioning having a power station that uses this type of fuel in the first place. Its role is meant to be a long term, evolving assessment. Large infrastructure projects / schemes usually have ramifications for the natural environment and as a result CIHT would like the commission to ensure that the programme works to meet agreed UK emissions targets.

High value transport investments

CIHT would recommend that the following process should be followed to prioritise an approach to investment:

- Identify the different classes of groups (customers) who are reliant on the network. As well as different users of the network, these customer groups could include amongst others, adjacent communities, non-users of the network, the environment, heritage and the highway asset itself.
- Identify the different purposes that the network is required to deliver to different customer groups.
- Analysis to confirm how the network will best meet the different purposes identified and to identify what investment is required to meet those different purposes of all customers.
- Confirm the wider benefits that will arise from meeting the needs of all customer groups and thereby define the Value for Money of the investment.
- Identify areas where investment in other modes will better meet the needs of customers and identify the parties best able to deliver that investment.

When considering high value transport investments the NIC must include investment to improve connectivity, resilience, maintenance and higher funding in local roads which are an essential part of the overall infrastructure networks. The NIC must recognise the value of the existing asset which includes the local road network, estimated in the government's Action for Roads[22] command paper to be worth £400bn. Resilience and maintenance of the existing, not just new infrastructure needs to be evaluated when considering the highest value transport investments which will allow people, freight and connecting places into and out of major urban areas.

Tackling congestion

[21] What does Brexit mean for construction?

[22] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/212590/action-for-roads.pdf

The UK's largest cities and towns are where the most significant economic activity takes place, where jobs are created and where businesses can thrive. Roads are vital to the transport networks in towns and cities. A recent report by data company Inrix suggested that British roads are the most congested in Europe, drawing upon a recent study, Inrix monitored traffic on every road in 123 cities, including London, Cardiff, Paris and Hamburg and found more than 20,300 so-called "traffic hotspots" in UK cities - well over double the number in Germany and twice that of France[23]. The Centre for Economics and Business Research and Inrix, identified that the cost of congestion to the London economy was $8.5bn in 2013, and would rise to $14.5bn in 2030. They estimated that the cumulative cost over that period would be more than $200bn[24].

In addition to the cost of congestion outlined above, it is important that the government recognises that highways and transport networks have two key functions; that of providing for the ***movement*** of people and goods and a contribution to the ***place*** in which they sit. Movement has been the focus of government and the sector but place is of great importance when considering accessibility and wider societal issues (including community and stakeholder engagement).

Conclusion

The strategy for transport and its associated infrastructure should be integrated both operationally and financially. The strategy should include the strategic and local road networks, rail, aviation and ports, setting out how those networks integrate with one another. Highest value transport investments should recognise that connectivity across all regions is essential to support and attract businesses and skilled workers. Investment should also recognise the value of improved environment, health and wellbeing, establishing a clear collaboration between policy areas ensuring inclusive, accessible environments for all users.

ANNEX A

[23] http://www.bbc.co.uk/news/uk-38149577
[24] https://www.ft.com/content/a50158ee-52de-11e4-a236-00144feab7de

South West

National Infrastructure Commission Call for Evidence – National Infrastructure Assessment. High Value Infrastructure Investments in Cities and Regions.

Information from CIHT **South West Committee** to inform CIHT's response 8 February 2017

The South West Region covers a large area with wide ranging infrastructure needs reflecting the diversity of its functional economic areas (covering five Local Enterprise Partnerships) and a mixture of cities, urban centres, towns, villages and deep rural areas. The northern part of the region is as far away from the southern part of the region as it is from Scotland.

Key strategic economic issues are the need to reduce the peripherality of the far south west by reducing journey times to London and the Midlands and improving access to national gateways such as ports and airports; the need to improve resilience of transport networks as much of the region has been cut-off in extreme weather events; the need to improve connectivity between growth centres in the region; and the need for urban transport systems to facilitate intense growth pressures in the city regions.

The key growth hubs in the region require infrastructure investment to accommodate planned growth and development, given a significant funding gap between what development can afford (viability challenges) and the infrastructure needed to ensure transport networks continue to function effectively in the future. Infrastructure improvements are needed on the local highway, bus, walking and cycling networks in our main towns.

New rail stations are required at a number of locations across the Region linked to localised growth and development proposals. These needs are covered in detail within individual responses from local authorities and LEP's across the Region.

South West Peninsula

The South West Peninsula covers a wide area covering Cornwall & Isles of Scilly, Devon, Somerset & Torbay; and the cities of Plymouth & Exeter. The Peninsula generally experiences lower levels of productivity than the UK average, with a key issue being peripherality, and consequently the distance between businesses and their markets. Research shows that there is a clear relationship between productivity levels and travel time from London, with a 6% productivity gap per 100 minutes' travel time. Approximate travel times to London by road vary from just under 3 hours to 4 hours.

Two of the highest value investment programmes supporting growth in the South West Peninsula are the A303/A358/A30 corridor improvement programme and the Peninsula Rail Task Force 20 year improvement strategy.

An economic assessment (http://www.somerset.gov.uk/policies-and-plans/schemes-and-initiatives/a30-a303-a358-improvement-project/) demonstrates that an end-to-end improvement of the A303/A358 to dual carriageway and smaller scale improvements on the A30 to Exeter would deliver 21,000 jobs and £41.6bn GVA increase through improved productivity of existing businesses; £21.2bn of taxation, welfare savings, disposable income and tourism benefits; and £1.9bn transport benefits. It is essential that Government allocates sufficient funds in the next road investment strategy to honour a commitment (https://www.gov.uk/government/publications/a303-a358-and-a30-corridor-feasibility-study-technical-report) to complete the end-to-end improvements despite recent cost increases.

The full economic potential of the corridor improvements will only be realised if the whole corridor is improved.

The 20 year rail strategy (https://peninsularailtaskforce.co.uk/closing-the-gap-the-south-west-peninsula-strategic-rail-blueprint/) proposes a long-term programme of investment in rail links between London and the South West which would unlock a host of benefits, generating an additional £7.2bn of GVA and £1.8bn of transport benefits. The strategy also suggests productivity benefits from simple improvements such as high quality/ uninterrupted wifi connectivity enabling productive use of the travel time. Both improvement programmes also tackle an inherent lack of resilience in the south west transport networks which are increasingly vulnerable to extreme weather events.

Other key road infrastructure improvements required to support growth and productivity in the South West Peninsula are

- M5 Corridor particularly at junctions which are the gateways to planned growth areas;
- A361 North Devon link road;
- A38 Devon Expressway (and inclusion of Plymouth on the Strategic National Corridor network);
- A30/A38 strategic road corridors in Cornwall need to be completed to national trunk road standard including dualling of the A30 Temple to Higher Carblake, dualling of the A30 Carland Cross to Chiverton and capacity improvements to key A30 junctions.

Airports are a vital link between the Isles of Scilly, Cornwall and the rest of the UK and beyond. Newquay Cornwall Airport is a vital link to London; major companies have identified air links as a key component in their decision making process for doing business. Without resilient air links to the Isles of Scilly there will be continued decline in visitors to the islands and to the quality of life and access to essential services by islanders. Improved air connections required are:

- International air connections: support to secure long term access to a London or other international hub airport e.g. Gatwick, Heathrow, Amsterdam.
- Regional Aircraft: Ensure continued accessibility of regional (turbo-prop) aircraft into hub and major airports.

Further investment in Penzance and St Mary's harbour is required to improve the resilience of the links to the Isles of Scilly

The Northern part of the Region - West of England 'City Region' & Gloucestershire

The West of England covers the four unitary authorities of Bath and North East Somerset, Bristol City, North Somerset and South Gloucestershire. Centred around the cities of Bristol and Bath, the West of England City Region typically has stronger economic performance and strong productivity, high-value employment and associated skills base.

The West of England faces a huge congestion challenge with no resilience, which poses a significant threat to productivity and an increasing threat to air quality. Infrastructure provision increasingly needs to focus on modal change away from car dependency and supporting public transport and low carbon transport.

Investment in the rail network in the West of England is needed to deliver a considerable change in travel behaviour, provide a focus for urban redevelopment around existing and new stations and be better linked to other modes to provide a truly multi-modal transport network. The West of England rail network also serves as strategic cross roads for rail at a national level.

The planning and delivery of new and improved rail infrastructure is complex and it is difficult to link to financial beneficiaries in order to generate private sector contributions to new schemes. In order to overcome this, the NIC could consider how the funding and delivery of local rail schemes can be developed to create an equal risk and reward framework to encourage more third party investment in the rail network.

Improvements to the A38 corridor linking the M5 with Bristol Airport and improved transit linkages between the airport and Bristol would enable the airport to meet it's full potential as an economic growth hub and international gateway.

Key strategic infrastructure needs in Gloucestershire are:

- A417 'missing link' to complete the A417/419 strategic route linking the M4 and Swindon with Gloucester (see below).
- M5 Junction 10 – Upgrading to an all-movement junction to remove current access limitations and enable major development planned in north west Cheltenham.
- M5 Junction 9 Ashchurch/ A46 corridor.
- A40 corridor linking Cheltenham and Gloucester / Forest of Dean.

The Eastern part of the Region – Swindon & Wiltshire, Dorset, Bournemouth & Poole.

The eastern end of the region covers Swindon, Wiltshire, Bournemouth, Poole and Dorset with stronger functional relationships with the South East and the South Midlands.

There is significant investment (£2.8 billion) underway in the Great Western Mainline, with the electrification of the line between London Paddington and Cardiff via Swindon and Bristol Parkway, and the associated introduction of the IEP trains from 2018. These investments will improve rail links between Swindon and North Wiltshire and London, reducing journey times to 45 minutes, but the Government decision to defer investment in the electrification of the railway line into Bath and Bristol Temple Meads will mean that the full benefit of this investment will not be realised. The completion of the full electrification project is therefore a priority for the region.

On the Strategic Road Network, it is essential for the economy of the South West, and especially that of Gloucestershire and Swindon, that the current studies into the dualling of the A417 "missing link" South of Cheltenham is translated into action through the delivery of this scheme as part of Highways England's RIS2 programme. This will particularly boost the motor manufacturing sector at Swindon, and will improve strategic connectivity between the West Midlands, the South West and the South East.

Looking eastwards, the Government commitment to investment in the East – West Rail project linking Oxford and Cambridge, and in the parallel Oxford to Cambridge Expressway, is welcomed, but opportunities to maximise the benefits on this investment should not be overlooked. Specifically, these include the potential to operate rail services between the West of England and Oxford, Milton Keynes and Cambridge utilising the new railway line. This would connect Bristol, Bath, Chippenham and Swindon with destinations in the South Midlands and East Anglia without the need to travel into London and change trains there, thereby freeing up capacity on the Great Western Line. These rail services would also help facilitate new rail stations at Corsham (where there is a cluster of high-tech businesses centred around the significant digital infrastructure investment related to the Global Communications Centre at MOD Corsham) and Royal Wootton Bassett (which is near to the Defence School of Electronic and Mechanical Engineering at Lyneham) in Wiltshire.

Similarly, connectivity between Swindon and Oxford (and the M4 and the Oxford – Cambridge Expressway) would be greatly improved through the dualling of the A420 route

connecting the two. This has specific benefits for the economies of both Swindon and Oxford, with manufacturing industry such as BMW having bases in both communities. The improvement of the A420 would also provide congestion relief for the M4 into London and the A34 South of Oxford, freeing up capacity on these routes for their core roles of providing strategic connectivity to the South East and the South Coast ports respectively.

Therefore, the next generation of NIC work needs to examine the potential for strengthening the strategic connectivity between Swindon, North Wiltshire and the West of England (acting as a gateway to the South West) and Oxford.

Connectivity is also poor on the north – south axis within the 'Wessex' area that covers Dorset and the coastal ports in the south, the whole of Wiltshire, Bath and the intersection with the M4 corridor to the north. Wider economic benefits are being foregone due to this poor connectivity: the A46 / A36 corridor is constrained by having to pass through parts of Bath city centre; there are bottlenecks and capacity restrictions on the A350; and the rail corridor from Southampton through Wiltshire and on towards Bath, Bristol and Swindon has relatively long journey times.

Better connectivity will help close current 'productivity gaps' in the area. Improved north-south connectivity will also benefit long-distance traffic, especially commercial vehicle movements, from the Midlands into the area and on to the south coast. Other economic benefits will be the 'unlocking' of much needed new developments, especially new housing sites at strategic locations.

In recognition of the above issues, Wiltshire Council, Dorset County Council and Bath and North East Somerset Council have commissioned a 'Wessex: North to South Connectivity (included with Wiltshire Council's separate submission). This study effectively forms an initial evidence piece to better enable Highways England to consider including options for improvements that could be taken forward as part of its RIS2 process. The NIC should help support this work as part of its National Infrastructure Assessment process.

Strategic road and rail infrastructure requirements that are critical to economic growth in Dorset, Poole and Bournemouth include:

- A31 between Ashley Heath and M27 (Southampton).
- Major improvements to North-South route(s) accessing the M4 via A350.
- Improvements to the A37 (in conjunction with A303/A358 improvements) to provide far better access to M5 from Dorset via Yeovil/Taunton.
- Major new link road between Poole and A31, unlocking several thousand new homes.
- Further dualling of A35 at key locations to ease significant congestion on East-West journeys across the sub-region.:
- Faster rail journey times between Bournemouth, Poole, Weymouth & London through significant track and signalling upgrades.
- Improved rail routes via Weymouth to Exeter, Taunton, Bristol, Swindon, Salisbury – Yeovil South Chord proposal is key.
- Weymouth to London via Yeovil. Re-doubling of track between Wool and Morton. Power supply capacity improvements.
- 'Dorset Metro' – new and frequent cross-conurbation commuter train services, including new branch lines to Wimborne and Ferndown and potential for link to proposed Solent Metro.

Submission by the Chartered Institute of Logistics and Transport

to the National Infrastructure Assessment

Call for Evidence

The Chartered Institute of Logistics and Transport is a professional institution embracing all transport modes whose members are engaged in the provision of transport services for both passengers and freight, the management of logistics and the supply chain, transport planning, government and administration. Our principal concern is that transport policies and procedures should be effective and efficient, based on objective analysis of the issues and practical experience, and that good practice should be widely disseminated and adopted. The Institute has a number of specialist forums, a nationwide structure of locally based groups and a Public Policies Committee which considers the broad canvass of transport policy. This submission draws on contributions from all these sources.

Introduction

CILT supports the NIC's strategy of taking a holistic approach to assessing the nation's infrastructure requirements.

We view transport as an enabler of economic prosperity, environmental protection and quality of life. Equally, the economic and societal value transport systems provide is dependent on and interdependent with other types of infrastructure – particularly energy, digital communications, flood defences and drainage.

We view the NIC's remit as a starting point in addressing significant gaps in central government's policymaking by:

- Considering the interdependencies between different types of infrastructure and how decisions can be integrated to maximise the benefits of investment for users and the nation
- Taking a long term view of national infrastructure requirements.

Our response contains several key themes reflected throughout our submission.

1. Generating options for potential infrastructure schemes

Historically, the Department for Transport has drawn up options for developing road, rail and airport infrastructure on the basis that the economy and society will continue to develop in a consistent, predictable way without significant structural changes. Planning has tended to be tactical and short term rather than strategic. In addition, government departments have, for the most part, operated independently of one another.

This has had a number of impacts including:

1. The infrastructure schemes considered and implemented are drawn up from a narrow list of options devised by professional engineers rather than a full range of stakeholders;
2. There is no potential solution ready to be developed if transport requirements and technologies change;
3. Option generation does not consider emerging technology or structural social and economic changes that may occur;
4. Options or schemes do not always embrace wider or emerging policy considerations – e.g. changing demographics or pollution that could have a major impact in the medium and long term.

One example of the consequences is that 30-40 years ago, transport and other policies were based on projections of continued decline in the economic role of the major cities, a decline which had started in the 1950s. Since the turn of the millennium that has changed and cities are now regarded as the engines of economic growth. Transport infrastructure planning is attempting to adapt to the change after it has happened but lead times for infrastructure delivery mean it will be years before adequate infrastructure is in place. In addition a large number of projects have been planned for simultaneous delivery putting pressure on the skills base. Furthermore, there are no options to alter course to take account further changes in circumstances that may occur.

The NIC's longer term perspective offers the opportunity for a new approach. Options for appraisal must:

- Consider a full range of future outcomes in the context of rapid technological change and the evolution of global economies;
- Be drawn up from a wider source of community consultation and professional opinion;
- Be flexible and future proofed to the greatest extent possible.

The increasing speed of technological and social change nationally and globally in developing nations makes a new approach especially important. It is far easier to take the wrong decision and wrong choices will become evident more rapidly.

Therefore, the NIC should undertake a constantly updated scenarios examination exercise for its NIA, based on total and continuous situation awareness and mindful of current and potential stimuli.

We do, of course, accept the inherent uncertainties surrounding long term forecasts. Our recommendations provide a basis for selecting programmes and approaches that presume implementation yet are sufficiently robust to accommodate change.

2. Principles for appraising infrastructure options

The Department for Transport has developed a comprehensive research and evidence based approach to cost benefit analysis over several decades through its WebTAG appraisal system. It provides a robust cost benefit analysis and sets a benchmark for other sectors with less well developed assessment systems.

The DfT continually develops WebTAG, but there is scope for improvement. For example, insufficient weight is given to the economic benefit of freight schemes (as discussed in Q12). In addition, the inputs could be broadened further. This highlights the challenges the NIC faces in

seeking to assess infrastructure schemes across a range of sectors in a holistic way. However, experience of WebTAG's strong points and omissions does provide useful learning which can be used to develop principles for wider prioritisation of infrastructure requirements including an evaluation of the options available to address identified objectives. Assessments should aim to capture:

- Full user costs as well as non-user costs;
- The economic impact that an investment will make and the jobs created;
- As wide a range of benefits as possible including health, social inclusion and environmental protection – they are much harder to quantify precisely than costs but are no less valid and important inputs to decision making.

3. Integrated, longer-term planning

Successive governments have tried (sometimes with little conviction) and failed to create long term transport planning frameworks. Local authorities, which have wider responsibilities than individual government departments, are better placed to take a broader view. Some have developed long term plans which combine transport, housing, economic development, environment, health and social inclusion. The London Mayor's London Plan is a particularly good example. Recent moves to extend devolved responsibility have seen Merseytravel and Tyne and Wear create long term rail plans in a similar broad based context. This experience shows that there is a need to ensure decisions on local, national and regional infrastructure are taken at the appropriate level and that the relevant powers are devolved.

In addition it will be essential that central government departments develop strategic long term plans to replace current tactical documents, and co-ordinate them with one another. The objective should be to ensure departments consider all forms of infrastructure being assessed by the NIC in a holistic context which translates into option generation, assessment and implementation.

For example the value of transport projects may be improved by considering how to build in flood defences. The value of power generation schemes may be improved by considering the renewable energy requirements of the transport sector. The value of health policies may be improved by considering the transport infrastructure implications.

In this context, spatial planning is essential to ensure the infrastructure sectors the NIC is considering align with the requirements of housing, healthcare, education and commerce, and the way lifestyles evolve.

Q1 What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

The focus should be on projects which contribute to sustainability in its broadest sense – economic, social and environmental.

For cities, the immediate need is to reduce existing congestion and pollution. But investment is also required to accommodate future population increases and enable economic growth. For passenger travel, the evidence shows that public transport rather than road schemes will provide the greatest economic agglomeration benefits as well as low carbon, socially inclusive

transport. It is anticipated that, in the main, local freight will continue to move by road. The methods used in London for the management of freight and road capacity for the Olympic Games should be rolled out more widely. Better managed and less congested networks are needed.

On regional road and rail networks, the immediate emphasis should be on collections of smaller road and rail schemes which together provide high value, high impact solutions – for example replacing flat junctions with grade separated junctions.

Across all regions, there is a need to provide the infrastructure for nationwide use of decarbonised transport, such as creating widespread electric plug in points, battery replacement stations (perhaps using redundant petrol station sites) and compressed natural gas stations.

Freight infrastructure development should focus on connections to international ports and gateways. As set out in our report *UK Freight Planning to 2035*[1] report, all major distribution parks should be planned with a presumption of rail connection with suitable sites identified nationally and facilitated by local authorities. This would reduce the high cost of development and create a more effective market where national need is balanced clearly with local interests. It is crucial that corresponding rail network capacity is provided to cater for such developments, taking the whole length of journeys into account.

Planning for urban hubs where freight can be consolidated for the final delivery to users should be prioritised under national guidelines, and local authorities given powers to purchase land and determine its use for such schemes. This would provide necessary consolidation and relieve congestion in our cities and major towns. It would also cut pollution if electric or hybrid vehicles can be used for the last leg of the journey.

As emphasised in the introduction, it is also important to start assessing a full range of potential medium and longer term priorities now against the context of likely technological developments and social change nationally and internationally. For example, as developing nations become wealthier, how far will manufacturing production reside in the UK? It is important to consider what sectors may be impacted (potentially food production) and the requirements for regional supply chain infrastructure.

Q2 How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

Competitiveness depends on the efficient movement of goods and people and the ability to adapt networks rapidly to new demands – ideally as, or before, they emerge. In many areas of the country, transport infrastructure is not meeting these key requirements, with consequences for productivity, cost of trade and GDP (e.g. Eddington 2006[2], CEBR 2014[3]).

The most immediate single requirement in terms of increasing international competitiveness is better road and, in particular, rail links to short and deep sea unit load ports. They are the UK's

[1] Available from: http://ciltuk.org.uk/Portals/0/Documents/News/cilt_freight2035.pdf
[2] Available from: http://webarchive.nationalarchives.gov.uk/20090104005813/http:/www.dft.gov.uk/about/strategy/transportstrategy/eddingtonstudy/
[3] Available from: http://inrix.com/press-releases/traffic-congestion-to-cost-the-uk-economy-more-than-300-billion-over-the-next-16-years/

principal international freight gateways. While Felixstowe and Southampton handle the majority of goods the UK requires, London Gateway is building its volume and has invested in a significant amount of capacity that is likely to be taken up in the medium term. Tilbury, Liverpool 2 and Teesport are coming on stream recognising the change in routing emphasis with the widening of the Panama Canal, the restructuring of the container transport fleet and the possible effects of climate change.

The quality of transport links to and from all these ports has, and will have, a huge impact on the UK's trade and competitiveness. The most pressing need is action to significantly improve the capacity of the rail links (they are the most efficient and low carbon means of moving goods), particularly on the capacity constrained routes to Felixstowe and Southampton. For example, on the Felixstowe branch line demand is significantly in excess of the maximum freight capacity meaning many containers are transported less efficiently on congested roads. Upgrading this and other routes to deep sea ports may become even more important if, post Brexit, trade shifts in favour of the rest of the world.

Despite its economic importance, rail freight is currently some way down the Department for Transport's priorities: CILT recommends that this should be addressed as soon as possible.

As set out in the introduction, total situational awareness in all relevant government departments, forward thinking option generation and fully developed methods for evaluating freight schemes would have made the case for route improvements and the benefit they provide to the economy, the environment (in the case of rail freight) and quality of life (e.g. through enabling reliable delivery of goods) absolutely transparent.

Q3 How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

In our 2014 report *A Vision for Transport Planning*[4], we set out a potential framework for sustained high quality planning at central and local government level with responsibilities devolved to appropriate areas. Central government's role would focus on national networks.

Nationally, a medium to longer term spatial strategy for England would cover economic development, land use, transport, the environment and climate change, with strong links to health and education. The strategy would cover a period of 15-25 years and be refreshed at least once every five years. It would be binding on incoming governments until a new strategy had been consulted on and put in place. Preparation of the strategy would be the responsibility of a Cabinet Committee that included the Secretaries of State for all relevant departments as well as the Chancellor of the Exchequer. It would be drawn up working closely with key stakeholders from the public and private sectors.

The national spatial strategy should be complemented by regional strategies prepared by combined authorities, such as Greater Manchester, covering the same aspects of policy. The strategies would be developed in partnership with key stakeholders, and would apply until replaced.

[4] Available from: https://www.ciltuk.org.uk/Portals/0/Documents/Policy/2014/VFTP_2014v2.pdf

Q4 What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

A strong case for road pricing was set out in the Eddington report (2006)[5] and the detailed studies carried out for it using the National Transport Model. They showed that incentivising shifts in journeys to times when there is spare capacity on the network would significantly reduce the number of new roads required and make more efficient use of assets. The economic benefits of road pricing combined with a significant but smaller road improvement programme were estimated to be over £25bn per year and greater than could be achieved by increasing capacity in the absence of pricing.

The political sensitivity of the road pricing means the DfT has not examined it since. However, this year's Wolfson Economics Prize has provided an incentive for competitors to develop new ideas for better management of the road network. We anticipate that the NIC will note the submissions with particular interest given the wide range of policy issues road pricing impacts.

Ultimately, the potential application for road pricing will depend on political will. However, there are economic, environmental, social, technological and financial factors combining to increase the strength of the case year on year:

Economic: Congestion has continued to rise since Eddington's study with significant impacts on GDP. For example a 2014 report by CEBR found that congestion will cost the economy £300bn over the next 15 years. Such estimates, however, need to be qualified by the consideration that they rarely take account of the costs to the taxpayer of funding the interventions needed to reduce congestion.

Financial: More fuel efficient petrol and diesel vehicles, along with incentives for drivers to shift to electric vehicles which attract no road tax, will have a significant effect on government finances. The Treasury could lose tax income greater than current public spending on transport – at a time when additional funding will be required for road and rail investment and to increase electric charging infrastructure. Pricing also offers a potential means of raising funds to complete the network of 'smart' motorways and trunk routes incorporating secure goods vehicle parking, congestion monitoring and possibly partial vehicle automation with in-surface battery charging. In addition, there is potential for pricing to reduce the funding required for new roads.

Technological: Potentially, forthcoming Mobility as a Service applications could make road pricing acceptable to the public by setting it in the context of a holistic, personalised travel advisory service (see Q16).

Social: Current road taxation is clearly inefficient because it means drivers using uncongested roads at off-peak times (including most rural and inter-urban roads), pay far more for road use than is economically or environmentally justified, while drivers on congested roads at peak time pay too little. This is exacerbated by the tax differences between internal combustion and electric powered vehicles.

Environmental: As noted above, road pricing could be a key element in a package to enable a national electric charging network. There is also a growing concern about pollution, particularly in cities, and its impact on health.

[5] Available from: http://webarchive.nationalarchives.gov.uk/20090104005813/http:/www.dft.gov.uk/about/strategy/transportstrategy/eddingtonstudy/

Q5 How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

CILT's view is that in most circumstances, the priority should be to maintain existing infrastructure before building new assets. However, it is legitimate to evaluate the impact of deferring or reducing maintenance of existing assets against the benefits new infrastructure would deliver. The phasing of delivery for new infrastructure should account for sufficient costs to maintain existing parallel infrastructure until a switch over can be made. Similarly urban highway and emission control systems should consider as well as for freight deliveries the provision for and impact of maintenance and service traffic to maintain urban infrastructure, buildings and services vital tour economy. Factors to take into account include:

- The full economic and social costs of disruptive heavy maintenance requirements on existing assets and whether they will be avoided if new infrastructure is built;
- Expected changes in demand and patterns of use if new infrastructure is built;
- Whether available funding will be sufficient to guarantee that existing assets are maintained to an acceptable minimum standard if new infrastructure is built.

Evaluations must be informed by high quality data which enables accurate assessment and comparison of future maintenance requirements and spend on a steady state and enhanced network. It means national and local transport network owners need comprehensive asset databases so they can predict maintenance costs with reasonable certainty. However, at present the standard of asset bases is highly variable so it can be problematic to make informed judgements.

The NIC should consider setting standards and targets for data quality to help inform accurate decision making.

Q6 What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Experience in logistics suggests that, while there are benefits in having a competitive supplier base, collaboration can deliver further value by addressing challenges/opportunities in a different manner – most obviously via shared-user facilities and services. It would appear that similar conclusions have been reached in the construction sector, where alliances are now a common method of delivering major infrastructure projects, alongside the traditional model of competitive tendering.

Q7 What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

Transport is unusual in the NIC's infrastructure remit in that funding for some networks (e.g. local rail) is shared between central and local government. This results in 'game-playing' by local authorities in an attempt to win additional central government funding. It means the system is working less efficiently than it could at present. It would be more efficient if local authorities had not only the powers and responsibilities, but also the funds, to take and implement decisions on predominantly local matters. Road pricing would provide an income stream for local projects overseen by politicians accountable to the local electorate, not Parliament. This would reduce intervention from the DfT and the Treasury in local affairs.

In addition, infrastructure funding needs to be fully co-ordinated. The level at which co-ordination occurs should vary according the nature of the investment – the London Mayor, Transport for the North, other devolved administrations and central government all have a role, but investment in the major interurban routes must be coordinated by central government to ensure the outcome for UK plc is optimised.

Q8 Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

In terms of asset development after construction, there is considerable appetite for private sector operation and investment, especially where the infrastructure provides monopoly services. However, current business models often see assets sold on after 10 years, which creates risks that asset development will be based on short to medium term horizons. In other cases where the infrastructure operator faces competition (including the M6 toll road and roads in Australia), misjudgement of potential revenues has raised concerns among potential investors in future projects.

Funding for certain construction projects where there are high risks and construction costs (e.g. Thames Tideway Tunnel, HS1 and HS2, most renewable energy projects) depends on availability of public sector capital. This is unlikely to change.

There is an established and successful business model for private sector investment in ports.

Q9 How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Systems and working arrangements must be put in place so that all relevant government agencies and private sector partners have total situational awareness of one another's roles, plans strategies and service delivery.

For example, providing the infrastructure for a national system of electric car charging must include:

- Co-ordination of public and private sector investment in car charging points
- Investment to increase the capacity of the national grid;
- Public education programmes to inform people of when they can charge cars to take advantage of cheaper electricity at times of low demand;
- Development of technology – for example reservoir batteries.

The aim should be integrated strategic planning across the main sectors of the economy involving all relevant public and private sector partners.

Q10 What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

The progress of infrastructure schemes from initial concept through to opening is too time consuming, too costly and too subject to political change (e.g. decisions on Heathrow T5; runway capacity in the south east). The process needs to be simplified, shortened and made more resilient to political change. Other countries make decisions and progress to implementation in

a timely manner (additional runways for CDG Paris and Frankfurt are among many examples of how other democracies have a 'better' record of achievement).

Many sectors need rapid improvements to infrastructure, for example to:

- Overcome deficiencies in communications networks, both fixed line and mobile.
- Reduce the probabilities of serious flooding of communities and critical infrastructure
- Reduce congestion across the road network, together with its impacts on the environment
- Reduce congestion across much of the suburban rail network.

Making the required progress will depend on:

- A much more pro-active, can do, approach in Whitehall
- Changes in planning, enabling, procurement and construction management, each designed to speed the processes, but respecting the rights of those directly affected by schemes
- Better, easier, prompt compensation terms for those who are adversely affected
- A review of national planning frameworks to avoid unnecessary conflicts with regional plans where schemes are driven by specific requirements and circumstances – the devolved administrations should be engaged in central government planning process to ensure that regional and national policy developments are aligned.

In addition, we recommend that the NIC should promote the need for political parties to form a consensus on how to prevent unnecessary delays to nationally important infrastructure schemes. It should include recognition that all parties should have a common interest in efficient delivery of high quality projects. This means a duty to hold government to account rather than politically-motivated obstruction.

Q11 How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

As noted in the introduction, environmental sustainability in its broadest sense must be an integral part of infrastructure planning and operation. In general, the UK has good processes – for example through the DfT's methodology for assessing transport schemes and legislation (EU-driven) for wildlife protection.

This means trade-offs are made to balance environmental impact and providing infrastructure at affordable cost.

Striking the right balance in the future will require a thorough understanding of the environmental implications of new technology and the different types of choices that will be required. For example tidal barrages are becoming technologically and financially feasible, potentially offering a significant new source of renewable energy. However, they will have a significant impact on natural habitats. Government may need to choose whether it is more important to minimise climate change or protect wildlife.

Infrastructure investment should also be considered in the context of reducing CO2 emissions through mode shift (as set out in Q3). For example, all major distribution parks should be planned with a presumption of rail connection.

In addition, the NIC should consider the visual impact of infrastructure schemes. There are some excellent examples from Europe of projects (e.g. viaducts in mountainous regions) being designed to enhance beautiful natural environments, not to minimise their visual impact. The appearance of these structures also generates revenue through increased tourism. CILT's view is that the UK has paid too little attention to the visual appearance of infrastructure.

Q12 What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

DfT continually updates and improves WebTAG. However improvements are possible. For example:

1. Appraisal undervalues road freight infrastructure by failing to quantify the economic value of the goods carried, delivering them on time and preventing delay. However, a significant body of data does exist and can be made available to DfT (e.g. work by several universities and TfL on urban freight) to inform a revised evaluation system.

2. Unreliability caused by incidents is now well understood, and measures to reduce incidents are part of the appraisal process. But variability in journey times unrelated to incidents is not well understood. As a result there is a lack of policy or investment options which might reduce journey time variability. It means there is a strong case for research to understand why journey times vary for reasons which cannot be explained.

3. WebTAG should capture as wide a range of benefits as possible - they are harder to quantify precisely than costs but are no less valid and important. There is scope for further improvement in this respect, including broadening the range of impacts assessed (health being one).

4. DfT must ensure WebTAG takes account of data from new sources (e.g. mobile devices) to inform new approaches of assessing demand for passenger infrastructure. It will take time before any new approaches are sufficiently robust to replace existing model systems but DfT must be alert to all new inputs that will become available.

Q13 How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Historically, travel demand forecasting has been fairly reliable at a national level, but difficult to predict at a local level, which is key to assessing the need for infrastructure schemes. The impact of new technology on travel has also been unpredictable. Looking back many years, when TV ownership became commonplace it was expected that local urban travel would reduce because people would stop going to the cinema. But there was minimal impact. More recently, all evidence to date suggests that, contrary to initial expectations, better electronic media increases demand for business travel because it increases business activity.

It emphasises the need to develop robust appraisal models and reviews for a wide range of scenarios to understand and cater for the impacts of a broad range of policy decisions and societal trends.

For example, reviews have established that the rise in cycling has been as a result of health awareness, demography and spatial planning.

Issues relating to this question are discussed further in our *Vision 2035*[6] report.

Q14 What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas? (answer also applies to Q15)

The investments with the highest economic value are calculated through the DfT's established appraisal methodology. It is the most effective methodology in government, is regularly updated and tested. DfT is considering how to address issues in calculating the value of freight schemes.

However, the NIC should be aware that the most significant point which needs to be addressed in determining the highest value schemes is not related to the appraisal process itself. It is related to the scheme options assigned for evaluation. For example:

- Demand management through road pricing may be a better value option for increasing capacity on the road network than building new infrastructure. But it is not government policy so it is not evaluated
- More broadly, option generation is based on options devised through traditional engineering judgements and models, limiting the choices presented to ministers. Working in closer co-operation with other government departments and stakeholders would enable the DfT to consider and appraise a broader range of transport options. One potential example is ultra light rail technology being developed by Warwick University
- Taking this approach also opens the possibility of cross cutting infrastructure schemes being developed for appraisal. It means ministers could choose to select an infrastructure option which does not provide the highest value transport result but provides the widest range of benefits across the range of infrastructure sectors within the NIC's remit.

In the freight sector, new distribution networks are being developed to balance evolution in supply chain planning with the demand for a wholesale reduction in emissions and a change in emphasis in urban distribution to reduce vehicle numbers while optimising the effects of e-commerce. This requires infrastructure support to enable a necklace of multi-modal inland freight and processing centres located around logistics hubs to exploit port-centric distribution, and a ring of freight consolidation centres round conurbations to feed sustainable low emission last-mile deliveries. To determine the best value solution, options including locations at ports and airports need to be evaluated, breaking down modal silos.

Examples of cross sectoral boundaries which need to be broken down to ensure best value solutions are considered include integrating transport and health decisions. For example, decisions to cut back accident and emergency units in hospitals need to take into account the transport requirements (e.g. ambulance and transport access).

[6] Available from: https://www.ciltuk.org.uk/Portals/0/Documents/About%20Us/Vision2035.pdf

The NIC should give a clear steer to all areas of government that holistic infrastructure policy options must be developed which take account of cross-sectoral issues.

Q16 What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

MaaS is based on putting the consumer in control, providing personalised service and a full range of informed transport choices. As such it could have a very significant impact on making road user charging acceptable to the public. The concept is based on providing people with a choice of every option available to make their journey at different times and by different modes. For example, the technology could offer the user the choice of driving by a variety of routes with road pricing varying according to real time demand on the road. Alternatively, the user may prefer to choose a different mode of travel.

The concept of road user charging is designed to encourage mode shift and to spread demand by making most efficient use of road space. As noted in response to Q4, the Eddington transport study estimated that road pricing would cut congestion by over 30% by shifting traffic to less congested roads and less busy times of day and by encouraging more car-sharing. Combined with public transport improvements it can bring about a significant mode shift as happened when the London Congestion Charge was introduced. It is possible that packaging road user charging as part of MaaS may create additional decongestion benefits because users would be informed of the best value travel choice for their journey across all modes.

Q17 What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

The roll-out of 5G franchises to cover the entire country to provide constant sufficient bandwidth for continuous situation awareness. This requires a cross-agency approach.

Q18 Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Rapidly evolving digital technology is an enabler for maximising the benefits of infrastructure investment across all sectors. Therefore, the NIC should assess whether government or one of its agencies should have controlled integrated oversight of the sector, and what form that may take.

This could include requiring telecommunications companies to release appropriate big data as a condition of their licences, so that third parties can develop new personalised services to

promote efficient use of transport networks. This could include real time tracking data showing the location of mobile phone users, the location of vehicles and the content of loads.

Q20 What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

One potential solution which could have a significant impact that the NIC should consider is development of existing canal and piped infrastructure to create a water grid for water supply and flood balance also offering the opportunity for power generation. The work would involve confirming the infrastructure already available and the linkages required. We anticipate that planning, rather than cost, would be the primary issue for resolution.

Q21 What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Work on city distribution is taking account of requirements for low carbon vehicle charging. In terms of low carbon freight, there is a disparity at present between the cost of buying and maintaining vehicles and revenue earned from this secondary delivery cycle. Urban consolidation centres generally, but not in all cases, require subsidy. The GLA is funding the south London consolidation centre from savings on emissions charges payable to the EU.

The main obstacle is availability of suitable inner city accommodation for sustainable consolidation centres due to rising property values and business rates. Local authorities are directing little resource to freight movement. There is a case for the NIC to intervene.

Q24 How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

Measures to protect communities from flooding and backflush should be incorporated in transport infrastructure design at national and local level. National planning guidance does not address this issue adequately. National infrastructure guidance – to feed into national planning guidance – is demonstrably needed.

Submitted by:
[Name redacted]
[Job title redacted]
The Chartered Institute of Logistics and Transport
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February 2017

ceca

10 February 2017

Consultation Response

Civil Engineering Contractors Association
1 Birdcage Walk
London
SW1H 9JJ

10 February 2017

NIA Call for Evidence
National Infrastructure Commission
11 Philpot Lane
London
EC3M 8UD

Dear Sir/Madam,

Re. NIA Call For Evidence

The Civil Engineering Contractors Association (CECA) welcomes the opportunity to respond to the above named consultation.

CECA is the representative body for companies who work day-to-day to deliver, upgrade, and maintain the UK's transport and utility networks.

With more than 300 members throughout England, Scotland and Wales, we represent firms who together carry out up to 80 per cent of all civil engineering activity in the UK, in the key sectors of transport, energy, communications, waste and utilities including electricity and water.

Our members include some of the largest construction firms as well as a range of small specialist and regional contractors. Our industry supports the employment of over 200,000 people in the UK with annual activity worth £25 billion.

We have answered the questions where we feel that we can add the most value and our response can be found below.

Yours sincerely,

[redacted] [signature redacted]

[redacted] [name redacted]
[job title redacted]
Civil Engineering Contractors Association

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

The UK should strive to have the most modern, reliable and safe infrastructure in the world. Developments in technology will continue to improve our quality of life and how we work.

The attractiveness of where we choose to live and work and where developers and businesses choose to invest can be substantially enhanced by the right infrastructure. However, those places can also depreciate in their appeal by a lack of infrastructure, or development of infrastructure that does not meet local needs.

One of the biggest challenges to housing development is consideration of its potential impact on local infrastructure. CECA is supportive of the Government's £2.3bn Housing Infrastructure Fund which will facilitate local infrastructure investment to unlock land for housing to deliver up to 100,000 new homes in areas of high demand.

We believe that a key part of the National Infrastructure Commission's work must be to promote projects that enable regeneration, investment and energy production for local use. The regeneration and investment model has already been proven through the success of housing and development unlocked via projects such as the Jubilee Line extension and the DLR establishment in London, Crossrail, and also, in Manchester via the Metrolink extension to Media City in Salford Quays.

In our view the challenges associated with infrastructure and housing design, planning and delivery can be addressed by collaboration between infrastructure providers and developers. This would encourage the development of appropriate designs giving confidence to all parties involved.

To this end, we would suggest the introduction of a recognised excellence benchmark to encourage interaction. This would result in improved designs and the adoption of best practice to achieve a quality standard for developments, similar to how BREEAM[1] is used for buildings.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Effective competition and collaboration creates innovation to provide greater efficiency and improved productivity.

CECA believes that the process of collaboration will become the norm over the next ten years as our customers and tier 1 contractors become more sophisticated in securing and developing their supply chains in order to retain capacity.

However, our members' experience of collaboration is, at the moment, divided. Where it works it adds substantial value to a project, but when it is poorly planned it can produce ineffective teams and management.

Furthermore, members have further indicated that some tenders have placed a too significant importance on collaboration, impacting on the ability of contractors to deliver the work required.

We believe that if collaboration is to be effective, it must be recognised as a professional skill with appropriate training and qualifications. This must be supported by the development the role organisations such as the Institute of Collaborative Working play in the professionalisation of this skill.

Improving the way in which we procure infrastructure will also drive forward competition [redacted] compete effectively as infrastructure procurement in the UK has reached crisis point with [redacted] facing increasing pressures on resources.

In our view efficiency and cost reduction are best achieved through long-term collaborative relati[redacted] in the establishment of a relationship develops trust which is likely to result in the effective man[redacted] costs further down the line. This is why, in our view the process of open procedure is not always effective in delivering world-class infrastructure efficiently as it does not encourage these collaborative behaviours.

1. BREEAM is a global assessment method for masterplanning projects, infrastructure and buildings. It addresses a number of lifecycle stages such as New Construction, Refurbishment and In-Use.

To this end, last year, CECA worked with its members to identify the eight most challenging elements of the procurement process and subsequently proposes a series of solutions to address them.

Further details can be found in our publication, *CECA Procurement Report: Directions in policy for the UK's infrastructure sector* which is free to download at: http://www.ceca.co.uk/media/246624/ceca-procurement-report-2016-master-for-upload.pdf.

[phone number redacted]

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For more information, please contact CECA [redacted] **on** [redacted] **or email** [redacted] [e-mail address redacted]

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[redacted]

National Infrastructure Commission
National infrastructure assessment call for evidence

Background to CIWEM

CIWEM is the leading independent Chartered professional body for water and environmental professionals, promoting excellence within the sector. The Institution provides independent comment on a wide range of issues related to water and environmental management, environmental resilience and sustainable development.

CIWEM welcomes the opportunity to respond to the National Infrastructure Commission on its call for evidence. This response has been formulated with the assistance of our Technical Panels who have a wealth of experience in the water and environment sector. We have tackled the questions that are in the areas most relevant to the Institution and its members.

Response to consultation questions

Energy

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved? Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

There is no such thing as a zero carbon power sector as any power generation system needs capital works which have embedded carbon. A power sector as close to zero carbon as possibly would have a diverse mix of renewable forms of generation, allied to significant storage and carbon capture. Nuclear is also likely to be part of this mix.

Demand for power varies during the day and between days, sometimes by a factor of about two. This gap is generally covered by fossil fuel. To minimise fossil fuel use it would be appropriate to store renewable energy for use in peak times and when renewable energy is insufficient. CIWEM considers there needs to be far greater emphasis on the more efficient use of energy through insulation, efficiency and demand management, alongside dispersed storage across the grid to mitigate peak electrical loads.

Whilst we support the development of solar and wind power, but issues with their intermittency are well understood. In contrast tidal energy does have gaps between tides which, for tidal lagoons and tidal barrages with modern ebb/flood generation, would be only about three hours. This gap can be covered by storage, particularly pumped storage. Traditionally this has been done by hydro pumped storage with schemes such as Dinorwig in North Wales storing about 9 GWh. Such schemes can last for 100 years, Dinorwig having been in use for about 35 years without significant renewal. Currently lithium ion batteries are being developed but so far these have relatively minimal output and relatively short life. However they can be distributed around the country. Consideration needs to be given to greater electrical storage systems.

The UK is blessed with large tidal ranges and there has been significant progress recently developing the science and technology of tidal lagoons. CIWEM believes that, providing they are sensitively designed and located with appropriate regard for the environment, they offer significant potential to

harness this natural resource. Assuming the Swansea lagoon goes ahead, the hydrological and ecological impacts should be monitored in detail. This can then be used to review the Severn Barrage scheme in light of new technological development since the time of the last review, which may significantly mitigate environmental impacts on intertidal habitats.

Vehicles could be part of the storage system by storing electricity in the batteries of electric cars. However there are several potential problems with this. At times when the grid would want to withdraw the energy to meet peak demand, generally in the evening, the cars may not be connected to the grid and most electrical loads in houses and businesses occur when people arrive (often having just exited a vehicle), so the process that gives rise to demand is not coincident with the need to charge vehicles. This needs careful thought on how it could be implemented. There has been a concern that charging will overload the grid. This is false; provided charging is staggered and synchronised it is entirely possible to charge with little impact on peak demand.

Water and wastewater (drainage and sewerage)

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute? Note: "demand" includes domestic, commercial, power generation and other major sources of demand.

In general climate change, demographic change, economics and environmental legislation all necessitate a more integrated approach to the management of water in the UK. In the UK our institutional arrangements for managing water have developed and remain in 'silos'. We also have an underlying problem in that we continue to develop in the south east where water availability issues are greatest.

Most of our sustainable groundwater is already fully committed, and during droughts there is little water in some of the rivers that is not required to maintain a healthy environment. Supply side solutions, including new sources and water transfers should be used alongside demand management approaches. On the supply side, encouraging indirect potable reuse schemes, e.g. aquifer recharge with wastewater effluent and encouraging better interconnectivity between the supply networks of adjacent water companies.

Water efficiency and demand management offers an area where incremental changes can be made towards more resilient systems (e.g. increased metering alongside tariff responses to water availability and use, reducing demand through improved customer behaviour). A big challenge in this area is communicating the risks around water scarcity when it is not seen more widely as a big societal risk. Raising customer awareness of the water they use can only help serve this and will improve the willingness to pay for improved resilience. There is a need to understand the value of water in different contexts and locations as currently water is undervalued.

Much of the water we use for non-potable purposes such as industrial applications, toilet flushing and irrigation, is unnecessarily treated to potable-water standards (we only need 3% of our water to be potable in the domestic context). Opportunities for increasing non-potable water use will translate into energy saving too, with efficiency on treatment process power and pumping.

Leakage

The industry average leakage level is about 20% of the amount put into supply. Several overseas suppliers have a much lower level. Current water company water resources management plans show little further reduction in leakage which for some companies is over 25%. Water companies should be encouraged to lower leakage significantly further.

Leakage reduction is a fundamental part of demand management and depends critically on water companies 'doing their bit' (and being able to demonstrate that they are doing so against easily understood targets). Good data are essential to understand current rates of consumption, to forecast consumption and to evaluate the cost-effectiveness of water efficiency, water balance, consumption, leakage and conservation interventions. We recommend greater consistency in measuring and estimating consumption and leakage and greater sharing of data, particularly between water companies, where there are clear financial and statistical benefits from working at scale.

Company ownership of supply pipes will also help identify leaks. Water UK state that around 30% of leakage is estimated to arise from customer-owned water supply pipes[1].

Metering

Households that are metered use about 10% less water than unmetered households. Southern Water found metering reduced consumption by 16%. Current meter penetration is about 55%, with Southern about 85%. Water companies should be encouraged to substantially increase metering penetration.

Getting full metering (or as close as technically practical) is critical. Whilst offering companies the mechanism to compulsorily meter is useful, the customer base is often suspicious of why this would be done, especially where the area is not perceived to have water resources 'problems'. Regulators and government put the emphasis on the water companies to promote metering, however we consider this should be driven by strong policy as the benefits are recognised.

CIWEM supports a move to smart metering which has extensive benefits beyond 'dumb' metering and intermediate options such as automatic meter reading (AMR). Thames Water are installing smart meters on households and thus obtaining real time information of flows. Thus, once sufficient meter penetration has been achieved, Thames should be able to identify leakage and wastage much more quickly and efficiently. Thus these should reduce significantly.

Compulsory metering would help with unmeasured consumption and smart metering would go some way to helping with data.

Initiatives such as the Green Deal had the potential to integrate water and energy efficiency and a 2012 UKWIR project demonstrated the quantitative and qualitative benefits of such programmes. However national programmes seem unlikely without a significant change in government policy and local programmes have more potential in the short term. Most water using appliances in a home are long lasting. New houses should be required to be to a lower water use standard than currently.[2]

Waste water reuse

Currently significant indirect reuse of wastewater occurs. As an example, Oxford's treated wastewater is diluted in the River Thames and some pumped out to be stored and treated to become part of London's water supply. The great advantage of waste water reuse is that the source is largely there throughout any drought of whatever length and severity. Greater use should be made of reused wastewater, especially when it would otherwise be discharged directly to the sea. Already the Langford scheme in Essex treats wastewater from Chelmsford that would otherwise be discharged into the tidal Blackwater, treats it to a higher standard and puts it into the Chelmer and thence into Hanningfield reservoir for public supply. Thames Water have a proposal to take Mogden STW effluent, treat it further and then use it to be part of the Teddington residual flow, thus releasing the same amount of

[1] For more information please see CIWEM's policy statement: http://www.ciwem.org/wp-content/uploads/2016/04/Water-supply-pipes.pdf

[2] For further information see CIWEM's 2016 report: *Water Efficiency helping customers to use less water in their homes* http://www.ciwem.org/wp-content/uploads/2016/02/Water-Efficiency.compressed.pdf

river water. Southern Water has plans to recirculate wastewater that has been treated further. Where security of public water supply quality can be maintained, such action should be encouraged.

Water UK have recently produced a long term water resources strategy. As part of this United Utilities would divert water from Vyrnwy reservoir, which currently supplies Liverpool and Manchester, to flow down the Severn to near Gloucester and then be pumped over the Cotswold to flow down the Thames to London. United Utilities would have had a substantial drop in demand for industrial water and would take the remaining balance from the Lake District. Thus, for limited new investment, London would effectively be supplied from the Lake District.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand? Note: this can include, but is not necessarily limited to, governance frameworks across the country.

The most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand are to:

1. Keep surface water from new developments out of combined systems and separating surface water out wherever opportunities arise.
2. To create overland flood exceedance routes in to minimise damage where systems capacity is exceeded.

Progressive surface water separation has been used extensively in Switzerland to manage capacity. Removal of a relatively small proportion of surface water from a combined system can give capacity to admit a significant increase in foul flows from new developments.

Increasing green space in urban areas can increase natural infiltration and reduce run-off helping to reduce flood risk and the transportation of pollutants. Urban layout and landscape should be carefully designed to allow the space for flood water to pass freely along pathways. Roads and streets constitute up to 70% of impervious areas in urban areas and as such they act as major conveyors of storm water and an important flow path when the drains beneath them are full to capacity.

Sustainable drainage systems (SuDS)

SuDS help to reduce urban diffuse pollution. They minimise surface water runoff with permeable surfaces, filters, storage areas, wetlands and balancing ponds. This helps to protect water quality and provide a habitat for wildlife in urban watercourses. SuDS reduce water treatment costs by improving water quality at the source rather than 'end of pipe'. The collective benefits of SuDS schemes provide a more cost effective solution and offer numerous benefits compared with traditional systems.

The Victorians pioneered the drainage system that we take for granted today but, as we build more developments, this approach needs to be used alongside modern, more sustainable options that work with nature. Ofwat estimates that about half of average annual flooding incidents are a result of the capacity of the drainage system being exceeded.

Well-designed SuDS can be built affordably and without delay in nearly all kinds of development as well as retrofitted in established developments. Arguments for not delivering SuDS on the basis of site constraints may be overstated and the range of options available means it is nearly always possible to incorporate some measures. SuDS are a cost effective alternative to conventional drainage when included early in the planning process and it is the failure to consider SuDS from the very start of a development's design that is a significant barrier to efficient delivery. They are far from the brake on development they may be portrayed as, given the diversity of options and techniques available.

The implementation of Schedule 3 of the Flood and Water Management Act 2010 was shelved by Government. A revised approach was announced based on 'strengthening' the planning system

(through the National Planning Policy Framework), to create an 'expectation' that major planning applications (i.e. those of ten dwellings or more) would include SuDS. Yet our research[3] published in February indicates that the vast majority involved in delivering SuDS consider current policy is ineffective with many new homes built without the full benefit of SuDS.

The main barrier to wide scale retrofit SuDS implementation in the UK is institutional, not technical. A policy that demands SuDS to be considered from the outset would ensure that they are well designed and implemented, delivering cost savings and so much more: Amenity, biodiversity and water quantity and quality benefits. The Government is reviewing the law and policy in England that requires SuDS to be included in new developments. Significantly greater effort should be invested in delivering sustainable drainage and green infrastructure both in new and existing developments than is currently the case. We urge the NIC to look further at SuDS should the government's review not result in change to policy or standards.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

This question should also include the use of the catchment for food and energy production. Catchments have so much more in the way of benefits (e.g. ecosystem services) and should not just be looked at through the lens of water and flooding. Although the catchment based approach started as a water quality initiative, the wider benefits of this approach for water resources, biodiversity and flood management are obvious, and further integration of activities and funding to achieve diverse outcomes should be strongly encouraged. The establishment of catchment partnerships in each catchment is key to achieving benefits for water and land use management. Schemes which engage with water polluters, e.g. farmers, pesticide industry will be far more effective.

There is a need to consider the full (ecosystem service) values associated with catchment management in order to make effective decisions. Both of these require effective economic analyses. At the UK Water Economics Forum those present agreed the most important economic issue facing UK water companies over the next 12 months was identified as taking on board natural capital accounting.

There is recognition amongst water economics professionals that in order to improve strategic planning in relation to water use there are some fundamental issues that need to be addressed:

1. adoption of the natural capital / ecosystem services approach,
2. improving business planning via economic valuation,
3. water pricing and the value of water (and the implications for abstraction).

There is beginning to be a more positive approach and dialogue towards the way that agricultural land is considered in flood risk management. The catchment based approach and payment for ecosystem services could assist in paying farmers to flood farmland where it is better used to store water to protect communities downstream.

[3] For more information please see CIWEM's 2017 report: *A place for SuDS?* www.ciwem.org/suds

Flood risk management

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

There is no strategic plan for managing flood risk in England. Responsibility for managing flood risk lies with many different agencies, often working to different standards of protection and this makes managing and funding flood mitigation measures a challenging process.

The Government's intention is to reduce risk by around five percent by 2021 and reduce expected annual damages by 12 per cent to 2050. This is to provide the optimum return on investment as beyond this point it becomes increasingly expensive to lower the risk further. However there is limited understanding of this with a perception from many that they are owed full protection from flooding and the public purse will pay for it. There is also a reality that sometimes we simply live in places that are no longer appropriate. Some places in the Somerset Levels or communities on rapidly eroding coasts for instance are cases for migration.

The Government is under no legal duty to provide flood risk management or provide protection to a certain standard. It is however under increasing pressure to adequately manage flood risk for both the societal and economic costs it can cause. Since the majority of funding is provided by the Government, every taxpayer pays towards flood risk management under the current arrangements. The approach in the UK is often compared to the Netherlands, where there is a legal commitment to flood safety standards. The UK's hydrology and geology is far more complex so it is comparably more expensive to lower flood risk. In the Netherlands there is a lot more political and public support for FCERM measures and this may be because two thirds of the land area is at risk, compared to around 15 per cent in the UK.

In recent years national funding to meet national priorities has shifted to one that is now based on both national and local funding and more local choice (the partnership funding era from 2012). CIWEM supports the emphasis on partnership funding as it aims to increase the number of schemes being supported, increases local choice and should lead to an increase in external contributions. It introduces the concept that beneficiaries should contribute towards schemes from which they derive gain, which would not otherwise go ahead.

CIWEM considers that the current priorities for allocating funds for flood defence schemes are appropriate, however partnership funding needs to be monitored to ensure it is delivering enough schemes and helping the most vulnerable. There is still some confusion in the general public and media as to how the new funding framework operates and who is responsible for managing residual flood risk. There needs to be a national conversation about what level of flood risk is acceptable and at what public cost. For a full discussion of flood funding and priorities please see CIWEM 2015.[4]

Setting of an acceptable return period is difficult because of the increasingly extreme climate we will be encountering. Even existing defences will not provide the planned 1:100 year protection if the statistical chance of such heavy rainfall in any given year has doubled. The latest climate science[5] suggests that future extreme rainfall may be higher than existing UK climate change allowances for rainfall intensity, largely due to summer convective storms such as those experienced in 2007 and

[4] CIWEM. 2015. Breaking the bank? Funding for FCERM in England, which assesses both the amount of funding and its prioritisation http://www.ciwem.org/wp-content/uploads/2016/02/Breaking-the-Bank.compressed-1.pdf

[5] Dale, Luck, Fowler et al. New climate change rainfall estimates for sustainable drainage. Engineering Sustainability. Part of UK Water Industry Research's programme of climate change related projects. https://www.researchgate.net/publication/284546535_New_climate_change_rainfall_estimates_for_sustainable_drainage

2012. Sub-daily intensities are likely to increase at a higher rate than daily intensities because of the impact of phenomena such as intense convective cells. Picking a numerically convenient notional return period will be arbitrary and subject to challenge when flooding occurs more frequently than the statistics say is likely. The vocabulary around levels of protection will need to change because many do not understand the risk or the need to take action.

Similarly the level of acceptable damage will also be a function of preparedness and the durability of the assets at risk. So the consequence of the flood rather than the blanket expectation of avoidance needs to be factored in.

There is a tension between high-level policy for flood risk management and the public expectation for flood protection, between policies that rely on "resistance" rather than "resilience". There needs to be a focus on increasing the resilience of communities that benefit from defences and those living in flood risk areas to also change attitudes and take self-help measures.

Measures to enable a house to resist flooding have been developed. Existing householders in flood risk areas must be encouraged to obtain appropriate measures to be put in place when warning of flooding has been issued, especially given that at the end of Flood RE risk reflective pricing will come back into force in 2039. Defra should ensure that Flood RE has an explicit aim to build awareness of risk with those receiving assistance. It must incentivise owners to implement property level protection to increase their flood resilience so that they are insurable once the scheme ends.

Property Level Flood Protection (PLP) measures are those where the whole fabric of the building is addressed to minimise water ingress (e.g. flood doors, door barriers, self-closing airbricks, pumps). This provides an affordable and effective first line of defence in mitigating against internal flooding of property. The other is Property Level Resilience (PLR) measures which reduce the amount of damage and clean-up time should a property be flooded (e.g. tiled concrete floors, water resistant plaster, raised electrics).

Short term post-event Government repair funding is inadvertently creating a lack of trust in the industry, whereby opportunists are selling certified products but potentially not installing them properly or not factoring in the whole property's vulnerability, leading to potentially inadequate protection. Often solutions are marketed at a price which reflects the size of recovery grant available. This situation can actually hinder the sustainable growth of the industry by distorting market conditions to the detriment of more responsible providers.

There is a need to make people confident enough in the industry to act and install equipment and measures. Resilient repair is equally needed alongside PLP so that people can get back to normal as soon as possible after a flood. In July 2016 CIWEM convened a round-table discussion attended by senior figures from the industry and communities to debate these issues. What was common to all aspects of this discussion however was the need for a recognised standard of survey, inspection and certification during the PLP/PLR process to give the underlying confidence to property owners and insurers alike that the measures being put in place are as effective as they can possibly be.

New developments should not be allowed to add to flood risk, by not adding pressure to the drainage system and putting in place SuDS (see answer to question 23). Policies or funding streams should not incentivise building in the floodplain unless effective mitigation and resilience measures are included and the development in question is appropriate for its location.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk? Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

When flood mitigation measures are progressed, affordability often limits the scale of measures that can be put in place, leaving a residual flood risk in extreme events. This can only be overcome by adopting innovative approaches to flood mitigation as part of catchment-wide planning, and ultimately preventing damaging and expensive water ingress to properties through PLP and PLR.

No strategy can eliminate flood risk. Natural flood management (NFM) measures are designed to manage risk by allowing identified areas to flood in order to decrease the flood risk elsewhere. These methods reduce the severity of flooding by gradually lowering the flood peak as it passes along a river.

NFM can reduce low return period floods. However flood damage is caused by long return period floods and NFM has limited, if any, mitigation of these. At Holnicote, modelling has clearly demonstrated a 25% reduction in 5 year return period flows, but minimal benefit in floods greater than about 25 year return period, i.e. the ones that cause the damage. Having said this there are a host of additional reasons for understanding improved land management and building more green infrastructure such as reducing soil erosion, improving biodiversity, water quality, soil fertility and amenity.

Good land management practices (agricultural soil management, sediment retention, floodplain reconnection, slowing surface water runoff, river restoration and re-planting) should be encouraged. Whilst these NFM methods are supported by evidence, there is a lack of empirical data at a catchment scale (i.e. their effectiveness is unique to the catchment). This has meant that it is difficult for schemes to attract national funding on the basis of current funding allocations through cost benefit assessments.

Similarly SuDS will not prevent major floods, but complement more catchment-wide thinking that promotes diffuse "networks" of flood response, rather than single large flood defence schemes. SuDS can reduce the pressure on conventional drainage systems that are often over-stretched, reducing sewer overflows (where surface water and sewer systems are combined) and additional costs. SuDS can be delivered in a variety of urban and rural contexts including housing, schools, community buildings, parks, public open spaces and highways. SuDS have far greater benefits beyond flood risk that are currently not being valued or assessed. See more in our report A Place for SuDS?[6]

See also the answer to question 25 for a discussion of property level protection.

Solid waste

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be? Note: A "circular economy" is an alternative to a traditional 'linear economy' (i.e. make, use, dispose) in which products are designed and packaged to minimise waste, and resources are kept in use for as long as possible, e.g. through re-use, recycling and greater recovery of materials through the waste management process

The government has recognised the value and contribution a more circular economy (i.e. recent statements from Defra) but has chosen to leave it to the market to resolve, opting to step back from waste policy. In 2011 CIWEM published a report[7] on moving towards a circular economy and little progress has been made since.

[6] CIWEM. 2017. *A place for SuDS?* www.ciwem.org/suds

[7] CIWEM. 2011. Less is more: waste prevention and resource optimisation across a lifecycle. http://www.ciwem.org/policy/waste-resources/

Nearly all of the recommendations are still relevant today such as: setting up a commission type structure or Office for Resource Management within government to monitor the impact of polices on resource use, changing the activities that VAT is charged upon and pricing externalities into decision making, extending producer responsibility to drive more measures up the waste hierarchy and introducing various incentive structures such as minimum standards, dynamic standards, voluntary labels and procurement standards. We consider it is very much within the power of the government to be able to drive the circular economy alongside businesses.

The EU has been leading on the circular economy and it is not yet known if the UK will adopt the Circular Economy package into domestic law before and whilst leaving the EU. Proposals within the Circular Economy package include an increased recycling target of 65% by 2030 as well as plans to harmonise definitions of recycling across EU Member States. Increases in targets for packaging recycling have also been proposed.

Date: as email

Dear Sirs,

Re: Response to the National Infrastructure Commission Call for Evidence

Thank you for the opportunity to respond on this important work. The Coastal Group Network (CGN) were keen to submit comments but were not aware of the request until very recently so our comments are not as detailed as we would like.

The Coastal Groups were formed late in 2008 as part of the Environment Agency's Strategic Overview at the request of Defra with a broad remit, part of which is to influence national level policy and implementation. We have no statutory or executive function but represent a broad stakeholder/partner base around the coastline of England and Wales.

The Coastal Group Network (CGN) would like to be included in any further discussion and consultation on this work.

This response should be read in conjunction with other key consultation responses that have been prepared across our Industry especially those from:

- Local Government Association (LGA) and the LGA Special Interest Group – Coastal Issues
- Individual Coastal Groups, Coastal Partnerships/Forums and individual Councils
- Professional Institutions such as the ICE (Maritime Panel) and CIWEM (Rivers and Coastal Group)
- Technical Advisors Group
- Regional Flood and Coastal Committees

We welcome the call for evidence and the chance to be able to influence this issue. This response has been produced by the Chairman of the Coastal Group Network however views of individual Local Authorities and other stakeholder/partners may vary.

General Comments

Whilst we understand that the Commission will tackle economic infrastructure we cannot understand how this will be done and so seriously inhibits how we respond. Also we cannot understand how the choice of the individual sectors has been made and are curious as to where one of the sectors of our work in coastal erosion fits? We acknowledge that you have included flood risk management which is another sector of our work but we are concerned that the more permanent effects of erosion seem to have been ignored. Whilst flooding can have devastating effects the land which has been flooded remains albeit very wet and soggy however if that land is eroded, by definition it is completely lost, there is nothing left and can no longer be used! In our sector of work the prevention of erosion is a key factor which often gets overlooked even though it could cut across many of the sectors that you list.

We raised in the last consultation the management and maintenance of coastal assets and hence the coast has been widely recognised as being a problem with multiple owners and organisational responsibility for some time. Although those responsible, generally the Environment Agency, Local Authorities or private owners have clear roles the differences in funding streams for maintenance and more importantly capital repair or replacement of major assets varies and causes confusion. In a

recent State of a Nation Survey assets within private and local authority responsibility were not surveyed and thus apparently omitted from any potential additional government maintenance funding. Whilst moves are being made to address this there still isn't a combined, robust system in place that can be used to assess the state of the Countries coastal erosion and flood assets.

As the Commission has set out a list of questions for us to address we will focus on those that we feel are most appropriate to our work and leave the others unanswered especially as so many are far too wide ranging and complex to answer for the numbers of sectors involved. (responses in italic text after the question):

QUESTIONS

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region? Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

In this instance as a National body it would be inappropriate to comment on the growth in individual regions or cities but the members of the CGN have contributed to the 6 year flood and coastal risk management programme which highlights the majority of risk management schemes requirements in the country at this time.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

We believe that no new infrastructure should be built in areas that are at risk from either erosion or flooding including all access routes thereto. Care should also be taken when planning new infrastructure that it does not conflict or impact on any areas set aside for coastal adaptation, realignment, biodiversity offsetting similar.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?
Measures are in place that all new schemes that are considered for government funding are based on a whole life cost but what isn't managed is whether the coasts set aside for maintenance during the life of an asset are indeed spent. All too often assets appear to be managed on a minimum intervention basis and rely all too often on being replaced at the end of their estimate useful life without them having the level of inspection and thus maintenance spent on them. Measures to monitor and manage this overtime may significantly improve the life and effectiveness of our assets.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors? Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

One impact to resilience not noted above is climate change and a good understanding of how this will affect not only existing but future infrastructure should be factored in.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

This is the million dollar question and one that we do not believe can be answered but all new infrastructure should have the minimum impact on the environment and where this is not possible there should be suitable compensatory measures at alternative locations in a bid to balance that impact.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent? Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

We cannot offer a positive response to this as having dealt with Cost Benefit and Partnership Funding approaches neither seems equitable for all schemes and there are always winners and losers. The current "black box" method of calculating scheme funding for flood and erosion risk management needs to be improved as there is a bias toward flooding schemes rather the total loss type erosion schemes. Also levels and extent or data required makes applications almost an industry in itself. More transparency and streamlining is needed.

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies? Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

Personal travel patterns with more home working businesses starting, particularly in rural areas, may reduce demand on the existing infrastructure but this is very dependent upon digital networks being in place to facilitate it.

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

The simple answer to what level of flood resilience should the UK aim for is 100% but that is not realistic as large areas are at risk from one or more sources of flooding and all but the highest degree of resilience measure would still not provide them with 100% resilience. We believe a more pragmatic approach to this is needed using examples from our European colleagues as a starter. Where new developments are considered in areas that may flood as a result of future climate change we need to be thinking about improved resilience to the fabric of the buildings, better more flood resilient design, better information to buyers at the outset and above all robust and accurate warning to provide enough time to make preparations. Only them could this be considered further.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk? Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

In coastal areas the description of natural flood risk management is not applicable unless measures such as managed realignment or managed roll-back of beaches is considered under this banner. Also most temporary and property level protection have limited effect when impacted by tidal flooding after a defence breach. The raising of buildings above flooding levels would however be property

level measure. Use of progressive asset development to form higher defences is an option but is dependent upon natural processes and sufficient lead times to develop sufficient heights of new beaches to provide the protection needed. Use of maintenance monies to provide "stich in time" repairs is good value for money and can pay dividends but only when budgets are available. All too often maintenance budgets have been used by the time defences could be enhanced by this method. New or alternative materials may be an option to bring down costs but are already measures taken when considering new works so in itself not something material to this argument. These are all good alternatives but in themselves not one off single answers. The single most effective measure to reduce flooding is to remove people and property from the area of risk, something only the planning system can achieve. Measures for Coastal Change Management areas have not been widely taken up by the planning authorities.

In conclusion there are more unanswered than there are answered questions and a small workshop to cover this aspect our work may be the best way forward so should you wish to take this up please let me know.

Should you have any queries or require clarification of any of the points raised please do not hesitate to contact us via the Chairman.

Yours sincerely

[name redacted]
[job title redacted]

The National Infrastructure Commission: National Infrastructure Assessment Call for Evidence, October 2016

Response from the Common Futures Network

Key Points

- The Common Futures Network (CFN) is an independent network of development professionals. We believe that a new and explicit development framework is needed for England

- Infrastructure investment is a means to an end and not an end in itself: it secures regeneration and facilitates planned development

- The national infrastructure assessment should explicitly reflect and support the national industrial strategy; but we are not sure that this linkage fully exists.

- Agreed national goals and outcomes, and not simply extrapolated trends, should be the basis for infrastructure investment

- For long term infrastructure plans, cost benefit analysis, as typically applied. can be spurious, and a wider approach to evaluation is needed, particularly in areas of market failure

- Intellectual capital is critically important to the 21st century; the knowledge-based economy and research investment should be included in the current assessment.

Context

This response has been prepared by Common Futures Network (CFN). CFN has been established in response to a perceived need for a more explicit understanding of the spatial dimension in setting national priorities, particularly for England, which lacks any form of national development framework.

CFN is independent of political, business or other sectional affiliations and our members include professionals with extensive experience in UK planning practice and consultancy, utility planning, regeneration, transport planning and academia, across the UK and internationally.

Our recommendations arise from a symposium held in December 2016 supported by the US Regional Plan Association and the Lincoln Institute of Land Policy, following which CFN has prepared an Interim Prospectus which sets out eight key propositions for tackling short and longer-term national spatial priorities. A summary containing these Propositions is at Appendix 1, and a copy of our Interim Prospectus is attached as supplementary evidence. Overarching this is our perception of the need to create a new agenda for England and the UK to promote a portfolio of actions based on:

- The global role of England and London within the UK
- A new devolved development programme building on sub-national strengths
- The need to deliver a new urban agenda designed to recognise, support and nurture the inherent growth potential of the networked system of cities outside of London
- A new rural agenda as a basis for connecting the rural hinterland of England
- Securing the natural capital of England
- An integrated infrastructure strategy rebalancing opportunities within England as part of the UK.

Our response focuses on the central purpose of your consultation, namely, to 'inform the Commission's understanding of the wider issues surrounding the review (it has) been asked to undertake'. It has regard to the three objectives of the NIC, to:

1. support sustainable economic growth <u>across all regions</u> of the UK (our emphasis added),
2. improve competitiveness, and
3. improve quality of life.

Our response reflects two central principles. First, that infrastructure investment is a means to an end, not an end in itself. It takes place to secure regeneration and service planned development as well as catering for established and anticipated needs. It can lead development but more importantly should be used to support wider economic and social goals. Second, that infrastructure investment has a major role to play in rebalancing the nation and reducing the unnecessary disparities in the patterns of development, competitiveness and quality of life, and the increased costs associated with regional imbalance.

This response is also based on the understanding that locally based integrated action will be necessary to deliver the full benefits of any infrastructure investment. This applies particularly to functional socio-economic areas (e.g. city regions) where there is a need for integrated transport action across a whole suite of policies, for example, inter-modality, ticketing, parking, environmental standards and social inclusion.

Consultation Questions

CFN considers that all the questions in your consultation are predicated to different degrees on there being an agreed development framework for England and thus the UK as a whole. Because there is no such vision or framework, there is no agreed context for answering these questions.

Our concern is reflected in the first question which is expressed in terms of what is needed for 'your city or region'**.** Whilst the needs of any particular city or region are matters that need to be taken into account, they need to recognise the following:

- The competitive future of the nation will be determined by networked systems of cities, and not cities or regions acting in isolation.
- Many issues can only be addressed at a national scale in terms of identifying needs and aspirations, not least the implications of rebalancing our economy and society.
- Sound infrastructure planning cannot be founded on a bottom-up set of proposals alone, evaluated solely on the basis of forecasts and cost benefit metrics, which are often highly inaccurate[1]. It needs a clear set of national priorities, and a strategy to address them and a programme to deliver them.
- These issues must be basic considerations in developing strategy. They must be integral to the option formulation and strategy making process. and not confined to the assessment of individual projects.
- To the extent that bottom up needs and aspirations are considered as an input to the National Infrastructure Assessment, these should relate to functional socio-economic areas, and not individual district council areas in order to deliver better urban places in terms of housing, environment, nature, internal connectivity

CFN's response therefore focuses on your higher order and overarching question: 'What potential ranges in distribution of people and jobs in 2050 needs to be planned for and supported by new infrastructure investment?'

[1] Arguably the most accurate forecasts of use of the Channel Tunnel were those produced for Sir Alfred Watkin in 1882 (Watkin predicted 4.5m journeys and the actual figure in 2003 was 6.3m): contemporary forecasts were inaccurate and some wildly so (No. 10 Policy Unit predicted 48m) (See Nicholas Faith, The Right Line (2007). For critiques of the rationale and accuracy of forecasters see Philip Tetlock, Expert Political Judgement (2006), Bent Flyveberg et al, Mega Projects and Risk (2003), and on the case for multi criteria based planning Omega Centre, UCL, Mega Projects: Lessons for Decision Makers (2008)

Integrating Infrastructure Planning into a Wider Development Framework

The quality and capacity of the transport, utilities and IT networks and the distribution of government research institutions and funding will be key to the shaping of our towns, cities and regions. The NIC provides a fresh opportunity to take an overview of infrastructure needs and priorities, both in terms of physical components and operating systems. As the Prime Minister has recognised, transformational change is required to rebalance the nation in terms of the distribution of opportunities for social as well as economic development[2]. We cannot continue only to pursue historic patterns of demand nor inherited constraints on capacity, either in new development, in regeneration or in the opening of new markets for business and housing.

While the NIC intends to take a scenario-based approach in its assessment, it runs the risk of being constrained by a lack of spatial context in the absence of a wider national development strategy, and the fact that housing and other aspects of economic infrastructure are outside its remit. Infrastructure planning and investment needs to guide and respond to development needs and open up opportunities in areas of need and opportunity rather than be driven solely by the 'bow wave of past demand'. It needs to recognise that major investments can lead to unforeseen opportunities. For example, pursuing the eastern approach of the Channel Tunnel Rail Link, rather than the southern approach suggested by conventional appraisal, ultimately led to the Olympics[3]. As is proposed in the Industrial Strategy Green Paper, agreed national outcomes and goals rather than extrapolated trends should be the basis for investment. Otherwise highly undesirable trends will simply become self-fulfilling.

With the notable exception of HS2 and 3, a trend-based approach has resulted in overwhelming bias towards areas of demand rather than to areas which need to be transformed, reinforcing the problems of peripheral areas, and favouring investment in already prosperous and congested areas.

Looking ahead there must be serious doubts about the reliability of economic forecasts as the sole basis for rational decision making, not least the past unreliability of trend-based and other forecasts, coupled with the huge uncertainties created by Brexit and by the new Trump administration policies in the USA[4]. It is therefore necessary to be explicit about the balance between meeting foreseeable demands and capturing overlooked and unforeseeable opportunities.

[2] The Prime Minister Theresa May, has argued that we need 'vision, determination and a plan to drive growth up and down the country – from rural areas to great cities'

[3] See Omega Centre, UCL Project Profile: Channel Tunnel Rail Link (2008)

[4] See Nicholas Taleb, The Black Swan (2007) for a critique of long term economic forecasting. Reviewing academic papers Taleb found that there was no convincing evidence that economists had the ability to predict the future and that, where they showed some ability, their predictions were only slightly better than random ones

New Choices

The shopping list of potential schemes will always be greater than available resources. Without a strategy to rebalance the distribution of people and jobs there is a risk of *ad hoc* selection on a project by project basis. Programmes need to be developed that are integrated with other investment if their outcomes are to meet wider national social and environmental needs and objectives.

Similarly, the time horizon that needs to be used for transport and utility planning and the age of the assets is very long indeed. Britain's trunk railway system is over 150 years old; significant parts of the trunk road system were planned by the Romans. Without a national framework in which to set new infrastructure investment, it is impossible to demonstrate that new transport investment decisions are being made on a consistent basis with other national policy[5]. Nor is it possible to demonstrate that they will result in net economic growth as opposed to displaced investment.

In the past, national choices may have been sub-optimal because:

- National priorities have been set without any explicit wider national development framework (e.g. airport capacity);
- Consultative processes have been unnecessarily confrontational because of the ad hoc nature of the project justification;
- They have been unable to fully exploit synergies at project interfaces, (e.g. between Crossrail and HS2);
- They have not fully anticipated the challenges of making network connections when determining the location of new power stations or airport expansion;
- There has been no basis for taking account of cumulative national impacts and benefits, because of the project-based (and trend-based) assessment processes involved;
- Critical decisions on the location of national investment in government research have been taken in isolation and usually in favour of already prosperous places[6].

[5] See Ian Wray, Great British Plans (2016) for a discussion of the merits of goal and objective based planning against cost benefit analysis where long time horizons and high levels of uncertainty prevail

[6] In his first statement as Chancellor in 2010 George Osborne was keen to protect investment in science. Announcing several major commitments to funding in new and expanded scientific projects, the Chancellor said 'I have decided to protect the science budget…at £4.6 billion a year'. Every major project in the Chancellor's list was in London and the south: the UK Centre for Medical Research and Innovation at St. Pancras; the Molecular Biology Lab in Cambridge; the Animal Health Institute at Pirbright, and the Diamond Synchrotron in Oxford.

Recommendations

As argued above, infrastructure investment is a means to an end, not an end in itself. The need for an agreed context for future opportunities and risks is critical to major investment decisions. The NIC has a key role to support the development of clear strategic plans for functional socio-economic areas, through working with local business, community and political leaders to nurture strategic place making. In the short term a key mechanism for doing so, would be for the National Infrastructure Assessment to be explicitly linked to the Industrial Strategy, given that the latter is intended to be place-based.

In the longer term, the National Infrastructure Assessment should:

- Recognise the need to reshape the economic and social geography of England, having regard especially to the Industrial Strategy and Housing White Paper

- Be set within and serve trans-regional development frameworks which provide for the anticipated future rebalancing of development in England, as well as opening up the new development areas required to meet some 10m additional population by 2050

- Reinforce the connectivity of networks of cities, including London, in the speed and capacity of their virtual and transport links

- Reduce delay and conflict, especially in the planning system, through an indicative framework of preferred development areas for renewable and other energy supply and infrastructure

- Be phased in advance of anticipated growth, not retrofitted

- For strategic infrastructure, be assessed within an England-wide evaluative framework for the overall programme of infrastructure and its environmental impact

- Help create new markets for development that better serve areas of need

- Recognise the need to make best possible use of the massive infrastructure assets we have inherited, including their structural maintenance.

Common Futures Network are keen to contribute further to the NIC's thinking leading to its Vision and Priorities document planned for summer 2017. Those network members with the greatest expertise to offer would be pleased to meet with NIC officers and/or board members to elaborate on this response.

Responses to Individual Questions

Question 1: What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

Other than inviting the submission of existing LEP and local strategies, there appears to be little consideration of national geography in the NIC's call for evidence. It is therefore difficult to see how the first of the NICs objectives – to support sustainable economic growth across all regions of the UK will be properly addressed, nor how the infrastructure assessment will give necessary support to the Industrial Strategy. Where Office for National Statistics and other trend-based projections underlie the analysis of initial supply-demand balances in each sector, these would serve to reinforce many undesirable long term outcomes. In particular, irrespective of the level of transport and other basic infrastructure investment, London's growth is likely to encounter a development threshold caused by housing constraints[7], whilst perfectly sound infrastructure in other parts of the country will be underused.

German law on spatial planning stipulates that infrastructure should be available to the population over the whole territory in an equitable way. In addition to cost benefit and environmental impact analyses, all strategic projects are subject to a 'spatial effects' analysis. A significant part of the long term budget for transport investment is reserved for projects which would not feature strongly on cost benefit grounds, but have a positive score on spatial effects: 60% of this budget was allocated to former East German states following reunification[8]. A similar policy should be considered in the UK.

We note that the 2014 National Infrastructure Plan[9] had a specific chapter on science and research infrastructure, acknowledging the importance of research investment, technology investment and intellectual capital. This was absolutely correct, but it is not clear if the current assessment will address this matter, and in particular the distribution of government funded research and government research institutes. Given that research is a basic driver of the knowledge based economy, we consider it crucial that this issue is properly addressed by the assessment[10]. There is very little up to date evidence on the issue and thus basic research needs to be commissioned[11]: historic research indicates that circa 90% of the UK government research institutes are located in or close to the 'golden triangle' (Oxford, Cambridge, London).

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[7] See the discussion of this issue in Cities Are Crucial: Report of the TCPA Urban Policy working group, Tomorrows Series Paper 17, July 2016 https://www.tcpa.org.uk/cities

[8] Ecotec/Faber Maunsell, Surface Infrastructure of National Economic Importance: A Study for England's Regional Development Agencies, January 2004

[9] HM Treasury/Infrastructure UK, National Infrastructure Plan, December 2014 (chapter 13)

[10] See for example C. Kirk, and K Cotton The Cambridge Phenomenon: 50 Years of Innovation and Enterprise , (2012), and Ian Wray Great British Plans, Chapter 9, The Cambridge Paradox (2016)

[11] We welcome and support the commitment to carry out such research given in the Industrial Strategy Green Paper

Question 2: How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

In our view the key concept is knowledge, rather than data or information (this includes tacit knowledge structured and exchanged within social and institutional settings[12]). Knowledge gateways will be critical to the further development of the knowledge economy, machine intelligence and artificial intelligence. They are created by the distribution of high level research in both private and public sectors and this in turn is determined by the location of relevant institutional platforms. We discuss in our response to Question 1 the critical importance of the distribution of government research institutions. Of almost equal import is the distribution of cultural spending, including national cultural institutions and the BBC.

Question 3: How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

It is important to consider the potential of investment in new nationally significant infrastructure to unlock new major housing (and economic) development. This is implicit in our overarching recommendation above that key infrastructure decisions should be considered within a wider development framework for England.

Question 12: What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

A common methodology to develop needs assessments across infrastructure sectors and to compare alternative options for addressing an agreed need is helpful (such as alternative routes for a rail or road link). Even so, there is a need to be more explicit about how competing national interests are traded off, e.g. between national infrastructure needs and protecting key landscapes of national significance.

However, cost benefit analysis as typically applied is unable to capture the potential benefits of transformational effects on economic growth and productivity; whilst its apparent precision can be spurious and misleading. Infrastructure investment operates over extremely long time periods, for which detailed forecasting is difficult and unreliable. This is particularly needed in the current uncertainties surrounding by Brexit and such matters as determining an appropriate rate of return in an ultra-low interest rate borrowing environment.

As indicated above we believe that in determining strategic infrastructure investment there is a need for other rational methodologies, including empirical studies, imaginative synthesis, generalised physical, environmental and social impacts (including spatial effects on the German model), and the use of goals, policies and multi criteria assessments[13]. This is the broad approach set out in the Industrial

[12] See Karl Polanyi, The Tacit Dimension (1966) and Jane Jacobs, The Economy of Cities (1969)

[13] Peter Self, Econocrats and the Policy Process: The Politics and Philosophy of Cost Benefit analysis (1975) is a good introduction to these issues

Strategy Green Paper, which identifies the need for infrastructure decisions to underpin and re-connect weaker local economies (rather than be determined solely on the basis of a cost benefit analysis rate of return)[14]. A wider approach to evaluation is needed in areas of market failure[15]. Otherwise success breeds success, congestion breeds congestion, and more than half the country is effectively abandoned. We have seen in the Brexit vote (and indeed in the election of Donald Trump) the profound electoral, political and social cohesion consequences of such tacit policies.

It is therefore necessary for policy to be able to respond to a range of possible futures for the nation, and not to be based on assumptions that past trends in development (whether growth or decline) will continue. In addition, account needs to be taken of the importance of achieving a more balanced national geographical pattern of development, even if that does not appear to maximise conventional measures of economic welfare.

Question 13: How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Any subsequent infrastructure strategy document should better reflect the type of country that the Prime Minister has said that she wants to create, giving more equal opportunities for all. As we argue above, this would have a different distribution of activities across the country than is implied by trend-based sectoral forecasts which are typically embedded in current decision-making. Infrastructure investment would be an important means of unlocking or creating opportunities outside the London mega-region.

In advance of this spatial vision being developed through the work streams that CFN suggests (see appendix), alternative spatial futures could be used.

Question 22: What are the most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

As research by Manchester University for the RTPI has shown[16], some of the areas of most acute water shortage are also currently areas of development pressure. Other parts of the UK such as North West England are in water surplus. An effective policy for rebalancing the UK's economy and society would reduce the need for extensive investment in new water supply capacity and distribution.

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[14] For example page 114 notes that investment should support the rebalancing of the economy; and page 116 that additional infrastructure spending should unlock growth in areas where connectivity is holding it back

[15] The 30 year history of regeneration investment in Liverpool is pertinent. Both the underground loop link rail system and the inner ring road could not have been justified in terms of cost benefit analysis – all the trends were negative. While once in terminal decline, Liverpool has now restructured its city centre economy in leisure, tourism, retailing and national conferences. The inner ring road (built as an 'act of faith') was crucial in facilitating the £1 billion private investment in Liverpool One. Over the past two years Liverpool has had a higher GVA growth rate than any other northern city.

[16] RTPI/ Manchester University, A Map for England (2012) http://www.rtpi.org.uk/media/11202/map_for_england_final_report__2012_.pdf

This submission was prepared by [name redacted], [name redacted] and [name redacted], taking into account the proceedings of the symposium held on 6 and 7 December 2016 and comments received subsequently. This paper has the broad support of Common Futures Network Contacts for CFN:
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[name redacted] [e-mail address redacted]
[name redacted] [e-mail address redacted]

APPENDIX 1

SUMMARY PROPOSITIONS OF COMMON FUTURES NETWORK

Towards a Common Future

The Prime Minister has set out the "*need for vision, determination and a plan to drive growth up and down the country - from rural areas to our great cities*."

The Prime Minister's ambitions require an integrated framework of action, which gives confidence to those who want to invest in the future of the country. The empowerment of local communities through the devolution and localism agenda needs to be strengthened, by providing a clearer context for local decision-making. Business development needs confidence in the longer-term future for investment.

There exist the foundations of such an integrated approach for Scotland, Wales and Northern Ireland, as set out in their respective national development frameworks - but there is no equivalent for England. The Government's initiatives for a National Industrial Strategy and a National Infrastructure Assessment are welcome but these are not sufficient to be successful in delivering this agenda in full.

The Common Futures Network (CFN) has therefore come together to respond to the interlinked challenges of inequality, low productivity, economic imbalance, and social and political cohesion. It seeks to transform rhetoric into action through a consensual, forward-looking and independent *Agenda* for shaping the future of England over the next 50 years.

Opportunities for Change

The following opportunities to rebuild the nation need a national framework of action:

- A better national balance of investment, research, culture, people and jobs, both urban and rural
- An economic strategy that harnesses the UK's full potential as a global mega-region
- An urban policy which sets out the roles of the major cities and their regions
- Securing the global role and functioning of the Capital Region of London
- Enhanced relationships between devolved administrations
- An infrastructure framework that underpins these, including movement and energy.

These challenges are overlain by the impacts of climate change and the potential implications of BREXIT. They are also hampered by fragmented administrative areas, and short-term outlooks. We need to change the way we do things!

A New Agenda for England

We need to build on the existing initiatives by harnessing fully the potential opportunities created by England's position as a *global economic region*. A fresh national agenda will help unite the nations of the UK by expressing their separate but interlinked identities, needs and ambitions. A new agenda is needed to translate government objectives into their spatial implications throughout England. Conversely, we need to consider geographical implications much more explicitly than at present when national policy decisions are taken, including those related to mainstream funding.

The immediate actions to tackle the short-term and longer-term national development priorities are therefore set out in the following eight Propositions. These could be informed by an independent body (comparable to the Office of Budget Responsibility).

The Propositions

Proposition 1: Creating a New Agenda for England to promote a portfolio of actions recognising geography based on:

- The global role of the London mega-region within the UK
- A new devolved development programme building on sub-national strengths
- An urban agenda to support the networked systems of cities
- A new rural agenda as a basis for connecting the rural hinterland of England
- Securing the natural capital of England
- An integrated infrastructure strategy rebalancing opportunities within England as part of the UK.

Proposition 2: Introducing a place-based Industrial Strategy to harness the agglomerative capacity of the UK, and England in particular, as a global mega-region, and a refreshed regional development programme reducing peripherality, identifying areas of industrial specialisation, linking research and development, and setting priorities and goals for underperforming parts of the country.

Proposition 3: Integrating Infrastructure to move the agenda beyond re-engineering the nation to rebalancing opportunities within England; also, opening up new development areas required to meet the additional 9m population by 2040.

Proposition 4: Building Networked Systems of Cities: Understanding and maximising functional linkages between cities, building upon, but not confined to, the three existing trans-regional priorities (Northern Powerhouse, Midlands Engine, and the Cambridge-Milton Keynes-Oxford Corridor), and other nationally significant opportunities (e.g. Heathrow-Swindon-Bristol), as well as the HS2 corridors.

Proposition 5: Securing the Global Role of London: Ensuring action throughout the London Capital Region supports the commercial, labour and housing markets upon which the future of London as a global city depends, through a high level non-statutory public – private forum, and also strengthening London's relationships with other major UK cities.

Proposition 6: Facilitating Devolution: Reinforcing the potential created by the emerging framework of Combined Authorities through a more structured and incentivised basis for collaborative action, whilst retaining a safety net for vulnerable towns.

Proposition 7: Identifying the Components of a Framework: Based on these propositions identifying the key issues that must be decided at a national level for England in terms of the *National Economic Hubs, Corridors* and *Networks* in support of the *National Flagship Projects* and the *National Priorities for Collaborative Action*.

Proposition 8: Linking Devolved National Frameworks through the British Irish Council's Working Group to provide a common context for cross-border cooperation, creating synergies and identifying cross-boundary and external relationships and nation-wide approaches to increasing self-sufficiency in food, raw materials and energy.

The Next Steps

These Propositions will be taken forward (and amplified) in a prospectus for a *Framework for England.* This will include seeking cross-party support. The form of follow-up will be responsive to the outcome of liaison with sponsors and partners.

TOWARDS A COMMON FUTURE
A NEW AGENDA FOR ENGLAND AND THE UK

Interim Prospectus of the
Common Futures Network

January 2017

ACKNOWLEDGEMENTS

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CONTENTS

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Common Futures Network
January 2017

SECTION 1

CONTEXT FOR A FRAMEWORK FOR ENGLAND AND THE UK

TOWARDS A COMMON FUTURE

The Need for Vision

The Prime Minister set out the following challenge from the outset of her tenure:

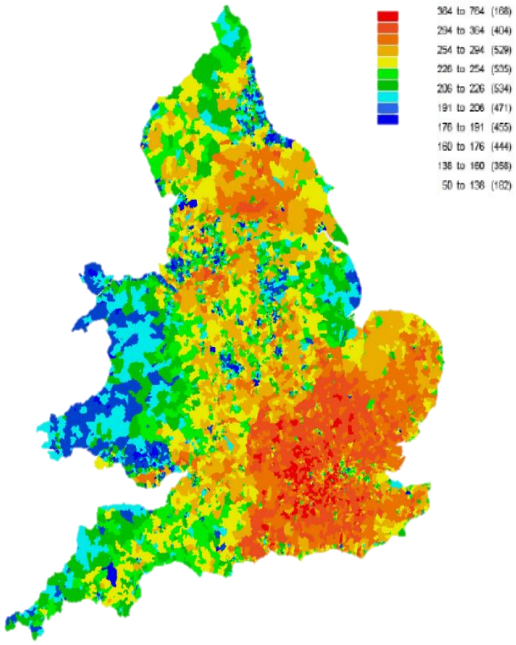
> "*We also need a plan to drive growth up and down the country - from rural areas to our great cities*".
> (2nd August 2016)

In October 2016, she set out her agenda more fully including the following:

> "*to tackle some of the economy's structural problems that hold people back. Things like the shortage of affordable homes. The need to make big decisions on – and invest in - our infrastructure. The need to rebalance the economy across sectors and areas in order to spread wealth and prosperity around the country.*
>
> *Politicians have talked about this for years. But the trouble is that this kind of change will never just happen by itself. If that's what we want, we need the vision and determination to see it through.*"
> (5th October 2016)

The Prime Minister's ambitions seek an integrated framework of action. This will give confidence to those who want to invest in the future of the country. As a result, the empowerment of local communities through the devolution and localism agenda will be set in a clear context for local decision making. Business will be given greater confidence through a more secure environment for investment. It is a win-win – localism and global competitiveness can both be strengthened.

Income per Capita, 2011



CASA analysis

The Need for Action

The *Common Futures Network* has been formed in response to this challenge. We set out here propositions for shaping the future of the country on which it seeks a cross-party support.

Economic growth and ensuring that its benefits are fairly shared across the nation are over-riding goals for the nation. The Government's emerging Industrial Strategy the National Infrastructure Assessment being prepared by the NIC will be central to ensuring that the nation is ready for the challenges ahead.

The Industrial Strategy must be place-based. The recommendations from the National Infrastructure Assessment – covering sectors such as energy, transport and broadband – will need to be designed to help its implementation. Both should support a general aim to rebalance the economy and wealth of the nation. However, there is also a need to transform the availability of affordable housing. Therefore, these initiatives need to be integrated into the wider agenda of social, economic and environmental change. In each of the devolved nations of Scotland, Wales and Northern Ireland there is an existing basis for a national development framework. But there is no equivalent for England.

A Prospectus for Common Futures

This Interim Prospectus sets out an immediate *Agenda* to fill this gap in England to benefit all communities - from rural areas to our great cities. It also forms a starting point for setting out a basis for developing a longer-term *National Development Framework* for the nation, and its implications for cross-border collaboration.

It represents a response to the radically changed circumstances in which the nation finds itself and the radical choices that must be made. The prospectus highlights some of the difficult choices and important collaborations involved. This particularly involves negotiating and navigating between 'rebalancing' an economy and a society at a time when successes need to be supported. It also involves making trade-offs between the triple bottom-lines of sustainable development.

NIC's vision for a digital Britain

THE NEED FOR CHANGE

National Agenda for Change

Our current national baseline trajectories have widely different impacts throughout England. The Prime Minister – in her comments of August and October 2016 – recognises that the pattern of development in Britain has to change if we want a fair society in which all prosper. Continuing uneven success will continue to undermine the nation's future.

The State of the Nation needs an overhaul. It needs to be re-engineered for the 21st century and structural upgrade. This is reflected in the aims for the Government's Industrial Strategy which seeks:

- *"An upgrade in our infrastructure so that we have smart and modern connections – physical and electronic.*
- *An upgrade in our education and training system so that we can benefit from the skilled workforce that we need in the future.*
- *An upgrade in the development and regeneration of those of our towns and cities that have fallen behind the rest of the country.*
- *An upgrade in our standards of corporate governance and in the relationship that government has with businesses of all shapes and sizes."*

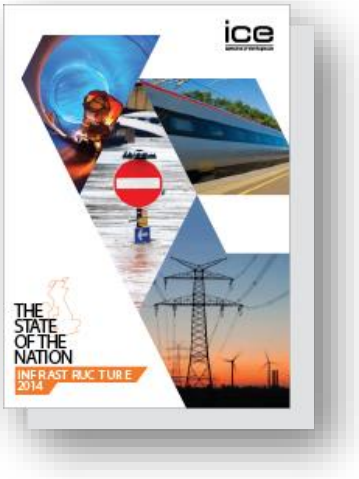
Rt.Hon. G Clark Secretary of State September 2016

Unlocking the Barriers

The agenda for change will require policies which unlock the barriers to change. This is acutely reflected by the inherited patterns of capital values and creation, and which creates disparities in entrepreneurial activity, local taxation and value capture opportunities.

Regional Variations in Value of Housing
(Savill's Research)

	£billion		
	2015 Value	5-year change	POPULATION ('000s)
CAPITAL REGION	3,418	975	19,308
MIDLANDS ENGINE	691	62	10,135
NORTHERN POWERHOUSE	896	11	14,933



Uniting the Nations

Whatever the outcome of the Brexit negotiations, the global position of the UK will change. We are in a change of era and not just an era of change. From experience, it is valuable to have a clear vision of how the nation should be shaped where it faces existential shifts.

The Scottish, Welsh and Northern Irish development frameworks allowed each of these countries the opportunity to set the agenda for coping with new powers and responsibilities. The same now should apply to the UK generally and England in particular, by explicitly identifying interlinked identities, need and ambitions.

Directions of Change

It is therefore critical that the underlying directions of change are addressed in terms of their varying implications for different parts of the country.

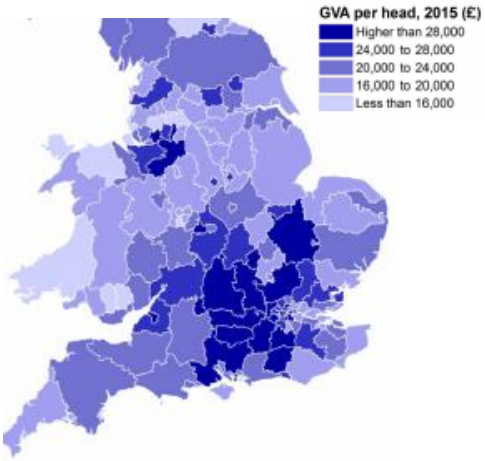
- Economic and social change requires some 9 million additional population to be housed by 2040 (ONS projections for England). There is no clear framework for accommodating this level of rapid urban growth. However, on existing trends over 50% of this growth is anticipated in London and the south east which will increase the strain on high cost housing and commercial markets and infrastructure which would curtail that growth.

- The impacts of economic growth are unequal. Social divisions have increased and, even within London, many households remain disadvantaged despite the economic success of the city. Growing social division is reinforced by the gap between the core areas of growth and more peripheral communities
  - between south and north;
  - between major and secondary cities;
  - between town and country; and
  - within regions and major cities.

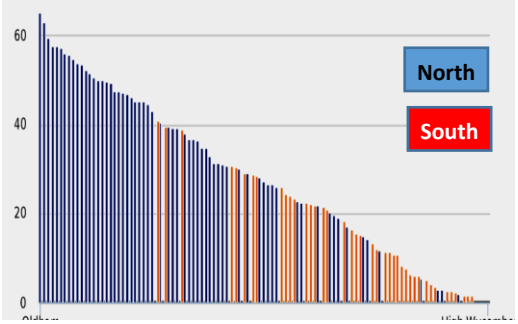
- Climate Change overlays these economic and social changes with differential impacts across the country affecting vulnerable communities in areas prone to flood risk, drought or overheating, and with predicted sea level changes also having serious longer term implications for many coastal communities. Climate change could also potentially affect food production and energy generation, and threaten the resilience of our ecosystems. Achieving targets for reducing our carbon footprint depends on radical changes in urban management.

- The new economies require clean and resilient environments. However, those areas of need suffer despoiled natural assets. The future lies in restoring and managing these, if they are to flourish. In particular, we need to restore the link between the major metropolitan centres with their rural setting e.g. through developing a national urban park system.

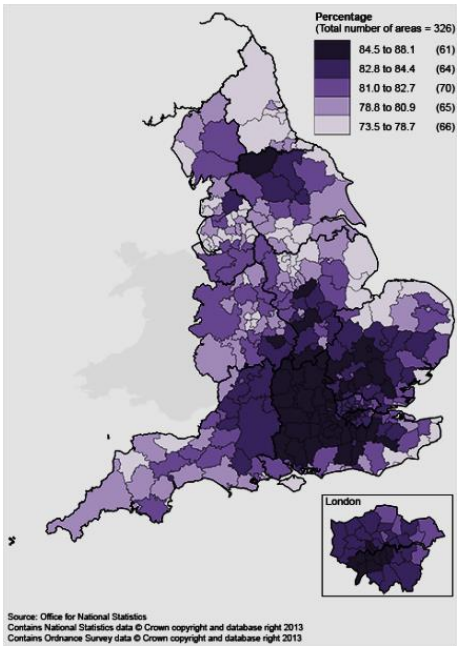
GVA / Head 2015



% Level of Deprivation in Towns & Cities (ONS-CLG 2015)



2011 Good Health (ONS)



THE NATION'S CHANGING GLOBAL ROLE

Global Competitiveness

The UK will have to reposition within a rapidly changing global market place. A key part of this are the emerging major urban complexes of the networks of cities – the mega-regions – which are the engines of growth and are transforming the global economy. They are harnessing the benefits of agglomeration in terms of labour, markets, capital, research and logistics.

The UK, and England in particular, should therefore be seen through this global lens. It is a networked *global economic region* comparable in scale and clout to the Boston-Washington axis in the United States, eastern seaboard. However not all parts of it contribute their full potential, and therefore reduce the potential national output and opportunities for their residents.

The Imperative for a National Framework

The impetus for change has been made more urgent by the Brexit decision

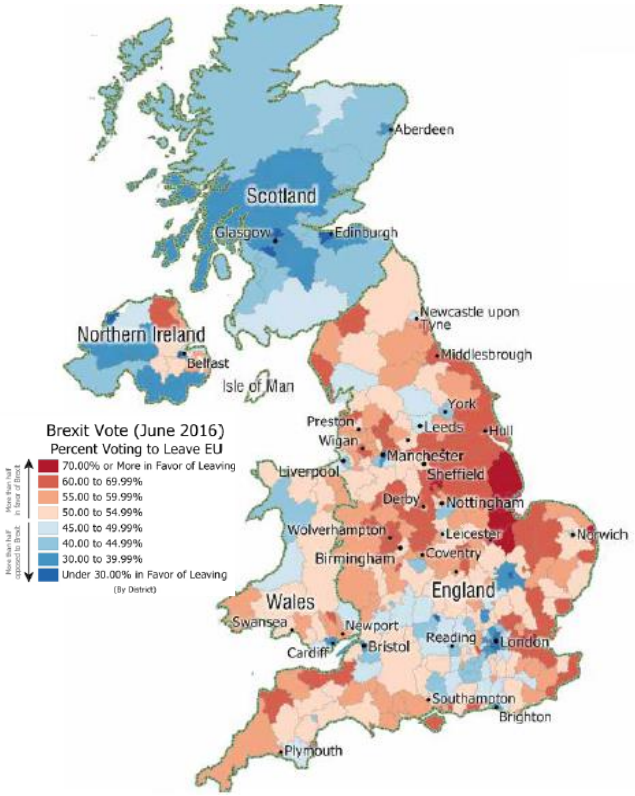
- The Brexit vote highlighted the social divisions in society. Marginalised cities, towns and regions expressed their detachment from the benefits of recent growth through their rejection of the *European Project* that was in fact meant to safeguard their interests.
- The prospect of tighter border controls will have implications for labour supply. However, some of the labour demands arising from economic growth could in part be met by rethinking regional development so as to increase activity rates and productivity;
- 'The baby must not be thrown out with the bath water'. Many parts and sectors of the British economy benefited from EU funding, policies and its related activities (e.g. EIB).
  - urban and rural regeneration that the EU underpinned needs to be translated into a fresh range of regional development programmes (refer Appendix 1).
  - University research and collaboration which cannot be replicated by maintaining funding alone.
  - environmental protection is closely intertwined for example with European Directives and the Natura 2000 network.
  - infrastructure frameworks e.g. TEN-T., TEN-E and eTEN.

Responding to Brexit

Whatever views are held on the referendum, the post-Brexit era will create the following opportunities:

- To improve on the delivery of funding in key areas, including
  - agriculture and rural development,
  - urban regeneration, and
  - university-based applied research;
- To empower regions and combined authorities not just with strategic responsibilities, but the taxing and investment powers needed to deliver strategies;
- To upskill and expand the local workforce, alongside significant productivity improvements, and thereby reduce the dependency on migration as a major means of meeting the demand for labour in a growing economy (especially within our bypassed communities);
- To proceed with strategic investments required to strengthen physical and economic links between English regions and their counterparts in the rest of the UK.

Geography of Voting in EU Referendum



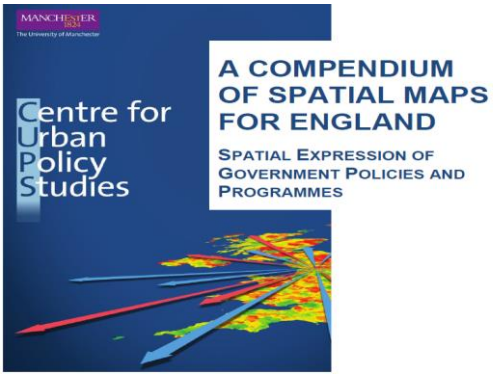
BUILDING ON THE CURRENT MOMENTUM

The Existing Consensus

There is significant scope to deliver the change agenda by building on the existing consensus and the momentum of current initiatives. It is accepted that:

- future economic recovery needs to be much broader-based in terms of who benefits;
- there must be a rebalancing of the distribution of development, which an unregulated market will not achieve; and
- there is a need to upgrade infrastructure, skill levels, housing affordability, and the resilience of energy supplies in the longer term, especially in our towns and cities.

These are embedded in the government's commitment to a range of over-arching policy objectives, especially in terms of climate change agreement, and the industrial and infrastructure strategies. This consensus needs to be sustained but also enhanced, through a clear spatial understanding and expression of policy, as highlighted in the Compendium produced by Professor Wong et al of Manchester University.



Existing Spatial Development Frameworks

Some key existing priorities are explicitly aligned with this agenda. These include the new combined authorities and the sub-national/trans-regional priorities for the Northern Powerhouse, Midlands Engine and Cambridge – Milton Keynes – Oxford Corridor and the HS2 Corridors. All these priorities however require an explicit spatial context. This is being developed for the Northern Powerhouse in the IPPR – RTPI report 'The Great North Plan'. Whilst the NIC is seeking to place the Cambridge - Milton Keynes - Oxford transport proposal within *"a joined-up plan for housing, jobs and infrastructure across the corridor"*.

Existing Environmental Frameworks

Investing in Natural Capital is key to the future national well-being. There is already a range of existing protected environmental resources. Our landscapes, habitats, historic heritage, agricultural systems, river basins, regional and national parks, forests and greenways should be seen as a national ecosystem of environmental assets and no longer a set of disparate protective designations. These Blue-Green Networks provide a range of socio-economic services to all communities in addition to their immediate environmental value, and should be seen as integral to the Industrial Strategy.

Emerging National Frameworks

There is also a wide range of national sectoral frameworks upon which to build an Agenda for England (refer Appendix 2). These will be given added focus by the emerging Industrial Strategy and the National Infrastructure Assessment (NIA) by the National Infrastructure Commission (NIC). The consultations being undertaken by the NIC and BEIS need to be rooted in a clear spatial framework.

In addition, the need to integrate the nation through new transport links is recognised in the Crossrail and HS2 and 3 proposals. This however needs to be extended and reinforced in terms of:

- the national development agenda for all areas.
- being better linked to development priorities, for example, to the areas that could be opened-up for major new housing growth.
- being expressed as an integrated programme and not just as a set of projects; and
- greater local input.

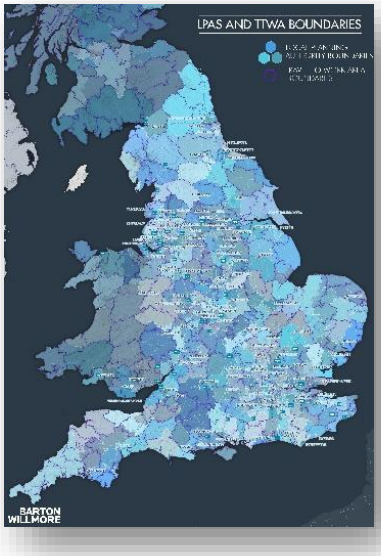
CHANGING HOW WE DO THINGS?

An Integrated Framework for England

There is an urgent need for a Framework for England which spells out the contribution that each part of the country will play. This is both nationally and at a sub-national scale, e.g. within the greater south east region or within the northern regions of the Northern Powerhouse. This also needs to take account of the mismatch between the economic and administrative geographies of the country.

Similarly, Industrial and Infrastructure strategies must be based on achieving a better balance of people and jobs and not be based upon the current trend-based projections and thus related cost benefit analyses) which lock-in historic patterns of change and reinforce national inequality of opportunity. It is also important to anticipate and plan for spill-over benefits and impacts that areas of development can have for other areas, so that communities are no longer 'left behind' in the growth of the nation.

A new agenda is therefore needed to translate government objectives into their spatial implications throughout England. Geographical implications need to be considered much more explicitly than at present when national policy decisions are taken, including those related to mainstream funding. Rebalancing should also be considered in relation to government investment and spending on government research institutes, culture, and the arts.



Barton Willmore internal research

The Administrative Paradox

There is a need for new tools to deliver transformative change to ensure that the future of the country is fair, inclusive and sustainable. The UK's strong central monetary control however is not sufficient to deliver this. As the Chief Economist to the Bank of England has made clear:

> *"The UK is towards the bottom of the league table within Europe in terms of the difference across regions,.. …,the Bank of England lacks the tools to tackle the problem,*
> *… (they) tend to work by lifting all boats across the whole of the UK,"*
> Andy Haldane (December 2016)

We need programmes of action that deliver better outcomes, harness new resources and allow full engagement of all. This will not be achieved through centralised short-term project based decision-making. It needs programmes of action that are sustained beyond election cycles. They also need to take account of the inter-relationship between, and wider impact of individual budgets and projects.

We all need to '*change how we do things*', if we are to get the best out of investment, whether this is in transport, housing or environmental action. If we are to deliver the potential of the nation, change is required in how we do things. This must not be just another shifting of the 'administrative deck chairs'. It is about trusting and enabling communities to create genuine win-win opportunities, and delivering greater international influence and local benefits.

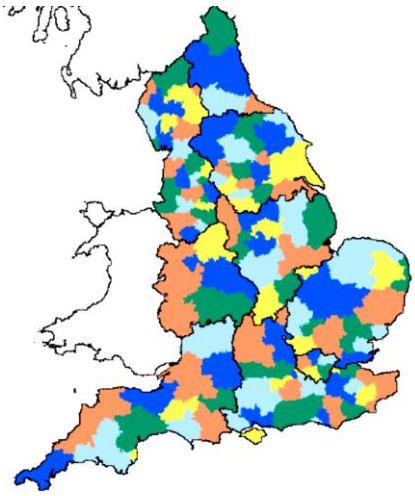
The Scope for Integrated Action

The need for a more integrated framework of local and national administration is reflected in the government's goals for greater subsidiarity and devolution (e.g. combined authorities) . It does not however address the need for better integration of those decisions that have to be decided nationally.

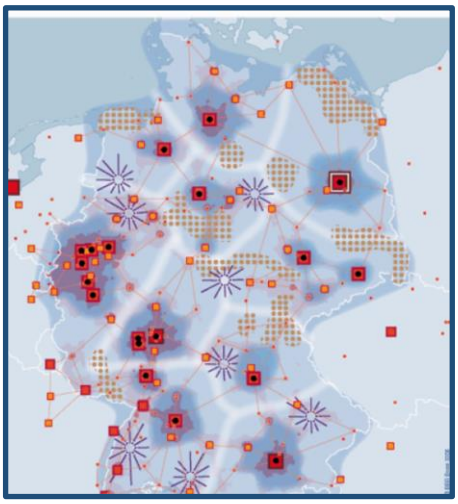
The scope for integrated action and better integration of policy lies in recognising where there are mutual interests between existing departmental silos and private and NGO sector groups, and where administrative boundaries have little relationship to the socio-economic geography within which people live and work. O This requires a more proactive approach to identifying where sub-national collaboration is required across areas and sectoral boundaries.

There are examples of this (e.g. Northern Powerhouse) which would benefit from being applied nation-wide more systematically. The methods of analysis are already being developed (e.g. strategic housing market areas) and impact tools (e.g. CASA-Catapult studies). There are also examples of applying this type of analysis at a national level (e.g. Germany and France) with area-wide interlinking of the individual metropolitan authorities as well as the regional governments.

Strategic Housing Market Assessment Areas (CLG: Geography of housing market areas, 2010)



Principle: Growth and Innovation Classification: Germany



Common Horizons

There is also a need to address the differing national long term horizons and assumptions used in differing policy areas. There is no common horizon used for national policy development. Although demographic analysis has a 25-year horizon, there is no agreed economic context for these. Most are merely driven by past trends thereby reinforcing the very problems that are supposed to be addressed. For example, the ONS projections have built assumptions about continued shift to the south and movement out from the inner urban areas, despite the priority given to reversing these.

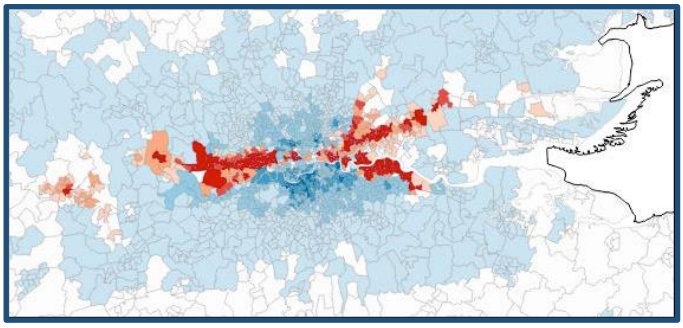
In the c*hange of era* that we face we need to be prepared to respond to a range of possible futures. The degree of uncertainty that we face is not marginal. This is reflected in the range of between 0 to 30 million population growth in the UK by 2050, set out in the ICE National Needs Assessment Vision. There are existing tools that could be developed and used for building and testing future scenarios (see CASA diagram)

The longer strategic horizons extend over many electoral cycles. Common and agreed analytical frameworks and future perspectives are required which sets out the present and future State of the Nation. This should include a form of *National Development Balance Sheet* of the scale and form of development that is aspired to over the longer term. (refer Appendix 3). This would be facilitated by an independent body (comparable to the role of Office of Budget Responsibility (OBR) on policy or the ONS on analysis or DATAR (Délégation Interministérielle à l'Aménagement du Territoire et à l'Attractivité Régionale) and the CGET (Le Commissariat général à l'égalité des territoires), in France.

National Planning Horizons

Economic	**15 years**	**(HMT)**
Demographic	**25 Years**	**(ONS)**
Transport	**35 Years**	**(DfT)**
Climate Change	**50 years +**	**(EA)**

Mode Shifts in Employed Population along Crossrail for London & the SE



Catapult & CASA Predicting Urban Futures

SECTION 2

A NEW AGENDA FOR ENGLAND AND THE UK

ORCHESTRATING CHANGE

The Opportunities

A new national Agenda for England is not only based on tackling the deep-rooted problems undermining the balance of development in the country but also harnessing the following key opportunities and strengths:

- Its position as a global economic region;
- Its highly-developed network of cities;
- Its framework of environmental resources;
- In responding to Brexit; and
- Uniting the nations of the UK.

Immediate Priority

In this change of era there needs to be an overarching vision that provides the place-based glue to stitch together projects and guide decisions about future investments (capturing synergy and interactions). The priority is in England which has no national development framework akin to the other home nations. This glue would run through an integrated set of policies to deliver "A *New Agenda for England*".

The Propositions

The Common Futures Network proposes to initiate a national discussion to take forward the creation of a longer-term framework for England. This will seek to tackle the above issues. We propose that a Prospectus making the case for a development framework for England be prepared urgently in collaboration with a wide group of partners drawing on the knowledge and expertise of concerned and knowledgeable individuals from across the country and sectoral interests.

The short-term and longer-term action to tackle the national development priorities are set out in the following eight Propositions. There are also matters which need to be addressed immediately. Therefore, the following sections also set out matters that need to be taken into account now by the Government and others players.

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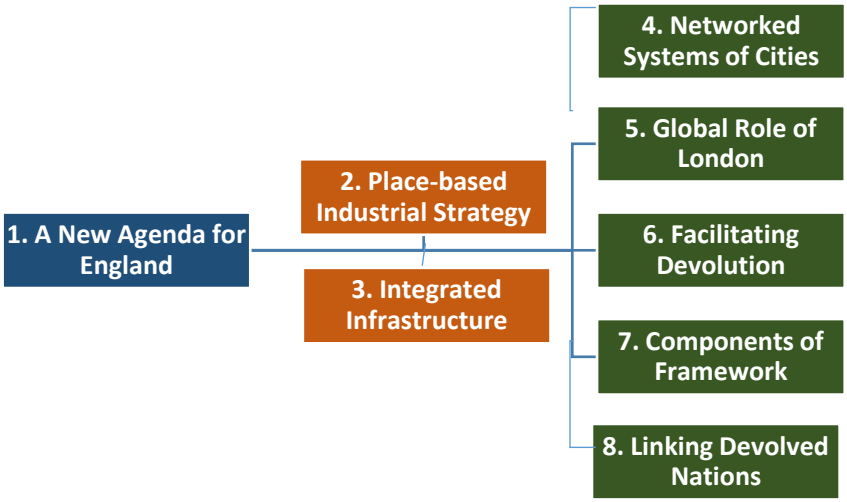
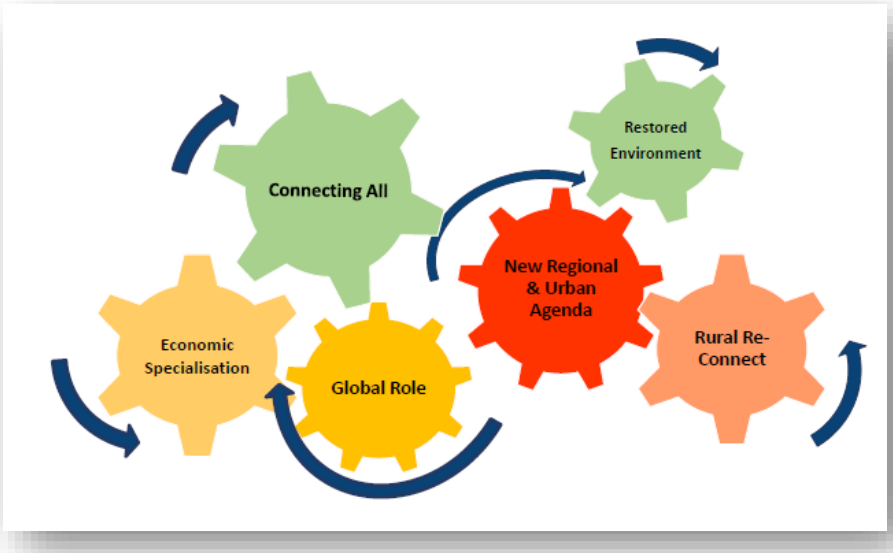


PROPOSITION 1
CREATING A NEW AGENDA FOR ENGLAND

Context

The following goals of Government need to be translated into explicit spatial frameworks of action for England and within the Government's guiding principles of sustainable development:

- To create the best possible conditions for British business in the long term.
- To build on our strengths and potential, especially those based on advanced manufacturing, low-carbon energy, the universities, professional services and creative industries.
- An economy that works for everyone, especially those most vulnerable.
- Regeneration, innovation and job creation should not be in separate policy silos.
- An urban agenda built around coherent city regions and an understanding of networks of cities, responding to the potential of each area.
- Opportunities need to be opened up to rural communities and smaller towns, including former industrial and coastal, as well as the major cities.



Proposition: A New Agenda for England

A new outward looking agenda is needed, setting out an integrated approach to tackling the three overarching issues of rapid urban growth, increasing social polarisation and climate change. It should address the spatial consequences of government policy and expenditure based on the following:

- Europe's only global mega-region and top-ranked global city to deliver the full benefits of an urbanised agglomeration of 60m+ population, comparable to Boston-Washington and the Shanghai mega-regions.
- A new regional agenda based on the nested functional areas, unlocking potential (as opposed to the historic agenda based upon problem areas).
- Economic specialisation of the major urban areas, need for regeneration and environmental priorities in the context and needs of potentially an extra 9m urban population.
- Reconnecting with the rural hinterland - integrating town and country and responding to the potential impact of removing CAP.
- Restoring and managing the environmental wealth of the nation on sustainable principles and responding to the need to meet climate change targets.
- Connecting the nation through linked core physical, social, cultural, and environmental infrastructure frameworks for the whole country.

This should be set within an understanding of the present and future State of the Nation. For this to have a general acceptance it needs to be have a level of independence and longer term status, equivalent to the role of the OBR and ONS in their respective areas of working.

Proposition 1
Creating A New Agenda for England

To promote a portfolio of actions recognising geography based on:

- **The global role of the London** mega-region within the UK.
- **A new devolved development programme** building on sub-national strengths.
- **An urban agenda** to support the networked systems of cities.
- **A new rural agenda** as a basis for connecting the rural hinterland of England
- **Securing the Natural Capital of England** through developing the national Green-Blue Network**;**
- **A integrated infrastructure strategy** rebalancing opportunities within England as part of the UK; and
- **State of the Nation** prepared independently, overseen by an 'OBR'-style body

PROPOSITION 2
INTRODUCING A PLACE-BASED INDUSTRIAL STRATEGY

Context

England is in effect a major global mega-region, which can harness the benefits of agglomeration associated with interconnected labour markets, research capacity and production. This allows labour markets to work with greater flexibility without general commute catchments being extended. This is enhanced through its links to Ireland and the other nations of the UK.

Its full potential is, however, not being optimised. The imbalance of opportunities and living standards that characterise 'the state of the nation' represent major untapped social and economic capital. It represents a major 'opportunity cost' that is not factored into policy debate sufficiently. It has been estimated that the Northern Powerhouse underperforms in GDP/capita by 25%, but that it has the potential for creating a significant number of jobs from within an upskilled existing workforce. If this was harnessed it would radically reduce the pressure of in-migration nationally.

These numbers, however, hide the synergy that could be created by integrating and incentivising the various networked systems of towns and cities. Combining and making available information systems in spatial format would be a useful step here. England has the potential to be more effective and harness the benefits of agglomeration, including:

- A much more diverse and flexible labour pool;
- A greatly increased internal market; and
- Extended supply chains and cooperative ventures (e.g. in R&D).

The industrial strategy should support cities and towns majoring on production and services in which they can excel (although not to the exclusion of other activities or other city regions), (see Box).

Illustrative Examples of City Specialisation (G Clark: Urbanist and Strategic Policy Analyst)

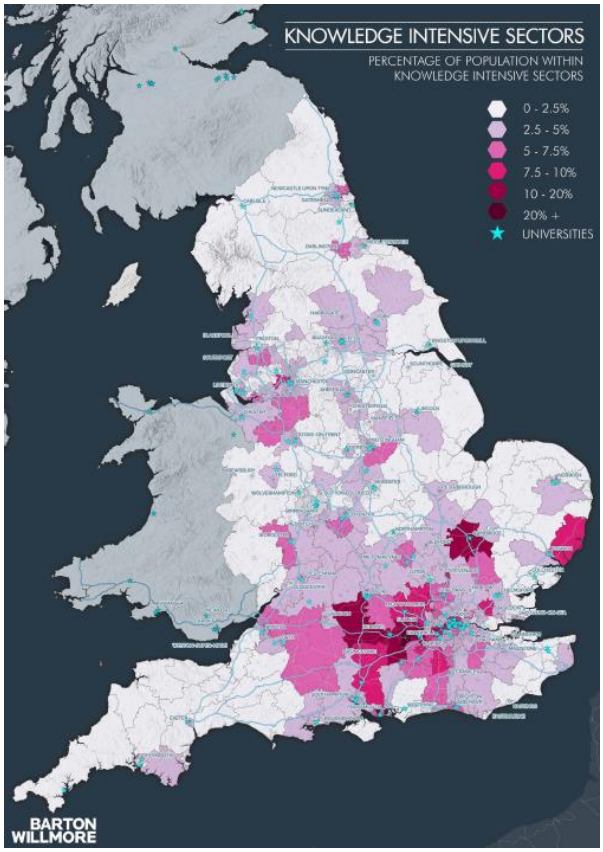
- World-class business location over 5-10 business cycles (London)
- Regenerated industrial cities (Glasgow, Manchester, Leeds, Liverpool, Birmingham)
- Development of knowledge and creative economy (London, Edinburgh, Glasgow, Bristol, Cambridge, Manchester and Oxford)
- Development of knowledge and creative economy (London, Edinburgh, Glasgow, Bristol, Cambridge and Oxford)
- Openness. Management of social and ethnic diversity (London, Birmingham, Manchester, Glasgow, Leicester)
- Sustainable development (Bristol, Newcastle, Brighton)

Proposition: A Place-based Industrial Strategy

The Government's industrial Strategy green paper sets out 10 pillars to drive economic growth. Three key physical development strands are of particular relevance here, which would benefit from a more integrated approach:

- The promotion of higher productivity, through science and research;
- Delivery of infrastructure projects and increased house building; and
- Continued support for regional development of cities and other economic areas outside London.

This agenda requires a clear spatial context. It is therefore proposed that the Industrial Strategy for the UK should develop the place-based agenda advocated by Rt. Hon Greg Clark MP, including the actions indicated in Proposition 2.



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Proposition 2:
Emphasising the the place-based dimention of the Industrial Strategy: Harnessing the potential of agglomeration

The Industrial Strategy should be place-based, including:

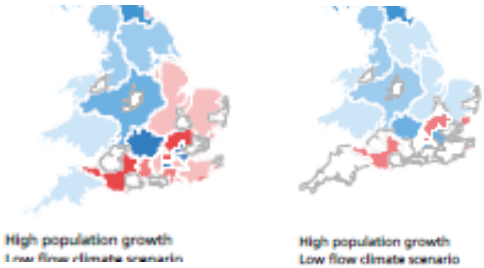
- Identification of the areas of industrial specialisation that should be promoted by individual city regions.
- Development of a network of innovation zones (comparable to the Sheffield AMID) linking the network of world-ranking universities to production ecosystems;
- Promoting projects which reduce peripherality between and within the economic regions of England;
- Establish a refreshed regional development programme based on the potential of regions not just on ameliorating their inherited problems; and
- Setting priorities and goals for education and skills uplift for specific underperforming parts of the country, beyond the national baselines and giving combined authorities the means to deliver against these.

PROPOSITION 3
INTEGRATED INFRASTRUCTURE

Context

The quality and capacity of the transport and IT networks will be key to the shaping of our towns and cities. The NIC provides a fresh opportunity to take an overview of infrastructure needs and priorities. However, transformational change must not be constrained by historic patterns of demand nor inherited constraints on capacity, either in development or in the opening up of new markets for business and housing.

Water Supply: Demand Balance 2015-2050
(Without & With management)



With the notable exception of HS2 and3, this results in greater bias towards areas of demand rather than to areas which need to be transformed in terms of their connectivity. There is therefore a tendency to reinforce the problems of peripheral areas – whether north / south, secondary towns / major city / and rural v urban. These divisions highlight the need to be more explicit about the balance between meeting foreseeable demand and capturing overlooked opportunities.

New Choices

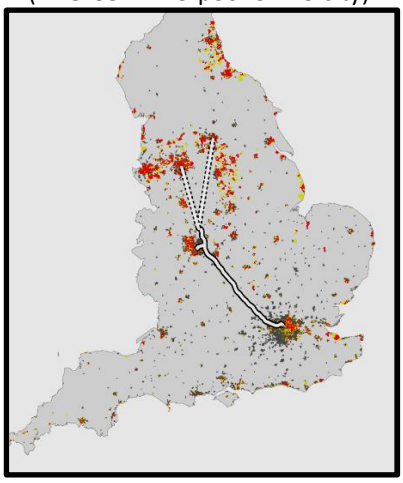
The shopping list of potential schemes will always be greater than available resources (in the past this has been estimated to be by a factor of 300%). Without a clear strategy to rebalance the distribution of people and jobs there is a risk of *ad hoc* selection on a project by project basis.

Similarly, the time horizon used for transport planning goes well beyond any agreed basis for economic change. Without a national framework in which to set new infrastructure investment, it is impossible to demonstrate that new transport investment decisions are being made on a consistent basis with other national policy. Nor is it possible to demonstrate that they will result in net economic growth as opposed to diversionary or displaced development.

In the past, national choices have been:

- At risk of delay whilst national priorities have been set in the absence of a wider development framework (e.g. airport capacity in the south-east); or
- Trapped in consultative processes which are unnecessarily confrontational because of the ad hoc nature of the project justification; and
- Often unable to fully exploit synergies at project interfaces (e.g. between Crossrail and HS2); and
- Without an agreed understanding of cumulative impact and benefit, because of the project-based (and trend based) assessment processes involved.

HS2 & Most Deprived Communities
(N. Green: Liverpool University)



Proposition: Integrating Infrastructure

The NIC represents a major opportunity for a more integrated approach to land-use and transport, but it is constrained in its formal remit. Infrastructure planning needs to respond to development needs and open up opportunities in areas of greatest need rather than be driven solely by the 'bow wave of past demand'. It also needs to recognise that investments can lead to opportunities, e.g. the Channel Tunnel Rail Link eastern approach to London ultimately led to the Olympics, Westfield and other regeneration investment at Stratford. Agreed national outcomes and goals rather than extrapolated trends should be the basis for investment.

The need for an agreed 'context' of future opportunities and risks is therefore critical to major investment decisions. A key mechanism for doing so, is for the NIC's needs assessment to be explicitly linked to the Industrial Strategy. This would mean that infrastructure investment was policy led rather than trend led. In the short term, this could be addressed through the approach being advocated in Proposition 3.

Proposition 3
Integrating Infrastructure

The National Infrastructure Assessment should recognise the need to reshape the economic and social geography of England and to be explicitly linked to the Industrial Strategy by:

- Being set within and serve trans-regional development frameworks which provide for the anticipated future rebalancing of development in England, and open up new development areas required to meet an estimated additional 10m population by 2050;
- Reinforcing the connectivity of the network of cities, including London, (Propositions 4 & 5) in terms of the speed and capacity of their high speed virtual and transport links;
- By reducing delay and conflict through an indicative framework of preferred development areas for renewable and other energy supply and infrastructure;
- Being phased in advance of anticipated growth not retrofitted;
- Being assessed within an England-wide evaluative framework for the overall programme of infrastructure; and
- Basing decisions on helping to create new markets for development that better serve areas of need.

PROPOSITION 4
BUILDING NETWORKED SYSTEMS OF CITIES

Context

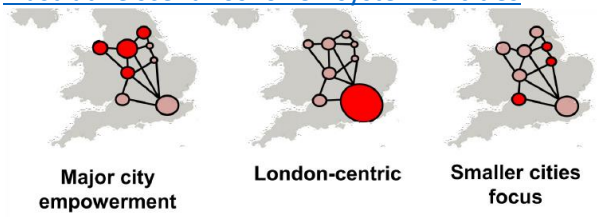
Cities are essential for national success, and have their greatest potential impact when operating as a networked system of cities. Cities or even groupings of cities are no longer stand-alone entities. They are interlinked, for example, in terms of labour, logistics and capital flows. This is especially true within England where many cities are closely related already. It will be even more important with the international 'catch-up' in technological communications sought by government (e.g. the NIC goals and Catapult programme).

However, even the most successful cities remain dependent on national funding and frameworks. This has been illustrated recently in the success of IT around Cambridge and advanced manufacturing in Manchester and Sheffield. It is desirable to have clarity about their respective national roles, alongside national funding decisions which give support to their role.

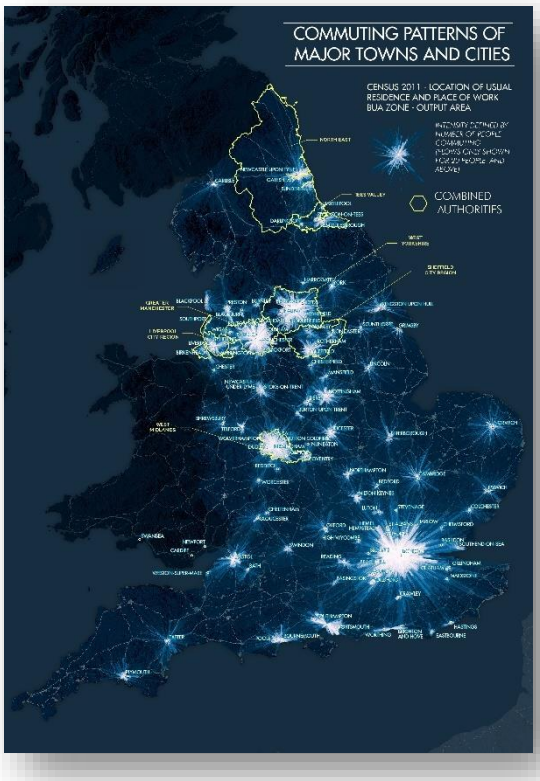
In this context, the efficiency of national systems of cities is critical. This is characterised by some, often larger, cities being more diversified and service-oriented, with high rates of business formation, and others cities specialising within an 'industrial ecosystem', whilst being centres of innovation in their own right.

There are however a range of possible strategic policy directions that could be developed. The Government's Future of Cities project used three scenarios to provide three contrasting reference points for considering the long-term future of, amongst other things, the national system of cities. This thinking requires to be taken forward through a national framework.

Illustrative scenarios for UK system of cities



Foresight Future of Cities project



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Proposition: Building Networked Systems of Cities

An explicit strategic framework building on the functional linkages between groupings of cities would seek to increase opportunities for investment, and for graduate retention and attraction Therefore, trans-regional action needs to be applied comprehensively to all nationally significant corridors of growth.

This agenda should be championed and incentivised by the Government, although bodies like Transport for the North, Midland Connect or the NIC as appropriate, may have a useful role in seeking consensus and agreement.

The four current initiatives express the national importance and potential for promoting networked cities on a trans-regional basis:

- The Northern Powerhouse
- Midlands Engine
- Cambridge-Milton Keynes- Oxford Corridor
- The HS2 Corridors

These existing initiatives would be strengthened and their full potential realised by taking explicit account of:

- The relationship between them;
- The relationship between core cities and the related secondary towns;
- Social and green infrastructure, in addition to those matters remitted to the NIC; and
- The intra-regional relationships e.g. between South Yorkshire and the East Midlands.

There are other national corridors which have similar potential that might also be recognised nationally. In addition to the two corridors related to Gatwick and Stansted (subject of earlier studies), these include

- The Extended Thames Gateway
- The Heathrow -M4-Bristol Corridor
- The Oxford-Thames Valley corridor
- Bristol-Severn-South Wales
- Atlantic Gateway

Proposition 4
Building Networked Systems of Cities

In order to harness the full benefits of urban agglomerations it is proposed that:

- the longer-term benefit of current trans-regional initiatives should be supported through joint non-statutory spatial frameworks;
- the TfN and NIC remit should be considered as possible means to enable and expedite the process;
- a comprehensive approach to networked cities and towns should be developed nationally; and
- the role of secondary cities and towns needs explicit consideration in the development of programmes and policies across these trans-national regions.

PROPOSITION 5 SECURING LONDON'S GLOBAL ROLE

Context – the Capital Region

London is the world's leading financial and cultural centre. Its competitiveness, however, cannot be taken for granted, particularly post Brexit. It needs to be diversified and be less polarised. In addition, its future viability is highly and increasingly interdependent with its wider Capital Region – each equally affected.

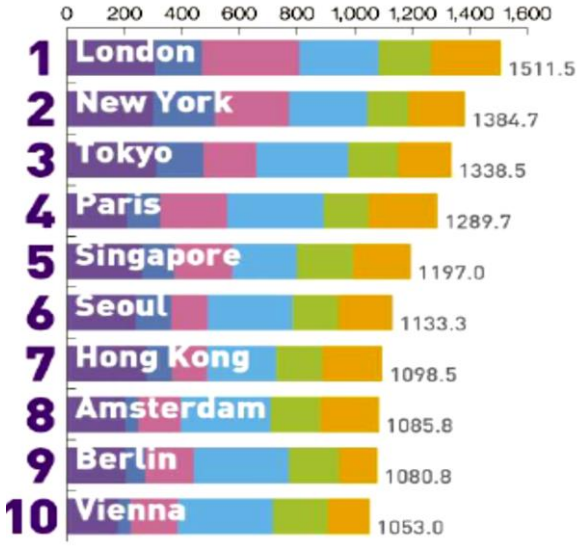
The scale of interaction within this Capital Region is reflected in the 1 million people commuting cross boundary daily, with increasing length of the average commuter trips and a net 70,000 annual net domestic out-migration of residents from London. These flows combined with the level of under-delivery of housing completions. As a result, there are acute problems of affordability and social polarisation. The challenge is to reverse these adverse impacts without damaging London's overall economic success and to invest in transport without generating house price inflation, in the context of the whole Capital Region.

In particular, the wider London region has increasing constraints upon its capacity to absorb the further pressures of growth anticipated from within London and local demands in the surrounding region. Infrastructure (road and rail, water and drainage and social and health services) is increasingly at or over capacity, depending on the area.

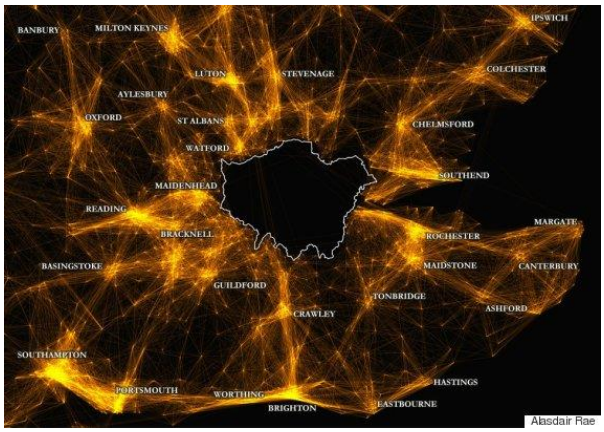
The major options for London-related growth lie within growth corridors three of which are of national significance requiring an economic-led approach to development: -

- Thames Gateway including Ebbsfleet Garden City and beyond, with centres out to Medway and Southend;
- London-Stansted-Cambridge linking Crossrail 2 and upgrading the West Anglia main line, with centres at Harlow, Cambridge and Huntingdon;
- The Western Wedge, linked to Heathrow's future growth in employment upon which it is partly dependent;
- The London-Milton Keynes-South Midlands corridor with growth potential unlocked by additional capacity along the WCML released by HS2.

Global City Ranking
[Global Power City Index (GPCI) 2016 report]



Commuting in London and the South East 2011
(Alasdair Rae: London the Supernova City)



Proposition: London's global role

There is, however, no forum for debating and managing these relationships within the Capital Region which involves well over 100 statutory bodies and councils. To quote the Aecom report London 2065

> *"To effectively balance London's growth and make informed choices about priorities for infrastructure investment we need to look at London differently as one of the UK's city regions – looking beyond current administrative boundaries."*

Growth of the London Capital Region lies also in the economic drivers arising from the networked towns which are not dependent on commuting into London. This has created a level of disconnect from the wider housing needs, with housing often only accepted in these areas if it meets local needs. The Capital region needs to rebalance the focus from being solely on London into recognising its network of outer centres, as demonstrated in the Polynet studies of Professor Peter Hall, and to revisit its relationships with other major UK cities.

The need for a comprehensive approach to this Capital Region also recognises risks that:

- London will end up in a 'housing-lock' which so excludes labour that it undermines it economic potential;
- Key quality of life factors including air quality will suffer on current trajectories; and
- The communities outside London are unable to absorb necessary levels of new homes through normal planning processes.

The nearest comparator is arguably New York, in terms of its role, size and ageing infrastructure, and participatory democratic processes. There the long-term strategic planning of the greater New York tristate region has been managed through a non-statutory Regional Plan Association of private sector and public interest. This approach is light touch and strategic.

Proposition 5
Securing the Global Role of the London mega-region

A high level non-statutory public – private forum should be created with the express remit of preparing a strategy for the London Capital Region in order to:

- secure the global role of London
- create the capacity for the potential scales of future growth
- ensure that all London's residents and workforce benefit from its economic success;
- rebalance the focus from being solely on London to one including its network of outer centres, and
- relate its economy and growth, to the planned changing connectivity to the rest of the country.

PROPOSITION 6
FACILITATING DEVOLUTION

Context

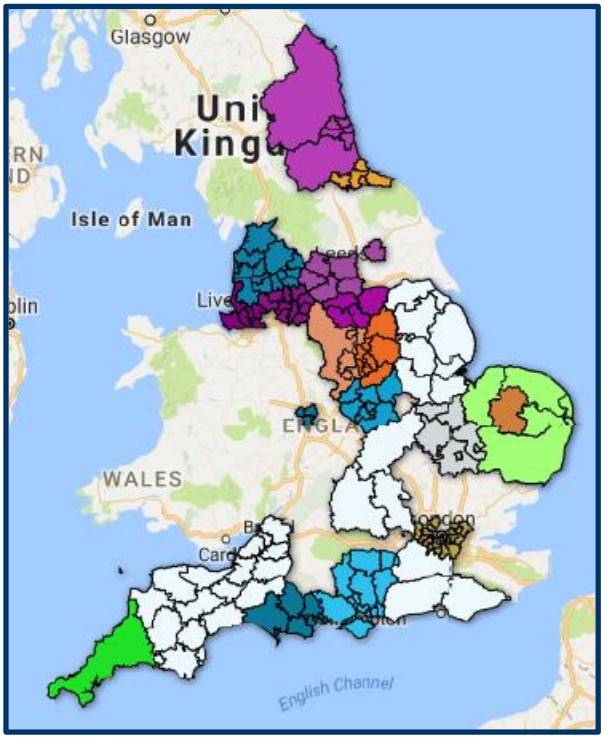
The re-empowering of local communities through devolution is long overdue. City regions are the natural building block of devolution, Therefore, the creation of Combined Authorities is a major step forward in re-establishing the capacity of local councils to make strategic decisions for the future of their areas.

Devolution will be most effective where the areas of joint working:

- relate to the functional areas within which people live and work – especially the housing market and journey to work areas which have been defined nationally; and
- have the confidence that they will be supported by, and not frustrated by, the decisions taken in 'another place'.

In this context, there are two issues that need to be addressed. Firstly, where the boundaries of Combined authorities are arbitrary it is desirable for their operational programmes to demonstrate how they relate to the nationally agreed socio-economic regions within which they sit. Secondly, many of the worst failures on duty to cooperate are on the fringes of metropolitan areas or around smaller economically buoyant cities, which the current combined authority boundaries do not address.

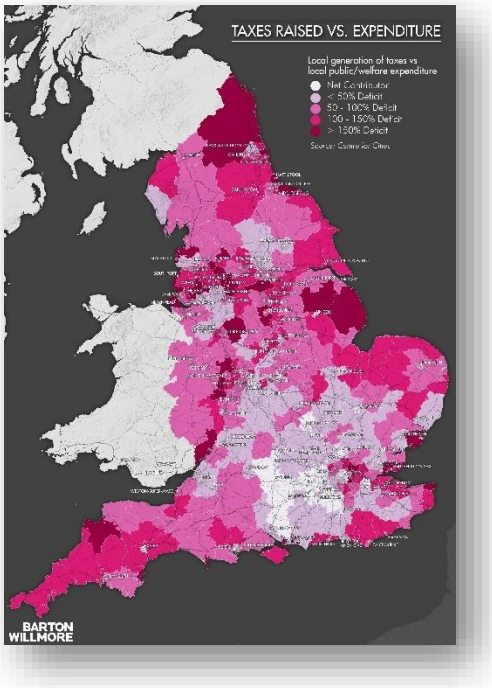
Devolution Map: Combined Authorities
(LGA: January 2017)



Proposition: Facilitating Devolution

The devolution of power and responsibilities to strategic governance partnerships is of national importance in the core metropolitan city regions because they are at the heart of the economic future of the nation. This shift needs accelerating through incentivisation and advocacy rather than government diktat.

It is therefore recommended that an even more proactive and place-based approach to devolution would yield real benefits in the pace of change. This is about providing a context for future devolution deals, for example by identifying where and how to fill the current gaps in collaboration. However, responsibilities cannot be devolved effectively without greater power over money and powers (e.g. raising revenues locally). Other towns and areas outside the main city regions however will often still need a safety net from central funding. Experience from the integration of Eastern Germany post reunification, shows the benefit of the Federal state ringfencing part of the national transport budget for this -to avoid a cost benefit analysis/market driven approach focusing spend on the established areas of the former West Germany.



Barton Willmore, Does England need a National Vision?

Proposition 6
Facilitating Devolution

In order to secure the full benefits from the programme of devolution to Combined Authorities, it is recommended that the development of the Devolution agenda should be set within the context of agreed functional areas in order to provide a framework for:

- Enabling a more structured basis for interpreting the duty to cooperate;
- Incentivising cooperative joint action;
- Identifying key gaps in the pattern of joint working; and
- Identifying national priorities for intervention.

PROPOSITION 7
IDENTIFYING THE COMPONENTS OF A FRAMEWORK

Context

Currently, national policy interest is contained in a wide range of documents. The RTPI *Map for England* has illustrated the extent of spatial advice that exists (implicit as well as explicit) in a wide range of sectoral policy. It has also demonstrated that when these are brought together they are not always consistent. This complexity and lack of clarity undermines the confidence necessary for local action.

A nationally agreed Framework would set out the contribution each area should make to delivering the national agenda (i.e. not seen as a bottom up process). Experience shows that without such guidance there is a real risk of delay and conflicting priorities.

It is, however, equally important that local entrepreneurial culture is not undermined by excessive or centralised micro-management. It is therefore critical that explicitly spatial national guidance relates to those matters that hold the nation together and drive it forward. This includes not only the core infrastructure systems and networks but also investment and spending on government research institutes, culture, and the arts.

Proposition: The Framework Components

A *Framework for England* will be an enabling framework of action. It should be light-touch, updateable and indicative and not proscriptive.

It is essential that any framework is focussed on those issues which can only and must be decided at a national level. Appendix 3 sets out an illustrative content.

The Common Futures Network proposes to take this conversation forward nationally during 2017. In order to assist these discussions, an outline approach will be prepared arising out of the 2016 London symposium discussions.

Proposition 7
Identifying the Components of a Framework for England

The scope of the Prospectus should focus on the national interest characterised in:

- The ***National Economic Hubs and Corridors*** which drive and secure the future of Britain e.g. Innovation zones or new settlements, or linked cities,
- The ***National Networks*** upon which all communities are dependent for accessing the national hubs and major urban centres;
- The ***National Flagship Projects*** which will transform the competitiveness and quality of life of England.
- The ***National Priorities for Collaborative Action*** where the level and scale of change is of national significance in terms of their potential) or from being at risk from either failing economies or physical threats e.g. sea level rise.

PROPOSITION 8
LINKING NATIONAL FRAMEWORKS

Context

There are already approved spatial frameworks for Scotland, Wales and Northern Ireland, (refer Appendix 4). These have a consistent set of issues based around the following key themes:

- A better national balance of people and jobs, both urban and rural;
- The function of cities and their regions;
- Environmental protection and enhancement; and
- The infrastructure framework that underpins these, including transport and energy.

Scotland, Wales and Northern Ireland have their own plans. However, they are often critically dependent on high level infrastructure in England (such as deep sea ports, energy, international airports and specialised services); as well as overland infrastructure to English markets and the continent. For all of this, and more, no equivalent plan exists in England. There are a range of component elements of national spatial frameworks which will help in creating a development framework for England.

Scotland

Scotland has a well-developed national framework, the third National Planning Framework (NPF3) which includes key themes – sustainable, low carbon, natural resilience and connected. It sets out the Government's priorities over the next 20-30 years and includes 14 national flagship developments.

Wales

The Wales Spatial Plan identifies 6 sub-regions in Wales and aims to deliver sustainable development through area strategies. It sets out cross-cutting national spatial priorities as a context for national and regional policies for specific sectors, such as health, education, housing and the economy, reflecting the distinctive characteristics of sub-regions of Wales and their cross-border relationships.

Northern Ireland

Northern Ireland has a Regional Development Strategy which aims to take account of the economic ambitions and needs of the Region, and put in place spatial planning, transport and housing priorities that will support and enable the aspirations of the Region to be met.

British Irish Council
Spatial Perspective

Proposition: Linking National Frameworks

It will be important to clarify how a Framework for England should relate to the frameworks for the devolved administrations in Scotland, Wales and Northern Ireland. Rather than propose an over-arching UK spatial perspective, it may be more appropriate to build on the Britain and Ireland institutional framework already in place. This could be achieved by charging the British Irish Council's Working Group on Collaborative Spatial Planning to report on the framework of mechanisms and incentives necessary to support cross-border co-operation.

While the Framework for England should be set in the devolved UK-wide context, there are specific issues that need to be addressed, including:

- Identifying cross-boundary and external relationships such as movement and economic growth;
- Nation-wide approaches to increasing self-sufficiency in food, raw materials and energy; and providing a common context for all four national frameworks for example on terms of international / global relationships.

Proposition 8
Linking Devolved National Frameworks

In order to strengthen the individual work of the devolved nations, it is proposed that there should be an explicit consideration of their interdependencies in terms of:

- the role of the major airports and ports serving Europe, the Americas and Asia;
- the relationship of north and south Wales to Merseyside /Cheshire and the Bristol/Severn estuarine areas, respectively;
- the links between Northern Ireland and the Republic of Ireland and transport links;
- the development of knowledge networks between the main universities;
- core understanding on such matters as international migration and other factors;
- The British Irish Council's Working Group to be asked to report on a framework to support cross-border co-operation.

WAY FORWARD

This Interim Prospectus seeks to start a wider conversation about the future of the nation. It wants to engage the wider policy community in this. It therefore does not set out a blue print of how it should be taken forward nor advocate a specific model of who should lead it. From experience this is best done through dialogue and not setting out a prescription at this stage. There are many governance models and they all have strengths and weaknesses, but can all work if their latent weaknesses are compensated in the associated checks and balances.

National Influence and Local Benefits

Whatever the model that is used to develop a Framework for England it will reap benefits in terms of national influence and local benefits.

A national Agenda for England is needed to address existing weaknesses and deliver a wide range of benefits (refer Boxes). It does not replace national sectoral initiatives or programmes of action but gives them greater impact by aligning them within a common framework.

Similarly, a national Agenda for England will also have demonstrable local benefits. It will provide confidence that actions taken locally will be supported and not undermined by action taken elsewhere.

Next Steps

It is therefore proposed that the next steps in making the case for a national development framework for England will be as follows:

1. Make submission to the consultations on the NIA and the Industrial Strategy green paper, and liaise with NIC and BEIS
2. Publicise and consult on this Interim Prospectus
3. Seek cross-party discussions and support
4. Open up the network to membership and support
5. Liaise with potential hosts for network website (domain registered)
6. Prepare a draft discussion document at Symposium 2 by mid-2017
7. Undertake wider consultation by end 2017.

The future form of follow-up will depend on the outcome of liaison with sponsors and partners.

The National Benefits of a Framework for England

- Provide a shared ambition across sectors and interest groups
- Set long-term priorities for the nation for the next 30 years
- Bridge the silos of Government to ensure the contribution of all sectors – health, social welfare, education, etc.
- A shared evidence base to support key policy decisions at national and local levels to leverage the greatest economic, social and environmental benefits
- Increase clarity and certainty for future national and international investment
- Provide coordination and support for devolved powers making local decisions and plans better and more effective
- Capture the greatest "bang for your buck" for infrastructure and public and private investment
- Avoid the confusion and missed opportunities of an uncoordinated and unplanned England.

The Local Benefits of a Framework for England

Policies and investments for regeneration and growth that benefit local communities through:

- Local and regional transport systems that connect to national and international transport modes;
- Strengthened research universities and teaching hospitals, and create technology transfer institutions to ensure that technologies in these places benefit the local, regional and national economy;
- Empowered local and metropolitan governments to innovate and invest in these activities and in improved education and other public services that open up new opportunities for people, locally;
- Protection of valuable and cherished places and spaces that are of more than local significance within a wider economic and social context.

APPENDICES

APPENDIX 1: EU Context Summary Background Note
(This summary is based on a fuller paper prepared for the Network by Professor Janice Morphet)

The EU has been a major and increasing influence on spatial, investment and planning policy in the UK over the last 40 years. Key areas where EU policy and programmes have been delivered in the UK include strategic transport routes and nodes; energy; housing and planning; the environment; maritime and ports policy. A revised version of Europe 2020 is now currently under preparation. An important part of the work towards a Framework for England should therefore be to assess how far these EU policies and actions impact on the strategic spatial strategy for England and the UK. As a corollary if the UK leaves the EU, the question remains about how physical links between the EU member states including Ireland will be managed.

Regardless of the outcome of Brexit, the geographical and trade links between the EU and the UK make these continuing relationships inevitable. The EU is now preparing a strategic framework to run to 2050 that will guide investment and wider territorial policy. Therefore, it is important to be clear about what its implications are for England, and the UK more generally. In a risk mitigation approach, it is desirable to consider how the NIC infrastructure assessment includes explicit EU policy frameworks that are procedurally committed.

In principle the infrastructure needs assessment being undertaken by the NIC should be a major contribution to this, but at present there is concern that it will not be spatial enough – i.e. clear about the needs and demands of all communities and the options for managing these to address the imbalances in the distribution of needs and demands for new development. A key mechanism for doing so, is for the NIC's infrastructure needs assessment to be explicitly linked to the Industrial Strategy.

APPENDIX 2: Existing National Sectoral Frameworks

The following are examples of what is already available. These are only illustrative and others have been documented in 'The Map for England':

- The Catapult Programme which provides a network of centres designed to transform the UK's capability for innovation
- Food Security: 'Securing food supplies up to 2050: the challenges faced by the UK';
- Water Stress: e.g. as highlighted in the Environment Agency report 'Water for People and the Environment' 2009;
- Water resources: Water resources long-term planning framework 2015-2065, Water UK, 2016;
- Flood Risk: Flooding in England: A National Assessment of Flood Risk;
- Impoverished Biodiversity: 'Lost life: England's lost and threatened species';
- Sustaining Ecosystems Services: refer recent report 'Draft synthesis of current status and recent trends';
- Energy & Climate: Low Carbon Transition Plan: national strategy for climate & energy;
- Renewable Energy: the 2009 UK Renewable Energy Strategy;
- Climate change adaptation: The National Adaptation Programme: Making the country resilient to a changing climate, Defra 2013.

Appendix 3: Illustrative Components of a National Framework for England

Based on experience elsewhere the components of a Framework could include the following illustrative examples.

A. A *'balance sheet'* and *'future business plan'* for the development of the nation, which would summarise the key components of the National Development Balance Sheet, for example as follows:
    a. A State of the Nation Report setting out:
        i. The aggregate capacity for development;
        ii. The underused capacities in our national stock (e.g. housing) and infrastructure systems;
        iii. The pinch points in our national infrastructure;
        iv. The scale and any identified priorities for urban regeneration; and
        v. Monitoring of the natural environment (e.g. level of risk).
    b. The 'Shifts' in the Nation setting out:
        i. The economic, social and environmental trends;
        ii. The national flows and goods, services and people; and
        iii. The external relationships.
    c. The National Perspectives on:
        i. The directions and distributions of change; and
        ii. The potential *'futures'* that should be accommodated and enabled.

B. The *National Economic Hubs* which drive and secure the economic and social future of the nation. These would include amongst other things the following key hubs:
    - Airports
    - Ports
    - Inland freight terminals
    - Knowledge/ research centres of excellence
    - Metropolitan commercial, cultural and city centres

C. The *National Networks* upon which all communities are dependent for accessing the national hubs and major metropolitan areas, including, inter alia:
    - Rail (passenger and freight
    - Road
    - Canals/river systems
    - Power grids
    - Telecommunications
    - The Water Catchment / Ecosystem Framework of England
    - Green Grid, e.g. Mersey Forest initiative and including a network of urban national parks

D. The *National Flagship Projects* to transform the competitiveness and quality of life of England which are recognised as national economic, social and environmental priorities, and could include for example:
    - Internationally important projects e.g. The Olympics/Commonwealth Games
    - Transport projects of national significance e.g. HS2, Crossrail
    - Sectoral priorities which have a strong spatial expression e.g. deprivation issues including health, skills, housing etc.
    - Brown priorities – i.e. regeneration priorities (e.g. UDCs and MDCs) or new town , garden cities or equivalent projects
    - Green-Blue priorities e.g. new national parks or national forestry projects

APPENDIX 4: A COLLABORATIVE MODEL FOR STRATEGIC SPATIAL PLANNING IN BRITAIN AND IRELAND
(This note is based on advice received from Scottish planning colleagues)

Background
There are already approved spatial frameworks for Scotland, Wales and Northern Ireland. In contrast the NPPF for England has no spatial dimension. In addition, there are established policy frameworks affecting the whole of the UK which have clear spatial implications - in particular these include EU regional and transport policies, and the range of environmental designations.

Scotland
Scotland has a well-developed national framework. It sets out the Government's development priorities over the next 20-30 years and identifies national developments which support the development strategy. The third National Planning Framework 3 approved in 2014 which includes key themes and specific national development projects:

- A successful sustainable place – supporting economic growth, regeneration and the creation of well-designed places
- A low carbon place – reducing our carbon emissions and adapting to climate change
- A natural resilient place – helping to protect and enhance our natural cultural assets and facilitating their sustainable use
- A connected place – supporting better transport and digital connectivity
- National development priorities, 14 developments are identified to deliver the strategy and set a regional context for local development plans.

Wales
The Wales Spatial Plan was last updated in 2008 and is less specific. It identifies 6 sub-regions in Wales without defining hard boundaries, reflecting the different linkages involved in daily activities. It seeks to:

- make sure that decisions are taken with regard to their impact beyond sectoral or administrative boundaries and that the core values of sustainable development govern everything we do
- set the context for local and community planning
- influence where we spend money through understanding the roles of and interactions between places
- provide a clear evidence base for the public, private and third (voluntary) sectors to develop policy and action.

The Wales Spatial Plan aims to deliver sustainable development through its area strategies in the context of a Sustainable Development Scheme. It sets out cross-cutting national spatial priorities. These provide the context for the application of national and regional policies for specific sectors, such as health, education, housing and the economy, reflecting the distinctive characteristics of different sub-regions (areas) of Wales and their cross-border relationships. Work on a next stage of the Spatial Plan is under consideration.

Northern Ireland
Northern Ireland has a Regional Development Strategy. The strategy aims to take account of the economic ambitions and needs of the Region, and put in place spatial planning, transport and housing priorities that will support and enable the aspirations of the Region to be met.

England
The English NPPF is however very different in nature and role. The NPPF sets out a framework of criteria based policies that need to be applied consistently across English local council areas. It is not however a spatial framework to lead change and to secure the required development of England.

European Experience
Within the EU, support is provided for cross-border, transnational and inter-regional co-operation in furtherance of Territorial Cohesion Policy. The INTERREG and ESPON programmes provide a framework for joint actions, policy exchanges and spatial data sharing between national, regional and local actors from different Member States. The budgets allocated to these programmes incentivise voluntary participation in

projects designed to further their objectives. Parts of the UK and Ireland fall within two of the macro-regions established as a framework for European territorial co-operation: the North Sea Region and the Atlantic Arc.

The framework for cross-border co-operation provided by the EU has been important in facilitating collaboration on spatial planning between the Republic of Ireland and Northern Ireland. It is anomalous, but perhaps a consequence of the ad hoc and asymmetric way in which powers have been devolved in the UK, that there is no equivalent framework to support collaboration on matters of common interest between its various administrations. Liaison between administrations on planning matters takes place on a Britain and Ireland basis through the Five Administrations meetings of the Heads of Planning and the British Irish Council Working Group on Collaborative Spatial Planning. The Five Administrations meetings are primarily concerned with sharing experience on practice and process and do not have a strong spatial focus.

Trans-national Experience

Scotland's first National Planning Framework (2004) identified opportunities to strengthen knowledge economy links around energy and off-shore expertise on the East Coast corridor between Aberdeen and Newcastle. The Regional Strategy for the North East of England recognised the economic influence of the Edinburgh City Region on the North East of England and included a commitment to improving accessibility and efficiency of movement along the East Coast corridor. Several meetings were held between officials in Scotland and the North East of England with a view to developing a strategic agenda for the East Coast corridor, but with the abolition of the English regions these links were severed. Following the UK General Election in May 2010, discussions took place between DCLG and Scottish Government officials with a view to agreeing a memorandum of understanding on co-operation between planning authorities on either side of the Scotland – England border, but these came to nothing.

During Scotland's independence referendum, Northumbria University published an interesting report urging local authorities in the North of England to develop collaborative links with Scotland in areas such as renewable energy and tourism whatever the constitutional outcome. It received a positive response from Scottish politicians. We should be aiming to develop mechanisms to support collaboration between the nations and regions of these islands on matters like spatial planning which are robust and flexible enough to remain effective however constitutional relationships may change in the future. Interestingly, in an article published in *The Independent* shortly after the referendum, the Conservative MEP, Daniel Hannan, suggested a bigger role for the British Irish Council in such matters.

British Irish Council Working Group

The British Irish Council was established as part of the multi-party agreement reached in Belfast in 1998. Its membership comprises representatives from the Irish Government; UK Government; Scottish Government; Northern Ireland Executive; Welsh Government; Isle of Man Government; Government of Jersey and Government of Guernsey.

At its Summit in Cardiff in February 2009, the British Irish Council agreed to ask the Northern Ireland Executive to lead a work sector to examine the benefits that could be gained from collaboration on Collaborative Spatial Planning. This work sector brings together officials from each of the Member Administrations who are responsible for national, island and regional development strategies. The group meets biannually to exchange information and perspectives on current spatial planning challenges.

At the Glasgow Summit in June 2016, Ministers asked officials to focus on the spatial planning aspects of housing delivery. A report on the outcome of this work will be presented to Ministers at a meeting in 2017.

As an expert group drawing representation from all the administrations of Britain and Ireland, it is well placed to develop formal mechanisms to support collaboration on strategic spatial planning between the administrations of these islands.

APPENDIX 5
Towards a Common Futures Network

London Symposium Participants, 6 & 7 December 2016

Participant	Organisation, location based in	Role
Prof Mike Batty	UCL	Bartlett Professor of Planning & Chair Centre for Advanced Spatial Analysis
Duncan Bowie	University of Westminster	Senior lecturer
Armando Carbonell	Lincoln Institute of Land Policy, Massachusetts	Chair urban planning program
Andy Dobson	David Simmons, Cambridge	Partner
Lourdes Germán	Lincoln Institute of Land Policy, Massachusetts	Director of International & Institute-wide Initiatives
Susan Emmett	Savills, London	Director residential research
Vincent Goodstadt	University of Manchester	Honorary Professor
Nick Green	University of Liverpool	Lecturer
Peter Hetherington	TCPA & The Guardian,	
Dr Andrew Jones	AECOM, London	Director, Practice Lead for Design Planning & Economics
Gerrit-Jan Knapp	Uni Maryland	Professor of Urban Studies & Planning
Kelvin MacDonald	Spatial Effects	Specialist adviser CLG Select Committee
Dr Tim Marshall	Oxford Brookes University	Emeritus Professor of Planning
Mac McCarthy	Lincoln Institute of Land Policy, Massachusetts	President and CEO
Dr Janice Morphet	UCL	Visiting Professor spatial planning
Kevin Murray	Kevin Murray Associates, Glasgow	Managing Director
Peter Nears	Visiting Professor	University of Liverpool
Hector Pearson	National Grid plc, Warwick	Planning Policy Manager
Andrew Pritchard	East Midlands Councils	Director of Policy
Graeme Purves	Scotland	Ex Chief Planner, Scottish Exec
Al Richardson	Royal Institution	Professor
David Rudlin	Urbed, Manchester	Director
Martin Simmons	TCPA, South East	Ex Chief Planner, London
Mark Sitch	Barton Willmore	Senior Partner
Jim Steer	SDG, London	Founder
Corinne Swain	Arup, London	Fellow
Sandy Taylor	Futures Network West Midlands	
Prof Cecilia Wong	University of Manchester	Director of Spatial Policy and Analysis Laboratory, MUI
John Worthington	Independent Transport Commission, London	DEGW founder
Ian Wray	University of Liverpool	Visiting Professor & Fellow
Bob Yaro	Regional Plan Association, USA	President Emeritus

London Symposium Participants, 6 December 2016 evening session only*

Jan Bessell	Pinsent Masons, Leeds	Strategic planning adviser
Trudi Elliott	RTPI	CEO
Dr Hugh Ellis	TCPA	Director of Policy

Those who have provided advice or support the objectives of the Network but unable to attend the London Symposium

Pam Alexander	Future Cities Catapult	Non-Executive Director
Mark Baker	University of Manchester	Reader in planning
Sue Bridge	Sue Bridge Consulting Ltd	Director
Andrew Carter	Centre for Cities	Deputy CEO
Greg Clark	UCL, City Leadership Laboratory	Visiting Professor & global adviser on cities
Lee Griffin	Aecom	Director Global Cities
Gavin Miller	ICE	Energy Policy Manager
Richard Milton	CASA	
Carolyn Organ	Barton Willmore, Reading	Associate
Prof Michael Parkinson	Uni Liverpool	Adviser to the VC
Robin Shepherd	Barton Willmore, Reading	Partner
Chris Shepley	Chris Shepley Associates, Bath	Ex Chief Planning Inspector
David Simmons	David Simmonds, Cambridge	Director
Tim Stonor	Space Syntax	Manging Director
David Thew	Futures Network West Midlands	Convenor
Robert Upton	Independent Advisor	Strategic Planning & Policy Consultant

Note: Anyone contributing to or supporting the Network does so in an individual capacity, not representing any organisation.

* John Godfrey, Director of Policy, No. 10 Policy Unit attended the London Symposium, 6 December 2016 evening session as an observer only

To find out more about the Common Futures Network, please contact:
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Competition and the National Infrastructure Commission

Introduction

1. The Competition & Markets Authority (CMA) is the UK's lead competition and consumer authority. Our aim is to make markets work well for consumers, businesses and the economy.

2. This paper outlines some of the key relationships between competition and infrastructure, drawing on our experience and that of our predecessor organisations, the Office of Fair Trading (OFT) and the Competition Commission (CC).

3. We have submitted this paper in case the material presented is useful to the National Infrastructure Commission (NIC), in the context of the National Infrastructure Assessment in particular, but also the NIC's wider work. We would be happy to discuss any aspects of this material that are of interest.

4. We note that the independent sector regulators have significant expertise in relation to incentivising and managing infrastructure; this paper is intended to be complementary to any input that the regulators may provide.

Competition can support infrastructure investment, both when infrastructure is centrally planned…

5. Where public bodies commission or incentivise infrastructure, competitive mechanisms can help maximise value for money[1]. For example, competitive tendering is being used by HS2 Limited to appoint contractors, by Ofgem in relation to new onshore transmission assets, and government has used reverse auctions to allocate Contracts for Difference to support low carbon electricity generation projects.

6. The OFT's infrastructure report (2010)[2] notes that encouraging providers to compete for infrastructure contracts (i.e. competition for the market) can be particularly beneficial where there is limited scope for facility based competition (i.e. competition in the market). This might be the case, for example, in the delivery of core network infrastructure where there are significant economies of scale.

7. As set out in the OFT's report on public sector commissioning (2011)[3], those who run tenders should be alert to the risk that coordination or outright bid-rigging could drive up costs in the supply chain. This may be particularly challenging on large infrastructure projects with complex supply chains; lead contractors may lack strong incentives to guard against big rigging by their sub-contractors, where these costs are passed through to the public purse.

Key message: tackling anti-competitive bid-rigging should be a priority in infrastructure tendering exercises

[1] Legal requirements including UK and EU law relating to state aid and competitive tendering in procurement are also a factor in the design of these mechanisms.

[2] Infrastructure Ownership and Control Stock-take

[3] Commissioning and competition in the public sector

8. Public bodies engaged in commissioning or funding infrastructure should also be alert to the wider impacts (and potential distortions) of this activity on competition and market structure. For example:
    - The OFT (2010) noted that where local authorities had tendered for waste collection and waste treatment services together (so that each bidder must offer both services), this created entry barriers in the waste collection market, without delivering significant cost savings due through economies of scope.
    - Public support for an infrastructure investment may create distortions, if awarded in a market where similar (unsupported) investments are also taking place. An example could be where public funding is provided to one player in a market in support of a universal service obligation. Where this takes place, the benefits sought should be carefully weighed against the potential distortions.

…and when infrastructure is a parameter of competition

9. Where feasible, facility-based competition (where businesses invest in rival infrastructure assets) creates greater potential for innovation than purely service-based competition (where downstream businesses rely on the assets of a single infrastructure monopolist).

10. Various work by the CMA and its predecessors highlights the potential value of diversity of infrastructure ownership. See for example:
    - The CMA's evaluation report on BAA airports (2016)[4]: the CMA found that breaking up the common ownership of Heathrow, Gatwick and Stansted had delivered significant benefits to passengers, including more efficient capital investment in facilities and services at divested airports.
    - The CC's ruling (2008)[5] on the acquisition of certain National Grid telecoms assets by Macquarie: these parties overlapped in the provision of Managed Transmission Services and Network Access to sites and associated facilities to terrestrial television and radio broadcasters. The CC found that loss of rivalry due to the acquisition could lead to higher prices and/or lower service quality and reduced innovation in certain markets, and put in place remedies to mitigate the adverse effects of the increased concentration.
    - The OFT's ruling (2005)[6] on the acquisition of Exeter airport by Macquarie and Ferrovial Aeropuertos: the OFT ruled that bringing Bristol and Exeter International Airports under common ownership had a realistic prospect of substantially lessening competition, including due to the potential for reduced investment incentives at Exeter airport.
    - The OFT infrastructure report (2010): the OFT noted that UK ports (including those under separate ownership) appeared to compete strongly with each other in some parts of the market; and found some evidence of new ports being developed and existing ports expanding or developing their activities in response to changes in demand.

Regulatory and competition frameworks are important in infrastructure markets

11. Ownership of infrastructure assets often confers a degree of market power, due to the natural monopoly characteristics of these assets and the limited ability of consumers to switch. As a

[4] BAA Airports: evaluation of remedies
[5] Macquarie UK Broadcast Ventures / National Grid Wireless Group merger inquiry
[6] Anticipated acquisition by Macquarie Airports Ltd and Ferrovial Aeropuertos SA of Exeter and Devon Airport Ltd

result, intervention by competition authorities and sector regulators (such as price controls, or access rules) may be needed in order to protect consumers.

12. However, competition authorities and regulators (in sectors where these are present) are alert to the risk that interventions in infrastructure markets may have a chilling effect on investment incentives – especially where firms have taken commercial risks in establishing their position.

13. The OFT (2010) set out the following framework for judging whether to prioritise interventions in relation to market power held by infrastructure owners:
    - Is there likely harm?
    - Could the problem be solved by the market?
    - Might the market power result from innovation or competition for the market?
    - Is there likely to be a big impact?

14. Taking the M6 toll road as an example, the OFT noted that the asset owner was likely to have pricing power due to inelastic demand. However, since the asset was tendered on the basis of competition for the market, with initial investors taking a risk on construction costs and likely future revenues, and since the original contract allowed the owner to raise charges, ex post intervention would risk chilling investment.

15. Similar issues arise can arise when downstream businesses seek access to an important infrastructure asset. The essential facilities literature says that, in order to protect investment incentives, an input/facility should only be considered essential, and competition authorities should only mandate access to that input/facility, when strict tests are met. For example, European case law (see Bronner) [7] suggests that refusals to supply are only unlawful when there is: a dominant firm; an indispensable asset; elimination of competition downstream; and no objective justification for the refusal.

Effective competition amongst downstream users can help maximise the benefits of infrastructure…

16. The availability of efficient, modern infrastructure in areas such as digital telecoms can support the productivity of the businesses that rely on that infrastructure and, in turn, boost the UK's international competitiveness.

17. Competition has a complementary role to play; a report by the CMA (2015)[8] shows that competition drives productivity in three main ways. First, within firms, competition acts as a disciplining device, placing pressure on the managers of firms to become more efficient. Secondly, competition ensures that more productive firms increase their market share at the expense of the less productive. These low productivity firms may then exit the market, to be replaced by higher productivity firms. Thirdly, competition drives firms to innovate, coming up with new products and processes which can lead to step-changes in efficiency.

[7] Oscar Bronner GmbH & Co. KG v. Mediaprint Zeitungs- und Zeitschriftenverlag GmbH & Co. KG, Case C-7/97, 1998 E.C.R. I-7791, [1999] 4 C.M.L.R. 112.
[8] CMA growth and productivity report

18. The CMA's rail report (2016) [9] found that on-rail competition amongst train operators could result in:
    - lower fares and growth in passenger numbers
    - greater incentives for operators to improve service quality and innovate
    - greater efficiency by train operators
    - more effective use of network capacity

    Therefore, on-rail competition can help ensure that the benefits from future investments in track infrastructure are maximised. In the same report, we also noted that on rail competition can stimulate greater private investment in infrastructure (as seen on the London-West Midlands route).

Key message: the benefits of infrastructure may not be maximised without effective competition in downstream sectors

…and new infrastructure deployment can represent an opportunity to make downstream markets more competitive

19. The CMA's Energy Market Investigation final report (2016)[10] set out a range of measures aimed at increasing competition between suppliers and helping more customers switch to better deals. New smart meter infrastructure is expected to facilitate time of use tariffs and ultimately more efficient utilisation of electricity generation and distribution assets. This benefit is more likely to be realised if suppliers face responsive customers who are engaged in the market and open to switching to new tariffs. Equally, through creating scope for these innovative tariffs, the existence of smart meters will provide retailers with a new opportunity to engage customers in the market, and may lead to more effective competition over time.

20. The CMA's evaluation report on BAA airports (2016) [11] found that relieving capacity constraints in the South-East would further strengthen the process of rivalry between airports to win and retain airlines, and increase competition between airlines.

Key message: infrastructure may have a profound effect on competition in downstream markets (and on the competitiveness of traded sectors) - this should be considered as part of social cost benefit analysis of infrastructure investments

[9] Passenger rail services: competition policy project
[10] Energy Market Investigation
[11] BAA Airports: evaluation of remedies

NATIONAL INFRASTRUCTURE ASSESMENT:
CONSULTATION RESPONSE FROM ConnectedCities

Response to consultation Question 3

How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

ConnectedCities is a Global Sustainable Development Strategy which is particularly applicable to the UK. (See www.ConnectedCities.co.uk) It draws its inspiration from Ebenezer Howard's Social Cities to integrate the most sustainable brownfield and greenfield locations. The vision is of groups of towns on rail lines voluntarily combining to form a ConnectedCity and plan future growth focused on compact, high quality, walkable developments around stations, both existing and new.

ConnectedCities proposes that each local area has to choose whether or not to accommodate their pro-rata share of the national growth. Those that grant planning permission for more than their share are assisted with government funding raised in part from those that choose to provide less. Thus some localities will experience no or minimal growth by voting to assist those which wish to expand. Hence generally development location is locally led and consensual.

Concept
The ConnectedCities concept is that all development should take place within walking distance of permanent way public transport with a good level of service. In most cases this means railway stations.

Our spatial strategy is one of promoting sustainable development by supporting the use of suitably located previously developed land and buildings and by focusing the majority of development on our towns, including urban extensions and new settlements both wholly within 1km of new rail stations, in order to make maximum use of existing facilities, social networks and infrastructure, and maximise opportunities to deliver new infrastructure. See http://www.connectedcities.co.uk/sustainable-growth

It does not consider development where it is not possible to be sustainable. See http://www.connectedcities.co.uk/vision-2050/green-belt

ConnectedCities focuses all development in the 1 km radius pedsheds (see http://www.connectedcities.co.uk/vision-2050/pedshed) of rail station, whether existing or new. This results in three conditions:

1. Town Growth Zones: development around existing stations. See http://www.connectedcities.co.uk/vision-2050/town-growth-zones

2. New Green Quarters: urban extensions in the pedsheds of new stations on the edge of existing towns. See http://www.connectedcities.co.uk/vision-2050/new-green-quarters

3. New Green Towns: new settlements in the pedsheds of new stations. See http://www.connectedcities.co.uk/vision-2050/new-green-towns

Green Belt
The ConnectedCities methodology does not permit the development of Green-belt land unless it falls within the pedshed of a rail station in order that it be served with sustainable transport. It is therefore against the release of land on the edges of existing settlements unless the above criteria are satisfied. See http://www.connectedcities.co.uk/the-connectedtowns

Land may only been removed from the Green Belt to enable strategic development in sustainable locations within 1km of a rail station.

Modal Shift
ConnectedCities concentrates on enabling an easy shift to sustainable transport modes. See http://www.connectedcities.co.uk/vision-2050/travel

Strategic Planning
ConnectedCities believes that effective strategic planning requires a longer time period than 2011 to 2031 to be considered, so prevision for new settlements can be included in plans. It considers that every area should have to plan for its pro-rata share of the ONS projected population growth to the same timescale as the NIC, I.e until 2051, and and in outline beyond to 2081. Such a timescale enables preparation for the necessary land ownership and infrastructure and to be addressed. The present short term piecemeal system does not permit sufficient breadth of view to make effective plans or integrate with infrastructure. It also means that the necessary large scale changes are 'seen coming' by the public at large.

Voluntary Federation of Towns to form a ConnectedCity
ConnectedCities proposes that local authorities are required to work together to consider the growth of a larger unit called a ConnectedCity, which is a voluntary federation of towns combining to plan. See http://www.connectedcities.co.uk/vision-2050/idea

Strategic development choices can then be compared, presented and democratically decided upon. See http://www.connectedcities.co.uk/case-studies/choises-for-development and http://www.connectedcities.co.uk/delivery/consultation

All infrastructures should be included in this process.

Case Study
A case study of the ConnectedCities methodology focuses on the area around the group of towns bounded by Knebworth and Watton at Stone in the south and Arlsey and Baldock to the north, much of which is within North Hertfordshire. See http://www.connectedcities.co.uk/case-studies/1st-connectedcity

Response to the National Infrastructure Commission's National Infrastructure Assessment Call for Evidence

February 2017

Prepared by Copper Consultancy Ltd

Author: [name redacted], [job title redacted], Copper Consultancy Email: [email address redacted]
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1. Introduction

Copper Consultancy (Copper) welcomes the National Infrastructure Commission's (NIC) Call for Evidence on the National Infrastructure Assessment (NIA) and is pleased to respond on this important topic.

Copper is a specialist in stakeholder communications, operating exclusively within the infrastructure sector. We are working on a range of major infrastructure projects in the UK across various sectors, including new nuclear and other energy projects; in transport, including Crossrail, HS2, Highways England and aviation; in the waste and water sectors; and on housing and commercial development projects.

We are members of the Major Projects Association and the National Infrastructure Projects Association.

Our breadth and depth of experience means we understand the balance between project need, benefits, long-term legacy and acceptability.

We previously responded to the NIA consultation in August 2016.

2. Our response

How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

We have based our response on question three of the Call for Evidence paper, with a particular focus on the second part of the question. Copper sees housing as a vital component to delivering infrastructure that creates better places to live and work and below we set out some key points for the NIC to consider.

First and foremost, future infrastructure should be designed and planned hand in hand with housing. The UK's need for housing and infrastructure in the future will be shaped by many factors, including:

- **Lifestyle trends** – the emerging transition towards flexible working, changing demand for types of homes, a requirement for shorter commutes, and greater access to cultural and leisure activities;
- **Shifting demographics** – a rapid global trend towards urbanisation along with people living longer;
- **Technological innovation** – advancements in all forms of technology, from telecommunications to the digitalisation of transport will impact how people communicate and travel in the future.

1. Housing and infrastructure is interconnected. UK Government and other devolved policy makers can take a lead in creating policy for the delivery of housing and infrastructure which is joined up. In a recent piece of research[1] carried out by Copper into public attitudes towards infrastructure, we found that British people are calling for political and industry leadership in how infrastructure and housing is planned and why. Around one in four participants cited more leadership from politicians and technical experts as factors that would increase their faith in the delivery of infrastructure.

2. Infrastructure prioritisation and design can be considered in the context of how it unlocks housing opportunities (and vice versa) and encourages wider investment to support economic growth and other societal benefits. According to our research, the public wants to be more involved in plan making and is interested in what it means for them in their area (67%). Our research supported this, showing that a key factor in shaping people's attitudes towards infrastructure investment was the

[1] *Independent survey of attitudes to infrastructure in Great Britain* (December 2015) http://www.copperconsultancy.com/wp-content/uploads/2015/12/20151203_Attitudes-to-infrastructure-in-Great-Britain-2015_FINAL-PDF.pdf

degree to which people perceived a benefit from the investment, either personally, in their community, or to jobs or the economy in the UK as a whole. There is an opportunity for the NIC to identify further initiatives which explore how infrastructure unlocks these wider societal benefits and housing in particular.

Crossrail 2 is a great example of where the narrative being articulated by Michelle Dix and her team is about Crossrail 2 not just being about building a railway. It's about delivering an ambitious plan for building new areas of growth which will benefit from better transport networks. Crossrail 2 is creating effective partnerships between local authorities, developers and communities to design, plan – and eventually deliver – better places for people to live and work. The NIA should promote this type of thinking and joined up working.

3. Our research identified housing as one of the top national and regional priorities, demonstrating that public opinion is already supportive of the need for housing in principle. The issue is where and what is built. Copper has found that where well designed and affordable homes are part of sustainable communities which connect people to jobs and facilities (schools, hospitals, leisure, waste, etc.), there is evidence that communities are more accepting of new infrastructure and housing. National and regional conversations which explore how infrastructure and housing can be integrated to plan our future needs could create a climate of greater public acceptance. The NIC has a unique opportunity to use the NIA to build positive public attitudes towards future infrastructure which delivers housing and other societal benefits to local communities and the country as a whole.

When considering how infrastructure should be designed, planned and delivered to create better places to live and work, we recommend the NIC's approach to delivering the NIA reflects the findings of our research. With a positive narrative that encourages people to buy into a 30-year plan for infrastructure development, people can join in the important journey to delivering sustainable economic growth and improved quality of life.

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<personal number and email>

Lord Adonis - Chairman
National Infrastructure Commission
1 Horse Guards Road
London
SW1A 2HQ

10th February 2017

Dear Andrew

National Infrastructure Commission call for evidence

I am writing in my role as portfolio lead of the Core Cities Low Carbon, Energy, Emergency Planning and Resilience Policy Hub.

I want to welcome the establishment of the National Infrastructure Commission in October 2015. It comes at a critical time, we must unlock future investment to enable our UK economy to plan, grow and deliver sustainable and inclusive growth over the long term.

Our response below sets out our view on delivering future proof infrastructure that will support the Government's Industrial Strategy. It builds on the work that Core Cities have previously commissioned that demonstrates that Countries which devolve power and finance to regional Cities perform better. The approach of the Core Cities is predicated on this devolution of decision making and finance. This can be seen in the City Deals brokered over the last couple of years. Building infrastructure that serves cities will drive our growth.

We also suggest that Core Cities should be involved in the decision making process around current/future infrastructure planning and delivery. City leaders are a layer of governance of equal democratic standing to national politicians. We would be happy to elaborate on this and any other points in any future discussion.

We look forward to the opportunity to discuss this further.

Yours sincerely,

Marvin

Marvin Rees
Mayor of Bristol

Core Cities response to NIC's Call for Evidence October 2016.

Preamble

The Core Cities strongly support the establishment of the independent National Infrastructure Commission. However, we believe that infrastructure needs to be seen and considered in a holistic way. At a local government level, we experience and have to respond to the outcomes of the various interconnected elements not operating as a consistent whole, as the following three examples demonstrate:

- Vulnerable households living in inefficient homes, which they cannot heat, or power. This creates additional demands on health and social care services and reduces quality of life for residents.
- Failure to invest in low carbon / decarbonised transport systems at the pace that we need within cities and their natural hinterlands and between cities, leading to the associated economic and health consequences.
- No requirement for the statutory utilities to link their infrastructure investment with our economic growth plans, leading to the associated economic and social consequences.

Therefore, while we have responded to some of the detailed questions as asked in the call for evidence, we would like to set the context of the Core Cities approach to sustainable growth, reducing social inequalities and the infrastructure investment and approach that is needed to enable this to happen. We have also highlighted three structural weaknesses in the current UK infrastructure set up.

Resilience

The development of new infrastructure should be undertaken with a full resilience audit, not limited to but including: how the new infrastructure will meet the challenges of climate adaptation, i.e. more frequent extreme weather events; how the new infrastructure will support the UK resilience to geo-political events, e.g. not relying on security of supply from unstable regions or governments; and how the new infrastructure will support the UK resilience to terrorist attack? Consideration should also be given to current existing energy and digital assets, such as electricity and telecommunication sub stations, many of which were previously built in areas with high level of flood risk.

All these questions suggest a more decentralised, embedded and diversified form of infrastructure production, not only geographically, but also between systems; heat, electricity, transport, water, waste and digitally and between regulatory entities, especially at the city region level to ensure efficiencies in the investment provision and decision for infrastructure construction.

Efficiency

The development of infrastructure should be considered in the context of efficiency. The Core Cities strongly support the UK Green Building Council's response to the last year's National Infrastructure Commission's call for evidence around the energy system. We suggest that energy efficiency investment in

UK homes should be seen as an infrastructure investment. In addition to the UK Green Building Council's well evidenced response for a wide-scale and deep retrofitting of energy efficiency measures to homes, the Core Cities would like to see a national infrastructure approach to the provision of heat networks. The provision of heat networks allows the delivery of heat to be undertaken in the most efficient and low carbon manner, while improving the overall efficiency, resilience and capacity of the UK energy and waste systems through the increased use of combined heat and power and energy from waste plants on heat networks.

Environmental & Social standards

The provision of the infrastructure as outlined in the National Infrastructure Plan 2014 amounts to £466bn. In addition, this call for evidence is likely to increase the level of investment by many further tens of billions.

The Core Cities advocate that during the design and construction phase whole life-cycle environmental and social impact assessments are undertaken and that high environmental and social standards are built into the tender and design specifications. The opportunity to achieve high standards on the design, construction and ongoing usage on such a scale of investment will impact positively on developing the necessary UK industries, skills and knowledge about how society will live in a very low carbon / decarbonised world. This is a set of skills and knowledge that the UK can export across the globe.

Interconnectedness of our regulatory system

The provision of the future infrastructure will ensure that the UK can compete in the global economy, contribute to reducing climate change emissions and be resilient to the future local and world extreme events, suggesting that the various strategic infrastructure investments be coordinated. Currently this does not happen successfully in the UK and is invariably ad hoc.

As an example, the provision of increased demand side management of the electricity network at a local level, through the provision of smart metering and in-home management systems, could also support the development of smart city improved transport management, water, waste management and heat and electricity storage and capacity solutions. However, because the UK has system regulators – Ofgem, Ofcom, ORR, Ofwat, Environment Agency, Natural Resources Wales, central and local government – this makes the coordination difficult. Core Cities have long advocated that we can take the local lead, responding to the local circumstances of each of our cities and its region. However, currently we have no mechanism to enable this to happen. If we did have a mechanism, we suggest that we would enable the provision of more interconnected diverse future proofed infrastructure investment quicker.

Structural weaknesses

From the Core Cities perspective, there are a number of overarching structural weaknesses within the UK infrastructure system; as follows:

a) Significant skills and capacity shortage within the infrastructure sphere across all aspects, e.g.

shortage of mechanical and electrical engineers to install smart metering, heat networks, grid reinforcement, etc. This is likely to hamper any large-scale infrastructure roll out across the UK and the future competitiveness of the UK within the global marketplace.

b) Significant and chronic capacity bottleneck at the pre-feasibility stage of projects. Many infrastructure projects are stuck or are proceeding slowly through the development pipeline due to the lack of human resource capacity to move projects from the pre and early feasibility stage into the more formal delivery stage. Grant and/or loan funding focussed purely at ready-to-go projects, compounds this problem. This has been recognised by the European Investment Bank and in Bristol a different type of grant funding was provided that unlocked projects with a leverage factor of 25:1; a similar approach with a lower leverage factor could be utilised by the UK Government.

c) Silo approach to infrastructure from regulators whether government or OF-regulators. **For example:** Bristol is seeking to develop holistic cross-discipline infrastructure solutions to build a resilient and future city. The prime example of this being the Temple Quarter Economic Zone (TQEZ), where the Council is interlinking local and national transport, city physical and economic development, research and academic capacity and utility heat and superfast broadband infrastructure to build an economic zone which creates sustainable future resilience economic growth over this century. However, this is against a backdrop of regulation which is established to achieve economic efficiency within its "silo" rather than economic efficiency across a programme of place-based infrastructure.

If the NIC could solve these three fundamentals by advocating for place-based single infrastructure budgets / programmes it would unlock 10s if not 100s millions of pounds of infrastructure development at a UK level.

Cross-Cutting Issues

1. ***What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?***

The individual Core Cities will respond directly with regard to their highest value infrastructure investments for their region.

2. ***How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?***

A number of the Core Cities have ports. The UK's major ports operate with no government subsidy or support and in a competitive environment with both other domestic and European ports; thus they are efficient, customer focused and able to successfully compete to secure and maintain business. The UK's major ports are mostly held in private ownership compared to their European counterparts, which are wholly or partly owned by their regions' local government.

The UK Government's recently published "Industrial Strategy" recognises that ports are hubs for employment and it suggests that improving connections to ports can help to promote trade and create jobs. UK ports collectively employ around 120,000 people, handling 500 million tonnes of freight each year, which represents over 95% of UK trade. When considering infrastructure investment, it is crucial that ports' links by sea, road and rail are not compromised by conflicts with passengers and commuters and that congestion on the transport networks is addressed to maintain the individual ports' competitive advantages associated with rapid movements of cargoes to and from the port.

For example: Bristol Port is an international gateway for freight with a small but increasing cruise service. The port deals with imports and exports from almost every continent and its West-coast position, close to the centre of the UK, makes it extremely attractive to customers seeking to move goods to and from the Midlands and M4 corridor.

The port is a multi-modal transport hub providing storage and processing facilities within its secure estate. The port already benefits from excellent links to the UK's strategic road and rail networks enabling the rapid and efficient distribution of cargo to and from the port to landside destinations across the UK.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

The Core Cities strongly advocate that all regulated infrastructure should have a statutory requirement to consult with regional economic centres and regional Core Cities regarding the investment of infrastructure. This will ensure that infrastructure is invested ahead of planned economic and housing development. These costs can be recovered from the developer through increased land value associated with sites that are development ready. In terms of design, integrated design teams across disciplines could come together for site preparation and holistic design approaches. Therefore, new housing developments should be required to consider the energy hierarchy in establishing how they will meet the energy demand most sustainably, which should also include accessibility to public transport.

4. What is the potential for demand management, recognising behavioural constraints and rebound effects?

Core Cities would advocate that the maximum potential for demand management is yet unknown. As a country we have yet to fully integrate advanced software in terms of the internet of things and also in behavioural demand response. We would strongly advocate a range of quick separate research lines of enquiry across a range of academic disciplines into the potential. It should also be noted that many of these possible interventions in the demand side will be at the local level and will require involvement of local government in a number of capacities; there is significant risk to this as public sector finances across the country are under increasing strain.

However, the introduction of smart meters in the domestic market has provided the ability to understand usage and enable utilities to understand consumption, thus allowing the potential to change payment processes/structure, e.g. to 30 minute pricing. This facilitates moving consumer demand to high cost and

low cost, thus pricing can be used as a mechanism to shift energy consumption to more appropriate times of the day, e.g. less demanding times. Through smart metering we may encourage residents to be more energy efficient, e.g. turn off lights.

In the commercial sector, peak energy usage tariffs are already being used. British Gas, in the domestic sector, offers a tariff for free energy at the weekend, but through this tariff the charge for energy in peak times is higher.

This possible move to more reflective Time of Use tariffs will need to be set within a counter balancing market to avoid spikes in energy usage or being mis-sold to the most vulnerable in society.

5. ***How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?***

Evidence suggests that to achieve UK carbon budgets to 2050; it will be insufficient to focus on new developments being lower carbon buildings. There is significant benefit in addressing the efficiency of existing assets.

6. ***What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?***

Core Cities are particularly concerned about the role of competition within the provision of infrastructure. So while we fully endorse and advocate competition in appointing companies and entities in the construction of the relevant infrastructure, we do not advocate competition in the allocation of infrastructure investment. Invariably, this detracts the extremely limited and high value human resource that should be focussed on design, planning and delivery of programmes of work in a holistic manner with other statutory infrastructure entities completing funding and competition applications. In addition, it does not allow a long-term programme of investment to be constructed, thereby undermining financial models, economies of scale, investment by supply chains into innovative solutions, investment in skills and skill and resource shortages as people move in and out of the industry.

In addition the Core Cities advocate that recognition is needed across the UK infrastructure investment that smart flexible proposals are being retrofitted on to an existing aging system often with limited life and capacity. Long term infrastructure investment to our current infrastructure will also be required to compliment smart solutions and new infrastructure development.

7. ***What changes in funding policy could improve the efficiency with which infrastructure services are delivered?***

Ultimately it is the general public who pays for infrastructure investment, either through taxation, regulated charges on utilities, in the cost of goods and services and / or directly. In some cases, this can be transparent and in other cases it can be opaque. What Core Cities would advocate is a “collection” of the

various approaches for greater clarity and a review of their current and future potential effectiveness, especially with regards to siloed regulatory regime.

For example: The move to decentralised energy is now under threat due to the proposed changes to embedded benefits - OFGEM's aim being to encourage the fast build of CCGT gas powered stations (with heat wasted to atmosphere). This will severely impact on the roll-out of decentralised power and heat energy.

In the case of heat networks, government need to ensure that projects are on an equal footing compared to other infrastructure in terms of business rates etc. Supporting local authorities to grant business rates relief or removing rates liabilities completely would assist their roll-out by removing a current barrier to their commerciality.

8. ***Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?***

Core Cities advocate that there are a considerable number of infrastructure projects and programmes that are "stuck" in the development pipeline due to the human resource capacity constraint in terms of skills, numbers and experience within both the public and private sector. The principal area of difficulty is in the pre-feasibility / development phase of any programme. To that end, we advocate that public sector funding or funding to the public sector should include small elements of revenue funding to unlock the pipeline based on a five to ten leverage factor, i.e. every £1 of public sector grant would leverage five to ten of project value, which could be both public and private funded projects. A combined grant and pre-agreed and authorised loan facility would enable projects to be enacted quickly.

For example: As raised through the consultation on the BEIS Heat Network Investment Programme, providing upfront capital either through grants or low cost, long term loans are essential for assisting projects which are commercially viable but which struggle to access finance. Such grants/ loans need to be available for both public and private sector recipients, even if they need to flow via local authorities etc. rather than go direct to private enterprises.

Such financing mechanisms are essential for bridging the gap between short term commercial interests and long term project lifetimes.

In addition to any new interventions, government policy needs to stabilise as energy projects in particular are struggling to secure investment, as uncertainty around subsidies etc. means investors are not willing to commit to long term projects.

9. ***How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?***

There are potentially 3 linked areas of focus which would increase infrastructure resilience collectively (as well as individually):

1. Ensure, at an appropriate spatial scale (city regions and their surrounding environment, social and economic catchments) that proper risk mapping is undertaken. The risk mapping would cover the requirement to map hazards (now and in the future informed by Core Cities projections) as well as exposed infrastructures. Ideally, this needs to be collective, cross infrastructure types and include a level of detail of assets and locations sufficient to understand resultant risks and vulnerabilities.
2. Linked to the above, ensure (require) a sharing and support of the risk map by infrastructure and other relevant parties, so some critical risks and interdependencies are not easily determined using public information on infrastructure alone. There needs to be the detail and a collaborative mapping, which will not ignore security or commercial sensitivity issues, but these could be addressed via utilising protected areas – a suggestion would be (and it's Cabinet Office approved) http://mappinggm.org.uk/gmodin/ and host info in closed secure areas. Another possibility is Resilience Direct, which most if not all providers and partners will have access to. But there is other much more sensitive info on there and access once granted is wide ranging, so it limits other manipulation, i.e. by academic experts due to security/data protection reasons.
3. Consider the development of impact chains to map hazards, drivers of risk, primary and secondary impacts and possible mitigation factors. These can be mapped at single infrastructure scale looking at interdependencies or cascade issues, or wider, or multiple impact chains can then be examined – see early roads and pluvial e.g. from RESIN

<redacted>

10. What changes can be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

Core Cities advocates that the planning system is not a barrier to the construction of infrastructure. For example, we are well aware that just across Bristol, Leeds, Manchester and Nottingham we have given planning consent to in excess of 68,000 housing units but these have not progressed because the market has not progressed them; even though it is well known that we have a national housing shortage. In addition, we refer the NIC to our answers to previous questions, especially regarding human resource capacity and siloed regulatory governance.

The current planning system lacks robustness with regards to energy infrastructure and fails to encourage or incentivise low carbon or renewable energy in most parts of the country outside of London. The National Planning Policy Framework is light touch and the removal of zero carbon homes/ allowable solutions makes it difficult for local planning authorities to require beyond the minimum. For example: the Core Cities advocate;

- To facilitate improved EV take up consideration needs to be given to the introduction of DCLG Development Control Planning policy to require a 3 phase energy supply point within any new home garage or parking space

- To facilitate broader long term energy planning consideration needs to be given to the introduction of DCLG Development Control Planning policy for an Energy Plan to be required as part of the larger planning applications

Current building regulations are too weak and there is no coherent approach or incentive to tackle the performance of existing building stock as well as new build. This is typified through the current inconsistencies in the SAP methodology, which hinders many low carbon technologies in favour of more carbon intensive alternatives.

For example: Liverpool City Council and the Liverpool Local Enterprise Partnership on behalf of the Core Cities have worked with HMT, Ofgem, DECC (as then), GLA and the DNO's to investigate new ways of working to deliver anticipatory infrastructure within the context of economic regeneration. Liverpool prepared ideas to test models for bringing forward planned investment into areas with no one lead developer or no large consortium partners. However, while they have been advised by the local DNO that this work is still of interest to Ofgem, as a Local Authority they have no standing in the conversations and no means of bringing a DNO to the table to work on funding solutions or financial risk assessment models. Therefore, without a significant change to a place based approach to infrastructure investment as advocated by the Core Cities in our preamble it will remain hard to bring forward fresh types of initiative as long as the ways of working and language used exclude the majority of end stakeholders.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

In the most recent review of UK biodiversity, the UK's Natural Ecosystem Assessment (NEA) states that 40% of our most important habitats and 30% of our rarest species were still declining. New infrastructure should protect and enhance rather than destroy our natural environment if the UK is to meet its goal of reversing long terms biodiversity loss by 2020. The management of existing infrastructure can also be examined and new approaches explored, which contribute to protecting and enhancing the natural environment. For example, through the Natural Course EU LIFE Integrated Project, partners are exploring how the management of transport infrastructure can be re-designed to reduce negative impacts on the water environment.

New approaches which enable this to happen whilst also delivering economic growth include adopting a principle of 'biodiversity net gain' with infrastructure providers such as Network Rail, Highways England, Berkeley Group, East West Rail already delivering on this agenda. There is also a growing body of literature concerning the application of a Natural Capital approach as a method of evaluating the wider economic and social benefits from our natural environment and this is likely to feature as a key core priority as part of Defra's 25 Year Environment Plan. The Core Cities advocate that the NIC makes reference to and supports Defra's 25 Year Environment Plan.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

No answer currently.

Transport

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

We know that this is an exciting time for transport. Demand has changed significantly over the past 35 years, as has the way in which people think about travel. As new technologies are adopted, they are changing travel habits and Core Cities thinks that the impacts of these changes will be felt greatest in cities. Some of these may be:

- Continued changes in working patterns away from 'traditional' hours and towards more flexible and diverse patterns of working, enabled by technology
- A readiness to consider alternatives to private car transport, reflected in decreases in car licence ownership in urban areas, particularly among young people.
- Demographic changes, with an increasing older population resulting in fewer work-related trips and increasing needs for appropriately-designed infrastructure
- The role of autonomous vehicles in changing the way in which we approach car ownership and usage, potentially increasing capacity but decreasing disincentives to travel

Core Cities are leaders in transport innovation and new technologies and many of the greatest gains from investment in technology will be in investment in areas with well-developed and well-used public transport networks.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

While single large investment schemes can be appealing, they often do not deliver the best results for the government and the residents of the areas affected. Larger schemes work well when balanced with complementary smaller schemes. **For example**: joining a highways investment with a wider traffic management system. In Newcastle, the Urban Traffic Management and Control centre has provided over £60m of network benefits in a decade and complemented other investment in capital infrastructure.

Work undertaken by the Urban Transport Group/Passenger Transport Executive Group and Jacobs in 2011 indicated the value of smaller transport schemes as part of a holistic whole of transport investment, with benefits of £3.50 for every £1 spent, representing high value for money. Continued funding for these smaller schemes, through the Integrated Transport Block and other funding sources, is crucial.

In allowing people to get around urban areas, evidence indicates that active travel (walking and cycling) schemes can have some of the highest cost-benefit ratios, of up to 20:1. These schemes have additional benefits beyond time savings, as findings from the Cycle Demonstration Towns found that for every £1 invested in cycle measures, the value of decreased mortality alone was £2.59.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

The Commission has previously, in High Speed North, looked at the relatively poor connections between urban areas in the North of England. However, this point applies more widely to all Core Cities. Ensuring that there is fast, efficient and reliable transport between urban areas should be integral to the Commissions response and Government policy as a whole and can provide important agglomeration effects. Transport between multiple urban areas has been identified as providing important economic benefits, additionality and investment, particularly around station hubs.

However, as noted in our response to Question 14, where there are large transport investments to connect multiple urban areas, these should be accompanied by programs of additional funding for smaller schemes around these improvements to deliver the greatest possible value for money of investment.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

No answer currently.

Digital Communications

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

The UK is well behind its international competitors in the delivery of full fibre infrastructure to the premises. Portugal and Spain has 60% coverage, compared to 2% in the UK. This is already impacting on our reputation as digital leaders and in the medium to long term will impact on international inward investment decision making unless it is addressed. The recent NESTA Digital City Index confirmed none of the UK cities surveyed scored highly on digital infrastructure because of this.

For example: in Greater Manchester they are aiming to find the quickest route to achieve a full fibre infrastructure, working with the grain of the market.

In this context Core Cities would welcome the opportunities to accelerate investment through the Government's Digital Infrastructure Investment Fund, whilst recognising the £400m funding allocation for the whole of the UK is relatively small compared with the size of the task and will therefore have to be targeted at cities to deliver the best return on investment. Further investment will be needed in fibre in order for Core Cities to remain competitive with peer cities in Europe. The public sector has an important role in facilitating this through aggregation of demand.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Core Cities welcome the significant shift in Government policy towards fibre investment signalled in the Autumn Statement.

In that context, it is clear that the approach by Ofcom has shifted too as illustrated by its decision to pursue a legal split of BT Openreach from BT retail within the BT Group to accelerate market investment.

Core Cities consider that digital connectivity is a utility for our businesses, organisations and citizens – our vision is for "always on" unlimited bandwidth available on a competitive basis at the infrastructure and retail level. To achieve this, there is a need to galvanise the wider provider market outside of BT and Virgin Media to invest on a commercial basis in fibre infrastructure. We are therefore looking for the Government's Digital Infrastructure Investment Fund to support investment in fibre by smaller providers to provide a more competitive market.

We also believe that the public has an important role in bringing forward market investment through aggregation of demand as stated above

With regards specifically to smart meter and appliance roll out the Core Cities would advocate that there are a number of missed opportunities and issues that still need to be resolved as follows;

- For the consumer, smart meter and appliance benefits are likely but still not proven. We advocate that the benefits of smart meter and appliance roll out should not be over sold, and that the focus of the roll out should be on identifying and articulating the wider systems benefits which are easier to realise and understand; rather than trying to promote this as being driven by consumer benefit.
- The future consumer benefits will require supporting behavioural activity packages, which are not planned for and "external" entities to the energy system bring forward new business propositions, which are currently clearly not understood.
- Core Cities would support smart meter roll out being a DNO function rather than a Retail supplier function.
- Core Cities advocate that Ofgem and BEIS should fully realise the national value of the commercial consequent anonymised data to created revenue streams for the relief of fuel poverty and other social benefits rather than this being left to a more fractured energy retail market.
- The NIC should recognise that Government, Insurance and Fire Service advice is still **not** to leave laundry white goods running over night or when the property is unattended, this will impact on the roll out of time of use tariffs.
- The Core Cities advocate that there are too many (an estimated 732 in distribution and 501 in transmission) small innovation schemes, which are not leading to embedded best practice. This is compounded by perceived vested interests in regulation and DNO's which are not naturally picking up good practice from other DNO's or moving solutions forward at pace. The Core Cities advocate that new mechanisms are needed to embed national learning points and that other entities wishing

to undertake innovation should have access to innovation funding with a duty for DNOs and the energy system to cooperate.

Energy

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

Many of the Core Cities have undertaken mini-stern analysis for their city. In all cases the decarbonisation of heat centred on the installation of heat networks within the urban conurbation. This approach is further backed up with practical examples of northern Europe especially Denmark and Sweden, which have progressed decarbonisation of heat quicker than the UK. Where heat networks are impractical to install, the injection of bio-gas and hydrogen into the gas network along with heat pumps would be a logical approach to follow. The timescales of heat networks as long-term infrastructure assets, along with the scale of change that needs to occur, indicate that the roll-out of heat networks has to start in earnest if the UK is to meet its carbon reduction targets. Typically, looking at the development timescale for northern European heat networks it has taken some 40 years to construct networks that cover the majority of urban conurbations in these countries, even with significant regulatory and financial assistance. It should also be noted that the provision of heat networks allows for improved sustainability and efficiency in the power networks as we move to a more embedded electrical generation model.

In addition to the installation of heat networks the Core Cities strongly advocate the UK Green Building Council's well evidenced response for a wide-scale and deep retrofitting of energy efficiency measures to homes. All the mini-sterns undertaken by the Core Cities have indicated that insulation is a net positive contributor to the local and UK GVA.

The meaning of the term "highest value solution" needs consideration as it could relate to the highest financial, environmental, or wider social value. It is also unlikely that there will be a single solution for commercial and domestic customers, or indeed for customers in different parts of the country, and solutions should be determined at a local level.

Solutions are likely to include:

- Combustion boilers (using zero carbon fuels such as H2, syngas, biomass and biofuel)
- Heat pumps (which are only zero carbon if the grid is decarbonised)
- Solar thermal (again, only zero carbon if the circulating pumps use zero carbon electricity)
- Uptake of HEMS (home energy management services), which alongside Smart Meters provide accurate monitoring of consumption and encouraging behavioural change (both consumer & market).

Decisions are needed now regarding planning policy and building regulations as they are impacting on current building stock and currently acting as a barrier to zero carbon solutions. Current building

regulations and design standards are also resulting in building stock which will constrict the extent to which zero carbon solutions can be delivered over the next 50 years.

To reduce the demand in heat it is advisable to improve the fabric of existing housing and building stock, e.g. through external wall insulation and cavity wall insulation. Large scale and long term strategic projects, e.g. area based, providing competitive prices are needed to attract the market and to drive industry in this sector.

20. What does the most effective zero carbon power sector look like in 2050. How would this be achieved?

From a Core Cities perspective an effective zero carbon power sector cannot be separated from the consumer and requirement for heat. It is probably nothing like what we currently imagine, however, it will have a mixture of renewable embedded generation and large-scale central generation assets, linked into Europe wide super DC transmission lines, along with storage capacity (battery & H2) at both a grid, distribution and household level, all controlled with fast digital technology. Many consumers whether domestic or commercial will pay a service charge instead of a unit charge and services could include heating to a required temperature, hot water, digital content, appliance and vehicle provision, embedded distribution storage, household storage, and other services that we have not yet envisaged.

How it will be achieved is through the continued adaption of the energy market though the interventions of new suppliers, market carbon price mechanisms and the roll-out of heat, electric vehicle and appliance technologies enabled by digital software.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

No answer currently.

Water and Wastewater

22. What are the most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

No answer currently.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

No answer currently.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

Delivering a catchment based approach, as required by Government under the EU Water Framework Directive, benefits from effective management and enhancement of Natural Capital assets so as to deliver multiple benefits for the water environment. Green infrastructure investments can be introduced to "slow the flow" of run-off and to reduce the impact of urban and rural pollution from diffuse sources. Natural Capital interventions offer the greatest returns when they are implemented alongside, and as a complement to, more traditional engineered solutions.

For example: within Greater Manchester a street tree planting project has been delivered in Howard Street Salford to explore the multiple benefits from natural solutions and further projects are planned as part of the Natural Course EU LIFE Integrated Project.

Flood risk management

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

Core Cities advocate that there is a need at a UK level to understand and require a more consistent use of 'design floods' (the probability of flood occurrence) within the design, maintenance and construction of existing and new infrastructure. For example, currently a wide range of standards are used from water companies who use 1 in 20 or 30 annual chance events, the insurance industry who use 1 in 75 annual chance events and the EA/Lead Local Flood Authorities (including the NPPF planning process) use 1 in 100 or 200 annual chance events. Applying consistent design standards across all Risk Management Authorities, infrastructure providers and other organisations would help to ensure a more holistic management of flood risks.

By identifying a set of more consistent standards, consideration can be given to the relevant and appropriate level of risk, which should be applied to various assets/infrastructures and what level of resilience would be appropriate. This review is around infrastructure particularly, but this is a wider point. Consistent approaches would then allow for identification of an appropriate suite of resilience standards, based on the level of risk and the requisite level of resilience. So for instance, what flood return period should certain assets be protected from absolutely? Are there higher return period events where an internal flood resistance should be applied or a recognition that water will enter and it's about ensuring resilience/recovery from the flood event. The consistent approach would also allow (and need) the consideration of how a changing climate and its effects on the probability of levels of increasing flood hazards would and should affect the level of resilience.

However, this wider ranging and consolidation of return periods and consideration of consequent impact on the desired level of protection must occur before assessing the resilience standards balancing costs and development pressures occur.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

Natural Flood Management (NFM) schemes provide a cost-effective means of "slowing the flow" in relation to fluvial flood events and to building resilience within the urban environment and helping to reduce the risk of surface water flooding. NFM interventions offer the best results when they are aligned with more traditional solutions.

For example: within Greater Manchester engineered flood defence works are planned for the towns of Rochdale and Littleborough alongside NFM measures in the upper parts of the River Roch catchment. Together these schemes will offer greater resilience to communities across the district of Rochdale.

However, Natural Flood Management seems to be currently more focussed at the strategic scale and particularly on the existing natural environment at the upper reaches of catchments. And whilst this is welcomed, one of the big flooding risks in cities arises from the highly urbanised environment where intense rainfall events can overwhelm traditional drainage infrastructure. Therefore, the Core Cities recommends that the NIC considers these limitations are inherent if the UK natural flood management approach remains limited to the traditional up catchment nature based solutions approach to flood management. Recognition of and encouragement, investment and delivery of sustainable drainage systems, both in new development and the challenging but vital need to more widely retrofit them within our existing urban fabric should be a key element of any future infrastructure investment.

The Core Cities advocate that it is vital that this approach to managing water both above and within the urban fabric via nature based solutions at various scales works with other more innovative technologies and practices. Both now and because of the increasing challenge of our changing climate, at times water will not be able to be managed within channels by more traditional flood defence interventions or even through controlling its flow with wider ranging nature based solutions. At these times water will impact upon the built fabric and infrastructure and a complimentary and robust approach to promoting and applying the innovative solutions that the NIC have rightly identified within question 26 (i.e. property level protection, early warning, asset maintenance and innovative flood resilient materials) will also be required.

Solid waste

No answer currently to this theme.

ENDS

National Infrastructure Assessment call for evidence

Response from Cory Riverside Energy

Please find below Cory's perspectives on the needs for UK infrastructure in relation to the waste management sector. The layout of our document follows the specific topics and questions raised by the NIC. Supplementary materials in the form of supporting evidence graphs and charts are supplied under separate cover as well as cross-referenced in the document text.

Executive Summary

The UK significantly lacks the necessary waste treatment infrastructure (typically Energy from Waste facilities, EfW) to process the UK's residual waste (i.e. waste that remains from either domestic black bags or industry after recycling of useful materials such as paper, wood, plastics etc.).

This lack of infrastructure already wastes significant quantities of power generation, heat generation, construction materials for homes and infrastructure by shipping the waste (which is a form of fuel) abroad, where other nations charge UK local authorities and industry a fee for the pleasure of burning it to generate energy for their own use. Over 4 million tonnes of "waste for fuel" (RDF) were carted abroad at significant cost to UK taxpayers and industry from our shores in 2016 alone.

Reversing this trend, increasing UK processing capacity and halting costly shipment of this fuel abroad, represents a significant opportunity for generating power, heat, jobs, wealth, tax revenues, and green construction products to power and construct UK homes and transport infrastructure in the immediate future.

Intervention by government, discouraging RDF export and providing this clear direction through environment policy and taxation, will incentivise private sector investment in EfW facilities that enable the UK's industry and investors to address this infrastructure deficiency - with the outcome of processing UK waste inside UK shores, with the outcome of a more productive, "greener" and self-sufficient nation generating greater jobs, wealth and exchequer revenue, rather than shipping these benefits abroad.

This is a matter of closing the loop to generate circular economic benefits within the UK.

Cross-cutting issues:

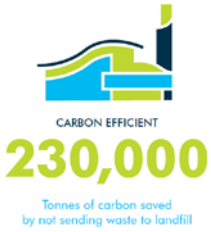
What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

Energy from Waste (EfW)

The success of landfill diversion measures in the UK has meant landfill capacity has depleted far more rapidly than replacement residual waste infrastructure can come on stream. Landfill capacity was estimated at 20 million tonnes in 2015. This is expected to almost halve by 2020 before dropping further to 6 million tonnes in 2025 and just 4 million tonnes in 2030.

There is therefore a desperate need for investment in EfW plants, which require significant capital investment. EfW provides many benefits that contribute to long term sustainable growth:

- Environmental – EfW supports the waste hierarchy by diverting waste that cannot be recycled away from burial in landfill. This avoids emissions associated with landfill and also offsets emissions through energy generation, resulting in overall carbon savings.[1]



  - Currently we estimate **UK EfW provides a net reduction of c. 230,000 tonnes CO_2e**[2] compared to disposal of the same quantity of waste into landfill. The biomass fraction (54% in 2015) of waste is considered renewable, contributing to UK renewable targets. These results are consistent with other studies.[3][4][5]

  - As a source of low-carbon electricity and/or heat, EfW benefits the UK's security of supply as well as contributing to renewable energy targets. In 2015, **EfW contributed to 1.6% of the UK's total electricity and 3.3% of renewable electricity.**[6] Although this is relatively small in overall national terms, it plays a significant role in the UK's energy mix. This relates to also to the cross cutting aim of security of energy supply and the delivery of low carbon and affordable energy.

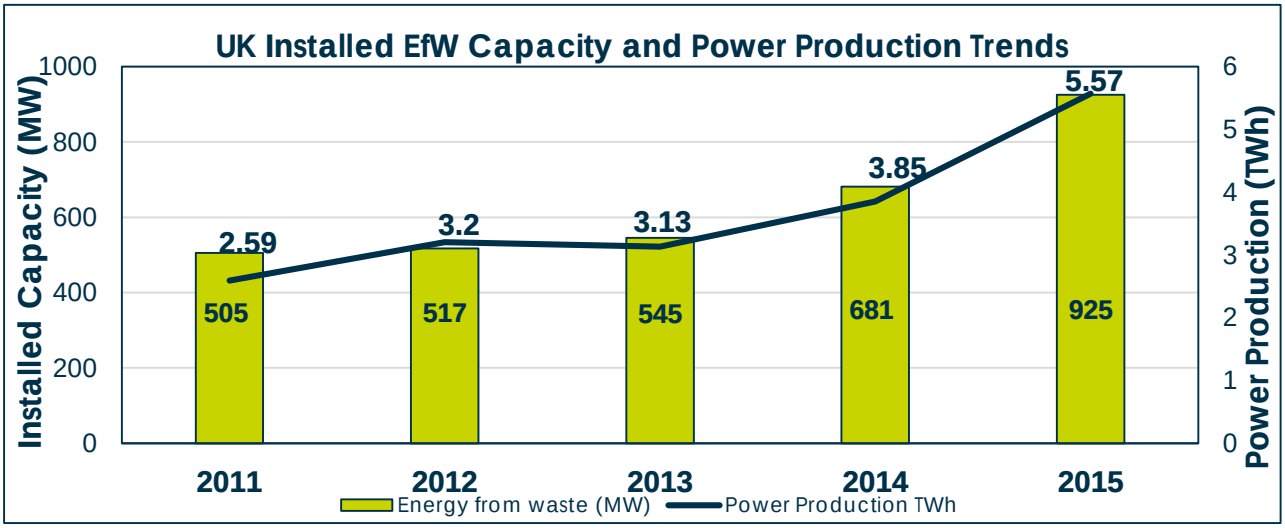
- An EfW plant captures **more than 15 times** the amount of exportable electricity compared to equivalent landfill gas capture operation from processing the same amount of residual waste

1 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/567502/Digest_waste_resource_2016_rev4.pdf, p.59
2 Cory paper "EfW and the Circular Economy": International EfW Conference, London, 9 December 2016
3 Defra 2014, Energy recovery for residual waste: "A carbon based modelling report"
4 Green Investment Bank 2014, "The UK residual waste market"
5 Fichtner, Lincolnshire EfW greenhouse gas assessment
6 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/577712/DUKES_2016_FINAL.pdf, p.192

- Economic – due to the tax on landfill and the sale of power, EfW is often a cheaper method of treating residual waste, resulting in savings to local authorities and growth within the industry which benefits local areas and the wider economy.

- Social – it provides thousands of jobs across the country, many of whom are high-skilled and engineering biased.

- By way of example the **Cory Riverside Energy plant in London Borough of Bexley** [7]
    - generates sufficient green electricity to power c. **166,000 homes: 525,000 MWh per annum**
    - saving the consumption of an equivalent 105 million m3 natural gas through a CCGT
    - produces c. 250,000 tonnes of ash which is all reused either as construction aggregates for civil engineering such as road building or to make breeze blocks for building homes.



- In 2015, installed UK EfW capacity has risen to **925 MW**, processing 8.48 Mt of waste
- In 2015, UK EfW contributed **5.57 TWh**
- Enough electricity to power circa **1.8 million homes** per annum

District heating

Most modern EfW plants are combined heat and power (CHP), however in most cases there is not the district heating infrastructure in place locally to provide an output for the heat.

[7] Cory paper "EfW and the Circular Economy": International EfW Conference, London, 9 December 2016

Utilising the heat significantly increases the efficiency of each plant, and would provide low-carbon, affordable and secure heating to thousands of homes.

The heat offtake should also be considered for use in adsorption chillers to create cooling for infrastructure such as data centres and refrigerated warehousing, where the heat provides a 24/7 alternative to heavy electricity use.

Material Recovery Facilities (MRFs)

As we seek to reach higher recycling rates, and seek to target increasing volumes of harder to recycle material, e.g. plastic pots, tubs and trays, fresh investment will be needed in existing and new sorting infrastructure.

Part of difficulty in recycling is the adverse impact of a depressed world market reducing demand for recycled materials, and consequently inhibiting cost effective recycling activities.

Unless Government is prepared to cross-subsidise recycling during times of global economic recession, recycling volumes will inevitably fall and rise following the global economy and commodity prices.

Alternative processes to back up recycling are needed to take up the slack during times of depression, for Government is highly unlikely to subsidise to secure a national target, and landfill is an unattractive option.

Therefore, not only is EfW capacity needed in the UK to process the waste currently going into landfill or being shipped abroad, EfW capacity is also needed to cater for the elasticity that is an inevitable requisite of recyclate prices falling, offering a green sustainable alternative to recycling and avoiding resurgence of landfill.

We recommend that the UK Government chose to classify the ash (IBA) which is recycled from EfW facilities for use in construction products (such as concrete blocks or road base aggregates) then this tonnage (circa 2.5 million tonnes a year). This will then contribute to our nation achieving UK recycling targets. Other nations adopt this sensible stance, counting ash from EfW that is recovered and reused as a construction material towards its national recycling targets.

We recommend that Government encourage the EA to reconsider its current stance on this matter, which has defied common sense that a reclaimed reusable material should not be counted as a recycled material.

This intervention would help encourage local planning authorities to actively support the development of EfW plant in their councils and boroughs, as well as help the UK promote its circular economy credentials when trading abroad.

How should infrastructure most effectively contribute to the UK's international competitiveness?

The purpose of the UK's infrastructure is to enable our nation to compete

- sustainably,
- safely,
- efficiently, and
- economically

whilst providing our UK society with high quality enjoyable places where we can

- live,
- learn,
- heal, and
- grow

in a just, defendable and peaceful manner.

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

One of the biggest drivers of landfill diversion in the UK has been the Landfill Tax Escalator, introduced by HM Treasury in 1996 in response to the EU Landfill Directive. The tax made alternative, more environmentally-friendly approaches to waste management, such as recycling and energy recovery, more competitive. Combined with clear recycling targets and Government support in the form of PFI schemes, this measure has played a constructive role to help the UK meet its EU recycling and landfill diversion targets, become more resource efficient, and reduce GHG emissions from landfill. Whereas 20 years ago we were sending almost all our waste to landfill, we are now recycling approximately 45% of our household waste.[8]

The current standard rate of the landfill tax is currently set at £84.40/tonne. We understand the Environmental Services Association (ESA) believes that this tax is set at about the right level to continue to disincentivise landfill. The tax has in many ways been a great success, but generated some unwanted side effects – such as stimulating export of waste abroad for treatment. This is inefficient and is considered below in more detail. To achieve greater levels of resource efficiency, we need a range of measures that positively support waste treatment alongside power generation and resource generation within UK shores

8 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/496508/Digest_waste_resource_2016_v2.pdf, p.30

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Waste treatment facilities (recycling, AD and EfW) should to be integrated into the planning townscape so they are closer to the sources of waste production and closer to the end markets, reducing transport costs and emissions.

We currently estimate that from the 4 million tonnes of RDF exported in 2016, the transportation emissions created an additional 80,000 tonnes CO_2e in comparison to the treatment of similar volume of waste through the Cory Riverside Energy facility at in London Borough of Bexley.[9]

Where these are modern (i.e. include CHP heat offtakes) Energy from Waste facilities, their development on brownfield sites helps to bring land back into productive use, creating local wealth from business taxes, local job opportunities, local power generation and local heat – green energy at more affordable prices.

EfW is a reliable source of renewable baseload power for the grid. Utilising CHP significantly improves the efficiency of plants by delivering heat to households and businesses. There is a need to consider EfW-CHP at a strategic level, ensuring that sites are situated in the optimum locations to deliver heat to nearby buildings with consideration of existing and planned heat network infrastructure. CHP should therefore be more fully integrated into the wider planning regime.

AD similarly provides power to the grid or directly injects bio-methane to the gas grid. Bio-fuel production could be better utilised for transport fleets or supplying fuel for local public transit systems.

The development of AD and EfW facilities which produce local sources of heat and power should be encouraged in conjunction with local authorities and the local communities and local industries which they are capable of directly serving through direct power agreements and local heat distribution networks (refer below).

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Using our nation's residual waste to generate green electricity provides a reliable 24/7 cost effective base load supply (unlike some alternative green sources such as wind). EfW therefore is an inherently useful and important part of the future energy blend, and currently somewhat overlooked in its value for peak load generating capacity.

[9] Cory paper: International EfW conference, London, 9 December 2016

EfW offers opportunity for reliable green generation consistently to deliver into triad periods, when demand is high, yet other forms of green generation such as solar or wind may not be available due to time of day or prevalent weather conditions. Coupled with parallel investment in battery storage and other devices, EfW can provide a competent means of peak load management through the National Grid.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

Most EfW facilities have around a 35 to 45-year life span. Down-time of existing plants will mean there will need to be some contingency to ensure there is always capability to take up the slack during maintenance. Availability and reliability of a modern EfW facility is typically c. 93-95%

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Currently the gap between waste production (post recycling) and UK treatment capacity is huge.

The consequence of this has been to encourage transport of useful waste fuels to other countries, severely damaging the UK business case for further private economic treatment investment in UK infrastructure. Many UK industries and households who generate waste and need to dispose of it, through export of RDF are unwittingly paying for other EU nations to take our fuel from residual waste and profitably turn it into green electricity for cities in other EU nations.

In 2016 the **UK local authorities and industries paid to ship abroad over 4 million tonnes of useful RDF fuel**, and paid to have EU companies process that into electricity, heat and cheap construction aggregate which in turn fuelled Europe's cities and industries and infrastructure: helping to create wealth, employment and sustainable efficient economies outside the UK's borders.

Conversely the UK lost the power, heat, jobs and inward investment opportunities that were available through onshore use of this medium.

Exporting RDF is a nonsensical operation; not sustainable and distinctly inefficient in both economic and environmental terms, and if continued will mean that the UK will otherwise remain dependant on paying overseas countries to treat our waste – which is in fact even worse than freely giving away our nation's fuel and the secondary benefits from that fuel's consumption.

The UK Government would not pay other countries to take our country's oil reserves for their use in generating electricity – it would appear to be an irrational transaction. Why is our nation prepared to pay

for "a fuel from waste" to be transported overseas abroad rather than encourage than attract investment in local waste treatment capacity that turns it into electricity, heat and construction materials?

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered? Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

AND

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

ENERGY FROM WASTE

There is a huge tonnage of useful fuel from waste (RDF and SRF) shipped abroad.

Over 4 million tonnes in 2016.

Currently, from every tonne of RDF shipped abroad, HMT loses £80/tonne of landfill tax revenue which would otherwise be generated for benefit of the "UK plc", and the UK loses the benefit of consuming that RDF fuel within UK shores.

For each tonne, the industry or local authority who provides the waste for disposal is paying circa £20/tonne for the transport within the UK and shipping to the Continent. There is then an additional fee charged by the receiving facility (the gate fee) to take the fuel in and process it – before they profitably sell on in turn the electricity, heat and aggregates generated, and pay their business taxes on the continent (the UK Exchequer thereby again loses out) and creating employment on the continent at the expense of the UK.

> The UK's local authorities and industry are therefore paying to transport their useful fuel to a foreign business who charge them in turn to generate another nation's power from it.
>
> This makes little sense from a UK perspective.
>
> For each tonne of RDF shipped abroad, the UK loses revenue and wealth which otherwise would be retained on shore and incentivise investment in new UK EfW capacity to process our own waste, thereby generating green electricity and recover the residual ash into construction aggregates (typically the ash is used in making breezeblocks for housing or aggregates in the civil engineering industry such as roads) – whilst creating incremental local employment opportunities (plant construction, plant manufacture, plant maintenance and plant operation) and paying business taxes on the profits from that business too.

[It may be worth noting here that during the construction of the Cory Riverside Energy facility in LB Bexley, the construction process took 39 months, with more than 1,000 people employed on site at peak, with c. 6,000 people employed on the project as a whole. One third of the employees were local.][10]

The UK therefore loses the circular economic benefits and story of turning domestic, commercial and industrial residual waste into:

a. "green" electricity,
b. "green" breeze blocks for new homes,
c. "green" aggregates for construction,
d. significantly increased recycling levels (the UK would almost meet our national targets in one bound if the reused ash from EfW was correctly counted as recycled material)
e. reduction of aggregate mining from UK landscapes,
f. reduction of carbon footprint and congestion by reduction of road haulage of quarried materials
g. lost business taxes
h. lost employment opportunities
i. secondary industrial and economic benefits through construction manufacture and maintenance work

Instead the UK industry and local authorities are paying to send RDF abroad for another nation to secure these benefits instead – effectively subsidising electricity and construction in other EU countries – and losing the revenue necessary to fund new EfW facilities in the UK.

We recommend the UK Government consider:

1. Taxing all RDF exports (as wasted opportunity for the UK)) at c. £80/tonne exactly as for landfill tax.
2. This will put short term tax revenue into HMT, and
3. Discourage producers of waste from generating unnecessary waste (the "producer pays" principle), and
4. Create the opportunity for additional private sector inward investment into additional EfW capacity to provide cost-competitive on shore treatment with commensurate benefits outlined above

Without throttling back RDF through a government tax or levy to release investment opportunities in EfW capacity, our nation will continue to bleed value and opportunity from the UK to the benefit of facilities, businesses and nations on mainland Europe.

To reduce any adverse impact on pushing waste into landfill over the short term until more new EfW facilities came on stream in the UK, we recommend that Government should give warning now and commit

[10] Cory paper "EfW and the Circular Economy": International EfW Conference, London, 9 December 2016

to a rising profile of RDF taxation 2-3 years in advance (as it did with landfill tax) - which in turn will enable EfW developer and investor confidence to move quickly in response to the Government's signal by developing new EfW capacity ahead of the tax preventing the use of RDF export as an acceptable vehicle for disposal.

Combining Landfill and RDF Tax under a single mechanism will be easy to introduce for Government, and effectively penalise those who either throw useful residual waste into landfill or currently pay to have useful UK "fuel from waste" shipped to other countries. In both instances this action would benefit HMT and our nation through the increase in tax revenue, whilst creating the right economic balance and incentivises for the private sector rapidly to invest in further onshore EfW generating capacity in the UK, so that UK waste in future is utilised to produce our nation's power and construction aggregate to feed into the UK economy and infrastructure rather than another nation's.

"Green electricity and green materials should power UK homes and infrastructure"

We recommend that HM Government should commit to applying taxes similar to landfill taxation to discourage RDF Export as quickly as possible, thereby enabling UK industry and investors to invest and commission the long term sustainable EfW infrastructure our nation needs.

RECYCLING

Reforming existing Extended Producer Responsibility (EPR) schemes to transfer the cost of waste collections and treatment from local authorities to supply chains would improve funding for infrastructure. If applied to the whole of the domestic waste stream, this would save average council tax payers up to £250 per annum.

An RDF export tax is exactly a move in this direction, in keeping with the same principles imposed by the Landfill tax.

In the longer run, the improved incentives to design products and packaging for recyclability, as well as the strengthened recycling markets that would result, would drive increased resource efficiency and improve the productivity of the UK economy.

Incentives would also be strengthened for producers of products and packaging to be involved in design of waste collection systems which present and deliver materials which meet their requirements. This would have the knock-on effect of improving the recycling experience for householders and make it easier to do the right thing.

Fully funded EPR systems would also be more likely to produce secondary materials of consistent quality. This would improve the investment climate for domestic reprocessing facilities which feed UK manufacturing and would enable more value to be captured within the UK.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

Catchment boundaries

The current GLA policy of requiring that London's waste should be treated within London's boundaries should be rigorously enforced, so that local power, materials and jobs are created in London and not "bled away". Refer RDF above.

Other significant UK cities and major conurbations should be encouraged to adopt a similar principle providing local jobs, power, biofuel and aggregate materials from local waste treated through regional EfW and AD facilities. This cannot be pressed to too low a level – the economics don't work, but the Northern Powerhouse policy or that of the Manufacturing Midlands should mirror that of the GLA in respect of utilising local waste as fuel for energy and materials. Offtake into local transport networks for metros, trains, electric vehicles, industrial heating/cooling would be logical.

Residential development

With ambitious plans for housing growth, it is essential that the infrastructure for supply of adequate and efficient waste treatment is understood as readily as that of water, sewage, electricity, telecommunications and gas supply. This emphasis should be placed on local authorities as well as the developer.

Permitted development rights

Cory notes that the ESA welcomed changes introduced in 2015 to the General Permitted Development Order to extend permitted development rights to waste management development. While these allow minor changes to existing development – development highly likely to be otherwise approved – we note that this move has not met with universal approval among local authorities and who, in any event, still retain powers to impose planning conditions to remove permitted development rights.

Cory would be concerned if the Government's efforts to extend permitted development rights to the waste industry were subsequently undermined by planning authorities who might simply remove such rights by planning condition restrictions.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

When procuring waste disposal contracts, local authorities should be under a firm clear duty to properly score and rank the route and means of transportation of the waste to its ultimate disposal point – not only

its collection to transfer point, preferring those solutions that are lower in transport carbon emissions and minimise road congestion. The closer the treatment to the source should be better.

RDF shipped abroad generates approximately 4 times the carbon footprint through transport and double handling of an EfW solution within the UK. [11]

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Analytical consideration of the whole carbon footprint making comparison between "UK EfW" solutions and either "landfill" or "RDF followed by EfW" should be part of tender evaluation criteria by all local authorities procuring waste disposal, with bidders required to demonstrate and underwrite their solutions to the satisfaction of the procurer. This analysis would thereby take proper account of transport impacts and encourage reduction of unnecessary long distance truck journeys and shipping, and encourage use of shorter journeys and/or carbon efficient forms of transport such as rail/river in the event of a longer haul.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

As noted above, modern EfW plants are built CHP-ready, and in terms of carbon compare extremely favourably to exported RDF or landfilled solutions[12] .

However, the lack of district heating networks means there is a lost opportunity to provide heat to thousands of homes. Clearer planning guidelines when developing industrial areas or housing schemes would help partnerships.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

Barriers

Waste PFI schemes enabled the delivery of new MRFs and EfW plants which allowed us to increase recycling and decrease landfill significantly, but since the closure of the scheme, it is difficult to attract finance without the long-term guarantee of feedstock. Introduction of an RDF export tax will help provide incentive and market stimulus. Therefore short term contracts from local authorities are a direct inhibitor to securing finance from lenders in this sector. Contracts preferably need to be

[11] Cory presentation "EfW and the Circular Economy": International EfW Conference, London, 9 December 2016

[12] Cory presentation "EfW and the Circular Economy": International EfW Conference, London, 9 December 2016

committed to in a similar manner as to education or health care agreements for 15-30 years to attract investors o sensible terms, with around 70% of the tonnage committed through long term contracts (can be several rather than one). Of course, partnered arrangements with local authorities to share benefits alongside sharing risks or equity can always be considered under a variety of possible PPP arrangements (rather than pure “merchant” arrangements) although at times these PPP’s can lead to local political and legal complexities ahead of securing Financial Close. Nonetheless there is a pleasingly appropriate circularity to shared risks and rewards between private and public sectors when treating the public’s domestic waste.

On top of this, LECs were removed without warning in 2015 which was a significant blow to the industry, and the ongoing review of embedded benefits by Ofgem threatens the viability of energy from waste and anaerobic digestion.

This uncertainty and lack of support has led to a situation where the lack of waste treatment infrastructure is damaging the UK economy, losing exchequer revenue, losing jobs, losing opportunity for green power and heat generation whilst incurring unnecessary cost through shipping waste abroad for treatment.

The rate of landfill closures is exceeding the rate at which new treatment capacity is being developed. We estimate that by 2020, 15% of the UK’s current recycling capacity will close, reducing household recycling rates by 5% and leading to the loss of eight thousand jobs.

To fill this treatment gap, there is an increasing reliance on exports of recyclates and waste-derived fuel. This has a direct impact on the UK’s productivity, and increases the overall cost of managing resources. Building the necessary merchant capacity will require fresh private investment, but this is unlikely to be brought forward in the absence of clear policy direction, all the more important with the additional uncertainties brought about by the Brexit vote.

The challenges for the UK’s waste management system will only heighten as the population expands by an expected 10 million in the next 20 years and the economy grows by 2% per annum during that period. Indeed, after eight years of decline, household waste volumes are once again rising.

The Environment Agency is under-resourced and too preoccupied with flooding to provide strong regulatory oversight of the waste and recycling industry. This, coupled with low barriers to entry, and disjointed procurement of waste disposal on a lowest cost basis that ignores lost opportunities for local business taxes, jobs and wealth creation undermines the case for investment in new facilities.

An unintended unwelcome consequence of this lack of clear policy and discouragement of further investment is that waste materials enter the illegal sector and are abandoned (at great cost to landowners and public authorities). Increasing costs of regulatory compliance combined with low probability of detection for avoidance also increase the competitive advantage of non-compliant businesses, increasing the pressure on legitimate operators and further deterring inward investment in new facilities.

Existing producer responsibility schemes, for packaging in particular, will not deliver compliance with higher targets. Nor will they meet new requirements in circular economy package. Existing schemes were designed to meet compliance with existing targets at least cost to obligated industry but fail to provide the certainty which would lead to investment in new recycling capacity.

Costs and benefits

We estimate that a private sector-led package of investment in new waste infrastructure worth £10bn, enabled by a strong policy framework, would lead to:

- The creation of 15m tonnes of new processing capacity
- Savings of between £1bn to £4bn to the public purse
- The creation of 50,000 jobs
- Potential savings equivalent to between £50 and £250 per household on council tax bills

Conclusion

We ask the Government to recognise these needs, quickly considering and adopting the practical measures and recommended actions above, creating a positive economic spiral through investment in EfW facilities, that in turn consumes all residual waste as fuel within our own shores, generating green energy, green construction materials, jobs, taxes, wealth and benefits for our homes and our industries on a long-term competitive and sustainable basis.

By email only to NIAEvidence@nic.gsi.gov.uk

10th February 2017

National Infrastructure Assessment Call for Evidence: response from CPRE Kent

Dear Sirs,

I write on behalf of the Kent branch of CPRE not with a full response to the call for evidence on National Infrastructure Assessment, but with observations from the particular perspective of a third-sector environmental protection organisation operating within Kent, and closely involved with the infrastructure development needs in this part of the pressures South East of England.

We believe that the accurate assessment of infrastructure needs to support impartial, expert advice to Government is of utmost importance. However the changes to the planning system and the impending implementation of amendments to the Environmental Impact Assessment Regulations opens the prospect of very real damage if environmental constraints are overlooked in the specification, planning and implementation of major infrastructure projects.

There are three particular examples in Kent currently which serve to highlight the importance of careful consideration of infrastructure planning.

1: Freight management in Kent.

You will no doubt be aware that in the summer of 2015 a combination of significant challenges to the normal crossing of vehicles, including freight, at the Port of Dover and the Channel Tunnel (together the 'channel crossings') led to acute problems on Kent's road network: the M20 was closed for a period totalling several weeks in order for delayed freight vehicles to be queued on the motorway while other traffic was diverted to the wider roads network. The unprecedented length of implementation of this procedure, known as 'Operation Stack', led to social, economic and environmental problems which attracted national attention and as a result the (then) Chancellor announced in the 2015 Autumn Statement that £250M would be pledged to deliver a solution to the problems caused by Operation Stack.

There is no doubt that the congestion and misery caused by the extended implementation of Operation Stack in 2015 was intolerable. However, the solution proposed, and now being driven forward by Highways England and DfT, is a huge permanent lorry park (the size of Disneyland) at

the foot of the Kent Downs AONB off J11 of the M20. This is neither logical nor workable. We have written extensively on why the lorry park is not the right answer to the problems of Operation Stack[1] (REFS). We share this opinion with many others, not least the members of the House of Commons Transport Select Committee[2].

Nevertheless, under the provisions of the Highways Act, it appears that Highways England on behalf of the Secretary of State DfT are able to proceed in the construction of major infrastructure such as this lorry park without being subject to the requirements of EIA, while a private enterprise or local Highways Authority wishing to construct a similar scale of infrastructure would be subject to EIA. We would urge the imposition of safeguards to ensure that the full environmental impacts of infrastructure such as this cannot fall though similar loopholes under the new assessment system.

2: Sewerage provision

Kent is a very rural county with a history of dispersed development outside the urban conurbations and, frequently, patchy and inadequate sewage treatment provision. Incremental growth of rural communities has often been the cause of smaller scale rural treatment and pumping systems being inadvertently – but inevitably – overwhelmed. We can cite numerous cases where homes and communities previously benefiting from entirely adequate small-scale sewerage treatment have suffered sewage flooding as the result of treatment systems becoming overwhelmed by volumes they were not designed to cope with. In Woodchurch in Ashford Borough, for example, the problem of recent sewer flooding in properties, which had never suffered it before, is currently being dealt with by having the contents of holding storage tankered away for disposal elsewhere.

The focus of drainage work is too often just on the provision of SUDs to handle run off, and it is undoubtedly helpful to direct the intercepted surface water away from the sewerage networks. But the foul sewer provision is all too often ignored or assumed as a duty under Section 104 of the Water Management Act, and there is no cumulative assessment of infrastructure. One such example where the scale and cumulative effects of development were considered was the Integrated Water Management Strategy prepared under the 2004 Sustainable Communities Plan, which would have doubled the size of Ashford in Kent. Water supply and sewerage infrastructure were both considered and delivered. This does not happen in smaller developments, which cumulatively may have the same impacts although the infrastructure is neither identified nor delivered.

3: Water resource availability

The balance of water resources for much of the South East has been assessed by the Environment Agency as unsustainable. Proposed levels of housing development, when taken together with the forecast levels of climate instability, will impose an additional degree of stress that cannot be

[1] Written evidence
[2] Select Committee report on Operation Stack

sustained by further development of the region's indigenous resources. These factors are not taken into adequate account in the provisions of the NPPF.

CPRE Kent suggests that there is an increasingly strong case for a region-wide strategy transcending water company boundaries – one which is environmentally sustainable while delivering best value for money for customers and the community at large. Delivery of this strategy may require the creation of a body with the expertise and resources to formulate an optimum strategy, and the power to direct planning authorities and water companies in its implementation, but it must underlie all the requirements of the NPPF for delivery of the objectively assessed need for housing in every planning authority area in the region. We recognise that the NPPF allows for environmental and other constraints to be used as a factor when assessing the targets to be set in local plans, but it is clearly the case that housing targets are being set in LPAs across Kent which take no account of the water resource constraints of the wider south east. Watter Resurce South East is a voluntary forum of the Water Companies and the Environment Agency but has neither the resources nor authority for the strategic role that is needed.

Demand management may go some way to address the forecast deficit, but will need to be supplemented by a more fundamental approach to the conservation of the region's resources. We therefore urge that much greater priority is given to waste water re-use, especially in the more heavily stressed areas. More than half of the effluent processed within the Environment Agency's Southern Region is currently discharged to sea. This is a unique resource which can be treated and put into supply indirectly at relatively low cost, and constitutes an inherently sustainable and drought-proof solution which could be phased to match demand in the relatively short term. For example, the state of the art facility at Peacehaven has the capacity but not the authorisation to install the tertiary sewage treatment needed for indirect re-use and has a capacity of 2,000ML/day.

Until there is a strategy that ensures security of supply under all but the most exceptional of drought conditions, there must be some measurement of restraint. Development in those areas where resources have already been identified as unsustainable should only proceed where an integrated water supply strategy has been put in place and other planning criteria are satisfied.

[name redacted]
[job title redacted]

Submission to the National Infrastructure Commission

Call for Evidence – National Infrastructure Assessment

from Cumbria Local Enterprise Partnership

and Cumbria County Council

1.0 Introduction

1.1 Cumbria LEP and Cumbria County Council welcome this chance to contribute to the development of the first National Infrastructure Assessment. Cumbria is entering a time of unique economic opportunities to grow and be at the leading edge of a UK economy which is based on innovation, productivity and successful exports. Cumbria powers the Northern Powerhouse – with world-leading expertise in the energy and nuclear sectors, natural assets that provide water and energy for the rest of the North and the UK, and the Lake District which provides a world-class visitor destination for Northern, UK and International visitors.

1.2 Cumbria connects the Northern Powerhouse, and the rest of the UK, with Scotland and has key strategic connections across the Pennines with the North East. Through Workington and Barrow ports, and connections with regional airports, Cumbria is connected to global markets but with potential to do more.

1.3 Over £25 billion of investment into Cumbria is planned over the next decade – with 5 of the 8 largest investment projects in the North West being planned in Cumbria. The county's economy includes key specialisms with significant potential for future growth – in advanced manufacturing, in energy and nuclear, in the visitor economy, and in agriculture and food production. With unprecedented investment and supply chain opportunities over the next decade, we forecast that there will be 130,000 job opportunities in the county over the next 7 years.

1.4 The nuclear sector and supply chain have unprecedented opportunities for growth from the £16 billion investment into a new nuclear power station at Moorside in West Cumbria. This will sit next to the Sellafield site which is already the largest nuclear site in Europe – with the UK's foremost expertise in de-commissioning and waste management.

1.5 Global investors such as GlaxoSmithKline and BAE Systems are at the cutting-edge of advanced manufacturing and are making significant investments into the county, together with internationally competitive companies such as Innovia and New Balance.

1.6 The biggest challenges for Cumbria to maximise these unprecedented growth opportunities are infrastructure and population. Improved Infrastructure is critical – not only to Cumbria as a place to do business, to live and to visit – but to the whole of the UK as host to a number of nationally significant projects.

1.7 There are, within this context, unique opportunities for Cumbria to achieve a remarkable level of growth over the next decade. However, the greatest barrier to delivery of these projects and delivery of economic growth in the Northern Powerhouse is infrastructure – roads and rail to transport people, materials and

goods, digital connectivity to enable businesses to flourish, flood defences and resilient infrastructure to ensure that risks of extreme weather events is effectively managed, and infrastructure to enable water to be managed sustainably and cost-effectively.

2.0 Summary

2.1 New approaches are required to underpin the assessment of 'high value' in terms of infrastructure investment if the UK is to achieve sustainable growth where everyone benefits. Current approaches which focus on population that benefits in relation to the cost of design, construction and operation of infrastructure is not fit for this purpose. approaches must take into account the role of other areas of the country in providing strategic connectivity between major cities and across the UK, the role of all areas in delivering projects of national significance, and in the potential for UK-wide economic growth found in the country's towns and villages.

2.2 The National Infrastructure Assessment should a take into account cumulative impact on infrastructure from a number of nationally significant projects – and recognise that projects as critical to the UK's future as the proposed new nuclear power station at Moorside in West Cumbria, the North West Coast Connections project which will connect Moorside to the grid, and the United Utilities West Cumbria pipeline produce a cumulative need for specific infrastructure improvements. The Assessment needs to recognise that the local infrastructure improvements required to facilitate a major nationally significant infrastructure project are national issues that require a major national contribution to the solutions.

2.3 A revised approach to financing and funding new, and improvements to, infrastructure is needed which includes a mechanism for clawback from future development – to enable delivery of infrastructure in advance of development through borrowing but mitigating financial risks to the providers in the longer-term.

2.4 Investment in infrastructure improvements to strategic connectivity and quality public transport will provide value for money when also considered in the context of wider connectivity issues, including digital connectivity. Strategic routes should be considered in the context of the wider network – local routes can be strategic routes of national significance. For example, the Cumbria coastal railway line is critical to the success of a number of nationally significant infrastructure projects.

2.5 Improvements to the quality of public transport will support the modal shift required for a sustainable future transport system in the UK. Improvements to quality –

speed, capacity, reliability - require infrastructure improvements to support innovative and environmentally sustainable transport solutions.

2.6 Building in resilience to extreme weather events to the UK's infrastructure will be vital to maximising the benefit of capital investment. A national standard should be adopted for the design of infrastructure.

2.7 The National Infrastructure Assessment also needs to recognise the importance of investment in flood prevention with a package of solution including prioritised investment in flood defences and testing of catchment-wide approaches.

2.8 Upgrading the UK's digital infrastructure to meet the needs of current and future technologies is vital to the UK's future growth potential. The current approach results in a large diversity between areas in the quality of digital connectivity available. This is not acceptable. Maximising rural growth is a critical part of the UK future economic success; however, lack of / poor digital connectivity is major barrier to rural businesses. It is necessary, therefore, that areas of the UK are not left behind and that all areas should have the same opportunities for digital access.

2.9 In order to maximise the benefits of capital spend on new and improved infrastructure, robust plans, including identified resources, need to be put in place for monitoring, maintenance and regular renewal and upgrading.

3.0 Cross-cutting Issues

High Value Infrastructure Investments

3.1 The way in which 'high value' is assessed needs to be right for the whole of the UK. For the UK to achieve its objectives of creating sustainable growth where everybody benefits and a successful Northern Powerhouse, this assessment needs to work for all parts of the country – major cities and their surrounding regions, smaller cities and county towns, market towns, villages and the most rural areas.

3.2 This needs an approach to assessing cost and benefit that is fit for purpose – recognising the different needs of different areas, and meets the need of the current and future economy. An assessment that focuses on population that benefits in relation to the cost of design, construction and operation of infrastructure is not fit for this purpose – it will not share the opportunities and benefits of growth across the country.

3.3 The role of major cities and their surrounding regions is fully recognised in current approaches – and will be essential in future approaches. However, future approaches must take into account the role of other areas of the country in

providing strategic connectivity between major cities and across the UK, the role of all areas in delivering projects of national significance, and in the potential for UK-wide economic growth found in the country's smaller cities, towns and villages.

3.4 Cumbria LEP, through the development of the Cumbria Strategic Economic Plan, has a clear set of infrastructure improvements which are critical to the delivery of major nationally significant infrastructure projects over the next 3 decades, to maximising the wider economic growth opportunities arising from planned investment, and to facilitate long-term sustainable growth in the county, across the Northern Powerhouse and the whole of the UK.

3.5 National priorities being delivered in Cumbria require national solutions and interventions to ensure that the infrastructure improvements needed are put in place in the right places at the right times.

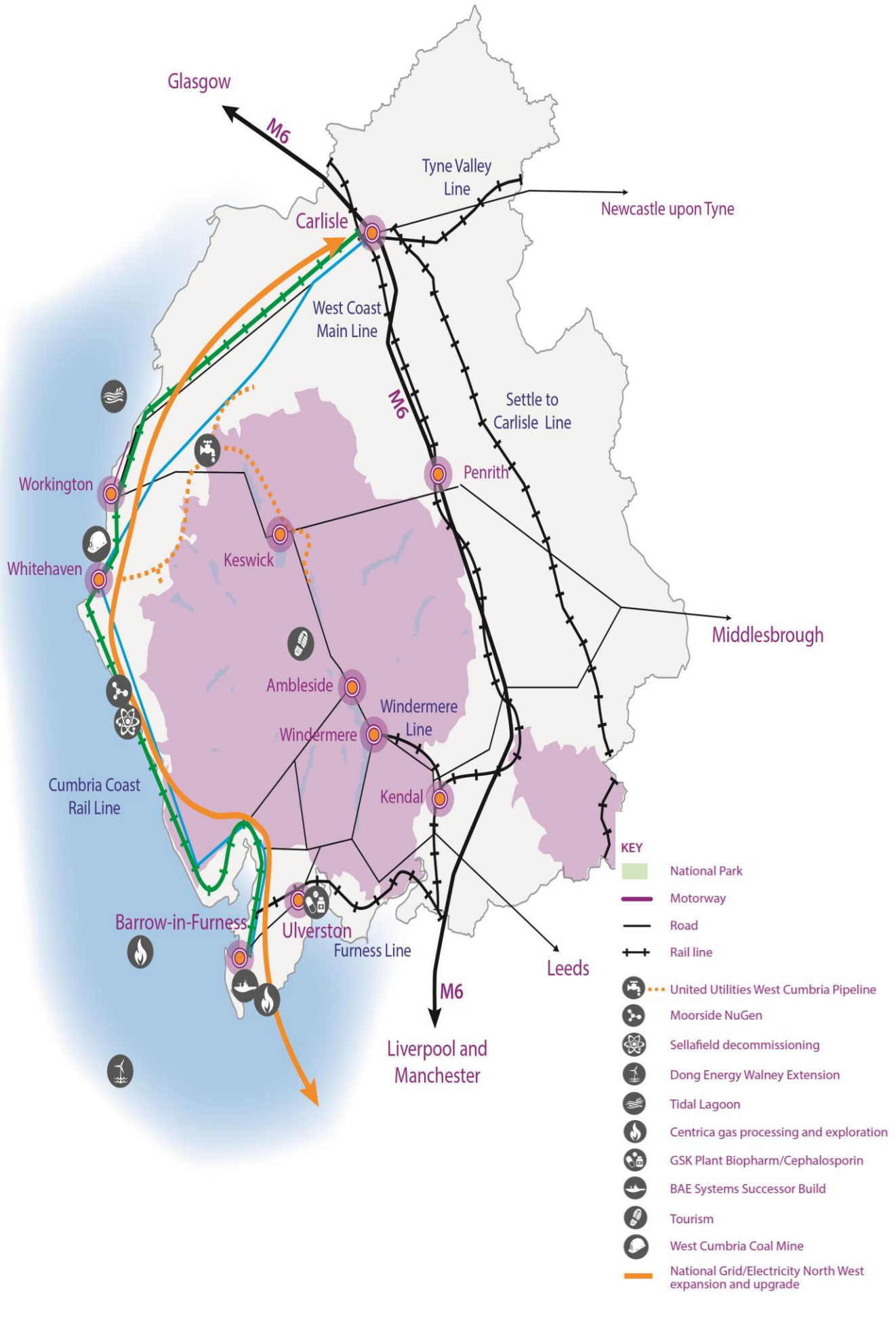
3.6 Current infrastructure in Cumbria – roads, rail, energy, digital and in terms of flood resilience – is inadequate. The Strategic Economic Plan Strategic Economic Plan | Cumbria Local Enterprise Partnership recognises this infrastructure deficit and identifies infrastructure improvements as one of 4 key drivers for growth in the short and long-term.

3.7 Given the current inadequacy of the county's infrastructure and the importance of improvements to secure major nationally significant projects and future growth, Cumbria LEP also has an Infrastructure Plan in place, underpinned by a Strategic Investment Plan, to set out clear priorities and plans for delivery. We are clear that local partners have a major role to play – the LEP, local authorities and developers – in delivering infrastructure improvements but also recognise the major role that the UK Government needs to play too. This is why it is critical that the National Infrastructure Assessment recognises the needs of Cumbria.

Cumbria Infrastructure Plan
Cumbria Infrastructure Plan | Cumbria Local Enterprise Partnership

Cumbria Strategic Investment Plan
Cumbria's Strategic Investment Plan | Cumbria Local Enterprise Partnership

3.8 The map below illustrates the national significant projects planned for Cumbria over the next decade – attached to at least £25 billion of investment, and the county's key strategic connections.


Glasgow
M6
Tyne Valley Line
Newcastle upon Tyne
Carlisle
West Coast Main Line
M6
Settle to Carlisle Line
Penrith
Workington
Whitehaven
Keswick
Middlesbrough
Ambleside
Windermere Line
Windermere
Cumbria Coast Rail Line
Kendal
Barrow-in-Furness
Ulverston
Furness Line
Leeds
M6
Liverpool and Manchester
KEY
National Park
Motorway
Road
Rail line
United Utilities West Cumbria Pipeline
Moorside NuGen
Sellafield decommissioning
Dong Energy Walney Extension
Tidal Lagoon
Centrica gas processing and exploration
GSK Plant Biopharm/Cephalosporin
BAE Systems Successor Build
Tourism
West Cumbria Coal Mine
National Grid/Electricity North West expansion and upgrade

Financing and Funding

3.9 A new model for financing infrastructure is critical to the UK's future economic sustainability. National economic, planning and infrastructure policy must innovate to test out new models for delivery of infrastructure improvements. The additional funding – financed through government borrowing – is welcome but it is not a long-term solution to improving and maintaining the UK's critical infrastructure over the coming decades.

3.10 The Government's intention to review the planning obligations policy announced in the recently published Housing White Paper is welcome but it must take into account one major issue. New or improved infrastructure is often required in advance of development – to enable the construction of the development, to attract the investment required, to attract the required workforce and supply chain development. The current approach does not recognise this and therefore becomes a barrier to growth.

3.11 A revised approach is needed which includes a mechanism for clawback from future development – to enable delivery of infrastructure in advance of development through borrowing but mitigates the risks of borrowing for local partners. Capacity for financial risk is a major barrier for Cumbria – with a number of small authorities, and the critical nature of infrastructure improvements to attracting and securing investment.

Resilience

3.12 Future infrastructure also needs resilience at the centre of its design, construction, operation and maintenance. The UK is faced with the challenge of more regular extreme weather events in the future, and areas such as Cumbria have experienced a number of major events within the last few years. The impact of flooding on communities, on business, and on the economy following on from the Winter Storms of December 2015 continue to addressed in areas of Cumbria, and will be for years to come.

3.13 The approximate total cost of Cumbria flood recovery is £500 million which includes costs for repairing damage to residential properties, business premises, and key infrastructure. The flooding caused major structural failures to 3 strategic routes through Cumbria, the closure of 49 roads throughout the county, and damage to a total of 557 bridges, with 3 bridges washed away.

3.14 Cumbria has experienced a frequency of similar events over the last decade or so that is more than other areas of the UK, but the last 2 years have seen devastation caused by floods in multiple areas across the UK. The risks faced by the UK's

infrastructure will only increase over the coming decades. This means that the UK as a whole needs a new approach to dealing with extreme weather events.

3.15 New technologies, and the recent experiences of places like Cumbria, could play a major role in ensuring the resilience of our infrastructure in the future. One approach that could be taken is to ensure there is a national standard adopted for the design of our infrastructure – this is essential in ensuring that the capital invested in infrastructure is maximised and not, literally, washed away.

3.16 The standards to be adopted, in the short and longer-term, will require considerable analysis and expertise – will building infrastructure to withstand a 1 in 100 year event be sufficient in the UK in the future?

3.17 Proactive early intervention is a key approach to be taken forward in achieving a more resilient infrastructure network. In Cumbria, we are working with DfT on new technology to remotely monitor bridges and on the modelling of impact of extreme weather events.

3.18 In terms of prevention of flooding, national investment in flood defences should remain a priority alongside the testing of other approaches. Catchment-wide approaches could be an important part of the package of solutions.

Maintenance and Renewal

3.19 New and improved infrastructure is critical to the UK's future; however, it is only if plans are made – and resources identified – to ensure that infrastructure is effectively monitored and maintained, and that renewal and upgrades are delivered in a timely manner. New smart technologies provide a new range of opportunities in this area. It is only if these opportunities are fully exploited that the benefits of capital invested in infrastructure will be maximised. Issues such as an existing maintenance deficit of £250 million on the Cumbrian highways network need to be addressed as part of the package of measures required to ensure an effective and resilient network.

4.0 Energy

4.1 A low carbon secure energy supply is critical to the UK's future sustainability and growth – placing the infrastructure to provide the supply as a central element of the UK's future infrastructure needs over the next decades.

4.2 To ensure security of supply a mix of low carbon technologies is needed – including nuclear, wind and tidal. There are some plans in place – including the new nuclear power station at Moorside in West Cumbria and potential for tidal lagoons –

however, these need to be supported by a programme of investment improvements, not just on the relevant development site, but to ensure the required connectivity from the sites to the rest of the UK and to ensure there are the required supply chain and construction facilities.

4.3 In areas such as Cumbria, where there are a number of major nationally significant infrastructure projects planned, the assessment of infrastructure need must in future consider cumulative impact. Cumbria LEP has assessed the collective infrastructure impact of the Moorside development, the related North West Coast Connections project which will link Moorside to the UK's electricity grid, the United Utilities West Cumbria Pipeline project plus other projects such as BAE investment in order to build the fleet of Successor submarines to carry the UK's nuclear deterrent, and GSK investment in Ulverston.

4.4 This assessment has resulted in a defined list of priority infrastructure improvements which are needed in order to enable these projects and maximise their economic impact. The time critical improvements required to enable the planned projects to succeed are:

- enhancements to the Cumbrian Coastal railway
- enhancements to the A595 Corridor
- flood resilience and mitigation
- improvements to the Port of Workington
- roll-out of 4G and broadband connectivity
- Carlisle Station and surrounding area
- Carlisle Airport enhancements

4.5 The county's longer-term infrastructure priorities to facilitate growth are:

- Carlisle Southern Link Road
- A590 enhancements
- A66 enhancements
- Ulverston bypass
- Whitehaven Relief Route

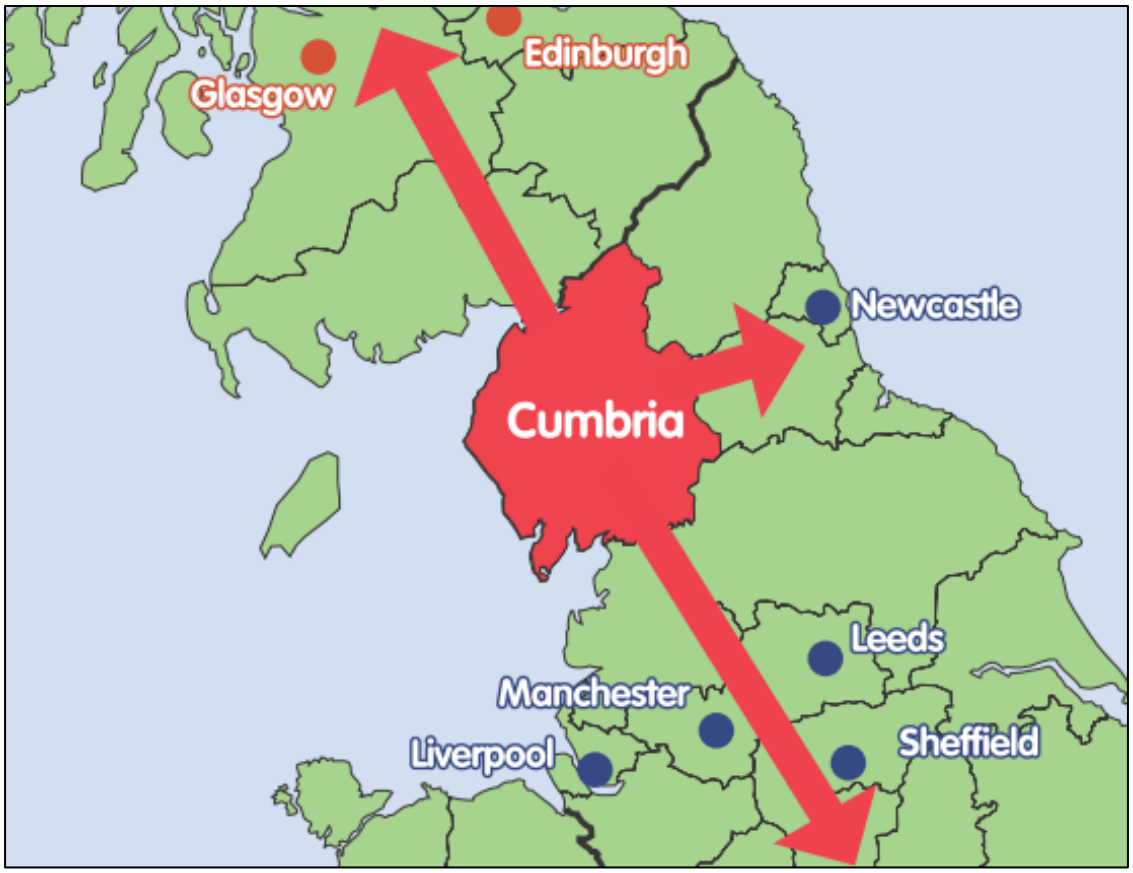
4.6 The current national planning and infrastructure funding policies do not take such cumulative impact into consideration. National policy has to evolve in order to take this cumulative impact into account, particularly in relation to the assessment of value for money. Without this, key pieces of the UK's future infrastructure are put at risk.

5.0 Transport

5.1 There are 2 elements which should be the focus for infrastructure assessment in respect of transport. These are ensuring strategic connectivity and quality public transport. Investment in improvements in these 2 areas will provide value for money when also considered in the context of wider connectivity issues, including digital connectivity.

5.2 Ensuring strategic connectivity between the nations, regions, cities and towns across the country is vital to supporting future growth where all parts of the country and population experience the benefits.

5.3 The map below shows how critical Cumbria is to UK-wide strategic connectivity.



5.4 Improvements incapacity and speed on key strategic routes – by road, rail or air – will provide high value investment essential for growth, and for delivering other major national infrastructure.

5.5 For example the Cumbrian Coastal railway line is not a strategic Trans-Pennine or north-south route on its own; however, with planned nationally significant developments in West Cumbria and Furness it has become a major strategic route for the UK. Improvements to the capacity and speed on this line are critical to a

number of nationally significant infrastructure projects, and to providing connectivity with the rest of the national rail network and ports.

Connecting Opportunities - Coastal Railway Line

Within North, West and South Cumbria the Cumbrian Coast Line provides essential connectivity between key settlements, large employment sites, ports at Workington and Barrow and the West Coast Mainline.

This connectivity represents a critical component of the Cumbrian economy; already the County has two-thirds of the UK's nuclear installations and a cutting edge advanced manufacturing sector. By linking many of key locations the line can play a significant role in the development and growth of these sectors; helping to improve access to local and national markets, increasing travel-to-work areas and in carrying the goods and material needed to support the construction and operation of major projects including the Moorside Power Station.

For the line to achieve this potential there is a requirement to deliver a significant increase in train path availability and local authorities, Cumbria LEP, private sector and Government are progressing scheme development and proactively develop new models for delivery of rail infrastructure enhancements.

5.6 It is widely recognised that there is a need to reduce demand for increased capacity on the country's road network – not just in cities where commuter travel needs to be addressed, but in areas such as the Lake District where innovative solutions for tourism and leisure travel are being developed.

5.7 A range of solutions need to be progressed in the medium to long-term to ensure the sustainability of the UK's transport system. These include facilitating and promoting increases in walking, in cycling, in park and ride schemes, in the use of Low Emission Vehicles plus rail and bus. Different solutions will work in different areas.

5.8 However, the critical factor to achieve significant modal shift is improving speed, capacity and reliability across these transport alternatives. The delivery of new and/or improved infrastructure is vital to delivering the quality and choice of transport that passengers and travellers need.

5.9 For example, investment in charging infrastructure for Low Emission Vehicles – not only on strategic routes but on routes between key settlements and development sites could deliver high value results in the long-term. Also, attractive and well managed rail stations will attract higher passenger numbers alongside the required capacity and reliability of services.

5.10 The interdependencies between improvements to rail infrastructure and rail franchises need to be taken into account and built into Network Rail and franchising plans in an integrated way. For example, delays in electrification have led to delays in delivering service and timetabling improvements through the Lake District on Northern franchise lines.

6.0 Digital Communications

6.1 Digital communications play an ever increasing role in lives and businesses in the UK and the country's digital infrastructure needs to evolve and be upgraded to meet current and future demand. Good digital connectivity is now a utility – necessary for participation in the economy and society.

6.2 Coverage and speed and reliability of connection are key to businesses and households – and more so in rural areas. Digital channels provide opportunities for entrepreneurs to start–up and run businesses in areas such as the Lake District that have not existed up until recent years. For the whole country to experience the opportunities and benefits of economic growth, and for issues such as overcrowding and housing crises in some parts of the UK to be resolved, the availability of reliable

digital coverage at a superfast speed and at an affordable price across the whole of the UK is critical.

6.3 The upgrading and extension of the UK's digital infrastructure should be based on the principle that all areas have access to the same standard of digital connectivity. As people living and working in the centre of a major city in the UK have access to the benefits of 5G, hyperfast broadband and other technologies to come, someone running a business in a rural part of Cumbria need to have the opportunity to access the same quality of connectivity.

6.4 There are more registered businesses per head in predominantly rural areas than in predominantly urban areas (excluding London). This reflects the importance of supporting business growth across rural areas to the future success of the UK economy driven by improved productivity and innovation.

6.5 There are, undoubtedly, particular challenges for the market in providing acceptable standards of digital connectivity to rural areas. Initiatives such as BDUK have played a valuable role in progress to date; however, there will be ever increasing challenges in the future as technology progresses at pace. These challenges will need to be considered very careful as the UK's approach to infrastructure emerges.

6.6 The vital role that digital connectivity now plays should also be reflected in planning policies. The National Planning Policy Framework should be reviewed to ensure digital connectivity is a key consideration in development. Designing-in of digital connectivity is a much more efficient and effective approach than retro-fitting.

7.0 Waste

7.1 The UK requires a package of measures to be implemented that reduces waste, and deals with waste that is produced more efficiently. Investment in innovation for treatment technology should be considered as an important element o fthis package.

7.2 The National Infrastructure Assessment should also explore the opportunities for the UK in waste policy resulting from exit from the EU. Changes to the export market for UK waste may have significant implications.

7.3 Measures should also be considered to provide a stable recycling market with a focus on potential for a floor price.

RESPONSE FROM THE CENTRE FOR THE UNDERSTANDING OF SUSTAINABLE PROSPERITY (CUSP) TO NATIONAL INFRASTRUCTURE ASSESSMENT CALL FOR EVIDENCE

The Centre for the Understanding of Sustainable Prosperity (CUSP) is an ESRC-funded research programme concerned with sustainability and its implications, at all levels, from individuals' understandings of their own "prosperity" to global questions such as climate change. CUSP is based at the University of Surrey. Our work leads us to the following responses to the Commission's questions -

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

a) Joined up thinking

In the context of infrastructure, 'demand management' should not be defined too narrowly: we urge the commission to consider the demand management potential of the 'infrastructure of civic life' (Sandel, 2009). For example, infrastructure investment in schools and hospitals, community halls and theatres, museums and public libraries empowers us to live in less materialistic ways. That is, certain forms of infrastructure enable people to engage with the world in ways that emphasise community and nature rather than individual wants and material possessions (Jackson, 2016). This is desirable because materialistic lifestyles are associated with higher energy demand and material throughput in the economy. Likewise, materialism is linked to lower levels of physical and mental health (Kasser, 2016). Consequently, investment in infrastructure that is aimed at strengthening our communities and our social lives is likely to reduce the strain on energy and health infrastructures, by providing wider societal benefits.

Similarly, when considering demand management it is vital that the infrastructure of the UK is considered as an integrated system. This will include, for example: assessing travel needs alongside the siting of residential and non- residential buildings; making use of waste heat in district heating networks through careful placing of buildings ; integrating disposal of waste in planning decisions, so that biogas emitted from anaerobic digestion of food waste can be easily and efficiently utilised.

b) The UK Building Stock

Assessment of UK building stock is key to demand management for energy. Buildings are responsible for a large proportion of UK (and global) energy use, and in the life cycle (construction, operation and demolition) of a building, approximately 80% of energy use occurs in the operation phase

(Cabeza *et al.* 2014). Buildings must be assessed in order to ascertain which buildings are suitable for retrofit to provide greater energy efficiency, and which buildings should be demolished and replaced. This should be applied to domestic and non-domestic buildings. Stringent, low carbon standards should be set for both refurbishment and new-build (Committee on Climate Change 2016). Energy efficiency refurbishment will include installation of, for example, loft insulation and cavity wall and solid wall insulation. Other options include low energy retrofit of LED lights and water efficiency measures such as rain water harvesting and grey water recycling, where appropriate. Likewise, low carbon options such as heat pumps should be considered where suitable. Smart controls are also important in demand management. Electrification of heat demand should also be considered. However, this will depend on the availability of renewable electricity. In summary there are many options for demand management during the lifetime of a building, and this can have a substantial impact on energy use.

This said, assessment of the UK building stock should be done on a life cycle thinking basis, in which all steps are taken into account[1]. This is because although most energy use occurs in operation, energy is used in every stage of a building's lifecycle. Moreover, embodied energy (energy used in production of building materials) makes up 10-20% of energy used across the whole of a building's life, and there are substantial opportunities for reducing this. Studies suggest that use of low carbon or recycled building materials can reduce the embodied energy of a building by 30-50% (Cabeza *et al.* 2014). Such opportunities would be missed if a life cycle thinking perspective was not taken in the assessment phase.

c) Travel infrastructure

A transition from a private vehicle based transport system towards an integrated public mobility system should be considered. In particular, options for active travel, such as walking and cycling, should be encouraged, as these have been shown to enhance both physical and mental health. In this way, they have added benefits for wider Government spending programmes, such as the NHS.

[1] For refurbishment: energy usage of building once refurbished for the remainder of its estimated lifetime; the embodied carbon in the materials used in refurbishment; environmental impacts of the demolition of the building at the end of its lifetime and end of life impacts of, for example, any materials sent to landfill (including the materials added in the refurbishment); any 'gains' that offset these through potential recycling.

For demolition and replacement: environmental impacts of the demolition of the building and end of life impacts of, for example, any materials sent to landfill; for life time impacts of the replacement building including all stages of it, from raw material extraction, processing and production of materials, transportation, use and end of life.

For example, in a review that assessed the evidence base concerning the economic assessment of investment in walking and cycling[2], Davis (2010) found that almost all of the studies reported highly significant economic benefits from walking and cycling interventions. In particular, for the UK studies reviewed, it was found that the benefits to costs ratio (BCR) median was 19:1 Davis (2010).

4d) Incentives, taxation and subsidies - a clear message to encourage low carbon options

Government use of incentives, taxation and subsidies should be reformed in order to encourage low carbon options. Currently, government policy often increases the price of low carbon options and reduces the price of high carbon alternatives. A topical example is the current discussions around changing tax regimes for domestic and business rooftop solar installations while also excluding large scale solar from bidding for government contracts to sell energy to the grid at the lowest guaranteed price. This represents the use of taxation to increase the price of a low carbon option and simultaneously prevent it from accessing an (effective) government subsidy. These kinds of pricing issues must be eliminated wherever possible for two reasons. First, low prices directly encourage encouraging high carbon behaviours. Second, when high carbon options are subsidised by government (or vice versa) they give the impression that choosing low carbon options is not considered important by government.

e) Rebound effect

The rebound effect will occur, and so it is important to factor it into plans and targets. Typical rebound effects have been found to be modest (0-32%) for efficiency measures affecting domestic energy use by UK households, larger (25-65%) for measures affecting vehicle fuel use, and very large (66-106%) for measures that reduce food waste (Chitnis et al, 2014)[3].

However, presence of the rebound effect does not mean that energy efficiency actions should not be taken (Druckman *et al.* 2011). Rebound effects of less than 100% do reduce anticipated energy savings but they do not eliminate savings altogether. On the other hand, backfire (rebound effects of more than 100%) should generally be avoided (Druckman *et al.* 2011, Chitnis *et al.* 2013). That said, there are likely to be cases where substantial rebound effects occur but energy efficiency measures are justified by other concerns. For example, energy efficiency rebound effects are highest for low income households (see Chitnis et al (2014)), but it is important to take into account the wider benefits (such as to the residents' health and wellbeing) that also result from these energy efficiency

[2] The evidence reviewed was from both peer reviewed and grey literature, and from both the UK and beyond.
[3] Rebound effects reported here are in terms of greenhouse gases.

actions. Consequently, the Commission should always consider rebound effects in their wider context.

Carrying out the assessment of the UK building stock (and following it up with appropriate actions) is the best way to minimize the rebound effect. This is because, in simple terms, the size of the rebound effect is related to the relative intensities (energy or greenhouse gas emissions per £ spent) of competing expenditure choices. Rebound occurs when money saved by an energy efficiency measure is spent on other goods and services (Druckman *et al*. 2011). If the money saved by an efficiency measure is spent on goods/services that are more intensive than the goods/services subject to the energy efficiency measure, then backfire will occur. Conversely, if the money saved by an energy efficiency measure is spent on goods that are less GHG intensive, then rebound effects will be less than 100% and carbon will be saved. As an illustration, Table 1 shows the GHG intensities of different types of expenditure.

An extreme example of bad practice with regards to the rebound effect was the promotion by a major supermarket that gave consumers 'air miles' when they purchased energy efficient light bulbs (Chitnis *et al.* 2013).

Conversely, encouraging energy efficiency actions is good practice with regards to the rebound effect. This is because direct energy use in buildings is one of the most GHG intensive forms of expenditure (see Table 1), and so energy efficiency actions will, generally speaking, result in a rebound effect of less than 100% (typically 0-32% as stated above).

In summary, while rebound effects are almost inevitable when enacting appropriate energy efficiency measures in the UK housing stock, they do not negate the usefulness of this type of demand management.

Table 1. GHG intensities by category for an average household. This shows that expenditure on electricity, gas, other fuels and vehicle fuels is approximately three times as GHG intensive as expenditure on the other categories and five times as intensive as the share-weighted mean. (Source: Table A.5 in Chitnis et al, 2014)

Description	GHG intensity ($kgCO_2e/£$)
Food & non-alcoholic beverages	1.05
Alcohol and tobacco	0.26
Clothing & footwear	0.54
Electricity	5.04
Gas	4.70
Other fuels	6.95
Other housing	0.28
Furnishings etc.	0.75
Health	0.35

Vehicle fuels and lubricants	2.61
Other transport	1.25
Communication	0.43
Recreation & culture	0.65
Education	0.25
Restaurants & hotels	0.59
Miscellaneous	0.52
Savings	0.57

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11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Infrastructure planning should consider – in addition to the "fiscal envelope" – the implications of the Climate Change Act and the implications of the fixed total land area of the UK.

The Climate Change Act 2008 does not include specific provisions regarding infrastructure, and so the National Infrastructure Commission – which is already committed to developing its recommendations in line with the Act – will need to come to a view about the share of the UK carbon budget that can be taken up by infrastructure building and use (e.g. both road building and extra car miles travelled). It will then need to assess the carbon implications of each infrastructure option it considers, so that it can ensure that its whole package of recommendations is within the **"carbon envelope"**.

Similarly, the "land envelope" is also crucially important. Again, a view will need to be reached as to the amount of land that can reasonably be devoted to infrastructure, bearing in mind competing uses, such as housing, industry, agriculture, and green space. The total package of recommendations will then need to be within this total **"land envelope"**. This will require analysis of the land take implications of each infrastructure option.

For each option, it would then be possible to see (and this can be imagined as a table of figures): the total financial cost, the cost to government, the carbon emissions implied, and the land take implied.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

The circular economy has the potential to reduce waste and hence help to solve waste infrastructure problems. CUSP research has explored the business responses to circular economy ideas through its *More Profit Less Stuff* programme, as well as research on challenges for smaller businesses with regard to investing in circular economy business models.

Better use of current infrastructure- At a local authority level, there is a range of household recycling approaches. Better regulation is needed to simplify the system, and avoid low quality recycling which contributes to the exporting of waste to developing countries where environmentally damaging recycling is more likely to occur – particularly with regards to waste electrical and electronic equipment (WEEE) (Perkins et al., 2014).

Attracting new entrants to provide innovative solutions – CUSP research on finance shows that there is a specific finance gap for green high-technology businesses as they seek funding for growth particularly as their commercialisation process is characterised by a longer time horizon investment. Government interventions like the UK Innovation Investment Fund have the potential to improve early stage private investment into recycling and advanced manufacturing sectors (Owen and North, 2015; Owen et al 2016).

Encouraging investment in the circular economy – Developing circular business models requires coordination from multiple supply chain actors. Businesses developing these new models recognise this and are calling for better regulation which aligns incentives between actors rather than seeking the removal of 'red tape'. This will provide the confidence to invest in the forward and backward supply chains where they do not already exist and ensure that the dis-assembly and re-manufacturing processes are done to a satisfactory standard. Regulation is also need to ensure manufacturers design products for ease of dis-assembly (Allwood & Cullen, 2012).

Full-cost accounting is required to ensure that business and government procurement take into consideration the negative environmental and social impact of waste (Jackson, 1996). There are also particular challenges facing the circular economy from the Brexit negotiations as many product components are assembled at different stages in different countries (for example cars). Thus future investment in the circular economy infrastructure needs to consider the likely regulation in the EU which will also affect the decisions of UK manufacturers seeking to continue to sell products in this market. This is particularly relevant to the UK automotive, aviation, heavy goods equipment and construction sectors where there are existing initiatives (e.g. Caterpillar ReManufacturing in Shrewsbury) and further opportunities for applying circular economy principles (Allwood & Cullen, 2012; Tennant, 2013; Brennan et al, 2015).

Research and development for the circular economy – CUSP researchers have been exploring the R&D and product design issues associated with the transition to a circular economy (Brennan et al, 2015). While high-value advanced manufacturing sectors (renewable energy technology, automotive and aerospace) are where there are the biggest opportunities for applying circular strategies, they are increasingly dependent on innovative composite materials which also represent a challenge. The production of advanced materials is increasingly outpacing our ability to re-use and recycle them safely, implying that extensive research and development is likely to be required (Yang et al, 2012).

This suggests that continuing to invest in the UK's currently world leading research on material science and biotechnology is critical in order to explore the potential of substitutable materials that are less toxic and safer to dis-assemble. Related to this is the need for research into the role of automated dis-assembly and the impact on jobs.

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NIC Call for Evidence

Response from [name redacted], [job title redacted], Centre for Transport Studies, University College London

This response covers the Transport questions plus some of the Cross-cutting issues. It is based on the [name redacted] other recent papers (see References section).

Future demand for personal travel (Q13)

Demand for personal travel has been tracked by the National Travel Survey for the past 40 years. Two invariants are observed over this period: average travel time has held steady at about an hour a day, and the average trip rate at about 1000 journeys a year. However, in one important respect there has been a change in travel behaviour on moving from the last century to the present. During the second half of the twentieth century, the average distance travelled by all surface modes rose steadily, as car ownership increased and new roads were built, to reach about 7000 miles per person per year by the mid-1990s. At that time growth ceased: there has been no increase in average distance travelled in this century.

About three-quarters of the average distance travelled is by car, hence, consistent with the National Travel Survey, we find that car use per capita has ceased to grow in Britain since the turn of the century, a phenomenon found generally in the developed economies and known as 'Peak Car'. A number of developments have contributed to this phenomenon including technological constraints that limit faster travel, demand saturation in respect of many of the daily journey purposes, and changes attitudes to the car on the part of many urban young people. While the future development of travel demand is uncertain, **a reasonable central case projection would assume no change in average per capita distance travelled** (by car and by all modes).

It follows that population growth would be the main determinant of future total travel demand. But the pattern of future demand depends on where the additional inhabitants are to be housed: to the extent that this is on on greenfield sites, such as 'garden towns' and 'garden villages', then the residents would own cars and road investment would be required. On the other hand, to the extent that population growth is accommodated within existing urban locations at higher density, then public transport investment would be needed. The balance between greenfield and urban would depend on a number of considerations: where employment growth occurs, both across regions and within regions as between city centres and peripheral locations; the impact of the planning regime; the salience of climate change targets; the preferences of the house-builders; and how and where transport investment takes place.

The scale and pattern of population growth is therefore central to future investment in transport infrastructure, with causality operating in both

directions: population growth driving investment, and investment determining the location and density of the future population.

Economic factors that affect travel demand, such as income growth and fuel prices, seem likely to be less important in the future than they were in the past when rising income drove growth in car ownership. Lower oil prices still make car use more affordable, as does improved fuel consumption through technological development. But the scope for cost-driven 'rebound effects' is limited by the time constraint that applies to daily travel (the hour a day).

Future transport technologies (Q13)

The history of technological factors that affect travel demand tells a story of slow and incremental progress. The fundamentals of the motor car have not changed since the first mass-produced automobile, the Model T Ford, hit the road a century ago. There has of course been vast improvement and refinement in many respects, but the amount of road space occupied has not changed, hence the growth of congestion, the dominant issue for road transport.

The main relevance of any technological innovation is therefore its impact on traffic congestion. (Improved safety and reduced pollution are desirable and achievable to the extent we are willing to pay for better technology and perhaps accept reduced speed of travel). Driverless cars, whether personally owned or as taxis with robot drivers, seem unlikely to make much impact on congestion. Traffic could indeed increase if demand for taxis grew on account of lower fares, cheaper robots replacing human drivers; and also if personally owned driverless vehicles were on the road when unoccupied rather than being parked. On the other hand, there could be reduction in road space for parked vehicles, although this would be mainly in off-street car parks and in residential suburbs: kerbside parking space in city centres is already quite limited and would be needed for loading and setting down, so the impact on urban congestion is likely to be small.

A development that could have a bigger impact on traffic congestion is the growth of sharing, as exemplified by UberPOOL, which encourages sharing of taxis by people going in the same direction in exchange for lower fares. BlaBlaCar is an example of a similar service for long distance trips. Such digital platforms could enhance the efficiency of the road system through increased vehicle occupancy. There are, however, two potential offsetting consequences: shared taxis may attract people from buses, which are even more space-efficient than shared taxis. Moreover, to the extent that people used shared taxis rather than personal cars in congested conditions, the road space freed up would allow other personal car users the opportunity to travel – a 'rebound effect' known in this context as 'induced traffic', which restores congestion to what it had been. Shared vehicle use could, however, reduce per capita carbon and other emissions provided that road space freed up is allocated for other uses, such as bus and cycle lanes.

Probably the most useful current digital innovation applicable to the road system is smartphone satnav route guidance that proposes the best route and provides

estimated journey time in the light of actual traffic conditions. This has the potential to improve network efficiency by encouraging road users who are flexible in their trip timing to avoid peak congestion. However, the advice provided by private sector information providers may not be optimal for overall network efficiency, and accordingly it would be desirable to commission a study of how information providers and network operators could best work together.

The switch to electric propulsion for road vehicles, to achieve greenhouse gas reduction targets, will require investment in electricity supply.

High value urban transport investments (Q14).

The railways in the nineteenth century succeeded by providing relatively fast and reliable station-to-station travel according to the timetable. In the twentieth century, the motorcar was increasingly preferred since it allowed door-to-door travel at time of choice. However, the car's very success has led to urban traffic congestion that has in turn stimulated a revival of urban rail. London's Docklands exemplifies the way in which public investment in rail routes can make low value land available for development by the private sector to accommodate a growing urban economy and population.

While urban road investments were common in the last century, the consequences have been mixed: better car-based mobility but at the cost of considerable detriments: pollution and community severance, without relieving congestion. Generally, it is recognised that the extensive presence of road vehicles impedes the interactions between people that yield agglomeration benefits, not just economic but also social and cultural, which is why big cities with good rail-based public transport attract people to work, study and live.

So urban road investment is rightly out of fashion, and indeed successful cities like London are reversing past decisions aimed at facilitating road traffic, for instance by reverting one-way gyratory flow to two-way traffic, and by increasing pedestrian space in central areas, which proves popular with both visitors and shops.

The high priority urban transport investments are rail in all its forms including trams, and Bus Rapid Transport, which, when properly implemented, offers rail-type speed and reliability at lower capital cost. However, the orthodox approach to transport economic appraisal endorsed by the Department for Transport disregards the value of development that results from making land accessible for development. This means that urban rail investments are undervalued. It is noteworthy that trams are common and well used in many relatively small European cities, with recent new developments in France in particular.

As well as creating new urban rail infrastructure, there is even higher value in increasing the capacity of existing infrastructure through both physical investment (better and more frequent trains at more accessible stations) and digital technologies, an approach recognised by the concept the 'Digital Railway'.

Thus improved signalling on the London Underground has permitted frequencies of as much as 36 trains an hour, increasing capacity by up to 30%.

For the longer term, one could envisage applying digital technologies to urban roads: a transport system involving driverless shared taxis and minibuses, plus demand management that constrains the use of single occupancy cars, plus some kind of flow management, analogous to air traffic control. This could provide speedy and reliable door-to-door travel at time of choice. However, the barriers are formidable – technological, commercial, governance, and public acceptability – hence the outcome is quite uncertain.

High value inter-urban transport investments (Q15)

Britain has a mature surface transport system in which every city is connected to others by dual-carriageway roads as a minimum, plus a substantial historic rail network. The road network enables efficient road haulage businesses to offer clients just-in-time delivery, for instance contracting to deliver from a central warehouse to retail supermarkets within specified 30-minute time slots. Common estimates of the cost to business of traffic congestion are not well founded, neglecting the beneficial impact of digital traffic information and fleet management techniques.

Given the likely growth in demand for rail travel, modernisation of existing routes in the form of electrification, local track improvements and better signalling (the 'Digital Railway') would generally be of high value. Wholly new routes, such as HS2, are harder to justify, given the high cost and the uncertain impact on the cities whose connectivity is enhanced.

Generally, there is little evidence for the benefits of investment in transport infrastructure to enhance connectivity between cities 50 miles or so apart (in contrast to good evidence of benefit of investment in intra-urban services). Consider Glasgow and Edinburgh, two very well connected cities by both road and rail. The economic structure of Glasgow has changed over the years, becoming less reliant on manufacturing as business services have grown. The new International Financial Services District is the location of twenty businesses, only one of which is a head office, the others being back offices or subsidiaries reporting to headquarters elsewhere. Of these, only two report to Edinburgh, the traditional centre of banking and finance in Scotland. So the good transport connectivity with Edinburgh does not seem to have been important for the growth of financial services in Glasgow.

A road scheme under current study involves building a tunnel under the Peak District National Park to improve road connectivity between Manchester and Sheffield, with journey time saving of up to 30 min. Depending on the precise route, the length of tunnel would be 12-20 miles, longer than most road tunnels in Europe, costing £8-12 billion. No quantitative estimation of benefits has yet been made, but it is hard to see how these could sufficient to justify such a large investment.

The Manchester-Sheffield scheme, together with two others under consideration in the Northern Powerhouse region, have a total cost estimated at £30 billion, which is twice the expenditure planned on the Strategic Road Network for the current five year period. The present uncritical enthusiasm for investment in transport infrastructure reflects wishful thinking driven by 'optimism bias', which overstates benefits and understate costs; while 'bias to action' on the part of those who hope to gain, whether political credit or business profit, generates enthusiasm for spending other peoples' money on projects that would be viewed more critically if the enthusiasts' own money were at stake.

In addition to the supposed economic benefits of enhanced connectivity, the other main reason for major road investments is the desire to relieve congestion. In general, congestion occurs in or near populated areas where the network accommodates both local and long distance traffic, as seen in the marked morning and evening peak use. Away from populated areas, traffic generally flows freely, although there may be particular congested sections requiring increased capacity, for instance where a business activity has grown incrementally. (Where major business growth is planned, the road infrastructure requirement would also be planned, as for example for a new airport runway.)

The orthodox economic case for adding capacity to a congested inter-urban road is based on the estimated time savings to users. However, it is not the practice to identify separately benefits to different classes of road user such as short distance commuters, long distance business and road freight. In part this reflects the lack of routine statistics for journey purpose and distance travelled on the road system (in contrast to rail where data from ticket sales allows full description of trip origins and destinations, which facilitates modelling). Use of mobile phone data is under investigation to aid road traffic modelling, but such data is not in the public domain.

On the basis of the available data, it seems likely that the bulk of the benefit of investment in the Strategic Road Network in populated parts of the country accrues to car commuters who take advantage of the higher speeds that initially result from increased capacity to travel further, particularly to have more choices when they change job or move house. This extra distance travelled is the cause of more traffic (known as 'induced traffic', the consequence of increased capacity), which restores congestion to what it had been, so that long distance traffic is not better off. This is the basis for the maxim that you can't build your way out of congestion, which we know from experience to be generally true.

What therefore might be done to relieve traffic congestion on inter-urban roads? The M6 Toll road exemplifies the possibility of providing a relief road where traffic flows freely on account of charges that deters local users. However, providing such a wholly new road would be a rare possibility.

For a more general approach to congestion relief, it is necessary to ask why congestion is a problem. Surveys of road users indicate that the main perceived problem is the uncertainty of journey time. This can be tackled by provision of predictive journey time information using digital technologies, of which a

number of applications exist. Those road users whose arrival times are inflexible can use such information to decide when to start out, while those who are flexible can vary departure to avoid peak traffic: this is win-win since the more the latter so act, the less the congestion experienced by those who are less flexible.

Given the limited benefits of enhanced inter-urban connectivity and the limited scope for mitigating congestion where it mostly arises, investment in costly civil engineering on the road network would not represent high value. Investment in digital technologies (which we might term the 'Digital Roadway') would be expected to offer better value.

The current enthusiasm for improving 'connectivity' contrasts with the keenness a decade ago for 'sustainability'. The former promotes travel while the latter sought to discourage travel, for instance by using the planning system to constrain the development of dispersed locations of shops and services accessible only by car.

With the downgrading of sustainability, meeting statutory greenhouse gas reduction targets must rely on a switch to electric propulsion. Such a switch will result in the loss of revenues from Fuel Duty, which will require consideration of alternative means by which road users should contribute to the cost of operating and developing the road system. This is likely to lead to some form of road use charging for electric vehicles. Such charging could be flexed to reflect the level of congestion, thus piggybacking a degree of demand management on the back of a revenue raising measure. Demand management of this kind would weaken the case for new investment in road capacity based on orthodox appraisal, and could impact helpfully on congestion by spreading peak demand.

Mobility as a Service (Q16)

Mobility as a Service (MaaS) is a concept whereby travel can be planned and charged via a smartphone app, taking advantage of all surface modes of transport other than the private car. However, there are barriers to the development of MaaS. While routing using smartphone apps is well established, inclusion of charging seems more difficult to achieve. It is unclear how well this approach would cope with the unreliability associated with road travel at times of peak demand. It is not clear how MaaS would be implemented, as between a public sector operator imposing a city-wide platform, or competition between private sector platforms.

At this early stage of development, it is not obvious that MaaS would have much impact on road usage or offer opportunities for road user charging, unless this approach succeeded to the extent that private cars could be excluded from city centres, then road user charging could be adopted as part of the MaaS offering.

Improvements to cost-benefit analysis techniques (Q 12)

Economic appraisal of proposed transport investments is based on a welfare economics framework in which user benefits are dominant. The main user benefit is the saving of travel time. However, average travel time has not changed over the past forty years, as measured by the National Travel Survey. People have taken advantage of transport investments that allow higher speeds to travel further, to gain more opportunities and choices of jobs, homes and services. This means that there are no time savings in the long run. Any time savings are short run and not appropriate for valuing investment in long lived infrastructure.

The long run impact of transport investment that permits faster travel is to make land accessible for development, as exemplified by London's Docklands, where public investment in the rail system has made land accessible for commercial and residential development by private sector enterprises, to accommodate the city's growing economy and population. However, the orthodox economic case for investment in, for instance, Crossrail disregards the uplift of real estate values that reflect the enhanced GVA that results from the developments.

Orthodox economic appraisal also disregards the spatial location of benefits, as exemplified by the case for HS2, which estimates national user benefits but is silent on spatial distribution as between London and the cities of the Midlands and the North.

The failure to incorporate the economic benefits arising from development, both magnitude and location, means that the WebTAG-type economic appraisal is very different from both the strategic case for a transport investment and the business/financial case. This is particularly relevant to identifying the scope for developers contributing to the financing of the transport infrastructure that make the development possible. For instance, the developers have contributed a quarter of the cost of the Northern Line extension to Battersea Power Station, with the Treasury agreeing to earmark the uplift in business rates to finance the remainder. However, the WebTAG-compliant economic case was completely unrelated, being based on notional times savings supposedly achieved by people who would never have visited the development before completion, plus notional agglomeration benefits derived from cross-sectional econometric analysis.

What is needed is an approach to economic appraisal based not on theoretical welfare economics but on the evidence from evaluation of the outcome of completed investments. Such evidence would generally include the uplift of real estate values and may include time savings where these are actually observed. The appropriate framework would be that of Spatial Economics or Urban Economics, which deal with the relationship between land use, land value and transport services, and how investment affects use and value. Such an approach would be more credible than welfare economics and more transparent than the use of proprietary SCGE models. A note on Spatial Economics is appended.

Planning of infrastructure (Q 3)

Since in the long run transport investment results in changes of land use, it is desirable that decisions involve planners and developers, as well as transport authorities (as well illustrated by the Northern Line extension). The economic appraisal framework needs to take into account the interests of all the parties (including externalities that would not be included in a business case).

The London Infrastructure Plan 2050 illustrates the way in which infrastructure to accommodate population and economic growth can be planned, taking advantage of the Mayor's responsibilities for both planning and transport.

Competition and collaboration (Q 6)

The issue is perhaps less the supply of infrastructure than its utilisation. Were coordination/collaboration to improve the utilisation of infrastructure, less investment may be needed. Car and taxi sharing were discussed above. Freight consolidation would be another example.

There is a good case for commissioning a study into the potential for digital technologies to increase the utilisation of the road network, including how the digital platforms can best be fostered, whether through competition or coordination.

Conclusions

The main conclusions are:

- Future travel demand will be driven mainly by population growth. But the pattern of demand depends on where housing to match this growth is located, as between greenfield or urban.

- Traffic congestion is the inevitable consequence of dense population and high levels of car ownership. There is little prospect of significant mitigation through costly civil engineering technologies. Digital approaches are likely to be far more cost-effective.

- Orthodox transport economic appraisal fails to recognise both the spatial distribution of benefits of investment and the impact on land use and property development. It needs to be supplemented with a spatial economics framework.

Appendix: a note on Spatial Economics

To accommodate evidence of land use change, we need an economic framework based on the sub-discipline of Spatial Economics. The classic work of von Thünen related the value of agricultural land, as measured by the rents that farmers

could afford to pay to land-owners, to the costs of transporting the produce to the nearest market (von Thünen, 1826). This approach, which linked land use, land value and transport costs, was extended to urban situations (Alonso, 1964) and forms part of urban economics (Tabuchi, 2011; Duranton and Puga, 2015).

Given that transport serves to move people through space, it is surprising that transport economists have generally neglected to develop spatial aspects, although these are recognised in standard texts (for instance Quinet and Vickerman, 2004). The potential is illustrated by the analysis of Arnott and Stiglitz (1981), which addressed the relationship between aggregate land rents and aggregate transport costs for a number of model city structures, and by the *ex post* cost-benefit analysis of Grimes and Liang (2010), who demonstrated how changes in land values can justify a road investment.

Transport modellers have long attempted to relate land use to transport provision: for recent reviews of theoretical aspects see Kii, Nakanishi, Nakamura and Doi (2016), while the practical application of such models has been discussed by Saujot, Lapparent, Arnaud and Prados (2016). However, such models generally lack economic content (an exception is Simmonds (2012)).

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23 January 2017

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Sent by email: NIAEvidence@nic.gsi.gov.uk

10th February 2017

Dear Sir/Madam,

RE: The National Infrastructure Assessment – Call for Evidence

Thank you for the opportunity to contribute evidence to inform the development of a National Infrastructure Assessment. I have pleasure in providing responses to Questions 1, 3, 10 and 13-16.

CROSS CUTTING ISSUES

Question 1: What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

Our economy has many strengths but it cannot realise its full potential due to constraints on connectivity. The South West is perceived to be distant from our centres of commerce as a result of journey times and the lack of resilience on its strategic road and rail network. Improving journey times and strengthening our routes into the South West peninsula are needed so that predicted increased volumes of people can have greater certainty about their journey, with networks more reliable and responsive to weather impacts or incidents. With respect of the strategic road network our priority is to secure investment to enhance the A30/A303 route to create a higher quality 2nd strategic route into the South West Peninsula.

Regarding the rail network, our priorities are securing investment in the critical Dawlish and Teignmouth cliffs sections of the Paddington mainline to ensure they can withstand the impacts of extreme weather events, which are expected to increase. Network Rail predictions identified that unless action is taken, similar events to those experienced in 2014 will occur 1 in every 4 years by 2065. The PRTF 'Closing the Gap' 20 year plan[1] report sets out the priorities regarding rail improvements

Traffic models built for the A30/A303 study predict that as traffic flows increase and conditions on the A358 and M5 deteriorate in the future, drivers will continue to choose the A30/A303 route. The traffic models also show that if improvements to the A358 are delivered, the vast majority of drivers will continue to choose the shortest route along the A30/A30.

The County Council is preparing a business case for improvement to the North Devon Link Road (A39/A361) and plans to make a submission in December 2017 in order to draw down

[1] https://peninsularailtaskforce.files.wordpress.com/2016/11/prtf-closing-the-gap.pdf

Local Majors funding. This investment is critical to the future growth plans for North Devon and Torridge – it would enable the area to strengthen its economy. The route suffers from congestion during peak hours between Barnstaple and Bideford and has high accident severity rate and low resilience when collisions occur. There is a danger it would fall further behind the rest of the country without investment in its transport infrastructure.

The motorway network around Exeter is a constraint to future growth not just within the Greater Exeter Local Plan area but also for the peninsula as it serves as a Gateway to Plymouth, Torbay and Cornwall. Congestion occurs during peak periods between M5 Junction 29 and 31 and will undoubtedly impact negatively on future economic growth plans for the sub region, therefore investment is needed, i.e. managed motorway.

Question 3: How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Through the Devon Structure Plan in the early 1990s a strategy was developed to accommodate a significant proportion of housing growth associated with Exeter and Plymouth at two nearby new communities – Cranbrook and Sherford respectively.

Cranbrook and Sherford are both in the process of being delivered, reaching different stages. Development commenced for Cranbrook in June 2011 with the first residents moving in during July 2012. 400 new home occupations are delivered in Cranbrook per year, a rate high for anywhere in the UK. In close proximity, skilled employment opportunities are being created with the development of Skypark and Exeter Science Park. Sherford is located within Plymouth and South Hams local authority areas. House building commenced in July 2016 and it is hoped the first residents will move in 2017.

A key criterion for the progress and now rapid delivery of homes at Cranbrook and employment opportunities nearby was early help from the Homes and Communities Agency who initially funded place-making facilities including the primary school, low carbon heating and other major infrastructure thus unlocking the development. The investment directly resulted in the delivery of homes.

Commencement of delivery at Sherford was initially slow. However, the Homes and Communities Agency injected £32 million into Sherford in 2013 which was critical to get work underway. Since this investment there has been significant progress, demonstrating the clear relationship between infrastructure investment and provision of homes.

It is clear that front loading funding to put in place infrastructure was fundamental to unlocking these two new communities. Given the current and widespread concerns over development viability, some form of government support for infrastructure delivery will continue to be vital to ensure early delivery of large sites going forward.

The financial landscape for funding transport infrastructure has changed following a significant reduction in the level of flexible funding available to local authorities. The Local Transport Plan Integrated Block has been almost halved since 2010/11 to help fund Growth Deals.

The Growth Deal process was intended to enable decision-making at a local level with greater influence from the business community; however we have found the process cumbersome, inflexible and inefficient in terms of use of resources for developing schemes. That said, it has meant that we have needed to change the way in which we use our integrated block funding, with a greater focus on prioritising strategic projects directly linked to delivery of housing and jobs. The change prompted the production of a Transport Infrastructure Plan to set out the priorities for investment (linked to Local Plans). This is

consistent with our approach with education infrastructure planning, where we also have a plan in place, which gives the development industry, key stakeholders and members greater clarity on future priorities and allows us internally to develop a pipeline of projects.

With reduced funding directly available to us, much of our funding is increasingly used for forward design of schemes or contributing match-funding to grant programmes. This has proven very successful in recent years where we have been able to take advantage of a range of Government funding initiatives, and not be reliant on Growth Deal funding. I have included a Table in Appendix 1 to demonstrate this. This shows over £100m of transport investment delivered in the Exeter and East Devon Growth Point area (to unlock strategic development sites on the edge of Exeter, in Cranbrook, Exeter Science Park and SkyPark). The majority of these programmes have required significant match funding and we have worked effectively in partnership with the district councils and developers to secure S106 to enable early delivery of infrastructure. Devon County Council's proactive approach to getting schemes shovel-ready has meant that we have been able to take advantage of funding opportunities when they arise. We have a strong track record in delivering schemes on time and to budget and hope that Government departments recognise the positive contribution we are making to support housing and jobs growth across the County.

Question 10: What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

Devon County Council, as a strategic authority, has a number of major statutory duties relating to the provision of infrastructure – including transport, education, youth provision, social and adult care services and libraries.

Since the introduction of the Community Infrastructure Levy (CIL) the roles of Local Planning Authorities (Charging Authorities) and upper tier authorities has changed significantly. For the County Council the greatest issue is that the responsibility for mitigating development is retained without the direct control over securing the funding required to mitigate the development. The County Council and Local Planning Authorities have a positive, collaborative approach. However, there would be significant benefits if County Councils were given direct responsibility for a specific proportion of total CIL receipts.

The whole viability assessment process is also not currently fit for purpose. Local authorities are ill-equipped to challenge developers' claims that delivery of infrastructure is not viable. In addition, CIL rates and developer contributions are based on excessive assumptions on land values, minimising the adopted CIL rates and section 106 contributions. These issues cause significant difficulty in securing sufficient funding to deliver the infrastructure required, meaning development impact is often not appropriately mitigated. To avoid this, the planning system needs to be better equipped to either control or capture land value uplift.

Another issue associated with the operation of CIL is the lack of control over phasing, at present development can get ahead of the delivery of critical infrastructure. One option to address this could be some form of Grampian type control to ensure infrastructure is in place to support sustainable development.

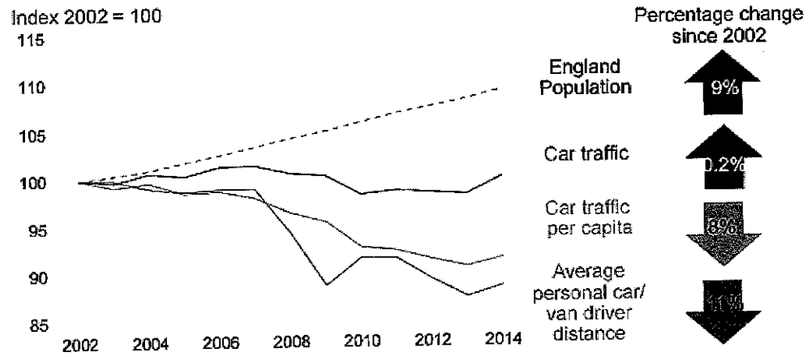
A revision to the current hybrid Section 106 and CIL approach would also improve the delivery of infrastructure. Site specific/allocation specific mitigation should be secured through the Section 106 process (particularly for strategic allocations) and a lower rate of CIL could be charged for all development based on use and scale. This approach would ensure that all development of certain uses would pay CIL which could be used for genuinely strategic infrastructure. Pooling restrictions would need to be removed to allow this to function efficiently.

TRANSPORT

Question 13: How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Since the turn of the millennium, travel patterns and trends have shifted away from the consistent increase in travel and car usage experienced through the latter half of the 20th Century to a levelling off in car usage since 2005 (DfT 2015 Road traffic forecasts). Alongside this, the 2016 DfT road traffic forecasts show that although car ownership and population are both rising, the average mileage per person is falling resulting in no rise in car traffic from 2002 to 2014 (see figure 1).

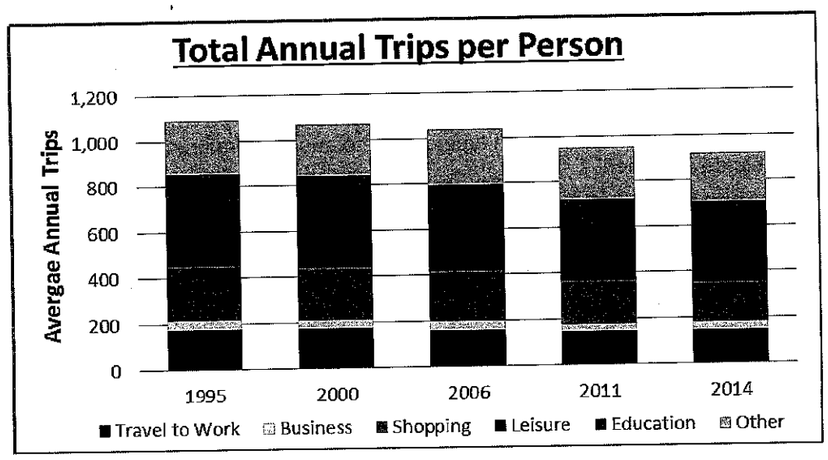
Figure 1: Average distance travelled per person (DfT: Road use statistics 2016)



This period included a recession which may have explained why travel has reduced, with 'business as usual' expected to return as the economy picks up. This is the view suggested in the DfT road traffic forecasts 2015 (para 3.14), although we would urge caution with these findings.

Further investigation of the causes suggests that the trend to travel less started at least 20 years ago and a fall in individual travel has been consistent. The National Travel Survey (NTS) has collected data on trips per person since 1995 and this data highlights that not only has the average number of trips per person fallen by 15% over this period (Figure 2) but that a fall in trips has been occurring year on year (even when GDP has been growing).

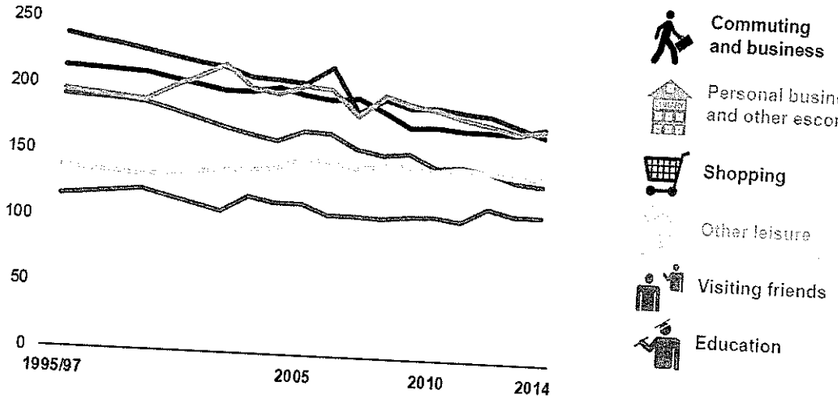
Figure 2: Average trips per person per year, by trip purpose (NTS)



Some of this fall is attributed to the significant changes in retail, where trips have fallen by 25% since 1995, linked to the rise of internet shopping. However, the number of trips for commuting, business and leisure purposes has also fallen by 15% - the impact of social media on reduced numbers of people may explain people visiting friends less. Only education (which is presumably pegged with population) remains consistent over this time (Figure 3). It is also worth noting that the reductions in travel of 12-17% are broadly consistent across the different modes, with only bus (-7%) bicycle (no change) and rail (+30%) not changing in line with these reductions.

Figure 3: Average trips per person per year, by trip purpose (NTS)

Average number of trips by purpose: England 1995/97 to 2014 [NTS0403]



These trends are clear, although the impact of this on the transport network is less so. Local data from Devon for this period shows that whilst on the local road vehicular traffic is either falling, or largely unchanged, the flows recorded on the Strategic Road Network have continued to rise. It is not clear why this is the case as intuitively it seems like digital access to services would be more likely to replace long distance journeys than shorter distance trips.

Looking to the future, it is reasonable to believe that enhanced digital connectivity will further offer an alternative to physical travel. This alternative digital access will, even when factoring in population growth, dampen any future traffic growth and most likely lead to a level of equilibrium where there is little further traffic growth. With 'digital accessibility' there are greater opportunities to access services without travelling, although people may be more inclined to travel by a mode where there can make more productive use of the transit time (such as Wi-Fi on public transport, or perhaps in a vehicle that they are not driving). What people will be able to do as a result of technology advancements and what people will want to do may be different and behavioural change is difficult to predict – for instance, although more people may be able to work from home as a result of better broadband connectivity, they may prefer human contact over a comparative isolated, lone working environment.

It would seem that the number of trips per person is set to continue to fall, although unless a purpose is fully replaced by digital access then the fall will slow and reach a reasonable minimum. With increased ability to access services digitally and a reducing need to travel, it seems likely that there may be a shift away from rising car ownership and a greater demand for either shared mobility or a modes with less substantial up-front costs than a car. This would seem particularly applicable for multiple car households and people may be more inclined to accept the reallocation of space currently given to highways, including car parking, to be reclaimed for public realm improvements or walking and cycling enhancements. This is

important in addressing the public health issue of people leading more sedentary lifestyles, potentially as a result of technological advancements.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?
Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

Exeter is the regional capital city and has the second largest geographic travel to work area in the UK, which presents a series of challenges, linked to future growth. Analysis suggests that there are substantially different travel patterns depending on whether the journeys are intra urban (i.e. starting and ending within the city boundary), inter urban (i.e. travelling from towns and villages to the city) or longer distance (i.e. affecting freight movements and wider connectivity with the rest of the country). The graphs in Appendix 2 illustrate how traffic growth trends in Devon vary between the urban routes of Exeter (which have decreased) and the rural roads (which have increased in line with national trends).

Previous Government studies, notably Eddington, emphasised the high value for money returns on improving Pinch Points. Devon has benefitted in recent years from Highways England and Local Pinch Point Fund opportunities, which have enabled highway improvements to help facilitate housing and jobs. Individually, the schemes provide significant benefit and offer good value for money; however, looking at the wider system, it is less clear whether this just shifts the problem to another part of the network.

Transport Appraisal still follows a traditional journey time/safety and congestion approach that was used in the 1960s and often fails to consider wider economic benefits (including unlocking development).

A significant amount of funding initiatives (notably Growth Deal transport funding) and investment in recent years have been targeted at traditional highway schemes in the interests of productivity, despite their being evidence that non-car mode investment can also boost productivity by increasing numbers of people accessing employment in congested environments. With historic city road networks reaching saturation point and with limited scope for additional road capacity, it feels that more funding should be directed to projects that increase the offer of alternative modes. The impact of technology creates opportunities to manage our networks more innovatively and plan our urban centres differently. Cities like Bristol and Cambridge have shown what can be achieved through significant investment in cycling, which has boosted numbers travelling more actively but also helped improve the quality of the urban environment, which we are keen to replicate in Exeter and our Devon towns.

Rail patronage has been growing significantly over recent years and provides an opportunity in centres with good rail coverage. The development of the Devon Metro system in recent years with 2 new stations delivered and 1 in progress is a very positive example of how we can maximise the use of the existing transport system. Similarly, many cities in the UK are now seeing cycle mode splits above 10% and, backed by quality design, offer significant potential to increase access into centres. In Devon, we have prepared a cycling strategy for the County, with schemes in preparation; however, without prospect of targeted funding and with Growth Deal generally not looking favourably on cycle schemes, there are challenges in delivering these ambitions. Traditional Park & Ride and/or Park & Rail schemes also offer an important means of increasing the number of people accessing a centre.

These measures offer the most realistic means of getting more people around our key economic centres and boosting productivity. By investing in town and city-based transport interventions which encourage shorter distance trips to be made more sustainably, it allows for

external car journeys (perhaps not able to be made by alternative modes) and freight movements to be moved more efficiently. The potential over forecasting of future traffic levels and under forecasting of rail patronage is an area that needs examining in more depth.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?
Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

Within rural areas, technology seems to provide an opportunity to deliver smaller scale public transport services that are more reactive to demand. This could include localised ride share, car clubs or other motorised shared mobility options. Essential to unlocking these is digital accessibility.

Devon is a large rural county with a significant part of the population outside of areas that can reasonably be served by conventional public transport services. We would therefore welcome any support towards trialling alternative measures that could present a more cost effective means of providing rural access.

As described in response to Question 1, investment in the strategic road (M5, A303, A361) and rail network (Paddington and Waterloo lines) is critical to ensure continued connectivity with the rest of the country, which is important for the South West region's economy.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

As with the trends identified above, we would expect that MAAS would be most likely to shift intra urban and shorter distance inter urban trips away from the private car to more sustainable modes. The impacts of this would be to remove traffic on local roads, particularly within urban areas, improving air quality and enabling the reallocation of road space for sustainable travel choices, such as public realm enhancements improving place-making and upgraded cycling infrastructure.

Although MAAS would ultimately encourage lower car ownership and in turn a greater propensity to travel by sustainable modes, a much lower impact on longer distance trips and the Strategic Road Network would be expected.

Yours sincerely,

[redacted] Signature redacted

[redacted] name redacted

[redacted] Job title redacted

Appendix 1

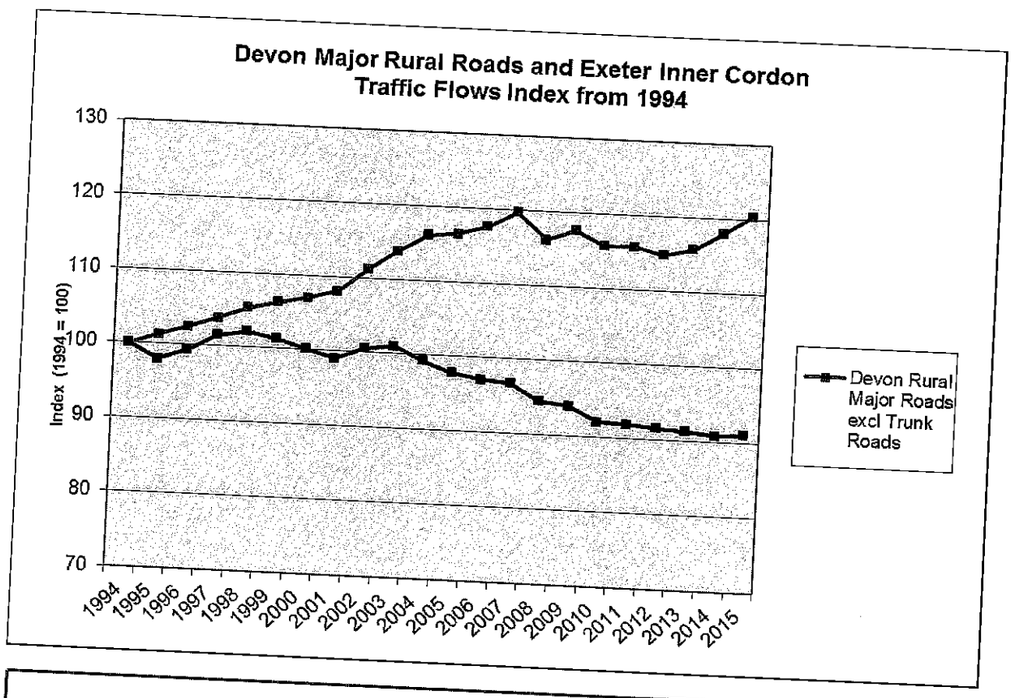
Scheme	Completed	Grant
Jct 29 (incl bus lanes)	10.5	Maj
Jct 30 Pinch Point	1	HAPPF
A38/A380 Splatford Split	5.5	HAPPF
Clyst Honiton Bypass	9	RIF, HCA
London Inn Square	1.6	
Cranbrook MLR (first phase)	6	RIF, HCA
M5 ped/cycle bridge	5	CIF
Cranbrook Station	4.5	
Road serving Cranbrook Station	2	
Newcourt Station	2	NSF
Airport Access Road	1.5	RGF
Anning Drive upgrade	0.3	
MET Office Link Road	1.4	GD1
Tithebarn Link Road Ph 1	3.7	LPPF, RGF
Cycle Demonstration Town	5.5	CE
Exe Estuary Cycle Trail	17	CE, CCF
Alphington outbound widen (PUA)	0.5	
Western Way widen PUA)	0.3	
Bridge Road widening	13.5	GD1, RGF
Tithebarn Link Road Ph 2a	2.2	G&HF
Sandy Park	2.7	GD1
Marsh Barton Station	7.4	GD1
Tithebarn Link Road Ph 2b	5.4	G&HF
Tithebarn Ped/Cycle Bridge	1.4	G&HF
Total	109.9	

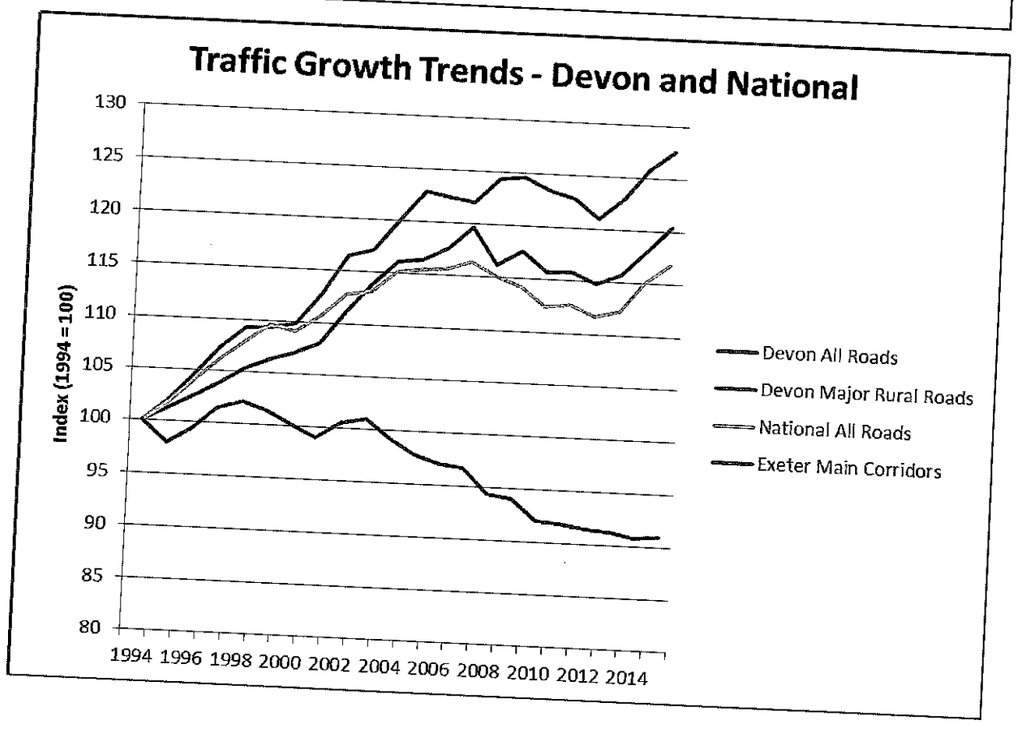
Rail	15.9
Ped/Cycle	30.5
Road	63.5
	109.9

Regional Infrastructure Fund	RIF
Major Schemes	Maj
Highways Agency Pinch Point Fund	HAPPF
Homes & Communities Agency	HCA
Community Infrastructure Fund	CIF
New Stations Fund	NSF
Regional Growth Fund	RGF
Growth Deal 1 - LEP	GD1
Local Pinch Point Fund	LPPF
Growth & Housing Fund	GHF
Cycling England	CE
Coastal Communities Fund	CCF

where blank, assume S106 or Local Transport Plan

Appendix 2





National Infrastructure Assessment – Call for Evidence

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9 February 2017

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DONG Energy Company Profile

DONG Energy is one of the leading energy groups in Northern Europe. Headquartered in Denmark, DONG Energy has around 6,700 employees, including over 800 staff in the UK. The Group generated DKK 61bn (GBP 7.1 billion) in revenue in 2016.

DONG Energy is a global leader in the development, construction and operation of offshore wind power, and the UK is our largest market. In the UK, we also sell electricity and gas to the industrial and commercial sectors and are in the process of constructing our first energy from waste enzyme technology plant, REnescience in Northwich in Cheshire.

DONG Energy's UK offshore wind activity is focused across three key hubs: in the North West in Barrow-in Furness and Liverpool, and in Grimsby.

Cross-cutting issues

1) ***What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?***

- As a company, we've made great progress in developing low carbon infrastructure in the UK. In 2016, we took important steps in the green transformation with the decision to invest in Hornsea Project One wind farm, which will be the largest in the world. We also initiated the construction of the world's first commercial-scale REnescience plant in Northwich that converts unsorted household waste into green energy.
- Investment in the offshore wind sector has supported sustainable economic growth across the whole of the UK and created thousands of highly-skilled jobs. Both as a country and as a business, we are leading the way in offshore wind infrastructure but this is a story that is just beginning. Much work has been undertaken by us (as developers) and the wider supply chain to help drive down the costs of offshore wind and continued support from Government will help to reduce costs even further.
- DONG Energy has committed to significant investment in offshore wind projects in the North West and North East:
    - We plan to invest £5.4bn in our projects in the Irish Sea up to 2019, generating £2.7 billion Gross Added Value (GVA) across the UK by 2025. We currently employ over 120 people in Barrow-in-Furness on long term, high pay jobs, and we expect this figure to grow to 200 following the inauguration of our Walney Extension wind farm. Our investments in Cumbria are estimated to generate £220 million GVA in the local economy by 2025. In the Liverpool City Region, further investments will support an average of 50 jobs from 2005-2019, rising to around

75 long-term jobs thereafter and generating around £70million in the local economy by 2025.[1]
    - In the Humber, we plan to invest £6bn in our offshore wind projects by 2019[2], including our plans to are building the world's largest offshore wind operation and maintenance hub initially to support our Westermost Rough, Race Bank and Hornsea Project One wind farms. This hub will create over 200 jobs long-term on top of the 38 people we currently employ here, as well as strengthening the offshore wind pipeline for the local supply chain.
- In addition to making a significant contribution towards decarbonising the UK power system, Hornsea Project One is a huge infrastructure project which is providing a real boost to UK firms. So far, our supply chain agreements for this project include:
    - a multi-million-pound contract to Babcock International for the world's **first offshore reactive compensation station**, securing around 100 jobs at their facility in Rosyth, Scotland;
    - a contract with Bladt Industries to supply 56 transition pieces from the Offshore Structures Britain (OSB) facility in Teesside, safeguarding 200 jobs;
    - the biggest contract in JDR's history to supply 242km of array cables for the project.
    - Ordering 95 towers and making a multi-million pound investment in CSWind's offshore wind tower manufacturing, enabling a new facility to be built in Cambeltown in Scotland.
- In the longer-term, we see significant potential for further growth in the Humber through both our Hornsea Project Two and Hornsea Project Three wind farms. Together, these two projects would have a capacity of over 4GW and could meet the electricity needs over well over 3.5 million homes, bringing low carbon power to the UK through sustainable economic growth, and creating hundreds of high value jobs in the process.

2) How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

- For offshore wind, port infrastructure is key to enabling projects to be built efficiently through easy access to suppliers across Northern Europe. It is also important in helping to develop the UK's supply chain.
- The UK has good shipping connections to the rest of Northern Europe and the USA, putting it in a strong position for offshore wind exports. Last year, we spoke to 10 of our suppliers (from smaller, entirely UK-based firms to large international companies with UK facilities), 70% of whom were already exporting out of the UK. For example, JDR cables in Hartlepool has started to export its sub-sea cables to German offshore wind projects and is looking to new markets in US and China. DeepOcean, who install and survey subsea cable and is based in Darlington, is looking to expand its operations into Europe and China off the back of success in the UK, including a recent contract to install

[1] This includes direct, supply chain and induced jobs. The majority of these jobs will be direct jobs at our O&M facilities

[2] http://www.dongenergy.co.uk/news/press-releases/articles/dong-energy-to-invest-six-billion-in-humber-region-by-2019

nearly 100 cables on our Hornsea Project One windfarm. A full link to our study 'Maximising Offshore Wind Exports' can be found **here**.

- Last year, as Chair of the Offshore Wind Industry Council (OWIC), we led the cross industry 'East Coast Review' to identify opportunities for offshore wind staging and construction facilities on the UK's East Coast. The report showed the significant capabilities of the UK's existing east coast ports, as well as their potential for future organic growth to support the sector.
- The report found that over the last five years, owners of ten east coast ports have spent or committed more than £400 million on facilities that are either exclusively or partially focused on capturing offshore wind activity.[3]
- The review found that continued investment will be required to upgrade the UK's existing port facilities so they can handle larger components and support the growing offshore wind sector.

3) What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

- A combination of smart and flexible demand-side management, cost-effective storage and better interconnection will all help to better integrate variable forms of power generation into the UK grid.
- As an electricity supplier to the commercial and industrial sectors in the UK we see growing interest amongst our customers in flexing their demand for electricity.
- However, a number of barriers remain to the growth of DSR:
    - Many non-domestic customers will not know their site operational requirements until a month, or even a day ahead, and do not want to incur penalties for not being available.
    - Many customers also believe that they do not have any flexibility as they run 24/7 operations with little variation throughout the day.
    - Customers may not want to invest money when they do not have clear sight of the financial benefit.
- To address some of the issues around penalties, we have recently introduced a new product: our 'Renewable Balancing Reserve' means that industrial customers who agree to flex their electricity demand to share the financial benefits associated with lower imbalance charges.
- The product has several advantages over other DSR schemes – it requires no commitment as customers are able to choose whether or not to reduce their demand each time a request is sent, without any financial penalties for failing to respond. The service also runs throughout the year and not just during the winter.
- End consumers need greater support so that they can invest in automation to enable more flexible volumes, make these volumes more easily accessible and to prove the value of providing flexibility, especially in small adjustments without impacting operations.

4) How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets

[3] https://ore.catapult.org.uk/wp-content/uploads/2016/08/BVGA-17004-Report-r2-final.pdf, p.4

- Offshore wind farms are designed to operate for 20-25 years so we have no direct experience of decommissioning sites in the UK, where our oldest wind farm, Barrow, is 11 years old.
- After 25 years of operation, we are decommissioning our Vindeby windfarm in Denmark.
- The likelihood of life extensions will depend on the physical state of the wind farms and economics. This will likely depend on the cost of operation versus the power price, given that the subsidy will have finished after only 15-20 years.
- To date the technology has advanced so quickly that the new turbines available are significantly larger than those installed previously, making life extension unprofitable in some cases.
- However, even if all of the technology would need to be replaced, many existing sites would remain attractive given the high wind speeds and shallow water depth of the Round 2 and Round 3 sites, coupled with the fact that Crown Estate leases are often for 50 years.
- The way we maintain our wind farms is evolving and improving as new technology is developed and projects are further from shore. We are starting to use Service Operation Vessels (SOVs) that enable technicians to live offshore for extended periods, drones to monitor the windfarms remotely, and walk to work gangways to increase safety.

5) *What changes in funding policy could improve the efficiency with which infrastructure services are delivered?*

- The lack of visibility of future wholesale electricity market prices beyond a year let alone over the lifetime of an asset, combined with the absence of credible carbon pricing makes investment in large scale low carbon generation like offshore wind difficult and expensive, even as lifetime costs fall.
- Government support is therefore still needed to deliver big, capital intensive infrastructure projects like offshore wind and the Contracts for Difference (CfDs) have been an efficient way of delivering new capacity for low carbon technologies.
- We view the CfD process positively, having helped to drive clear cost reduction in offshore wind through early stage technology support and then through the introduction of competition through auctions as the sector has matured.
- The benefits of past Government support in the offshore wind are clear: we are consistently delivering our projects on scale and to budget and the cost of energy from offshore wind has fallen by 32% since 2012 and is now below the joint UK Government and industry target of £100/MWh four years ahead of schedule.[4]
- We congratulate the Government on their recent confirmation of £730 million new spending on CfDs, with the first £290 million to auction in April this year. However, we need further clarification on both the timings of the spend and the scope for the remaining £440 million to support further UK supply chain growth. Regular auctions, put into place by legislation would reassure industry that the money committed will be spent either this parliament or next. This needs to be accompanied by increased visibility of the overall LCF framework post-2020, which we hope will be provided in the Spring Budget.

[4] https://www.ft.com/content/e7cce732-e171-11e6-9645-c9357a75844a

6) *How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?*

- The need to decarbonise and reduce air pollutants will drive electrification in road transport. High shares of low-carbon vehicles in the economy, particularly electric vehicles, will require significantly higher levels of low carbon electricity production in the future.
- A greater uptake of electricity in the heating sector may also be required e.g. through domestic and commercial heat pumps. Additionally, there remains a diverse set of options for low carbon heat including biogas production from a range of sources such as DONG Energy's REnescience plant in Northwich.
- Demand for electrical heating and transport may compliment intermittent generation as it may be possible to time shift some demand to periods of high wind generation or low demand.
- There will need to be smarter demand side management with increased automation built into both existing and new electrical demand.
- Both generation diversity and small scale distributed generation will add to resilience. Improved battery technology in the electricity sector will also be vital.
- Offshore wind offers multiple system ration benefits. It can provide ancillary services such as enhanced frequency response, it generates for 80-90% of the time (we can operate at wind speeds as low as 3m/s and up to 25-30m/s) and load factors are on track to pass 50%. The largest possible outage is limited to the export cable capacity and we can now operate our wind farms at very large distances offshore.
- Big Data will influence smart meters, using algorithms that work on consumer patterns to save energy by analysing home occupancy and appliance usage.
- Increased interconnection including hydro-electric from Norway, nuclear from France, thermal from the Netherlands and hydro and geo-thermal from Iceland will all add to grid resilience while all helping to decarbonise the UK's electricity mix.

7) *What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?*

- Increased clarity is needed on the process for new and upcoming offshore wind designations. It is difficult for all involved in the consenting process to understand the position that all parties should take on new designations and any potential subsequent Review of Consent procedures. We would welcome a clearly defined process for designating new sites which includes timescales and procedures for the designations, as well as clearer and more defined management measures for the sites.
- Transboundary consultation – it is difficult to receive feedback from all stakeholders involved in transboundary consultation, although this does not mean that the applicant has not engaged with the relevant stakeholder. It would be useful to have a clear and defined procedure for consulting with transboundary stakeholders, particularly in light of a change in relationship at the European level with some transboundary bodies.

- Resource – statutory bodies are ill equipped to deal with the significant workloads that the NSIP process places on them. In some circumstances this results in a lack of response from those bodies on important legal issues. In other circumstances this has a knock on effect on the services those bodies provide outside of the NSIP process, as sacrifices are made to achieve the NSIP deadlines.
- In recent DCOs there have been several delays and late decisions – early communication of these delays would be welcomed by the applicants as this is the main benefit of the NSIP system in relation to certainty of the timescales.

8) ***How should infrastructure most effectively contribute to protecting and enhancing the natural environment?***

- Environmental Impact Assessments and planning policy already provide a strong framework in which to consider environmental impacts. Any additional requirements would need to be carefully considered in order to avoid adding excessive costs to offshore wind projects.
- More weight could be placed on the environmental benefits of offshore wind projects including both carbon emission and environmental offsets.
- For instance, work has been done which shows that some seals use turbines, which act as artificial reefs, to hunt prey. Researchers have also pointed to the fact that in the case of these seals, both wind farms were newly built and more seals may come to use them for finding food over time, particularly if the artificial reefs at the base of the turbines are not yet fully established.
- More research is needed to assess the environmental impact of offshore wind farms, which are becoming more widespread in the North Sea, and resolve the uncertainty as to whether the structures increase the amount of wildlife or just concentrate in in one area.

9) ***What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?***

- Any infrastructure planning should factor in externalities such as a carbon price. This price should be consistent with the long-term targets laid out in UK carbon budgets and wider externalities such as impacts on air quality.

Transport

10) What are the highest value transport investments that can be used to connect people and places, out of and around major urban areas?

- Hull and Liverpool are two of our key coastal hubs and areas of large investment for our wind power business. As such, we would support better rail connectivity between the two cities to help drive efficiencies, open up an economic corridor from the Humber to Liverpool and Manchester, and assist in the creation of a real Northern Powerhouse.

11) ***What are the highest value infrastructure investments to secure digital connectivity across the country (taking into***

consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

- We are behind the Government's plans to upgrade the UK's digital landscape. Poor broadband speeds could have an adverse effect on productivity for some of our suppliers because they are based on industrial parks with no residential addresses, so providers might be more reluctant to connect them. Good digital infrastructure would provide them with new opportunities for growth through better connected business and consumers.

12) Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it if digital connectivity is becoming a utility?

- We are behind the Government's plans in the last Autumn Statement to set aside £400 million for a new Digital Infrastructure Investment Fund and look forward to engaging with Government on its delivery. **Energy**

13) What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

- Our 5MW REnescience plant is good example of how household waste, rather than going to landfill and emitting greenhouse gases, can be captured as a source of renewable gas for heat or power.
- From our perspective, the potential pathways to decarbonising heat must also be looked at within the context of the wider energy system.
- Increased electricity from offshore wind will certainly have a role to play in a highly decarbonised electricity future, when heat pumps or District Heating (DH) would have the added advantage of being able to use low-cost surplus renewable electricity.
- This concept is already used in countries with large amounts of renewable electricity in their energy mix – for example in Sweden, where a melting Spring and Autumn rains create surplus electricity from Hydropower which is sold cheaply and used for heat and hot water energy storage.[5]

14) What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

- The optimal energy mix in 2050 is impossible to predict given uncertainties around technological developments, cost and future consumer behaviour.
- However, given the significant natural resource (sites in shallow water with high wind speeds) and the recent rapid reductions in cost, UK offshore wind will form an essential part of any model for a zero carbon power sector by 2050.
- To reach a carbon intensity of 100g/kWh in 2030, the Committee on Climate Change (CCC) has forecast between 4-7GW of installed CCS

[5] https://www.theccc.org.uk/archive/aws/IA&S/Element%20Energy%20-%20Decarbonising%20heat%20to%202050%20-%20Report.pdf, p.32.

capacity by 2030[6]. However, the likelihood of the UK achieving this is diminishing following the recent government abolishment of the CCS demonstration programme.[7]

- New nuclear build is currently running behind schedule and a recent study has proposed that, by 2030, most of the available onshore wind and solar sites will have been exhausted – especially when taking into consideration land that could be needed for housing, further woodland, crops for biofuels and crops to increase Britain's food security.[8]
- Combining the CCC's low nuclear and no CCS power sector scenarios, it looks likely that 30 GW of offshore wind will be required in 2030.[9] This is easily achievable given that The Crown Estate and the CCC have both estimated that offshore wind has a potential resource of over 400 TWh/year from fixed foundations only – greater than total UK electricity demand in 2015.[10]
- Offshore wind has fewer barriers and risks to its roll-out than other options. For example, onshore wind and new nuclear face larger site restrictions and potential public opposition. Development of offshore wind therefore hedges against the risk that other options are constrained. This is particularly important given ongoing delays to nuclear and CCS.
- From 2010-2015, the UK has had an average build rate of 1GW offshore wind per year. Taking into account offshore wind's current trajectory, UK wind resources and the Government's need to meet its decarbonisation targets, the UK clearly has an unparalleled opportunity to develop offshore wind in the decades to come. The sector has the potential to become one of huge economic importance to the UK, supporting a thriving domestic supply chain and exporting technology all over the world.
- An average build rate of 2 GW offshore wind per year post-2020 is achievable and would leave the UK with 30 GW by the end of 2030. In order to achieve this, we need to plan ahead. Offshore wind farms can take as long as up to ten years from the award of the lease by The Crown Estate to first power generation.

Solid Waste

15) Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

- We recognise that EU framework has been a main driver of emissions reductions in the waste sector. Since 1990, waste emissions have fallen

[6] CCC (October, 2015). *Power sector scenarios for the fifth carbon budget.* Available online: https://www.theccc.org.uk/publication/power-sector-scenarios-for-the-fifth-carbon-budget/

[7] In November 2015, the UK government cancelled its £1bn ringed-fenced capital budget for carbon capture and storage (CCS) competition.

[8] http://www.cisl.cam.ac.uk/business-action/natural-resource-security/natural-capital-leaders-platform/pdfs/Land_Use_Press_Release_25_June_2014.pdf

[9] https://www.theccc.org.uk/wp-content/uploads/2015/10/Power-sector-scenarios-for-the-fifth-carbon-budget.pdf, p.96. Each scenario suggests a likely build rate of 15 GW in the 2020's (figure will increase with both combined to ≃20 GW).

[10] https://www.thecrownestate.co.uk/media/5493/ei-offshore-wind-cost-reduction-pathways-study.pdf

by 74% largely due to the UK Landfill Tax, introduced to meet UK obligations agreed to under the EU Landfill Directive. Clearly, it is important that this framework stays in place following the Brexit negotiations to continue to reduce emissions and divert biodegradable waste from landfill.

- Continued support for biogas technology is needed, especially in light of the closure of the Renewables Obligation (RO) scheme to new capacity on 1st April 2017. This can be achieved through the reinvigorating of feed-in tariffs (up to 5 MW) and, in the case of renewable heat, with continued support through the RHI. Given the right support, the biogas sector has massive growth potential over the coming years and needs to become an integral part of UK energy policy.

16) What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

- The circular economy package is an important step in promoting the transition to a green, efficient and independent economy, and DONG Energy fully support the objectives. Development of technology is an important tool in achieving the ambitious targets. Hence, technology neutrality must be the guiding principle.
- A circular economy should not pick winners but rather promote innovation to enable the UK to develop the best waste treatment systems. Current ambitious reuse and recycling targets make it important for new waste treatment processes to be counted as recycling. The recycling of the economical valuable raw materials in bio-waste must be maximised.
- For these reasons, our REnescience technology can contribute hugely to a more circular waste economy. By treating ordinary unsorted household waste and turning it biogas, REnescience takes away the burden of source segregation from the public, allowing for improved recycling rates and simpler (and cheaper) collection regimes to be put in place.
- Often, the drive to maximise recycling and reuse can lead to collecting materials for which there is no obvious sustainable end market. This is particularly the case when the market for this collected secondary material cannot compete with the market for cheaper virgin raw materials.

Doosan Babcock response to National Infrastructure Assessment Call for Evidence

Submission deadline: 10th February 2017

Response submitted by: Ian Chisholm (ian.chisholm@doosan.com)

About Doosan Babcock

Doosan Babcock is a global engineering organisation with over a century's experience in the energy sector and offices throughout the UK, Middle East and Europe. We provide engineering, aftermarket and upgrade services to thermal power, nuclear, oil and gas, petrochemical and process industries. Doosan Babcock was acquired by Doosan Heavy Industries & Construction in 2006, a subsidiary company of the Doosan Group of South Korea.

Doosan Babcock has continued to grow by offering superior value to customers and through investing in new technologies. Our extensive focus on research and development in the thermal energy sector has established Doosan Babcock as one of the world's leading providers of green energy solutions. Namely our development of advanced efficient boilers, biomass conversion technology, smart energy products and stationary fuel cells has confirmed us as a reliable, clean and green energy solutions provider.

Doosan Babcock has experience of developing heat networks in Europe and an interest in expanding this offering in the UK. Specifically developing heat networks powered by fuel cells in urban areas due to the dual strategic benefits fuel cells can provide to energy policy through lower carbon and air quality policy through ultra-low emissions of NOx and zero particulate emissions.

Answers to questions
Answers have been provided to questions 1, 9, 19 and 20.

Cross Cutting Issues	
1.	What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?
To achieve the decarbonisation of heat and maintain on track for the 80% carbon reduction target set for 2050, then we must act now to modernise the existing gas infrastructure to accommodate hydrogen and also develop at a regional level a heat network infrastructure. This will also require the support for development of technologies to ensure a green supply of hydrogen is available within the same	

timescales.

This approach will further support the decentralisation model that delivers improved energy efficiency, resilience and air quality assuming investment is made in the supporting technologies that would deliver this vision, such as hydrogen fuel cells, and would bring an integrated approach to transport, electricity and heat.

In support of this, further consideration is required in terms of the development of the distributed network to ensure it is capable of a more localised energy production and distribution approach. The knock on benefit of this, is to ease the load and as such investment spend in the transmission infrastructure.

9.	How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors? *Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.*

To achieve a resilient infrastructure system, the Government needs to adopt a holistic approach to energy which takes into account the interconnection between heat, power and transport.

Game changing solutions such as hydrogen and fuel cells offer a range of benefits for the flexibility of the system. Clear understanding of these, and their interconnections, will help to optimise outcomes. For example, hydrogen is an excellent energy storage medium - avoiding the cost of renewables curtailment and simultaneously decarbonising heat, power and transport. Similarly, fuel cells as stationary power or CHP, with a hydrogen and heat infrastructure in place can deliver substantial benefits to the energy system such as resilience, the elimination of carbon from the heat sector, air quality benefits, efficiency, noise pollution etc.

Energy

19.	What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

Various solutions and technologies exist to decarbonise heat in a sustainable fashion. For example, heat networks are a key infrastructure investment in cities as is the upgrade of the existing gas network to accommodate hydrogen. As outlined in answer to question 1 and 9 heat decarbonisation policy and solutions such as heat networks should be developed in a way that not only takes into consideration carbon but also the significant impacts of air pollution to our health and life expectancy. According to modelling gas combustion is set to overtake road transport as the largest source of NOx emissions in Central London between now and 2020, and increase to 48% of total NOx emissions in Central London by 2025[1].

Non-combustion technologies exist which can support with heat decarbonisation whilst also generating negligible emissions to air, one such technology is fuel cells.

[1] https://policyexchange.org.uk/wp-content/uploads/2016/09/up-in-the-air-part-2.pdf

Fuel cells are currently more expensive than gas CHP. However, this is without the social cost of NOx and CO2 valued. Such social benefits should be taken into consideration when assessing the highest value solutions for decarbonising heat.

Doosan Babcock commissioned a report in 2016 *'Averting an emerging air quality risk'* which outlined the environmental risks associated with a move towards a decentralised energy model, and solutions such as fuel cells which can minimise harmful emissions. The report included a discussion on potential drivers and enablers to allow such solutions to compete on a fairer basis with a levelised cost analysis, recognising social costs, to support this. A copy of the report, which has previously been shared with the National Infrastructure Commission is attached for reference.

20.	What does the most effective zero carbon power sector look like in 2050? How would this be achieved? *Note: the "zero carbon power sector" includes the generation, transmission and distribution processes*

As outlined in answer to question 9. an effective zero carbon power sector would be one that considers the wider risks and benefits of the technologies deployed. For example, fuel cells as stationary power or CHP, with a hydrogen and heat infrastructure in place can deliver substantial benefits to the energy and transport systems such as resilience, the elimination of carbon from the heat and transport sectors, air quality benefits, efficiency, noise pollution etc.

dot**Built**Environment

Personal stories from millennials involved in delivering infrastructure.

Response to the National Infrastructure Assessment

February 2017

dot**Built**Environment (.be)
*is a **network** that promotes digital adoption across the built environment.*

About dot**Built**Environment

Launched in June 2016, we are a network of young professionals working across all aspects of delivering the built environment.

We believe that the built environment is at the heart of our global society. It builds the foundation of our communities and connects us to local services and the rest of the world.

Whilst wider society becomes digitally adept we still build as we have done for the past millennia.

We want to transform the built environment into the cornerstone of our digital lives. Creating a world around us that connects people to their community, their government and their economy.

We promote open collaboration between the people that plan, design, construct, manage and maintain the built environment.

web: www.dotbuilte.org
email: change@dotbuilte.org

We are delighted to submit our response to the National Infrastructure Assessment

dot**Built**Environment was founded on the principle that continuing to deliver the infrastructure in the way that we do is unsustainable. The sector does not present an attractive career path to bright young people who want to embrace digital innovation and 21st Century ways of working. We encounter barriers to innovation and productivity in our everyday working lives which in turn has an impact on value for the end user. We see unnecessary environmental and social costs in the delivery of assets and want to provide a platform for early-career professionals to create change.

In developing our response to the National Infrastructure Assessment, we organised a roundtable in December which attracted a range of views on whether we want to make a case for digital transformation, sustainability, placemaking or procurement models.

We are a voluntary start-up grappling with trying to build a new network and engage people in changemaking. We could not turn down the opportunity to influence the National Infrastructure Assessment, but similarly we do not have the capacity to conduct any rigorous research which would stand up to scientific scrutiny.

At the end of the discussion we realised that we all have personal experience which each provides a different first hand view of problems in the delivery of infrastructure. In the principle of “a picture tells a thousand words”, we present in this report a small number of personal pen-profiles which were collected in response to the NIA.

The responses include answers from young consultants, designers and contractors, as well as 3rd sector practitioners and academics in England, Wales and Scotland, representing the smallest SME to the biggest multi-national. We all share a passion for innovation and industry transformation. We volunteer to make the infrastructure sector a more exciting place for young people to work and improve productivity, quality and value of project conception, delivery and the end product.

The profiles presented in this report present nuggets of issues, ideas for change and the personal impact of the daily frustrations we face.The profiles may not appear consistent, nor is there a set theme, but they are written by people who are actively trying to make things better.

The construction sector employs 3 million people in the UK with such numbers it’s difficult to put a face to a problem, we hope that the following profiles provide interesting reading and a different angle to support your assessment.

Best Wishes

The dot**Built**Environment Team

Profiles

Neil Thompson

Construction

I lead digital transformation for a large contractor in the UK

How I want to work
I want my working environment to be mobile and reflecting my WIP to others in order to crowdsource expertise and develop my network

What is blocking me from working this way
Traditional ideas around working in site cabins and offices. We either need to be out on the field being productive or researching/participating in continuous improvement

How this is impacting my productivity
I believe the environment is the platform that culture should thrive on. Our relationships are adversarial and we all take advantage of the information asymmetries between parties... personally and commercially.

How I feel it can be improved
Two fold, stronger and more representative leadership. I'm not saying we need a god like a figure to save us. I'm saying we need small teams of 4/5 people that lead. Also, having organisations focus on collaborative environments, both physical and digital to build a more attractive culture.

Alex MacLaren

Architecture and Higher Education

I work part-time as principal in a small architecture practice and part-time as an assistant professor at a university. My work means I need to travel the length of the country (between Edinburgh and London) frequently, sometimes twice a week.

How I want to work
I need to be able to work efficiently in transit, as I spend much of my time in transit. As 3/4G has got better, and wifi more widely available, I have increasingly begun to rely on text-based online comms and on Skype (phone can be less effective in noisy and public environments). I want to share images easily: often a diagram is easier to explain something than text. I want to communicate with more than one person at once; I assume Skype and/or google hangouts will work for this; I am frustrated when bandwidth and/or infrastructure let's me down. I want to physically travel at flexible times of day. I prefer the train to the plane, as I get more done in static transit. When meeting times prevent me using normal train services, I use the sleeper train. The sleeper train has just installed USB sockets for phone charging. I love this.

What is blocking me from working this way
Poor digital infrastructure. (Improving massively, quickly, but my appetite is insatiable). Slow or dysfunctional train connections (thank god I don't have to use Southern Rail). Security is also an issue. Officially my academic workplace is not comfortable with me accessing a lot of my data whilst using an open network. Data security is important.

How this is impacting my productivity
If we wish to support portfolio careers and a migratory workforce, -and/or flexible working, we need to provide reliable, digitally-enabled transport infrastructure. This enables me to be productive whilst travelling: - a huge percentage of my time.

How I feel it can be improved
General investment in digital literacy (e.g. Doteveryone). Investment in wifi and 4G infrastructure Acknowledgement of value of quality transport infrastructure- emphasis being on affordability and reliability. (Speed becomes less important if productivity is enabled on board).

Dan Rossiter

Construction Education and Research

A chartered Architectural Technologist. I was born, raised, and live in Cardiff. I work for the Building Research Establishment (BRE) as a BIM specialist undertaking assessments, auditing, content development, training, research, and advisory services to support industry in achieving BIM Level 2. This role has me travelling across the UK

often, and occasionally across the globe. As such I rely on remote connections to access my work and attend meetings; making a stable internet connection a necessity. Also, as I travel often, I am a frequent long distance driver and public transport user.
How I want to work I want to be able to influence change nationally while working outside of London, in a city that contains my family, fiancee and social life without having to feeling left out. For obvious reasons London is typically the source of activity for national activities. To engage in such activities I require high quality video conferencing facilities and efficient transport networks.
What is blocking me from working this way The current data and transport infrastructure in the UK is not suitable for me to achieve this goal. Teleconference. Despite it's appearance, London does not have good teleconference capabilities. More often than not, I am 'skyed' into a meeting from a laptop showing connected to a single microphone in the middle of a table, where I cannot hear anyone clearly. Meaning that if I wish to contribute I need to do so physically. Road. Despite being only 150 miles apart, it takes three hours to drive from Cardiff to London. This is largely due to congestion and constant road restrictions which much of the M4 limited to 50mph. Also, due to known bottlenecks such as the Brynglas tunnels this can often be extended to four hours. Recent night closures for maintenance have also meant rush hour traffic cannot be avoided without significant redirection. Rail. Due to the delays on the road, rail appears to be an ideal choice. However, due to the ageing carriages in operation many of the trains I board do not have power outlets, or sufficient space for my laptop. Also due to the cost of tickets it is often cheaper for me to Drive as opposed to travel by train, providing no advantage to travel by rail. Air. While flights to London are possible, poor connection services to Cardiff airport mean that it is often quicker to travel by train which while no laptop space might be available, business calls can be made.
How this is impacting my productivity Heavy investment is being made my UK Government into BIM, and by extension the collaborative production of information. As it stands, I cannot collaborate with London based colleagues on equal terms unless I am attending physically; which decreases my utilisation rate as I cannot work effectively if at all in transit.
How I feel it can be improved Further research is required into non-office based working. Ideally, non-centralised working spaces designed to enable collaboration through remote working. Spaces such as these would limit my need for travel, lowering congestion and improving my utilisation rate. If I could work outside of London effectively, I could spend less time travelling, and more time contributing to the delivery of our built environment.

Mac Muzvimwe

Consultancy

Quantity Surveyor by trade but now a cost management team leader and Building Information Modelling into business as usual for the national business.

How I want to work
Flexible working, home, office, London.

What is blocking me from working this way
Travel to London is expensive and long; would good if trains ran on time and the wifi on the train was good.

How this is impacting my productivity
Missed opportunities if not based in London. Lost productive time as well.

How I feel it can be improved
HS3 should cover the forgotten South West. Better investment in rail and onboard wifi services.

David Knight

Structural Engineering

I'm a design engineer, with projects ranging from small footbridges to moving structures to large highway bridges.

How I want to work
I want to work flexibly, working in the most appropriate location with the right support and technology to assist that. I want to collaborate with the best teams wherever they are located.

What is blocking me from working this way

Mobile data services, particularly on London transport, are patchy and do not always support remote access to files and software. This robustness must be improved before cloud or distributed computing is feasible on the move.
How this is impacting my productivity Significant portions of my day are taken up travelling to meetings. This time could be better utilised.
How I feel it can be improved Increased funding for focused data services on the underground/on trains.

# Mark Morrison Bridge design	
26, male, father of 2, bridge engineer and property developer. Interested in transport infrastructure and smart cities. Day to day work involves bridge and ancillary civils design and assessment.	
How I want to work With flexibility of location and methods. Taking advantage of cutting edge technology and having the opportunity to step back and think about what I'm doing and consider other solutions or options.	
What is blocking me from working this way Tied to desk by company policy and the need for some softwares that can only be used on desktops. The nature of the work means you are often discouraged, not by people but by process, from stepping back and really thinking about what you are doing.	
How this is impacting my productivity If everyone works this way then we get locked into achieving excellence according to flawed processes and not excellence in our deliverables	
How I feel it can be improved Creating a digital open-source platform for all infrastructure.	

Anonymous

Not-for-Profit

Marketing

How I want to work
I want to work more flexibly and have the option to work remotely (from home).

What is blocking me from working this way
Management!

How this is impacting my productivity
I have to commute to work and the trains are not reliable, this eats into my working day and when there are problems with the trains going home this causes a high level as stress as I need to figure out how to get back for childcare arrangements. I am not particularly productive when worrying about how I am going to get home and continually checking national rail enquiries.

How I feel it can be improved
Better leadership and a shift in management attitudes and ultimately trust!

Ben Pritchard

Cross sector, but mostly infrastructure

Consultant based in London, work with organisations at all tiers of the supply chain and all shapes and sizes. Help them improve their operations, develop long term strategies for growth, improve their commercial and procurement practice creating a more collaborative approach to construction.

How I want to work
Flexible with my location, hours and duration of work, greater ability to access data from anywhere at anytime. Having more certainty in my commute. (I've made 40 delay repay claims in the last 7 months) Ability to be productive when traveling to work, from work and between meetings where appropriate. I lost an hour of my day last week because my paper season ticket had for the 4th time stopped working and needed replacing. Why do we still need and use paper tickets?? Where certain clients are in

remote areas having the ability to have high quality digital meetings. having a sector that embraces the principles of open data, sharing best practice in more measurable and tangible ways that supports the greater good of the industry. Having a common language for skills, costs, design etc to make the transfer of skills and information more seamless.

What is blocking me from working this way

A better-connected rail network (lack of 2g never mind 4g in some areas) Poor quality rolling stock, no wi-fi, no plug, barely enough seats, poor heating system, no tables. Poor communication. You mind less the delay if you understand what's going on. Lack of connectivity in rural areas makes working digitally difficult. A greater appreciation, understanding and implementation of cyber security and the benefits of open data. Creating and embracing a common data protocol that simplifies the way we approach and share information (look to things such as the banking sectors open API for learning)

How this is impacting my productivity

as an example, a major risk to HS2 is the congestion of our road network and general infrastructure making logistics a major concern and issue. The nuclear new build programme is only feasible with major infrastructure improvements in the first place. In past roles i would spend circa 30% of my working week traveling as a lack of connectivity meant face to face meetings could only be held face to face. little or no work could be done during that traveling time and as such productivity would not be as high as possible. simple operations (such as online contract management) become difficult when connectivity lacks. you are unable to fully operate the system 'in the field' as it is designed, it often crashes or times out and you end up having to do it again. All of this hampers productivity in an administration point of view, but also has a negative effect on the quality and accuracy of communication. A local road was extended to have a third lane last summer to ease congestion issues. Although completed in September, remedial works are required due to poor design that won't start until March, the third lane will have been coned off for over 6 months once it finally opens. What was built to ease congestion has created more through confusion and disturbance at a number of junctions.

How I feel it can be improved

Greater consideration of the long term requirements of the infrastructure asset when modernising. More design with the end user in mind and greater collaboration with them during the design process. A real push to improve connectivity (free wifi, 4g and 5g) across the UK. An emphasis at some point during education on how to maximise the ability to collaborate virtually. Too much emphasis currently is had on the need for 'face to face' to be physically 'face to face' to make a difference. More inclusivity across the UK in future investment, but also to support understanding why and what the knock on benefits of certain investments are to the wider economy. creation of a digital infrastructure that allows the sharing of information across the industry to improve standards when it comes to cost, productivity, H&S and anything and everything else we collect data for.

Anne Kemp

Infrastructure

Director BIM Strategy

How I want to work
Balance of home and office

What is blocking me from working this way
Internet / mobile connection - in rural location

How this is impacting my productivity
Loss of time travelling

How I feel it can be improved
Improved connectivity in rural areas

Tom Bartley

Highways Consultancy

I am a senior engineer completing an Engineering Doctorate in innovation in infrastructure delivery. Juggling trying to be an engineer, management consultant, academic and changemaker and also having a life. Dropping the occasional ball.

How I want to work
I want to work with people who think systemically, considering the consequences of actions and collaborating with others to solve problems together. I want my work to be supported by Information Technologies and process which work with the way I want to work, rather than present a fudge of “good enough”.

What is blocking me from working this way
A skills shortage, coupled with low margins preventing investment in business improvement, training and upskilling. It is very difficult to justify investing in training

people in basis collaboration and digital skills. Contracts requiring use to engage in joint ventures which means that there is no value in developing intellectual property, because we simply gift it to our competition.
How this is impacting my productivity Everywhere I look a see sub-optimal solutions which answer the small questions, but don't connect to answer the big questions. Jumping from project to project, constantly assembling and disbanding teams means that lessons learned don't get embedded and we revert to type or reinvent the wheel.
How I feel it can be improved Public sector clients providing an overhead for suppliers to engage in continuous improvement to enhance their competitive position. Encouraging contracts which support the delivery of outcomes above outputs.

James Daniel Infrastructure Services	
Head of Digital Engineering. Responsible for setting and delivering a BIM & Digital Engineering strategy for Skanska's Infrastructure Services business in line with the Skanska UK BIM & Digital Engineering Policy and Strategic objectives. Raising BIM awareness and competence across the business and in ensuring our supply chain are aligned with our BIM strategy and are able to deliver services which meet our BIM and digital engineering needs. Providing support to specific projects during the work winning phase and through the life of the contracts with the utilisation of specialist resources and by engaging, influencing and supporting the operational and maintenance teams.	
How I want to work Fluidly and dynamically across all elements of our business structure and supply chain.	
What is blocking me from working this way Financial commitment to change, Cultural commitment to changing the way things are done.	
How this is impacting my productivity	

One accepts that there is to be a level of compromise in this industry, but all too often compromise in Digital evolution restricts good design and well maintained assets which in the long run shows poor quality choices.
How I feel it can be improved Increase the awareness of the benefit to change, and show that compromise isn't really the answer.

# Dwight Wilson Construction	
I'm an engineer specialising in the use of BIM and integrating digital solutions to improve project delivery.	
How I want to work I would like to work in a choice of environments best suited to delivering solutions to the problem at hand, this may take the form of collaborative co-working spaces free from the stigma of success at the cost of others but innovation through the strength of shared learning.	
What is blocking me from working this way Cultural inertia in how to collaborate for shared gains, although investment has risen on infrastructure projects for R&D still not at the required levels to filter into the rest of the industry. Contracts do not reward innovation thus it is not the imperative to innovate and share this learning. We do not invite enough cross industry expertise into our innovation teams, there is still not enough diversity of ideas across construction.	
How this is impacting my productivity Although I am aware of more effective digital methodologies to deliver projects, the opportunity to maximise their benefits is not presented on the majority of projects.	
How I feel it can be improved The leaders and those who hold client relationships need to be educated in the benefits of embracing more transparent digital methodologies. A culture of shared gain needs to be imbedded into the industry, as ultimately a non collaborative digital race to the bottom is far worse than the traditional one faced, and it's in everyone's interest to work together learning from each others lessons openly for a progressive fair and competitive market.	

Ana Tam

Heritage

I'm a conservator working to document, preserve and advise on heritage assets including buildings and public art.

How I want to work
I travel for work--anywhere from densely urban to more remote locations. I would like to travel more for work as I love what I do. But there have been times I've had to turn down work due to travel constraints, primarily because logistics clashed with available childcare options. I look forward to driverless vehicles because I am hoping it will allow me to use my travel time more effectively and productively while still getting me (and some materials and equipment) to any far flung place on the road network (and not be limited by the rail network).

What is blocking me from working this way
Because of the non-location-specific nature of my work, it would be immensely helpful to be able to access childcare “on the road” with 'Hub' areas, not just in town centres but also by main stations and park & ride locations where there would be amenities like wifi, gyms, and childcare facilities or at least child-friendly places such as toy libraries or regular libraries for ad hoc use, so that at key nodes of the transport network there are childcare support options as readily as there are cafes and mini supermarkets.

How this is impacting my productivity
Being able to work remotely helps bridge the childcare gap thanks to more cloud-based working but this is very reliant on sustained connectivity (wireless, 4G, etc.).

How I feel it can be improved
If only childcare was part of our infrastructure. I wait in hope whenever I read of projects like this:
http://www.nesta.org.uk/blog/childcare-next-grand-infrastructure-project

dot**Built**Environment

change@dotbuilte.org

Led and compiled by [name redacted], [e-mail address redacted]

National Infrastructure Commission: Call for Evidence on National Infrastructure Assessment
Submission from Drax Group plc

Cross-cutting issues

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

The UK has historically been and will continue to be a trading nation. Having modern, high-quality port facilities in place to support and facilitate this trade – particularly as the UK focuses on brokering new international trade deals with other nations in a post-Brexit environment – is essential to the UK's future global competitiveness.

The North of England is a 'super region' for freight that handles around a third of UK road, rail, distribution centre and port activity against a population that only represents 24% of the UK total. It is also home to several major port, distribution and haulage companies. Drax has directly benefited from its proximity to these trade gateways: last year, nearly six million tonnes of compressed wood pellets arrived into four northern ports and were subsequently transported by rail to Drax Power Station. Transporting these shipments by waterborne and rail freight (as opposed to road freight) enables Drax to significantly reduce the carbon footprint of its supply chain, as well as being more cost effective for the business.

Another key component to the competitiveness of the UK economy going forward is access to affordable sources of low carbon energy. In recent years significant progress has been made by renewable generators through innovation and learning-by-doing to drive down their costs: for example, a recent report by Arup for BEIS found that the costs of converting coal power stations to biomass have reduced by approximately 23% since 2013.[1] The report found that other renewable technologies have also achieved cost reductions of similar magnitude.

As renewables have not yet reached the point where they are commercially viable without some level of support, the Government's focus in the coming years should be to continue to support low carbon technologies that achieve decarbonisation in the power sector at least cost to the consumer. In making their assessment on the 'affordability' of different technologies, they should consider not just the cost of constructing and operating a power installation – the 'levelised cost' – but whether these technologies also impose additional costs on the system. For example, the intermittent nature of wind and solar means that National Grid as the system operator must accrue additional costs to balancing the energy system during periods when the wind isn't blowing and the sun isn't shining. These costs are not currently paid by these technologies but rather are socialised across all generators – and ultimately passed on to consumers. A more holistic analysis of different renewable technologies would therefore capture these 'system integration' costs, which of course can be mitigated to some extent by the presence of flexible generation on the system. Imperial

[1] Arup, 'Review of Renewable Electricity Generation Cost and Technical Assumptions', pg. 8, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/566718/Arup_Renewable_Generation_Cost_Report.pdf

College London together with NERA Economic Consulting has undertaken significant research over the past two years to quantify these system costs.[2]

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

Clearly a key consideration for policy-makers is whether the objective of a new capital project can be achieved through alternative means without the associated outlay. This issue is particularly relevant to the UK energy sector, where a number of large power stations face decommissioning over the coming years due to a combination of challenging economics and environmental regulations, yet remain essential to the country's energy security in the near term.

The £700m biomass conversion project undertaken at Drax Power Station illustrates this point. By converting three of its six generating units from coal to sustainable biomass, Drax has become the UK's single largest source of renewable electricity in just three years, generating 22% of the country's renewable output in 2016. Given that Drax is an existing asset with connections to the national grid already in place, the capital cost of securing the same amount of renewable power through alternative new build projects would likely be several multiples of this investment.

Maintaining and repairing existing energy assets also delivers significant socio-economic benefits to the communities in which they operate. Research undertaken by Oxford Economics on behalf of Drax last year found that around 14,150 UK jobs are supported by Drax Power Station and Drax's retail business Haven Power.[3] This includes employees directly employed by Drax as well as indirect and induced employment across Drax's supply chain. Drax also contributed around £1.2bn towards UK GDP in 2015. In the event that Drax did not take the decision (supported by the Government) several years ago to convert three of its coal units to biomass, the socio-economic footprint of the company would be far lower, reflecting the challenging regulatory and economic outlook for coal generation.

It is clear that new generation capacity is required to at the very least offset that which is coming off the grid. Inevitably private investment will only come forward to support this capacity if investors believe that they can get a reasonable rate of return, underpinned by stable and long-term revenue streams. The Government has been relatively successful in recent years bringing forward new renewable capacity through support schemes such as the Renewable Obligation, Feed in Tariffs and Contracts for Difference. However it has been less successful incentivising new gas generation through the Capacity Market, which has consistently produced a clearing price lower than that required to support a new build gas plant. The Government has already explored creating a more level playing field for auction participants by removing certain 'embedded benefits' enjoyed by embedded generators such as diesel, who as a result can afford to submit a lower bidding price. However, further action may be required in this area if the Government is going to deliver the additional gas generation required to provide baseload and/or flexible peaking.

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[2] NERA Economic Consulting, 'System integration costs for alternative low carbon generation technologies – policy implications' (2015), https://www.theccc.org.uk/publication/system-integration-costs-for-alternative-low-carbon-generation-technologies-policy-implications

[3] Oxford Economics, 'The Economic Impact of Drax Group in the UK' (2016), http://draximpact.co.uk/public/Oxford_Economics-Economic_impact_of_Drax_in_the_UK.pdf.

Transport

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Over the last 10-15 years, the geographic pattern of UK trade has changed notably, with 44% of the UK's exports going to the EU compared to 55% in 1999. Much of this change can be accounted for by the economic growth in China and India, which along with the United States have emerged as increasingly important global trade partners for the UK. The US and China have also become the UK's second and third largest source of imports.

On the basis that these trends continue and UK trade patterns become more global in nature, we must ensure the infrastructure is in place to capture international trade from other competing trade gateways. It is essential therefore that government policy continues to support private investment in UK ports through complementary infrastructure investment in roads and more specifically rail connections to a focussed group of major ports. For example, Peel Ports has invested £400 million over the past three years to construct the Liverpool2 deep-water terminal, which will allow the port to handle two 13,500 TEU post-panamax vessels simultaneously – the largest container ships in the world. This investment will strengthen the Port of Liverpool's ability to capture trade via North America and the Panama Canal.

With the right focussed infrastructure investments, the Port of Liverpool can operate as the UK's west coast 'super port'. With the right investment in west-east coast rail infrastructure, there is an opportunity to develop a similar, complementary gateway on the east coast of England to capture continental trade and to allow for the interchange of shipments using the UK as an intermediate land bridge. To make such a project a reality would inevitably require close co-operation between private industry, local and central government. Drax notes with interest the 'Humber super port' proposal, supported by the Humber LEP, which would involve greater collaboration between ports on the North and South Humber banks; and the development of an enterprise zone at Teesport on the site of the former SSI steel works. Either of these projects would benefit from having a strong infrastructure link to the Port of Liverpool.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Despite the North of England's status as a 'super region' for UK freight, Northern transport networks in their current state pose capacity problems and gaps in connectivity that negatively impact the productivity of the region. As noted recently by Transport for the North:

"There is heavy concentration of freight activity on a relative small proportion of the North's road and rail network which are shared with high volumes of car and passenger train demand. The levels of utilisation and congestion that emerge present significant barriers to capacity and the efficiency of movement from/to and between North of England freight and logistics sites as well as sometimes competing demands for capacity."[4]

[4] Transport for the North, 'Northern Freight and Logistics Report' (2016), pg. 24, http://www.transportforthenorth.com/wp-content/uploads/TfN-Freight-and-Logistics-Report.pdf.

This is certainly Drax's experience. In recent years it has invested significant time and resources working with Network Rail and other stakeholders to identify areas where the travel time for biomass shipments can be reduced. As a result, the travel time from the Port of Immingham to Drax has now reduced from three hours 10 minutes to two hours 38 minutes, whilst the travel time from the Port of Liverpool to Drax has also reduced from 10 hours 42 minutes to six hours two minutes on some runs. However despite the efforts of Drax and Network Rail, a typical coast-to-coast rail journey from one port to the other would take approximately eight hours and 40 minutes between the ports. When compared to an equivalent road movement over the same distance taking three hours in normal road conditions, this illustrates how significant an obstacle this capacity constraint in the rail freight system is in harnessing the true potential of the UK's east-west port connectivity.

We would argue the highest value transport investment to facilitate the easier movement of goods across the region, whilst also benefiting easier passenger movement, would be to invest in a high speed freight rail link from the Port of Liverpool to an east coast import/export facility. Correcting what is a disproportionately high travel time between points, given the distances involved and a significant drag on productivity. To address this issue, Drax and many other parties have called for Transport for the North to become a recognised statutory body, as was previously proposed by the Government, which would provide it with the necessary budget control and autonomy to deliver the investment required to resolve some of these constraints in the East-West transport axis.

Energy

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

In the near term, there is no single solution to completely decarbonise the UK heat network. Therefore, efforts from policymakers should be focused on promoting proven decarbonisation solutions that represent 'no regret'/'low regret' options – namely biomass heat, energy efficiency measures and heat pumps – that can help the UK make progress towards meetings it 2020 renewable heat target.

In the case of biomass, this solution has already played a significant role in enabling consumers off the gas grid to switch from fossil fuels to a renewable alternative. Under the Renewable Heat Incentive (RHI), biomass systems have accounted for 92% of all new non-domestic installations and 78% of total renewable heat generated. In the domestic sector deployment has also been successful, with biomass accounting for 34% of new installations and 56% of total renewable heat generated. Further deployment rates are likely to be bolstered by the Government's decision before Christmas to uplift the support rate for domestic biomass and combine the three non-domestic biomass tariffs into one single tariff.

In the case of heat pumps, whilst the Government has signalled its desire to support this technology through incentives such as the RHI, in practice the electrification of heat raises structural considerations for the power sector. The seasonal dimension of electric heating means that a significant volume of generating capacity will be required for a short period of time to meet peak annual demand. Previous government estimates place total UK peak heat demand at c. 300GW, compared to current peak demand in the electricity sector of c.

60GW[5]. This raises two questions: how to deliver the level of generation required for these peak periods, and how to avoid underutilisation of this excess capacity during the rest of the year. In such a scenario, cost-effective deployment of commercial storage at scale would be required to help alleviate the overcapacity issue?

In parallel with supporting these deployment-ready technologies, the government and industry should also work together to explore longer-term solutions that are not presently commercially viable or cost competitive but could deliver decarbonisation at scale in the future. These options include converting the existing gas grid to hydrogen or using the biomass supply chain developed for the biomass power industry to provide feedstock for the bio-gas industry. This could be supported/incentivised through for example a meaningful cost of carbon applied to the heat sector.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

The most cost effective zero carbon power sector is one that contains sufficient flexibility to minimise the amount of actions required of National Grid to balance the system. In recent years, the growth of intermittent sources of renewable generation to support the UK's decarbonisation has meant that National Grid has been forced to take an increasing number of these balancing actions to ensure supply meets demand. It also must ensure that the grid's frequency and voltage is balanced on a minute-by-minute basis. Historically these services have been procured by National Grid from large flexible thermal plant, which are well equipped to increase or decrease their output.

However, with a significant number of coal power stations expected to come off the system in the coming years, the number of operational plant technically capable of providing these services is dwindling significantly. For example, neither interconnectors, wind nor solar power can contribute to system inertia; interconnectors and solar are also incapable to providing dynamic response. As a result, between now and 2020 National Grid estimates that the costs associated with balancing the system will double to £2bn per year – costs that will ultimately be passed on to consumers.

The National Infrastructure Commission has already published a report on 'smart power', which outlines how additional flexibility can be delivered onto the grid through innovative solutions such as smart grids and energy storage. Whilst Drax agrees that these technologies will have a role to play on the grid in the coming decades, it is also important to recognise their technical limitations. It is clear that any future power mix will require a flexible, controllable source of generation to complement baseload technologies such as nuclear power and intermittent technologies such as wind and solar. Biomass power is the only low carbon source of generation that can provide this flexibility at significant scale. As previously noted, in 2016 22% of the UK's total renewable electricity was generated just from three units converted to biomass at Drax Power Station. These units have the flexibility to ramp up from 200MW to 645MW and vice-versa when needed by the grid.

[5] DECC, 'The Future of Heating: Meeting the Challenge' (2013), pgs. 102/103, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/190149/16_04-DECC-The_Future_of_Heating_Accessible-10.pdf

In the medium to long-term, there is a significant decarbonisation opportunity presented by combining biomass with carbon capture and storage technology. As analysis from the Committee on Climate Change notes:

"In the long term, if CCS can be successfully applied to biomass power generation, it offers a route to negative emissions through sequestering biogenic emissions. Our appropriate use modelling suggests that biomass with CCS is likely to be desirable if available since the stored emissions can be used to offset emissions in sectors that are particularly hard or expensive to reduce."[6]

Drax shares the view that the deployment of CCS for power, industrial and heat uses is crucial to the UK achieving its long-term decarbonisation ambitions. A key strength of the White Rose CCS project, of which Drax was a consortium member, was that the 'anchor' demonstration power plant provided significant CO_2 storage and transport infrastructure that multiple industrial users in the Humber Estuary could utilise. This 'anchor' model provided a number of financial and non-financial benefits including reducing the unit cost of CCS per MWh, establishing the pipeline infrastructure for future CCS projects, and simplifying planning and consenting.[7] On that basis we remain of the view that this is a model that the Government should continue as part of its on-going review of the potential for CCS following its decision to cancel the CCS Commercialisation Programme in 2015.

The most cost effective way to achieve the investment required in the power sector between now and 2050 is to have a meaningful carbon price that sends out a clear price signal to investors. To date the UK has taken a leading role on carbon pricing, introducing a Carbon Price Support mechanism that provides greater certainty to investors than the EU's Emissions Trading Scheme. The Government has committed to providing further information on the trajectory of the Carbon Price Support beyond 2020/21 in the Spring Budget. Drax supports the extension of the Carbon Price Support at its current level of £18 per tonne of carbon through to 2025 at the very least. This would provide the industry with forward visibility on policy and help incentivise future investment in low carbon energy.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

The increased uptake of electric vehicles, combined with the electrification of heating the industrial, commercial and residential sectors, will inevitably result in increased demand on the electricity network. The net impact of this increase is illustrated in National Grid's 'Gone Green' and 'Consumer Power' future energy scenarios, which forecast annual electricity demand increasing from 334 TWh/year in 2015 to 352 TWh/year and 384 TWh/year respectively.[8] Commuting patterns will also have an impact, with many EV users returning home to recharge their vehicles during the peak evening demand period.

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[6] Committee on Climate Change, 'Biomass in power generation' (2011), pg.11, https://www.theccc.org.uk/archive/aws2/Bioenergy/1463%20CCC_Bio-TP4_power_FINALwithBkMks.pdf

[7] Dr Leigh Hackett, 'Commercialising CCS - What needs to happen?' (2016): http://www.icheme.org/~/media/Documents/icheme/Media%20centre/Policy%20reports/Commercialisation%20of%20CCS%20-%20What%20needs%20to%20happen%20-%20Presentation%20from%20Leigh%20Hackett%20December%202016.pdf

[8] National Grid, 'Future Energy Scenarios' (2016), pgs. 25/26.

Against a backdrop of large volumes of coal and nuclear thermal generation decommissioning over the coming years, this net increase in electricity demand would inevitably place significant pressure on new sources of low carbon generation to come forward – ideally located near to the large urban areas that are driving this demand.

From: <email address>
Sent: 07 February 2017 11:24
To: NIAEvidence@nic.gsi.gov.uk.
Subject: Energy efficiency as infrastructure
Attachments: Building the Future _Final report.pdf; Energy efficiency as infrastructure September Final.pdf

Dear Sir / Madam – in response to your call for evidence I'd like to draw your attention to two key reports setting out the case for making energy efficiency an infrastructure priority. This is the most cost effective way to de-carbonise heat. The reports are attached.

Best wishes

<Name>
<Job Title>
E3G
<Address>
Tel: <Telephone Number>
www.e3g.org

EAST RIDING OF YORKSHIRE COUNCIL

National Infrastructure Assessment. Call for Evidence

Response from East Riding of Yorkshire Council, Transport Policy

Question 1: What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

East Riding of Yorkshire Council and our partners in both the Humber Local Enterprise Partnership (LEP) and the York, North Yorkshire and East Riding (YNYER) LEP believe that there are significant gaps in east-west transport connectivity across the North of England which is restricting economic development and business performance both locally and at a regional level.

This lack of connectivity is evident in both rail and road links which diminish in capacity and capability east of the A1(M), resulting in congestion and unreliable journey times for traffic accessing the port facilities and emerging green energy industries alongside the Humber and for those travelling between the key cities of Hull and York. The growth of rural businesses in the East Riding of Yorkshire and parts of North Yorkshire, particularly in the tourism sector, is also restricted by the lack of access and connection to markets and the wider network.

The East Riding is seen as being at the periphery of the region, which inhibits inward investment and restricts the potential for growth in new businesses and associated job creation. The perceived lack of transport access to key employment sites, particularly for public transport users, restricts investment in residential development for potential commuters.

In addition, current proposals for improvements to rail and road links do not fully reflect the need for investment in connections to Hull and the East Riding of Yorkshire.

Improving east-west transport links by addressing transport issues that suppress economic growth is highlighted as one of the five strategic priorities in the YNYER LEP's Strategic Economic Plan. This will result in better access to customers, markets and labour and increased access to national and international market opportunities for local businesses. The issue of poor east-west transport connectivity in the Humber is also referenced in the Humber LEP's SEP (page 31).

Investment in improvements to both road and rail links would provide cost effective and deliverable benefits to the economy of the East Riding and the neighbouring cities of Hull and York, as well as to the wider North of England.

Current proposals focus primarily on connectivity between Leeds and Manchester, with some consideration for the positions of Sheffield, Liverpool and Newcastle. While these proposals are welcome they will have minimal impact for residents to the east, and improvements to the links to the port facilities and emerging green energy industries of the Humber as well as connectivity between Hull and York do not appear to have been fully considered. These links are critical to provide access to international markets for businesses across the North of England and fundamental to the successful development of the Northern Powerhouse.

Our recommendations for priority improvements to east-west connectivity across the north are:

- A1079 capacity improvements:
- Electrification of the Hull to Selby railway line: and
- A63 improvements.

These are described in more detail below.

As well as larger transport schemes, additional investment in flood alleviation measures would have a significant impact in terms of unlocking local development sites and improving the viability and long term sustainability of the area. Many businesses investigating potential locations cite flood risk and

drainage as one of their key concerns. If this was addressed through the delivery of significant flood alleviation measures in the East Riding it would provide developers with the confidence to invest in the area.

1. A1079 Capacity Enhancements

The A1079 forms the principal road link between the two major cities of York and Hull, connecting the port facilities in Hull with York, North Yorkshire, the A64 and A1(M) and onwards to the North East. It also provides a vital road link between numerous towns and villages, connecting residents to employment and services, tourists to local attractions and businesses to labour, suppliers, and markets.

Formerly part of the Strategic Road Network, the A1079 was 'detrunked' and transferred to local authority control in 2003. The Council has delivered several junction improvement schemes along the A1079 in recent years with a combination of DfT funding, local contributions and private sector contributions, including new roundabouts on the A1079 at Hodsow Lane, Pocklington and Holme Road, Market Weighton. However, larger scale capacity improvements have not been deliverable given the levels of funding available.

The A1079 is single carriageway for much of its length and is perceived by many users as slow and unreliable. Current use is constrained by capacity which in turn inhibits future economic development. There are also road safety issues on the A1079, many of which arise from drivers becoming frustrated with inconsistent speeds and taking risks by overtaking on single carriageway sections. Despite the introduction of junction improvement schemes, congestion and safety issues on the A1079 remain a high profile concern for both East Riding and York Councils and the local community. A local group, the Action Access A1079 partnership, is campaigning locally for improvements to the route, and local councillors and MPs have taken an active interest in the issue. The route is also seen by the YNYER LEP as crucial to the economic development of the area and the need to improve the route is included as a key priority in the relevant SEP.

The identified problems along the A1079 corridor can be summarised as follows:

- High existing traffic levels with up to 18,000 vehicles per day using the route, causing localised congestion:
- Low speeds along the route with average speeds of 28mph along some sections, resulting in driver frustration and delays:
- High variability between journey times throughout the day with a coefficient of variation of 0.57 along some sections in the AM peak, which affects business efficiency and quality of life for commuters:
- Up to 20% of total traffic flow is made up of HGVs and up to 18% of traffic from the Humber Ports uses the A1079 corridor, contributing towards unreliable journey times and slow average speeds:
- An average of over 13 casualties per mile along the A1079 corridor which causes suffering for individuals and results in significant costs to businesses in terms of delays and lost productivity: and
- Over 13,000 new houses forecast to be constructed along the A1079 corridor with additional significant projected employment development, which will increase traffic levels on an already congested route.

There is no direct rail line between the East Riding/Hull and York, with rail users having to travel via Selby or Doncaster, or via Scarborough, to travel between these two cities. This results in long journey times and means the train is often not a viable option for regular travellers. For example, the distance between Beverley in the East Riding and York is 30 miles but the average time to make this journey by train is two hours. This means that car travel is the only realistic option for many travelling between

York and Hull and the A1079 corridor will continue to be the main transport link between these two cities.

Upgrading the whole route or sections of it to dual carriageway standard would significantly improve journey times, journey time reliability and overall connectivity between Hull and York, the towns along the A1079 and onwards to Northern Yorkshire and the cities of the North East served by the A1. This will in turn support economic growth in the area by making it more attractive for investment. The results of an improved route would be:

- Improved journey times and journey reliability for users of the A1079, particularly for commuters, HGVs and port traffic:
- Improved safety for users of the A1079 and surrounding roads, footways and connecting routes:
- Support for potential future housing and employment development across the area as identified in York and East Riding's Local Plans: and
- Increased connectivity between York, the East Riding and Hull and support for local businesses to access labour, supplies and markets.

Feasibility on a proposed scheme to dual a 1 mile stretch of the A1079 between Barmby Moor and Wilberfoss has been completed, and has been shown to offer high value for money. However, the scheme cost is currently estimated at £28m, which is over and above the levels that the Council or the LEP could fund. A comprehensive study of the benefits of dualling the entire route would be extremely beneficial but has so far not been prepared as there has been insufficient funding to commission this major piece of work.

2. Electrification of the Hull to Selby Railway Line

In autumn 2013 the Government announced plans for the North TransPennine electrification scheme covering the Manchester to York and Selby rail line. This left a number of parts of the existing North Trans Pennine network including Hull, Middlesbrough and Scarborough without electrification schemes. The extension of electrification to Hull is important to the economy of the area as it would bring reduced journey times, and potentially improved rolling stock, both contributing towards making the area more attractive to do business in. Furthermore with some parts of the rail network electrified but others not, service planning becomes difficult if there is a desire to maximise the use of the electrified infrastructure.

The Northern Way study on City Region Connectivity highlighted that east-west connectivity has been greatly overshadowed by north-south links connecting northern cities to the south, particularly London. Barriers to physical movement, such as time and distance, are seen as a possible reason for the lack of interdependence and as a restrictor of growth. Whilst benefits achievable through improved connections to London are large, improving TransPennine rail connectivity is of greater benefit to the north.

Business to business connectivity is a key factor in supporting productivity growth across the wider North, therefore current levels of rail connectivity from Hull and the East Riding can be considered to be a major constraint. Hull is already disadvantaged both in network travel times and number of trains and this is likely to be exacerbated by exclusion from an electrified network.

Examination of the rail connectivity between the northern cities clearly demonstrates that Hull and the East Riding are limited not just by the geographical peripherality within the North but also by less frequent services and poorer access to the main north-south mainline route. Although partly addressed by the new Northern and TransPennine rail franchises, to achieve maximum benefits the

electrification of the route between Hull and Selby is necessary to ensure consistent connectivity across the TransPennine corridor.

The relatively low level of rail trips between Hull and neighbouring urban centres reflects the perceived limited rail connectivity between these areas. This is a contributory factor to low levels of business interaction and limits opportunities to increase economic activity. This situation will be exacerbated should part of the TransPennine Corridor be electrified and the section from Selby to Hull be excluded.

Rail journeys on the TransPennine Corridor from Hull are slow when compared with other city pair journeys and are not competitive with the car other than for city centre to city centre trips. The level of connectivity suppresses the level of commuting and restricts rail growth within the sub area, acting as a limiting factor on job mobility and economic activity. It can be concluded therefore that the North Humber Bank is hampered by some basic infrastructure deficiencies, including poor transport links to the rest of the Yorkshire & Humber region and beyond.

A consortia of private sector investors, led by Hull Trains and supported by MPs and local authorities, put forward the case for electrification of the rail line between Selby and Hull to the DfT in 2014. In November 2016 the DfT announced that they would not support this proposal, stating that the disruption caused by electrifying the line would outweigh any benefits and that the introduction of bi-mode trains by First Hull Trains and improved services on both the East Coast Mainline and the Northern Rail franchises meant electrification was unnecessary.

Both East Riding of Yorkshire Council and Hull City Council continue to strongly support the case for extending the electrification to Hull as soon as possible to enable the realisation of the potential opportunities offered by improved transport infrastructure and the wider implications for the emerging Humber economy. The need for an extension to the existing electrification programme is also referenced in the Humber Rail Strategy and Rail North's Long Term Rail Strategy.

3. Improvements to the A63

The A63 between the M62 Junction 38 and Hull is part of the Strategic Road Network, managed by Highways England. The route provides the principle connection between the national motorway network and the port facilities and emerging green energy businesses in Hull.

The A63 is a dual carriageway, representing a significant restriction on movement due to a reduced capacity when compared to the M62 link to the west. The route is particularly congested in the urban area of Hull especially during peak hours, and this results in slow and unreliable journeys and is a significant block on investment in the emerging Humber Green Port industries and Enterprise Zones, including the sites included in the recent extension to the Humber EZ.

A scheme for improvements at Castle Street in Hull has been developed and will be funded by Highways England. However, the construction start date for this has been continually put back, with a provisional date now of 2022. It is imperative that Highways England is enabled to deliver this scheme as quickly as possible to remove the restriction on access to the port facilities, to support the potential for developing green energy businesses and to facilitate east-west movement of people and goods across the North of England.

A63 capacity enhancements would allow businesses in the area to exploit the higher national profile created by the 2017 City of Culture designation in the years following and to provide reliable access to international freight connections for businesses in the North of England.

There is also localised congestion around busy junctions on the A63 in the East Riding such as the Welton/Brough junction, which provides access for residents in the growing town of Elloughton/Brough and for commercial users based at the former British Aerospace site (now Enterprise Zone). This Welton/Brough junction is a substandard design which results in congestion, queuing and risk, particularly at peak times. Development of the Enterprise Zone at the former British Aerospace manufacturing site in Brough is severely constrained due to the restricted access provided by this junction and the South Cave junction to the west.

Question 2: How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

The Humber ports provide key economic connections to our international partners and represent a vital outlet for business across the North of England and beyond. Hull, Goole, Grimsby and Immingham contribute £2.2 billion to the UK economy every year and the Humber ports support 33,000 jobs and together handle more than 65 million tonnes of cargo. There is ample scope for future development, particularly in connection with green energy industries and supporting businesses.

Anecdotal evidence suggests that many hauliers are now choosing to use the Hull ports and the links to Rotterdam to avoid the issues at Calais and the roads in the south of England which are perceived to be significantly more congested than those to the north. This suggests that the volume of freight traffic passing through the Humber ports could increase significantly in future years.

Current constraints are fundamentally transport related and need to be addressed through improved road and rail links to the existing national network. Over the next two decades access to these ports and the emerging green energy industries will be crucial to the successful economic regeneration of the region. Potential development of visitor based businesses will need better access to the cities of the North of England. Connection to the west and northwest needs to be improved to provide confidence in quick and reliable transport for businesses to reach their markets.

Question 3: How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Infrastructure and planning teams at local government level should continue to work closely together as the most relevant bodies to allocate and promote future sustainable development sites. The government's policy of developing brownfield sites as the ideal location for new development is welcomed, as these are often best located to access existing transport, employment, education, healthcare and other facilities. As such, brownfield sites often offer the best option in terms of reducing car use and encouraging sustainable travel from new development sites, with corresponding benefits to the environment and the individual.

For other development sites, use of Community Infrastructure Levy should be promoted where possible to ensure that new residents and businesses can access such sites using sustainable travel modes such as walking, cycling and public transport.

Question 4: What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

The East Riding of Yorkshire is essentially a rural area with a transport network connecting small towns. The potential for demand management on our routes is limited although the management of car parking in our busier towns does allow some influence on journey choice. Through the Council's

Local Sustainable Transport Fund project we worked closely with schools and businesses in the town of Goole and were able to demonstrate quantified impacts on travel patterns as a result of targeted marketing combined with infrastructure improvements to promote sustainable travel. A national report sets out best practice and lessons learnt through this process, and the potential impacts on modal shift as a result of targeted interventions – see:
https://www.gov.uk/government/publications/local-sustainable-transport-fund-what-works

The safety of road users, particularly walkers and cyclists, should be a key consideration in developing congestion management proposals. There is a perception (often accurate), particularly in some more built up urban areas, that those making trips by active modes specifically cycling are disproportionally at risk of being involved in a collision and this may deter some from making the switch from travelling by car.

The use of demand management techniques in some urban settlements may help to address congestion issues. This could be in the form of reallocating road space for public transport and walkers/cyclists, or the introduction of additional workplace parking levies at appropriate sites.

The effectiveness of demand management on strategic routes is less certain and would require very careful assessment to identify potential negative outcomes. For example charging on the Strategic Road Network would inevitably lead to displacement of traffic onto local roads which are already stressed in places.

Question 5: How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

In essence there is no point in building infrastructure which cannot be maintained and ensuring that existing assets are fit for purpose should be given priority over new build. The balance between capital and revenue funding is delicate and significant cuts to both funding sources have created issues for delivery bodies in recent years.

There is currently a disproportionate split between funding for local roads and the Strategic Road Network. The Strategic Road Network comprises only 2% of the total road network and whilst it carries 33% of all vehicle mileage it also receives over five times as much funding per mile than local authority managed roads ('A Major Road Network for England', Rees Jeffreys Road Fund study, October 2016 - http://www.reesjeffreys.co.uk/wp-content/uploads/2016/10/A-Major-Road-Network-for-England-David-Quarmby-and-Phil-Carey-Rees-Jeffreys-Road-Fund-October-2016.pdf)

This funding disparity looks set to increase still further with the introduction of the National Road Fund in 2020 funded by vehicle excise duty but for investment only on the Strategic Road Network. This must be addressed and further funding awarded for maintenance of local roads if these invaluable local road networks are to remain fit for purpose.

The Council recently bid for an additional £16.7m of funding from the YNYER LEP's Local Growth Fund to deliver an enhanced programme of maintenance on our 'A' classified roads. We were one of only two local authorities in England to bid for maintenance funding through this process. The Business Case for this was based around modelling and appraisal work undertaken using the Highways Maintenance Appraisal Tool (HMAT) developed by the Transport Research Laboratory (TRL) on behalf of the DfT. This allowed us to produce a BCR for the scheme of 8.36, which demonstrated that maintenance schemes can often deliver equal or higher value for money than new infrastructure schemes. This is important, and should be considered when funding streams are being developed and distributed.

Question 7: What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

Funding streams for infrastructure maintenance and improvement are increasingly short term in their outlook. For example, formula funding for local transport and maintenance schemes is only indicatively allocated until 2021, with some funding for sustainable transport only available for a single year (for example, the sustainable travel transition year fund). Other funding streams are announced at very short notice, and, whilst very welcome, put additional pressure on delivery authorities to spend this within tight timescales. For example, the recently announced National Productivity Infrastructure Fund was a completely new funding stream, announced in January 2017, with large amounts of capital funding allocated which must be spent in full in 2017/18.

There is also a recent trend towards competitive bidding for funds. The Council has been extremely successful in securing additional funding following the submission of high quality bids, and welcomes this process. However, this does put pressure on local authorities to have a number of 'shovel ready' projects lined up, and requires expertise of staff with experience in this field. The uncertainty around the bid process can make longer term planning more challenging. These bidding opportunities are usually for capital funding and we would welcome further opportunities to bid for revenue funding to ensure the long term maintenance of our existing assets.

Question 10: What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

There have been issues with developers failing to deliver infrastructure improvements conditioned as part of planning approval in a timely manner. This is, in part, due to a desire to comply with national planning guidance and allow development, often in marginal circumstances. There has been at least one case in the East Riding where Local Growth Fund monies have been allocated to a developer for a scheme already required as part of the planning consent. A more realistic and market led approach to mitigating measures needs to be included in national planning guidance.

The development of Transport for the North (TfN) provides a potential structure for managing the delivery of large scale priority projects. TfN should offer opportunities for coalescing Local Growth Fund and Department for Transport funding at critical points to enable delivery of priority schemes. Limited funding is available to local authorities to contribute to these major projects but they can provide local expertise and knowledge. However, it is essential that funding already allocated for local authorities is not compromised in the development of these 'transformational' schemes.

Question 11: How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Larger infrastructure projects should continue to require robust evidence that the environmental impacts have been considered and mitigated where possible. This includes submission of a Strategic Environmental Assessment and Habitats Regulation Assessment. The design of new infrastructure should be sympathetic to the surrounding environment and use natural and recycled materials where appropriate. Early involvement of environmental stakeholders will assist this process.

Question 13: How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Car ownership and traffic levels are continuing to rise, putting pressure on the road network, particularly at peak times and in built up urban areas. However, the demographic of car drivers is

shifting, with a drop in car use amongst younger people who appear more willing to consider alternatives to the car when supported by a high quality public transport and sustainable transport network. Conversely, our aging population is likely to result in fewer commuting trips by car but an increased requirement to access healthcare and leisure facilities with many people choosing to continue to drive well in to old age.

In the future it seems likely many companies will adopt a more flexible approach to working to reduce the amount of unproductive time that staff, customers and goods spend sitting in traffic congestion. This may include flexible start/finish times, increased home or remote working and a push for people to complete more activities, such as shopping, online rather than visiting sites in person. As the popularity of online services continues to rise the number and proportion of trips made by delivery vehicles, particularly LGVs, is likely to increase.

This shift towards flexible and home working will increase the requirement for superfast broadband and improved mobile phone coverage across the country. This is particularly relevant in rural areas which, in some locations, are being increasingly left behind as faster internet connectivity and mobile phone coverage is rolled out across more built up urban areas.

Ride sharing apps such as Uber are increasing in popularity and are likely to expand to offer almost full UK coverage in due course. This includes Uber Pool, where trips are shared with other people travelling to and from similar locations. While ride sharing and pooling may be less popular in rural areas there is great potential for this type of service to reduce the number of cars on the road in larger urban settlements.

The future for electric vehicles remains uncertain. Whilst take up to date has been reasonable this has been influenced by the Government's plug in car grant which is unlikely to continue over the coming decades. Installation of electric vehicle charging points across the UK has been highly varied, with some areas offering numerous charge points and others offering none at all. If the Government is committed to continuing to promote this new technology concerns with sporadic charge point networks and the limited range of electric vehicles must be addressed.

At a national level, trials of driverless and autonomous vehicles are ongoing and it seems likely that this technology will form part of the future transport offer in some form. Whilst this is cautiously welcomed and may result in significant benefits to road safety, such vehicles must be protected from the threat of hackers who may access these systems and take control of the vehicle.

Question 14: What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Future major schemes for the East Riding are set out within the relevant SEP, and considered in more detail in question 1 of this response. Generally these schemes have been developed to realise significant journey time savings, casualty reductions and environmental benefits whilst facilitating future development. As a result we are confident that they offer extremely high value for money.

Using WebTAG evaluation pedestrian and cycle schemes often provide much higher benefit/cost ratios than other transport schemes. A DfT Value for Money assessment of recent cycling grants shows that schemes can offer Benefit Cost Ratios (BCRs) of up to 35:1 (see https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/348943/vfm-assessment-of-cycling-grants.pdf)

The benefits of increased levels of cycling are well documented and have been outlined recently in the Government's draft Cycling and Walking Investment Strategy (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/512895/cycling-and-walking-investment-strategy.pdf) To maximise their benefits both walking and cycling provision must be fully integrated with the road and public transport networks.

Question 15: What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

The East Riding of Yorkshire is a large rural area and experiences very different transport challenges to those faced by a more built up urban authority. Many funding opportunities appear to be geared towards urban areas and rural areas can struggle to access equal funding opportunities to those provided to urban authorities. For example, this Council was not able to access either round of the Cycle City Ambition funding managed by the DfT.

The Council is a member of Transport for the North (TfN) and is working closely with TfN officers in the development of its Strategic Transport Plan. It is anticipated that this will consider a number of potential high value 'transformational' schemes for the north of England that, if constructed, will boost the economy of the north with corresponding benefits for local residents.

This will complement the recent large local major scheme funding announced by the DfT, which has provided feasibility funding for 12 high value 'transformational' schemes across the country. Funding was awarded to East Riding of Yorkshire Council to develop a £44m improvement scheme for the Jocks Lodge junction, where the A1079 (York to Hull) and A164 (Beverley to Humber Bridge) meet.

Question 25: What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

Flood risk is a key issue in the East Riding and the wider Humber area. 79% of residential properties (121,788), 85% of commercial properties, 71% of main roads (267km), and 76% of Listed Buildings (1,806) in the area are at risk from one or more sources of flooding, as well as and 56% of the area's agricultural land (131,108 hectares). The area is also home to major industries, including power stations, refineries and the country's largest port complex. Most of the remaining land is farmed, vital to England's food security.

Tidal surge events have had a significant impact upon national infrastructure and businesses, such as Oil Refineries, as well as the sustainability of major settlements. In addition to the risk of flooding, the East Riding is an area with a rapidly eroding coastline. The soft boulder clay which forms the coastline from Bridlington to Spurn Point erodes at an average rate of 1.5-2.5 metres a year, although isolated individual cliff losses can exceed 20 metres. This poses a threat to houses, farmsteads and holiday home parks situated near the cliff edge and introduces a long term viability risk for tourism businesses located on our coastline.

In the Humber we are keen to ensure that business and employment development sites can be mitigated against floods and see local responses as most effective in developing these. A level of flood resilience which protects key infrastructure should be seen as minimum to secure supply of services such as electricity, telecommunications, water, healthcare and transport.

Question 26: What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

With the support of elected members, local MPs and major businesses, the Humber Local Authorities along with the Humber Local Enterprise Partnership submitted an innovative proposal to Central Government in 2015 seeking a commitment for a single settlement of £1.28bn required to improve estuary-wide flood defences along the Humber Estuary. This proposal was unsuccessful in securing funding and following feedback from the government the EA is now leading on further work to develop this proposal in further detail. A long term commitment to addressing flood risk in the Humber region is crucial to support the long term economic viability of the area.

Ipswich
Lowestoft

ESTA

East Suffolk Travellers' Association

THE BEEHIVE
HALL ROAD
OULTON BROAD
LOWESTOFT
SUFFOLK NR32 3AW

25 FEBRUARY 2017

Dear [Name redacted]

GREAT EASTERN MAIN LINE IMPROVEMENTS

With a membership of 337, ESTA represents rail users on the East Suffolk and Lowestoft to Norwich lines. The provision of a markedly increased train fleet by the Train Operating Company, Greater Anglia, replacing rolling stock which is mainly over thirty years old, is welcomed. However, with an increase in the number of services improvements in infrastructure are necessary. ESTA considers these should be provided to achieve the following improvements:

* On rural and secondary routes there should be a minimum line speed of 70mph. On the East Suffolk line the current line speed is 55mph, dictated by the considerable number of automatic half barrier locally monitored level crossings.
* A reliable hourly service between Ipswich and Peterborough, which provides connections for the various East Coast Main Line services.

Yours sincerely

[Signature redacted]
[Job title redacted]
[Professional affiliation redacted]

Thank you for the opportunity to provide evidence to inform the National Infrastructure Commission's development of a National Infrastructure Assessment. The following evidence is provided by East Sussex County Council.

Should you have any queries on the evidence below, please contact:

[name redacted] [job title redacted]
East Sussex County Council

[e-mail address redacted]
[phone number redacted]

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

From an East Sussex perspective, investment in the following are the highest value locally important infrastructure requirements which will support long term sustainable growth, in terms of delivering planned housing and employment space, in our growth areas of Bexhill/Hastings, Eastbourne/South Wealden and Newhaven:

Capital

Road

A27/A22

The provision of an offline dual carriageway between Lewes and Polegate, along with other road infrastructure improvements in the area, such as a new link road between Hailsham bypass and A22 Dicker Road, has been identified as critical to supporting the significant additional housing and employment growth in the south Wealden area coming forward through the emerging Wealden Local Plan.

The estimated cost of the scheme is £408m and from an update of the 2014 Feasibility Improvement Study undertaken by DfT/Highways England, the benefit:cost ratio of the scheme is 4.18.

A21

Improvements to the A21 corridor will support the previous and current investment in economic growth in Bexhill and Hastings as well as the future growth plans for the area set out in the SE LEP's Strategic Economic Plan.

There have been long-standing proposals for improvements to other sections of the A21 over the years. Through the LEP and other forums, the County Council are and will continue to lobby Government and Highways England (HE) for further improvements to the A21 which provide greater journey time reliability between Bexhill/Hastings, Kent, London and beyond. These improvements include:

- Kippings Cross and Lamberhurst which would then provide a continuous dual carriageway standard road from south of Lamberhurst to the M25 (estimated cost £150m); and

- the Flimwell/Hurst Green area to address the severance issues along this section of the route (£80m).

A26

Realignment of road between Beddingham (Lewes) and Newhaven (estimated cost £30m) would help improve freight access to Newhaven Port, support the town's Enterprise Zone status as well as support the planned housing growth in the Newhaven area.

Rail

Brighton Mainline

The Network Rail Sussex Route Study, published in September 2015, identifies a package of infrastructure improvements primarily to the Brighton mainline to support future rail capacity needs. The following schemes identified in the Study include:

- Victoria Platform 8 access and reversible working
- Additional track and grade separation at Windmill Bridge junction, grade separation at Coulsdon North junction and an additional platform at East Croydon
- track layout changes at Gatwick Airport and Clapham junction
- Haywards Heath turnback
- Grade separation at Keymer Junction and additional platform at Wivelsfield

High Speed Rail to Bexhill, Hastings and Rye

Following an assessment by Network Rail in 2013, there is a good business case for running high speed rail services to Bexhill, Hastings and Rye which could significantly reduce journey times to and from London. An analysis of the economic case has identified this would be a real game changer for the local area with the potential to 'super charge' the local economy and generate £354m of economic and regenerative benefits to the local area by 2044. It would also increase business investment and growth in Hastings and Bexhill will improve the image and perception of the area as a business location and increase the attractiveness of the area as a place to live and work.

As part of the Kent Route Study, Network Rail are looking at the various options for delivering high speed rail services to Bexhill, Hastings and Rye in more detail. Whilst electrification is an option, it is very expensive and the timescales for delivery would be very long. Therefore Network Rail is also developing proposals that could be delivered incrementally and negate the need to electrify including:

- line speed improvements – Hampden Park to Bo Peep 70 to 90mph; Ore to Doleham 40 to 60; Doleham to Ashford 60 to 90.
- track layout improvements at Appledore junction and a longer passing loop at Rye.
- changes at Ashford International Station to platforms and track layout to enable High speed trains to get from the Marshlink onto the High Speed line.
- alternative options for high speed rolling stock – bi-mode electric/diesel.

Reinstatement of Uckfield – Lewes rail line

The reinstatement of the Uckfield – Lewes rail line (estimated cost £200m) would help improve long term rail capacity between London and South Coast. This would need to be augmented with improvements to the rail network which provide a rail link through at Tunbridge Wells and capacity improvements into and through London.

Revenue

In addition, there needs to be a longer term plan coupled with an investment strategy to improve the resilience of the road and rail network and to make better use of the existing infrastructure.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

Infrastructure's contribution to UK's International Competitiveness

Transport Infrastructure

As set out in the Government's recent Industrial Strategy (2017), the quality of the UKs transport infrastructure has been rated as second lowest among G7 countries and according to World Economic Forum surveys our overall infrastructure is perceived by international businesses as worse than our competitors. The suggested causes of this are seen as:

- lack of clear long-term plans and budgets,
- a complex planning system, and
- failure to align planning for infrastructure with planning for housing and industry.

It is recognised in the Strategy document that the UK's energy, transport, water, flood defence and digital infrastructure needs be upgraded to enable businesses to thrive. If this aim is to be achieved in East Sussex, it is important that Government:

- reaffirms and commits to longer term spending plans and provide clarity on infrastructure investment proposals to boost business confidence
- Considers more carefully the interdependencies of infrastructure sectors (e.g. transport energy and digital) to ensure more joined up policies that better meet national and local needs
- Continues to ensure that East Sussex and the Local Enterprise Partnerships which cover our geography (South East LEP and Coast to Capital LEP are able to deliver locally through continued long term commitment to programmes such as the Local Growth Fund and Local Transport Plan schemes (Local Transport improvements and Highways/Structural Maintenance)
- Continue with Large Local Major funding for local authority promoted schemes which are not within the delivery scope of strategic infrastructure programmes managed by Highways England or beyond the scope of Local Growth Fund programme
- Provides the opportunities for private financing models in order to increase investment in road and rail upgrades such as:
    - Government bonds and loans,
    - Public/Private Funding Partnerships (PF2),
    - the 'Chiltern Railways' model of enabling long term investment in rail infrastructure coupled with a long term franchise to enable the train operating company to make a review on their investment (Project Evergreen).
- Ensure that along with our Three Southern Counties partners (West Sussex and Surrey) we feel the benefits of the devolution agenda in the form of a devolution deal with combined authority status but without the need for a mayor which does not neatly fit the shire county devolution model.
- Support the establishment of the Transport for the South East (TfSE) sub national transport body (STB) to ensure alignment between investment in strategic infrastructure, through strategic providers such as Network Rail and Highways England, and our local growth and infrastructure priorities which thereby drive up productivity and prosperity across the TfSE STB area.

Data and Digital Infrastructure

As well as physical and digital infrastructure, we need to make sure that we also have in place an effective data infrastructure for an economy in which 'open data' drives growth, efficiency and innovation.

As the OECD report 'Data-driven Innovation (DDI) for Growth and Well-being 2015' points out data are an infrastructural resource. Physical infrastructure such as roads and bridges enables benefits

to 'spill over', for instance, by fostering trade and social exchanges. In the same way, greater access to data also has beneficial spill-overs, whereby data can be used and re-used to open up significant growth opportunities, or to generate benefits across society in ways that could not be foreseen when the data were created. However, countries – and governments in particular – risk under-investing in data and data analytics with the risk of undermining the UK's capacity to innovate through the use of data to accelerate research and the development of new products, processes, organisational methods and markets.

Data driven innovation is reliant on investments in R&D on key technologies such as 'big data analytics', cloud and high-performance computing, and the internet of things but also on security and privacy enhancing technologies. Countries with enhanced capacities to supply and adopt improved internet services and advanced data analysis technologies will be in the best position to benefit.

The OECD has identified two sets of challenges, or tensions that need to be addressed by policy makers in order to maximise the benefits of DDI, and mitigate the associated economic and societal risks:

- the need to promote "openness" in the global data systems and thus the free flow of data across nations, sectors, and organisations, and at the same time to address legitimate considerations of individuals' and organisations' opposing interests (including in particular their interests in the protection of privacy and intellectual property rights)
- the need to activate the enablers of data driven innovation such as funding technological development and the infrastructure to support and help spread data driven innovation across the economy, and at the same time to address the potential negative effects such as impact on labour markets of increasing automation.

Role of Ports/Airports as International Gateways

As an island nation the UK is dependent on its ports, airports and patterns of trade strongly influence the role of these gateways in the UK economy. Effective road and rail connectivity is key to their continued success.

Ports such as Newhaven are highly dependent on road and rail connectivity for the inward and outward movement of freight. However, road congestion on the strategic road network serving Newhaven causes increased travel times and reduced journey time reliability, which increases freight costs whilst insufficient rail freight facilities or available paths on the network suppresses the potential scope for transporting some freight by rail. Freight at Newhaven has increased to 1.62m tonnes (in 2015), which is up over 25% on 2014 at 1.2m tonnes of freight moved.

In addition, millions of people travel via ports and airports to go to and from the county. Providing a good, well connected port such as Newhaven, which has an increasingly successful ferry service with Dieppe that has seen growth in passenger numbers to over 409,000 (in 2015) a rise of over 40% since 2015, and airports such as Gatwick Airport whose passenger numbers have also increased significantly over the last few years with now nearly 45 million passengers per annum, are therefore vital to support to our tourism industry as well as making a major contribution to the UK economy. We also have the port of Rye that is used more for leisure and fishing industries.

Many of the key gateways near East Sussex- especially Gatwick with its continued expansion within the confines of its single runway operation and Heathrow with its proposed third runway - will be subject to further growth in the future. This growth generates more people, goods and services, which will rely on effective road and rail connectivity. As with our national infrastructure, the Government needs to set out a clear surface access strategy so that supporting infrastructure to key international gateways such as Heathrow and Gatwick as well to ports such as Newhaven and Rye can be developed, delivered and funded (either publically or privately) to support growth in their activity and enable access for residents, businesses and visitors to and from the county.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Local authorities play a key role in establishing a 'vision' for their area, and that the capacity to plan proactively and engage with communities is vital in delivering this vision, wellbeing, prosperity and a stronger sense of place. At present, the Local Plan making process undertaken by local planning authorities plays a key role in establishing the vision for creating a better place for people to live and work in albeit the local planning authorities are often not the providers of the infrastructure required to support their vision and planned housing/employment growth.

In order to ensure and effective balance between people, place and prosperity it is importance to carefully consider how new economic infrastructure aimed at increasing prosperity will be integrated into the wider built environment (i.e. the impact on place). The link between people and place is sometimes lost in decision-making concerning the built environment and the agencies working on the development and introduction of new infrastructure at both the national and local levels need to work more closely with local people, local authorities and other partners to ensure that infrastructure investments deliver maximum wider social, environmental and economic benefits.

To help design, plan and deliver infrastructure in Wealden, the District Council and East Sussex County Council have developed a 'road map' process which maps out the expected delivery timescales for housing allocations in a given area and similarly the timescales for developing and delivering the infrastructure required to support the delivery of the housing. This has helped to match infrastructure planning and funding programmes of county council infrastructure such as transport improvements and education facilities. However, there needs to be a more joined up approach between infrastructure investment in larger national projects that would be brought forward through the strategic transport provider's programmes (e.g. Highways England), Local Plan and the actual delivery of housing. There is also the risk that the overall emphasis on speed and quantity of housing supply may threaten the timely delivery of infrastructure required to support that growth, thereby creating a disjoint in achieving sustainable planning and the delivery of high quality development.

A key constraint on infrastructure delivery is the availability of funding relative to the overall cost of the infrastructure. Whilst Community Infrastructure Levy monies help support the delivery of infrastructure, it is only top up funding to augment other funding sources, and therefore many local authorities have a 'funding gap' between the cost of infrastructure and the funding available. Therefore, Local authorities should be empowered and encouraged to use existing or new funding solutions including local infrastructure funding or forms of devolved pooled resources to ensure better integrations between housing and infrastructure provision.

The devolution agenda offers the scope to include local infrastructure funding or some form of devolved pooled resource in order to kick-start development whilst the establishment of sub-national transport bodies enables local authorities, such as East Sussex, to have a greater voice in influencing the funding priorities within the investment programmes of strategic transport infrastructure providers such as Network Rail and Highways England.

This also involves the need for effective infrastructure planning to hold the utility firms to account and ensure they are undertaking long term plans in line with B/DC and county council future planned needs not just reacting to what is being planned or as currently is the case not aligning their short, medium and longer term plans on infrastructure with what is planned locally. Infrastructure should include environmental infrastructure and specifically the importance of natural capital in creating vibrant communities. This closer integration and interaction between infrastructure, in its widest sense and housing is absolutely vital to create better places to live and work.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

Context

There is an increasing focus on demand management in local government across a range of sectors because of the realisation that supply side efficiencies will not bridge the funding gap. Demand-side management measures are increasingly being investigated as an alternative to traditional supply-led options. However, demand management approach significantly changes the roles and relationships between service provider and customer and this transformation can require high levels of investment in order to realise longer term savings.

Utilities

Currently under the supply-led approach each of the utilities makes an assessment of the increased demand that a housing, commercial or industrial development will require, estimates the extra infrastructure costs required to support this and then allocates all or a proportion of the costs to the developer. The utilities approach is to supply more of their product to consumers which under existing regulatory frameworks is one way of increasing profitability. As a consequence the supply led model of infrastructure provision has the effect of increasing levels of water and energy use, waste production and trip generation.

A demand side management approach to infrastructure provision requires much closer coordination between different interests:

- utilities engaging with customers to help manage their demand
- the retrofitting of demand management measures to existing development
- the involvement of utilities in an early stage of the development process to assist designers.

Demand side management activities tend to push the utilities into closer relationships with their customers, local authorities, training and local economic development agencies as they are no longer simply considered with ensuring an adequate supply of electricity up to the customer's meter.

Sustainable Travel

East Sussex recognises the contribution that demand management measures which encourage and provide for attractive active travel options – walking and cycling – as well as supporting journeys undertaken by public transport can make to cutting congestion, tackling poor air quality, improving health and ultimately help improve our economy. Through our capital programme for Local Transport Improvements we have, and will continue to invest, in walking, cycling and public transport measures and this investment has been augmented significantly by the levels of Local Growth Fund monies we have secured through the Local Enterprise Partnerships.

In addition, managing the demand for travel has been supported by our success in securing Local Sustainable Transport Fund monies in 2012, and again in 2015. This enabled the delivery of an ambitious programme of schemes and initiatives which encouraged greater levels of walking and cycling, particularly working with schools and businesses, as well as providing a wheels to work scheme to support access to work, education and training for those without access to a car. Through the recently successful Access Fund bid, we will be able to continue these types of initiatives and support our capital investment in sustainable travel infrastructure.

However, current national appraisal and assurance frameworks present challenges when making the case for cycling, walking and public transport infrastructure. As user benefits and travel time are such a great proportion of the benefits of schemes in urban areas, investments which aim to reduce and reallocate road space away from motor vehicles often do not meet Cost-Benefit thresholds despite very positive air quality, health and environmental impacts. In spite of their widespread use there remains very limited empirical evidence to support the emphasis given to cost/benefit calculations in transport appraisal.

Road Pricing

With increasing capacity constraints on the road and rail network, shortage of capital and land for new infrastructure and declining income from Vehicle Excise Duty (due to an increase in the efficiency of motor vehicles and increase reliance on alternative fuels) are likely to prompt the need to consider the possible introduction of a national road pricing scheme.

As for the unintended consequences of demand management initiatives such as road pricing, there is ongoing debate about the potential impact in cutting congestion and reducing emissions. By optimising road use there is the probability that the volume of traffic could be increased overall, and with it emissions of carbon dioxide – and these effects would be intensified if road charges were offset by reductions in fuel duty to ensure the political acceptability of the scheme. As with all major new proposals the devil is in the detail and much will rest on how any scheme is configured and the extent to which any unintended consequences can be 'managed out'.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

There is a need to move away from 'build it and walk away' mentality and ensure that there is a better balance between one off capital expenditure in constructing new assets and ongoing revenue expenditure of maintaining and repairing existing assets.

East Sussex, through its Highway Asset Management approach, takes lifecycle costs into consideration when balancing both of these aspects. The scope and scale, design, maintenance, materials and recycling aspects of future maintenance need to be considered in order to mitigate extraordinary maintenance costs associated with 'value managed' schemes.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

The establishment of sub national transport bodies offers the opportunity to improve co-ordination and provide greater collaboration between strategic transport infrastructure providers such as Network Rail and Highways England, Local Enterprise Partnerships and local transport authorities, in ensuring that the local infrastructure priorities for the area are identified and delivered.

As per point made above there needs to be much closer collaboration and join up between utility firms long term planning both individually and collectively with public authorities like county councils and borough and district councils responsibilities. If we can get this long term planning with rolling 5-10 year action plans committing to investment this will provide greater certainty in the planning system for housing, business and other assets that can meet demand.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

Energy

The Department is looking into using varied stamp duty and council tax rates as levers to incentivise households to undertake energy efficiency improvements. We urge the Department to work with the Treasury to develop straightforward policy options and publish an impact assessment of these options. Complex policies must not get in the way of delivering energy efficiency objectives. The Government must ensure that support mechanisms are in place to ensure that vulnerable households and fuel-poor consumers are not negatively impacted from the introduction of such incentives.

Transport

One of the changes in funding policy that could improve the delivery of transport infrastructure is to reduce the level of competition-based funding which often have restricted time constraints for spend and delivery. Whilst this may have some merit in allowing a more flexible approach from central government in terms of project selection, at a local level this produces significant challenges in terms of project selection and delivery with the element of competition meaning local authorities are often only given a matter of weeks to develop and submit a comprehensive business case if they wish to be successful in bidding for funding. This means that it is challenging to bring forward projects which fall outside traditional cyclical funding envelopes or are at a very early stage. As a consequence, there is always a bias toward 'shovel ready' projects, which may not be the most optimal to achieving long-term benefits.

In addition, the preponderance of capital funding over revenue based funding means that there are significant challenges for authorities to deliver infrastructure services efficiently. The lack of revenue funding can mean that longer term priorities are not addressed efficiently.

Furthermore, the delivery of transport infrastructure could be made more efficient with longer term funding certainty and a broader range of funding mechanisms being made available to infrastructure providers to provide the increased levels of funding investment necessary. Whilst the situation has improved in recent years, transport infrastructure investment is still hampered by 'short/medium funding' cycles which means planning the need for investment over a longer time horizon is not achievable.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

No comments

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

The future proofing of infrastructure requires careful consideration of future disruptions in the asset management systems of the organisations responsible for infrastructure management. Consideration needs to be given to:

- infrastructural resilience – resilience to unexpected/uncontrollable events and circumstances; and
- change management capability – capability to adapt or respond to changing needs, uses or capacities.

A resilience focus requires interdependencies to be considered. These can be:

- between different infrastructure elements (e.g. within a bridge);
- between infrastructure systems (e.g. between water infrastructure and energy infrastructure – such as how a flooding event could shut down an electricity substation); or
- between infrastructure and livelihoods (e.g. how raised road embankments may exacerbate flooding).

These are examples where failure may occur through a domino-effect, where risks are cascaded from one weak point or interface (lack of resilience) and can have knock-on effects to whole communities or and the economy.

The cross-cutting challenge of climate change increases the need to articulate and plan for resilience across geographical areas and different infrastructure systems.

Infrastructure cannot be resilient if it is poorly maintained. The increasing risk of climate change will increase the resources, expertise and skills needed to maintain infrastructure. Maintenance also preserves the economic value of infrastructure investment by extending the life of infrastructure into the future. In addition infrastructure may need to be adapted, which may also change the way it is operated and maintained.

A key challenge is for sufficient skills and resources to be available to deliver resilient infrastructure, and ensure it is properly maintained. This includes ensuring that there are sufficient contractors, planners, engineers and operators and they all have the required skills. It will also include the skills to collect, model and interpret risk information (e.g. climate, hydrology related) so that it informs infrastructure investment choices and subsequent design.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

Digital

The planning system must ensure that full fibre networks are delivered as a matter of course to new build and industrial sites. Without a driver such as this, developers have a choice about whether to provide for the digital infrastructure that is needed now and for the future, despite incentives from broadband infrastructure providers. This must not be allowed to continue.

Funding

Consideration needs to be given to how Community Infrastructure Levy (CIL) and the section 106 regime work together. With s106 agreements, County Councils – as infrastructure providers – could be co-signatory to the legal agreement and thereby receive contributions towards its infrastructure. The restrictions on securing contributions introduced in April 2010, whereby no more than five contributions could be secured beyond that date towards an infrastructure project or infrastructure type, has inhibited the ability of infrastructure providers to secure the level of development contributions needed to fund and deliver infrastructure projects. This is especially the case in the scenario where smaller development sites make up the five contributions secured to an infrastructure project/type.

As a consequence, the reduced ability to secure development funding has increased the burden on infrastructure providers to 'top up' the remaining funding and thereby affects the timely delivery of infrastructure. Increasing the number of contributions that could be secured towards an infrastructure project/type would reduce this burden and increase the efficiency of providers delivering infrastructure on time.

Whilst infrastructure needs are set out in Local Plan Infrastructure Delivery Plans, with local planning authorities now introducing their CIL's, they are now responsible for the prioritisation and

allocation of CIL receipts towards infrastructure. This does not sit comfortably when they are not the providers of the infrastructure required to support their housing needs.

In East Sussex, two of our four local planning authorities (Lewes and Eastbourne) who have introduced CIL have recognised that the County Council, as a major infrastructure provider, should receive a proportion of the CIL receipts generated from development in their respective areas. The regulations should be amended to ensure that County Council's, as key infrastructure providers, are given a guaranteed proportion of CIL receipts from the local planning authorities in their area to provide greater funding certainty and long term planning for infrastructure delivery.

Planning Structure

Consideration also needs to be given as to how strategic planning is undertaken. The current plan-making arrangements do not lend themselves to the effective planning, prioritisation, co-ordination and delivery of significant infrastructure needs across the wider area. Formalised arrangements for greater planning across local planning authority boundaries and joint plan making should be allowed for these pitfalls to be avoided.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Natural capital and the environment have often been seen as a block to infrastructure development. The natural environment offers public health opportunities, wildlife diversity benefits, improvements to air quality, water quality, flooding and ensuring greater resilience to climate change. There is merit in reinvigorating the role of the Local Nature Partnerships. Working collaboratively with their Local Enterprise Partnership, by providing advice and expertise on the value of the natural environment and exploring how LNPs and LEPs can help deliver each other's aims. LNPs could help LEPs to integrate the value of the services provided by the natural environment in their economic decision making. Where infrastructure projects are implemented, consideration needs to be given to how the project fits into the natural environment and where practical minimise the impact through good quality design and appropriate mitigation (e.g. tree planting for screening, using the contours of the land for the project to fit into the landscape). In some instances, infrastructure projects which move the impacts away from existing special landscapes could help to enhance and protect that natural environment.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

Current transport cost-benefit techniques are very focussed on journey time savings, safety benefits, accessibility improvements and the impacts of the environment. Whilst these factors are important, they do not necessarily fully quantify the economic benefits that schemes can have on a local area, particularly where the scheme is an economic development scheme (e.g. a road unlocking a development area or access to the Port) rather than a conventional transport scheme. That said, DfT's recent review of its analysis and methodologies regarding scheme's wider economic impact assessment and on values of time is welcomed and goes some way to redressing this balance.

However, there are a number of further changes which would make the system credible and transparent, reducing its appearance as a 'black box' and ultimately increasing trust in the appraisal process. These are:-

- the current appraisal system does not allow us to capture the land value increases caused by these improvement schemes and consequently there are challenges in terms of their appraisal. A more open appraisal system would better capture these benefits.

- The current appraisal system struggles with the appraisal of highway maintenance schemes.
- The current appraisal system struggles to fully capture and appraise the benefits of walking and cycling projects such as health benefits as referenced in the earlier questions.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

Although it is difficult to forecast exactly what the socio economic landscape and resulting travel patterns will look like in 2050, there are a number of current trends that are likely to continue to shape future travel patterns:

- Continuation of the trend away from traditional "Monday to Friday 9 to 5" working patterns with technology through superfast broadband, 4G and 5G+ enabling more homeworking, flexible working, video conferencing, dispersed employment locations and part-time working.
- younger people not wishing or unable to own a car, especially in urban areas, considering alternatives and being supported by an adequate public transport, cycling and walking network.
- Increased changes in how and where people shop and bank with consequent rise in van traffic or use of 'drones' for deliveries.
- An increasingly older population, resulting in fewer work-related trips; much greater focus on travel to health facilities; more leisure journeys ; higher expectations of independent mobility; increased need for appropriately designed infrastructure and services.
- Increased expectations of the quality of public transport in terms of speed, reliability punctuality, comfort, seamless ticketing and comprehensive technology-based information before, during and after a journey.
- The increased use of alternatives to petrol/diesel – battery or hydrogen – to power vehicles
- The potential for new technologies, such as driverless cars, to change the way in which we approach car ownership, mobility and the use of our time while travelling.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

The highest value transport investments to get people and freight into and out of the major urban areas in East Sussex would be:

- Eastbourne/South Wealden – an offline dual carriageway between Lewes and Polegate. An update of the 2014 Feasibility Improvement Study undertaken by DfT/Highways England, to reflect the revised land use assumptions arising from the additional housing and employment coming forward in Wealden's emerging Local Plan, has indicated that based on a £408m investment the benefit:cost ratio would increase from 1.3 to 4.18.
- Bexhill/Hastings – running high speed rail services on the Marshlink/East Coastway via Ashford International to serve Bexhill, Hastings and Rye. An appraisal of the wider economic benefits of the scheme identified that the scheme would generate over £350m of economic benefits for the local area by 2044.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

Rural transport presents different issues to that in single urban areas and it can be difficult for it to secure equal funding opportunities. In more rural areas, it is important for capital investment to be matched by revenue spending which can help support the provision of services that are vital lifelines to communities. Although these investments may perform less well on traditional value for money metrics they are crucial to sustaining the vitality of these areas.

In terms of connecting multiple urban areas and regions, the establishment of the sub-national transport body, Transport for the South East, will identify the highest value transport investments to deliver economic growth across the urban and rural areas of the South East of England.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

Mobility as a service (MaaS) uses a digital interface to source and manage the provision of a transport related service(s) which meets the mobility requirements of a customer using any form of transport service, public or private.

The widespread adoption of MaaS should lead to a more efficient use of vehicles and road space, although the extent to which this will be the case will only become apparent once the results of a number of pilot projects are available. The results of these experiments will also determine the extent to which MaaS will offer an alternative to demand management approaches such as road user charging. Therefore, it is too early to say.

Digital communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

Mobile connectivity is a modern necessity and should be treated as such with availability of service the norm. At the current time because infrastructure investment has been too little and too slow (mainly, but by no means exclusively, in rural counties such as East Sussex) there exist too many not-spots and very intermittent coverage, which is not conducive to today's ways of doing business via multi-function smartphones. Good 4G coverage must be secured now, via legislation if necessary, using the concept of the Broadband Universal Service Obligation based on a measure of the service consumers actually receive wherever they need it. The UK must become well placed to take advantage of 5G capacity when it becomes available but cannot wait until this begins to replace 4G in the 2020s.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Note: the existing "regime" refers to the current market, competition and planning frameworks. "Digital communications" includes both fixed and mobile connectivity.

Many existing initiatives, including the Government's Superfast Broadband project, and to a certain extent the now defunct Mobile Infrastructure Project, have gone a long way to delivering what is needed. Certainly here in East Sussex, thanks to the investment that East Sussex County Council and Broadband Delivery UK have made available to support the rollout of superfast broadband, we expect coverage to be in the region of 97% in the county by end December 2017 and we are about to tender for a third phase of activity to take this to as close to 100% as possible. However, due to

large housing numbers coming forward over coming years (with 2,000 housing completions expected each year) this will not be enough as the county continues to grow homes and businesses. The Government must establish deployment of digital infrastructure – both fixed and mobile – as a priority in national policy and work with Local planning authorities to encourage prioritisation in local planning policy.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

Follow the recommendations made by the Committee on Climate Change in its October 2016 report titled 'Next steps for UK heat policy'.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?
Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

No comments

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

The infrastructure implications of low carbon (electric or bio-fuel) vehicles are that with increased take up of such vehicles over time, there will to be a need for increased provision of off-street, on street and at home/business charging facilities. In addition, this will need to be coupled with improved battery life to increase the distance that can be travelled on a single charge and ensuring that costs for electric vehicles are competitive with those for petrol/diesel fuelled vehicles.

In terms of energy production, investment in a broad range of energy technologies and their efficiency, in particular in renewables, to continue to provide electric power for low carbon vehicles as well as in alternative low carbon vehicle technologies such as hydrogen power.

Water and wastewater (drainage and sewerage):

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?
Note: "demand" includes domestic, commercial, power generation and other major sources of demand.

Demand management relies in large part on behavioural change and is clearly difficult to achieve. The most effective intervention in this context is metering.

On the supply side the principal resource in the South East is aquifers. The water companies have proposed a mix of resources to avoid reliance on below ground sources of supply. New resources (reservoirs), desalination and inter-company transfers all feature in water resource planning. Desalination is clearly a last resort and has a number of environmental problems attached to it. New resources are affected by planning and various consenting requirements which lead to long lead in times. It would be for the water companies, however, to determine whether this is an impediment to balancing supply and demand.

Intercompany transfers are not without their financial and environmental costs. However, it may be that this is the preferred element of a suite of measures to manage the demand supply balance.

Planning for water resources needs to be considered more thoroughly as part of the development process. The absence of a strategic framework and the prevalence of "jigsaw" planning have led to greater difficulties for infrastructure providers of all types to keep in step with growth. We consider that the reintroduction of formalised strategic planning to allow a planned approach to growth across the country would be an effective intervention (we are firmly of the view that current strategic planning arrangements, primarily through the requirement to comply with the Duty to Co-operate, are not an effective way of addressing the strategic demand and supply of infrastructure, which includes water resources).

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

Note: this can include, but is not necessarily limited to, governance frameworks across the country.

The revised emphasis on strategic planning is necessary to ensure that foul sewerage provision is in step with development needs.

The current inadequacies of drainage systems are of concern. The question suggests that the only problem is with meeting future development pressures, and that current systems are up to the job.

As a consequence of under investment by the private water companies, the country, and the South East in particular, is playing catch up. Systems are "just about managing" in many centres of population and are often easily tipped into crisis. The management of systems is often reactive, not pre-emptive.

Ofwat sets the criteria against which the water companies are judged. The current regime allows the public realm to be flooded by surface and foul water as water companies are not judged on their performance in this area. A review of the Regulator's priorities with regard to flooding, and by implication the adequacy of sewerage capacity, is necessary.

Schedule 3 of the Flood and Water Management Act introduced Sustainable Drainage Approval Bodies (SAB). This role would be performed by the upper tier local authorities, also known as the Lead Local Flood Authorities. These would have effectively regulated and maintained drainage (non-foul) as part of new development. However, the government considered this to be a brake on growth and did not commence this aspect of the Act.

In its place the government designated Lead Local Flood Authorities as statutory consultees to the planning system. However, their advice is not binding, and developments can, and are, being approved despite concerns/objections being raised by the Lead Local Flood Authorities.

Furthermore, the adoption and subsequent maintenance of new drainage infrastructure is not effectively addressed under this new arrangement. This leaves a potential legacy of widespread surface water problems for future generations.

The introduction of a body regulating drainage designs at a local level (i.e. the SAB) would ensure the effective implementation of robust and appropriate drainage systems which would be maintained for the lifetime of the development.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

The whole catchment approach is not new; it is a long standing concept which is easy to understand but less easy to implement.

It is important to reconcile the competing priorities of the very many and different agencies, authorities and private sector organisations who are essential to the delivery of a whole catchment

approach. However, there is no single legal mechanism available for an organisation to achieve this. Instead, reliance is placed upon partnership working and issues arise around self-interest.

However, we do not think new primary legislation is appropriate as it may place too much power in one agency and it would have profound implications for allied legislation.

It may be that existing legislation and regulatory priorities are reoriented towards a whole catchment approach.

The maintenance of existing systems should not be forgotten. Whilst accommodating growth is important, it is essential that the infrastructure we already have is fit for purpose.

Flood risk management:

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

The UK should aim to achieve the highest possible level of flood resilience given the constraints that are outlined in the question. It should not be forgotten that the summer 2007 floods cost the UK economy £3.5bn.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?
Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

We should be managing risk at the strategic level and utilising property level resilience as a means of last resort. This strategic risk management, much like the catchment approach, relies upon a variety of interested parties coordinating their actions to minimise risk.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

In terms of East Sussex County Council and Brighton & Hove City Council we are 13 years into a 30 year Waste PFI contract with South Downs Waste Services Ltd. The contract provides infrastructure for the recovery, recycling and composting of household waste in East Sussex and Brighton & Hove. The contract and infrastructure were devised in order to meet government and EU targets on recycling and the reduction of biodegradable waste to landfill.

East Sussex and Brighton & Hove have a statutory obligation to dispose of or recycle waste collected by them or on their behalf. This function has been contracted out to South Downs Waste Services Ltd.

This contract has provided a number of transfer and treatment facilities within East Sussex and Brighton & Hove including:

1. A number of strategically located Waste Transfer Stations for the transfer and onwards movement of waste and recycling generated by residents.
2. An Energy Recovery Facility (ERF) at Newhaven, which creates energy from the vast majority of the residual waste collected in East Sussex. A small amount of residual waste which is unsuitable for energy recovery is sent to landfill.

3. A Materials Sorting Facility for the sorting and onwards movement of recycling collected from residents in East Sussex and Brighton & Hove.
4. An In Vessel Composting facility that processes garden and food waste from residents.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

Note: A "circular economy" is an alternative to a traditional 'linear economy' (i.e. make, use, dispose) in which products are designed and packaged to minimise waste, and resources are kept in use for as long as possible, e.g. through re-use, recycling and greater recovery of materials through the waste management process.

Market conditions and contractual arrangements strongly influence the circular economy. If it's not cost effective to minimise waste and keep resources in use for as long as possible, and if contractual arrangements between local authorities and contractors do not allow it, then circular economy practices cannot develop easily.

Regulation can force changes but these can come at additional cost if the market is not developed enough to cope effectively.

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Ecotricity Response to the Call for Evidence on a Smart, Flexible Energy System

Dear Electricity Systems Teams,

Ecotricity is an independent renewable energy generator and supplier, with over 190,000 gas and electricity customers. Our commitment to those customers is that the money they pay for their energy bills will contribute towards powering the UK from renewable sources. We have followed this pledge since first generating renewable electricity in 1998, and are now at the forefront of new renewable generation with ongoing research into a number of new technologies including tidal power, biomethane and storage. In 2011 we introduced the Electric Highway, a network of Electric Vehicle (EV) charging points which now stretches across the country with charging points at all motorway service stations. By ensuring that EV drivers had the opportunity to charge at regular intervals, the Electric Highway, has played a significant role in increasing EV uptake.

As a renewables generator and a new entrant into the storage market we welcome this call for evidence on flexibility. A smart, flexible system is essential for enabling the decarbonisation of the energy market and ensuring energy security whilst keeping prices low.

Much needs to be done in order to get to this point. We believe that the following aims must take priority:

- Increase regulatory certainty for storage and collocated generation.
- Ensure the treatment of storage with respect to charging and network connections reflects the fact that is disptatchable and brings system benefits.
- Amend the connections queuing system to ensure that storage can be prioritised when it brings benefits to others in the queue.

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- Improve transparency and competition in balancing services by ensuring that all services are procured through open auctions.
- Ensure that DNOs publish all available information on best places to connect storage to improve accessibility and ensure competition.
- Enable DNOs to make system wide upgrades to their networks by amending their mandate under the RIIO process.
- Decrease the clip size for Firm Frequency Response (FFR) to 1MW.
- Encourage automated smart appliances and home storage to ensure domestic customer level Demand Side Response (DSR).

Enabling Storage

Question 1: Have we identified and correctly assessed the main policy and regulatory barriers to the development of storage? Are there any additional barriers faced by industry?

Yes, we agree that network connections, network charging and a lack of regulatory clarity are all barriers to storage.

Question 2: Have we identified and correctly assessed the issues regarding network connections for storage?
Have we identified the correct areas where more progress is required?

Yes, the consultation identifies the key issues with respect to network connections. We would welcome additional clarity on the connections process and the network security standards that are needed. We would urge DNOs to prioritise resolving the remaining uncertainties on this.

With respect to information about where connections are available, we find heat maps to be particularly useful for our new generators and we believe that they could be effectively applied to storage. We note, however, current heatmaps are not always kept up to date and do not cover lower voltage lines. We would urge DNOs to expand the coverage of their heatmaps for both storage and generation.

These changes would enable storage developers to identify areas where storage would be most valuable to the network quickly, which will increase the overall benefit that each new storage installation brings to all parties.

We agree that storage should be given priority over other customers in the connection queue when the DNO can show that this would benefit other customers. We would urge DNOs to take a more creative and proactive approach to assessing how storage could be used to relieve strain on the network. For, example, as a generator, we have been told that there is no spare capacity for network connections in the south of Scotland. If this is indeed the case, then the DNO should explore whether and how storage could be used to free up more capacity.

We have direct experience of the problematic way in which connection queues operate in relation to storage. On one our sites in development, Alveston Wind Park Ltd, we initially secured a 20MW grid connection. Our final wind park will be around 7MW in capacity and we wanted to make use of the remaining 13MW by installing storage. When we applied to add this storage we were sent to the back of the connections queue, despite the fact that this change will not increase the connection capacity needed and will not add strain to the grid. A more pragmatic approach is needed.

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Question 3: Have we identified and correctly assessed the issues regarding storage and network charging?
Do you agree that flexible connection agreements could help to address issues regarding storage and network charging?

The way in which storage is classified by DNOs is inconsistent: it is usually classed as non-intermittent, but in some circumstances it is not. Classifying storage as intermittent is inappropriate because it ignores the fact that is controllable and flexible. Intermittent generation is subject to a flat rate, whilst non-intermittent charges vary depending on the strain on the network. Classifying storage as non-intermittent therefore provides an incentive for it to be used to balance the network, rather than add to its strain. Connection charges should also be amended to take account of the fact that storage tends to export in times of peak demand and imports during peak generation, reducing stress on the network.

We understand that this question is also being considered as part of the Common Distribution Charging Methodology; however, this process is likely to take some time. Given the current inconsistencies and potential delays we believe that it would be helpful for Ofgem to issue guidance clarifying that storage should be treated as non-intermittent.

We believe that the wider network benefits of storage could be taken advantage of through flexible connections. For example, where the DNO can receive a guarantee that the storage will only import in times of high generation and low demand, and only export in times of low generation and high demand should be rewarded.

Question 4: Do you agree with our assessment that network operators could use storage to support their networks?
Are there sufficient existing safeguards to enable the development of a competitive market for storage?
Are there any circumstances in which network companies should own storage?

We have concerns about the competition implications of DNOs owning their own storage. Regardless of whether they do start owning storage, it is essential that they publish all relevant information about best places to connect. This would improve accessibility and competition for all prospective storage developers and ensure that no one has an unfair advantage due to inside information.

Question 5: Do you agree with our assessment of the regulatory approaches available to provide greater clarity for storage?
Please provide evidence to support your views, including any alternative regulatory approaches that you believe we should consider, and your views on how the capacity of a storage installation should be assessed for planning purposes.

There is currently very little certainty with respect to how the addition of storage would affect an existing RO or FIT accredited site. This, and in particular the fact that developers need to re-accredit a site following the addition of storage, causes significant nervousness amongst investors in the original installation. This re-accreditation risk can prevent storage being added to such sites. The fact that in practice Ofgem will almost certainly approve the re-accreditation is not sufficient comfort to nervous investors. We believe that Ofgem should amend the process for adding storage so that re-accreditation is not needed and issue guidance clarifying that storage will not invalidate an existing site.

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Question 6: Do you agree with any of the proposed definitions of storage? If applicable, how would you amend any of these definitions? Please provide evidence to support your views.

We do not believe that any of the definitions are sufficient because none of them allow for other types of storage including mechanical and heat. Therefore, whichever is chosen should be amended to include this.

Aggregators

Question 7: What are the impacts of the perceived barriers for aggregators and other market participants? Please provide your views on:

- **balancing services;**
- **extracting value from the balancing mechanism and wholesale market;**
- **other market barriers; and**
- **consumer protection.**

Do you have evidence of the benefits that could accrue to consumers from removing or reducing them?

A key barrier to access balancing services is the complex and opaque manner in which balancing services are procured. It is difficult for new entrants to navigate these multiple methods or to get much visibility of available prices. We believe that the best way to tackle this is for National Grid to openly publish information about what they need and for all balancing services to be secured via auctions, which should be open to as many participants as possible. The grid should not be able to contract for balancing outside of these auctions as this will reduce competition. For example, prior to last year's Enhanced Frequency Response (EFR) auction we understand that a bilateral contract for balancing services was agreed between National Grid and RES, which resulted in less capacity being auctioned. In future, such arrangements should either be included within the EFR/FFR auction, or form a separate open tender process.

We agree that current clip size limits in balancing services present a barrier to Demand Side Response (DSR) and storage, which tend to operate in much smaller clip sizes than generation. The recent reduction of clip size of EFR to 1MW, which resulted in a significant increase in participation from storage, is a good example of the potential success of this. We believe that National Grid should take the same approach to FFR.

Question 8: What are your views on these different approaches to dealing with the barriers set out above?

We do not have any strong views on this.

Question 9: What are your views on the pros and cons of the options outlined in Table 5? Please provide evidence for your answers.

We believe that a Code of Practice for aggregators combined with a watching brief from Ofgem would be sensible.

With respect to the impact on suppliers' balancing positions, it is important that suppliers are able to protect themselves against unexpected shifts in demand by large consumers. However, we believe that suppliers should be able to manage this themselves by having contractual requirements that oblige notification of involvement in balancing services and/or compensation for their impact.

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Question 10: Do you agree with our assessment of the risks to system stability if aggregators' systems are not robust and secure? Do you have views on the tools outlined to mitigate this risk?

We believe that the penalties in place are already sufficient.

Smart tariffs

Question 15: To what extent do you believe Government and Ofgem should play a role in promoting smart tariffs or enabling new business models in this area? Please provide a rationale for your answer, and, if you feel Government and Ofgem should play a role, examples of the sort of interventions which might be helpful.
Our response to this question is combined with question 16.

Question 16: If deemed appropriate, when would it be most sensible for Government/Ofgem to take any further action to drive the market (i.e. what are the relevant trigger points for determining whether to take action)? Please provide a rationale for your answer.

The most effective way for the Government and Ofgem to intervene in relation to Demand Side Response (DSR) at a domestic consumer level is to help encourage uptake of in home storage and smart appliances. We believe that such appliances, combined with smart meters will enable the development of automated DSR at a domestic level, which could have significant results in aggregate.

Although consumers can gain financial benefit from changing their consumption habits in response to smart tariffs, the hassle involved in this compared to the relatively small financial gain means that smart tariffs are unlikely to be sufficient on their own. The most effective means of achieving a smart system which includes domestic customers is through combining smart tariffs and grid support service earnings with home storage and smart appliances. This will be best facilitated through aggregators; whilst the end consumer that gets the financial benefit, they would have limited involvement in the front end. Contracting for grid support delivery services and organising its delivery would be done by the aggregator or other third party intermediary.

Please refer to our response to the section on electric vehicles

Question 18: Do you recognise the reasons we have identified for why suppliers may not offer or why larger non-domestic consumers may not take up, smart tariffs? If so, please provide details, especially if you have experienced them. Have we missed any?

We agree that consumer preference for simplicity and perception of low reward for smart tariffs are key reasons why uptake of smart tariffs has been limited. As noted in response to Question 15, manual responses to time of use is too time consuming and complicated to be attractive to many consumers. A far more effective approach would be to promote and reward the uptake of technology that can automate this.

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Other Government Policies

Question 25: Can you provide evidence to show how existing Government policies can help or hinder the transition to a smart energy future?

As noted in response to Question 5, the current lack of certainty that developers have with respect to treatment of a site with existing RO or FIT accreditation works as a disincentive for co-locating storage with generation.

On the question of how to ensure that the same unit of energy does not receive a double benefit, we believe that this can be easily achieved through installing a BSC accredited meter between the generator and storage. Ecotricity has a number of RO accredited wind parks with onsite demand. Our generation is metered by BSC compliant meters at the base of the wind turbines before power is taken on a private network to the onsite customer. This generation data is submitted to Ofgem and ROCs are granted for them. We separately meter spill to the grid of power not consumed by the onsite customer, but this has no bearing on the RO process. We believe that this straightforward mechanism could easily be applied to onsite storage.

We understand the convenience, from a system perspective of keeping storage in a separate BMU and this would be one way of ensuring that storage providers do not pay end consumer costs. However, we are concerned that this would increase costs for developers both through the need to maintain an additional BMU and extra administration costs. If the Government does decide to take this proposal forward, it is important that storage BMUs are eligible for embedded benefits: storage brings down system costs, a service that embedded benefits are designed to reward. Furthermore, without embedded benefits, storage development will not be sufficiently profitable.

Question 26: What changes to CM application/verification processes could reduce barriers to flexibility in the near term, and what longer term evolutions within/alongside the CM might be needed to enable newer forms of flexibility (such as storage and DSR) to contribute in light of future smart system developments?

Please see our response to the Capacity Market consultation in Annex A and our proposed amendment to the Capacity Market Rules in Annex B.

As noted in our consultation response, it is important that the Government refrain from the proposal to increase credit requirements for DSR. This could risk reducing the already low participation of DSR in the auction, this counteracting the Government's efforts to increase DSR. Our proposal to introduce a maximum carbon emissions limit of 450g CO2/kWh was proposed primarily for climate change requirements, would have the added benefit of favouring flexibility in the form of Demand Side Response and storage.

Our modification proposal to amend the definition of a Distribution Connection would ensure that co-located storage, which is owned and operated by a party not named on the connection agreement to participate in the capacity auction. We believe that such a clarification will encourage more storage participation in the capacity market.

We agree with the Government's view that entry requirements for DSR could be simplified.

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Question 27: Do you have any evidence to support measures that would best incentivise renewable generation, but fully account for the costs and benefits of distributed generation on a smart system?

In our report, 2030 Vision for a Green Britain[1], which was produced with modelling from Cambridge Econometrics, we propose a new method of calculating the full cost of a given technology. This method, known as the Integrated Net Cost of Energy, would account for the full costs and benefits of each form of power generation and include this within the price. We have included an excerpt from this report in Annex C.

Appliances

Question 28: Do you agree with the 4 principles for smart appliances set out above (interoperability, data privacy, grid security, energy consumption)?

- **Yes**
- **No (please explain)**

Yes, we agree with these four principles.

Ultra Low Emissions Vehicles

Question 33: How might Government and industry best engage electric vehicle users to promote smart charging for system benefit?

The key barriers to EV take up remains price. We would encourage the Government to follow the example of Norway, which has exempted EVs from VAT and created a positive price differential. Other successful examples include the differential taxing of diesel and unleaded petrol. Given the significant environmental benefits of EVs over petrol cars, such tax incentives make a lot of sense.

A prerequisite to significantly increasing electric vehicle uptake without adding substantial strain to the network is strategic grid upgrades in major towns and cities, where demand for EVs can be expected to be high.

Question 34: What barriers are there for vehicle and electricity system participants (e.g. vehicle manufacturers, aggregators, energy suppliers, network and system operators) to develop consumer propositions for the:

- **control or shift of electricity consumption during vehicle charging; or**
- **utilisation of an electric vehicle battery for putting electricity back into homes, businesses or the network?**

If smart charge modulation is introduced, it would be more efficient and effective for these to be incorporated into the charger, effectively making it a smart device, rather than requiring specifications in electric vehicles themselves. Such changes will require upgrading of charging hardware and thus will depend on sufficient funding being made available.

We understand the appeal of using electric vehicles for DSR, but there are many issues that must be considered first. Repeated charging and discharging would have an impact on the battery life. This could have cross over impacts on the battery warranties as EV batteries are

[1] https://www.ecotricity.co.uk/about-ecotricity/our-eco-credentials/our-2030-vision-for-a-green-britain

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not designed to cycle whilst stationary. In addition, technical issues such as temperature regulation for air cooled batteries should also be considered.

With respect to customer propositions for grid services we believe that commercial EV charging points have a role to play in this. Where the EV owner's permission exists, we see potential for the pump operator to provide DSR and receive payment from National Grid. The charge operator could then pass this benefit onto the EV owner through a credit.

For at home or workplace charging electricity providers could provide a similar role.

Roles of different parties in systems and networks

Question 43: Do you agree with the emerging system requirements we have identified (set out in Figure 1)? Are any missing?

Yes, we agree the emerging system requirements included in the consultation. We strongly support the move to more local balancing and an increase in flexibility, and we believe that the Government has identified all key requirements for this.

Increased visibility is particularly crucial. As noted above, we find heatmaps to be a particularly useful tool and strongly support an increase in their use and incentives for DNOs to ensure that these are kept up to date.

We strongly support whole system network planning. The current process of "pay as you go upgrades" of individual lines in response to network connection requests is highly inefficient and leads to situations in which a grid connection for a small generator could cost upwards of £1million and take several years. It is one of the reasons why large areas of the network are considered "full". Planning ahead and upgrading large parts of the network before connection requests are made would avoid many of those problems.

An increase in flexibility with respect to network connections is also crucial. In our experience, DNOs tend to only give quotes in response to specific requests rather than offer a variety of options that could be much more achievable, with only minor variations from the original request. Please see our response to *Getting a Connection where the Network is Constrained* in Annex D for more details on this.

Question 45: With regard to the need for immediate action:

a) Do you agree with the proposed roles of DSOs and the need for increased coordination between DSOs, the SO and TOs in delivering efficient network planning and local/system-wide use of resources?

Yes, we agree with the proposal that DSOs be responsible for operating efficient, coordinated and economical distribution networks. They will make active use of new technologies, providers and solutions; and have an increased role in delivering an efficient, co-ordinated and economical wider system.

The current system is not sufficiently joined up and we believe that significant benefits could come from the more joined up approach described in the consultation.

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b) How could industry best carry these activities forward? Do you agree the further progress we describe is both necessary and possible over the coming year?

We agree that DNOs can and must improve visibility of the steps that they are taking and make efficient use of smart meters and other technology. We also support the position that all parties need to: increase co-ordination between each other; develop formalised frameworks for network planning and whole system requirements; and develop efficient local and whole system use of resources.

c) Are there any legal or regulatory barriers (e.g. including appropriate incentives), to the immediate actions we identify as necessary? If so, please state and prioritise them.

Yes. We understand that the current mandate that DNOs have from Ofgem under the RIIO framework explicitly discourages them from carrying out strategic network upgrades in advance of receiving network connection requests. It appears that the justification for this discouragement is that such upgrades are viewed as "speculative" investments. Such a perspective might have been appropriate in the past. However, the current level of congestion on the grid and the substantial delays that generators experience, coupled with the urgent need to enable more intermittent renewable generation to connect, means that this perspective is no longer appropriate. It is essential that Ofgem reconsider its position and allow DNOs to plan the network and make strategic upgrades wherever there is limited capacity.

Question 46: With regard to further future changes to arrangements:

a) Do you consider that further changes to roles and arrangements are likely to be necessary? Please provide reasons. If so, when do you consider they would be needed? Why?

We believe that the current problems of limited network capacity and expensive grid connections will only get worse without the changes to grid upgrades proposed.

b) What are your views on the different models, including:

i. whether the models presented illustrate the right range of potential arrangements to act as a basis for further thinking and analysis? Are there any other models/trials we should be aware of?

ii. which other changes or arrangements might be needed to support the adoption of different models?

iii. do you have any initial thoughts on the potential benefits, costs and risks of the models?

We support the market signals and arrangements approach as the one which provides the most flexibility. However, it is important that fixed constraints such as planning and other reasons for decisions with respect to generator location are accounted for and not penalised.

Conclusion:

We strongly support the Government and Ofgem's focus on moving to a more flexible system. Taking full advantage of the rapid development of storage, electric vehicles and smart technologies will require rapid changes in regulation, infrastructure and charging.

Crucial changes include: amending the way storage is treated with respect to charging and network connections, so that these reflect the system benefits that storage brings and amending the

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mandate of DNOs to ensure that they make the strategic network upgrades necessary to support increased EV uptake and more distributed generation.

Changes to the balancing mechanism are also needed to ensure that all services are procured in a transparent and competitive manner. Increased participation in balancing services and the capacity market can be achieved by enabling stacking of revenues and reducing the minimum clip sizes.

We are sceptical about the possibility for significant developments that rely on changes to consumer behaviour, even with the assistance of smart time of use tariffs. However, we believe that combining such tariffs with smart meters, smart enabled appliances and at home storage so that responses to price changes can be automated has significant potential.

Ecotricity welcomes the opportunity to respond and hope you take our comments on board. We also welcome any further contact in response to this submission. Please contac[redacted]nd [redacted] or [redacted] [contact details redacted]

Yours sincerely,

[signature redacted]
[contact details redacted]

[redacted]

[name redacted]
[job title redacted]

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Annex A: Response to Consultation on Capacity Market Rules (enclosed)
Annex B: Capacity Market Rules Change Proposal (enclosed)
Annex C: Excerpt from our 2030 Vision for a Greener Britain (below)
Annex D: Response to Getting a Connection where the Network is Constrained (enclosed)

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Annex C

Excerpt from *Ecotricity's 2030 Vision for a Green Britain*
Full report available here: https://www.ecotricity.co.uk/about-ecotricity/our-eco-credentials/our-2030-vision-for-a-green-britain

Integrated Net Cost of Energy (INCOE)

Introduced in 2025, after rigorous testing by the Department of Energy and Climate Change and scrutiny in parliament, the new Integrated Net Cost of Electricity (INCOE) measure revolutionised the way in which Britain understands the cost, and benefit, of its energy choices to our economy and society. It wasn't popular with the oil, gas and coal industries because it revealed the true cost of burning fossil fuels. But fortunately the government stuck with it. The need to develop new ways of measuring the overall costs and benefits of different energy choices was recognised early in the 2000s as a necessary antidote to the sort of short term thinking which argued that we should just burn dirty coal for our power because it was 'cheap'. The first step was the launch of the European carbon market in 2005 which tried to make dirty sources of energy pay for their pollution. But once people noticed that the price of energy didn't include the cost of its pollution, companies, academics and civil servants began to think about what else wasn't being included. As more research was done, people began to realise that a whole raft of costs were not being considered, making it impossible to make the right decisions on how Britain should be powering itself. People pointed out that Britain was exposed to political threats to its oil and gas supply, but the cost of insuring against this risk wasn't included in their price. Britain was paying for the need to back-up renewables for when the wind isn't blowing or the sun isn't shining, but this wasn't included in their price. Britain was paying to dispose of nuclear waste, but this wasn't included in the price of nuclear power. Even though we had the European carbon market, it wasn't working properly and the real impact of carbon on our environment wasn't included in anything's price. But just as important as the costs which were not being paid for, the benefits of different energy types were not being accounted for either. Most importantly this included the massive economic opportunity for Britain of building out a renewable energy industry. When we looked at the costs and benefits of renewables we weren't measuring the new jobs and new businesses, the rejuvenation of the communities who would build parts for wind turbines and solar plants. We were looking at the picture with one eye closed. And when all of these costs and benefits were taken into account, it showed something remarkable. In 2025 when all of the impacts on the environment and people's health were taken into account for coal, and all the benefits of the jobs, new businesses and tax revenues were taken into account for the offshore wind industry, coal was shown overall to cost Britain the most, and offshore wind the least! After that Britain's energy choices were made while firmly focussed on the bigger picture.

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Ecotricity Response to the Consultation on the National Infrastructure Assessment

Dear National Infrastructure Commission,

Thank you for the opportunity to respond to this consultation. We welcome the establishment of the National Infrastructure Commission and the overall strategic approach that it is taking.

Ecotricity is an independent renewable energy generator and supplier, with around 180,000 gas and electricity customers. We have been generating renewable electricity since 1998, with 80.72 MW of renewable electricity generation from wind and solar and 80.72MW in the pipeline. We also own and operate a small scale wind turbine manufacturer, Britwind, which has customers across the country and around the world. This experience as a vertically integrated renewable energy company makes us well placed to comment on electricity infrastructure needs.

Ecotricity have been supplying gas since 2010 and our gas mix includes green gas certified by biomethane certificate schemes. We are in the process of developing our own green gas mills and currently have 9 sites in the development process. Once up and running, these sites will use grass cuttings as a feedstock. This grass will come from the following sources: management arisings (grass cuttings) from nature reserves, where grass management is necessary to maintain the quality of nature habitats; local farms that use grass as a break crop in crop rotation; and grass grown on land that is not suitable for food cultivation. The method that we propose will have benefits for farming, soil, water quality and flood defence. Therefore, it is a solution that has the potential to answer multiple problems that the National Infrastructure Assessment (NIA) will be addressing.

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We believe that our experience in the market makes us well placed to respond to the questions posed. Indeed we have already set out our own vision for a Green Britain in 2030[1], which we enclose in Appendix A.

The Missing Infrastructure Sector: Soil

There is one major area of infrastructure missing: soil. As a nation, our ability to produce our own food is dependent on maintaining healthy soils, but degradation in soil quality is already hitting crop yields[2]. Arable farming in the UK is contributing to in top soil dereliction to the point that climate change could rapidly create desertification, followed by high rainfall induced soil erosion. The Countryside Survey of 2007[3] found significant decreases in soil carbon concentrations between 1978 and 2007. Numerous surveys including in arable and horticultural broad habitats in the UK have had similar findings. Most worryingly, recent studies by Sheffield University suggest that the UK has only 100 harvests left[4] . Relying on imports to replace this is not an option as the UN predicts that if current practises continue, the global average could be just 60 years of farming left[5].

Such dereliction is not inevitable and with the correct policies and practices these problems can be reversed. Just as the development of our electricity infrastructure benefits from appropriate policies, so too does soil health. Furthermore, the practices that help restore soil health are also instrumental in flood defence and improving water quality and, as we will demonstrate below, can also be incorporated into the energy infrastructure. It therefore makes sense that soil maintenance should be seen as an infrastructure priority and form a part of the National Infrastructure Assessment (NIA).

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[1] The 2030 Vision and the Econometrics report, on which much of the work was based is available on our website: https://www.ecotricity.co.uk/about-ecotricity/our-eco-credentials/our-2030-vision-for-a-green-britain

[2] Allison, R. 2014. UK Soil crisis hitting crop yields, warns experts. *Farmers Weekly.* 10th Feburary, available [Online] at: http://www.fwi.co.uk/arable/uk-soil-crisis-hitting-crop-yields-warns-expert.htm

[3] Emmett, B.A., Reynolds, B., Chamberlain, P.M., Rowe, E., Spurgeon, D., Brittain, S.A., Frogbrook, Z., Hughes, S., Lawlor, A.J., Poskitt, J., Potter, E., Robinson, D.A., Scott, A., Wood, C., Woods, C. 2010. *Countryside Survey: Soils Report from 2007.* Technical Report No. 9/07 NERC/Centre for Ecology & Hydrology 192pp. (CEH Project Number: C03259). Available [Online] at: http://www.countrysidesurvey.org.uk/content/uk-results-2007

See also: Jones, A., Panagos, S., Barcelo, F., Bouraoui, F., Bosco, C., Dewitte, O., Gardi, C., Erhard, M., Hervas, J., Hiederer, R., Jeffery, S., Lukewille, A., Marmo, L., Montanarella, L., Olazabal, C., Petersen, J-E., Penizek, V., Strassburger, T., Toth, G., van Den Eeckhaut, M., van Liedekerke, M., Verheijen, F., Viestova, E., and Yigini, Y. 2012. *The State of Soil in Europe.* European Environmental Agency. Available [Online] at: http://eusoils.jrc.ec.europa.eu/ESDB_Archive/eusoils_docs/other/EUR25186.pdf

Environment Agency's 'State of Soils' publication from 2004, links organic matter losses and arable cultivation practices: http://www.adlib.ac.uk/resources/000/030/045/stateofsoils_775492.pdf

Walling, D.E. & Quine, T.A. (1991), 'Recent rates of soil loss from areas of arable cultivation in the UK, sediment and stream water quality in a changing environment: trends and explanation' (Proceedings of the Vienna Symposium, August 1991) IAHS Publ. no. 203.

[4] Case, P. 2014. Only 100 harvests left in UK farm soils, scientists warn. *Farmers Weekly.* 21st October, available [Online] at: http://www.fwi.co.uk/news/only-100-harvests-left-in-uk-farm-soils-scientists-warn.htm

[5] Arsenault, C. 2014. Only 60 years of farming left if soil degradation continues. *Scientific America.* 5th December, available [Online] at: http://www.scientificamerican.com/article/only-60-years-of-farming-left-if-soil-degradation-continues/

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Question 1: The Government has given the National Infrastructure Commission objectives to:

- **Foster long-term and sustainable economic growth across all regions of the UK**
- **Improve the UK's international competitiveness**
- **Improve the quality of life for those living in the UK**

What issues do you think are particularly important to consider as the Commission works to this objective?

We have combined our response to questions 1 and 2 below.

Question 2: Are there any principles that should inform the way the Commission produces the NIA that are missing?

It is not clear from the consultation whether environmental sustainability is already a key objective or whether the reference to sustainability is only in relation to economic sustainability.

It is essential that the National Infrastructure Commission prioritises environmental sustainability and greenhouse gas reduction. As a body charged with taking a long term view of multiple infrastructure issues it is important that its assessments and recommendations do not "lock-in" polluting industries and practices. In order to be meaningful, recommendations should meet and exceed the UK's National and International targets and enable the UK to meet the carbon reduction commitments recommended by the Committee on Climate Change. A failure to take the Committee's recommendations on board, would not only risk deprioritising climate change as a national concern, but will also undermine the Commission's remit of taking a long term view.

Question 3: Do you agree that the NIA should cover these sectors in the way in which they are each described?

Yes, we believe that transport, energy, water and drainage, flood defence, waste and digital communications are all important areas. As currently presented, sustainability and climate change prevention do not appear to be central concerns in the way that these will be addressed. As noted above, these should be central concerns for all sectors.

Question 4: Are there particular aspects of infrastructure provision in these sectors which you think the NIA should focus on?

We have combined our response to question 4 and 5 below.

Question 5: The NIA will seek to pull together infrastructure needs across sectors, recognising interdependencies. Are there are particular areas where you think such interdependencies are likely to be important?

Electricity Networks

With respect to electricity, one key area that needs to be investigated is that of the distribution and transmission networks. In their current state, the networks are not able to accommodate additional generation, particularly distributed generation. In short, the grid was not designed with distributed, intermittent generation in mind and must now be upgraded to enable renewable generation to come on line.

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Under the current framework developers frequently need to pay significant sums for network upgrades as a condition of connecting to the grid. Lines are upgraded separately in response to individual connection requests. In our view, a far more efficient approach would be for whole regions to be upgraded together in anticipation of additional generation connected. We provide more detail on this and other problems we have experienced in the attached response to Ofgem's consultation on Getting an Electricity Connection when the network is constrained in Appendix B.

Credit for Onsite Generation

One way to reduce demand on the distribution networks is to encourage generation on private wires that directly supply an end customer. This reduces demand on the network by replacing electricity that would otherwise flow across the distribution network to supply that customer. By reducing the load on the network, onsite generation is effectively reducing the costs of maintaining it. We would suggest that the Commission should explore ways of incentivising such onsite and private wire generation. The primary way in which the cost of carrying electricity over the distribution network is met is through Distribution Use of System (DUoS) charges, paid for by suppliers and passed on to energy consumers. One means of recognising the benefit from distributed generation could be via a form of DUoS credit to the onsite generator, which would reflect the benefit that this brings to the system.

Green Gas: Heat

The fact that the electricity network is already stretched to meet the requirements of new forms of generation must be taken into consideration when assessing renewable heat solutions. When addressing the issue of how to decarbonise heat, there has long been an assumption that it can simply be electrified. As noted by the Energy Networks Association[6], to do so would require a complete overhaul of the electricity networks as, even with upgrades already scheduled, the network as it currently stands could not support the additional demand. A far more efficient approach would be to use the existing gas infrastructure to look at making gas sustainable through the use of biomethane, also known as green gas.

As well as assessing interdependencies, the NIA should consider solutions that address multiple infrastructure priorities. Biomethane for grid injection is one example of such a solution. Not only does it have the advantage of using existing pipeline infrastructure, but when grass is used as the feedstock and grown through the method we are proposing, it also contributes to soil improvement; carbon reduction, flood defence and reduces chemical run offs into waterways. This is detailed below.

Green Gas: Improvements in Soil Quality

A major factor in soil dereliction referred to above has been the over concentration of single crops. Low grade arable areas have become extremely dependant on chemicals from herbicides, pesticides and fertilizers, due to their low quality. Although this chemical input improves short term production, in the long run it simply compounds the problem of soil dereliction.

[6] Energy Network Association (ENA) response to Scottish Parliament. ENA. [Undated]. *Submission from Energy Networks Association.* Available [Online] at: www.parliament.scot/.../Inquiries/Energy_Networks_Association.pdf

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On their own, annual arable crops, do not create sufficient soil organic matter to replace the losses from long term arable farming. However, this lost organic matter can be recreated by alternating crops with deep rooted mixed species grasses. This contributes to improved soil health, structure and texture; and both provides an alternative to chemical input and counteracts the impact of its historical use. The benefit of this change of land use can be extended by growing medium to long term grass leys. If managed for silage production, grass leys enable a change of agricultural practice, which over a period of time removes the requirement of added agrichemicals and artificial fertilizers.

Restoration of soil organic matter levels results in major improvements in soil health and texture. This has the following key benefits: improved surfactant adhesion of chemicals within the soil, which provides a natural method of controlled release when conditions for plant growth are at their best; a reversal of top soil dereliction and soil erosion; an increase in soil fertility; and a reduced dependence on chemical fertilizers. Together, all these factors increase the long term ability of the soil to support food production.

Green Gas: improvements in drinking water quality

The improvement of soil organic matter not only increases long term food production; it can also have wider benefits to reducing chemical run off (leaching); improving drinking water quality; and improving flood defences.

Common practice arable farming (using oilseed rape as a break crop in rotation with wheat) relies on specific herbicides and molluscicides such as carbitamide and metaldehyde. In certain places these are exceeding legal limits in drinking water, which causes severe problems at certain times of the year. Replacing bare arable land with a managed turf slows the flow of water and reduces the speed of percolation into the rocks, increasing the opportunity for chemicals to breakdown before entering waterways.

This reduction in speed of flow also provides for increased rainfall absorption, better runoff impedance, downstream flash flooding reduction and better soil moisture retention. This enables the soil to hold and breakdown herbicides and molluscicides, preventing them from contaminating reservoirs; significantly reducing the cost of making water fit for human consumption. A 2015 study[7] into the use of vegetation buffers to retain pesticides in water saturated zones found that grass contributed to reduced pesticide content. A similar study conducted in Southern Quebec[8] in 2009 found that that grassed buffer strips reduced runoff water by 40%; phosphorous reduced by 86%, NH4 by 47%, NO3 by 33% and e. Coli by 48%.

Ecotricity has been working on a pilot project with Thames Water and local farmers in the Cotswolds. This is being achieved through DEFRA funding for the Upper Thames Catchment Payment for Ecosystem Services Pilot. The Pilot is based on evaluating the impact of arable farming in a confined part of the Thames catchment and then evaluating the impact of reversion of arable practice to grow mixed species grassland on water body quality improvement. A proposed associate anaerobic digestion plant will consume the production from the grassland created, giving the pilot commercial support.

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[7] Aguiar Jr, T.R., Bortolozo, F.R., Hansel, F.A., Rasera, K. and Ferreira, M.T. 2015. Riparian buffer zones as pesticide filters of no-till crops. *Environmental Science and Pollution Research*, *22* (14): pp.10618-10626.

[8] Duchemin, M., and Hogue, R. 2009. Reduction in agricultural non-point source pollution in the first year following establishment of an integrated grass/tree filter strip system in southern Quebec (Canada). Agriculture, Ecosystems and Environment.

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Preliminary results from this pilot show a significant reduction in the chemical run off from the land and therefore an improvement in the drinking water in the area. We enclose a copy of this report as evidence in Appendix C.

Green Gas: Flood Prevention

As noted above, grass matt reduces the speed of water flow and retains water reducing flash flooding. This relationship has been well documented in numerous studies. For example, a 2011 study[9] compared runoff and sediment across conditions in which grasses (used for biomass) were either removed or not removed and found that grass removal increased sediment run off by average of 15%.

Water Companies as Energy Consumers

With respect to the relationship that energy has with waste, it is important to consider that water management companies are significant users of energy as well as being potential contributors to renewable solutions.

Aviation and Wind Turbines

Another area that should be looked at is the relationship between wind turbines and aviation: specifically the way in which wind turbines can interfere with radar. Wind farms that are built near airports frequently need to put in place radar mitigation technology as a condition of planning permission. This is currently done on a case by case basis due to the different radar systems at different airports. The cost and length of time taken to develop this technology can be prohibitive, which means that otherwise viable consented projects do not get built. We would urge the Commission to include an overall assessment of this and explore ways of standardising air traffic systems and the radar mitigation technology in order to bring down costs and facilitate more generation.

Question 6: Do you agree that the NIA should focus on these cross-cutting issues?

We have combined our response to questions 6, 7 and 8 below.

Question 7: Are there any other cross-cutting issues that you think are particularly important?

Questions 8 Do you agree with this methodological approach?

We believe that all the cross cutting issues listed should be considered. However, it is not clear from the consultation document how the Commision would weight these different priorities, although it appears that cost will be prioritised. Our view is that, given the urgency of the threat that is posed by climate change and the additional strains it will place on infrastructure; it is climate change that needs to be given the highest weighting.

[9] Wilson, H.M., Cruse, R.M. and Burras, C.L. 2011. Perennial grass management impacts on runoff and sediment export from vegetated channels in pulse flow runoff events. *Biomass and bioenergy, 35* (1): 429-436.

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Sustainability and Climate Change

In addressing climate change commitments, the commission should look at both replacing polluting technologies and improving the capacity of the natural environment to sequester (capture) carbon. This is another area in which soil is critical. As well as enabling plant growth, soil itself is a key carbon sink and the maintenance of soil organic matter is essential for long term carbon sequestration. Again, the method of green gas production which we propose, through improving soil organic matter, will also improve its ability to sequester carbon.

With respect to bodies that should be consulted, we would suggest that the Committee on Climate Change should be included.

Finance and Funding

In relation to energy, it is important to note that no new build technology is currently viable without subsidy. The Government's recent cuts to renewables subsidies have created a reduction in confidence and stalled a lot of investment. In order to regain confidence and ensure the necessary energy infrastructure can be built, it is essential that this be addressed. Therefore, the Commission should look at the role of Government in relation to finance and funding and how it can encourage rather than discourage investment.

Demand Management and Storage

We support the Commission's inclusion of demand management as an area to consider. With respect to energy, demand pricing as an incentive to encourage home storage solutions. In particular, how home scale storage can work with smart meters to encourage load shedding (demand reduction) at peak times.

We would also advocate an investigation into the current barriers to deployment of storage. Ecotricity are exploring possibilities for using home scale storage to balance the local network: home scale batteries would import electricity at times of low demand and high generation and export at times of high demand and low generation. One specific barrier we have come across is the way in which Distribution Network Operators (DNOs) treat storage as if it were generation. For example, generators (and batteries) with a capacity of up to 3.8kW need to perform a G83 test and notify the DNO of the installation. There is a limit to the number of G83 installations that a single developer can have in one area. The rationale for this limit is that DNOs do not want generation flooding onto the network at the same time, which makes sense for generation; however, it does not make sense for storage, which balances the network rather than overloading it.

The role of grid scale storage on reducing demand on the network, and how this can be combined with intermittent generation, should also be explored. Storage technology is still not commercially viable on a grid scale without subsidy and; the Commission should make exploring how it can move to full commercialisation a priority.

Question 9: Do you have examples of successful models which are particularly good at looking at long-term, complex strategic prioritisation in uncertain environments?

We do not currently have any such models that we would recommend.

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Question 10: Do you believe the Commission has identified the most important infrastructure drivers?

We agree that economic growth and productivity, population and demography, climate change and environment, and technology are all important drivers.

In addition we would add constitutional, policy and legislative change. This is particularly relevant in light of the recent vote to leave the European Union. The Commission should consider both the direct impact of any EU regulations that cease to apply to us and the impact that the vote to leave has on investor confidence.

Question 11: The NIA will aim to set out a portfolio of investments that best meets the demands of the UK in the future. Do you have a view on the most appropriate methodology to determine that portfolio?

We have combined our response to questions 11 and 12 below.

Question 12: In your view, are there any relevant factors that have not been addressed by the Commission in its methodological approach?

The methodology used should include the whole cost of a given option including all direct and indirect subsidies and externalities such as pollution. With respect to energy, this would include tax breaks; the costs of disposing of nuclear waste; air pollution and its consequential health problems; and, critically, carbon emissions.

In addition, the Commission should explore the indirect benefits that each option brings such as job creation in rural deprived areas, displacing subsidies for other goods and reducing dependence on imports. In relation to our green gas proposal, the fact that it can provide an additional income for farmers and therefore reduce the need for agricultural subsidies should be factored in. Under Defra's Catchment Sensitive Farming Project[10], farmers could earn between £182/ha and £253/ha for growing and maintaining grassland. This grass would need to be cut or grazed, but there was not necessarily any use for the grass cuttings. If farmers could receive an income by selling the grass cuttings as AD feedstock then this subsidy could be reduced.

In relation to energy, Ecotricity has outlined a methodology for calculating the total cost and benefits of different technologies. We have labelled this the Integrated Net Cost of Energy (INCOE): this would combine all costs and benefits that each technology has for society overall. Please see pages 10- 12 of our 2030 Vision in Appendix A.

Question 13: How best do you believe the Commission can engage with different parts of society to help build its evidence base and test its conclusions?

In addition to publishing the consultation documents on its website, the Commission should proactively email copies to all relevant businesses, civil society groups, academic institutions

[10] Natural England. 2016. *Countryside Stewardship: Higher Tier Manual.* Available [Online] at: https://www.gov.uk/government/collections/countryside-stewardship-get-paid-for-environmental-land-management#higher-tier [Last accessed: 3/08/2016]
Also see - Natural England. 2014. *Catchment Sensitive Farming: reduce agricultural water pollution.* Available [online] at: https://www.gov.uk/guidance/catchment-sensitive-farming-reduce-agricultural-water-pollution [Last accessed: 3/08/2016]

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and local authorities. It should also contact relevant trade press and encourage them to write about the consultations.

Conclusion

In summary Ecotricity supports the broad approach that the Commission proposes to take with the NIA and we agree that the areas identified should be examined. We believe that there is one additional infrastructure area that needs to be included: soil. Soil preservation is critical in ensuring a secure food supply and in removing carbon from the atmosphere.

Ecotrotricity urges the Commission to explore the opportunities presented by biomethane from grass feedstock. When grown with the appropriate method, this can provide solutions to the requirement for: renewable energy, flood defence, water treatment and carbon reduction. In addition, it makes sense economically to use the significant gas pipeline infrastructure that we already have in place.

Additional areas that we believe should be the focus of the Commission's attention include: how the electricity grid is upgraded; the role of storage and how aviation radar mitigation technological development can be made more efficient.

Ecotricity welcomes the opportunity to respond and hope you take our comments on board. We also welcome any further contact in response to this submission. Please contact [redacted] on [redacted] [contact details redacted]

Yours sincerely,

[redacted] [signature redacted]

[name redacted]

[redacted] [job title redacted]

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Green Gas

The opportunity for Britain

November 2016

ecotricity

Executive summary

The 14th of March 2016 was an historic day for Britain. On that day, Energy Minister Andrea Leadsom committed the government to set in law a post-2050 goal of net zero emissions. That's very much the future of Britain that we set out in Ecotricity's 2030 Vision[1].

To get there, we are going to have to work on a new frontier – to remove the carbon emissions from our nation's heating.

This is a major challenge. In the short term, we are struggling to meet our 2020 target of 12% of our heating from renewable sources. In the longer term, we will never remove the carbon from our economy if we cannot remove the carbon from our heating, which accounts for around 45% of our total energy use.

We believe that we have found a solution that could play a significant part in this: Green Gas Mills.

Through the process of Anaerobic Digestion, our Green Gas Mills use native grasses as fuel to produce biomethane (or 'Green Gas' as we call it). The big benefits of Green Gas are that it is a fuel source that will never run out, it's virtually carbon neutral, it reduces the need to import fossil fuels from overseas or frack the countryside, and it uses existing infrastructure such as the gas grid and household heating systems.

The potential for Green Gas in Britain

In the short term, Green Gas can immediately play a key role in helping to meet our 2020 renewable heat target. A typical Green Gas Mill at 5MW will require about 3,000 acres of grassland to supply 3,500 homes with all the gas they need. That's less than one acre per household.

The construction of 1,000 Green Gas Mills, each of 5MW capacity, would be enough to make up the current shortfall against our 12% target and would create around 15,000 jobs and pump £1.5 billion into the rural economy.

In the long term, with domestic gas demand expected to fall, each 5MW Green Gas Mill should supply almost 5,000 homes. Meaning Britain should have enough suitable land to supply the overwhelming majority of household heating using Green Gas Mills fed by grass – all without reducing Britain's agricultural production.

The construction of 5,000 Green Gas Mills, each of 5MW capacity, would be enough to supply 97% of British households and would create around 75,000 jobs and pump £7.5 billion into the rural economy. We believe this could be achieved by 2035.

This would require a massive scaling up of Green Gas and there will be challenges but it shows just how big the potential is.

Green Gas with benefits

Green Gas Mills can decarbonise our heating and help tackle climate change. They have other benefits too; they can:

- Boost rural economies: each Green Gas Mill will generate around 30 jobs and £3 million a year in feedstock contracts for farmers
- Enhance food productivity: soil health is improved when grass feedstocks are grown in rotation with crops on arable land
- Support wildlife and biodiversity by providing a habitat rich in pollen and nectar for bees and other insects in area growing feedstock grasses
- Reduce our reliance on gas imports as North Sea production declines and obviate the need for fracking

- Use existing gas infrastructure: allowing us to simply change the gas we use from fossil fuel to grass fuelled.

We believe that Green Gas Mills are the antithesis of fracking: virtually carbon neutral, they are a genuinely renewable source of indigenous gas; they offer an inexhaustible, rather than limited, supply; and they bring enhanced local economic benefits without risks to water supply, air quality, local communities, or climate targets. In fact, Green Gas Mills bring significant environmental benefits.

We know there are concerns around 'energy crops' which are another way of making bio methane, if the incentives are wrong, farmers may stop growing food on arable land and move instead to growing crops as biofuel for biogas. This is a legitimate concern – Britain's farmland is precious and needs to be protected. Energy crops are not the way to go.

The other widely discussed method of producing green gas is from food waste, but this comes with its own problems.

We have found another way to make green gas in Britain - from grass. It has none of the disadvantages of either food waste or energy crops, or fracking - and considerable advantages over all three. It's a big opportunity for Britain.

How can we support Green Gas Mills?

Green Gas Mills are in their infancy. We think they have great potential, but to get going and show what they can achieve we need support from policymakers. As a priority, we hope the government will:

- Maintain support to bio-methane producers through the non-domestic Renewable Heat Incentive (RHI)
- Clarify regulation and classification of permitted feedstocks under the RHI to ensure that feedstocks like native grasses, which do not threaten food production, are supported
- Avoid duplicating the regulations in place for bio-methane injection with extra rules under the RHI
- Provide further clarity post-2020 on targets for the decarbonisation of heating.

Decarbonising heating is the next big challenge as we strive to become Green Britain. We believe Green Gas Mills can play a major part in meeting that challenge. We are looking forward to proving it!

Introduction: The new frontier for decarbonisation

14 March 2016 was an historic day for the UK. On that day Energy Minister Andrea Leadsom committed the government to set in law a post-2050 goal of net zero emissions. It's now official: the future of Britain is a Green Britain, like the one we set out in Ecotricity's 2030 Vision[2].

The UK has made some good progress. In 2015 23% of the UK's electricity was generated by renewables[3]. Britain's carbon emissions have fallen by 27% over the last ten years[4]. We at Ecotricity have been proud to play our part; installing 80MW of renewable energy capacity through our 'bills to mills' business model, enough to power 56,000 homes.

But the UK is now approaching the next chapter of our challenge: decarbonising heating.

The UK's Chief Scientific Adviser to the Department of Energy and Climate Change Professor John Loughhead put it pretty bluntly: "perhaps the greatest challenge to meeting our long-term emissions target is decarbonising our heating system."[5]

Heating accounts for 45% of all energy use in the UK and is the cause of the majority of the residential emissions that make up almost a quarter of the UK's greenhouse gas emissions every year (Figure 1)[6]. It is simple: unless we can decarbonise heating, we will never become Green Britain.

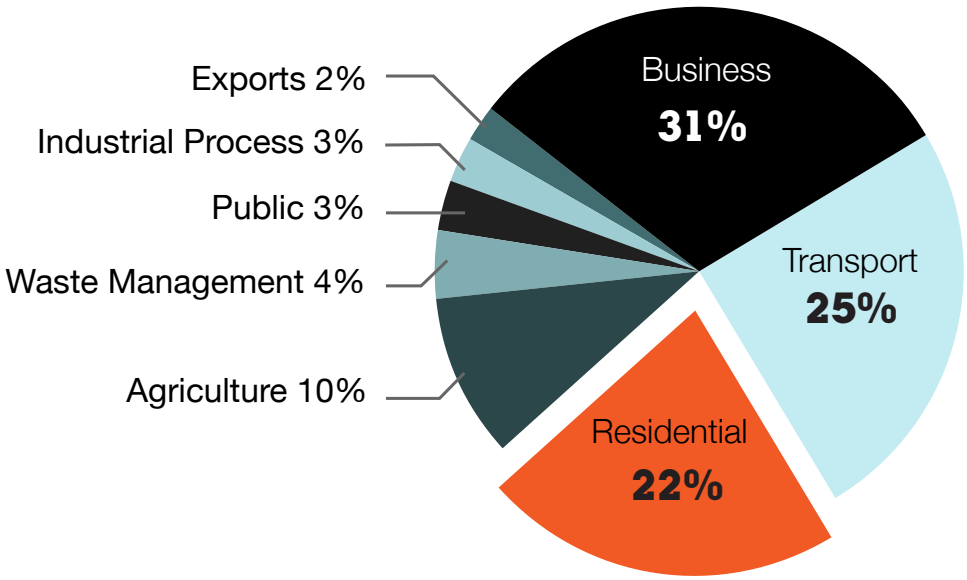


Figure 1. UK greenhouse gas emissions 2014 by end user
Source: DECC

But we also face big challenges in the short term. As part of our overall 2020 target of reducing carbon emissions by 35% compared to 1990 levels Britain has committed to supplying 15% of our energy from renewable sources.

The good news is that the UK beat its interim 2013/2014 target of 5.4%, with 6.3% of final energy consumption coming from renewables (Figure 2). The bad news is that according to the former Secretary of State for Energy and Climate Change Amber Rudd, the UK government currently thinks that unless we accelerate there will be a shortfall of around 50TWh or 3.5 percentage points come 2020; that's enough energy to heat every household in London, Birmingham, Leeds and Bristol combined.

Amber Rudd has suggested that renewable heat could make up around 20TWh or 1.5 percentage points of that shortfall (enough to heat half the households in London).

A big challenge. But we think we have got a solution that can help us hit our targets in the short term, and transform into Green Britain in the longer term: the Green Gas Mill.

We are excited about its potential, so we have put this paper together to:

- Introduce our Green Gas Mills and explain how they work;
- Set out how they help us decarbonise our heating and meet our 2020 renewable heat and energy targets;
- Take a look at the scale of the potential for Green Gas to displace fossil fuel gas over the longer term;
- Explain the additional benefits of Green Gas Mills which go beyond decarbonising our heating;
- Highlight how the UK government can help Green Gas fulfil its potential.

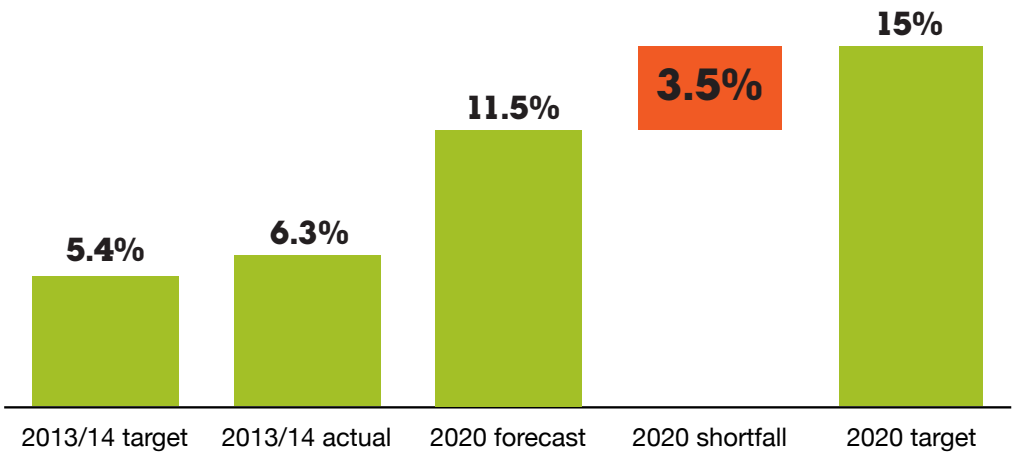


Figure 2. UK progress towards 2020 renewables target

Source: DECC

A beginner's guide to the Green Gas Mill

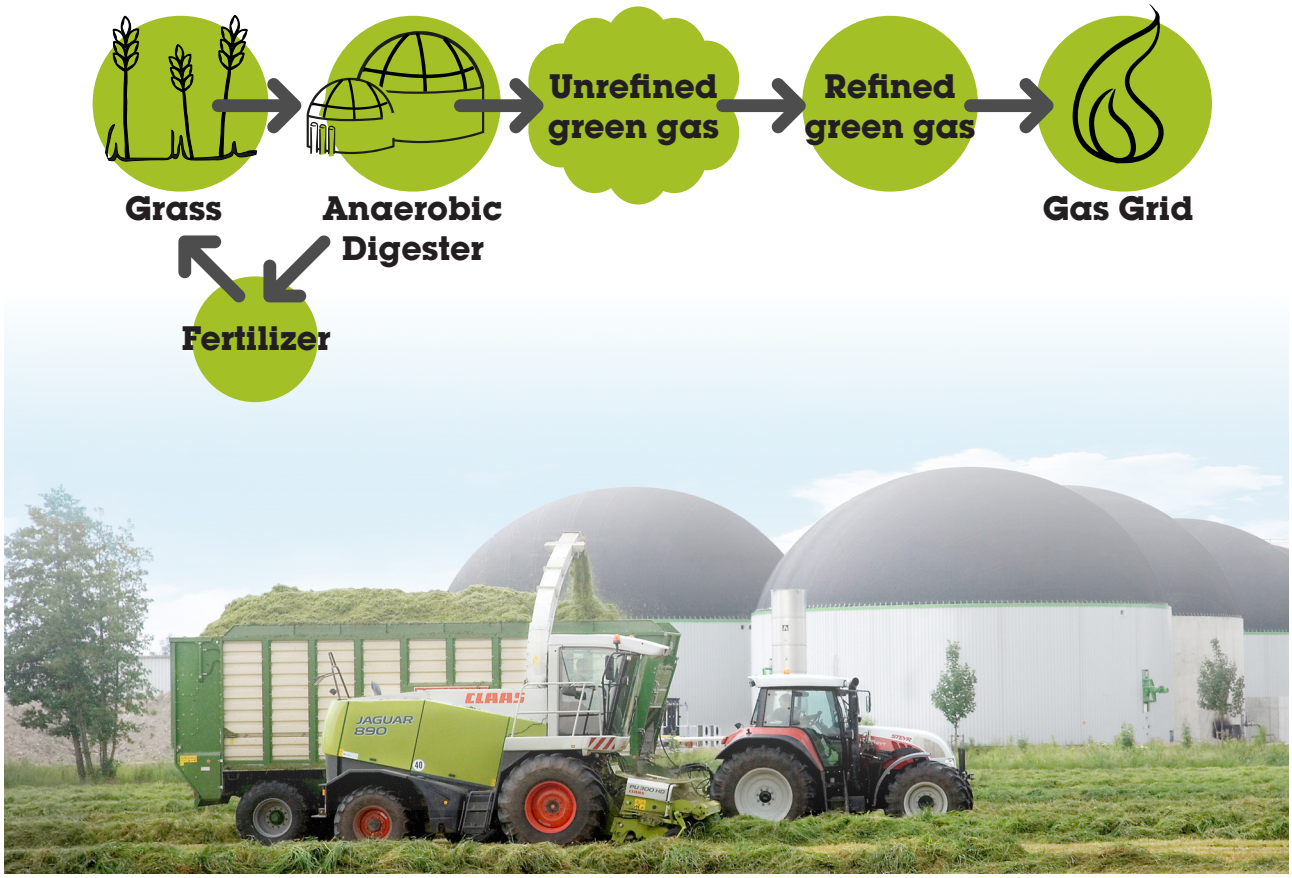
We have been working on our Green Gas Mills for a while now, and we are not the only ones. There were around 50 similar plants operating in Britain by the end of 2015[7]. These Green Gas Mills are potentially revolutionary: using native grasses as fuel they produce bio-methane (our Green Gas), which is both renewable and virtually carbon-neutral but can be used just like fossil fuel gas. The big difference is that bio- methane recycles existing carbon in the atmosphere which has been absorbed by the grass, rather than fossil fuel gas which releases carbon and methane which was previously safely stored underground when it is burned.

The way the Green Gas Mills work is pretty simple. We fuel them with organic feedstocks – in our case grass – which bacteria then break down in an oxygen-free environment through a process of Anaerobic Digestion (AD). From the process of AD we get two main outputs: biogas and 'waste products' which aren't actually wasted at all, but can be used as a rich source of organic fertiliser.

In many ways the process is just like a cow: the grass goes in one end, and gas and fertiliser come out the other! But in this case, rather than the gas 'escaping' like it does from cows, we collect it and use it.

Some people use the biogas to produce electricity in small on-site generators. Our Green Gas Mills go one step further. Once we have the biogas it is then 'scrubbed': purified and brought up to the UK's high environmental and safety standards as bio-methane. Once it has been scrubbed it can be fed directly into the national gas network to be used for heating in gas-fired boilers or for cooking on a normal hob.

That's the beauty of the Green Gas Mill: you can be cooking on Green Gas and you won't even notice!



Achieving Our Green Potential Part I: hitting our targets

"The highest potential for additional renewable heat is from bio-methane injection into the gas grid…" – Amber Rudd, Secretary for Energy and Climate Change letter to ministers, 29 October 2015[9].

So how can Green Gas Mills help the UK meet the heating challenge? The UK's 2020 renewable energy target includes a renewable heat sub-target of supplying 12% of heating demand through renewable energy. The latest figures for renewable heat from the Department of Energy and Climate Change show that we are currently at 4.9%, leaving a shortfall of 7.1 percentage points, or 42.5 TWh per year[10].

National Grid has projected future scenarios, which highlight the possibility of a three-fold increase from 60 bio-methane connections today to up to 197 connections by 2020, and an almost ten-fold increase to 587 by 2030[11]. We think this represents an absolute minimum, 197 of our Green Gas Mills would generate up to 17TWh of renewable heat – leaving us only one third of the way to making up that 12% target.

The road to carbon neutrality

Our Green Gas is virtually carbon-neutral, but we are not just trying to reduce emissions from the gas itself, but from all the processes which go into producing it, or the 'life-cycle emissions'. That can include the emissions from harvesting the grass, collecting the grass, powering the Green Gas Mills and any other process involved. Measuring this can be really tricky.

We estimate that the carbon intensity (the amount of carbon emitted with every unit of energy generated) of our Green Gas is 33gCO2/kWh. We are pretty proud of this, and as you can see it is streets ahead of the average fossil fuel gas carbon intensity of 184gCO2/kWh[8].

But we think we can do better. We are working on new prototypes for the Green Gas Mills which will power and heat themselves with their own low carbon energy, rather than relying on the grid. We are looking at organic fertilisers for the grasses and using our Green Gas to power the trucks which collect the grass.

Our goal? To get as close to completely carbon-neutral as we possibly can.

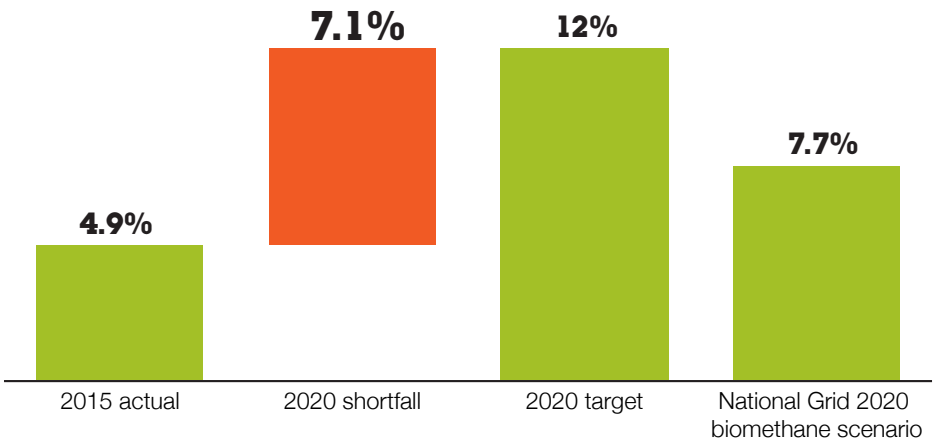


Figure 2. UK progress towards 2020 renewable heat target
Source: DECC, National Grid

Theoretically the whole 7.1 percentage point shortfall could be met by 1000 of our Green Gas Mills. Given where we are now, this would represent a massive up scaling of bio-methane in the UK, and we are not suggesting that Ecotricity goes it alone. But we do agree with Amber Rudd that bio-methane has the highest potential for providing additional renewable heat energy to help us reach our 12% renewable heat target, and that overall 15% renewable energy target.

Why? For three reasons:

- **Distribution:** We can use the UK's existing gas infrastructure to distribute bio-methane through a highly efficient and nation-wide transmission and distribution network which provides heating for 80% of UK homes at no extra cost on our energy bills. It also means we can use people's existing boilers. This is a major advantage compared to other forms of renewable heating like heat pumps, which require installation of costly and often bulky units in people's homes.
- **Versatility:** Bio-methane is versatile and can be used for power generation, heating and cooking. Biogas from sources such as industrial or domestic waste is an important part of the emerging circular economy, but it produces gas of mixed quality which can often only be burned for power generation. The advantage of bio-methane is its superior quality which means it can be straight into the gas grid and used directly for heating homes and cooking.
- **Growth:** Bio-methane production is already growing rapidly. In 2012 the UK did not have a single bio-methane gas mill, however by the end of 2015 it had 50 mills producing an estimated 2.5TWh of renewable heat energy[12], enough to supply heat to 190,000 homes. And the speed and scale of the expansion is accelerating as the industry brings costs down and experience brings economies of scale and operational learning.

Achieving Our Green Potential Part II: becoming Green Britain

The UK is in a race to meet its 2020 targets, but this is just a staging post on the longer journey to a decarbonised Green Britain. Ultimately we believe that for the UK to decarbonise its heating sector we are going to have to rely on a range of technologies, from Green Gas Mills to solar heating to the electrification of heating through air and ground source heat pumps.

The key is going to be getting the balance right. Low carbon heat technologies like heat pumps are going to be important, but even National Grid's 'Gone Green' scenario includes fewer than half of all UK households with some form of low carbon heating technology installed by 2035[13]. We believe Green Gas can help fill the gap.

To illustrate how, we have put together three scenarios to set out in theory how far we could go in decarbonising our heating through the use of Green Gas Mills by 2035 (Table 1). These are not predictions. They are not about what we think is probable. They are about what is possible, ranging from what we think is a bare minimum to the very ambitious. Ultimately these scenarios are about highlighting how far we could go and providing the context for a discussion about how much Green Gas Mills could achieve.

	Low ambition	Middling ambition	Maximum Green Gas
Green Gas Mills	1000	2500	5000
Green gas generated (TWh)	42.5	106.3	212.5
UK households supplied (%)	20%	49%	97%
Estimated carbon saving (mn tCO2)	6.6	16.6	33.2
Revenues generated per year (£mn)	1500	3750	7500
Employees	15000	37500	75000

Table 1. Green Gas Mills 2035 scenarios
Source: Ecotricity calculations, Energy Savings Trust, DECC

Beyond decarbonisation: Green Gas with benefits

The great thing about Green Gas Mills is that not only can they decarbonise our heating, but there are a range of other benefits for Britain, both at a local and national level. We see four big ones.

1. Boosting the rural economy and supporting our farmers

Green Gas Mills bring significant economic benefits to local rural communities. Each Green Gas Mill creates around 30 jobs in cultivating and collecting feedstock, operation and maintenance, and site management. Through contracts for the grass feedstock, we estimate each Green Gas Mill will contribute £1.5 million per year, or £30 million in their operating lifetime, to the local rural economy.

This would be a huge boost to our rural communities at a critical time. According to the Department for Environmental, Rural Affairs and Farming (DEFRA) recent years have seen incomes per farm either stagnant or falling across the board: these are tough times for Britain's farmers (Figure 3)[14] . Farmers are already on the path to Green Britain. The National Farmers Union (NFU) estimates that one in three farmers and growers have already invested in some form of renewable energy production.

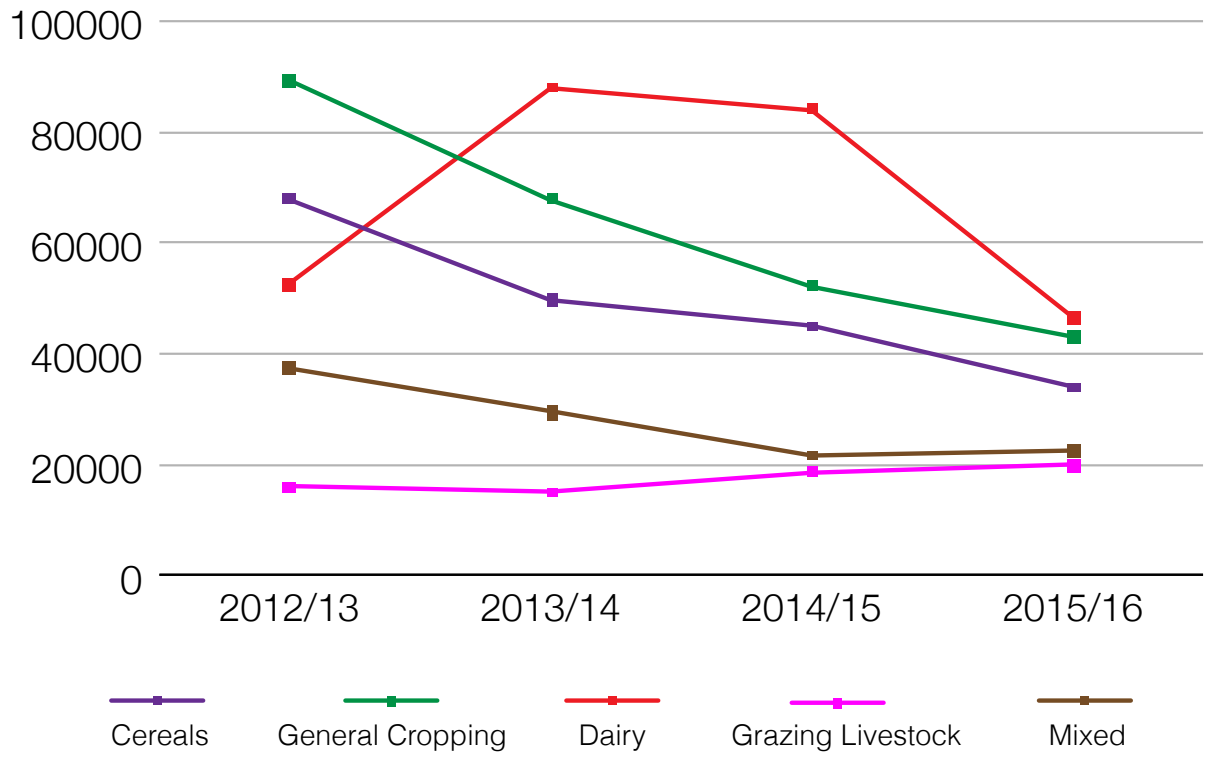


Figure 3. Average income per farm (£/farm)
Source: DEFRA

2. Enhancing the food productivity of arable farmland by improving soil health

The varieties of native grass species we use in our Green Gas Mills can enhance the food productivity of arable farmland and improve soil health when used in crop rotation cycles whilst breaking disease and fungal cycles which can persist in the soil[15]. Deep-rooted grassland is able to create and restore healthy organic matter to the topsoil in a way that can't be replicated by simply adding organic topsoils or manures. In addition, our Green Gas Mills produce organic fertiliser as a co-product of Anaerobic Digestion, which can reduce costly and environmental damaging reliance on synthetic fertilisers. Ultimately this can also help turn lower quality land

suitable for growing feed for livestock into more productive land suitable for growing food crops for humans. Growing grass crops on arable land creates an absorbent matt on the surface, which has the benefit of impeding rainfall runoff, thereby providing greater community benefit from reduced flood risk.

3. Creating habitats for wildlife

Since 1930 it is estimated that Britain has lost 97% of its flower rich grassland with only isolated pockets remaining. This has caused the decline of many species of farmland bird and insects, particularly of bees, which play a vital role in the ecosystem. Our Green Gas Mills will help to reverse this dangerous trend by creating an economic argument for management and stewardship of species rich grassland. Just 1000 Mills would support an area of 1 million hectares (or 2.5 million acres, about half the size of Wales), maintaining land with a rich variety of wild flowers and grasses. This land will then provide pollen and nectar rich habitats for birds and insects such as pollinating bees.

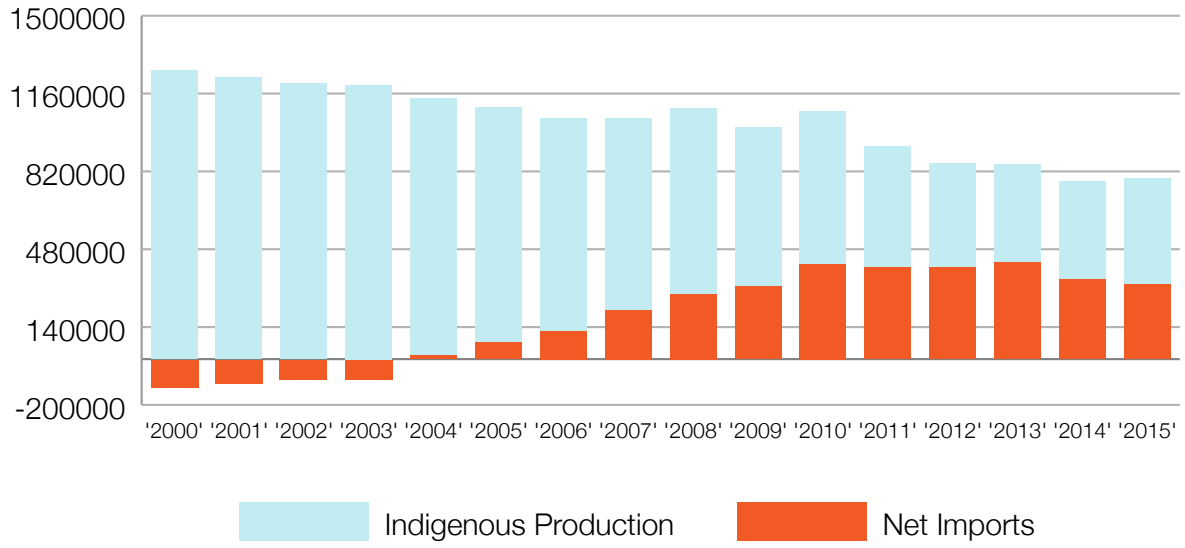


Figure 4. UK gas consumption by source (GWh)
Source: DECC

4. Reducing our reliance on fossil fuel imports

While the UK's gas consumption overall is going down, the amount we are importing is going up as the North Sea runs out (Figure 4). The UK Oil and Gas Authority has projected that by 2030 the UK could be importing three quarters of all our gas. As a result more and more of the money we spend on importing fossil fuels will be going abroad making us better customers for the Netherlands, Norway and Qatar, rather than staying at home and benefiting the British economy[16]. Rising payments for fossil fuel imports have in recent years contributed to a current account deficit, which hit £32.6 billion (7% of GDP) in Q4 2015 – the highest level the Office for National Statistics has on record since the Second World War[17].

So there you have it. Not only can Green Gas Mills put us on the road to Green Britain, but they can help our farmers, boost our food productivity, generate jobs, foster our wildlife and reduce our reliance on fossil fuel imports.

Green Gas Mills: doing good by doing it right

"The Government's policy is that the primary purpose of agricultural land should be for growing food."[23] – DECC 3 March 2016

There have been concerns raised about biogas and bio-methane that if we get the incentives wrong too many farmers will stop growing food on their arable land and move to growing crops as fuel instead. Critics have for example pointed out that in 2014 almost a fifth of all maize grown in the country was for Anaerobic Digestion, and took up around 0.7% of England's total arable land[24].

We think that they are right to be concerned – the UK's farmland is precious and needs to be protected and improved for the sake of food production and the necessary environmental gains.

But we also think that if we put the right protections in place we can both fulfill the potential we have in this country for bio-methane, and keep growing the food we need. That is why Ecotricity is committed to never using energy crops and to making sure our feedstocks never contribute to a reduction in food crop production.

That means we focus foremost of growing grass on marginal or under-utilised grazing land and on arable farmland of reduced quality (i.e. often only capable of growing feed crops for livestock).

Firstly, the amount of marginal or under-utilised grassland is growing. For example, the area of grassland used for grazing cattle has almost halved since 1990 due to changes in farming methods and agricultural subsidies that have led to reduced beef and dairy herds. We are hopeful that as people opt to eat less meat to reduce their carbon footprints this will accelerate the availability of land.

Secondly, we can grow grass temporarily on arable farmland for two to four years as a break-crop in rotation with food crops. As we explained above, this can help to increase overall food production and quality by improving soil health and reducing disease.

What we need is a regulatory framework, which protects land which should be used for growing food for humans, but where appropriate allows us to maximise production on under-utilised farmland and improve its quality by growing feedstock for AD, like in our Green Gas Mills. In addition, the improvement in soil quality from the Green Gas Mills process will increase the amount of farmland that is suitable to grow crops for human consumption. As part of our recommendations for how Britain can fulfill our Green Gas potential, we set out some areas we think are important.

Green Gas: the antidote to fracking

One area where we think that Green Gas Mills can catch the public imagination is as a virtually carbon-neutral alternative to fracking. DECC's own public attitudes tracker has found that despite the government's attempts to push fracking, more people in the UK object to fracking than support it (31% to 19%)[18]. Opposition is even stronger (53%) among those who say they know more about fracking[19].

As the government is finding out, despite their attempts to push ahead regardless, the strength of local resistance has been testimony to just how unpopular fracking really is[20] – and why the government has sought to take the decision over whether fracking goes ahead out of local hands[21].

But what is perhaps most interesting is that among those who support fracking the top three reasons people give are: needing to use all available energy sources (35%); reducing dependence on conventional fossil fuels (34%); and reducing dependence from other countries for UK's energy supply (32%). We believe our Green Gas Mills can help us meet all three of those objectives without risk of environmental damage, threat to our water supplies or negative impacts on local communities from diesel fuelled trucks loaded with chemicals pounding up and down the roads[22].

The message we want to get out is this: Green Gas is the antidote to fracking.

How can we support Green Gas Mills?

The bio-methane story in the UK is just beginning, but it is already under threat from possible government plans to cut support, despite it being one of the few technologies which can help meet the challenge of hitting our 2020 targets and decarbonising our economy in the longer term. The government's goals of protecting food production and minimising the costs on bills is important, but the policy response risks throwing the baby out with the bathwater.

To ensure that bio-methane can play its full role in helping the UK meet its renewable heat target for 2020 we believe that the government should take the following steps:

- Maintain support for bio-methane producers through the non-domestic Renewable Heat Incentive (RHI);
- Clarify regulation and classification of permitted feedstocks under the RHI to ensure that while there are appropriate restrictions on those which may have a detrimental impact on UK food production, these are clearly differentiated from other feedstocks like native grasses which do not threaten food production;
- Ensure that policy supports the use of sustainable grass feedstock grown temporarily on arable farmland as a break-crop in rotation with food crops;
- Avoid duplicating the regulations and standards in place for bio-methane injection with extra rules under the RHI;
- Provide further clarity on targets for the decarbonisation of UK heating post-2020.

If the government can commit to these points, then we and other bio-methane producers are ready to show how we can help the UK decarbonise and meet its renewables targets, and how we can do so in partnership with Britain's rural communities.

With 2020 just around the corner, it is time to get going.

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“

Green gas should clearly play its part in our energy mix. With the government set to miss its legally binding targets on renewable heat - this looks like an answer.

”

Baroness Lynne Featherstone, Liberal Democrat Energy and Climate Change spokesperson

“

As the UK ratifies the Paris climate agreement, we must not start up a new fossil fuel industry by backing fracking. We welcome every effort to help people heat their homes without relying on fossil fuels. Energy produced from agricultural and food waste will play an important part in a low-carbon future, and experiments in the use of other renewable and widely available biodegradable materials, such as in Ecotricity's Green Gas Mills, could be a step in the right direction. We look forward to seeing how the Mills can work to generate energy, support farmers and encourage positive uses for marginal and fallow land without compromising food production.

”

Tony Bosworth, Friends of the Earth Energy Campaigner

“

As long as it's not competing with food production, green gas like this project can be really helpful in getting UK on to a cleaner and lower carbon path. Agriculture need not simply be part of the problem in tackling climate change, but shows innovation can mean it's part of the solution, and improve wildlife habitat at the same time.

”

Doug Parr, Chief Scientist and Policy Director of Greenpeace UK

“

The sooner we can stop using gas from fossil sources, the greater our chances of avoiding runaway climate change. Right now, we're still very dependent on gas to heat our homes – and we need as much of it as possible to come from biological sources, rather than from fossil fuels. So it's really good to see Ecotricity's latest Green Gas initiative in this incredibly important area.

”

Jonathon Porritt, environmentalist

ecotricity

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Ecotricity Response to National Infrastructure Commission Report:
The impact of technological change on future infrastructure supply and demand

Dear National Infrastructure Commission,

Ecotricity is an independent renewable energy generator and supplier, with over 190,000 gas and electricity customers. Our commitment to those customers is that the money they pay for their energy bills will contribute towards powering the UK by renewable sources. We have followed this pledge since first generating renewable electricity in 1998, and are now at the forefront of new renewable generation with ongoing research into tidal power, storage and biomethane.

We welcome the National Infrastructure Commission's investigation into the relationship between technological change and infrastructure. We believe that this comes at a particularly critical time with technological change in storage, smart meters and electric vehicles bringing significant change to the market.

Developments in electricity storage are a key technological change that will drive savings in infrastructure needs by reducing strain on the grid. It will also bring down some of the grid associated infrastructure costs of intermittent renewable energy, which in turn reduce infrastructure requirements associated with fossil fuel generation. In the move to decarbonise heat, the pathway with the lowest infrastructure impact and highest benefit is biomethane from sustainable feedstocks such as grass.

With respect to transport, we expect the recent rise in electric vehicle use to continue. This will require significant upgrades on the electricity networks; however, it will not require an entire new infrastructure system as would be the case with hydrogen fuel cell cars.

Technological developments that create demand for additional infrastructure: intermittent renewable electricity generation

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Renewable electricity generation has made substantial gains in recent years and last year accounted for around 25% of the UK's demand. [1] Changes in Government policy towards onshore wind and solar PV are already stalling and significantly slowing deployment. This slowdown has been compounded by significant grid connection costs and delays. As detailed in our response to the NIC's NIA in August, we believe that changing the way in which DNOs approach network upgrades needs to be changed. Moving the current model, which charges developers vast sums for upgrades to individual lines to one in which a more strategic approach is taken to whole areas, would we believe lead to significant changes.

Technological developments that create demand for additional infrastructure: electric vehicles

Electric vehicles are transforming the car market and technological developments are bringing down costs; increasing the speed of charging; and improving efficiency.

In 2011 Ecotricity introduced the Electric Highway, a network of Electric Vehicle (EV) charging points which now stretches across the country with charging points at most motorway service stations. By ensuring that EV drivers had the opportunity to charge at regular intervals, the Electric Highway, has played a significant role in increasing EV uptake. This increased demand combined with technological developments and policies to bring down emissions in various countries, are driving changes in manufacturing priorities. Evidence from vehicle manufacturing shows that all car manufacturers are heavily investing in electric models and there are now over 40 different electric and plug in hybrid models available on the market. Furthermore, with ranges reaching 400 miles and charging time down to 15 minutes, EVs will become increasingly popular for a wider demographic of road user.

The conversion of the UK's car fleet to electric vehicles will require significant upgrades to electricity networks to enable them to meet the added demand.

These changes need to be factored into forecasts about increased demand and policies to ensure that grid upgrades are sufficient to meet it.

Nonetheless, we believe that these changes are achievable and when compared with alternative technologies, they present a lower infrastructure challenge.

Hydrogen fuel cell vehicles are one such alternative. Whilst EV development depends on upgrades to existing infrastructure, increasing use of hydrogen fuel cell vehicles would require an entirely new refuelling infrastructure. This, combined with lower roundtrip efficiency makes it an inferior route to transport decarbonisation.

1 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/542570/Fuelmixdisclosurewebpage2016_3_.pdf

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Technological developments that lower the cost of supplying infrastructure: storage

Storage has significant potential to reduce infrastructure costs by reducing peak demand, reducing the reserve capacity required and improving the load factor of the electricity grid.

In order to prevent a security of supply risk, the total available electricity capacity of the country has to meet or exceed the maximum demand. As energy storage deployment increases, peak demand for power generation can be reduced: batteries and other forms of storage import electricity during times of high generation and low demand and export it during times of high demand and low generation.

Ecotricity is investing in battery technology and we see three key models for its uses:

- Standalone grid connected;
- Co-located with intermittent renewable generation; and
- Behind the meter in customer homes and businesses.

Standalone grid connected storage can be used by National Grid to balance the overall system. As it is capable of deploying at short notice (down to the second) it is suitable for the provision of ancillary services such as Firm Frequency Response (FFR) and Enhanced Frequency Response (EFR) as well as longer term back up generation.

Storage that is co-located with intermittent generation can also provide the grid balancing services described above. This has the additional advantage of maximising available capacity at existing sites; smoothing out the export to grid; reducing the export capacity needed for the grid connection and ensuring that it is used to its full extent. This is critical because, as noted above, grid connections are a key barrier to the deployment of renewable generation: they are frequently upward of £1million and may take several years to construct. By reducing the maximum capacity for new connections, storage can help speed up grid connections.

Behind the meter storage, combined with smart and time of use meters enables consumers to benefit from lower off peak prices. It can also ensure that they get greater benefit from onsite Microgeneration. In aggregate these consumers can play a key role in smoothing peak demand across the country.

All forms of storage reduce the need for grid reinforcements beyond their immediate connection points; help smooth peaks and troughs in demand and generation; enable more fossil fuel generation to be replaced with renewables; remove the need for highly polluting peaking plants to stay online; and ensure security of supply. It must therefore be seen as an infrastructure priority.

Recent successes in the Capacity Market and EFR auction are a positive; but if the full potential of storage is to be realised then there are a number of barriers that must be removed. These include:

- Increasing regulatory certainty for storage and collocated generation.

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- Ensuring the treatment of storage with respect to charging and network connections reflects the fact that is disptatchable and brings system benefits.
- Amending the connections queuing system to ensure that storage can be prioritised when it brings benefits to others in the queue.
- Improving transparency and competition in balancing services by ensuring that all services are procured through open auctions, better enabling new players in the storage market to participate.
- Ensuring that DNOs publish all available information on best places to connect storage to improve accessibility and ensure competition.
- Enabling DNOs to make system wide upgrades to their networks by amending their mandate under the RIIO process.
- Decreasing the clip size for Firm Frequency Response (FFR) to 1MW.

We have provided more detail about these in our response to the BEIS and Ofgem call for evidence on flexibility, which we have included in Appendix A.

Technological change that reduces the need to build new infrastructure: biomethane

Biomethane for grid injection presents a key opportunity to use the existing gas pipeline infrastructure, whilst moving to a sustainable home grown source of gas.

Ecotricity has recently received planning permission for our first anaerobic digester, which will use grass grown as part of a crop rotation in local farms. The digestate will be returned to the farms as a fertilizer, thus reducing reliance on chemical fertilizers. By providing an incentive for farmers to use break crops our model has significant advantages in terms of improving soil health, which improves its long term ability to support food. Such soil improvements have numerous additional advantages of improving its ability to absorb carbon; reducing flood risk; and improving water quality. We detailed these advantages in our response to the NIC's National Infrastructure Consultation in August 2016 and we enclose it in Appendix B for your convenience.

Since August we have also published a report on the full potential for biomethane in the UK and the advantages of the method we plan to use. This can be found in Appendix C.

The debate around decarbonisation of heat has, we believe, been over optimistic about the potential for heat to be electrified. This has ignored the vast upgrades to the electricity grid that would be needed to meet this demand. Indeed, as Alan Whitehead MP noted in a recent to industry and policy makers,[2] the increase in demand could be as much as six fold.

By contrast biomethane provides a route to decarbonisation of heat that does not require the astronomical increase in grid costs that electrification does. Nor does it require new

[2] Speech at Cornwall Insight's Conference "*Towards a Flexible Energy System*", London, 8th of February 2017.

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infrastructure in the form of a different grid or new household appliances, as is the case with hydrogen.

As with electricity, biomethane can also be used in transport and is particularly suitable for heavy goods vehicles. This will require new refuelling infrastructure, but again we would not expect the logistical challenge to be as high as it would be for hydrogen.

Conclusion

With respect to electricity the key infrastructure need is increasing grid capacity and improving the speed with which grid connections can be met. Without such changes, deployment in new renewable generation will be significantly delayed or in some cases impossible. We urge the NIC to investigate alternative ways in which grid upgrades and new connections could be met.

Similarly, the increase in electric vehicles will require grid upgrades to meet the new demand. However, it is important to note that such upgrades are unlikely to require the level of investment that would be needed if we went down the route of hydrogen fuel cell vehicles, which would require an entirely new infrastructure for refuelling.

These severe constraints on the electricity grid are one of the many reasons why we believe that sustainably sourced biomethane is a better route to decarbonisation of the grid than electrification of heat.

Ecotricity welcomes the opportunity to respond and hope you take our comments on board. We also welcome any further contact in response to this submission. Please contact [redacted] [contact details redacted]

Yours sincerely,

[redacted] [signature redacted]

[redacted] [name redacted]

[redacted] [job title redacted]

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NIA Call for Evidence
National Infrastructure Commission
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London
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Email to: NIAEvidence@nic.gsi.gov.uk

10 February 2017

National Infrastructure Assessment Call for Evidence

EDF Energy is one of the UK's largest energy companies with activities throughout the energy chain. Our interests include nuclear, coal and gas-fired electricity generation, renewables, and energy supply to end users. We have over five million electricity and gas customer accounts in the UK, including residential and business users.

EDF Energy welcomes this Call for Evidence. As recognised by the Government's Green Paper on Industrial Strategy, it is essential to ensure that the shift to a low carbon economy is done in a way that minimises the cost to UK businesses, taxpayers and consumers. This requires long term certainty in planning and infrastructure policy, underpinned by sound and comprehensive evidence. Public and business acceptance of the decisions taken and an understanding of the reasons for the choices made are also required, to ensure that a political consensus on energy and other infrastructure is maintained. This Call for Evidence enables the NIC to engage with a large number of organisations to gather the best available evidence so that the National Infrastructure Assessment (NIA) can provide the basis for a consensus on infrastructure policy.

There is a crucial role for nuclear energy in the transition to a low carbon economy, as part of a diverse energy mix that includes contributions from all mature low carbon technologies. Nuclear energy helps to guarantee long-term energy independence and contributes to economic growth and the competitiveness of other industries. EDF Energy believes that low carbon electricity will be an essential component of the decarbonisation of the UK economy, including a major contribution to the challenges of decarbonising heat and transport. The UK must follow the least cost, most secure pathway to deliver new low carbon electricity generation sources, underpinned by other key infrastructure components, including the electricity transmission system. Nuclear energy is part of that optimum pathway.

Delivery of the UK's energy policy goals of secure, affordable and sustainable energy requires significant investment in electricity generation and networks. To deliver this investment, the industry requires a stable policy framework. Government must ensure that this framework supports the development of an efficient generation mix, which takes account of the whole system costs of different technologies, including the costs of managing the network and dealing with intermittency.

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Successive governments have recognised the importance of bringing forward investment in energy infrastructure to deliver new low carbon generation, while maintaining a secure and affordable energy supply. EDF Energy would like to highlight two essential areas of the current policy framework. The first is an effective planning system, comprising the Nationally Significant Infrastructure Projects (NSIP) Regime and the National Policy Statements (NPSs). The second is the Electricity Market Reform (EMR) package, to support decarbonisation of generation in a secure and affordable way. The NIC has a key role to play in ensuring that both of these policy frameworks continue to bring forward investment in energy infrastructure, identifying improvements where necessary while maintaining a stable policy environment.

A key step in the future planning regime will be the production of the first NIA in 2018 by the NIC, which will trigger a review of Planning Policy including the Nationally Significant Infrastructure Projects (NSIP) Regime and the National Policy Statements (NPSs). The energy sector already has extensive analysis and definition of the infrastructure need, which provides a useful set of principles and structure for further development within the sector. It is important that the NIA builds upon and integrates the existing body of policy measures, recommending changes only where there is a clear need for it.

EDF Energy is a developer and operator of a diverse portfolio of electricity infrastructure, each element of which has a significant investment value and positive impact on sustainable growth, both locally and nationally. We recognise the need to strike the right balance between the benefits delivered by the operation of a long-term energy asset and the social, economic and environmental impacts associated with the asset construction, operation and decommissioning. This important balance is currently achieved by Development Consent Orders (DCOs) within the current national planning system.

The EMR package provides the right set of measures (the Capacity Market, Contracts for Difference and the Carbon Price Floor) to drive the investments needed to ensure security of supply and to make the transition to a low carbon generation mix in an affordable way. EDF Energy believes it is important for investor confidence to ensure the stability of the EMR framework, whilst recognising that it needs to evolve as the market develops, in particular, to ensure that the costs of developing and operating the network are fairly allocated, and that grid services are procured efficiently.

Our detailed responses are set out in the attachment to this letter. Should you wish to discuss any of the issues raised in our response or have any queries, please contact [name redacted] on [telephone number redacted], or myself.

I confirm that this letter and its attachment may be published on National Infrastructure Commission's website.

Yours sincerely,

[signature reducted]

[name redacted]
[job title redacted]

Attachment

National Infrastructure Assessment Call for Evidence

EDF Energy's response to your questions

Cross-cutting issues:

Q1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region? *Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.*

The development of a low carbon, secure and affordable electricity system will require major infrastructure investments, many of which will contribute to sustainable growth in their locality. Government has an essential role to play in ensuring the market framework supports this development. This framework must take account of the whole system costs of different technologies, including the costs they impose on the network and the costs of providing back-up generation to deal with intermittency. A range of new energy technologies will be needed, including distributed energy resources, demand response, aggregation and community energy schemes. These must be combined with a continuation of the existing centralised transmission system, with large synchronous generators continuing to play an essential role for system security and operability and for the power they provide.

The Government's Green Paper on its Industrial Strategy highlights the importance of building on the particular strengths of different places. This stresses the importance of addressing factors that hold places back and the opportunity to achieve this by investing in key infrastructure projects to encourage growth.

A prime example of the national and local benefits of major infrastructure projects is the development of new nuclear. EDF Energy is building the new nuclear power station at Hinkley Point C in Somerset and is working to deliver a fleet of new nuclear power stations, including Hinkley Point C, Sizewell in Suffolk and Bradwell in Essex, each capable of delivering low carbon electricity to power around six million homes. These will bring social, economic and environmental benefits, including key local impacts on employment, accommodation, demography, local expenditure, local primary care and education.

At Hinkley Point C, for example, a total of almost £4bn will go into the regional economy over its lifetime. This is composed of c£1.5bn during construction and c£2.4bn during operations with preferred bidders nominated or contracts signed for over 90%, by value, of the construction contracts. UK-based businesses are set to secure 64% of the total construction spend.

Each project would create a significant number of jobs across a range of sectors, meaning these projects can be at the forefront of the revitalisation of the UK's industrial and skills base. For example, Sizewell C would create around 25,000 different roles during its construction, just like its sister project at Hinkley Point C. The skill base created by these projects will benefit other low carbon infrastructure projects, as well as other strategically important projects that the UK

desperately needs. These skills will also help British businesses win nuclear and other supply chain contracts all over the world, a key component of an Industrial Strategy for the Nuclear Sector, which is especially important against the background of the UK leaving the European Union.

A further example of the regional benefits of new electricity generation is the potential for the development of non-mainland wind power (for example, located on Scottish islands) which can make the best use of the excellent wind resource of non-mainland locations. This drives local economic growth and employment through the high level of local added value in island economies. It can also overcome the barrier to growth in island locations from less reliable electricity supplies, by enabling a new transmission connection to the mainland. EDF Energy has an interest in Lewis Wind Power, a joint venture with AMEC Foster Wheeler, seeking to develop two wind farm projects on the Isle of Lewis, with a total capacity in 342MW. We have recently responded to the Government's consultation on the treatment of non-mainland wind projects in the Contract for Difference (CfD) arrangements.

EDF Energy has a range of existing electricity generating assets including nuclear, coal, gas and renewables operations. Existing and mothballed power generation sites are considered ideal locations for future development of new generation assets. This is because these sites already have many of the key aspects that a new generation asset would require, such as grid connection, cooling water, gas supply and transport networks. Other development (e.g. residential and commercial) in and around these assets should be carefully controlled to ensure that they do not have any implications on the longer-term use of those sites for alternative energy generation. Life extension will mean we will continue to invest substantially in the UK over a longer period. EDF Energy's nuclear generation business uses over 300 major suppliers, and almost 90% of its total annual supply chain spend of around £800m is in the UK.

Q2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

In an increasingly market-driven global economy, a national economy needs to be competitive to develop and prosper. An essential part of a competitive economy is an effective energy infrastructure.

The competitiveness of UK business is underpinned by the security and affordability of the electricity supplied, which in turn requires resilience of the energy system. Nuclear energy is a key component to guarantee long-term energy independence and contributes to economic growth, and the competitiveness of other industries. This can play a key role in delivering the least cost, most secure pathway for implementing low carbon electricity generation sources. An affordable and secure electricity supply will provide the base for development and operation of other infrastructure which will, in turn, enable a competitive economy.

The UK has an internationally leading framework for decarbonisation in the Climate Change Act. In a world where Climate Change will become increasingly expensive to mitigate, this will be a long term competitive advantage. It is vital that UK Government continues to promote international cooperation and progress on this topic, and continues to promote the progressive pricing of carbon to ensure a more level playing field between fossil and low carbon technologies.

Q3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

The NIC has a key role in independently defining the nation's long-term infrastructure needs prioritising, planning and testing value for money, to ensure that investment is properly targeted to deliver maximum benefit. It can provide an independent voice which can not only inform debates to ensure rational decision making but also has a crucial role to explain such costs to the public, to support ongoing acceptance of the need for such investments.

Delivery of the UK's energy policy goals of secure, affordable and sustainable energy requires significant investment in electricity generation and networks. To deliver this investment, the industry requires a stable policy framework. Government must ensure that this framework supports the development of an efficient generation mix, which takes account of the whole system costs of different technologies, including the costs of managing the network and dealing with intermittency.

Successive governments have recognised the importance of bringing forward investment in energy infrastructure to deliver new low carbon generation, while maintaining a secure and affordable energy supply. EDF Energy would like to highlight two essential areas of the current policy framework. The first is an effective planning system, comprising the Nationally Significant Infrastructure Projects (NSIP) Regime and the National Policy Statements (NPSs); this is discussed further in the answer to Question 10. The second is the Electricity Market Reform (EMR) package, to support decarbonisation of generation in a secure and affordable way. The NIC has a key role to play in ensuring that both of these policy frameworks continue to bring forward investment in energy infrastructure, identifying improvements where necessary while maintaining a stable policy environment.

The EMR package provides the right set of measures (the Capacity Market, Contracts for Difference and the Carbon Price Floor) to drive the investments needed to ensure security of supply and to make the transition to a low carbon generation mix in an affordable way. EDF Energy believes it is important for investor confidence to ensure the stability of the EMR framework, whilst recognising that it needs to evolve as the market develops, in particular, to ensure that the costs of developing and operating the network are fairly allocated, and that grid services are procured efficiently.

Network charging reform is a priority and we welcome Ofgem's intention to review and act on critical issues in 2017. For decentralised resources to contribute to a smart, flexible energy system in a sustainable way that drives investment in the most efficient generation mix there must be a fair allocation of costs including network charges.

We have identified significant impacts on the capacity and energy markets from distortions created by embedded benefits, particularly from avoidance of transmission network charges. Distributed generators can be overcompensated through network charges and we see increasing evidence of network charging avoidance by installing generation 'behind the meter' and the use of private wire networks. If market participants rely on having access to the transmission and distribution networks, we believe they should make a fair contribution to their costs. We believe that a move to a more fixed or capacity based system of charges would better achieve this than the current approach.

We also believe that National Grid can do more to structure their procurement processes in a way that enables developers to combine different revenue streams to achieve more efficient outcomes for customers. This will become more important as developers increasingly need to combine revenues from multiple sources such as the energy market, the Capacity Market and provision of grid services in order to make an investment case for their projects. We have recent experience of this with our West Burton battery project, which in addition to its contract with National Grid for Enhanced Frequency Response also won a 15 year agreement in the recent capacity auction.

Although it is clear that there is an increasing role for decentralised generation, this must be the right type of generation, and that it is appropriately sited. For example, the widespread introduction of small diesel reciprocating engines in populated areas would not create better places to live or work. There is a lot to commend a healthy complement of reliable, grid based centralised generation. For example, on one site, Hinkley Point C will generate a massive 7% of UK need. When Sizewell C is commissioned, the combination with Sizewell B will generate 10% of UK need. They do not contribute to air pollution; they are professionally and efficiently managed, and provide a critical energy supply role around the clock.

Q4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects? *Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.*

The energy system is going through a significant transition as the sector decarbonises and smart technologies develop. We are seeing a rapid growth in decentralised generation and the increasing ability of consumers to play an active role. EDF Energy wants to play a key role in this transition and is finding innovative ways to support the move to a smarter, more flexible energy system.

Demand Side Response (DSR) will be an important contributor to this transition. It is important, however, that DSR is correctly defined as true load shifting or reduction. It is not appropriate to define behind-the-meter generation as DSR. We are concerned that a lot of procured DSR capacity in recent capacity auctions is in fact generation. Technologies should be accurately defined and the classification of behind-the-meter fossil fuelled generation as a 'smart' new technology is unhelpful when targeting a low-carbon future.

The rebound effect associated with a reduction in expected price as a result of new technologies that increase the efficiency of the electricity / gas use and the behavioural responses to that use in customers can be pronounced. This is most noticeable for vulnerable customers who redirect that saving back into their electricity / gas usage to effectively neutralise the positive gain from the reduction in energy that was expected to occur. However, such behavioural rebound effects are less pronounced for more affluent households and for businesses. For both of these market segments, EDF Energy believes that rebound effects can be limited through appropriate price signals.

Q5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

In the electricity sector, many investment decisions are taken by private companies within a framework that is heavily influenced by Government policy decisions. This includes the measures in the Electricity Market Reform (EMR) package to drive the investments needed to ensure security of supply and to make the transition to a low carbon generation mix in an affordable way. It is important to ensure that that these mechanisms help to achieve the right balance between investment in the maintenance, repair and life extension of existing assets and investment in the construction of new assets.

The Capacity Market addresses this issue by ensuring that existing and new capacity competes in the same technology neutral auction. New capacity is able to secure capacity agreements of up to 15 years to provide the certainty to underpin new investment. Existing assets are eligible for one year capacity agreements or, in exceptional circumstances, capacity agreements of up to three years to support major refurbishment. We believe that the basic design of the Capacity Market provides the right approach to ensure that there is adequate capacity to ensure security of supply and that it will deliver broadly the right balance of investment between existing and new capacity. We also support the Government's current approach of regular review of the detailed design of the Capacity Market with incremental improvements where necessary, particularly where refinement of the existing framework is needed to ensure the fair treatment of emerging technologies and business models.

The Contracts for Difference (CFD) arrangements are specifically designed to support investment in new low carbon generation. It is therefore important to ensure that there is adequate incentive to ensure that existing low carbon assets are maintained, and their lives extended especially where this provides a cost effective source of low carbon generation providing better value for money for customers than investment in replacement capacity. For example, EDF Energy continues to invest in our existing nuclear plants to extend their lives and to maintain and improve their performance and to ensure that they continue to provide secure and reliable baseload low carbon generation.

An essential means to provide the right signal for investment in existing low carbon generation capacity is through carbon pricing that ensures that carbon-emitting plants bear the cost of their emissions; ideally, this would have been delivered by the EU Emissions Trading System. However, in practice, this has failed to provide an effective carbon price signal; for this reason, the Carbon Price Floor was introduced in the Finance Act 2011. Although many people have highlighted the role that it has played in driving the switch from coal-fired to gas-fired generation, it is also important to recognise that it will have a longer term role in supporting decarbonisation after the closure of the coal fleet both by supporting existing low carbon generation and by reducing, and potentially eliminating, the need for support through the CfD mechanism for new low carbon investment.

EDF Energy believes that there is also potential to increase generating capacity through the repowering of some onshore wind farms with more efficient turbines, and where appropriate in environmental terms the extension of existing sites.

Q6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Energy infrastructure, along with other infrastructure, increasingly relies on centrally built Information and Communication Technology (ICT) systems to coordinate and maximise the benefits. We have been concerned by the overly optimistic timescales provided for the centrally built ICT systems which have created additional costs with customers impacted by the resultant over runs. Examples of over runs include the DCC (Data Communications Company) with smart metering and Nexus (Gas Settlement Reform based on changes to the UK Link system). The DCC, in particular, links national infrastructure with housing stock via a smart meter.

In such circumstances, the government should investigate opportunities to deliver future programmes in a less constrained timescale to minimise the risk of further cost escalation to the detriment of customers.

Q7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered? *Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.*

Two key elements of funding the delivery of infrastructure in the electricity sector are the recovery of the costs of Government policies through levies recovered in customers' energy bills and the way in which the costs of electricity transmission and distribution networks are recovered through the charges for these services.

The costs of electricity decarbonisation (through the Renewables Obligation, Feed-in Tariffs and CFDs) have been recovered through electricity bills. However, as we move to decarbonise other infrastructure, including the decarbonisation of heat, it will be important to achieve an equitable distribution of policy costs between gas and electricity. This is necessary both for fairness and for provision of the right price signals to customers.

EDF Energy believes that it is vital to ensure that network costs are allocated fairly between all parties who use the networks. The current arrangements have not kept pace with market and technology change. This is unfair as it allows some parties to avoid paying their fair share leaving others to pick up the cost. It is also inefficient as it will distort investment decisions.

EDF Energy promoted reforms to tackle the most significant issue-the "embedded benefits" received by certain small generators connected to the distribution network, which were materially distorting outcomes in the Capacity Market. Embedded generators can play a valuable role where they compete on equal terms with transmission-connected plant. We are keen that Ofgem follows through to implement reforms to the embedded benefits regime early this year, as a precursor to its wider network charging review.

At a domestic level, a customer can avoid significant network charges by installing a solar panel and reducing their energy use through the year, and yet when they need the network most (winter peak when it is dark) the network will be fully loaded and under most stress and the customer will not be self-generating. It is important that charging arrangements change to reflect the different ways in which people are using the networks. We believe that if parties rely on having access to the transmission and distribution networks, they should make a fair contribution to their costs. We support the work Ofgem is doing to undertake a review of network charging arrangements. We

believe that there should be a move towards a more fixed or capacity based system of charges to reduce the scope for avoidance and better reflect the use that parties are making of the networks. Such a change has happened or is actively being considered in other jurisdictions around the world, including Australia, the Netherlands and the US.

Q8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets? *Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.*

EDF Energy undertakes and considers investment across a broad range of projects. This includes capital intensive new build power generation projects in new nuclear, renewable and fossil fuelled projects. New nuclear projects provide an example of a situation in which arrangements are in place to provide funding to projects (the project can be paid for by customers during its operating phase if it is awarded a CFD[1]), but where financing projects (raising the upfront capital investment to pay for construction) can be challenging.

The CFD enables the costs of a new low-carbon generation project to be funded during its operating life through a combination of supplier levies which provides the necessary funds to operate the CFD framework and revenues earned from the wholesale electricity market. The CFD is vital for financing low-carbon generation. It provides some protection from market price risk. This is important for low-carbon generation technologies due to their high upfront capital costs. Customers benefit from this mitigation of price volatility risk through a reduction in the cost of capital, which lowers the ultimate costs to consumers of low-carbon generation. However, significant financing challenges can remain for new nuclear and other low-carbon generation projects:

- The size of large projects can limit the pool of sponsors with the balance sheet capability to finance projects without external finance (equity and / or debt);
- New nuclear and other low-carbon generation technologies are exposed to risks in construction and operation. The risk profile of low-carbon generation is greater than at some other infrastructure projects, for instance in regulated infrastructure.

Evolution in the CFD structure and associated support mechanisms that address the issues above could improve the ability of new nuclear and other low-carbon projects to obtain the external equity and debt investment required to finance projects and would need to remain compliant with the relevant competition law and state aid rules. These interventions could also reduce the cost of capital and thereby provide value for money for customers.
The Thames Tideway Tunnel (TTT) provides a recent example of a large infrastructure project where a number of Government interventions have been applied in order to improve the attractiveness of the providers of finance. As a result of these interventions, the TTT project was attractive to a wide

[1] A low carbon generator party to a CFD is paid, or pays, the difference between the 'strike price' (a price for electricity that is intended to reflect the costs of investing in a low carbon technology) and the 'reference price' reflecting a market price of electricity in the GB market. The generator receives a payment in the event that the reference price is below the strike price and vice-versa. In addition to CFD cash flows, the low carbon generator receives payment for its electricity sold on the wholesale market.

pool of investors and ultimately achieved what is considered to be a highly competitive price to the ultimate benefit of customers.

Q9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors? *Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.*

This question is best addressed through existing arrangements to ensure infrastructure resilience. For example, EDF Energy supports and contributes to industry wide initiatives which enhance the resilience of electricity infrastructure; including the development of electricity infrastructure responses to unexpected events through the Government sponsored Energy Emergency Executive Committee (E3C). This group has supported initiatives such as the energy sector responses to pandemic, security and cyber threats. The NIC should be aware of the initiatives and outcomes of the E3C to ensure there is no duplication of efforts in this area.

EDF Energy's new nuclear power stations are being designed with security as a primary consideration. Resilience against external events such as severe weather and cyber-attacks are taken extremely seriously and plans are scrutinised by the independent regulatory bodies such as the Office for Nuclear Regulation. We have also implemented a companywide business continuity management framework to support the continuity of its operations during major unexpected events.

EDF Energy supports an increased role for interconnection. However, while interconnection makes an important contribution to resilience, it can also expose the UK to risks arising in neighbouring countries. This includes the risk, for example, that similar weather conditions across large areas lead to high electricity demand coupled with low output from Intermittent renewable sources at the same time in a number of neighbouring countries. Interconnection does not remove the need for secure, reliable, low carbon electricity generation.

Q10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

The NIC will produce the first NIA in 2018 and this will trigger a review of Planning Policy including the Nationally Significant Infrastructure Projects (NSIP) Regime and the National Policy Statements (NPSs). For sectors like energy, where there is already extensive analysis and definition of need, it is important that the NIA builds upon and integrates existing work, such as energy NPSs and EMR, rather than duplicating or contradicting it.

EDF Energy believes that the NPS's should evolve and be updated and that this should be an output from the NIA process to ensure consistency of policy. We urge the NIC to keep any changes to the planning system to a minimum; the planning framework needs time to allow it to deliver and any changes should be minor and enabling. It is important to retain the overarching policy framework provided by the NPS for energy infrastructure.

While we do not envisage the need for wholesale change to Planning Policy, there will be opportunities for minor and enabling changes. EDF Energy believes that the existing planning

process is the right one and we believe that any proposed changes to the rules should ensure that they preserve fair treatment for all types of asset and technologies.

Q11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

EDF Energy believes that the NIC should support the work of the Committee on Climate Change (CCC) and actively engage with them. This is in order to link infrastructure development proposals with climate and adaptation objectives to protect and enhance the natural environment.

Development and infrastructure will most effectively contribute to the protection and enhancement of the natural environment through careful consideration and good planning. Planning and Environmental Impact Assessment (EIA) are comprehensively tested tools that provide environmental, economic and social benefits through natural solutions as they help to identify and mitigate aspects of environmentally unsustainable infrastructure.

EDF Energy recognises the value of the voluntary use of natural capital as an additional option for ensuring that infrastructure developments can be more sustainable. There is also a societal benefit to delivery of improvements in the natural environment through sustainable development and environmental engineering of the built environment. Technical specifications can be made to improve the functionality or environmental impact of infrastructure developments. The environmental improvements of these measures can be assessed through award schemes such as Civil Engineering Environmental Quality Assessment (CEEQUAL) and the Building Research Establishment Environmental Assessment Methodology (BREEAM).

The consenting process for energy infrastructure projects can create situations where post construction monitoring is routinely applied in relation to ecology and ornithology related effects. This is important where the EIA process identifies a requirement to monitor the effectiveness of mitigation measures. However, in other cases, it will lead to unnecessary costs and should be avoided.

Q12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent? *Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.*

Government has significantly improved its capability to professionally model the UK electricity system over the last five years. In particular, the development by DECC / BEIS of the Dynamic Dispatch Model for hour-by-hour modelling of the operation of the electricity system has significantly improved the quality of insight that analysis can provide. We believe Government takes a rigorous approach to assessing costs and benefits against well-founded counterfactuals.

Further improvements could be made by bringing the modelling of energy requirements for heat and transport to the same standard as modelling of electricity sector through the use of "whole energy system" models, such as the Enhanced Simulation Modelling Environment (ESME) model developed by the Energy Technologies Institute or the Governments UK TM model. Greater transparency is a particular requirement of models of this complexity, and we applaud BEIS' efforts

to provide access to the data and methods assumed in the model, although we note these have yet to be completed.

However, our experiences of the use of Cost-Benefit-Assessment (CBA) particularly when addressing environmental costs and benefits are very different. Often bespoke approaches are used which include significant differences in method of determining the cost-benefit elements of impacted stakeholders. We believe that the use of a standardised, consistent CBA method across Government would improve the credibility of policy decision making. It would also better enable evaluation of competing policy options. Flexibility should be available to account for special circumstances but these should be the exception rather than the norm.

We have particular concerns in the use of CBA when assessing environmental factors where there are very high levels of uncertainty in the economic valuation of environmental characteristics and when the actual environmental outcomes are not sufficiently addressed. There is a significant risk that a CBA can over-estimate the value of environmental benefits and underestimate the costs of delivering a particular environmental outcome. If new infrastructure does not proceed as a result of a misleading CBA, there could be loss of utility and value for society as a whole.

We believe that improvements to the Environmental CBA method could be delivered through a thorough review of Environmental CBA, including an examination of the challenges of valuing environmental changes. This aspect is becoming increasingly important as the use of Natural Capital and associated concepts becomes more widespread in the assessment of infrastructure development.

We emphasise that the credibility of cost-benefit analysis depends on a comprehensive system-wide view being taken. We have noted shortcomings, for example, in Ofgem's analysis of the costs and benefits of new interconnection, which neglected to include the impact of lower wholesale power prices on the cost of CFDs.

Digital communications:

Q17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

EDF Energy has ambitious digital plans but is constrained, in part, by the existing telecommunications infrastructure in the UK. Fast fixed and mobile broadband and 2G (for smart meters) and 3G, 4G and 5G will be key to our digital transformation. We believe continued urgent focus and investment is required to ensure fast broadband is made available to 100% of the country, including remote rural locations (where some of our power stations are located). That it can be provisioned with much faster order lead times, with the flexibility to scale broadband up or down according to demand, and with sufficient resilience to ensure a continuous, uninterrupted supply. The same requirements apply to 3G and 4G and 5G coverage will need to be provided as a matter of urgency.

Our digital transformation plans include the desire to leverage value out of large volumes of data, including smart meter data, which must be reliably accessible in real time in order to be of benefit to our customers. Data volumes are driving the continual need to upgrade the UK's telecommunications infrastructure and are central to our strategic growth.

Energy:

Q19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

EDF Energy supports the Committee on Climate Change's (CCC) proposal that "The forthcoming Emissions Reduction Plan must incorporate immediate action and prepare for decisions to be made in the next Parliament. The Government's plan for meeting the fourth and fifth carbon budgets should set clear goals for improving efficiency and rolling out low-carbon heating."

Decarbonisation of heat is critical to achieving the objective of 80% reductions in greenhouse gas emissions in the Climate Change Act 2008. However, there is as yet, no clear shared understanding of how to achieve it and no policy framework to deliver it. Many of the changes that will reduce emissions will also contribute toward modern, affordable, comfortable homes and workplaces and can be delivered alongside expansion in the number of homes.

Initial areas of policy and investment focus are:

- **Reducing heat loss in buildings through improved fabric efficiency standards in building and installing insulation, where appropriate and cost effective;**
- **Increasing consumer awareness and trust of renewable heat technologies; and**
- **Starting to decarbonise heat supplies by moving away from fossil fuels and using low carbon heat technologies, such as heat pumps.**

Further important considerations include:

Combined Heat and Power (CHP) - Current UK policy is largely driving the market toward small-scale Combined Heat and Power (CHP), which is predominantly gas-fuelled. Although this helps to reduce carbon emissions, it will not provide a zero carbon solution and must be seen as only a transitional route to decarbonisation. The Government's heat policy therefore needs to ensure that other, more sustainable, sources of decarbonising heat are sufficiently supported, e.g. energy from waste, heat pumps and biogas plants.

Embedded benefits – A further consideration for CHP is that such projects are supported by the transmission network charging regime which provides an excessive financial benefit through the "embedded benefits" via suppliers. Reform of the embedded benefit regime is essential for the efficient development and operation of the electricity system and EDF Energy supports efforts to achieve this reform. However, it must be recognised that the loss of embedded benefits will have a significant impact on the heat market, particularly small-scale CHP.

Incentivising heat projects - In general, financial schemes need to ensure they are supporting and incentivising the development and use of heat, and not the electricity as a by-product. We therefore remain supportive of both the Renewable Heat Incentive (RHI) scheme and the current Heat Networks Investment Project (HNIP) pilot. It is too early to judge the impact that the latter will have on the heat market.

Establishing high quality standards in energy management – The key to energy management and control of use of heating systems is to ensure effective monitoring and measurement of energy and how it is used. Achieving this will require establishment of clear standards to drive quality of

service and data. Consideration needs to be given to how this can be embedded into the energy management supply chain.

Off-gas grid areas - In order to decarbonise heat, Government needs to provide low-carbon alternatives to oil and coal in off-gas grid areas. Financial incentives and support will be most effective due to the high upfront costs of low-carbon alternatives. The location of off-gas grid properties leads to prohibitive costs for connection to the gas grid. It would not be sensible to finance such high costs due to the transitionary nature of gas used for heat. Introducing regulatory changes and providing support to renewable alternatives will also help to initiate development in these geographic areas.

Boiler standards - We support the Government's key objectives to raise domestic boiler standards and the performance of the whole heating system. This will enable consumers to take control of their system by requiring timer and temperature controls on boiler installations. Government policies can go further and provide a more long-term coordinated and sustainable approach to address heating and energy efficiency to provide certainty to the industry. This will encourage the industry to invest with confidence and enable delivery to occur at a more effective rate. Publishing a robust heat strategy is key to such an approach.

Energy efficiency - We believe that the Government's Emission Reduction Plan should continue to set clear policy goals for new-build and energy efficiency improvements to existing buildings. In many cases the gap between the best and poor performing buildings could be reduced substantially. This could be achieved through performance reporting in offices linked to Environmental Management Systems which will reduce costs and add value to assets. An immediate priority should be to ensure there is a plan to ensure that all cost-effective energy efficiency opportunities are taken.

Policy certainty to support infrastructure investment - There needs to be a commitment in both central and local Government to support the development of the infrastructure required for heat (and cooling) networks. In particular, UK heat policy needs to provide long term certainty. Many, including local authorities, can be put off by the risk of investment and long contracts, due to budget constraints and uncertainty. This is despite the potential long-term social and environmental benefits, particularly if scale of use can be achieved. Developers need to have some form of assurance that political support centrally will not change in a way that will impact on the attractiveness of a business case over such a long timescale.

Recovery of policy costs – If any costs of decarbonising heat are recovered through customer energy bills; this must be predominantly borne by gas, correcting the current imbalance between the policy cost of carbon reductions from electricity and gas.

Q20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved? *Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.*

EDF Energy recognises that although it is impossible to describe precisely what the most effective zero carbon power sector in 2050 would look like, there are various features common to a large number of diverse analyses of the potential outcomes. The most important of these is the central role for nuclear power generation. Some key areas of uncertainty, listed below, mean that a wide range of scenarios may be regarded as credible. However, we believe it is possible to identify some

key features that we would expect to find in an effective zero carbon power sector in 2050 and some of the important policy initiatives that are likely to be required to achieve it.

Areas of uncertainty - Despite further improvements in energy efficiency, we expect electricity demand to grow significantly through electrification of heating and transport and increasing consumption from data and communication services. However, there is considerable uncertainty over the magnitude of this demand growth and the impact that it will have on the daily and annual profiles of demand. There is clearly great uncertainty over the path of technology development affecting which technologies are available for deployment and the relative costs of the available technologies. Fossil fuel commodity prices are likely to remain volatile and, although this will only impact on the costs of a fully decarbonised system if Carbon Capture and Storage (CCS) plays a major role, it is likely to affect the policy instruments required to achieve this system.

A (practically) zero carbon power sector in 2050 - As now, a key issue will be how supply and demand are balanced. Active management of demand will play a much more significant role in this balancing than it has traditionally done; this will be particularly important for managing electricity demand for electric vehicles and heating, requiring a smart, integrated approach to shift demand to periods of lower cost where possible and rationalise investment in electricity transmission and distribution infrastructure. New technologies such as smart meters integrated into smart energy systems will help to enable automatic shifting of domestic customer demand to reduce energy costs. Industrial and commercial users will continue to be commercially incentivised to shift demand from peak times when their activities allow them to do so. It is important to understand the limitations of demand-side management in primarily shifting demand to periods of lower prices rather than avoiding demand indefinitely. A substantial portion of demand cannot be avoided indefinitely due to inherent characteristics such as working hours and spoilage of perishable goods.

A diverse mix of low carbon generation technologies will be needed to manage electricity system balancing in 2050. Due to its ability to provide large volumes of firm, low carbon generation, nuclear would have a prominent role in providing baseload electricity needs. Large scale renewables such as onshore and offshore wind and ground-mounted solar PV would also be needed to supply low carbon energy and help fully decarbonise the power sector. Combined, nuclear and large scale renewables would need to account for 70%+ electricity generation by 2050. Unabated fossil fuel sources can play only a very limited role but as they are highly flexible it may be more economic to retain some of these assets to help system balancing and provide capacity during a small number of peak periods. The role for fossil fuel sources would increase if cost-effective solutions incorporating CCS can be developed to provide flexible low carbon generation.

We expect the generation mix to continue to be dominated by large transmission-connected generators (primarily offshore wind and nuclear). Distributed energy resources such as smaller onshore wind projects and rooftop solar PV could increase their penetration to c20% (by energy volume) of the mix. Batteries and other storage technologies may also play a larger role in system balancing if costs fall substantially. However, even with significant cost reductions, battery assets would be better used for applications with short cycle times such as fast-acting frequency response, voltage management and within day balancing of supply and demand.

The 2050 system is likely to require a significantly larger asset base in networks (interconnection with neighbouring countries, transmission and distribution) than we currently have due to the

addition of new sources of demand and new generation assets. The efficient deployment of investment in networks will be critical to minimise costs.

Policy initiatives required to achieve the transition to 2050 - Electricity Market Reform (EMR) provides the arrangements to ensure that electricity infrastructure is delivered as efficiently as possible. The EMR framework is designed to deliver the transition to a low carbon generation mix and to maintain security of supply at an affordable cost to consumers. In the 2020s there is a challenge to replace retiring fossil-fuel and nuclear capacity whilst delivering a cost-effective, reliable and lower carbon system. The solution will be a combination of extension of existing asset lives and construction of new capacity, recognising that intermittent plant imposes additional integration costs on the system.

The EMR package, including the Carbon Price Floor, Contracts for Difference (CFDs) and the Capacity Market continues to provide a good basis to drive the transition to a low carbon generation mix. However, the detailed operation of these mechanisms will evolve over time. It will be essential to complement them with further measures, including reform of network charging and better arrangements for procurement of flexibility services. Reform of network charging is a priority; it must ensure that charges are allocated fairly and in a manner that does not distort decisions about investment in, or operation of, generation assets, including distributed energy resources. National Grid must also develop procurement of flexibility services in a way that is transparent, market wide and technology neutral.

EMR provides the right mechanisms to drive the transition to a low carbon system; as we approach the completion of this transition, it is likely to be necessary to replace these mechanisms. By this stage, it will be necessary for the commercial framework to evolve to include market arrangements that better allow the recovery of long run marginal costs of low carbon generation in a system principally consisting of assets with short run marginal costs close to zero.

Q21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

The most significant route for development of low carbon vehicles will be through electric vehicles (EVs) although biofuels or hydrogen may play a role, especially for heavy goods vehicles. The mass adoption of EVs has the potential for a very significant impact on the electricity system. Without changes to today's electricity market arrangements, the impact of EV charging would have a material adverse impact on the balancing of supply and demand on the electricity system. Furthermore, EV charging is likely to lead to local capacity constraints on distribution networks.

However, as cars are parked 95% of the time, there is significant potential to shift the period over which they are charged up. There is the further possibility of actively using the storage capacity of EVs to manage absorb high intermittent loads from renewable generation and to balance the system. Smart grids combined with EVs may offer significant benefits. Current development of centrally managed demand response strategies, data gathering and analytical intelligence for forecasting demand will help to address network constraints. Developing charging point connection policies may help to allow Distribution Network Operators (DNO) greater visibility and control over their networks.

It is therefore essential to develop the right approach to manage these impacts, requiring the use of one or more of the following:

- Direct support from general taxation, e.g. by paying for reinforcement of the distribution network; and/or
- Cost-reflective charges for network use and electricity consumption would ensure that EV owners paid their fair share of wider system costs; and/or
- Mandatory managed control of EV battery charging operation by either suppliers or network operators.

EDF Energy finds the arguments for and against these differing approaches to be finely balanced. The mix of economics, human behaviours, and technology development makes it difficult to assess their future effectiveness. We see further investigation of the practicalities of managed charging as an important area for research and trials to evaluate consumer acceptability and overall system benefit. Ideally, the longer term direction of travel should be towards cost-reflective price signals. Full realisation of the benefits of integrating EVs into the energy market is likely to involve a mix of players in the industry exploring new opportunities.

At some stage, significant electricity distribution network upgrades are likely to be needed. To minimise disruption, such upgrades must be well planned well and coordinated as far as possible with other infrastructure upgrades.

Water and wastewater (drainage and sewerage):

Q22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute? *Note: "demand" includes domestic, commercial, power generation and other major sources of demand.*

The UK Government is reforming the way that freshwater will be allocated and licensed across England and Wales. This is being implemented through initiatives on water abstraction reform and water resilience planning. The aim of reform is to create a water resourcing system that allows greater flexibility to respond to future pressures on the environment, business and public water supply given an increasing population and climate change factors.

Under the abstraction reform initiatives, current power plant abstraction licences will be reviewed and become part of the site Environmental Permit. New conditions will be applied. These will include daily/annual volume limits, intake arrangements and a set of standard catchment rules that apply to all abstractors. The new conditions are planned to come into effect during the early 2020s. They will provide regulators with the ability to better align individual water allowances with local water availability. EDF Energy believes that there are lessons to be learned from the Electricity Market Reform process and its conclusions for competitive markets.

Existing electricity generation sites have an intrinsic value which is based on a number of factors which includes access to cooling water, transport and grid connections. Future development of thermal power stations at existing power station locations is dependent on continued access to water resource allocation with sufficient reliability and sufficient regulatory robustness at an acceptable price. This is to meet the reasonable needs of power plant operators and provide sufficient confidence to current and future investors. The use of water by thermal power plant for

steam-cycle cooling leads to improved thermal efficiency compared with dry-cooling. This improved efficiency delivers many key benefits, including more electricity produced for a given fuel consumption, contributing to the affordability of electricity supply. Opportunities to site thermal power plant at new coastal locations are limited. Consequently, inland water-cooled power plants, in particular, play a key role in delivering a secure and affordable electricity supply.

The greatest risks to the current operation and future development of new plant at existing power station locations due to inland surface water abstraction reform/resilience planning initiatives are:

1. Reduced ability of existing plant to deliver their full market potential for energy production, meet capacity obligations or provide flexible grid balancing capacity; and
2. Reduced capability and value of existing and historic generation sites for future development.

EDF Energy believes that it would be sensible to guarantee equitable treatment of thermal power plant during water resource allocation determination alongside competing demands arising from public water supply, agriculture, navigation and allocation to environmental protection.

Q24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

EDF Energy understands and supports the whole catchment approach to managing water systems through delivery of positive and sustained outcomes for the water environment by promoting a better understanding of the environment at a local level. As noted in the response to Question 11 above, the voluntary use of natural capital principles may help to deliver better outcomes for water users, catchments when developing sustainable water infrastructure. We also believe that local collaboration and transparent decision-making when both planning and delivering activities to improve the water environment are essential for effective management of water supply, wastewater and flood risk.

Flood risk management:

Q25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

As a developer and operator of water-dependent power plant, EDF Energy supports plans to manage flood risk. We produce power plant flood protection strategies as part of any new development consent application. These are determined at the project design stage and they are required to be effective throughout plant life. It is normal practice for developers of new power plant to consider flood risk as part of the development consent process and Environmental Impact Assessment (EIA). EDF Energy believes that there is a balance to be struck between the 'social', 'economic' and 'environmental' objectives of EIA. Additionally, there are strong commercial incentives for power plant operators to ensure that their generation assets continue to be appropriately protected against flood risk.

EDF Energy
February 2017

Written evidence from EEF – the manufacturers' organisation to the National Infrastructure Commission on

National Infrastructure Assessment – Call for Evidence

February 2017

About EEF

1. EEF, the manufacturers' organisation, is the representative voice of UK manufacturing, with offices in London, Brussels, every English region and Wales. Collectively we represent 20,000 companies of all sizes, from start-ups to multinationals, across engineering, manufacturing, technology and the wider industrial sector. We directly represent over 5,000 businesses who are members of EEF.
2. Everything we do – from providing essential business support and training to championing manufacturing in the UK and the EU – is designed to help British manufacturers compete, innovate and grow.
3. In this submission we set out our response to the National Infrastructure Commission's (NIC) Call for Evidence on undertaking a National Infrastructure Assessment (NIA).
4. This response builds on EEF's depth of work with manufacturers across a number of years through surveys, member engagement and committees to develop a robust understanding of infrastructure priorities for the sector.

Overview

5. EEF takes a macro level view on the requirements of industry in relation to infrastructure. While there are understandable difficulties in forecasting infrastructure requirements out to 2050 we welcome the Commission's ambition to take a long view on future infrastructure need.
6. This ambition may be difficult in the short term given the uncertainties surrounding the UK's exit from the European Union – particularly in the transport space. Deep supply chains coupled with the EU as a major export destination for manufactured exports may shift depending on future customs requirements and procedures – the knock on impact on stock keeping and warehousing and traffic flows will be difficult to forecast by the Commission.
7. Despite this, we know that reliable and resilient infrastructure will continue to be a key underpinning factor determining the UK's competitiveness as a location for manufacturing.
    a. Roads will continue to be essential. From sending and receiving goods and raw materials to managing supply chains and accessing new markets overseas, good transport infrastructure is a key component for delivering better-balanced growth.
    b. Digital infrastructure will be important for data flows across supply chains and in supporting manufacturers to improve their productivity.
    c. Energy infrastructure will continue to be key to the production process particularly energy intensive processes in sectors such as steel.
8. Meeting the needs of the manufacturing sector will be important in enabling the UK to meet its ambition as a global manufacturing nation in the future. Our response below (which looks at selected questions) focusses on the particular issues we feel should be considered as part of the overall National Infrastructure Assessment.

Cross-cutting issues:

What are the highest value infrastructure investments that would support long-term sustainable growth?

9. EEF regularly surveys our members on their experiences and expectations of UK infrastructure and how these support their overall business ambitions. Our surveys consistently show the road network to be the number one priority for manufacturers – particularly the strategic road network, the backbone of the economy.

    a. Recent attempts to support investment in this network, such as the Road Investment Strategy, should provide the much needed boost to deliver improvements to the strategic road network over the long term.

10. This importance is then followed by digital infrastructure, which has ramped up the agenda to match the pace of manufacturers' investment as part of the 4th industrial revolution. 91% of manufacturers say a high speed internet connection is as important to their business as electricity and water.

11. The local road network, energy supply and international air links complete the picture of the top five most important infrastructure networks for manufacturers from a need for investment point of view.

How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

12. UK manufacturing is a nimble sector responding quickly to changes within global supply chains. This presents a need to get goods to market quickly and international gateways, particularly airports, offer that.

13. Airports matter to a global sector like manufacturing. They facilitate face to face interaction required for a range of business activities and support global trade. Creating and maintaining air links is important if the UK is to remain globally competitive.

14. Supporting the expansion of new destinations from regional airports should be investigated by the Commission as part of its Assessment. Greater access to new trade destinations from regional airports supports manufacturing competitiveness due to reduced country to country trade costs as a result of more destinations being served more frequently.

What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

15. Funding for local and strategic road improvements must be put on a sustainable footing. Our surveys show that there is majority support amongst manufacturers for moving away from the current funding model of using existing general taxation and spending review cycles to allocate funding to roads.

16. The Government has announced the recreation of a Vehicle Excise Duty (VED) linked Roads Fund. This will pay for the management, operation and maintenance of England's strategic A-road and motorway network. However, while the Government has made a step in the right direction, this is only a partial fix focussed solely on the strategic road network. This isn't a whole network solution but provides a remedy for just 3% of the road network by length and 33% by journeys.

17. The local road network is also a crucial asset and one that is deteriorating. Many motorists paying into the Roads Fund will not recognise the distinction between strategic roads and local roads, particularly as 84% of all A-roads are managed as local roads. The Roads Fund should be expanded in scope to cover non-SRN principal roads and the Commission should investigate this as part of their Assessment.

18. This expansion of scope would deliver the same level of certainty to local authorities as Highways England will enjoy and with it boost business productivity through the provision of a more reliable and resilient road network.

Energy:

What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

19. It is important here to define what is meant by 'highest value'. We consider this to encompass a number factors:
    a. Delivered at least overall cost to businesses, government and the taxpayer.
    b. Enabling cost-effective sources for commercial consumers, sustaining or improving their competitiveness domestically and internationally through access to affordable, decarbonised heat.
    c. Delivered in a holistic way – encompassing power, industry, and residential consumers, and laying infrastructure that can be multi-purpose or laid in conjunction with other, complementary, decarbonisation infrastructure, such as for gas, electricity and carbon dioxide transport.

What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

20. There is plenty of expert technical evidence on the future of the power sector, and how best to arrive at it. Our main concern is that it is arrived at in the most cost-effective manner to ensure decarbonisation occurs but without undermining the competitiveness of the UK's energy-intensive industries.
21. In general, a zero-carbon power sector needs to strike a balance in terms of intermittent, baseload and flexible energy generation and demand, as well as plant and services that can maintain the stability of the grid. Interconnection with Europe is also expected to play an increasingly important role, with electricity interconnection another possible route to access cost-effective, low-carbon energy.
22. Trends towards decentralisation will be a major influence on the future transmission and distribution systems that support a low-carbon mix. But thought will also be needed here into how that is paid for – for example, a fully decentralised energy system could result in energy-intensive manufacturing companies bearing a greater share of network costs. How this impacts future electricity costs needs clarification, as electricity costs encompass energy, network and policy costs, and the UK already has significantly more expensive electricity than other European countries.
23. Equally, it will be important that the focus is not only on having a zero-carbon power sector, particularly as the aim is for national decarbonisation. There is a need for multi-sectoral, not just power sector, decarbonisation.
24. An 'ideal' decarbonised power sector would not be developed in isolation, but embrace synergies with technologies applicable to other sectors too such as Carbon Capture & Storage (CCS) and renewable heat. All sectors of the UK economy need to work in conjunction to allow multiple routes to cost-effective decarbonisation including, for example, through energy efficiency, heat and carbon abatement in the coming decades.
25. On CCS, for instance, the 2016 report from Lord Oxburgh's Advisory group concluded CCS has an essential role to play in reducing emissions in all the major fossil fuel consuming sectors in the UK: electricity generation, heating, transport and industry. How CCS can be used to reduce emissions in these sectors must be considered in the round and of course the infrastructure required developed with all these sectors in mind.

26. As the recent proposition from Teesside Collective demonstrates, the government will have an important role to play in bringing forward the necessary carbon dioxide transport and storage networks alongside other participants.

For further information contact

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NIC: National Infrastructure Assessment Call for Evidence

Response from the **Energy Intensive Users Group**

General Comments

The Energy Intensive Users Group (EIUG) represents the UK's energy intensive industries (EIIs) including manufacturers of steel, chemicals, fertilisers, paper, cement, lime, glass, ceramics, gypsum, glass, aluminium and industrial gases that compete in global markets and depend on access to secure, internationally competitive energy supplies to remain in business. These foundation industries employ 200,000 people directly, support 800,000 jobs including their supply chains, and make a £15bn pa contribution to UK GDP.

Responses to Specific Questions

Cross-cutting issues:

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?
Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

EIIs depend on continuous access to secure baseload energy supplies to remain in business.

It is important to recognise constraints as well as opportunities for industrial demand management, especially for continuous processes, and for other processes that have limited opportunities for demand side management (DSR). Also, DSR is already comparatively widely employed in EIIs that operate flexible processes, so there may be limited scale for realistic expansion in the industrial sector.

DSR is more about smoothing the overall demand profile than demand reduction *per se* – i.e. it is not an alternative to baseload energy provision and all that it entails in terms of infrastructure maintenance and development.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?
Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

It may be more efficient to deliver some elements of low carbon infrastructure partly or wholly through general taxation than levies on consumer bills, particularly where uncertainty about continuity or political/economic sustainability of future policy raises risk and hence cost of capital to investors.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

Industry needs market-led, least cost decarbonisation of heat if it is to remain internationally competitive. Where there are lower cost opportunities for heat decarbonisation in other sectors, these should be pursued first (domestic heating, buildings, commercial, public sector). Subsidies should not distort use in different sectors, e.g. by favouring use of biomass in power generation over its use in industry.

Gas will remain an essential chemical feedstock and heating fuel for certain industrial applications for the immediate and foreseeable future. It may be sensible to assess the technical and economic potential for hydrogen as a substitute or for blending with natural gas, but it would be premature to reach any decisions about its deployment until further assessment and demonstration projects have taken place.

There are existing high value heat decarbonisation opportunities that are not yet fully adopted or maximised. For example, despite availability of subsidies to encourage investment in renewable electricity generation and low carbon heating (Renewable Heat Incentive, RHI) there is no equivalent support available to industrial processes that use direct heating (e.g. cement and lime manufacturing). Paradoxically, only processes with the added inefficiency of heating by an intermediate liquid are eligible for the RHI. This lack of support means that there is no incentive for manufacturers to invest in infrastructure to overcome the technical challenges of switching away from fossil fuels to low carbon alternatives, such as biomass or biomass waste derived fuels. Furthermore, the subsidy vacuum restricts these manufacturers from maximising their low carbon fuel sources because they are competing for the same sources in a distorted market that favours electricity generation and RHI listed technologies. There is an urgent need to reform policies to allow support for direct heating using non-fossil fuels in industrial processes.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?
Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

A decarbonised power sector must continue to deliver baseload and dispatchable supply at internationally competitive prices with at least the same level of security as at present. The effectiveness should be judged by the service it delivers to consumers in terms of reliability and value for money. It is therefore desirable to encourage diversity, but equally to avoid central planning based around arbitrary targets that may or may not prove technically, environmentally or commercially practical. This applies equally to energy generation, transmission, distribution, storage, and import infrastructure – the objective should be to maximise productivity across the entire energy chain.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Consideration will need to be given to the potentially significant impact of electric vehicle charging on the electricity system in terms of the additional electricity generation, storage, transmission and distribution capacity that may be required to maintain security of supply.

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10 February 2017

Lord Adonis
Chair
National Infrastructure Commission

Dear Lord Adonis

Ref: Call for Evidence: National Infrastructure Assessment

My organisation welcomes the chance to respond to your call for evidence.

Energy & Utility Skills is the skills body for the energy and utilities sector, with membership comprising of the major infrastructure companies within water, power, gas and waste recovery/renewable along with their main delivery partners. Our sector is responsible for delivery of around 56% of the National Infrastructure Plan.

The National Infrastructure Plan for Skills had initially highlighted that skills "would be the most pressing issue" in the successful delivery of the infrastructure needs, and this has been restated in the Productivity Strategy and more recently in the new Industrial Strategy, where skills and infrastructure now sit as two of the ten key pillars of Government focus.

As I know you are acutely aware from when we met through your extensive work in the transport skills arena, the reality is that without the right people with the right skills, in the right roles, at the right time, and for an affordable and sustainable cost, the overall infrastructure strategies simply cannot be delivered. It is for this reason that as our submission to this call for evidence, we ask your National Infrastructure Assessment *to take explicit account of ensuring sustainability and resilience for workforce renewal and skills*.

The challenges are significant, but surmountable, if collective action is taken. Our sector alone requires circa 221,000 new recruits during the next 10 years, as around 100,000 people (20%) in the workforce start to retire, 90,000 leave the sector to find new roles and 31,000 new jobs are created. To compound the challenge, the energy and utilities sector has a relatively high proportion of hard-to-fill vacancies (36%), which is higher than any other sector.[1] The national average is 23%. This high percentage is driven by a lack of proficient skills and it will be vital to address this in order to deliver the National Infrastructure Plan.

Yesterday, we sent you a launch copy of the first-ever Energy & Utilities Workforce Renewal and Skills Strategy. Twenty seven of the most senior organisations in the sector, working via an initiative called the

[1] UKCES (2015) *Employer Skills Survey*

Energy and Utility Skills Partnership, have set out the evidence for the challenge that exists, initiated new pilot trials to take on some of the most significant issues, and started to open dialogue across the key interest groups to remove what I judge as long-held fatigue about 'the skills cliff-edge'.

The Strategy sets out how the sector can build a sustainable pipeline of talent by recruiting, training, upskilling and then retaining high performing workers over time. It focuses on three key priorities for action:

- Mass recruitment initiatives and sector attraction work to increase the future talent pool
- Maximising investment in skills made by asset owners and their supply chain - through procurement
- Opening the flow of talent through use of skills passports and targeting specific skills shortages.

Our sector has also become the first ever to graduate apprentices on the new Standards, has already brought 76 new talents through the only functioning end point assessment service in the utility and infrastructure sector, and has achieved numerous 'firsts' in the Westminster apprenticeship system along the way, including graduating the first ever female engineering candidate.

In the infrastructure environment we do, however, also face numerous challenges. An example is that all the major utility strategies from Government sponsoring departments and regulators miss references to ensuring and encouraging sustainable workforce renewal and skills development. This includes within strategies where the bodies have duties to sustainability and resilience. The thought process to date has been that "the market will provide". I do not see the evidence of that approach working, or that such an assumption does not come with an accompanying price tag as companies fight for the best, in a period of the lowest unemployment for 11 years.

Individual regulated utilities and their critical delivery partners and supply chains simply cannot be left to manage this UK-wide business risk alone.

A copy of the inaugural Energy & Utilities Workforce Renewal and Skills Strategy is provided with this letter. I would be very pleased to meet with you and your team, or to arrange a meeting with a representative group of these key employers, to discuss not only the key workforce issues impacting on infrastructure delivery in our sector but also the proposed solutions.

In summary, our evidence calls for:

1) The National Infrastructure Assessment to explicitly recognise the need for sustainable and resilient strategic workforce renewal and skills, and:

2) The largest single contributor to the delivery of that plan – the energy & utilities sector – to be explicitly recognised for its vital role and the right conditions to be created through the National Infrastructure Commission for joined-up policy and sector solutions.

If there is anything further we can assist with, do please let me know.

Yours sincerely

[Respondent name redacted], Energy &
Utility Skills Group

National Infrastructure Assessment: Call for Evidence

Energy Networks Association (ENA) represents the “wires and pipes” transmission and distribution network operators for gas and electricity in the UK and Ireland. Our members control and maintain the critical national infrastructure that delivers these vital services into customers’ homes and businesses.

Since privatisation, the networks have delivered value for customers and the UK economy though improved performance and lower costs:

- Network costs are now 17% lower than they were when at the time of privatisation.
- The stability of the regulatory model has ensured consistent investment. Between 1990 and 2020, £80 billion will have been invested in the gas and electricity networks.
- This investment has delivered UK energy networks which are amongst the most reliable in the world. There has been a reduction in power cuts of 30% since 2002. The reliability of the transmission networks and gas distribution network is over 99.9%.

Executive Summary

Our networks are vital facilitators of the UK’s efforts to decarbonise the heat, power and transport sectors. The evolution already underway in our networks will ensure that customers continue to have secure and affordable supplies of gas and electricity in a sustainable energy system.

There is a growing appreciation across the energy industry of the need to ensure a whole system approach to infrastructure planning and operation in order to best meet the interests of UK customers. As the representative body for both gas and electricity networks, ENA is well placed to consider challenges across the power, heat and transport sectors in a holistic way, without bias towards particular technologies or energy sources.

This submission will outline the work being carried out by ENA and our member companies to facilitate the decarbonisation of heat, power and transport in a secure and affordable way, which considers the interests of customers as a priority:

- **The gas networks will have an important transitional role to play in a holistic approach to meeting carbon reduction targets, which considers affordability, energy security and customer choice.**
- **Efficient use of the UK's extensive gas infrastructure will also play a long term role in meeting low carbon heat demand through the use of green gas such as biomethane and hydrogen. Green gas can also help decarbonising the transport sector as a fuel for Heavy Goods Vehicles (HGVs).**
- **Gas network companies are investing in new infrastructure through the Iron Mains Replacement Programme (IMRP). It is envisaged that the majority of low-pressure distribution network will be made up of polyethylene by 2030, making the transportation of hydrogen possible.**
- **Gas Distribution Networks (GDNs) are trialling innovation projects to demonstrate the potential that biomethane, hydrogen networks, and bio-SNG can play in the future energy system to deliver reliable, affordable and low carbon of energy for heat, cooking and transport. Regulatory and policy decisions must be made in the short term, prior to 2021, to enable the UK to benefit over the longer term from its gas network infrastructure and the exciting potential of green gas.**
- **The electricity networks are evolving to become smart grids, which will be crucial to connecting increased Distributed Generation (DG) from renewable sources and managing the changing nature of supply and demand associated with the low carbon technologies such as electric vehicles (EV). ENA is working with member companies and key stakeholders to define the changing roles and responsibilities of network operators to ensure a whole system approach is taken which identifies the best models to adopt for customers.**
- **The 28GW of generation now connected to the distribution network has required DNOs move away from their traditional passive role, to become**

more active managers, using real time data to make interventions on their networks to keep costs down for customers. With DNOs taking on an increasing number of system operator functions we have started to see the transition to a new Distribution System Operator (DSO) role.

- **The DSO evolution cannot be viewed in isolation as it will have a significant impact across the system and have implications for the way distribution operators interact with service providers and other parties. ENA has launched a major programme of work to consider these changes and the impact of the DSO transition across the system and particularly the need for closer working between network operators at the transmission and distribution level. The TSO-DSO (Transmission System Operator – Distribution System Operator) project will bring network operators and key stakeholders together to explore some of the detailed challenges around evolving roles and responsibilities in the short, medium and long term to ensure that the best models for UK customers are identified and taken forward.**
- **As we move towards a more flexible energy system it is essential that thinking on this topic is customer centric so that changes are designed to advance the public interest, rather than being designed around technologies or existing industry processes and structures.**

1. **<u>What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?</u>**

The focus of the UK's decarbonisation effort has so far predominantly fallen on the electricity sector, and how we generate an increasing proportion of our power from renewable sources.

Only relatively recently has attention started to fall on how we meet the significant challenge of decarbonising heat, which accounts for around 45% of the UK's total energy needs.

The UK Government's target is for 12% of heat demand to be met by renewable sources by 2020, and the Scottish Government's Climate Change Plan has set a target for 80% of domestic heat to be from low carbon sources by 2032.

Meeting these targets, whilst meeting peak energy demand in winter, is recognised as possibly the biggest challenge facing the energy industry. It will require detailed consideration of how we make efficient use of our energy infrastructure, and how we adapt that infrastructure to ensure an affordable and secure progression to a low carbon economy. Any decarbonisation plan will also need to address power and transport, alongside heat, as part of a whole energy system approach.

There is a growing body of evidence which demonstrates the importance of gas, and the gas networks, in meeting peak heat demand in a secure and affordable way; both in the short term and over the long term as part of a sustainable energy mix.

The UK benefits from an extensive gas network, which delivers over 720TWh of energy to customers and covers 284,000km. It is an extremely valuable asset and a feat of engineering which has helped industry to grow and has provided an affordable way to heat our homes over many decades. Making efficient use of this asset is in the overwhelming interest of consumers; is necessary to meet peak heat demand; and will enable us to keep costs low as we move to a low carbon economy.

Gas is the fuel choice for UK consumers, meeting the heating needs of almost 85% of domestic properties and the cooking needs of around 50% residential and service sector buildings. Whilst the way we heat homes and businesses will gradually change as we decarbonise, gas is set to remain dominant for some time at least.

Over 80% of peak energy usage is currently derived from gas. Without gas and the gas grid there is simply not enough energy for the UK to function, or the means to transport that energy to end users during peak periods. With the population set to increase by 22% by 2050, total energy demand will increase significantly.

Whilst electrification of heat can play a role in some areas, full electrification is not a viable solution to meeting low carbon heat demand. The gas network will be required to mitigate the increased demand on the electricity network from low carbon technologies such as heat pumps and electric vehicles. Reinforcing the electricity

network to meet peak heat demand in winter, if possible, has been shown to be a prohibitively expensive pathway for the decarbonisation of heat.[1]

The cheap and reliable nature of gas for heat has very important implications for energy affordability and fuel poverty. Heating your home by gas is around 3 times cheaper than using electricity and saves consumers over £400 per annum compared to alternatives. Low carbon solutions which make the most of existing infrastructure will reduce cost, as well as minimising disruption to communities and businesses from new developments.

The role of the gas networks in combating fuel poverty is demonstrated in the Fuel Poor Network Extension (FPNES) scheme. In 2014-15, 60,000 new gas connections were provided by the Gas Distribution Networks. Of these, over 12,000 were delivered under the FPNES as part of the networks' social obligations for households considered to be 'fuel poor'. An additional 15,000 households were connected in the previous year, in total meeting around 30% of the networks' target for 2013-2021.

A study carried out by Wales and West Utilities considered the decarbonisation challenges from a consumer perspective, and found that in Bridgend, which is representative of a typical British town, over 80% of customers had little or no financial means of moving away from gas heating to more expensive alternatives, and would therefore require a significant amount of subsidy if they were to do so. The study also concluded that even with the significant level of subsidy which would be required take up of alternative energy infrastructure solutions can take up to 50 years.[2]

Green Gas and Low Carbon Heat

As well as being vital to meeting heat demand in the short term and over the transition to a low carbon future, the gas networks can play a long term role in a sustainable energy system through the injection of green gas into the network.

The UK's gas distribution network companies (GDNs) are leading innovation projects which are providing technical understanding of green gas injection into the grid, as

[1] Delta EE Report, "2050 Pathways for Domestic Heat" (2012)
[2] Wales and West Utilities, "Bridgend Future Modelling" (2015)

well as demonstrating commercial potential and highlighting necessary regulatory changes to encourage growth in the sector.

- *Biomethane*

Biomethane injection into the grid has seen rapid growth in recent years, driven by GDN innovation and Government support through the Renewable Heat Incentive (RHI). The Non Domestic RHI provides support to 58 biomethane to grid plants across the UK already, and a further 28 have applied for the scheme.[3] By January 2016, 2.35 TWh of renewable gas had been injected into the grid.[4]

The Government's target is for 12% of heat demand to be met by renewable sources by 2020, and biomethane has the potential to meet over 10% of domestic UK heat demand by that year.

As well contributing to a reduction in carbon emissions, the injection of biomethane into the grid offers wider benefits to the whole energy system in terms of affordability, security and customer choice.

Unlike other low carbon heat options, such as electric heat pumps or heat networks, the use of biomethane utilises existing infrastructure and requires no expansion of the gas or electricity network, saving customers money. By removing the need build new infrastructure, there is an added economic benefit in minimising disruption to road users and businesses from new developments. Furthermore, biomethane does not require new domestic appliances to be installed, meaning further cost savings for bill payers and making it an attractive option for customer's heating needs.

In addition to environmental and financial benefits of biomethane to grid, it offers a source of domestic gas which increases the diversity and security of supply, reducing the UK's reliance on foreign imports.

Continued support through the RHI will be crucial for biomethane to grid to continue the impressive contribution it is making to 2020 renewable heat targets.

[3] BEIS RHI Deployment Statistics, November 2016, https://www.gov.uk/government/statistics/rhi-deployment-data-november-2016

[4] Aggregated figure from Ofgem RHI Public Report, as at 3 January 2016. https://rhi.ofgem.gov.uk/.

- *Hydrogen*

Of the various forms of green gas which could be injected into the network, Hydrogen offers another area of exciting potential. While there are still uncertainties surrounding its availability and cost it could play a significant role in meeting future heating requirements, as it does In Hong Kong where 49% of the town gas mix is hydrogen. The use of hydrogen rich gas in the UK networks is also not a new concept, as demonstrated by the historic use of town gas in this country.

Through the Iron Mains Replacement Programme (IMRP), it is envisaged that the majority of low-pressure distribution network will be made up of polyethylene by 2030, making the transportation of hydrogen possible in principle.

Hydrogen would offer many of the same benefits as biogas in terms of making use of existing infrastructure to decarbonise UK heat demand; it would leave no carbon footprint as the combustion of hydrogen with oxygen results in water and heat. Studies have shown that customers' existing appliances could operate safely with up to 10% hydrogen concentration.

The injection of hydrogen into the gas network also has potential benefits in terms of energy storage and a solution to the intermittency of wind generation. Known as 'Power to Gas' technology, excess electricity generated from wind can be converted into hydrogen gas through a process of electrolysis and stored in the gas network to meet heat demand. National Grid estimate that the gas network currently has up to 650 GWh of storage, and even if all the UK wind generation were to be stored in this way it would use only 5% of the grid.

Northern Gas Networks and its partners are leading an innovative trial, H21 Leeds Citygate, which aims to investigate the challenges, benefits, risks and opportunities of converting the existing gas network in a major UK city, Leeds, to a hydrogen network. The study is designed as a blue print which would be transferable to other UK cities where the decarbonisation of heat, transportation and electric is much more difficult but also provides the biggest return on carbon reduction.

In addition National Grid Gas Distribution's 'HyDeploy' project will demonstrate on Keele University's private network that natural gas containing levels of hydrogen (10% to 20%) beyond those permitted by the current safety standards (0.1%) can be distributed and utilised safely.

SGN are committed to a 100% hydrogen network demonstration in Scotland and are currently undertaking feasibility studies for 3 sites, seeking to select the most economic and viable location. Each site will be scalable and will look to utilise the hydrogen infrastructure in place for other applications including hydrogen vehicles and Combined Heat and Power (CHP) applications.

- *BioSNG*

Alongside biomethane, GDNs are investigating ways to make efficient use of domestic waste in meeting heat demand. Through the Gas Network Innovation Competition established by Ofgem, National Grid Gas Distribution has launched a project looking at turning household waste into gas which can be injected into the gas network.

The project is developing a demonstration plant in Swindon, which processes refuse derived fuel into pipeline-quality bio-substitute natural gas (BioSNG) that is indistinguishable from 'normal' gas used for heating and cooking. The construction and commissioning of the BioSNG pilot plant is now complete. Individual components of the plant are now being operated in standalone mode, prior to end-to-end operation of the process, which is expected to take place in Q2 2016.

By early in the next decade a fleet of bioSNG plants could be in operation, delivering large quantities of renewable gas into Britain's gas pipeline network.

A suitably-designed RHI with a dedicated tariff for biomethane from thermal sources is essential to support the first full-scale commercial BioSNG plants, and the current review of the RHI affords an ideal opportunity to put such a tariff in place. Separating the tariffs acknowledges and supports the different status of market maturity between Biomethane from AD and thermal sources.

The UK Gas Networks role in a 2050 Whole Energy System

There is a growing body of evidence which demonstrates that decarbonising heat will require a holistic approach which considers the interests of customers and retains a role for the gas network in delivering green gas to homes and businesses. As well as recent reports from Policy Exchange[5] and Imperial College[6], Energy Networks Association commissioned KPMG to produce the 'The UK Gas Networks role in a 2050 whole energy system' in 2016.[7]

This report explored the ways that the heat sector can be decarbonised, by looking at four possible future scenarios; evolution of gas networks and green gas; prosumer (self-generating heating and energy solutions); diversified energy sources with different technologies used across the country; and electric future with a switch to electric heating systems like heat pumps.

The report finds that evolution of the gas networks, injecting green gas such as hydrogen into the grid, offers significant cost savings against alternative low carbon heating sources. It is also shown to be the most practical scenario in terms of technical feasibility and, importantly, acceptance from customers and society. The value that customers place in the convenience and reliability of current heating solutions is shown to be an important consideration in future policy decisions.

The analysis identifies advantages from continued use of the gas network, and concludes that the future is likely to include a range of solutions borrowing from each of the scenarios considered.

Recommendations from the report include:

- Gas and electricity policy decisions need to be firmed up ahead of the next RIIO network price controls, due to the long term nature of network investments. More detailed assessment on the acceptance of major change by consumers and society is needed, with regard to both policy and practicality aspects.
- Gas and heat innovation funding and piloting needs to continue, especially in areas that help to firm up the understanding of options for 2050.

[5] Policy Exchange, "Too Hot to Handle? How to decarbonise domestic heating" (2016)
[6] Imperial College, "Managing Heat System Decarbonisation", (2016)
[7] KPMG, "'The UK Gas Networks role in a 2050 whole energy system' (2016)

- Transport decarbonisation policy needs to be integrated with power and heat decarbonisation policy

Policy and Regulatory Considerations

The next price control period for Gas Distribution Networks, RIIO-GD2, will commence from March 2021 providing a fast approaching deadline for decisions regarding heat decarbonisation in light of the recommendation listed above.

Work is already under way to consider regulatory issues that will need to address to facilitate green gas injection into the network. An innovation project being undertaken by SGN in Oban is looking to demonstrate that the UK gas quality regulations (The Wobbe Index) could be safely widened. Current regulations are based on the composition of North Sea gas, and green gases such as biomethane require expensive processing in order to meet existing standards.

If the Oban project does demonstrate that national standards could be safely revised then it would open up the market to a more diverse range of energy sources by removing processing costs and improving the comparative economic case for green gas injection. SGN estimate that revising the Wobbe Index could save the industry £325 million each year and result in lower prices for consumers. The project will report its findings to the regulator Ofgem this summer.

Continued support through the RHI is crucial for biomethane to grid to continue the impressive contribution it is making to 2020 renewable heat targets.

The decision to reduce the support available to primary energy crop projects could potentially reduce the number of new gas to grid project being commissioned, given that large amounts of food waste are currently locked in to long term contacts. ENA and its members strongly recommend that the government's waste policy should be aligned to changes in the RHI, to ensure that sufficient feedstock is available to meet the government's ambitions for lower-carbon gas.

As the Committee on Climate Change suggested in their report on the Next Steps for UK Heat Policy,[8] the government needs to consider how to support green gas production once the current RHI funding expires. Early decisions will help investors and the networks prepare for likely developments in the 2020s.

We would like to see closer working between the Scottish Government and the UK Government as they work to identify the best approaches to long term heat decarbonisation in pursuit of the renewable heat targets set out above.

2. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

ENA members recognise that traditional roles and responsibilities of network companies will need to change to deliver a secure and affordable low carbon energy system. In order to facilitate a transition to a low carbon economy, energy networks are adapting infrastructure and rolling out innovation in smart network solutions to maintain security of supply, deliver efficiency and keep the cost to consumers low.

The traditional role of the electricity distribution networks in the energy market has been relatively passive; taking energy in one direction, from generation to consumer with predictable levels of supply and demand.

The growth of intermittent renewables connecting to the electricity distribution network and the possible electrification of some sources of heat and transport will profoundly impact on the nature of Distribution Network Operators (DNO) and the wider energy market.

Distribution System Operator

The growth of Distributed Generation (DG) has outstripped expectations in recent years, with solar PV connected, already surpassing levels previously expected by 2030. The 28GW of generation now connected to the distribution network has required

[8] https://www.theccc.org.uk/wp-content/uploads/2016/10/Next-steps-for-UK-heat-policy-Committee-on-Climate-Change-October-2016.pdf, p. 70-71.

DNOs move away from their traditional passive role, to become more active managers, using real time data to make interventions on their networks to keep costs down for customers.

With DNOs taking on an increasing number of system operator functions we have started to see the transition to a new Distribution System Operator (DSO) role. This has been enabled by network innovation projects funded through the Low Carbon Network Fund and RIIO regulatory framework. The learnings from these projects have delivered vital technical understanding of technologies like energy storage and demand side response mechanisms to allow DNOs to make significant progress towards a DSO role in a short space of time. The networks share this knowledge through the Smarter Networks Portal to ensure that all customers can benefit from the findings from LCNF and RIIO innovation projects.[9]

Smart network solutions utilising storage and demand side response are being rolled into business as usual for companies and have already enabled close to £1bn of cost savings for customers to be embedded within the current RIIO ED1 price control which runs to 2023. A recent report commissioned by Ofgem further highlighted the significant benefits that can be delivered for customers as these innovations are rolled out across the UK in the years ahead.[10]

DNOs have adapted effectively to facilitate a rapid increase in Distributed Generation, and the technical governance and understanding is in place to meet the challenges outlined above. The requirement now is to consider changes to the energy market to upscale capability and capacity for active management of the network at the distribution level and enable a full DSO transition.

TSO-DSO Project

The DSO evolution cannot be viewed in isolation as it will have a significant impact across the system and have implications for the way distribution operators interact with service providers and other parties. Transmission and distribution network operators have already had to respond to the rapid increase in DG connections by

[9] Smarter Networks Portal

[10] Ofgem Network Innovation Review (2016)

working more closely to address operational issues caused by an increasing amount of energy flowing back onto the distribution network and being exported onto the transmission network.

ENA has launched a major programme of work to consider these changes and the impact of the DSO transition across the system and particularly the need for closer working between network operators at the transmission and distribution level. The TSO-DSO (Transmission System Operator – Distribution System Operator) project will bring network operators and key stakeholders together to explore some of the detailed challenges around evolving roles and responsibilities in the short, medium and long term to ensure that the best models for UK customers are identified and taken forward.

There are several development areas that have been identified that will form part of the TSO-DSO project:

• Development and alignment of Transmission and Distribution incentives to deliver whole system benefits is key to optimising network investment, system security and delivering benefits to consumers.

This includes using the mechanisms available within RIIO-T1/ED1 to deliver whole system benefits in the short- to mid-term and then subsequently RIIO-T2/ED2.

• Transparency of planned/anticipated contracted actions, which will be vital in order to facilitate markets to provide network solutions in a whole system view. This needs to include transparency to customers, market participants, DSOs and SO.

• Improved forecasting, both in terms of better longer to medium term forecasting of load and generation growth and more joined up forecasting across DSOs and the SO.

• Connection arrangements will be reviewed.

• EU codes, planning standards & LCTs are key drivers that would merit further discussion & consideration.

• How Independent Distribution Network Operators (IDNOs) and private wire networks are reflected in TSO-DSO developments.

It is essential that thinking on this topic is customer centric so that changes are designed to advance the public interest, rather than being designed around technologies or existing industry processes and structures. There is a customer experience workstream envisaged in ENA's TSO-DSO project to ensure that this remains a focus.

Regulatory and commercial barriers to flexible energy

- Enabling Storage

Storage on the electricity distribution network can play a role alongside other solutions in meeting the challenge of increased intermittency from renewable generation.

Through innovation funding mechanisms network companies have trialled storage technologies and explored the potential of battery storage technology to deliver benefits to customers. Examples include SSEN's NINES project in Shetland which included the installation of a battery to deliver learning regarding the operation of MW scale batteries on a constrained distribution network. UK Power Networks Smarter Network Storage project explored how energy storage could be used to provide benefits to consumers by deferring traditional network reinforcement and demonstrated additional benefits that can be gained from the technology to maximise value. In order to achieve these additional benefits, the technology can be used for a range of other system-wide services, to benefit other electricity system participants.

In order for battery storage to play a role in the balancing of the network in a low carbon future, there needs to be further clarity on how it is treated from a regulatory perspective. There is ambiguity within the existing framework as to whether DNOs can own and operate storage assets where that involves buying and selling energy into the market. ENA members believe storage has an important role to play in addressing network challenges and therefore should be available to network operators to support their networks.

However, storage needs to be considered as one potential form of flexibility and all different forms of distributed energy resource should be treated fairly to provide flexibility. In some cases, bidirectional electricity storage (e.g. batteries, but not

exclusively), because of its need to charge and discharge, can increase rather than reduce network loading where other solutions (such as energy vector - heat or hydrogen) do not. We need to ensure that the market place provides equal and fair access and charging arrangements for all types of flexibility and not artificially distorting the market to certain types.

Our members support flexibility, including storage, being procured from the competitive market place as a commercial service. However, we do not yet know if the commercial market place can provide viable storage services in the highly location specific manner networks may need, therefore we believe that the option to allow network operators to own and operate storage in the future, where it can provide benefits to consumers but where the market place cannot provide it, should not be precluded at this stage.

Storage, and flexibility more generally, must be considered as part of a whole system solution to deliver benefits to customers with closer working between the System Operator and network operators. There needs to be clarity on which services can be stacked and how to deliver whole system benefits so that certainty is provided for investment/innovation. This is likely to encompass more access to information across industry parties. This is likely to be an evolutionary development path, but there needs to be a development initiative to consider this and this is a priority for consideration in the ENA's TSO-DSO project in 2017.

- Network charges and price signals for flexibility

ENA members agree that current use of system and connection charging arrangements will need to develop to meet the needs of a smart, flexible energy system.

Our members have identified a number of current issues that are likely to merit consideration in the near future. We will define these issues as a priority for 2017 within ENA's TSO-DSO Project so that we can better scope what changes we believe might be required and how they might be implemented mindful of other industry initiatives (e.g. Ofgem's work on charging arrangements for embedded generation).

Examples of these issues include:

- Generation connection and constraint management payments, addressing the different approaches to constraints between transmission and distribution, the impact of changes to constraints on flexible connected generators and the approach to generation connections and charges where high cost constraints are not addressed by connection charges (more than one voltage level above the point of connection).
- Intermittent generation and demand (including behind the meter generation) avoiding use of system charges. As most DG does not pay Balancing Services Use of System (BSUoS) charges, it does not contribute to the cost associated with the impact of intermittent generation on balancing charges. Therefore, there is a lack of incentive for these generators to reduce the balancing costs they impose.

Charging mechanisms should reflect principles of:

- Whole system cost reflectivity (rather than focusing on individual licensed parties) to deliver the best value for customers.
- Equality in charging to ensure that all flexibility providers and customers are presented with a level playing field.

Support for innovation through the regulatory framework

We believe that the current support arrangements for network innovation are broadly fit for purpose and continue to be required.

We have identified that there could be improvements made to the schemes to:

- Support innovation that delivers value across the whole system and beyond individual network or system operator business scope.
- Introduce a stronger link to innovation priorities from developing Government policy thinking (e.g. industrial strategy).
- Support trialling of emerging commercial and market models and not just technology to be embedded into network/system operator operations.

- Facilitate cross energy vector projects (e.g. Hydrogen) and not just electricity (e.g. in NIA/NIC).
- Supporting local energy (including community energy schemes) provision to the areas that need to be supported to ensure approaches exist to support those least able to adopt smart flexibility technologies.
- Innovation projects towards the end of price control windows are driven to shorter timescales to complete in time, whereas supporting longer timeframes may allow projects time to demonstrate value.

Facilitating Low Carbon Connections

Demand for connections has been on the rise for a number of years, but with changes in Government policy in areas such as distributed generation (DG), this has significantly outstripped predictions. UK growth and the development of new technologies such as storage have also presented additional challenges for Distribution Network Operators (DNOs) with more speculative requests for connections.

Government and Ofgem are aware of the challenges this poses for network companies, however, they also want to see the removal of perceived barriers to growth. Networks themselves are not the barriers, and in fact enable this growth, however, they are constrained by the policy and regulatory framework they must operate within. A number of positive actions to improve the situation are already underway, with the support of the developer community

o Stakeholder Engagement

Over recent years DNOs have implemented a number of measures to improve how they provide information for developers and DG connectors as well as making them a key stakeholder in their business planning. These efforts have resulted in satisfaction levels of 80%.

So-called heat maps are now available to show connectors where capacity exists and DNOs provide connections surgeries which allow an opportunity for those wishing to

get a connection to get advice, guidance and support at an early stage. ENA is now responsible for organising the annual DG Fora which take place in Cardiff, Glasgow and London to bring together the DG, IDNO and DNO sectors to look at how both connections and competitive market can be improved.

- Investment ahead of need

DNOs have been grappling with the challenges of anticipatory investment for many years and it is one area that significantly holds back the ability to provide additional capacity to support unknown, but predictable growth. Trials for allowing isolated anticipatory investment are underway with WPD and UKPN where some constraints issue have been greatest. This allows the DNOs to invest ahead of need and charge subsequent connectors for the reinforcement that was made. Allowing more scope for investment ahead of need in some areas would give DNOs far greater flexibility to plan the network. While continuing to protect customers from unnecessary costs is important, the current constraints are clearly a result of DNOs not having the freedom to invest in anticipation of justified future need.

- Facilitating Competition - Competition in Connections Code of Practice

Following a consultation by Ofgem, a licence condition was approved requiring the development of a Code of Practice to govern the way DNOs provide the necessary services associated with competitive connections. The new Code of Practice will better inform the process and ensure the best service for customers. It represents a significant step forward in the further development of the competitive connections market. Through the new website, all parties will be able to influence the development of the Code of Practice and consequently the services which DNOs provide to further improve competition.

- Making the best use of current network assets - Connection Milestones

Setting connection milestones is one option that will assist issues of unused capacity. Where the offered capacity is not being used and sufficient progress as to demonstrate intention to use allocated capacity isn't seen, DNOs will be able to withdraw their offer and allocate it to other connectors who are ready to progress. We have been working

closely with the DG community on this and it has received support but we are continuing to consult on this.

o Assessment and Design Fees

The scale of applications to connect to the distribution network has represented a significant challenge for network operator businesses and we believe that the current arrangements for Assessment & Design fees require change to focus on a fairer allocation of costs, so the right people pay for the design work undertaken by networks.

Currently there is no cost for submitting a request for a connection and the work associated with processing an offer. This has resulted in a significant number of speculative requests being undertaken by DNOs rather than developers seeking a collaborative discussion with the network operator.

The costs for these are only charged on those who accept the connection offer and they are also required to meet the costs of those offers which are not accepted. These speculative submissions account for around 70% of all requests and the changes we have proposed could make a real difference and provide a better service to customers. We would urge Government to move quickly with Ofgem to make the necessary changes.

3. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Ultra Low Emission Vehicles

DNOs are anticipating an increase in demand on their network from a growing number of electric vehicle (EV) charging points, and more people charging EVs at home. As well as increasing demand on the network, electric vehicles present a number of challenges for DNOs associated with simultaneous charging of cars at peak times and a greater level of unpredictable demand.

In order to facilitate these changes in electricity demand DNOs are working closely with partners, including OLEV, to ensure that infrastructure is able to meet the

challenges posed by EVs in the years ahead. DNOs also work with stakeholders in the EV sector to feed into the development of UK standards for electric vehicles, charging connections and charging infrastructure.

Smart charging is a significant enabler to maximising the use of EVs (and storage assets more generally) and minimising the impact on the networks, therefore it is key to promote and engage customers of the benefits of smart charging. In a market where EV uptake is increasing, this is a significant and near-term challenge.

It is also important for the development of the supporting infrastructure for EVs that technology and commercial standards develop to enable visibility and control smart charging of vehicles. It will be essential that electricity networks have visibility of the location, availability and dynamic usage of charging infrastructure. Standards will also allow for safe, secure, and interoperable smart charging to be realised.

We would encourage the Government to coordinate an approach to accessing EV charging infrastructure that meets the needs of the industry and consumers. ENA members have worked collaboratively to carry out a highlevel assessment of the potential impact of more widespread roll-out of electric vehicles and the associated charging smart-charging infrastructure. Part of that work included an analysis of the potential network investment cost to support charging infrastructure for EVs, which identified that under some relatively ambitious but nevertheless plausible take up scenarios there would be a need for substantial investments between now and 2040. We would be happy to discuss this work, and potentially to develop it further, as part of the ongoing dialogue with BEIS.

Gas in vehicles

Tackling emissions in the transport sector will clearly be vital if the UK is to meet its ambitious carbon reduction targets, and it is in this area where the use of low carbon gas in vehicles can make another important contribution. This will be particularly important in the transportation of heavy goods, as the electrification of Heavy Goods Vehicles (HGV) is not practical.

HGVs account for 20% of the UK's carbon emissions. Natural Gas Vehicles (NGVs) not only produce lower levels of greenhouse gas than diesel engine alternatives, but could also provide up to 40% fuel cost savings compared with diesel. Gas vehicles could provide up to 28% reduction in CO2 emissions in the transportation of goods in the UK.

National Grid have connected the UK's first high pressure, public-access Compressed Natural Gas filling station for HGVs at Leyland, which is capable of 'fast filling' over 500 HGVs a day. John Lewis Partnership has signed up to use the station for refueling its fleet of HGV's as part of the company's commitment to reducing its carbon footprint. When fully operational the plant will be able to reduce greenhouse gas emissions by more than 5000 tonnes per year.

Northern Gas Networks are also working with Leeds City Council on a similar CNG project. The Department for Transport are considering further changes to the support mechanism for renewable fuels including gas,[11] and the government needs to ensure that this is joined up with an infrastructure strategy that provides sufficient refuelling capacity.

[11] https://www.gov.uk/government/consultations/renewable-transport-fuel-obligation-proposed-changes-for-2017

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Submission to the National Infrastructure Assessment Call for Evidence

[Names redacted]

Energy Policy Group, University of Exeter

Summary

This submission argues that GB is trapped in an infrastructure which is not fit for purpose. GB is not going to be able to transform to a fit for purpose infrastructure system unless those who pay for it also support it. The infrastructure changes which occur have to be those which GB people want, and value in their everyday lives. This is a move to an energy efficient Britain – whether this is buildings, the energy system, the transport system and the waste and water systems. All these systems need governance overhauls to provide appropriate incentives for the 'new' sustainable, cost effective and efficient systems and to stop providing incentives to the 'old' system. This is not as radical as it might seem. Other countries around the world are implementing these transformations and GB should learn from them.

Introduction

It is our great pleasure to submit evidence to the National Infrastructure Assessment (NIA) Call for Evidence. The Energy Policy Group (EPG) of the University of Exeter has submitted evidence to the National Infrastructure Commission (NIC) twice before. Firstly, in January 2016 to the Electricity Interconnection and Storage consultation[1] ; and secondly, in August 2016 to the NIC consultation on NIA process and methodology[2] .

We essentially argued in the first of these submissions, that the GB energy governance process (by which we mean policies, institutions, regulation, network and market rules and incentives) is not fit for purpose, and needs to be overhauled if the NIC Vision of Smart Power is to materialise. The second submission argued that whilst we broadly agree with undertaking an NIA, it will only be meaningful if there is meaningful involvement of GB people in its creation, and meaningful consent by GB people to its recommendations. The

[1] http://projects.exeter.ac.uk/igov/submission-national-infrastructure-commission-call-for-evidence/
[2] http://projects.exeter.ac.uk/igov/submission-nic-national-infrastructure-assessment-process-methodology/

Innovation and Governance project, within the EPG, has produced updated papers in this two areas since our last submissions to the NIC and these are: the IGov Fit-for-Purpose GB Institutional Framework (Governing for Innovation, Sustainability and Affordability[3]); and People, Demand, and Governance in Future Energy Systems[4].

Much of our thinking below in this submission continues to reflect those ideas. The IGov website[5] provides detailed case studies of why the GB governance is not fit for purpose (eg Codes regulation[6]) and more details about the proposed institutional framework (for example, distribution service providers)[7].

We are, of course, always happy to provide further input to the NIC if requested.

We first provide an overall comment on the call for evidence, then answer some of the questions, and then conclude.

An overall EPG Comment on the Call for Evidence

An overarching point we would wish to make, is that transforming to a fit-for-purpose GB infrastructure is not just about technology and kit – it is also about people and appropriate governance which links people and their everyday wishes and concerns to their infrastructure needs (whatever that interaction might be).

Moreover, the different infrastructure sectors cannot be separated out – effectively energy, transport, digital communications, waste and waste water, flood risk management and solid waste – and they have to work together in a complementary manner. One can see with all these sectors, that they could do this given the newly available and economic technologies[8]. They all – possibly with the exception of the digital communication sector - have complex governance systems where value is still, broadly, provided for the 'old' system. All of them need an overhaul of their governance systems to ensure that value reflects the outcomes which are wanted (e.g. improved environmental performance, bill reductions and cost effectiveness) through appropriate means (new entrants, new services, innovation and people-focus) and which enable efficiencies between sectors to be captured.

Looking at the energy system in particular, the current governance (rules and incentives) within energy and transport broadly continues to place value for 'old', non-smart, centralised energy at the centre of the system, with 'new' hybrid, centralised /decentralised, flexible energy services still entering only at the margins. The energy system effectively treats people as passive payers of costs rather than actors who may be interested in having more choice and control or as those whose requirements they should serve. Given that people have to accept infrastructural change, live with it, use it and pay for it, then their involvement with it (including its development) has to fit their everyday lives. The energy system operation continues to be top-down and linear rather than bottom-up and multi-dimensional. Energy infrastructure therefore needs to be planned from the starting point of the end user. It is only in this latter approach – which would prioritise granular values, new services, new entrants and new ways of doing things - that system energy efficiency and demand side response can be maximised; and an effective decarbonised heat policy can be implemented.

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[3] http://projects.exeter.ac.uk/igov/wp-content/uploads/2016/11/Final-Framework-Paper.pdf
[4] http://projects.exeter.ac.uk/igov/working-paper-people-demand-and-governance-in-future-energy-systems/
[5] http://projects.exeter.ac.uk/igov/
[6] http://projects.exeter.ac.uk/igov/paper-innovation-and-the-governance-of-energy-industry-codes/
[7] http://projects.exeter.ac.uk/igov/new-thinking-distribution-service-providers/
[8] https://www.gov.uk/government/publications/smart-power-a-national-infrastructure-commission-report

Amongst other energy governance changes, it requires distribution network operators to transform into distribution market facilitators and coordinators (as is occurring, for example, in New York and California). This requires a new form of regulation (a move from revenue based to performance based), and it requires the energy system – within the wider infrastructure system - to be people – focused.

Yes, technology is part of this infrastructural transformation – but only one dimension of it. And the transformation will not occur cost effectively or coherently, unless the other dimensions are there to complement it.

Answering Questions

Q1,2 and 3 As said above, we do not think of infrastructure only as technology, pieces of kit or systems, such as roads, railway lines or ports. Having said that, the two infrastructure projects we would initiate would be an Energy Efficient Britain programme to encompass buildings (new and existing, domestic and non-domestic) and smart energy system operation across GB; and the implementation of an integrated public transport system which reflects the everyday lives (and needs) of people. Together, this would revolutionise Britain.

Energy efficient buildings require building or refurbishment to high specification. This requires the skills to do it; a tightening of building regulations; and a source of cheap finance. We support a KfW-type revolving 0% loan programme capitalised from government debt. A properly functioning Green Investment Bank (GIB) – along the lines of KfW – would also, of course, enable loans for public transport. Energy efficient buildings (including domestic homes) need minimal energy for space heating, and are one important dimension of a cost-effective, decarbonised heat policy. If buildings have their own solar thermal panels, then they also use much reduced energy for water heating[9]. Moreover, new sustainable, domestic homes do not need to be expensive[10].

Combining energy efficient buildings with new energy system operation via new institutions as described above[11], and a public transport system more suited to people's everyday lives would be a step change in GB infrastructure. Moreover, these changes are people-focused. These are the infrastructure changes which most affect people's lives, and must over time contribute to the UK's competitiveness. As the NIC East West Transport Link report highlighted, the UK is increasingly becoming a place where it is hard to have a happy work-life balance. Those that can choose, will choose to live in a place where the work-life balance is better[12].

Q4 If governance is set up to enable energy efficient buildings; to require efficient appliances which also minimise electricity use; to encourage a flexible, energy system operation to maximise demand side

[9] Author lives in a house which uses minimal energy for space heating and has solar thermal panels for water heating.
[10] For example, see the 'custom build model'. They are half way between traditional sustainable new homes and self-build homes, where home buyers can choose from a range of options, where contractors are lined up to be chosen from, and where homes are sustainable and cheap. See Homemade at Heartlands as a good GB example https://www.homemadeheartlands.co.uk/ .
[11] http://projects.exeter.ac.uk/igov/wp-content/uploads/2016/11/Final-Framework-Paper.pdf
[12] https://www.gov.uk/government/news/new-east-west-transport-links-could-provide-a-once-in-a-generation-opportunity-for-britains-silicon-valley-armitt

response and other flexibility possibilities[13]; to be customer focused; and to have the institutions to facilitate all of this, then GB could be hugely more energy efficient than we currently are.

However, the point about implementing institutional change to enable innovation and the overcoming of inertia is that we do not know where it will take us, other than to be more energy efficient. We know that ICT has now effectively come to be applied in energy – albeit is being implemented in widely different ways depending on the governance of the country. If we transformed our distribution companies into distribution resource procurers or distribution market facilitators, as in California and New York, then we can say institutionally the UK would be in a good place to enable innovation to occur so that demand could be managed, reduced[14] and made as flexible as far as possible.

Q5 In general, the UK has been very poor at setting a firm date for when certain unwanted assets would become heavily incentivised against. The current Capacity Market is a good example of mixed messages giving support to fossil fuel generation. The UK should not be giving support to resources which are delivering unwanted outcomes. If Government believes in the market, then they should let that market work. There is no point in Government saying they want to move to a sustainable energy system and then simultaneously supporting both sustainable and non-sustainable energy[15].

Q7 As said above, we would argue that an efficient 0% revolving loans programme open to domestic, local authorities and in some cases companies – similar to the KfW loans in Germany – together with appropriate regulatory drivers and incentives for end users would revolutionise the roll-out of Energy Efficient Britain. An overlap with that is the issue of the fuel poor in the UK. We do not believe that all the responsibility of reducing the numbers of fuel poor should lie alone with suppliers, and existing efforts to collaborate on targeting with Local Authorities, the Department of Work and Pensions and civil society organisations should be rapidly expanded.

Q10 The IGov project has argued that UK governance needs to be overhauled[16] and that the way people and their demands are viewed needs to alter[17] to ensure that the UK has a 'liveable' infrastructure, that people want and which is delivered as efficiently as possible . We have made numerous submissions to multiple bodies and places about this. Please see the IGov website http://projects.exeter.ac.uk/igov/. Examples are a submission to BEIS Ofgem[18]; to NIC[19]; and to the CMA[20].

Q11 A low carbon, energy efficient infrastructure is the most effective means to protect and enhance the environment. That infrastructure has to be people focused, and has to enable people to carry on with their

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[13] http://projects.exeter.ac.uk/igov/submission-beisofgem-smart-flexible-energy-system-a-call-for-evidence/
[14] Reduce, flatten and flex http://projects.exeter.ac.uk/igov/new-thinking-a-no-regret-energy-policy-reduce-flatten-and-flex/
[15] http://projects.exeter.ac.uk/igov/submission-beisofgem-smart-flexible-energy-system-a-call-for-evidence/.
[16] http://projects.exeter.ac.uk/igov/wp-content/uploads/2016/11/Final-Framework-Paper.pdf
[17] People, Demand, and Governance in Future Energy Systems (http://projects.exeter.ac.uk/igov/working-paper-people-demand-and-governance-in-future-energy-systems/

[18] http://projects.exeter.ac.uk/igov/submission-beisofgem-smart-flexible-energy-system-a-call-for-evidence/
[19] http://projects.exeter.ac.uk/igov/submission-national-infrastructure-commission-call-for-evidence/
[20] We have written several submissions to the CMA, see for example http://projects.exeter.ac.uk/igov/submission-to-cma-energy-market-investigation-provisional-findings-possible-remedies/

lives. Some people may make pro-environment choices. In general though, Government has to ensure infrastructure which allows individuals to go about their lives in a sustainable fashion. This infrastructure is a well-functioning transport system; energy efficient buildings; and an energy efficient (and therefore cost effective) smart energy system.[21].

Q19 The highest value, least cost solution for decarbonising heat is energy efficient buildings, and the move to a flexible, smart energy system which is able to tap into demand side response down to the lowest distribution level.

Q20 What needs to be done is to put in place a governance system which encourages innovation and flexibility, and which does not lock-in any particular technology use and which is regulated based on what outputs are wanted – for example, low carbon, flexibility etc. We argue that the IGov institutional framework is a framework which does this[22].

Q21 Low carbon vehicles could be a very useful part of a flexible, smart energy system – but they could also be a real problem if governance is not in place to ensure that vehicle owners or users are paid for the value their provide to the system. Currently, value for flexibility is not very granular – and rarely reaches down to the distribution level and certainly not for EV storage. If, in the future, this did occur then EV cars could be used as a system asset, providing useful storage facilities for when supply is cheap and available, and a source of power from storage when supply is limited and expensive. This would mean that less distribution and transmission capacity upgrades would be needed[23].

Conclusion

At root, we would argue that GB is trapped in an infrastructure which is not fit for purpose. GB is not going to be able to transform to a fit for purpose infrastructure system unless those who pay for it also support it. The infrastructure changes which occur have to be those which GB people want, and value in their everyday lives. This is a move to an energy efficient Britain – whether this is buildings, the energy system, the transport system and the waste and water systems. All these systems need governance overhauls to provide appropriate incentives for the 'new' sustainable, cost effective and efficient systems and to stop providing incentives to the 'old' system. This is not as radical as it might seem. Other countries around the world are implementing these transformations and GB should learn from them.

[21] See People, Demand and Governance ibid

[22] http://projects.exeter.ac.uk/igov/wp-content/uploads/2016/11/Final-Framework-Paper.pdf

[23] http://projects.exeter.ac.uk/igov/new-thinking-cheap-ubiquitous-battery-storage/

The voice of the energy industry

National Infrastructure Assessment Call for evidence submission

February 2017

About Energy UK

Energy UK is the trade association for the GB energy industry with a membership of over 90 suppliers, generators, and stakeholders with a business interest in the production and supply of electricity and gas for domestic and business consumers. Our membership encompasses the truly diverse nature of the UK's energy industry – from established FTSE 100 companies' right through to new, growing suppliers and generators, which now makes up over half of our membership.

Energy UK welcomes the opportunity to make this submission to the National Infrastructure Commission regarding their National Infrastructure Assessment Call for evidence. We believe this is a first opportunity for Energy UK to share with the NIC its vision on successfully producing and delivering a National Infrastructure strategy. We are looking forward to further engagement during 2017.

Introduction

Energy UK views the National Infrastructure Commission as the body to take a strategic view into the long-term needs of the British economy. It is, therefore, essential that it adopts a whole system approach to producing the NIA which recognises that policy decisions taken in one government department can have a substantial impact on the policies of other departments and their sectors. There is a need for a collaborative approach to policy making which ensures that government departments do not become siloed in their thinking. Government, energy and industry need to come together to develop the most cost effective solutions to support the future of infrastructure needs of GB.

Vision

Deliver a powerful national infrastructure that provides the strongest possible foundations for the UK to move towards 2050 and beyond in an inclusive manner that means that all actors of society benefits from the transition to a new, modern society.

Key messages

- As we progress to a low carbon electricity system there will be significant investment needed to build new, flexible, low carbon electricity generation. This requires policy stability.
- Energy efficiency should be a national priority. Energy efficient buildings are crucial to the success of decarbonisation of the UK and creating strong foundations for a modern society.
- The transmission and distribution networks are the backbone of our society, a vital infrastructure that needs serious investments in order to make sure it is fit for the future to deliver low carbon energy in a secure, efficient and affordable way.
- In a world of tough global competition, energy costs can be an important factor for business. Delivering energy infrastructure and improved energy efficiency measures now, at lowest cost, will place the UK in a competitive advantage.
- DSR is widely expected to help the electricity network adjust to changes in demand due to the electrification of heat and transport, and the integration of distributed generation and storage. However, measuring the effectiveness, consumer acceptance and the challenges for DSR is difficult without evidence from large-scale trials.
- The creation of a smart energy network will allow for full integration of flexibility that is key to increasing the maximum potential of demand management.
- Funding policy should reward infrastructure services that promote the long-term strategy to achieve carbon emission reduction targets to avoid expensive retrofitting. Long term vision to 2050 is needed.
- Energy UK proposes the establishment of an 'Energy Taskforce' to consider the interactions between energy infrastructure, including: heat, power and transport.
- Planning policy is essential to the success of any infrastructure programme and development or re-development and is therefore one of the key tools in providing a stable, reliable market into which parties can invest.
- Strong building regulations should ensure the natural environment is taken into account.
- Improving the energy efficiency of UK buildings is an essential perquisite to effectively decarbonise heat.
- There is no "one fits all" solution, but a combination of solutions for which a holistic review must be conducted to optimise the carbon reduction / implementation cost balance. Decisions need to be made before 2020 so rollout can take place in the 2020s.
- The most effective near zero carbon power sector must not compromise security of supply and be delivered at lowest cost.
- The decarbonisation of transport is critical to the UK achieving its legally binding climate change commitments. However, impacts to transmission infrastructure must be considered and planned in order to account for the increased electricity being generated and distributed as to not threaten security of supply.
- Customer engagement will be crucial to successfully make the transition to a low carbon society.

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

[Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.]

Generation

As we progress to a low carbon electricity system there will be significant investment needed to build new, flexible, low carbon electricity generation. The mechanisms used to meet these ambitions are:

- The Capacity Market provides security of supply by paying generators to be available at times of system peak. This mechanism is primarily used to bring forward technologies that can provide power when needed, including CCGTs, OCGTs, reciprocating engines, pumped storage and batteries.
- Contracts for Difference are used to promote low carbon technologies from wind and solar to nuclear power.
- The CPF provides a stable carbon price signal to investors in the absence of the EU Emissions Trading System doing so, and we call on the Government to set a clear direction regarding the future of the CPF.

There is also growing use of new energy services such as storage, Demand Side Response (DSR) and aggregation to react to the need to provide additional flexibility on the system.

Interconnection is also due to expand over the coming years with significant projects planned to connect the UK to Norway as well as several other projects increasing our capacity to Europe.

Energy efficient buildings

Energy Efficiency should be a national priority. Energy efficient buildings are crucial to the success of decarbonisation of the UK and creating strong foundations for a modern society.

- Investing in the energy efficiency of buildings will provide several benefits:
    - The money saved by energy consumers via lower bills will allow them to spend more on other goods and services.
    - The maintenance and improvement of the building stock will create jobs in the supply-chain, for instance via the installation of energy efficiency measures.
    - It will help protect consumers who are in fuel poverty and reduce the health impacts and costs associated with living in a cold home.
    - It will help reduce consumer demand for energy, freeing up energy capacity more cost-effectively than building new power stations, networks and storage.
- Frontier Economics in 2015[1] calculated that a national programme of investment in energy efficiency in the UK could deliver major economic and social benefits – approximately £8.7 billion over a period of ten years.
- UK-GBC in 2014 also calculated that major investment in energy efficiency could almost double the number of people employed in the energy efficiency industry to 260,000.[2]
- Zero carbon new build should be the standard to avoid any retrofitting in the future and optimise energy use, with the following benefits:
    - Housing and industrial and commercial sites fit for the future;
    - Foundation for strong supply chain;

[1] Frontier Economics, Energy Efficiency: An Infrastructure Priority, 2015. http://www.frontier-economics.com/documents/2015/09/energy-efficiency-infrastructure-priority.pdf

[2] Up from 135,000 in 2014. UKGBC, A Housing Stock Fit for the Future, 2014. http://www.ukgbc.org/resources/publication/housing-stock-fit-future-making-home-energy-efficiency-national-infrastructure

- Minimise impact on the natural environment.

Networks

The transmission and distribution networks are the backbone of our society, carrying electricity and gas wherever it is required. This is a vital infrastructure that needs serious investments in order to make sure it is fit for the future. We need reliable energy networks that will provide low carbon energy in a secure, efficient and affordable way.

"Soft investments" such as a more independent System Operator (SO) and Distribution Network Operators (DNO) transitioning to Distribution System Operators (DSO) are needed to manage increased intermittency and allow a greater amount of technologies to participate in balancing, flexibility etc. are needed:

- There is a clear benefit in utilising the full capability of the new, renewable generation deployed across the UK at both transmission and distribution level. In supporting the system's ability to fully utilise this generation the costs of the system will be minimised.
- The cost of voltage control and controlling the system frequency can fall significantly if the capabilities of distributed generation as well as active DSOs are fully utilised. Electricity network companies and the SO have a role to play in adapting their mechanisms, including how to connect new generation sites and reinforce conventional network.
- Gas network companies also have a role to play in being able to meet the demand for gas providing backup for intermittent renewable generation or peaking capability whether transmission or distribution connected.
- They also play a role in facilitating new connections as the low carbon pathways develop, including biomethane production, compressed natural gas (CNG) for vehicles or potentially conversion to hydrogen for the distribution networks.
- There is a need to ensure that charges, including policy costs and network charges are allocated in a way that reflects the costs of the services being provided. A reform of regulatory arrangements is needed to ensure that they keep pace with innovative technologies as they play a greater role in future networks.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

- Competitiveness will come from efficient, reliable energy generation, networks and buildings, bringing down infrastructure costs to the lowest possible level.
- Low carbon, affordable, reliable energy networks should be fit for future and require investment now to drive lowest costs in the longer term.
- Energy efficient buildings minimise energy costs to businesses with options to minimise further through demand management, driving down overall operating costs.
- In a world of tough global competition, low energy costs are attractive bringing a competitive advantage now compared to other countries not making infrastructure a priority.
- Investing in innovation now also offers an opportunity to export skills and services in the future.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Energy Efficiency should be a national priority.

- We need a national plan to improve the UK's existing housing stock.
- The UK has some of the worst performing housing in terms of energy efficiency in Europe. There are over 20 million homes in the UK which are below EPC band B/C[3]. This leaves residents with energy bills that are higher than necessary and at risk of fuel poverty.

[3] http://www.endfuelpoverty.org.uk/autumn-statement-overlooking-energy-efficiency-will-leave-millions-in-the-cold-this-winter/

- All new build and other infrastructure, domestic and non-domestic should be developed within a low carbon and sustainability framework. This requires strong building regulations and a more holistic approach to planning and building to maximise energy efficiency, minimising energy usage and allowing for demand management to help optimise the energy system and minimise energy costs and inefficiency.
- All new build and infrastructure should have a low carbon heating system incorporated to avoid expansive future retrofitting. There is a need now to identify the lowest regret options for low carbon heat.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

[Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.]

DSR - Demand Side Response (DSR)

- DSR is widely expected to help the electricity network adjust to changes in demand due to the electrification of heat and transport, and integration of distributed generation and storage.
- Measuring the effectiveness, consumer acceptance and the challenges for DSR is difficult without evidence from large-scale trials. Continuing input from Low Carbon Network Fund trials and coming Electricity Network Innovation Competition trials will help to identify the savings created by different approaches to DSR models. A 2015 study estimated that 3GW of flexibility could be delivered through network flexibility including a smart grid system, if rolled out across the UK market. This is likely to increase when taking into account the rise in uptake of Heat Pumps and Electric Vehicles, which will offer much higher aggregated domestic resource.
- Bloomberg New Energy Finance give an averaged prediction of 30% annual growth for the Electric vehicles, with EVs becoming 35% of global new light-duty vehicle sales by 2040[4].

Storage

- The energy storage research facility at Willenhall substation is a great example of the worth of storage in managing demand, as the installed 2MW/1MWh storage capacity is estimated to be able to power up to 3,000 homes for 20 minutes.
- Storage recently gained more than 3.2GW of contracts for winter 2020/21 in the Capacity Market auction, as well as being successful in the National Grid Enhanced Frequency Response (EFR) tender to provide 200MW to the grid. The current UK pipeline of commercial, industrial, and utility scale storage projects is 2.3GW.
- It is also important to look at the effect of domestic storage as a part of the role of DSR, as reductions in the price of lithium-ion batteries, the current most popular storage technology, result in greater investment in storage and will allow for electric vehicles to have a larger impact on DSR capacity.
- We support the decision of the Industrial Strategy Green Paper in recognising the role of storage in both smart energy systems and the automotive industry. Energy UK and our members await the findings of the Walport Report on battery technology, energy storage and grid technology.
- The next challenge for storage is to create an effective long term response solution. Current storage solutions are based around meeting spikes in supply or demand, but in order to fully utilise excess renewable generation, storage must be able to displace supply for longer periods. For example, storing wind energy generated overnight to meet demand throughout the day.

Energy Efficiency

- Energy efficiency should be a national priority.

[4] https://about.bnef.com/press-releases/electric-vehicles-to-be-35-of-global-new-car-sales-by-2040/

- The Carbon Plan 2050 scenarios set out by DECC require energy efficiency to contribute a reduction in final energy consumption per capita between 2007 and 2050 of 31-54%[5].
- It is important that the demand reductions that can be achieved through energy efficiency are not overlooked in policy and are given the sufficient attention from all areas of government.
- The Committee on Climate Change predicts, in their paper Next Steps for UK Heat Policy[6], a 15% reduction in energy used for heating existing buildings by 2030 through efficiency improvements.
- Other estimates vary, and this figure is dependent on support for energy efficiency measures and incentives from both government and consumers.

Smart Meters

- The results of the Energy Demand Research Project (2007-2010) suggested that the positive savings from smart meters depend on providing consumers with appropriate additional interventions, and subsequent trials have attempted to find the right balance of solutions to give the consumer the greatest advantage.
- Additional smart systems enable the automation of DSR in domestic settings, reducing the complexity of arrangements for consumers, and creating fast-response flexibility.
- Smart can also be applied to the creation of a wider management system that integrates generation, storage, and aggregated demand reduction resources.
- The creation of a smart system of meters and monitors that allow for full integration of flexibility is key to increasing the maximum potential of demand management.

Consumer Engagement/Behavioural Constraints

- To reach the full potential of the demand management, it is important to ensure that consumers take full advantage of Time-of-Use tariffs, smart meters, and domestic storage and generation. Green Energy UK have recently announced the UK's first commercially available Time-of-Use tariff, and we expect other suppliers to follow suit once smart meter penetration amongst their customers makes the business case more attractive.
- Automation will reduce the amount of involvement needed from consumers, but consumers will need a basic understanding of what alternative systems, technical options, and financial support they have access to.
- This should be addressed via a mixed approach involving consumer engagement campaigns, easily accessible information, and comparison tools.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

The EMR package (Capacity Market, Contract for Difference and Carbon Price Floor) provides the right tools to decarbonise and provide security of supply to the UKs electricity system.

- These mechanisms give generators the right framework to invest and maintain assets, therefore, it is down to developers to balance the maintenance/repair costs against the construction of new assets. We consider that the market provides the right signals to allow industry to effectively plan repairs and maintenance.
- There should be no constraint put on outages as this work will be necessary to the safe operation of the assets.
- It may be helpful for future interactions between DNOs/TO with regards to planned outages to allow for any repair/maintenance work to be coordinated with plant operators.
- A long term vision of the future needs of the system will be useful to developers looking to enter the market.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

[5] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65602/6927-energy-efficiency-strategy--the-energy-efficiency.pdf
6 https://www.theccc.org.uk/wp-content/uploads/2016/10/Next-steps-for-UK-heat-policy-Committee-on-Climate-Change-October-2016.pdf

- For electricity generation, both the Capacity Market and the Contract for Difference (CfD) allocate contracts based on open auctions which provide capacity at least cost to consumers.
- Networks are also being put up for tender which is introducing competition in the market (distribution and transmission).
- Housing: linking building and carbon regulations, as well as smart homes and grid will help develop a new supply chain.
- There is a need to encourage innovation to push new technologies, creating new markets for the UK to supply both the domestic and international demand.
- Energy efficiency – the industry for the last 20 years has been dependent on subsidies raised via energy bills, undermining the value of energy efficiency to the public. A genuine market for energy efficiency measures has never developed. Recognising energy efficiency as a national priority is a way of developing a competitive environment and a strong supply chain.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

[Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.]

In all cases, more certainty around policy framework and expected outcomes are vital to make any funding policy successful.

Investment

- Funding policy should encourage innovation and creates a positive environment for new businesses to thrive.
- Funding policy should reward infrastructure services that promote the long term strategy to achieve carbon emission reduction targets to avoid expensive retrofitting. A long term vision to 2050 is needed.
- Government's Electricity Market Reform has provided the right framework to support long term investment in the power generation sector. Policies such as the Contract for Difference (CfD) has provided long term certainty for investors. The announced level of funding for this parliamentary term (£720m) has been an effective signal to ensure that industry can align to deliver.
  A clear framework will allow other parts of the system to respond –. Strategic investment in networks should work with EMR and other policies to ensure the network is fit for purpose and capacity is available to allow new projects to connect to the system.

- We are supportive of the work done by the Distributed Generation (DG) Distribution Network Operator (DNO) Steering Group and the Quicker and More Efficient Connections (QMEC) work stream.
- We are supportive of the resulting publication released by the Energy Networks Association on Milestones which is designed to make more efficient use of existing capacity on the electricity network by setting principles on which DNOs could withdraw a connection offer from a customer if developments are not progressing.
- In addition, Energy UK is supportive of the continuing work being done on material change to connection applications as a part of the queue management work which will promote representative and accurate applications for connection. The new Electricity Network Association (ENA) queue management guidelines, which should lead to more efficient and predictable treatment of connection applications across DNOs and minimise 'bed blocking', can also be applied to storage. We ask that Ofgem monitor whether the DNOs apply these voluntary measures and if improvements are not seen then it may be that regulatory measures become appropriate.
- We support introducing appropriate Upfront Assessment and Design (A&D) fees for all connections in order to deter speculative and multiple applications which can lead to delays in assessing connections and reduces the ability of the DNO to provide support to genuine projects.

Energy efficiency

- For the last 20 years industry has been dependent on subsidies regressively raised via energy bills. We have a concern that the current policy framework is overly reliant on funding through supplier obligation subsidies like the Energy Companies Obligation (ECO). Energy UK strongly

believes that the fairest and most progressive method of funding energy efficiency programmes is through general taxation. A top-down approach through obligations on suppliers has, in our view, led to an expectation that energy efficiency should be provided free of charge, undermining the value of energy efficiency to the public. The able-to-pay market for energy efficiency needs to become sustainable

- As announced in the 2015 Budget, we, however, know that approx. £640 million per annum will continue to be spent by energy companies on energy efficiency measures to deliver their ECO obligations until the early 2020s. Additional funding and investment in energy efficiency is, therefore, needed alongside ECO to help drive demand for energy efficiency in the able-to-pay market not captured under ECO, and to help fund high cost measures and hard to treat homes which will not attract ECO funding.
- We note that the Scottish Government is also doing some interesting work to stimulate the able to pay market for energy efficiency measures by providing industry loans. Through Scotland's Home Energy Efficiency Programmes (HEEPS) loan scheme households can get up to £15,000 per property, and landlords with multiple properties are eligible for up to £100,000 in total. The repayment period varies based on the amount borrowed but those taking out higher value loans will be able to pay back over 10 years.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?
[Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.]

Energy UK proposes the establishment of an 'Energy Taskforce' to consider the interactions between energy infrastructure, including: heat, power and transport.

- This taskforce should consider the long-term infrastructure needs to deliver a safe, secure, and decarbonised economy at lowest cost to customers.
- Energy UK believes that the taskforce should have strong links with government (Department for Business, Energy and Industrial Strategy) and the National Infrastructure Commission in order to have most impact.

Any infrastructure programme should ensure it clearly identifies all types of risks and their sources as well as the types of consequences (economic, physical, security, etc.) in order to mitigate (avoid negative economic impact of disruptive events through thorough risk assessment).

- A holistic approach is needed to understand the behaviour of interdepend infrastructures.
- Design and solutions must be adaptable and resilient.
- There is a need to clearly identify propagation risks associated with both physical and information interdependent systems.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

Planning policy is essential to the success of any infrastructure programme and development or re-development. Planning should be one of the key tools in providing a stable, reliable market into which parties can invest. We recommend:

- The continuation of the National Infrastructure Commission.
- A far-sighted view of developments and cognisance of developmental timelines for major infrastructure such as energy.
- The implementation of statutory timescales to ensure that decisions are not outstanding with the associated impact on developments.
- The continuation of National Planning Policy Statements for Energy. These NPS should be developed in conjunction and in consultation with the NIC and industry.
- Considering the process of repowering:
    - As older stations reach the end of their operational life these sites may be "repowered". This refers to the process of replacing electricity generation infrastructure and includes all measures which improve the efficiency and capacity by means of retrofitting/replacing the latest technology.

- Repowered sites can have many benefits from cost savings through use of existing infrastructure such as grid connections and roads.
- The CfD is the obvious mechanism to allow these redeveloped sites a route to market. This would increase competition against other mature technologies providing renewable generation at least cost to the consumer.
- DECC reviewed the principle of repowering in its Statutory Consultation on the Renewables Obligation Order 2011.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

- Environmental Impact Assessments and planning policy already provide a strong framework in which to consider environmental impacts. Any additional requirements would needed to be carefully considered in order to avoid adding excessive costs to projects.
- Strong building regulations should ensure the natural environment is taken into account. There are many technologies and building designs that enhance the natural environment (green roofs and walls, rain water catching, air heat pumps, self-regulated buildings, trees as carbon capture, etc.) and these should be more widely considered where the wider benefits (inc. environmental) outweigh the costs.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

Heat has not yet been tackled effectively and must be addressed urgently. The housing stock is very heterogeneous and is likely to require the deployment of a range of different solutions. The scale of change required means that there is a need to ensure strong building, energy efficiency and appliance standards are in place to allow for a smooth transition and engage all parties, from households to local authorities, supply chain and industrial and commercial sites.

To effectively decarbonise heat, improving the energy efficiency of UK buildings is an essential perquisite. There is also a need to assess, review and evaluate the potential of the various technologies currently available.

- Energy Efficiency needs to be a national priority for which, capital investment could be released to help encourage and bring all UK buildings up to a minimum standard.
- Not one solution as such, but combination of solutions that combines the following:
  - Increased use of hybrid technologies
  - The use of heat pumps and biomass boilers in properties off the gas grid where energy efficiency measures have been implemented to ensure maximum optimisation;
  - Repurposing the existing gas network with the use of Green Gases (hydrogen or hydrogen /biomethane blend) where there is an economic case to do so, alongside the introduction of new adapted boilers and CCS (if hydrogen is preferred option).
  - District heating networks implemented where possible.District heating should be a planning requisite on any new development.

A holistic review must be conducted for each option and application to optimise the carbon reduction / implementation cost balance.

Decisions need to be made before 2020 so rollout can take place in the 2020's, trials should therefore be carried out in the next few years.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?
[Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.]

The most effective near zero carbon power sector will be based on as much low carbon generation on the system as possible without compromising security of supply.

The system will use smart, flexible systems to ensure that participation from DSR, storage, peaking generation and low carbon generation operate efficiently together.

To achieve this most effective zero carbon power sector, several steps need to be taken:

Reform the ancillary services market to allow off service providers to participate in the market. The existing process for entering the ancillary services market has a number of key issues preventing the entry of intermittent, renewable generation:

- The tendering process and the need for a long-term guarantee on availability of generation inhibits intermittent technologies from participating effectively. This makes it difficult to factor the longer term needs of the system into the design of the next generation of assets.
- Tendering ancillary services over different timescales (long term, medium term and spot) could help. Specifically, tendering on a spot basis could make it easier for intermittent technologies to compete for ancillary services.
- Enabling all technologies to participate in a smart, flexible energy system by providing these services will promote the transition to a smart electricity system at least cost to consumers.

The following areas are where Energy UK members consider an ancillary services market would be beneficial:

- Increased transparency for product procurement
- A level playing field between all technologies and sizes of service provider is needed to ensure these can participate in the ancillary services market
- Optimisation of revenue streams will result in least cost solution for generating power and maintaining system stability.
- A framework for local balancing and the transition to Distribution Network Operators is needed to ensure future ancillary service markets are designed efficiently
- Engineering requirements need to be reviewed to account for a smarter more dynamic power system
- The cost of paying for balancing the system should be reviewed.

Continued support for the Capacity Market which is already incentivising major investments in and development of both the storage and DSR markets:

- BEIS's recent efforts to remove market distortions and create a more open and transparent Capacity Market are encouraging as refining the structure, transparency and regulation of the Capacity Market will help secure its longevity and continued investability.
- Ensuring this complements the provision of ancillary serves (where appropriate) will also be important to extracting maximum value from different markets. As the 2016 T-4 Capacity Market auction has proven, the storage and DSR industries are already capable of successfully competing within the existing auction regime.
- The growth of the DSR industry and the continued reduction in costs for batteries will, we believe, enable both to make significant and valuable contributions to the future smart system although BEIS must ensure that the rules and framework remains appropriate to correctly value these technologies contribution to security of supply.
- Ensuring that the CM is technology agnostic is a key principle which must be retained, and that where there are potential barriers and solutions need to be brought forward.

A functioning, fair and transparent secondary trading regime would be beneficial for the CM. We appreciate the challenges associated with secondary trading such as the potential for sudden influx when margins are low, however the benefits of a functioning regime outweigh the risks. The ability to do so minimises the costs to the generator and, in turn, the cost to the consumer as the alternative to

such a trade would be the use of the balancing market post gate closure, which has significant costs associated with it.

Mature renewable support

- The primary focus of the CfD regime is to support the construction of low carbon generation at the minimal cost to the consumer.
- Under the scheme as it was initially designed this would have meant funds available through Pot 1 facilitating mature, low-cost technologies to drive growth in the low-carbon sector.
- The Government's decision to allocate solely through Pot 2 to date has challenged the cost-effectiveness of the decarbonisation of electricity generation as is reflected in the findings of the Competition and Markets Authority's investigation into the energy market.

Flexibility, Manage intermittency

responded to Ofgem and BEIS's 'Smart, Flexible Energy System' call for evidence[7].

- Within the Energy UK submission, the main points made included asking for clarity around the future structure of the energy industry, taking a whole systems approach to energy policy with consideration given to how heat, transport and gas networks will operate with electricity in the future. This should be underpinned by streamlining regulation and simplifying code frameworks to ensure the amount of regulation doesn't become a barrier to entry.
- With such a wide range of policy areas being discussed within the call for evidence it was considered important that a programme delivery vehicle be established to ensure the various recommendations are delivered in a timely manner while ensuring that interdependencies between policies is recognised to facilitate the transition to a smarter, more flexible energy system.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

The decarbonisation of transport is critical to the UK achieving its legally binding climate change commitments. The UK Government is promoting the uptake of low emission vehicles by offering grants for zero or low emission vehicles.

Generation

- High shares of low-carbon vehicles in the economy, particularly electric vehicles will require significantly higher levels of low carbon electricity production in the future.
- For UK investment in generation, this is seen as a positive investment signal.
- Through the use of aggregated DSR, storage, two-way charging (V2G (vehicle to grid) and V2X (vehicle to everyting), and a smart charging system, foreseeable future energy demands from EVs can be met without unduly extending the lifespan of the UK's high emission generation capacity. Intermittency concerns around renewable generation should be addressed through these measures to avoid unnecessary spikes in wholesale prices. The creation of a smart IT system is necessary for these solutions to be integrated.

Networks

- Improvements will be needed to transmission infrastructure in order to account for the increased electricity being generated and distributed as to not threaten security of supply.
- Distribution networks improvements may be required in order to provide enough capacity for vehicle charging. The sensible and cost effective option seems to be the utilisation of demand side response in order to avoid the need to dig up roads to install new electrical cabling capacity.

7 Energy UK's full response: http://www.energy-uk.org.uk/publication.html?task=file.download&id=6007

- Data collected from the 2012-2015 My Electric Avenue project indicates that the use of EVs by between 40-70% of consumers would require reinforcement of 32% of low voltage networks if DSR, Storage, managed charging, and distributed generation are not utilised[8].
- A form of control or incentive of when electric vehicles are likely to be charged by consumers will be key for balancing supply and demand on the transmission network.

Electricity storage

- Low carbon vehicles could have a significant impact in terms of storage opportunities and become a potential contributor to the UK's overall energy capacity at peak times, if used effectively. More research into this potential is needed.
- Customer engagement will be crucial to deliver an efficient demand side. All customers plugging in at peak time would lead to stress on the system, and in order to mitigate the risk of a sudden spike in demand, smart-enabled charge points would need to be introduced to allow for DSR, managed charging, and aggregation of charging assets.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?
[Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.]

- As firms compete to capture market share within the low carbon vehicle market and knowledge of technological methods improves, electric cars will become increasingly affordable for consumers.
- Government support for low carbon vehicles means that in the future growth for the typical method for transport (private) will likely be an Ultra-Low Emission Vehicle. Travel patterns will therefore be dependent on the infrastructure for refuelling, as patterns may be reduced by at-home recharging, or increased by the need to travel longer distances to reach a charge point/hydrogen enabled fuel pump.
- Cars are likely to become increasingly unwelcome in major urban centres due to congestion and safety, creating greater scope for a sharing economy in these areas. These would be replaced by ride sharing, park and ride schemes and local tram networks, but individual preferences will limit the overall impact[9].
- Improvements in battery technology will enable electric vehicles to travel even longer distances without the need to recharge, resulting in little impact on the distance one can travel. For longer journeys, however, the increasing use of long distance coaches and the rail sector are both important and desirable developments.
- Another variable is whether or not new transport technologies receive the capital required to support and sustain the development of an economy of low carbon electric vehicles or hydrogen vehicles.
- It is also worth noting that the increasing use of communication technologies, combined with increasing ease of transport between London and other cities, could result in more companies opening offices outside of London, potentially easing congestion in the capital but affecting travel patterns found in other cities and towns.
- Ultimately, people will continue to make day-to-day decisions on how to travel based on marginal costs, which continue to favour travel by car (for current car owners) instead of other travel modes[9].

8 Electric Nation, electricnation.org.uk.
[9] Energy Technology Institute - An affordable transition to sustainable and secure energy for light vehicles in the UK

[name redacted]

From: [name redacted]
Sent: 15 February 2017 12:42
To: [e-mail address redacted]
Cc: NIA Evidence; NIC Discussion Papers
Subject: RE: Engineering and Physical Sciences Submission

Hi [name redacted],
Thanks very much for getting in touch.
We'll review the below information as a response to our call for evidence on the National Infrastructure Assessment, which closed on Friday. We'll reach out if we'd like to further explore any of the EPSRC's work detailed below.
Please do get in touch with me directly [e-mail address redacted] if you'd like to know any more about the NIC or the NIA.
Kind regards,
[name redacted]
[name redacted]| [job title redacted]
National Infrastructure Commission
[phone number redacted] | 5th Floor, 11 Philpot Lane, London EC3M 8UD
Twitter: @NatInfraCom
Website: gov.uk/NIC
NATIONAL INFRASTRUCTURE COMMISSION

From: [name redacted] (EPSRC, Capability) [e-mail address redacted]
Sent: 10 February 2017 17:22
To: NIC Discussion Papers <NICDiscussionPapers@NIC.gsi.gov.uk>
Subject: Engineering and Physical Sciences Submission
To whom it may concern,
The Engineering and Physical Sciences Research Council (https://www.epsrc.ac.uk/) welcomes the opportunity to provide comment and further evidence to support the work of the National Infrastructure Commission in putting together a National Infrastructure Assessment looking at the drivers of future infrastructure supply and demand in the UK.
EPSRC is the main UK government agency for funding research and training in engineering and the physical sciences, investing more than £800 million a year in a broad range of subjects - from mathematics to materials science, and from information technology to structural engineering. EPSRC is a non-departmental public body principally funded through the Science Budget by the Department for Business, Energy & Industrial Strategy (BEIS). We employ around 230 staff in Swindon.
Detailed information on our portfolio can be found on our website (https://www.epsrc.ac.uk/research/ourportfolio/vop/). Specific themes and projects of relevance to the consultation includes:

Energy:

- Supergen: The Supergen programme was set up in 2001 to deliver sustained and coordinated research on Sustainable PowER GENeration and supply, focusing on several key research areas, including bioenergy; energy networks; energy storage; fuel cells; hydrogen and other vectors; marine, wave and tidal; solar technology; and wind power. For phase 3, EPSRC supported seven Supergen hubs with £150 million of investment over a five year period (including a series challenge calls and Centres for Doctoral Training).

Internet Of Things :

- EPSRC's biggest IoT investment by far is the PETRAS research hub. This hub delivers research, development, and translation for the Internet of Things, focussing on privacy, ethics, trust, reliability, acceptability, and security/safety (PETRAS). https://www.petrashub.org/
  http://gow.epsrc.ac.uk/NGBOViewGrant.aspx?GrantRef=EP/N02334X/1

Materials:

- SYnthesizing 3D METAmaterials for RF, microwave and THz applications (SYMETA https://www.symeta.co.uk/): An EPSRC Grand Challenge funded with £4m. SYMETA's grand vision is to deliver a palette of novel, multi-functional 3D metamaterials (synthetic composite materials with structure that exhibit properties not usually found in natural materials) using emerging additive manufacturing (AM), with the potential to support a single 'design-build' process. Their goal, to compile a palette of meta-atoms (the basic building blocks of metamaterials) and then to organise these inclusions systematically to give the desired bulk properties, opens up a plethora of new structures. This will not only improve existing applications but inspire new applications by breaking down barriers to innovation. Introducing these novel structures into the complex world of electronic design will offer a radical new way of designing and manufacturing electronics. The metamaterials will be developed to give end-users the electromagnetic responses they require, for a wide range of communication, electronics, energy and defence applications.

Robotics:

- Aerial Additive Building Manufacturing: Distributed Unmanned Aerial Systems for in-situ manufacturing of the built environment http://gow.epsrc.ac.uk/NGBOViewGrant.aspx?GrantRef=EP/N018494/1 This research proposal aims to develop the world's first Aerial Additive Building Manufacturing (Aerial ABM) System consisting of a swarm of aerial robots (Unmanned Aerial Systems (UAS)) that can autonomously assess and manufacture building structures. Aerial ABM offers major improvements to human safety, speed, flexibility, and manufacturing efficiency compared to existing ABM and standard building construction technologies.

Transport:

- **Towards Autonomy: Smart Connected Control (TASCC):** An £11 million programme jointly funded between Jaguar Land Rover and EPSRC.

  The five projects currently funded related to autonomous driving.

Please get in touch for more information.
Regards,
[name redacted]
[job title redacted]
[e-mail address redacted]
Tel: [phone number redacted]
Mobile: [phone number redacted]

Visit our blog for debate, shared thinking and new perspectives on issues affecting the engineering and physical sciences community.

English Regional Transport Association (ERTA)

~ A voluntary unincorporated membership based association seeking to restore strategic missing rail links and improve the environment as a result. ~

	**[Job title redacted]:** [Name redacted], [Address redacted] T. [Phone number redacted] E. [Email address redacted]	
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~ Making a contribution towards retention and improvement in better public transport. ~		

07 February 2017

Dear Sir/Madam,

National Infrastructure Assessment (NIA) for Friday 10th February 2017 ERTA Final Submission

Our main propositions and secondary considerations:

1. Northampton-Bedford railway reopening
2. Bedford – Sandy-Cambridge East-West Rail Link.

1. **Northampton-Bedford**. We and our predecessor organisation (BRTA) have been arguing for this rail route to be protected and reopened for 20 years. Key merits we see:

- Link Bedford and Midland Main Line South with Northampton and West Coast Main Line/direct Birmingham-Luton Airport arc.
- Offer rail choice locally (A428) and regionally M1 (Northampton-Luton parallel) and Northampton-Bedford-Cambridge (should be part of East-West Rail) rail parallel end to end A45-A14 Northampton/M1-Felixstowe arc.
- Revolutionise public transport between Bedford, Olney and Northampton, saving time, boosting frequency and integrated with local buses at Olney.
- Would cut congestion into existing stations of Bedford and Milton Keynes and demand for parking/land use pressure.
- Would bring footfall and spend to Bedford and Northampton traditional town centres
- would link 4 airports (Gatwick, Luton, Coventry and Birmingham)
- would provide a loop off the West Coast Main Line (Northampton-Bedford-Bletchley) allowing non-time-critical operations which in turn frees up paths and capacity to serve Milton Keynes Central
- Northampton and points North West and Bedford and points south and east are growing population centres.
- The volume of traffic and emissions overall is unacceptable. This rail link would help in providing much needed transport choice and cut congestion emissions long and short distances.

Studies have been done hitherto: Handley Report 2001, LSMMMS 2003, Capita Symonds 2004, Laurence Gregory 2004 – all favourable. Route hasn't been protected very well, blockages at Olney and road threats at Northampton. Needs a champion, backer and agency home. It, with East-West Rail offers more scope to break

the roads for everything monopoly from conception to assumption, from design and planning to practical readiness for courting what may be on offer. It is lamentable that lack-lustre performance of Marston Vale units inform unreliability giving a diminished impression and experience of rail when we're trying to promote a positive image. We know of no one agent seeking pro-actively to foster conditions for line-born freight and Forders Sidings and Bletchley depot lie idle and everything seems postponed for future-future, when need is now and retrospectively. This brings some disillusionment to all but the hardiest of enthusiasts who want more freight to go by rail and believe rail to be better for the land use and environment. Local Councils tend to say they cannot support Northampton-Bedford because they are stretched with East-West Rail whereas an integrated approach would see grades of interest and action informing a consumatory conclusion of real delivery and progress on an incremental scale. Getting a station at Retail Park, Kempston (population 18, 000+) would add considerably to footfall on local Marston Vale off peak services making the case for more and better frequency, Bank Holiday and Sunday services on what is marketed as a 'leisure line' and for work (localised commuting). The franchise system here seems to be being used against doing it 'now' and abates to 2021 before any improvement can be done, which is rigid and inflexible and doesn't do justice to hitherto studies making the case (Steer Davis Gleave circa 2000/2001) which said the Retail Station would add 100 extra passengers off peak per day to Marston Vales service – part of East-West Rail.

2. **Bedford-Sandy-Cambridge:** Part of East-West rail yet blockages and debates on exact route abound amidst walls of silence. We interpret traditional as Bedford-Sandy-Cambridge. This needs to be confirmed and the following ironed out:

Bedford/Bedford St John's	**Cardington Road**	**Willington**
Will a triangle be reinstated at St John's? The old station is constrained to just 4 coach length trains as London Road Bridge blocks expansion eastwards. The inner route demands trains go into Bedford Midland and out again. Will we be able to sustain 1984 St John's Halt and reopen the old St John's? Nothing here is straight-forward and we're keen to see a design specification from the Consortium spelling out how they intend to tackle these issues. The 1984 St John's Halt would have to be slightly modified to accommodate the curve into St John's and a group seems entrenched against any changes or accommodation?	Here the old bridge was swept away and a dual carriageway inserted for Tesco. However you could insert single carriageway fanning out to two east of the railway theatre. However, level crossings are unpopular and making a road bridge given the close proximity of Longholme Way - Rope Walk junction and roundabout, makes the road bridge idea prohibitive. A level crossing would be cheaper than bridges and less intrusive. The other factor is that a Sandy-Bedford rail link could be creaming off traffic along the A603 and cuts queues anyway.	Some have added to their gardens across the old trackbed, Danes Camp bestrides the course of old railway, it is a narrow gap hedged in by the lapping waters of the River Great Ouse. Before you approach Willington, you have the spectrum of a rowing lake and development being threatened to be resurrected as a scuppering technique. Scuppering by default as the training lake rules out an island pillar for the railway to bridge the lake and thus rules out the railway. Outer routes have their blockages especially between Cople and Willington for example and linking with the Midland Main Line even at a Wixams Station, then denies Bedford Town Centre.

Blunham	Sandy	Shepreth v Trumpington
Housing estate blocks old trackbed and old station site. Realignment would require using some land which is currently a garden centre cum agriculture. Realignment then has to cross diagonally over the old River Ivel Bridge and fit in the Sustrans Cycleway. In-keeping landscape practise means that high gradient viaducts may not be in-keeping and so getting the railway through this pinch point remains an issue.	If you go around Blunham to the north of modern built Sandy, you then have a huge curve to swing back over or under the East Coast Main Line, into Sandy and beyond. Old route via Potton and Gamlingay is blocked and so a railway bypass or new route would be required. This means virgin soils or new blockages have to be tackled and destination Cambridge could help determine best route.	If, as proposed the new railway links up at Shepreth, you have to share twin tracks to Shepreth Junction; then share just 3 tracks with the Bishops Stortford lines into Cambridge, through Cambridge to Norwich and Ipswich respectively. To enter Cambridge by the former Trumpington Junction requires either slewing the road space or cut and covering the Guided Busway; and things like bridging the M11, clearing a track through the Trumpington Park and Ride where a new halt could link road, bus interchange and rail.

I submit these two as main considerations and would also like to draw your attention to our Campaigns page which has many other schemes we endorse for further study and assessment. Local Government is strapped for cash, LEP too remote – never answers our emails and letters – and parishes like Olney seem bent on development and dismiss the railway restoration as pie in the sky – but that locks into oil/road/car/lorry reliance and Olney gets via the A509 Milton Keynes radial artery, more than its fair share of traffic and should ideally be rail served and bypassed. Our campaigns page is: https://ertarail.com/campaigns/

I attach a copy of the Handley alignment which shows how a new rail route could have been done to correct existing alignment blockages. Alas, due to nil support and a lack of resources, a new alignment would have to be studied by a qualified consultant. We just lack £30, 000.

I trust this submission accords with what you wish and we remain interested to engage any way we may within reasonable time and resource thresholds.

Yours faithfully,

[Name redacted]
[Job title redacted]

Population of within a 5 mile catchment of the Handley Alignment*
* Approximate and as on-line quick reference could enable.

	Place	Population	Place	Population
	Olney	**6, 500**	**Astwood and Hardmead**	**250**
	Turvey	**1, 525**	**Chichley**	**100**
	Bozeat	**1, 225**	**Clifton Reynes and Newton Blossimville**	**450**
	Stoke Goldington	**550**	**Lavendon**	**1, 250**
	Newpoer Pagnell	**15, 100**	**Warrington**	**50**
	Horton	**433**	**Harrold**	**1, 691**
	Ravenstone	**200**	**Yardley Hastings**	**745**
	Embertson	**600**	**Denton**	**779**
	Sherrington	**950**	**Brafield**	**656**
	Tyringham and Filgrave	**250**	**Gayhurst**	**150**
Sub Totals		**27, 333**		**6, 121**
Combined Population Example Total: 33, 454				

References

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http://www.bedford.gov.uk/council_and_democracy/statistics_and_census/parish_profiles.aspx
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National Infrastructure Assessment Call for Evidence

Response from Suffolk County Council

This note supplements that provided by the Joint Suffolk Member Working Group which has already been sent on to you. Suffolk County Council is a party to that group and endorses the comments therein.

Cross cutting issues

1. What are the highest value infrastructure investments that would support long term growth in your city or region?

In Suffolk, we have produced a Strategic Planning and Infrastructure Framework that looks at the delivery of housing and jobs growth to 2050. This has identified key infrastructure requirements to help deliver this growth including,

- Improvements to the strategic road network to support our ambitious growth ambitions (as set out in the Joint Suffolk Member Working Group response).
- Improving the rail line from Felixstowe to Nuneaton and points north. This is not just about track but also about more efficient (digitised) signalling which allows for increased capacity using existing hardware.
- Improvements to the rail junctions at Ely which is a critical rail node for the whole region and is a significant constraint on growth.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

Suffolk is home to the port of Felixstowe which handles 40% of the UK's container traffic and is the main container port for the Northern Powerhouse. We also have the largest grain exporting port in the country at Ipswich. Road and rail infrastructure to support these nationally significant assets is crucial. The new Industrial Strategy places a clear emphasis on the role of exporting in driving national growth so having a ports network with the right infrastructure for growth will be critical for the future economy of the UK

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

4. **What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?**

5. **How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?**

   Simply maintaining and repairing assets will not support long-term growth. Our region has in the past done poorly compared to other regions for infrastructure investment – based on a repair and maintain policy. Despite this it has remained one of the three regions that are net contributors to UK plc. However, appropriate interventions at an earlier stage would not have led to the deficits identified at 1. above which are now acting as a brake on growth.

6. **What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?**

7. **What changes in funding policy could improve the efficiency with which infrastructure services are delivered?**

8. **Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well- functioning markets?**

9. **How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?**

10. **What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?**

    Forward funding of infrastructure to ensure provision is in place before development would make growth more acceptable and deliverable. However it would require more intervention from the public sector at national and local level.

11. **How should infrastructure most effectively contribute to protecting and enhancing the natural environment?**

    We welcome the inclusion of this question in the NIC consultation, as it demonstrates Governments' commitment to being the first generation to leave the natural environment better than we found it.

First, we should not lose sight of the natural environment's intrinsic value, nor our moral obligation to protect it. However, notwithstanding this, the role that the natural environment plays, through providing immeasurable natural capital, on which society depends, is a key consideration for NIC. Use of the mitigation hierarchy in infrastructure development is a tried and tested mechanism that supports good decision-making, as is a collaborative approach that involves appropriate stakeholders. However, we need to think more broadly about the definition of the natural environment, widening it from the traditional approach of evaluating impacts on protected sites, species and landscapes (such as through EIA), aspects that are, unhelpfully, still widely seen as constraints on growth, to the role these and other natural environment features, such as those covered by the definitions of natural capital, play in the sustainable future of society.

Infrastructure development should take full account of natural capital accounting in decision-making to ensure that our natural capital (the world's stocks of natural assets which include geology, soil, air, water and all living things) is not unsustainably depleted. This should be a fundamental principle in infrastructure development. Society depends, and will continue to depend, on the health and wealth of our natural capital, so it is vital that this generation does not unsustainably deplete stocks as we grow the economy. Natural capital audits and accounting will be increasingly important in the future, such that conservation (and enhancement) of the natural environment and thereby its ability to support life on earth, is properly considered in decision-making.

A further, more specific, area that NIC should consider is the role that the natural environment (and its conservation & enhancement) plays in a circular economy and as part of this in our health & wellbeing. There is much evidence, for example in the UK National Ecosystem Assessment, to demonstrate the benefits of the natural environment to mental and physical health and quality of life, and thereby to a healthy workforce, to inward investment in an area where the natural environment remains a strong asset, and to economic prosperity itself. In 2015 a Suffolk wide poll demonstrated that the countryside & coast is seen by the vast majority of respondents as the best thing about living in Suffolk. Similarly, Visit Suffolk's market segmentation analysis in 2015, showed that natural and heritage attractions were by far the most visited. Both are simple, yet powerful, demonstrations of the importance of the natural environment to contemporary societal agendas. This demonstrates that we cannot and should not separate the natural environment from wider decision-making, and in fact that across society we should see the importance of natural environment as a key building block of our economic prosperity and health & well-being.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Transport

13. How will travel patterns change between now and 2050? What will be the impact of adoption of new technologies?

High speed broadband availability across Suffolk will provide an increased opportunity for working from home for at least part of the week. This has the potential to reduce the level of commuting traffic to centres of employment, however the growth in population will still see an overall growth in traffic volume. It is also likely to increase the volume of local traffic (10-15 miles) with the opportunity for local shopping and socialising. The peak time commute is liable to spread over the day and the inter peak liable to grow in number levelling out the peaks across the day.

Local production of goods using 3D printing technology has the potential to provide a more distributed supply network. This has the potential to increase the demand on travel to the new local centres both for raw materials freight transport and customers visiting the sites.

Suffolk already has an above average older demographic and this is liable to increase. The short distance travel demand using new forms of mobility scooters and electric bicycles is expected to increase. Trips of 1-10 miles for retail and socialising will grow and place a demand on the infrastructure with new accessible purpose built “roads” being require to cater for this slower moving traffic.

Autonomous vehicles will provide the opportunity for higher volumes of vehicles travelling closer together and at consistent speeds. There is also the opportunity to reduce personal vehicle ownership with the related reduction in parking demand. The vehicles would also allow for greater usage of vehicles by those currently unable to drive due to infirmity or age (including under 17s), thereby increasing the numbers using the road network.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

On the assumption that economic growth will continue to develop in London, and the 3 major centres in the East i.e. Cambridge, Ipswich and Norwich investment is required in providing high speed and frequent transport between the centres. Improvements to the speed, reliable and frequent train links between the centres is key for both movement of both people and freight.

Pinch points on the trunk road require attention to improve the reliability of travel, this includes the provision of improvements at major junctions and interchange points on the network. These include the provision of new and enhancement of existing river crossings to increase the network capacity and to provide network resilience.

Within the urban areas sustainable transport improvements are essential to retain a working centre open for residential, commercial and leisure use. The provision of priority routes and areas for non- motorised and smaller sized/slower vehicles are key to achieving this.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

The continued growth of Felixstowe port as a centre for goods entering and leaving the UK requires investment in the connectivity of the port with the rest of the UK.

Short distance local travel in rural areas, needs to be improved, so that smaller sized and slower vehicle options are viewed as the normal means of getting around. The provision of routes segregated from the faster and larger vehicles is key to this goal.

With the potential for the growth of a more distributed network of local centres of production the transport network to these sites needs to be addressed. Improvements to the road and rail capacity and the requirement for improved maintenance as these routes become more heavily utilised.

16. What opportunities does "mobility as a service" create for road user charging? How would this affect road usage?

Mobility as a service is likely to drive down car ownership and with it parking demand. Associated with mobility as a service is the demand and requirement for full coverage and availability of real time on line data to ensure efficient movement.

In relation to road user charging this would need to be managed on a per mile basis which requires 100% accurate data coverage of vehicle movements to track, record and charge. Options to toll individual roads present a problem given the limited trunk road options and the potential impact from alternative routes through local roads and villages.

Management of the costs of travel could also be used to manage travel demand with peak time charging, emission charging and congestion zone charging. Freight road traffic to be managed along agreed corridors with penalties for non-compliance.

Digital communications

17. What are the highest value infrastructure investments to secure digital connectivity across the county (taking into consideration the inherent uncertainty in predicting long term technlogy trend)? When would decisions need to be made?

SCC believes that the UK requires both a breadth and depth of connectivity. There is no doubt that urban and business centres require to gigabit fixed fibre services to compete internationally, and likewise, the UK needs to be at the forefront of LTE and emerging 5G deployments for mobile connectivity. It is highly likely that the majority of this connectivity will be provided by the existing commercial marketplace, with all mobile operators currently signed up to 99% coverage of 4G by the end of 2017. SCC also believes however that policy needs to address the needs of the rural economy, and the platform for acceleration of the digital economy which can only be provided once ubiquitous broadband access is a reality. Therefore, given national broadband coverage will reach around 95% by 2019, our view is that we need to push on with the hardest to reach areas to ensure that full coverage is achieved as quickly as possible.

18. Is the existing digital communications regime going to deliver what is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Since the inception of state intervention to increase fibre broadband rollout beyond the half of the country which was addressed commercially, Suffolk has been fully supportive and adoptive of government policy, led by the BDUK unit in DCMS. We were extremely pleased to sign our initial contract under the BDUK framework in December 2011, and completed that scheme ahead of target, under budget, and with an over delivery in terms of premises covered. This took us to the then policy commitment of 85% superfast fibre coverage, a considerable step towards eradicating the digital divide in Suffolk, and providing ubiquitous internet access required to live, work, consume services, and enable a digital economy to grow and become default in the UK.

Acutely aware that this scheme still left around 15% of Suffolk, or over 50,000 premises in the county who are unable to access digital services which the vast majority of the country take for granted, we were the first county nationally to

proceed under the BDUK Superfast Extension Programme, and now have a contract which will see us reach 96% coverage by 2019.

This does leave Suffolk County Council with two key issues to address. Firstly, there is no policy commitment or funding made available to address the circa ten thousand Suffolk premises who will be left behind after existing policy interventions are delivered. Secondly, for those who have now waited from 2011, through to 2019, there was a very high degree of frustration and disillusion felt.

To date, the solution proposed by DCMS has been the "Universal Service Obligation", providing 10Mbps by 2020. In Suffolk, we remain concerned about the inadequacies within this proposed approach.

Firstly, the USO cites a speed of 10Mbps in 2020, based on the Ofcom Annual Report of 2015. Whilst 10Mbps is sufficient today for the market to sell current broadband packages, as the market develops and the connection has to cope with multiple devices, HD/4K content, VPN and other applications it will be insufficient by the time the USO comes into force in 2020. Therefore, our view is that this policy condemns a proportion of Suffolk residents to a second class service. Technically, long reach VDSL using the copper network also neglects to bring fibre close enough to these properties to provide a clear upgrade path beyond ~10Mbps, creating the serious risk of a need to intervene again as bandwidth demands increase.

It is clear from this proposed policy that government believes that completing the rural broadband rollout does not represent value for money as you reach the final few percent. We would propose that, rather than looking at the cost of the first premise upgraded with state funding, or the last one to benefit, we should instead look at the average cost per premise within the entire intervention from 50% to 100% as a single strategic programme, rather than the cost of the final premise connected. Fibre can reach 99% of the UK without being overly costly per premise, and the average cost per premise across the entire intervention should be where we focus our minds when evaluating value for money and shaping government policy.

In terms of the current policy and market composition, and the announcement in the Autumn Statement 2016, our key concern is that lack of policy and funding commitments in place to provide ubiquitous, upgradable superfast access. Whilst we can see the merit in committing £400m of government funding to intervene in urban areas and increase speeds further, we are aware that these areas have already been subject to commercial and/or state funded upgrades, and for which a healthy commercial market exists to provide further upgrades (eg CityFibre, Hyperoptic, MNOs)

Instead, we believe that funding should be committed to ensuring broadband access for all – this could be in addition to the money for extending full fibre access. We believe that until ubiquitous access exists, the digital economy can never truly embed and excel, not least in counties such as Suffolk. We have strongly urged government to communicate a clear and equitable strategy for those left behind after the delivery of current policy.

The recent DCMS consultation on this subject discusses the desire to stimulate market activity in rural areas. In Suffolk, our view is that this is a difficult commercial proposition which we have discussed with many alternative providers. Having spent close to £1bn of public subsidy to reach the areas between 50% and 95% coverage due to market failure, we suggest that it is abundantly clear that the only realistic, viable option is to extend and build that scheme for the final few percent, rather than to seek to create a thriving infrastructure market in the very hardest to reach areas at this point in time.

The consultation also discussed public sector demand aggregation. Having tested this extensively in Suffolk, it is quite clear that this does not form a viable solution for rural broadband access. Prior to the state funded Openreach FTTC rollout, public sector bodies were driven to spend vast sums of money funding private connections to rural primary schools and offices; connections which due to legal, commercial and technical reasons could never be "opened up" to provide to consumers. However, as the DCMS/LA funded schemes with BT have rolled out, we have been able to utilise the open access OpenReach infrastructure to replace these privately funded connections, saving money and negating the need for vast, privately owned public networks which duplicated spend (between private WANs and state funded Openreach FTTX networks). This model will continue in the market, and only the CityFibre style infrastructure build schemes will be viable, and by definition, these will be in urban areas, overbuilding existing state funded Openreach networks, or privately funded Virgin Media networks.

Energy

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

21. What are the implications of low carbon vehicles for energy production?

Water and wastewater (drainage and sewerage)

22. What are the most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

Suffolk is considered to be in a state of severe water stress, although water companies currently have plans in place to supply existing projected growth this is very likely to increase and when combined with the projected impacts of climate change the future cost of supply is likely to rise. Future domestic demand needs to be tackled in all new build developments with increased requirement for housebuilders to install measures that limit demand, this needs to go beyond low water use taps and toilet and include grey water systems that will reduce demand as well as positively impacting the management of surface water.

Another intervention that would enable more sustainable water supply would be greater flexibility to be applied to current water resources regulations. Competition for water in availability in Suffolk is high and agricultural irrigation is vital to maintain the local rural economy, the regulations for control of groundwater and fluvial extraction are outdated and do not fit with some of the more innovative solutions. For example in order to drain low lying coastal farm land fresh water has historically been pumped over defences to the sea/estuary, our data suggests that for the Suffolk coast this is equivalent to the amount of water currently used to irrigate in the local area. Therefore, twice the water currently used is available, however, to use this water abstraction licences would be required but are not forthcoming under current regulations (designed to retain current resources), this is clearly not conducive to solving the issue of supply. Flexibility to recognise, this water pumped to sea as "wasted resource" would facilitate opportunities for it to be used to supplement irrigation demand and public water supply

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

Flood risk management

25. What level of flood resilience should the UK aim to achieve, balancing cost, development pressure and the long-term risks posed by climate change?

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

Natural Flood Management will be a vital tool to manage pluvial and fluvial flood risk reduction in Suffolk, we have a number of projects exploring the practical delivery of this technique. The merits are well understood locally and can be modelled effectively, a key barrier/opportunity is the involvement of landowners. Their agreement to "sacrifice" land to make room for water is a vital agreement and the current structure and management of the agricultural subsidy system is not flexible enough to enable schemes to be delivered easily. The review of the post-Brexit agricultural subsidy package should look to embed incentives for landowners to become partners in in delivering public good by reducing flood risk to property.

Solid waste

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity to finance innovation, to meet landfill and recycling objectives and and to assign responsibility for waste.

The current financial regime is effective in encouraging diversion from landfill. However, the lack of national policy direction on waste and appropriate financial mechanisms is widely acknowledged to be the cause of plateaued/falling recycling performance. The current producer responsibility regime for packaging fails to support the costs of material collection from households and legislation confuses accountability for recycling. Greater clarity of roles would be beneficial to all and stimulate investment. Producer responsibility should mean just that, with industry taking responsibility for funding the full costs of recycling and ensuring that markets exist for the secondary materials that they generate. Local authorities are excellently paced to be the collection agents for industry, due to their unique position in already having a customer interface and relationship with householders; much of the necessary infrastructure in place to deliver the collection service; and an obvious operational synergy between recycling collections and refuse collections. By clarifying responsibilities in this way and removing duplication and ambiguity, government could also enable a move to greater consistency in service provision to residents. Many of the major producers affected would recognise this model, it being how they are required to operate already in many other markets across Europe.

28. What are the barriers to acjhievinga more circular economy. What would the costs and benefits (private and social) be?

Enhanced producer responsibility is an essential pre-requisite to moving towards a circular economy. Such a move will also require a significant cultural shift away from owning products to buying services, in order to better incentivise and reward investment in improved durability and design for re-use and recycling. Examples such as the move from buying media to subscribing to streaming services demonstrate that such cultural shift is possible.

Briefing Note

10 February 2017

EIC response to the National Infrastructure Assessment

Q24. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

The UK should seek to achieve the highest flood resilience level it can balancing costs, development pressure and long-term risks.

If we accept that the government will need to make trade-offs because there is clearly a limit to the flood defence budget (welcome recent increases notwithstanding), the government must be transparent and clear with the public and business about the decisions it makes. As such, what is missing from this question is an opportunity to discuss the government's relative priorities for flood resilience. The questions about whether flood resilience should prioritise homes vs businesses, deprived areas vs areas that are economically significant, the North vs the South East, people vs the environment, societal assets vs critical infrastructure. Stories such as this imply that the government is making these decisions without public oversight. As a result, this presents a risk that the government will lack credibility on flood resilience when the next flood event does happen, unless its priorities are clearly communicated.

Climate change is clearly set to have a severe impact on flood risk management over the coming decades. The Committee on Climate Change's recently published Climate Change Risk Assessment, published every 5 years, points to evidence that highlights action and adaptation that needs to be taken immediately, to stall the seemingly inevitable rise in global sea levels that the CCC's report highlights for the rest of the 21st century and beyond.

Below is a synopsis of a recent presentation by Daniel Johns, the Head of Adaptation for the Committee on Climate Change. It highlights four clear areas where reform is required:

A) Infrastructure: The National Flood Resilience Review looked at the infrastructure assets within the extreme flood outline and identified more than 500 energy, water, communications, health clinics and other kind of infrastructure assets within that extreme flood outline, but there has been no published action plan about how those risks and vulnerabilities are going to be addressed. Within the Autumn Statement we had more money for road and for rail infrastructure resilience projects, but so far there has been no published account about how we're going to address, over the long term, the assets that are probably in the wrong place. The December 2013 tidal surge reminded us how much of the coastline is vulnerable to storms and tidal surge. We will see more examples like this where homes cannot be saved and need to be demolished.

B) We are halfway through the first planning epoch within shoreline management plans and at the end of the planning epoch, many policies are due to turn from "hold the line", to policies which are about managed alignment, and realignment, and no active intervention; this is a problem we are storing up, and at the moment we are not gearing up to engage those communities who in the past

have seen people protect and maintain defences, where the implication of these shoreline management plans is that there will be people stepping back.

C) Soil erosion: Increasingly people are recognising the role that land management can play in helping to avoid flood risk, but it is clear that farming is part of the problem - poor land management practice is leading to and causing muddy floods and we're losing rich fertile soils off the hillsides, because we're planting things like maize and not winter cover crops that avoid these kind of muddy floods taking place. So we need to use farmland as a resource and recognise that much of it is actually part of the flood plain, to help manage the flood risk to avoid and try to reduce as far as possible the overall economic damages of these events.

D) New developments: new development is continuing and we're planning to build a million new homes in this country over the next five years, and stats from DCLG published in early December showed that one in ten new properties in recent years has been built in the 1% flood plain, in flood zone three, essentially so that means that we are still adding to the problem. At least there's the national planning guidance which means those properties should be built in ways which minimise the residual risk, but when you're building that quantity of housing in different parts of the country it has to have consequences for the risks and the costs of flood management in future.

Q25. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

SuDs (sustainable drainage systems):
The government missed a major opportunity to limit flood risk and deliver a series of other benefits in its Housing and Planning Act when Schedule 3, the clause in the Water Management Act 2010 that calls for SuDS Approval Bodies that would approve new drainage systems for new and redeveloped sites, was determined to remain unimplemented. The result is that there is very little oversight of SuDS projects that can lead to poor designs and maintenance. Ultimately, this misleads the public into thinking they are protected when they are not.

Despite this, when designed, constructed and maintained correctly, the benefits of SuDS are clear and multidimensional. To name just a few, SuDS enable decreased flood risk, improved water quality, greater amenity/liveability and rainwater harvesting – for a full list and case studies, see here.

Property Level Resilience:
Property level resilience has often been overlooked by reviews of national flood resilience capacity, so we are encouraged that the technology is explicitly referred to in this document.

The property level resilience (or property level protection[1] - PLP) market is relatively young and there is a need for stricter standards both in terms of training and products to ensure that once a consumer believes they are protected, they truly are. At the moment, faulty products installed incorrectly by untrained (or, in some cases, opportunistic) providers mean that the certified companies in the sector are being denigrated while the two remain indistinguishable to consumers.

Furthermore, government initiatives, like the Repair and Renew Grant, are deployed in the wake of flood events rather than making subsidy available to consumers before floods to encourage members of the public

[1] There is some debate in the flood protection sector about whether flood 'resistance' or 'resilience' should be aspired to. The Flood Advisory Service has found that when explained to the public what flood resistance and flood resilience meant, 90% of respondents expressed a preference for resistance (water exclusion strategy) to resilience (letting the water in, but adapting a home so it recovers more quickly).

to take a long term view of protecting their property. The grant also failed to ensure that the taxpayers' money spent on improvements to properties were credible products[2] installed by qualified professionals[3]. This meant that in some cases, the government has directly funded malpractice. These issues around training and standards are the risks to be considered when deploying PLP solutions as government policy, but could be relatively easily abated by action from the government.
Whilst we accept the need to build more homes in the UK, ACE believes that the CCC's warnings on the urgent need for adaptation must be taken into account. This will require a change to building regulations, there is a need for Part C to be adapted for new homes to include passive measures to prevent water ingress via doorways, airbricks and drainage. It is currently all too easy for developers to push through plans (with few checks and balances in some cases), and, coupled with the lack of building regulations, the absence of accountability on developers' post-sale needs to be changed.

Evidence from DCLG (as outlined in point D in our response to the previous question) points to potentially 100,000 new homes being built in flood zone 3 over the next 5 years. PLP has been proven to reduce residual risk to a property, so it would be a sensible solution to require developers to incorporate flood doors, non-return valves and anti-flood airbricks to these new homes as a "belt and braces" measure. The cost of taking such measures at the "build stage" is significantly reduced compared to retro-fit. In addition, developers should take responsibility for the cost of insurance for a period of, say, 10 years for all new build homes, and this could be administered via the existing NHBC warranty. Flood insurance is not covered by Flood Re, so this would be a twin incentive for all buyers of new build property. Finally, we should be aiming to build in resistance measures as outlined here to a 1/100-year event if possible.

The benefits to PLP products are as follows:

- It allows individual homeowners to take responsibility for their own flood risk, alleviating some responsibility of the government;
- PLP products can be installed in a bespoke way, allowing homeowners and experts to come to a solution that can be agreed based on personal priorities and risk appetite;
- PLP products can be quickly and easily installed and require limited maintenance;
- PLP could provide opportunity for developments on otherwise unfeasible plots (i.e. flood plains, which are increasingly relied upon for housebuilding)

Q26. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

There is a well-documented need for increased treatment capacity in the waste management sector. A 2014 Defra report[4] stated the following:

> *estimating around 22 million tonnes capacity gap (per annum) between residual waste arisings and the amount of treatment infrastructure capacity either 'operating' or 'under construction'. The report also suggests that this capacity gap will decrease to just under 11*

[2] 72% of respondents to a Flood Advisory Service survey said that choosing Kitemark over non Kitemark flood products was important or very important
[3] 78% of respondents to the Flood Advisory Service survey said that they felt it was important or very important to choose Kitemark installation for their PLP products
[4] Defra, *Energy from Waste: A Guide to the debate* (2014)

million tonnes (per annum) by 2020 if the waste treatment capacity that has planning consent (around 12 million tonnes) reaches financial close and begins construction.

However, the question above fails to clarify which *type* of waste treatment infrastructure the UK requires – more landfill, recycling or energy from waste (EfW) capacity. Principally, the government needs to decide on this question so that investment opportunities can be taken by private companies.

For now, recycling levels have plateaued for several reasons:

i. Recycling efforts in the UK have reached a point where the less challenging waste has been process responsibly. This means that further investment in recycling infrastructure is likely to suffer from diminishing returns;
ii. Local authorities, who still retain much control over domestic and commercial collection, are suffering from diminished budgets and therefore lack capacity to invest in more behaviour change campaigns which have proved successful in the past;
iii. There has been an historical strategic reliance on the European Union to take the lead on recycling/resource policy. This has meant that the government has broadly failed to provide a vision for recycling in the UK.

Thus, if further intensive investments in recycling infrastructure were to come about, much of the capacity may go unused.

If recycling is becoming more difficult, however, that does not mean that we endorse more capacity in landfilling. The UK has come a long way in decreasing its willingness to landfill and this should not be reversed for environmental reasons. We believe the Landfill Tax has reached the right level. Any further increase in the tax would result in an even worse rate of waste crime and avoidance[5], instead much better enforcement must be a priority, but it is important that it be maintained at its current level to encourage better overall environmental options.

With high levels of tax on landfill, waste companies have resorted to exporting waste. The UK has become more dependent on RDF exports since 2010 to Northern European countries such as Germany, the Netherlands and Scandinavia, as a means of managing waste in a reasonably environmentally sound way. The export of RDF has drastically increased in recent years. In 2010, the UK did not export and RDF, now exports are estimated to be around 3 million tonnes. In theory, increasing the level of RDF export is a good solution to the problem, but the risk of changing demand on the continent or regulatory de-synchronisation in a post-Brexit market might mean that relying on European markets is a risky strategy.

Instead, the government should consider incentivising an increase in domestic EfW capacity. This would enable the UK to have reasonably environmentally sound and self-sufficient systems to manage waste. Though EfW capacity increases are the best solution to the lack of infrastructure in the waste sector, there are important challenges that need to be addressed by government. Energy from waste plants take 10 years to develop, have a lifespan of 20-30 years and require significant financing, normally from a range of sources.

This climate of risk often leads to companies opting for proven technologies and the services of traditionally successful companies, thereby preventing new market entries and innovation. This means that innovation in the waste sector can be difficult. However, attempts by the industry to learn from other sectors, such as oil and gas, could be a way forward. There is more capital available now than any time in history but the lack of

[5] See CIWM Journal Online, *£150 Million Landfill Tax Gap Reported by HMRC* (2016)

good, dependable projects in EfW is a clear barrier. Government action to make investment more likely would be encouraged.

Q27. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

One major barrier to achieving the circular economy is low virgin commodity prices. For example, if oil is cheap to buy, it is less economically viable to recycle plastics and can be cheaper to simply use more raw material to manufacture new products. This price disparity undermines the business case for recycling.

Another is the lack of national regulatory instruments to push materials up the waste hierarchy. Instead, European Union targets have been the main driver for change in the sector. As noted above, preventing landfilling has been a major policy success in the UK, especially considering the country's historic habit for the practice, but the best environmental outcomes have not been attained.

Further, there are little in the way of incentives to encourage circular use of resources. Sweden has recently proposed tax reform to decrease VAT on repairs from 25% to 12%. This type of initiative would disincentivise throwing away difficult to recycle white goods and electrical goods and stimulate a domestic repairs industry at the detriment to foreign goods imports. Similar financial incentives could be a useful mechanism to deliver a meaningful transition up the waste hierarchy.

Products are also routinely produced with a linear mind set. European Union eco-design standards are encouraging and enable evermore products to be reused. The government needs to ensure that the legislative framework for product design continues to push towards more sustainable consumer goods. The European Commission's new Circular Economy Package, for example, has further standards and requirements for eco-design and we would encourage the government to adopt these standards regardless of the UK's future relationship with the EU.

Finally, there is a need to change consumer behaviour. This starts with changing the public's ideas about the merits of buying new goods and encouraging consumers to reuse, share or donate products. This is certainly a challenge for any government because the interests of product businesses, whose aim is to sell as many units as possible, do not obviously align with a change in consumption culture that would inhibit purchases. However, government can support the repairs sector, provide ample infrastructure for donation (clothes banks etc) and raise public awareness about the social benefits of a more circular approach to consumption.

E.ON response

The National Infrastructure Assessment: Call for Evidence

Executive Summary

- Planning for the UK's infrastructure needs is about meeting the country's immediate requirements as well as investing in the UK's future. One of the most important long-term objectives is for the UK to reduce greenhouse gas emissions. The Carbon Plan 2050 scenarios set out by the Department of Energy and Climate Change required energy efficiency to contribute a reduction in final energy consumption per capita of 31-54% between 2007 and 2050.

- Energy efficiency is a critical part of decarbonising heat in the most cost effective way through reducing wasteful energy use. We believe, therefore, that energy efficiency should be designated an infrastructure priority. The energy efficiency of buildings is integral to the wider energy infrastructure because it directly influences demand and, therefore, impacts decisions about future capacity requirements of a decarbonised energy system.

- New domestic and commercial properties should be built to low carbon standards to avoid the need for more costly retrofit in the future. The housing standards review commencing in 2017 should send a very clear signal to the market that new build properties in the 2020s will be required to install lower carbon heating solutions.

- The Government needs to be bolder in its expectations for the able to pay sector to engage with energy efficiency. It must lead and educate consumers to recognise the importance of being energy efficient and put in place policies that will drive action and begin to change consumer attitudes towards energy efficiency.

- Heat decarbonisation represents a much bigger challenge than decarbonising electricity since the solutions will have more of a direct impact on homes and businesses. The highest value solution is likely to combine technologies such as district heating, electrification and greener gas alongside a resolute and universal effort to improve the energy efficiency of buildings.

- To enable industry to prepare for the 2030s, we believe that key decisions on the long-term direction of heat policy should be made by the early 2020s at the latest. To facilitate this, we support calls for the use of innovation funding and targeted pilot schemes during this Parliament so that a credible long term plan can be developed. This should form part of the forthcoming Emissions Reduction Plan.

- Zero carbon power in 2050 is also likely to consist of a portfolio of technologies, some of which are already relatively mature today whereas others may be in the early stages of development. Government's role should be to provide the frameworks and regulatory clarity that will allow the most effective technologies to develop. It should not attempt to pick winners and define what those technologies are today.

- Technological innovation is driving major change in the automotive industry which we believe will deliver considerable benefits, both in terms of helping to reduce carbon emissions and in support of the Industrial Strategy. Policy makers today should focus on developing frameworks which support the implementation of managed charging solutions as part of the transition to a flexible electricity system and zero emission vehicles with significant electricity storage capability.

CROSS-CUTTING

Question 1

What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

1. We believe that, alongside traditional infrastructure, energy efficiency should be a National Infrastructure Priority. The energy efficiency of buildings is integral to the wider energy infrastructure because it directly influences demand and, therefore, the decisions that have to be made about future capacity requirements of a decarbonised energy system.

2. Energy efficient buildings will be crucial to the successful decarbonisation of heat in the UK regardless of the eventual technology pathway. In the near-term, there needs to be much greater ambition around energy efficiency to prepare for gearing up on the decarbonisation of heat in the 2020s. We believe that the classification of energy efficiency as an infrastructure priority is the only way to create the step change required to achieve this.

3. Reducing household energy demand is fundamental to reducing carbon emissions, particularly in light of the expected increase in the numbers of households over the next decades. The UK has some of the least efficient housing stock in Europe and without addressing this issue, heat demand will rise far higher than it should do.

4. Upgrading homes to a higher energy efficiency standard will not only help tackle carbon emissions but will bring co-benefits for individual households, the wider community and society. Better insulated homes are more affordable to heat, leading to lower fuel bills. This, in turn, is likely to lead to fewer households living in cold homes, reducing the incidences of illness linked to cold homes and alleviating some of the burden on the health and social care systems.

5. A nationwide retrofit programme would create demand for services across the country with local installers and contractors well placed to carry out home energy efficiency improvements. This would result in growth of local jobs, boosting employment and regional economic growth[1]. The UK GBC, in a 2014 report[2], calculated that major investment in energy efficiency could almost double the number of people employed in the energy efficiency industry to 260,000.

6. All new properties should be built to low carbon heating standards to avoid the need for more expensive retrofit in the future. This includes commercial buildings where the benefits of reducing consumption include lower operating costs as well as more environmentally responsible credentials.

7. District heating has an important role to play in delivering lower carbon heat to homes, businesses and public buildings, helping to decarbonise cities and regions. Heat networks are often the most cost effective solution in high density areas and can accommodate changes in the heat source over time as lower carbon and renewable options become more cost effective.

8. Heat networks can form an integral part of local energy systems whereby solutions for heat decarbonisation can be designed to meet the needs of the local area in the most suitable way. If designed and built as part of a local strategic development plan and with the capacity to expand or ability to interconnect with other networks in the future, heat networks can make an important, high value contribution towards heat decarbonisation.

Question 3

How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

9. Infrastructure denotes the facilities and systems that underpin a country and communities. They provide the foundations that enable people and the economy to function effectively. Buildings

[1] *Building the Future: the economic and fiscal impacts of making homes energy efficient,* Verco and Cambridge Econometrics, 2014.
[2] *A housing stock fit for the future: making home energy efficiency a national infrastructure priority*, UK Green Building Council, 2014

are a fundamental part of that basic framework, constituting the fabric of households, businesses and industry alike. However, poorly insulated buildings are costly to heat as well as being costly from an environmental perspective and in terms of health outcomes and living standards.

10. Heating in the UK currently accounts for nearly half of all energy consumed and one third of total greenhouse gas emissions[3]. Addressing this and tackling the UK's inefficient housing stock requires the Government to lead, contributing infrastructure funding to galvanise action and ensuring improvements are delivered effectively and in time to lay the foundations for progress on decarbonising heat in the 2020s. The first step to successful and cost effective heat decarbonisation must be to reduce demand to a level that excludes wasteful heat so that the challenge being addressed is the right one.

11. Planning for the UK's infrastructure needs is about meeting the country's immediate requirements as well as investing in the UK's future. Improvements to the energy efficiency of buildings addresses both an immediate need, in terms of helping to alleviate fuel poverty, and the UK's long-term goals of significantly reducing carbon emissions by managing the demand on energy infrastructure.

12. Energy efficiency can also play an important role in regenerating an area, so that it becomes a place where people want to live and enjoy the local amenities. Improving the attractiveness of an area by making existing homes more desirable to live in will help to improve the local economy and attract new businesses into the area.

13. Complementary to the retrofitting measures to support regeneration of an area is the positive impact that new buildings can make, especially where they may be iconic. Ensuring all new buildings, both domestic and non-domestic, meet a low carbon heating standard we believe can also contribute to making places better to live in. It will however require stronger building regulations and a more holistic approach to planning and building.

Question 4

What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing

[3] *Too Hot to Handle? How to decarbonise domestic heating,* Policy Exchange, 2016

at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

14. The demand side has an important, and growing, role to play in keeping the system in balance. National Grid have set an aspiration of between 30% and 50% of the balancing services market to be met from the demand side over the coming few years. With the right long term framework in place, we agree that this could be achieved.

15. However, rather than quantifying in absolute terms how much the demand side should contribute, the focus should be on designing the ancillary services framework in a way that allows all technologies, from both the demand and generation side, to participate. The emphasis should be on removing barriers so that there is a level playing field and the most cost effective solutions are rewarded by the market, thereby keeping costs as low as possible for customers.

16. The demand side can also play an important role in helping to alleviate local network constraints. In the past, the solutions that would have been adopted by network operators would have been focussed on reinforcing or replacing particular circuits and lines. Whilst these types of propositions should continue to be explored, it is clear that Demand Side Response and battery storage can also help to alleviate local system constraints.

17. Whilst we do not know the full potential of these demand side solutions, we believe they could present opportunities for lower cost solutions, which would bring benefits for customers. As a company, we successfully won a contract from National Grid for the provision of Enhanced Frequency Response (EFR) for a new 10MW battery at our Blackburn Meadows site. This battery has also secured a 15 year Capacity Market agreement.

18. The electrification of vehicles will provide a significant source of new electricity storage capacity which can be utilised in a flexible way. The Government is already forecasting that, by 2030, there will be 8 million ultra-low emission vehicles on the roads and we anticipate that, by 2050, most vehicles will meet this definition. Since these assets will be spread across the country, they will be able to provide decentralised demand side solutions such as frequency response, demand turn-up and other demand management services to the System Operator and the Distribution System Operators.

19. Smart meters are a key enabler for supporting smarter tariffs and, alongside settlement reform for domestic and smaller commercial customers, provide the opportunity for suppliers to offer a greater variety of Time of Use tariffs. The extent to which there will be customer appetite is unclear but, for some customers who have the ability to flex their demand, there may be interest in these types of propositions.

20. Innovation by manufacturers in offering smarter appliances that can automatically respond to pricing signals provides another route. At this stage, it is not clear what the potential is, but it is important from a policy perspective that there are no barriers to their development.

21. As we have already stated, we believe that energy efficiency should be a National Infrastructure Priority given its importance in delivering the 5th Carbon Budget and the UK's longer term carbon budgets. The Committee on Climate Change[4] predict a 15% reduction in energy used for heating existing buildings by 2030 through efficiency improvements. The Carbon Plan 2050 scenarios set out by DECC required energy efficiency to contribute a reduction in final energy consumption per capita between 2007 and 2050 of 31-54%. Without a major focus on energy efficiency, the challenge of decarbonising heat will be that much greater and more expensive.

ENERGY

Question 19

What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

22. Reducing greenhouse gas emissions to supply space heating and hot water is widely recognised as a much bigger challenge than decarbonising electricity where significant progress has already been made. This is partly due to the fact that the solutions will have more of a direct impact on individual households, at point of use, rather than at generation or production.

23. The pathway to decarbonisation is likely to combine a number of solutions including district heating, electrification of heating and greener gas technologies, alongside a resolute and universal effort to improve the energy efficiency of buildings. It is likely that the highest value 'solution' will be a combination of technologies rather than a 'one-size-fits all' solution. The options for low carbon heating are predominantly decentralised so what works best will depend on location and property type.

24. Improving the energy efficiency of existing residential and commercial buildings and implementing high energy performance standards for new build properties is fundamental to addressing the challenge in a cost effective way. We firmly believe that, to achieve this, energy efficiency must be designated as an infrastructure priority.

[4] *Next steps for UK heat policy*, Committee on Climate Change, October 2016

25. The Government should adopt a 'no regrets' policy of high ambition in energy efficiency, which will require action taken to address in particular the 7m solid wall homes that are currently uninsulated. The Government also needs to be bolder in its expectations for the able to pay sector to engage with energy efficiency. First, it must lead and educate consumers to recognise the importance of being energy efficient and emphasise the role that every individual has to play. But it must also put in place policies that will drive action and begin to change consumer attitudes towards energy efficiency.

26. Whilst challenging, this will be necessary if consumers are to engage with energy efficiency and begin to acknowledge that the way we heat our homes will need to change. The rollout of smart metering is expected to help increase engagement in this area. However, it should be seen as an enabler to reducing consumption and energy bills and there will need to be a clear demand pull to convert interest into action.

27. In existing homes, efficiency improvements should be delivered by insulation to cavity walls, internal and external solid wall, loft and underfloor insulation, as well as by the replacement of windows and doors with thermally efficient versions. Around 90% will still be in use by 2050 so there will need to be a large retrofit programme, treating 20k properties per week for over 20 years, in preparation for delivering low carbon heat to these homes.[5] Clearly this represents a major infrastructure investment challenge which should be afforded a high priority status within Government.

28. The housing standards review which commences in 2017 should send a very clear signal to the market that new build properties in the 2020s will be required to install lower carbon heating solutions. It is important, however, that regulatory standards should not select a particular technology solution, instead leaving it to the market to innovate and come up with the most cost effective solutions for meeting tighter performance standards.

29. In off gas-grid areas, renewable heating technologies have a clear role to play. Government should consider how best to incentivise their uptake in the 2020s given that the Renewable Heat Incentive (RHI) is only guaranteed to be open until 2020/21. Should the RHI continue throughout the 2020s, it is important that it continues to be funded by the Government.

<u>District heating</u>

30. In urban areas, one of the most suitable and cost effective solutions is likely to be district heating, with increased focus going forwards on interconnection between schemes and the recovery of heat from industrial and waste sources. District heating networks are most suitable

[5] *Managing heat system decarbonisation*, Imperial College, April 2016

for new-build developments or as part of suitably designed local energy systems, typically located around a city or major conurbation where there is a reliable anchor load.

31. High standards of building energy efficiency will help to stabilise the levels of heat demand and reduce the spikes in heat consumption in the early morning and late afternoon. A more stable heat demand will incentivise higher load factors and reduce the risk of heat starvation in district heating networks.

32. Key decisions which are required to support heat network development are:

    - Standardisation of heat network conditions, primarily feed and return temperatures.
    - Assessment of business rates valuation of district heating networks on an economic basis rather than one of original cost.
    - Consumer protection framework which provides confidence to households on standards of service and heat quality whilst encouraging innovation in the market place and reducing risk to investors.

33. According to the Committee on Climate Change, district heating could provide up to 20% of total building heat demand by 2050[6]. This leaves the rest of the market to pursue either an electrification or green gas pathway, although both of these options have their challenges and will require considerable innovation.

    Electrification

34. Heating demand has a much more peaky profile than current electricity demand with large within-day and seasonal variations. This will create challenges for electricity generating assets. It is likely that, even with energy efficiency improvements, a move to an electric heating world will require substantial amounts of new generating capacity. Although high standards of energy efficiency in buildings will help to create more stable demand, the heat demand profile will still require heat storage otherwise the electricity generating assets may be under-utilised for long periods of time.

35. In areas of lower population density, electrification is likely to be the highest value heat decarbonisation solution, with central and local electricity, and heat storage as part of the overall solution. In order to support this, there is a need for innovation funding to be spent on electric heating solutions between now and the early 2020s to drive down the cost of heat pumps and other renewable technologies.

[6] CCC, October 2016

Greener gas

36. Switching to lower carbon gases could allow the existing gas network to continue to be utilised as part of the future energy system, avoiding stranded assets. The options comprise increasing the proportion of biogas mixed with natural gas, blending in hydrogen, or full hydrogen conversion[7].

37. The main restrictions to how much biogas could be produced are the sustainability and availability of the source fuel. It has been estimated by National Grid that around 80-120TWh per year of biomethane could be produced in the UK, mainly from waste. This equates to around 32% of domestic heating demand in 2050 and between 30-50% of overall gas demand.

38. Alternatively, a small proportion of hydrogen could be blended with natural gas. It is estimated that the current network is capable of accommodating a blend of up to 10% hydrogen without requiring changes to appliances or pipes, comparable to the gas grid in Germany today. This approach would mean very little, if any, disruption for customers. However, blending would only save a third of the carbon by volume due to the lower energy content of hydrogen[8].

39. Full conversion of the gas grid to hydrogen presents more considerable challenges, spanning cost, technical complexity and consumer acceptance.

40. Delivering the 5th carbon budget will require as a minimum deployment of low carbon heating solutions for new build and off-gas grid properties. However to enable industry to prepare for the 2030s, we believe that key decisions on the long-term direction of heat policy should be made by the early 2020s at the latest. To support this, we support calls for the use of innovation funding and targeted pilot schemes during this Parliament so that a credible long term plan can be developed. This should form part of the forthcoming Emissions Reduction Plan.

Question 20

What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

41. If the UK is to deliver its legally binding carbon targets in 2050 as set out in the Climate Change Act, it is clear that the power sector will need to have been largely, if not entirely, decarbonised.

[7] *H21 Leeds City Gate*, Northern Gas Networks, July 2016
[8] Northern Gas Networks, July 2016

In addition, the network will need to be highly flexible and resilient to accommodate all types of generation with ancillary services that optimise electricity usage and a smoothed out demand curve to minimise the need for peaking plants.

42. Zero carbon power in 2050 is likely to consist of a portfolio of technologies, some of which are already relatively mature today. However, other technologies may be in their very early stages of development so attempting to establish, today, what the most effective zero carbon power sector in 2050 will look like is premature. It may well rely, at least in part, on one of the many technologies in their infancy today, but it is impossible to say at this stage which of those technologies will be successful in 30 years' time.

43. The role of Government should be to provide the frameworks and regulatory clarity that will allow the most effective technologies to develop. It should not attempt to pick winners and define what those technologies are today.

44. The power sector today is at a watershed. Renewable energy technologies which have relied on subsidies in the past are almost, if not already, at the point of cost parity with traditional forms of generation. Low or zero carbon power generation usually has low or zero marginal cost (as removing carbon usually means removing or reducing fuel – a key driver of marginal cost). Energy markets have evolved around technologies with high marginal costs. Government's priority should be to explore ways to allow these different forms of power generation (both high and low marginal cost) to compete alongside each other and to look to the future where low marginal cost power generation is likely to dominate.

45. By demonstrating an understanding of these challenges faced by the power sector and providing visibility now of the frameworks which will deliver value to investors in future, developers of existing and new low carbon technologies will have the confidence to develop and deliver their projects. To retain credibility, it is important that the market framework is able to drive forward the most cost effective technologies, thereby ensuring that all households and businesses do not have to pay any more than they need to in order to achieve a zero carbon power sector.

46. This means being able to exploit, for example, onshore wind's full potential (where there is local support for such developments) and solar PV. Offshore wind can offer significant potential, especially if the recent trend of cost reductions seen in other parts of Europe can be replicated here. We also believe that there is a role for biomass CHP at the local level. Marine technologies consisting of wave and tidal have the technical potential to contribute towards the target, but for this to become a reality, significant cost reductions will be required.

47. Many of the renewable technologies mentioned above are not dispatchable, and operate more on a 'must run' basis as and when the natural resource is available. However, as the cost of battery storage continues to fall, the potential to operate these assets on a more flexible basis

increases. It is therefore conceivable that, in 2050, renewables could make up a much larger generation mix than was considered feasible or desirable just a few years ago.

48. In 2050, the market share of renewables versus the alternative low carbon options of new nuclear and CCS is likely to be driven by the success or otherwise of energy storage and/or the ability to shift demand based on the availability of renewable generation. However, if heating and transport are to become increasingly electrified, which is likely in order to meet economy-wide emissions goals, there may well be a role for all of these technologies in 2050 to meet the resulting increases in power demand.

49. Many renewable technologies utilise energy from the weather and therefore produce intermittent generation. In order to support the shift towards a more renewable electricity system, the need for (and therefore the value of) flexibility is expected to increase. Traditional generation plant will not have the capacity to meet this increased need for system balancing services and, as a consequence, the demand side will have a much greater role to play.

50. Demand Side Response, distributed generation and battery storage are able to offer services such as frequency response and fast reserve as a credible alternative to traditional generation solutions. Renewable technologies, such as wind, also have the potential to provide ancillary services by, for example, turning down production at short notice. However, the current framework encourages production from these assets whenever the wind resource is available.

51. Distribution systems will need to continue to develop to be able to act as multi-directional networks, serving central to local, local to central and local to local electricity flows. In order to be able to effectively manage the electricity system, it will be important that there is a managed transition to Distribution System Operators (DSOs) and that they coordinate their activity with the Transmission System Operator (TSO) so that the system is run in the most cost effective and holistic way for customers.

Question 21

What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

52. Technological innovation is driving major change in the automotive industry and we believe this will deliver considerable benefits, both in terms of helping to reduce carbon emissions but also in support of the Industrial Strategy.

53. Whilst we recognise that there are some challenges to address in enabling the large scale deployment of electric vehicles, we do not believe that these are insurmountable. Policy makers

today should focus on developing frameworks which support the implementation of managed charging solutions as part of the transition to a flexible electricity system, and zero emission vehicles with significant electricity storage capability.

54. We support the view that all cars and vans should be zero emission by 2050 and believe that a considerable amount of HGV miles can be electrified.

Energy Production

55. Electric vehicles will undoubtedly contribute to an increase in electricity demand. However, the extent to which demand to support electric vehicles will be served from onsite generation sources (behind the meter) such as roof top solar PV is more uncertain.

56. As the cost of solar PV continues to fall, this technology will be able to increasingly compete without the need for subsidy, making such propositions attractive for customers. When combined with a more flexible electricity system, this will help to minimise the amount of new generation that will need to be built to serve households and businesses with electric vehicle charging infrastructure.

57. It is also worth noting that electric vehicles will be able to store a large amount of electricity across a geographically widespread area which exceeds the energy required for transport. As such, the deployment of electric vehicles in large numbers can support increasing the generation efficiency from intermittent renewable sources such as wind and solar. Electric vehicles are, therefore, likely to play an important system balancing role in the future, storing energy when there is excess supply, and releasing it back to the grid to support demand when it is needed by the System Operator. In this context, we support encouraging electric vehicle charging at work places.

Transmission

58. Transmission is likely to be largely unaffected by the energy demand from low emission vehicles as demand is expected to be met by localised solutions in the smart grid context. However, centralised generation from renewable sources such as offshore windfarms should not be constrained by the transmission network and in-depth analysis may be required to determine the needs for future investments.

Networks

59. Managed smart charging solutions are an important component for helping to address the potential constraints that some network companies claim will result from the growth of electric vehicles. There will be a need for some targeted investment in the distribution network,

however we believe smart charging and innovative tariffs will be able to mitigate much of this by optimising when charging occurs and ensuring that customers do not charge at the same time.

60. At the transmission level, there is a need to investigate how much reinforcement may be required, however the nature of the electric vehicle means that it is carrying power over distances and serving a similar function to traditional fixed assets. As such we currently do not anticipate there would be a need for significant investment in this area.

Storage

61. The electric vehicle fleet will inherently implement a geographically widespread energy storage capability. This will be of significant value in the V2X context and in terms of the potential for ancillary services that can be provided to the System Operator.

62. We expect customers to charge their vehicles either at home or at work. However for some, and for the haulage fleet, we see a role for strategically located public charging infrastructure. To support this will be a role for rapid charging infrastructure, which may be supported by appropriate on-site generation and storage facilities.

New Infra-structure Requirements

63. Although low emission vehicles are likely to be able to meet their charging demands at relatively low power requirements, some transport applications may require high power charging capabilities which would need to be met either by onsite generation or the distribution network. Consideration may also be given to how to increase opportunities for charging points embedded in the road network. These would utilise inductive power transfer or pantographs for HGVs at strategically important sections of the national road network. It is suggested that this should form part of a rolling maintenance programme for the UK road network.

64. The level of investment and choice of technologies will continue to change until the innovation of technology reaches a stable plateau. This should be incentivised in order to accelerate the process of product and services development in the national infrastructure context.

E.ON

February 2017

National Infrastructure Assessment call for evidence

Response from ESA

The Environmental Services Association (ESA) is the trade association which represents the UK's waste management and secondary resources industry. ESA's members provide a wide range of essential resource management services to the public and private sectors.

The UK's waste and secondary resource industry is leading the transformation of how the UK's waste is managed. An industry with an annual turnover of £11billion,[1] our Members have helped England's recycling rate quintuple in the last decade and provide 12% of the UK's renewable electricity.[2]

The ESA welcomes the opportunity to advise the National Infrastructure Commission on what we believe to be the infrastructure challenges facing waste and resource management in the UK.

Cross-cutting issues:

1. ***What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?***

When considering waste management, it is important that there is the right infrastructure in place to manage waste appropriately at each stage of the waste hierarchy. Though the industry is continually striving to maximise the value of waste as a resource and thereby contribute to sustainable growth, infrastructure at each tier of the hierarchy is equally important, even if it is transitional to a certain degree.

There is currently a worrying lack of investment in new recycling and treatment capacity for solid waste. This is a particularly pressing concern for the treatment of residual, non-recyclable, waste where high landfill tax levels have led to pan-industry plans to close remaining landfill capacity at a significant rate. It is estimated that four fifths of our landfill capacity will close during the period 2015-2020. We currently export over three million tonnes of refuse-derived fuel to treatment plants in other parts of Europe but the industry believes that this market is now approaching saturation which means that investment in new domestic capacity is crucial.

New Energy from Waste (EfW) plants have lead in times of four to six years, which means that we must make decisions now about new treatment capacity or else we will unwittingly enter a

[1] ESA estimate based on ONS data

[2] DECC (2016), Digest of UK Energy Statistics Chapter 6 Renewable Sources of Energy p.192

situation where the only viable option for treating much of our residual waste in the 2020s will be by opening new landfills. This would reverse the policy direction of the past two decades and put us out of step on waste management policy with much of the rest of the developed world.

Landfill

Landfill still plays an important role in waste management. In part it is transitional whilst other treatment capacity is developed, but it will always play a significant if smaller role in managing residues from EfW and recycling plants, and other non-combustible, non-recyclable residual waste streams. Since it is consumed as it is used, it is vital that landfill replacement continues to be planned for.

Over the past 20 years landfill reduction has been a success story for the industry and has allowed us to reduce our greenhouse gas emissions by 70%[3] whilst increasing recycling and energy recovery rates.

However, the success of landfill diversion measures in the UK has meant landfill capacity is depleting far more rapidly than replacement residual waste infrastructure can come on stream. Given that new treatment plants have around a four year lead-in time, the capacity gap must be urgently addressed before we run out of space and reach a waste management crisis. We discuss this further in Q28.

Energy from Waste (EfW)

There is therefore a desperate need for investment in EfW plants, which require significant capital investment. EfW provides many benefits that contribute to long term sustainable growth:

- Environmental – it supports the waste hierarchy in diverting waste that cannot be recycled from landfill. This avoids emissions associated with landfill and also offsets emissions through energy generation, resulting in overall carbon savings.[4]

- As a source of low-carbon electricity and/or heat, EfW benefits the UK's security of supply as well as contributing to renewable energy targets. In 2015, it contributed to 1.6% of the UK's total electricity and 3.3% of renewable electricity.[5] It therefore plays a small but significant role in the UK's energy mix.

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3 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/407432/20150203_2013_Final_Emissions_statistics.pdf, p.12

4 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/567502/Digest_waste_resource_2016_rev4.pdf, p.59

5 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/577712/DUKES_2016_FINAL.pdf, p.192

- Economic – due to the tax on landfill and the sale of power, EfW is often a cheaper method of treating residual waste, resulting in savings to local authorities and growth within the industry which benefits local areas and the wider economy.

- Social – it provides thousands of jobs across the country, many of which are high-skilled.

Material Recovery Facilities (MRFs)

As we seek to reach higher recycling rates, and seek to target increasing volumes of harder to recycle material, eg plastic pots, tubs and trays, fresh investment will be needed in existing and new sorting infrastructure.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

At present we are sending over 3m tonnes of Refuse Derived Fuel (RDF) to northern Europe at cost to us. Given that the UK is a net importer of electricity, it makes far more sense to build domestic capacity to generate reliable, low-carbon electricity from this resource to contribute to the UK's energy mix.

We are also exporting around 13.5m tonnes of our recyclates, when we could be processing the material domestically for the benefit of jobs and growth in the UK.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Waste facilities should to be integrated into the townscape so they are closer to the sources of waste production and closer to the end markets, reducing transport costs and emissions. Development of these facilities on brownfield sites helps to bring land back into productive use.

There are many missed opportunities at the planning stage of EfW to utilise the heat off take. There is a need to consider EfW-CHP at a strategic level, assessing whether sites can be situated to deliver heat to nearby buildings, particularly industrial processors, with consideration of existing and planned heat network infrastructure. CHP should therefore be more fully integrated into the wider planning regime.

Bio-fuel production from waste treatment processes could also be better utilised for transport fleets or supplying fuel for public transit systems.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

One aspect of demand management relating to waste is waste prevention. It is important to assess how plans to encourage waste prevention and increase recycling will impact waste management capacity requirements.

Another aspect is the demand for secondary raw materials. In order for the recycling industry to survive, let alone thrive, it is imperative that more measures are taken to stimulate the demand for recycled content, such as public procurement rules in favour of secondary raw materials. We cannot simply keep pushing waste out of landfill and energy recovery without strong end markets for that material.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

Many waste facilities have a life span of up to 25 years. Down-time of existing plants will mean there will need to be some contingency to ensure there is always capability to take up the slack during maintenance.

As previously discussed, the industry is managing a steady decline in landfill, but landfill replacement will always be necessary if not on the same as scale the past.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered? Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

See answer to Q8.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

Reforming existing Extended Producer Responsibility (EPR) schemes to transfer the cost of waste collections and treatment from local authorities to supply chains would improve funding for recycling infrastructure. If applied to the whole of the domestic waste stream, this would relieve the burden on cash-strapped local authorities and save average council tax payers up to £250 per annum.

In the longer run, the improved incentives to design products and packaging for recyclability, as well as the strengthened recycling markets that would result, would drive increased resource efficiency and improve the productivity of the UK economy.

Incentives would also be strengthened for producers of products and packaging to be involved in design of waste collection systems which present and deliver materials which meet their requirements. This would have the knock-on effect of improving the recycling experience for householders and make it easier to do the right thing.

Fully funded EPR systems would also be more likely to produce secondary materials of consistent quality. This would improve the investment climate for domestic reprocessing facilities which feed UK manufacturing and would enable more value to be captured within the UK.

For residual waste treatment, there have been recent worrying developments of local authorities seeking to cancel waste PFI contracts 20 years early, once the high risk construction phase has been successfully delivered by the private sector. This has the potential to undermine investor confidence in future projects and at the very least will lead to stronger scrutiny of the termination clauses and could necessitate the introduction of new term clauses.

It has proven difficult to finance large-scale EfW projects without the support of underpinning local authority anchor contracts for feedstock supply. The Government may wish to revisit – in collaboration with the waste and investment sectors – how merchant facilities without an anchor contract could be financed going forward.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Weak and volatile global commodity markets are a serious threat to the recycling industry. We have also seen costs of RDF exports rise since the UK decided to exit the EU, and there is a risk that this will become a less viable option in the future. It is therefore important to build UK recycling and energy recovery capacity.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

<u>Catchment boundaries</u>

The planning system should promote the recycling and recovery of waste which enables movement of materials to areas where they can be cost-effectively input into manufacturing processes. However, ESA's Members have reported frequent instances whereby planning authorities impose mileage limits on the haulage of waste to and from facilities (i.e. imposing catchments).

Such an approach is not only anti-competitive and difficult to enforce, but fails to acknowledge that some waste facilities could have a highly specialised role requiring a large catchment area extending beyond a planning authority's administrative boundaries.

<u>Change of use</u>

Many modern industrial units are intentionally designed to be suitable for a wide range of industrial processes and occupiers, and many are therefore suitable for the processing of waste

or recyclables with little or no requirement for modification. In most circumstances all that is required is the installation of plant and equipment.

Opportunities to use industrial units for relevant waste management development should not be missed simply because of confusion within planning authorities about application of the use classes order.

Planning-permitting interface

Overlapping interests and requirements within both the planning and permitting (pollution control) regimes leads to duplication of information requests and additional administrative burdens in the form of costs and time for both developers and competent authorities. Planning authorities should therefore refrain from duplicating the work of the Environment Agency by seeking to regulate pollution control issues through planning consent.

Residential encroachment

While ESA understands that local authorities have targets to increase housing supply, meeting housing demand should not be at the expense of other vital components of the economy.

Over recent years we note that residential encroachment of existing waste management facilities (or land designated in plans for industrial/commercial development) has become of increasing concern. The proximity of housing (as sensitive receptors) places operational constraints on existing or new waste management development.

This appears somewhat counter intuitive: householders *rely* on local waste management facilities to sort and recycle their waste, encroachment onto which would likely affect their ability to operate efficiently. While modern waste management facilities can of course co-exist with other types of development, we suggest that more sensitive development (such as housing) should be prevented from encroaching within 200 metres of existing facilities or allocated sites.

Permitted development rights

ESA welcomed changes introduced in 2015 to the General Permitted Development Order to extend permitted development rights to waste management development. While these allow minor changes to existing development – development highly likely to be otherwise approved – we note that this move has not met with universal approval among local authorities and who, in any event, still retain powers to impose planning conditions to remove permitted development rights.

ESA would be concerned if the Government's efforts to extend permitted development rights to the waste industry were subsequently undermined by planning authorities who might simply remove such rights by planning condition restrictions.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Our Members who operate landfills undertake site restoration when the landfill is due to close. These projects, largely through the Landfill Communities Fund, protect and enhance wildlife at the sites.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

As previously mentioned, modern EfW plants are built CHP-ready, however the lack of district heating networks means there is a lost opportunity to provide heat to thousands of homes and businesses.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

One of the biggest drivers of landfill diversion in the UK has been the Landfill Tax, introduced by HM Treasury in 1996 in response to the EU Landfill Directive. The tax made alternative, more environmentally-friendly approaches to waste management, such as recycling and energy recovery, more competitive. Combined with clear recycling targets and Government support in the form of PFI schemes, this measure has played a constructive role in helping the UK meet its EU recycling and landfill diversion targets, become more resource efficient, and reduce GHG emissions from landfill. Whereas 20 years ago we were sending almost all our waste to landfill, we are now recycling approximately 45% of our household waste.[6]

The current standard rate of the landfill tax is currently set at £84.40/tonne. ESA believes this is set at about the right level to continue to disincentivise landfill. The tax has in many ways been a great success, but we must acknowledge that many of the easy wins of a more circular economy have now been gained. To achieve greater levels of resource efficiency, we need a range of measures that positively support waste treatment and resource management further up the waste hierarchy.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

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6 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/496508/Digest_waste_resource_2016_v2.pdf, p.30

Barriers

We are now in a situation where, after years of progress, recycling rates are flatlining and even going backwards as latest figures show. At the same time, landfill capacity is rapidly declining at a much faster rate than alternative residual waste treatment is coming on stream. This is unsurprising when there is currently a notable absence of policy support for sustainable waste management.

Some of the historic policy support for the industry has ended or in some cases been prematurely pulled, creating an unstable climate which is deterring investment in the industry.

Waste PFI schemes enabled the delivery of new MRFs and EfW plants which allowed us to increase recycling and decrease landfill significantly, but since the closure of the scheme, it is difficult to attract finance without the long-term guarantee of feedstock. We would like to see something fills its place, such as green Industrial Building Allowances.

On top of this, LECs were removed without warning in 2015 which was a significant blow to the industry, and the ongoing review of embedded benefits by Ofgem threatens the viability of EfW and AD.

This uncertainty and lack of support has led to a situation where we are currently experiencing a waste treatment capacity gap which is threatening the industry. The rate of landfill closures is exceeding the rate at which new treatment capacity is being developed. Landfill capacity was estimated at 20 million tonnes in 2015. This is expected to almost halve by 2020 before dropping further to 6 million tonnes in 2025 and just 4 million tonnes in 2030. We estimate that by 2020, 15% of the UK's current recycling capacity will close, reducing household recycling rates by 5% and leading to the loss of eight thousand jobs.

To fill this gap, there is an increasing reliance on exports of recyclates and waste-derived fuel. This has a direct impact on the UK's productivity, and increases the overall cost of managing resources. Building the necessary merchant capacity will require fresh private investment, but this is unlikely to be brought forward in the absence of clear policy direction, all the more important with the additional uncertainties over the terms of the UK's eventual exit from the European Union.

The challenges for the UK's waste management system will only heighten as the population expands by an expected 10 million in the next 20 years and the economy grows by 2% per annum during that period. Indeed, after eight years of decline, household waste volumes are once again rising.

The Environment Agency is under-resourced and too preoccupied with flooding to provide strong regulatory oversight of the waste and recycling industry. This, coupled with low barriers to entry, undermines the case for investment in new facilities as material enters the illegal sector and is abandoned (at great cost to landowners and public authorities). Increasing costs of

regulatory compliance combined with low probability of detection for avoidance is increasing the competitive advantage of non-compliant businesses, increasing the pressure on legitimate operators.

Existing producer responsibility schemes, for packaging in particular, will not deliver compliance with higher targets. Nor will they meet new requirements in circular economy package. Existing schemes were designed to meet compliance with existing targets at least cost to obligated industry but fail to provide the certainty which would lead to investment in new recycling capacity.

To avert a crisis in the short-term, new landfills will have to be opened, the planning for which must take place now.

In the longer term, we believe that 'push' measures to increase recycling, such as the landfill tax and higher targets, have reached a point where they are no longer effective on their own. Instead, we would like to see more 'pull' measures which help stimulate a demand for recycled material to drive true circularity and attract investment.

Costs and benefits

We estimate that a private sector-led package of investment in new waste infrastructure worth £10bn, enabled by a strong policy framework, would lead to:

- The creation of 15m tonnes of new processing capacity
- Savings of between £1bn to £4bn to the public purse
- The creation of 50,000 jobs
- Potential savings equivalent to between £50 and £250 per household on council tax bills

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Energy Systems Catapult Response to the National Infrastructure Assessment Call for Evidence

Introduction

1. This response is submitted on behalf of the Energy Systems Catapult (ESC). The ESC is an independent company whose remit is to create innovation in UK energy markets and also create business opportunities. The ESC is looking at a "whole systems approach" and is responsible for the delivery of the **Smart Systems and Heat (SSH) Programme** on behalf of the Energy Technologies Institute (ETI).

2. The ESC is working with the UK government and local authorities to deliver the SSH Programme**,** determining the most effective means of decarbonising the UK's 27 million homes and contributing to the target of an 80% reduction in the UK's Greenhouse Gas emissions by 2050. The SSH Programme is developing a cost-effective area-by-area deployment approach. A modelling framework ("*EnergyPath*™ *Networks*") has been developed that allows the design of the most cost-effective energy system in a local area, including energy efficiency interventions for the homes in that area. We have worked with Newcastle City Council to develop a Local Energy Plan that seeks to reduce carbon emissions by 90% by 2050. We are also working with Bridgend County Borough Council and the Greater Manchester Authority to develop similar local energy plans. We believe that this approach can lead to a significant reduction in carbon emissions from heat in buildings.

3. Another key element of the SSH programme is the development of a Home Energy Management System (HEMS) which will allow the smart operation of domestic heating and other applications. HEMS will enable innovative new business models and allow the householder to automatically control energy usage and potentially help to balance the energy system. To realise the benefits from HEMS, new energy supply licence arrangements and consumer protection will need to be developed to allow energy service providers to offer levels of comfort rather than merely supplying kWh of energy. Digitalisation may also have a key role, with ICT enabling integration and sophisticated customer interaction through the acquisition and use of data and information. There is a need for the development of standard data protocols so that customers are not tied in to single service suppliers and the switching costs do not put up barriers to competition.

4. The ESC is also leading the Future Power System Architecture (FPSA) project in collaboration with the Institution of Engineering and Technology (IET). This project seeks to determine the functions that will be required to enable a future, low carbon, power system to operate in the face of transformative change, and hence to enable recommendations to be made that will inform policy and regulatory considerations..

5. We have answered questions in the *"Cross-cutting"* section that we feel are relevant to our area of work and expertise, and all questions in the *"Energy*" section. If you wish to

discuss the contents of this submission, please contact [name redacted] at: [email redacted].

Summary

6. Achieving the changes that are needed to decarbonise the energy system on the scale required to meet the 2050 climate change targets will be a massive task over the coming decades. If the decarbonisation programme starts in 2025, around 100,000 dwellings per year to 2050 would need to be retrofitted with low carbon measures – this is both a significant opportunity to future-proof home energy, and build new skills and businesses and also a considerable logistical challenge that is likely to cost over £300 billion (in 2015 money)[1].

7. Clear and consistent policy is critical to ensuring a supportive environment for investment in low carbon alternatives but there is considerable uncertainty in the UK energy policy environment. Decarbonisation of heating will also require close involvement of Local Authorities, who have access to much of the information, and some of the powers, required to execute local heat decarbonisation strategies more effectively, but not the resources to discharge these actions.

8. Heating buildings accounts for around 450 TWh/year of energy demand in GB[2], around half of the total demand. Most of the energy demand is for domestic space heating and is satisfied with natural gas boilers in homes throughout the country. However, residential and industrial sectors are responsible for roughly equal emissions due to industry needing higher temperature heat, which is provided by more carbon intensive fuels. Space heating resulted in the emission of approximately 100 megatonnes of carbon dioxide equivalent ($MtCO_2e$) into the atmosphere in 2008, 18% of the total carbon emissions including industry, power stations and transport. Total heat demand, including industry, contributed 182 $MtCO_2e$, bringing the total to 32%.

9. A new approach to planning and delivering local energy systems is needed if we are to meet the challenge of climate change and deliver a resilient and low carbon energy system that works for the people, communities and businesses of the UK. The UK has committed to a legally binding obligation to cut greenhouse gas emissions by 80% by 2050 (against 1990 levels). In addition, the Paris Climate Conference achieved a binding and universal agreement with the aim of keeping global warming below 2°C. Cutting carbon emissions from buildings is recognised as more cost effective compared to achieving deeper emissions reduction in other sectors such as transport. Reducing and managing energy demand from homes and buildings and transforming the UK's energy system is essential to cost effectively meeting national and local carbon reduction targets.

10. Improving energy efficiency helps increase the sustainability, resilience and affordability of the energy system and can help bring down carbon emissions and reduce fuel poverty.

[1] ESMe Forecast – Energy Technologies Institute (2015)

[2] "*Policy for Heat: Transforming the System: Future Heat Series, Part 2*" – A report by Carbon Connect (October 2015)

However, despite the legislative efforts of the *Climate Change Act (2008)* and the *Energy Act (2013)*, the UK has a relatively low installation rate of retrofit energy efficiency measures.

11. Retrofit energy efficiency in buildings is an important part of many low carbon, low fuel poverty pathways and it is an essential part of the UK's future heat and electrical infrastructure mix. Some progress has been made in recent years with energy saving in retrofits, such as developments in the skills of the UK energy efficiency workforce, the drafting of the Private Rented Sector Regulations and mortgage providers beginning to take a greater interest in energy efficiency. Some debate remains about the impact the roll-out of smart meters will have.

Detailed Response to "Cross-cutting issues" and "Energy" Questions

Cross-cutting issues:

4. What is the maximum potential for demand management[3], recognising behavioural constraints and rebound effects?

12. A report by Frontier Economics[4] indicated that there is around **6-8GW** of potential demand side response currently available in Great Britain (based on a peak demand of around 60GW): this figure[5] includes around 5GW of dispatchable, distributed generation, 1.3GW of heating and ventilation and lighting demand and 3-5GW of electric resistive and electrical appliances demand. With the potential increase in electrification of heat and transport, the Frontier report indicates that the potential for DSR by 2035 is 20-25GW (based on a peak demand of around 110GW) – this includes around 7GW of electrical storage. Of course, the potential amount of DSR will vary considerably depending on the energy solutions actually deployed. To meet the projected increase in electrical demand from millions of heat pumps and electric vehicles will require a significant upgrade of the electricity transmission and (especially) distribution networks.

13. For demand side management to play a much bigger role in future low carbon systems will require price signals to be cost reflective, consistent and expressed in consumer offerings. The GB System Operator (GBSO), procures various reserve services to maintain the security and stability of the electricity system – these offer potentially significant opportunities for the demand side. STOR (Short-Term Operating Reserve) offers Demand-Side Providers the opportunity to contract to provide aggregated demand reduction. Frequency Control by Demand Management also provides a potential income stream where demand can be automatically interrupted when the system frequency breaches the low frequency relay setting on site.

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[3] Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction.

[4] Frontier Economics: *"Future potential for DSR in Great Britain"*, October 2015.

[5] This does not include a potential 20GW of I&C back-up generation – (some of) this may be available for DSR but there is some doubt as to whether much of it is actually serviceable.

14. In future, aggregated domestic demand reduction is likely to play a significant part in balancing the electricity network – this will be bid into distribution networks at lower voltages. The arrangements for the provision of these services will need to be developed. An alternative route to market is the Balancing Mechanism, through accepted offers (for demand reduction) and bids (for demand increase) – this will be possible when advanced control and measuring technology such as that possible with Home Energy Management Systems (HEMS) are introduced. HEMS could allow automatic DSR to be provided to aggregators – this should help to mitigate the behavioural constraints and rebound effects that can occur with DSR. Rebound effects can also be reduced by increasing energy efficiency through better control of energy use, through better insulation and through installing more efficient electrical appliances. These measures will help to realise the full potential of electricity demand management.

15. We support the policy ambition for flexibility providers to be able to access revenues that reflect the true value of their flexibility through maximising access to a range of existing markets including wholesale, capacity, balancing and ancillary services plus new markets, likely to be at a distribution level.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

16. The low carbon transition raises a range of broader co-ordination issues, within and across network infrastructures which may not be capable of resolution through familiar market mechanisms. This includes handling integration and interactions with Carbon Capture and Storage (CCS), hydrogen and vehicle charging demands and infrastructure. Energy vectors are becoming increasingly interconnected, such as through gas boilers hybridised with electric heat pumps, petrol engines hybridised with batteries for vehicle motive power, multiple energy conversion assets in heat network energy centres, etc. At times of electrical system stress, it should be possible to switch gas/electricity hybrid heat pumps to operate on gas, thus creating electrical demand reduction.

17. For energy networks[6], it is essential that there is a clear, long term and flexible framework that encourages performance competition, enables sensible levels of investment ahead of need and that when new assets are installed they are future-proof. Lower costs and cost of capital will be achieved within a framework that offers clarity on desired outcomes, a long-term perspective and a sound legal basis, including grandfathering principles.

18. In the longer-term, energy vectors will become increasingly interconnected, such as through gas boilers hybridised with electric heat pumps, petrol engines hybridised with batteries for vehicle motive power, multiple energy conversion assets in heat network

[6] The important role of networks was highlighted by the European Commission which estimated that, of the €1 trillion investment needed in the EU energy system to 2020, €600 million would be for networks, with two-thirds of this in distribution.

energy centres, etc. At times of electrical system stress, it should be possible to switch gas/electricity hybrid heat pumps to operate on gas for short periods, thus creating electrical demand reduction. Without hybrid solutions, the demand for electricity will become both larger and more volatile

19. The regulatory regime and statutory frameworks that currently apply to other utility networks should be extended to cover heat networks to support developers and operators to facilitate access to lower costs of capital, and therefore lower costs for customers, as well as to protect consumers and investors. It would appear logical to extend the remit of the existing regulator for gas and electricity to cover this, rather than to create a separate body.

20. The flexibility offered by energy storage can have a positive impact and can potentially reduce a network operator's costs by offsetting the need to reinforce the network. However, there is an element of risk in relying on both energy storage and Demand Side Response (DSR) in that the expected kWh of energy increase or demand reduction may not turn up. It seems appropriate that flexibility should be rewarded with lower connection and use of system charges where it reduces network and system balancing costs but non-delivery penalties will need to apply. We believe that to deliver the full benefits of flexibility, price signals will need to develop to reflect the value to our energy system of smart technologies and processes

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

21. Jones Lang Lasalle[7] (JLL) carried out a study of the planning regulations in Great Britain. The study showed that the position in terms of detailed planning policy and guidance is further developed and more detailed in England and Scotland compared to Wales. The overall conclusion reached was that the planning policy position whilst referenced in documents such as the National Planning Policy Framework (NPPF) and the more recent Planning Practice Guide (PPG - 2014) and in the Scottish Planning Policy (SPP), could be strengthened to enable wider deployment of low carbon energy schemes across the UK.

22. The UK Government has encouraged Local Planning Authorities (LPAs) to adopt Local Development Orders (LDOs) in order to lower the barriers to development and growth. The National Planning Policy Framework (NPPF) in England recognises that the planning system has an important role in encouraging sustainable growth and specifically encourages a proactive approach to meet development needs of business and reduce the burden of planning requirements. It suggests consideration should be given to LDOs in order to "*relax planning controls for particular areas or categories of development, where the impacts would be acceptable, and in particular where this would promote economic, social and environmental gains for the area, such as boosting enterprise*".

[7] JLL: *"Planning Policy and Consenting Strategy: Review and Recommendations – Volume 2"*, August 2014.

23. LDOs have been used to grant planning permission for a heat network, including pipes, heat exchange equipment, street furniture, informational signage and ancillary engineering works. An example of this is the London Borough of Newham: the Council approved their District Heating Network LDO in March 2013 covering the Royal Docks[8], Beckton and Canning Town. This LDO took circa 18 months to prepare following the commissioning of an initial Heat Mapping Study in November 2011 and grants planning permission for minor works associated with implementing the Newham Heat Network.

24. The intention of the LDO was to promote the development of decentralised energy in Newham. The District Heating LDO granted planning permission for *"a heat network including pipes, heat exchange equipment, street furniture, informational signage and ancillary engineering works along the length of the route*". The LDO did however exclude any thermal energy generating plant or equipment and any development in listed buildings. **The ESC believes that the use of LDOs should be extended to facilitate the installation of Heat Networks (including pipes, heat exchange equipment, street furniture, informational signage and ancillary engineering works).**

25. We consider that there is also an opportunity for statutory Development Plans to identify parts of urban areas/settlements suitable for decentralised energy and related infrastructure and this could be considered in the form of zonings or *"heat network/smart system opportunity areas"*. The use of heat mapping could provide an evidential basis for such zonings, underpinning plan allocations/policies. Consideration should also be given to policy to support requirements in planning obligations to facilitate on-site deployment of district heating/smart system infrastructure.

26. The SSH Programme is developing a cost-effective area-by-area deployment approach. A modelling framework ("*EnergyPath*™ *Networks*" (EPN)) has been developed that allows the design of the most cost-effective energy system in a local area, including energy efficiency interventions for the homes in that area. The ESC is working with local authorities in Newcastle, Bridgend and Greater Manchester to develop Local Energy Plans using the EPN modelling framework. We believe that coordinated local energy plans can lead to a significant reduction in carbon emissions from heat in buildings, and that local authorities, working with commercial partners, are best-paced to take on responsibility for local area strategic planning. This will lead to a structured, coordinated approach to energy planning rather a patchwork delivery of unconnected and potentially incompatible and inefficient energy projects.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

27. To meet the UK's target of an 80% reduction in the UK's Greenhouse Gas emissions by 2050, will require the decarbonisation of domestic heating. The Smart Systems and Heat Programme was set up in 2013 to plan the decarbonisation of the UK's 27 million existing homes and small businesses. The ESC is working with the UK government and local

[8] The LDO was part of the streamlined planning process for the Royal Docks Enterprise Zone.

authorities to deliver the SSH Programme on behalf of the Energy Technologies Institute (ETI). Much of the UK's current housing stock has low thermal efficiency. With increasing fuel prices the costs for many people of keeping warm in their homes is becoming unsustainable. Changes will be required to improve the thermal efficiency of buildings and to replace fossil-fuel fired boilers with alternative, lower carbon heat sources such as heat networks and heat pumps. Due to the diverse nature of the current building stock and the people who live in it, there are many different options which could be chosen as part of a local area energy strategy.

28. Modelling by the ETI, using its ESMe model, indicates that the move to a decarbonised heating solution needs to start around the mid-2030s with the replacement of gas boilers with electric resistive heating and heat pumps and low-carbon district heating schemes. This needs to gather pace in the 2040's with the phasing out of gas-fired heating to decarbonise space and water heating. The re-purposing of the gas transmission network to use more biogas or hydrogen is also being investigated, although both of these alternatives give rise to problems: little or no reduction in CO_2 if burning biogas and safety and production issues if using hydrogen.

29. Achieving the changes that are needed to decarbonise the energy system on the scale required to meet the 2050 climate change targets will be a massive task over the coming decades. If the decarbonisation programme starts in 2025, around 100,000 dwellings per year to 2050 would need to be retrofitted with low carbon measures – this is a considerable logistical challenge and is likely to cost over £300 billion (in 2015 money)[9]. Consistent energy policy is key to building the confidence investors need to finance this transition. In short, a policy framework is required to deliver the most efficient system that meets consumer needs at a society level, with provisions made for the fuel poor.

30. Local authorities, driven by statutory requirements, and a desire to deliver socio-economic benefits associated with energy related schemes, are increasingly involved in local energy planning. The problem they face is how to decide which options are most appropriate for their local area and in what order they should be prioritised. The ESC believes that this can be best achieved through local strategic energy system planning[10], building coherent transition plans that meet government targets, rather than just opportunistic projects. As mentioned above, the SSH Programme is developing a cost-effective area-by-area deployment approach. This approach, using the EPN modelling framework, could potentially allow any local area in the UK to design the most cost-effective local energy system, including energy efficiency interventions for the homes in that area.

31. The EPN modelling framework is designed to allow modification of the input data to reflect local opportunities, needs and constraints and to allow assessment of different future scenarios. Use of the framework in a strategic energy network planning activity is intended to result in a strategy for a local authority to use to transform its current energy infrastructure to a future design which meets local requirements. EPN will integrate and

[9] ESMe Forecast – Energy Technologies Institute (2015)

[10] The ESC is currently working with three local authorities: Newcastle City Council, Bridgend County Borough Council and Greater Manchester Authority to develop local area strategies using the ESC's EnergyPath Networks Model.

help prioritise: building fabric insulation; heat conversion at the network and building level; heat storage at the network and building level; gas, electricity, heat and other distribution network installation, upgrade, maintenance or decommissioning.

32. The introduction of heat networks, especially those using heat from ambient sources such as from electricity generating stations and industrial processes, could play an important part in meeting local energy needs and achieving decarbonisation targets.

33. Digitalisation may also have a key role, with ICT enabling integration and sophisticated customer interaction through the acquisition and use of data and information. An important emerging technology is the Home Energy Management System as exemplified by the *Home Energy Services Gateway (*HESG) – this is currently being developed by the Energy Technologies Institute in conjunction with the ESC and is being trialled in around 30 homes. This will enable innovative new business models and allow the householder to automatically control energy usage and potentially help to balance the energy system.

34. The Renewable Heat Incentive offers some incentive to consumers to switch to low carbon heating systems but analysis by Frontier Economics and the ETI[11] found that financial incentives should in general be delivered through upfront rather than ongoing payments, given consumers' tendency to focus on upfront rather than lifetime costs and benefits. Consumers focus on near term costs and benefits in their decision making, while businesses face limits to the extent they can spread costs for consumers[12]. So, the introduction of competitive loans to consumers, either through central or local government or through private companies, would likely improve the uptake of low carbon heating solutions

35. Policy mechanisms to-date have largely incentivised specific technologies. However, technology-specific subsidies drive technology-specific applications and the ESC believes it would be better to support innovation separately, rather than focus on specific technologies. Policy frameworks therefore need to bring forward the right investment at a reasonable cost of capital (the '*investment phase*'), enable efficient operation of networks (the '*operational phase*'), and support retail markets that empower consumer choice and involvement.

36. Setting carbon targets would be an effective means of incentivising low carbon interventions. There is currently no *System Integrator* role in the Home Heat Market, and hence no effective co-ordination of CO_2 emissions reductions. One option would be to place an obligation on Energy Suppliers/Energy Service Providers (ESP) to reduce CO_2 emissions in domestic properties, similar to that placed on car manufacturers to reduce CO_2 emissions in cars. This could be achieved by applying a **Carbon Intensity Threshold (CIT)** which would be an average gCO_2/kWh target for the ESP's domestic supply portfolio. The target would be set at a level that would incentivise the ESP to introduce a number of low-carbon interventions across its portfolio.

[11] Frontier Economics, "*Overcoming barriers to smarter heat solutions in UK homes – A report prepared for the ETI*", April 2015.
[12] This is because investments in these interventions are largely sunk and therefore spreading costs is akin to offering an unsecured loan.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

37. The ETI has modelled extensively the future UK energy sector using its ESMe model. This has indicated that the future power sector will need to start decarbonising from the 2030's. Unabated fossil-fuelled generation (mainly from gas as coal-fired power stations are due to be phased out by 2025) will start to be replaced by nuclear, renewables and gas-fired generation with combined capture an storage (CCS) in the 2030s. By 2050, the ETI expects that the UK power sector will be decarbonised. The UK seems well-placed to benefit from CCS, with relatively good access to depleted offshore gas and oil fields. The development of CCS could allow the UK to use existing and new (fracking) gas resources to complement renewable and nuclear generation and improve security and stability of supply.

38. The UK energy markets are unable to deliver against low carbon policy objectives due to a number of factors, including: policy uncertainty and sub-optimal policy interventions, the structure of the markets, and consumer inertia. Another key factor is that energy prices so far fail to internalise the carbon externality. All these factors impact on decisions made in investment, in the operation of assets and in consumer choices.

39. Behaviour change will be crucial in enabling the UK to meet its emissions reductions targets. The UK government and independent bodies such as the Committee on Climate Change (CCC) need to build the case that a low carbon future will need to be different, and that it's impossible to deliver unless there's enough support for nuclear, CCS, offshore wind, energy efficiency and low-carbon heating. Rather than trying to convince people to change how they live e.g. use less heat, travel less, etc, the focus should be on encouraging and enabling people to make different key decisions, and later, on improving the outcome. For instance, with transport, consumers should be encouraged to buy a plug-in hybrid vehicle; or with heating, switching to lower carbon heat sources when they replace their boiler and upgrading the thermal insulation of their home when they improve it.

40. In the longer-term, energy vectors will become increasingly interconnected, such as through gas boilers hybridised with electric heat pumps, petrol engines hybridised with batteries for vehicle motive power, multiple energy conversion assets in heat network energy centres, etc. At times of electrical system stress, it should be possible to switch gas/electricity hybrid heat pumps to operate on gas for short periods, thus creating electrical demand reduction. Without hybrid solutions, the demand for electricity will become both larger and more volatile

41. There are inherent problems in relying on pure market signals to deliver security of supply in electricity: price spikes attract regulatory and political risk, and wholesale prices are insufficient to reward investment in additional capacity. Therefore, separate mechanisms such as a capacity market may be required to stimulate investment in new electricity power stations.

42. Investors in infrastructure face inherent 'time inconsistency' risks associated with recovering investments once costs have been sunk. This makes investment in energy networks inherently subject to policy risk, particularly for new network infrastructures. An example of this is a developer of a heat network who currently faces a significant risk of stranded, underused and underfinanced assets.

43. The low carbon transition raises a range of broader co-ordination issues, within and across network infrastructures which may not be capable of resolution through familiar market mechanisms. This includes handling integration and interactions with CCS, hydrogen and vehicle charging demands and infrastructure.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

44. The projected increase in low carbon vehicles ("EV"), coupled with the electrification of heat, will require a significant upgrade to the electricity transmission and distribution networks. It is assumed that much of the increased electricity required will generated at the distribution level, coupled with grid-connected electricity storage. A major barrier will be providing an affordable charging infrastructure for households, especially those without access to off-street parking. In addition, new monitoring and control facilities will be needed by the network operator. Managed EV charging could also be used to provide other benefits to the system. For example, EV chargers could be made frequency sensitive and provide frequency response, thus reducing the need for this to be purchased from generators. Alternatively, EVs could be used to boost demand at times of surplus low carbon generation on the system. To achieve these system benefits, the customer must be appropriately remunerated.

45. To engage EV users, it will be important to recognise and manage the tensions between what the customer wants (e.g. high vehicle range and rapid charging) with what suits the electricity system (low charging currents and avoiding the peak). Failing to balance these issues could lead to a need to limit deployment of EV on the one hand, or huge expenditure for relatively modest carbon savings on the other, if we build a fleet of gas fired generation to allow charging of EVs at the time of peak demand.

46. In the long-term, customers could opt out by agreeing to pay for the necessary network upgrading costs. However, it may not be appropriate to allow customers to opt out in the short term as this will increase the impact on other customers and/or prevent the network operator from being able to manage the load on their network. Rules would need to be agreed to ensure fairness. For example, if the EV charging load cannot be met in full, should all customers be scaled back equally, or would a cap on the maximum level of charge need to be introduced? It may be appropriate to socialise (most of) the costs of upgrading the network to cater for EV users. Advance-warning of network problems would allow users to plan and arrange to car-share, use public transport, fuel a Plug-In Hybrid etc.

Full List of Cross-cutting and Energy Questions

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

Energy

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Essex County Council response to National Infrastructure Assessment Call for Evidence. Response sent by [name redacted][email redacted][telephone redacted][approver names redacted].

Essex County Council Response to a Call for Evidence

National Infrastructure Assessment

10 February 2016

Contact: Tel:

Approved:

Introduction

The delivery of infrastructure is fundamental to our ambitions for economic growth and building new homes. ONS Population projections forecast a population increase of 298,700 people (an increase of 17%) in Essex county council with Southend and Thurrock. These Greater Essex authorities are required to accommodate housing and economic growth over the 20 year period to 2036 delivering on average nearly 9,000 dwellings per year, or 180,000 dwellings over the 20 year period. This compares to average annual completions of 4,630 dwellings per year across Essex from 2004 to 2015. With existing infrastructure under pressure, we need to see change for this

Costs

Our growth and infrastructure framework estimates the delivering of the necessary infrastructure to support that growth from now to 2036 is **estimated to cost at least £10.4 billion** in 2016 terms. This represents an estimate of capital delivery costs only and does not include the additional annual revenue requirements and maintenance costs in Greater Essex. Reviewing the potential capital costs of delivery alongside currently identified secured funding, potential funding from public, private and developer contributions highlights a **remaining funding gap estimate of over £4.4 billion** at 2016 prices to 2036.

In particular the growth in journeys by road and rail has not been matched by sufficient government investment to enhance the network. The framework has identified that major transport projects need to secure £26.5 billion (regional) and £5.5 billion (cross-boundary) funding. These projects currently have a funding gap of around £11 billion.

Social infrastructure

Population growth on the scale required in greater Essex over the next 20 years will require additional social as well as physical infrastructure. National infrastructure planning needs to consider the assets required to deliver public services. Over 20 years greater Essex will need an additional 140 primary school classes and 130 secondary classes costing over £1bn; of those 53 primary and 70 secondary classes are needed by 2020. AECOM estimate in the GIF that 94,000 square metres of additional acute bed space is needed over the same period.

Utility provision

We have a detailed evidence base of in the GIF setting out the risks to utility provision in support of housing growth in greater Essex over the next 20 years, with water stress on the list of concerns, which we can share with the Commission.

There is the potential to change policy to improve the forward delivery of utilities for housing growth. Regulated utilities cannot forward fund infrastructure investment, in order to reduce charges to current users. As a result new utilities provision (gas, water and electricity) is tied to planning permissions for individual sites, with the costs put onto developers / land owners at the point of development. Negotiations can take time and add development risk for house builders. Where a final permission tips a local system over capacity, that developer is asked to foot the new infrastructure.

Government plans to give additional weight to the delivery of Local Plans, as set out in the Housing White Paper. With this additional certainty of delivery, utilities should be allowed to forward fund infrastructure for reasonably sized sites within Local Plans. This should help to provide a 'serviced plot' model of development, increasing certainty for developers and increasing the pace of house building. Utilities companies should be able to recoup some costs when service plots are sold / developed.

Broadband is now a core utility for homes and businesses. Government should set a national policy requiring the installation of superfast broadband as part of the requirements for new housing developments, with the ability to ratchet up the speed of connection mandated as technology improves.

Transport

Essex County Council is the Highways and Transportation Authority for the administrative county of Essex. Essex has a population of 1.4 million people and supports 766,000 jobs, it is home to over 73,500 businesses and generates over £30bn per year for the UK economy. The transport network is key to the prosperity and vitality of Essex, connecting the rapidly growing urban centres of Chelmsford, Colchester, Braintree, Harlow and Basildon with London and the rest of Great Britain. The rail network also provides essential access to the Thames and Haven Ports, and Stansted and Southend Airports. An efficient and effective rail network is therefore essential to Essex and the UK as a whole.

The Essex Local transport Plan states that *"Our Vision is for a transport system that supports sustainable economic growth and helps deliver the best quality of life for the residents of Essex."*

Investment in our transport networks is essential to ensure the efficient and effective movement of people and goods improving the lives of drivers, passengers and other transport users; to boost economic growth; to enable people to live independently; to help create great places to live, work and visit.

To better understand where more strategic interventions are necessary, all of the local authorities in Essex have cooperated in the preparation of a Growth and Infrastructure Framework (GIF). The framework presents an overview of growth patterns to 2036, evidences the infrastructure required, and estimates likely costs and funding gaps

Essex identifies four strategic transport corridors as the key priorities for future growth and investment. Three corridors radiate out of London with the fourth providing connectivity to the north and west;

- M11 corridor including the West Anglia mainline,
- the A12 corridor including the Great Eastern mainline,
- the A13/A127 corridor and parallel Essex Thameside rail line.
- the Essex economy is also dependent upon a fourth corridor providing connectivity between Essex to the rest of Britain via the A120/A14 and parallel rail routes.

The analysis in the GIF estimates that regional transport costs will be £26.6bn over the next 20 years, with a funding gap of £9.2bn. The sub-regional and local transport costs over the same period will be £5.5bn with a funding gap of £1.7bn

Road

The road network is under pressure, and needs to see investment, as well as modal shift. Census analysis identifies that current commuting patterns place a significant pressure on the road and rail network across Essex, Southend and Thurrock. Opportunity exists to increase walking, cycling and public transport trips, particularly in the major urban settlements and a package of measures that encourages modal shift to local walking, cycling and public transport is essential if the level of housing growth identified is to be delivered without significant detrimental impact on an already congested transport network. However, the need for investment in new infrastructure remains.

The section of the M25 that runs through Greater Essex is dominated by the Dartford river crossing where peak time queuing is commonplace, especially on the Dartford southern approach. ECC strongly agrees with the proposal for a new Lower Thames Crossing:

- The economic benefits of a new crossing are significant with significant potential for regeneration and job creation. A study undertaken by KPMG in 2010 calculated that a new crossing at Location C could contribute £12.7 billion to the local economy.
- The provision of a faster, more reliable route to the Midlands and North from the Channel ports will be particularly attractive to long-distance freight traffic and will have the benefit of diverting many of these journeys away from Dartford.
- The provision of an independent crossing built to modern standards and suitable for all users will not only radically improve the resilience of crossing the Lower Thames but also the resilience of the strategic road network (SRN) between Kent, the Midlands/North and mainland Europe.
- The Highways England consultation documents and other studies have shown that during incidents at Dartford, traffic diverts to other crossings (notably the Blackwall Tunnel) or the

long way around the M25. Providing a suitable alternative crossing point, has the dual benefit of releasing capacity at Dartford and elsewhere on the strategic road network.

In the west of Essex the M11 provides a strategic north-south road link between London and the M25 in the south and Cambridge and the A14 in the north. The M11 carries a large volume of freight movements. Journey times on the M11, particularly north of London Stansted Airport, where the road becomes two-lanes in each direction. While the new junction at Harlow (Junction 7a) will support growth around this area, Junctions 7 and 8 currently suffer from peak time congestion which constrains growth. The level of growth anticipated at London Stansted Airport and neighbouring growth on the A120 corridor (Junction 8) and around Harlow (Junction 7) will require improvements to be made. The M11 also suffers from peak time congestion towards London and the A406 North Circular.

The A12 provides a key spine road linking London and the M25 with Chelmsford, Colchester, Ipswich, and the A14 for the port of Felixstowe. This is a major container freight corridor connecting London and the M25 to the south and the Ports of Harwich and Felixstowe to the north. The corridor suffers from peak time congestion around the key urban settlements (Brentwood, Chelmsford, Witham and Colchester) with congestion at junctions particularly around Chelmsford and Colchester an acute problem. Journey reliability poses a major issue on the A12 with limited alternative routes meaning that when delays occur these can be severe and have knock on effects for neighbouring routes. With the A12 being at capacity some traffic diverts through the Chelmsford, exacerbating problems for residents, and commuters, and worsening air quality in the urban area.

In the south of Essex the A13 and A127 provide strategic highway access to Thurrock, Basildon, Southend, London Gateway Port and London Southend Airport. Both the A13 and A127 suffer from significant levels of congestion and the A127 in particular features a substandard layout for the volume and type of traffic that it carries. As a result substantial improvements and significant investment is required to increase capacity to facilitate growth. The A13 carries a significant volume of strategic traffic with its national importance growing with the development of London Gateway Port. The A130 provides the strategic access between the A12 at Chelmsford and the south Essex, connecting to the A127 and A13. Improvements are required to relieve bottlenecks, particularly where the A130 meets the A127 at Fairglen and A12 at Howe Green.

Working with Southend, ECC has developed the A127 Corridor for Growth Strategy (click on blue underlined text for hyperlinks) and has embarked on the development of a similar investment plan for the A13.

North of Chelmsford access towards Braintree and London Stansted Airport is provided via the A130/A131. Delivery of a north east bypass for Chelmsford is needed to support growth around Chelmsford and Braintree and to improve strategic north-south access to London Stansted Airport.

The A120 provides an east-west strategic connection across the north of Essex. The central section between Braintree and the A12 suffers significant congestion. A scheme to upgrade this corridor to dual carriageway is required if growth in the north of Essex is to be realised. In particular, congestion around Braintree at Galley's Corner and Marks Farm constrains growth. The final section of the A120

between Colchester and Harwich provides an important connection to/from the Port of Harwich and will need to be enhanced if the Port is to grow as anticipated.

Route options for the A120 are currently the subject of a public consultation.

Essex County Council participated in the development of the Rees Jeffreys Road Fund report on *A Major Road Network for England* published in in October 2016,

This report identifies 3,800 miles of local authority-controlled 'A' roads, which, alongside the strategic road network, forms an 8,000 mile Major Road Network (MRN): 4% of the English road network but carrying 43% of traffic. The report seeks new ways to plan, manage and fund this network that is so essential to the National economy and for the delivery of local growth. It is investment in this wider network that is needed to support growth across Essex.

Essex's priorities for road investment are -

- Lower Thames Crossing
- M25 junctions 30/31 long term improvements
- M25 junction 28 improvements
- M11 Peak Time HGV over-taking restriction and technology upgrades
- M11 junction 7 improvements
- M11 junction 8 short and longer-term improvements
- M11 J7a and link to Gilden Way, Harlow
- A14 Cambridge to Huntingdon Improvement Scheme
- A12 Whole route technology upgrade
- A12 widening – Chelmsford to A120
- A12 widening – M25 to Chelmsford
- A12 widening – Colchester Bypass
- A127 Corridor for Growth Route Based strategy improvements
- A127/A130 Fairglen Interchange
- Widening of A13 between A128 and A1014
- A13 Route Based strategy improvements
- A120 Braintree to A12 improvements
- A120 Hare Green to Harwich Improvements
- A120 Millennium Way Slips (Braintree)
- Chelmsford North East By-pass

Rail

Passenger numbers in Essex are at all-time record levels and the rail network is already at or close to capacity, with further substantial growth expected to follow the provision of significant numbers of new homes and jobs across Essex. For example Network Rail's South and East Market Study identifies passenger growth in Essex of up to 75% by the 2040s.

It is also important that investment plans address the needs of freight transport. The Essex rail network includes nationally important freight routes particularly for intermodal port traffic from the Port of Felixstowe and London Gateway. The forecast growth in Network Rail Freight Market Study over the next 30 years is dramatic, essentially doubling each ten years and it is essential that both

passenger and freight growth can be accommodated. ECC responded to the National Infrastructure Commission Studies – call for ideas with a proposal "Delivering the Freight and Logistic Capability for the East of England" noting that the means of transporting goods is at risk of under-investment through a fragmented approach across the public and private sector.

ECC played a key role in the development of the *Rail Prospectus for East Anglia*; authored and supported by a strong cross-party and multi-agency alliance of MPs, county councils, Local Enterprise Partnerships, other local authorities, businesses and rail user groups across the four counties of Essex, Cambridgeshire, Norfolk and Suffolk. The Prospectus put forward the case for a realistic and technically feasible 20 year programme of improvements which will help create thousands of jobs and unlock billions of pounds of growth for the UK economy. Essex is also an active contributor to the Great Eastern Mainline Taskforce and the West Anglia Taskforce established to further the case for investment in these two key rail corridors.

In our recent response to the *Office of Rail and Road (ORR) PR18 consultation - Draft guidance on Network Rail's strategic business plans* ECC stated that Network Rail should prioritise projects that:

- provide users of the network with an improved service,
- support local growth,
- increase patronage (both passenger and freight), and
- generate income.

Key projects currently planned in and around Essex such as the 4-tracking of the West Anglia mainline as a precursor to the introduction of Crossrail 2, and capacity enhancements on the Great Eastern mainline such as Bow Junction re-configuring and the provision of passing loops between Shenfield and Colchester meet all four of these criteria and are essential for the future prosperity of Essex.

Based upon these criteria Essex's priorities for rail investment are:

- Bow junction realignment, this project was planned for delivery in CP5 and should be a priority for CP6 to maximise the benefits associated with the introduction of Crossrail.
- Improvements at Liverpool St Station ensuring that all platforms can accommodate the new 240m trains.
- Local line speed improvements on the West Anglia mainline and Great Eastern mainline to reduce journey times for all passenger and to maximise the benefits associated with the introduction of the new train fleet.
- 4-tracking along the Lea Valley as a precursor to the introduction of Crossrail 2 along the West Anglia mainline. ECC believes that there is an opportunity to commence works in CP6.
- Working with local partners to ensure the timely delivery of Beaulieu Park station to ease crowding at Chelmsford station.
- Capacity increases on the Great Eastern mainline between Shenfield and Colchester – passing loops north of Witham.
- Infrastructure improvements necessary to deliver two trains per hour on the Braintree branch line.
- Capacity increases serving Stansted Airport including doubling of the access tunnel.
- Longer term capacity increases at Liverpool St to accommodate long term growth predictions.
- Longer term freight capacity enhancements.

- The introduction of the “digital railway”, ECC believes that there is scope for early introduction in Essex to prove the effectiveness of the concept.

Airports

Greater Essex features two international airports with London Stansted Airport in the north west and London Southend Airport in the south east.

London Stansted Airport enjoys a dominant position as one of the UK’s major hub airports serving mainly the low cost and package holiday markets and benefits from large demand for freight. The airport facilitates significant inward investment to Greater Essex. Demand at London Stansted Airport is growing fast with considerable employment growth of up to 10,000 jobs forecast by the 2030s.

Essex County Council supports the expansion of Stansted Airport within is current single runway capacity. However, a package of surface access improvements will be required if the airport is to continue to grow at the current rate. In particular rail journey times to London, rail access to elsewhere in Britain, and M11 Junction 8 represent ~~two~~ major constraints to growth.

London Southend Airport provides access to a range of European destinations and recent improvements have included a dedicated railway station but access remains constrained by the operation of the A127.

Ports

Three major container ports are located on the periphery of Essex; the Haven Ports (Felixstowe and Harwich), London Gateway and the Port of Tilbury. At Harwich passenger services are also provided by Stena Line offering a strategic freight and passenger link to wider Europe.

These ports all generate significant volume of road and rail freight movements that are felt across the strategic road and rail networks. The ports are major employment hubs and are a focus for downstream supply chain and logistics jobs. All three ports are expanding and infrastructure requirement outlined above is necessary to support this growth. Growth at London Gateway is constrained by rail freight having to route via London to access the wider network. A long term solution will be required to prevent the Port having to rely on road based transport.

Ends

ETI submission to National Infrastructure Assessment (call for evidence by the National Infrastructure Commission)

Overview

- The UK will need to transform its energy infrastructure over the next 30 years – as part of the transition to a modern, cost effective, low carbon energy system.
- Making the right strategic choices in our energy mix (and therefore associated transmission and distribution network infrastructures) will deliver large economic gains and enhance long-term productivity
    - ETI analysis and evidence estimates benefits of good decision making in the energy transition over the next 3 decades worth around 1% of GDP or more
- In terms of energy network infrastructure the UK needs to invest to:
    - adapt and enhance existing networks,
    - create efficient and effective new networks where appropriate
    - and to integrate different networks so that they can operate and interact efficiently in real time across different energy vectors (gas, electricity, heat or hydrogen)
- To guide and shape an efficient set of investments, the UK needs to develop a more coherent policy and governance environment for investment decisions in energy infrastructure, with more consistent and reliable price signals, stable policy and strategic governance.
- The UK needs to build the capability to deploy a balanced portfolio of energy technologies, as it approaches the challenge of transitioning energy infrastructure.
- Whole system analysis points to the particular value of bioenergy and carbon capture and storage (CCS), as enablers of a range of flexible and versatile forms of low carbon energy. The government should give particular focus to enabling the development of these two technologies over the next decade, since their development and availability will profoundly influence the shape of investments required in long life energy infrastructures (e.g. pipe and wire networks, various forms of energy generation, conversion and storage).

Overview of broad shape of optimum pathway for UK energy system development to 2030 and on to 2050 (based on current evidence & analysis)

ETI's widely supported national energy system analysis provides a strong evidence base for understanding the necessary portfolio of low carbon options which would support a pragmatic, deliverable and cost-effective system transition to 2030 and then on to 2050. The activity needed in the next decade is strongly influenced by the optimum shape of the long-term 2050 goal. Below are ETI's 'realistic optimum' views on the overall 2050 energy system shape.

Overview of a 'realistic optimum' 2050 energy system

System element	Most promising 2050 technology portfolio (from current analysis of options, costs, performance and deployment characteristics)
Electricity	A balanced portfolio based primarily on : • nuclear (large units and, potentially, small modular reactors) • CCS (mainly gas or biomass) • wind (on and offshore) • further inter-connectors Hydrogen turbines - can offer vital flexibility in the medium term (with hydrogen storage providing large-scale energy storage). Other renewables - likely to play supporting or niche roles in the portfolio. Continued progress with energy efficiency and smart systems and controls to contain the need for further costly generation capacity, despite increased electrification of heat and transport demands (particularly from 2030 onwards).
Heat	A mixture of technologies including: • electrification of heating (including heat pumps and smart controls) - particularly in lower density housing • local area heat networks in suitable urban and suburban settings - although initially these may be supplied by gas CHP they will ultimately need low carbon sources, such as marine heat pumps, waste heat from industry or power, biomass or geothermal • potentially, hydrogen (using gas distribution networks) and biomass boilers in suitable locations Gas could still have an important, but more limited role, to meet peak heat demands. Building fabric upgrades are also likely to play an important, but again limited, role.
Transport	Progressive electrification of light transport (particularly plug in hybrids), improved efficiency in conventional vehicles (both light and heavy duty), and potentially some hydrogen fueled options for back to base vehicles (to limit infrastructure). Conventional fuels could still play an important role in plug-in hybrids and HDVs, particularly if biomass with CCS provides negative emissions (and therefore headroom for continued emissions from more difficult to decarbonise sectors).
Industry	Significant but declining reliance on fossil fuels, but with an increasing role for CCS, biomass and hydrogen (produced with CCS).

System flexibility and optionality	Hydrogen produced through advanced gasification and stored at scale in salt caverns to provide critical energy storage and flexibility across electricity, heat, transport and industrial demands. Gasification of sustainable biomass with CCS can also deliver negative emissions and create options to avoid high costs technologies that would otherwise be needed for parts of heat and transport demand.

Other actions required to enable investment in a future UK energy system

The UK should focus public sector innovation spend over the next decade on the technologies and value chains that can demonstrate the potential to play a large scale, significant and cost effective role in the UK's transition to low carbon energy over the period to 2050.

Many of these are not single technologies but integrated value chains composed of individually quite mature technologies but combined in new ways and at increasing scale. Incentivising commercialisation requires progress needs to be made across the entire value chain and risk management demonstrated for multiple actors in that value chain. Persuading highly conservative investors (such as those who have historically supported energy projects) to support such developments is essentially impractical without clear policy direction from Government. Key areas for potential action are highlighted below.

Bioenergy (agricultural practices and advanced gasification)

Domestic bioenergy, including short rotation forestry, requires support to increase the rate of plantings of 2nd generation crops to about 30,000 hectares a year (approx. 1.7% of total agricultural land after 10 years[1]), primarily on marginal, poor performing arable land and appropriate grasslands. Pre-processing and conversion technologies, notably advanced gasification, can unlock the potential flexibility for bioenergy and waste to be converted to power, heat, hydrogen, synthetic natural gas or liquid transport fuels at the local town level, key to optimising the overall emissions savings including those from transport logistics. ETI have articulated the technical and economic case for domestic bioenergy crop production with a number of case studies on real farm sites showing there can be positive benefits cases for transitioning some existing arable and livestock farm operations to biomass production[2].

This potential needs building into industrial strategy considerations across the relevant departments (principally BEIS and DEFRA).

Bioenergy with CCS (BECCS)

Support is needed over the next 5-10 years to demonstrate and commercialise BECCS technology and the wider biomass and CO2 storage supply chain in the UK

Numerous bioenergy value chains can deliver significant carbon savings and sizeable negative emissions when using BECCS.

[1] Utilised Agricultural Area in 2015 was 17,147,199 ha according to Defra (2016) Area of Crops Grown for Bioenergy in England and the UK: 2008-2015, https://www.gov.uk/government/statistics/area-of-crops-grown-for-bioenergy-in-england-and-the-uk-2008-2015

[2] Bioenergy crops in the UK : case studies of successful whole farm integration http://www.eti.co.uk/library/bioenergy-crops-in-the-uk-case-studies-on-successful-whole-farm-integration-evidence-pack

A feedstock planting rate of 30,000 hectares p.a., combined with moderate imports, is sufficient to keep the UK on the trajectory for meeting 2050s bioenergy and negative emissions targets.

With changes to farming practices to improve productivity of land use (in line with those achieved by European rivals) and reductions in food waste throughout the supply chain, there could be sufficient spare land in the UK agricultural system to meet this without impacting existing levels of food security.

There are suitable combinations of feedstocks, pre-processing, conversion and carbon capture technologies which can deliver the target levels of carbon savings.

Greatest emissions savings are when bioenergy is used with CCS. Biomass and waste are then best used through conversion technologies which result in power (electricity) or hydrogen.

The UK has sufficient CO_2 storage. UK storage for >10GW of power generation and industrial CO2 sources have been identified and well-qualified (1.5GTe of CO2 storage capacity).

The major components of a BECCS system have largely been derisked individually but it remains for them to be put together at scale. Japan is moving ahead with the world's first power plant capable of capturing carbon from biomass, and therefore the first to deliver 'negative emissions'. ETI has developed an evidence base which shows positive answers on the key UK questions around Bioenergy and BECCS[3].

BECCS needs to be incorporated into the Government's decarbonisation and CCS strategies. The successful deployment of BECCS would have a dramatic impact on the shape of the UK's energy infrastructure needs required to meet 2050 carbon targets.

Offshore Wind (and Tidal stream)

Offshore Wind is successfully being deployed, with the support of subsidies, and costs are falling. Further cost reductions are possible by moving into stronger wind areas which, for the UK, are generally in deeper waters and require step changes in the technology being deployed. Marine tidal stream energy, whilst less mature, has also shown the potential for significant cost reduction but will need ongoing support to de-risk investment in new technology components.

Responses to specific questions raised in the call for evidence

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

The ETI's analysis is national in coverage, but incorporates a strong regional component, reflecting the key spatial dimensions of energy resource endowments and the distribution of energy demands.

[3] The evidence for deploying bioenergy with CCS (BECCS) in the UK
http://www.eti.co.uk/insights/the-evidence-for-deploying-bioenergy-with-ccs-beccs-in-the-uk

From the perspective of enabling the UK's low carbon transition, our analysis points clearly to the development of a regional CCS cluster as the highest value infrastructure investment with a strong regional dimension.

As discussed above, CCS is the highest value group of energy technologies for the UK's low carbon future. If CCS is not available then our analysis suggests that costs of meeting carbon targets are likely to be doubled in broad terms. The value of CCS derives from its flexibility and versatility, enabling a range of pathways for decarbonisation of heat and transport (as well as electricity), as well as the delivery of negative emissions (which in turn provide valuable headroom in how 2050 carbon targets are met).

Our work on CO_2 storage in the North Sea demonstrates that the best available early sites are in the southern North Sea, easily accessible from Teesside or the Humber region. These regions also account for large volumes of industrial CO2 emissions and are well-situated for investment in power plants fitted with CCS. Thus we would view the development of CCS infrastructure (CO2 transport and storage assets) to enable development of CCS cluster in the north east of England as the single most valuable energy infrastructure investment at this point in time.

This regional configuration would also support further development of the CCS sector and in the longer term BECCS. Further details in our recent insights paper on BECCS[4]

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

For energy infrastructure the interaction between infrastructure and housing is most obvious in relation to the challenges of decarbonising heat for homes and local areas across the UK.

System designs and local spatial plans are needed to enable the efficient development of energy assets and to support consumer engagement. Solutions are likely to vary reflecting the specific characteristics of housing and settlement density. Heat networks could play a key role, requiring investment in new infrastructure assets, along with the integration of flexible combinations of heat pumps, electrification, hydrogen, improvements in thermal efficiency and smarter approaches to demand side response. The local planning and design of smart heat and power energy systems, needs to be based on comprehensive evidence and analysis of local conditions and needs.

The ETI's Smart Systems and Heat (SSH) programme is examining many of these challenges, developing new analytical tools and building knowledge on how best to integrate technologies and new business models. A good early example of good practice in this context is the Spatial Energy Plan for Greater Manchester Combined Authority project which was commissioned as part of the SSH programme and undertaken through collaboration between the Greater Manchester Combined Authority and the Energy Systems Catapult.

[4] The evidence for deploying bioenergy with CCS (BECCS) in the UK
http://www.eti.co.uk/insights/the-evidence-for-deploying-bioenergy-with-ccs-beccs-in-the-uk

The study has consolidated the significant data and existing evidence relating to the local energy system to provide a platform for future energy planning in the region and the development of suitable policies within the emerging spatial planning framework for Greater Manchester.[5]

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

The true scope for demand management in energy is only likely to be revealed over time through large scale trials and experience with new consumer friendly offerings. This is likely to be particularly important both in domestic heat and managed vehicle charging. For this reason the ETI supports investment in large-scale trials to build knowledge about what works best for mainstream consumers. The ETI is pursuing knowledge building through its SSH programme in relation to home energy demand and through the Consumers Vehicles and Energy Integration (CVEI) project in relation to energy demand for light transport. The second stage of the CVEI project will deliver a trial involving approximately 250 mass-market users to validate the impact of solutions identified in stage one and understand consumer and fleet responses to the vehicles and to managed charging schemes. See for example https://d2umxnkyjne36n.cloudfront.net/documents/CVEI-Stage-1-Summary-Leaflet-_Final.pdf?mtime=20160913133715

Our insights paper 'Consumer challenges for low carbon heat' discusses the importance of improving people's control over heating. (https://s3-eu-west-1.amazonaws.com/assets.eti.co.uk/legacyUploads/2015/11/3501-Consumer-Insights.pdf).

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Our analysis of the UK energy transition is very much from a whole system perspective encompassing the analysis of the technologies, infrastructure and systems to meet our needs for energy services across power, heat, transport and industry. Given the challenge of decarbonisation our analysis points to the high value to the UK economy of enabling a broader mix of energy technologies and vectors (heat, power and gaseous fuels) within a more integrated system of energy transmission, storage and distribution. We need competitive processes to reveal the most cost-efficient combination of emissions of reductions across different parts of the economy. But we also need strategic decision-making and governance to guide key collective choices, particularly in relation to investments in network infrastructure. A good example of this is the need for new forms of public/private collaboration and risk sharing to make early investments in CCS deliverable. The case for this is most obvious for investment in transport and storage infrastructure, since this is

[5] https://es.catapult.org.uk/wp-content/uploads/2016/05/Compressed_GMCA_Spatial_Energy_Plan_2016_11_07-LATEST-ilovepdf-compressed.pdf

likely to be shared and require some form of economic and access regulation.

We commissioned perspectives on the options for reforming governance and regulatory arrangements for the UK's energy network infrastructures through our project 'Enabling efficient networks for low carbon futures'. There is a need for a wider debate on potentially radical changes to the governance and regulation of investment in energy network infrastructures to strengthen the influence of whole system and multi-vector dimensions. This should encompass the role for strategic planning / system design functions as well as the role of competitive processes and market disciplines in driving cost-efficiency in investment decisions. Further detail is contained in our report http://www.eti.co.uk/library/enabling-efficient-networks-for-low-carbon-futures

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?
Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

In relation to energy infrastructure, a whole system perspective enables analysis of the options for building the portfolio of emissions reductions across all parts of the energy system to meet carbon targets. To reveal and enable commercial deployment of the most efficient portfolio, funding mechanisms should ideally enable a level competitive playing field for action to reduce emissions across all forms of energy (electricity, heat, transport and industrial demand). Current funding mechanisms for low carbon energy are vector-specific or even technology-specific in their design (e.g. contracts for difference for low carbon electricity or the renewable heat incentive [RHI]).

In future, more consideration should be given to policy designs which deliver technology neutral incentives in the delivery of emissions reductions. This could be through greater reliance on an economy-wide carbon price to drive investment in decarbonisation across the economy. The ETI has also published a recent perspective which raises the potential to use carbon-intensity standards rather than subsidies to support a market driven transition to low carbon alternatives. ETI perspective: 'Rethinking clean energy policy: from subsidies to standards'.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?
Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

ETI's analysis suggests that there a number of technologies or projects which offer a highly valuable potential contribution to meeting UK low carbon energy needs, but which face severe difficulties from an investment or financeability perspective.

New forms of collective network infrastructure face particular investment challenges where there is no clear framework for the governance of decision making or economic regulation. Examples of this include:

- potential investments in town or city-scale heat networks, which may well offer high value in enabling cost-effective decarbonisation of heat, but where the UK lacks an established governance and regulatory framework and investors may perceive a range of risks around their ability to recover their investment
- Investment in CCS infrastructure, particularly CO2 transport and storage infrastructure where investors are likely to perceive risks relating to the governance of sharing and access, and long term liabilities.

Government or regulatory intervention can unlock private sector finance and there are a wide range of examples of tailored intervention to allocate risks appropriately from the UK's experience with sector regulation (e.g. the approach to regulated asset bases or the use of 're-openers' to handle pre-specified risks by economic regulators). The specific design of intervention will need to be tailored to the particular circumstances and characteristics of the project/infrastructure in question.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

National carbon targets mean that the depth of decarbonisation required in different infrastructure sectors such as electricity, heat and transport infrastructure is mutually inter-dependent.

A number of the key energy infrastructure options carry significant deployment risks around issues such as site availability, consenting, social acceptability etc. A range of risks and constraints have, for example delayed the construction and commissioning of large scale new nuclear projects to date. We can improve resilience to risks in different parts of the energy infrastructure by developing a broad national capability to deploy a portfolio of key energy technologies. ETI's analysis of this is set out in Options, Choices, Actions: UK scenarios for a low carbon energy system transition.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

New forms of governance will be required to enable effective planning and infrastructure investment particularly in heat and local smart power infrastructure and assets. An increased role for local authorities in local area spatial energy planning could enable better decision making about local energy infrastructure needs, adapted to local circumstances within a democratic governance framework. The ETI and Energy System Catapult work with local authorities through the SSH programme is building understanding of good practice in this context.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Mitigation of climate change is central to protecting and enhancing the natural environment. Decisions about energy infrastructure needs should be informed by a strong national strategy for carbon emissions reduction. For example, the government is right to begin exploring the future role of the gas grid in a low carbon future.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

At present many of the cost benefit analyses and impact assessments used to assess energy policies and interventions rely on partial or sector-specific analysis. The introduction of economy-wide carbon targets introduces a new form of inter-dependence which is often not fully reflected in analysis. For example, current attention on flexibility within the electricity system is tending to assume that flexibility to meet variations in demand must be provided within the electricity system, whereas there are a wide range of non-electrical potential options for delivering flexibility in the energy system.

In the context of radical and inter-dependent change across all elements of the energy system, it is vital that cost-benefit analysis is informed by credible, evidence-based analysis which adopts a whole system perspective in assessing both costs and benefits. Metrics to guide policy priorities should move beyond 'partial metrics' such as the levelised cost of electricity (LCOE). Excessive reliance on such partial metrics' or partial analyses can lead to sub-optimal decisions given the inter-dependent nature of major energy infrastructure investments. If summary metrics are required to guide decision makers, they should internalise all relevant cost and benefits (e.g. impacts on whole system costs).

Modelling is an important approach to quantifying costs and benefits in these terms. But the modelling assumptions and techniques can be made transparent and results produced in usable formats to guide real world decision making. Complex modelling techniques are used successfully in a wide variety of contexts to analyse complex problems. The key is to enable more effective transparency and understanding of how results can and should be used to guide decision making. Stress testing analysis and use of credible and understandable scenarios can play an important role in identifying options and decisions which are robust against a wide range of future risks.

The role of modelling in informing policy development is considered in the ETI paper 'Modelling the UK energy system: practical insights for technology development and policy making'.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

The ETI published an extensive analysis of how trends in UK mobility may develop over the period to 2050. This is contained in section 1.3 (pages 15-20 of our publication An affordable transition to sustainable and secure energy for light vehicles in the UK

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

The UK needs to develop and deploy a portfolio of low carbon heat technologies. The highest value solution is likely to vary depending on local circumstances and building stock. The ETI's SSH programme is building knowledge on how to develop local area energy planning to identify the highest value solutions reflecting local conditions and preferences.

The portfolio of low carbon heat solutions includes:

- electrification of heating (including heat pumps and smart controls) - particularly in lower density housing
- local area heat networks in suitable urban and suburban settings - although initially these may be supplied by gas CHP they will ultimately need low carbon sources, such as marine heat pumps, waste heat from industry or power, biomass or geothermal
- potentially, hydrogen (using gas distribution networks)
- further deployment of biomass heat boilers in properties (and for industrial processes) that are otherwise difficult to decarbonise. The role of biomass heat may be larger if CCS is not developed.
- Gas could still have an important, but more limited role, to meet peak heat demands.
- Building fabric upgrades are also likely to play an important, but again limited, role.

Over the next decade the UK needs to invest in t**esting and proving key 'next step' options for low carbon heating.** This should include hydrogen, noting that the most economic production routes will require integration with CCS.

The bulk of work in decarbonising heat should be delivered after 2030 but considerable effort is required pre-2030 to build consumer and investor confidence and industrial capability. Before 2030 the following steps make sense:

- Gradual deployment of heat pumps and biomass boilers particularly for off-gas grid homes.
- Continued development of district heating solutions in suitable localities particularly where a waste or another cost-effective heat source is available.
- Continuing emphasis on building energy efficiency measures, including cost-effective retrofits, actions to ensure thermal efficiency in new buildings (e.g. building codes) and development of consumer-friendly controls and installations.
- Investigation of repurposing the gas grid to carry hydrogen and the necessary retrofits required in homes and to the gas system (noting that hydrogen at this scale can only realistically be supplied in combination with CCS).
- Progressing a range of solutions for industrial heat (at a range of scales) including biomass, combined heat and power and CCS.

By 2025/2030 the UK needs to be implementing low carbon heating solutions at a rate of ~1m homes per year. Building consumer understanding and acceptance requires new low carbon heating systems to be tested in widespread demonstrators in major conurbations. This needs to cover new build and retrofit and to recognise that there are a range of heating solutions that could

be implemented. Selection of a particular solution is likely to vary with geography, predominance of building types and occupancy in a particular area, existing connectivity to gas and electricity grids and the availability of local heat sources (industrial plants for instance). The option of using hydrogen to replace natural gas in the gas grid requires further R&D prior to demonstration to confirm various aspects of its feasibility.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved? *Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.*

The NIC's Smart Power report identified the importance of flexibility in the electricity system, and focused particularly on the role of inter-connectors, DSR and storage. This analysis was helpfully informed by the work carried out by Imperial College for the Committee on Climate Change.

ETI analysis tends to take a broader 'whole energy system' approach and incorporates some apparently important technology options that to our knowledge are not fully reflected in the Imperial College analysis (e.g. the potential production of hydrogen from biomass gasification with CCS). Our whole system analysis leads to our view that an effective, low carbon power sector is likely to be based on a balanced portfolio primarily composed of:

- nuclear (large units and, potentially, small modular reactors)
- CCS (mainly gas or biomass)
- wind (on and offshore)
- further inter-connectors

Hydrogen turbines - can offer vital flexibility in the medium term (with hydrogen storage providing large-scale energy storage).

Other renewables - likely to play supporting or niche roles in the portfolio.

Continued progress with energy efficiency and smart systems and controls to contain the need for further costly generation capacity, despite increased electrification of heat and transport demands (particularly from 2030 onwards).

We would encourage the NIC to place analysis of future electricity system and infrastructure needs in a broader whole energy system context. Our analysis suggests that there are potentially valuable roles for CCS, bioenergy and hydrogen in providing flexible, low carbon forms of power, while also reducing the overall requirement to invest in costly generation capacity. Similarly our analysis points to the potential for other forms of energy storage (e.g. heat storage) which may have important implications for the storage or generation capacity needs within the electricity sector.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

ETI's analysis of these issues is set out in our publication An affordable transition to sustainable and secure energy for light vehicles in the UK. Key headline points include the following:

- Alongside continued improvements in the efficiency of conventional vehicles, ETI analysis points to the versatility and value of plug in hybrid electric vehicles in enabling progressive decarbonisation of light transport.
- Under a range of futures, growth in PHEV use will require substantial further investment to enhance and adapt local electricity distribution infrastructure.
- Managed charging of plug-in vehicles through intelligent charging systems offers substantial scope to reduce the costs of network upgrades required.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be? *Note: A "circular economy" is an alternative to a traditional 'linear economy' (i.e. make, use, dispose) in which products are designed and packaged to minimise waste, and resources are kept in use for as long as possible, e.g. through re-use, recycling and greater recovery of materials through the waste management process.*

The ETI's interest in the solid waste market is in relation to the energy from waste sector and the role this can play in delivering greenhouse gas emissions savings out to 2050. For plants using waste feedstocks, it is important to ensure that the waste used has been treated in accordance with the principles of the waste hierarchy, for example through ensuring all economically recoverable recyclates have been removed and through encouraging reductions in food waste at source. While these measures, and a move to a more circular economy, may restrict future residual waste arisings there will always be a waste stream which it is appropriate to use for energy recovery.

At present, waste-to-energy plants receive a gate fee for the waste they use and revenue from the heat and/or electricity they produce. When gates fees are high, the balance of these two revenue streams can be an incentive for waste-to-energy plants to maximise waste throughput at the expense of conversion efficiency. This is not the best use of waste feedstocks - waste should be used in an efficient conversion process which is effective at delivering system level greenhouse gas emissions savings. However, policies to reduce waste arisings and increase recycling, coupled with increased competition for feedstocks could lead to a fall in gate fee revenues, meaning operators are more reliant on revenue from the sale of the heat and/or power generated which will encourage greater conversion efficiency.

The ETI's work to date highlights advanced gasification (gasification of biomass and wastes with subsequent syngas clean up) as of critical strategic importance to a future low-carbon energy system, as it is a scalable, flexible, efficient and cost effective means of producing energy[6]. Whilst broader classifications of gasification technology (to heat and power) are being deployed commercially in the UK, advanced gasification to produce heat, power or bioSNG[7] is only just

[6] As outlined in in our ESME http://www.eti.co.uk/options-choices-actions-uk-scenarios-for-a-low-carbon-energy-system/ and BVCM insights papers http://www.eti.co.uk/bioenergy-insights-into-the-future-uk-bioenergy-sector-gained-using-the-etis-bioenergy-value-chain-model-bvcm/

[7] Biomass derived Synthetic Natural Gas

starting to be demonstrated at a commercial scale[8] but has the potential to be more efficient – both in terms of amounts of feedstock required, and in conversion to energy - than most partial gasification or combustion systems.

The ETI has assessed the potential of three different configurations of advanced gasification and gas clean up systems through our Waste Gasification projects. These three configurations used two distinct types of medium temperature gasification combined with three types of high and low temperature syngas treatment systems[9]. We assessed plant designs capable of net electrical efficiency of more than 25% (from initial 'raw waste' feedstock to power generation), and availability greater than 80% at the 'town' scale (i.e. 5-20MW). The designs were evidenced through significant analysis of UK waste feedstocks, modelling, and laboratory and pilot-scale testing of different components. The ETI is exploring options to progress one of these designs to construction and demonstration and expects to launch the demonstrator project shortly. Successfully delivering an Advanced Gasification Demonstrator project will be a major step in the acceleration and de-risking of this important technology.

Written evidence submitted by the Energy Technologies Institute (ETI), February 2017.

[Name redacted], [Job title redacted]
[phone number redacted]
[email address redacted]

[8] http://blog.advancedplasmapower.com/latest-news/biosng-pilot-plant-converts-household-waste-methane/
[9] http://www.eti.co.uk/programmes/bioenergy/waste-gasification

Partnership for Urban South Hampshire
Office of the Executive Leader, Fareham Borough Council,
Civic Offices, Civic Way, FAREHAM, Hampshire PO16 7PU

NIA Call for Evidence
National Infrastructure Commission
11 Philpot Lane
London
EC3M 8UD

10th February 2017

Dear Colleague

Re: National Infrastructure Assessment Call for Evidence

The Partnership for Urban South Hampshire (PUSH) welcomes the establishment of the National Infrastructure Commission to provide the government with impartial, expert advice on major long-term infrastructure challenges. We also welcome that your objectives include supporting sustainable economic growth across all regions of the UK, improving competitiveness and improving the quality of life for people

PUSH was originally formed in 2003 following a recognition by the Leaders of Eastleigh, Fareham, Gosport, Havant, Portsmouth and Southampton councils (the urban core of South Hampshire) and Hampshire County Council that South Hampshire was underperforming in economic terms in comparison with the remainder of South-East England and that, as employers and skills providers do not recognise the administrative boundaries of councils, neither should the Leaders. The Leaders therefore determined to work together to advance the economic prospects for the area.

Subsequently in response to the South East England Regional Assembly requirement for a 20 year plan for functional economic areas within the South East PUSH invited the Leaders of East Hampshire, New Forest, Test Valley and Winchester to join in recognition that the natural economic area of South Hampshire included parts of those areas also. Subsequent to PUSH setting up, with business leaders, the Solent LEP the Isle of Wight Leader also accepted an invitation to join. PUSH moved from an informal meeting of Council Leaders to a formally constituted Joint Committee with overview and scrutiny arrangements. It also dispensed significant sums of government money devolved to it to invest in key infrastructure and skills projects in the South Hampshire area while working with Solent Transport's highways authorities, the Solent LEP and many other government bodies and agencies.

The PUSH area includes Portsmouth and Southampton which are two large, growing and densely populated cities. As social and economic systems the two cities play a dominant role in generating and in absorbing growth which increases densities still further. This presents challenges and increased costs in terms of the need to upgrade existing infrastructure to support this growth within the constrained urban environments. Whilst the mainland part of the PUSH area is the most urbanised area in Southern England outside of London, there are also habitats of international significance and over 290 miles of coastline. This presents specific infrastructure challenges. The Isle of Wight is also a key part of the PUSH area but as an Island there are very particular and significant challenges around transport and connectivity.

There are significant nationally important assets within the PUSH area which with appropriate infrastructure investment could support the growth of the national economy. Southampton International Airport, located in Eastleigh Borough Council, plays an important complementary role in the South East's aviation offer, and has significant capacity for expansion (freeing up capacity at other airports in the South East). The airport is expected to surpass 2 million passengers in 2017 and there are plans for Southampton to become an aerotropolis. Improved access to Heathrow Airport is also of importance to the PUSH area.

The Port of Southampton is strategically positioned in relation to the UK automotive industry based in the Midlands Engine and Northern Powerhouse, and is just 20 nautical miles from the key Shanghai to Rotterdam shipping superhighway. It is the UKs prime export port, and is strategically placed to support the changing flows of international trade. It alone handles exports worth more than £40 billion, with 90% of exports going to destinations outside of the EU.

The Port of Portsmouth (including Portsmouth International Port and HM Naval Base) provide the anchor points for our globally leading marine and maritime sector, contributing 20.5% of our GVA, 5% of our private sector jobs and 7% of all manufacturing in the area. Portsmouth International Port is the second largest

cross channel ferry port providing a gateway for over 2 million passengers and up to 1 million cars and freight vehicles to France, Spain and the Channel Islands. It is also the main port in the UK for deep sea fruit and vegetable imports with up to 70% of the bananas consumed in the UK passing through the port.

The Naval Base will see the first of two new QE Class Aircraft Carriers arrive at their base port this year. They are the largest and most complex warships in the history of the Royal Navy. These ships are significant strategic national assets and will require reliable and upgraded infrastructure (most notably transport and energy). Their arrival will result in associated peaks and troughs in infrastructure demand and draw on a pool of skilled labour that will be nationwide - requiring strong connectivity to the Solent.

Taken together these three gateways are of prime national significance and already contribute significantly to the UK economy. However there has been significant national underinvestment in infrastructure in the PUSH area and so there is scope for these assets to contribute significantly more to the national economy. Transport issues provide excellent examples of the lack of investment in the area. The strategic transport links beyond the PUSH area are important to the economy of PUSH and with the national port assets are of significance to the national economy and other regions within the UK. So for example this means that there is a need to invest in both the A3 and the A34/M3 corridors.

There are particular transport connectivity challenges, which are, in part, influenced by the polycentric nature of the area, population growth and the presence of key international gateways as described above. Within the PUSH area, Portsmouth to Southampton rail connectivity is slow (45 - 60 minutes for a 20 mile journey, compared to Nottingham - Derby (20 minutes for 15 miles) or Newcastle - Sunderland (also 20 minutes for 15 miles). As a further example it can be quicker to get to Gatwick from Portsmouth than from Portsmouth to Southampton Airport). This results in driving on the M27 being the default option, resulting in chronic peak period congestion. Rail access between Portsmouth and London is also unacceptably slow (between 96 minutes and 129 minutes for a journey of 75 miles, compared to Bristol Parkway to London with a journey time of 100 minutes for 115 miles. This erodes the geographic proximity of Portsmouth to Southampton Airport and on a wider basis to London, which is becoming even more pronounced as rail access to London from other towns and cities is enhanced. Journey times for the Isle of Wight have the additional complication of the sea crossing and when added to the slow mainland journey times this means that accessibility and connectivity issues for the Isle of Wight are exacerbated.

It would be a mistake to think of the PUSH area, and its significance to the national economy, as just relating to the two cities and the ports / airport. There is significant growth opportunity along the whole M27 corridor and the area around it. Critical infrastructure, such as improvements to the road network, will help unlock

economic growth. By providing the infrastructure to encourage both housing development and economic growth there is an opportunity to create development hubs (such as at Welborne in Fareham) which will reduce the pressure on infrastructure in the cities.

There are also major development opportunities around the western area of PUSH particularly alongside the western edge of Southampton Water and down to the Solent .Should there be expansion of Southampton Port, infrastructure development in this area would be needed to support the expansion. The area also provides significant opportunities to improve growth and productivity in its own right. This will require major national infrastructure investment in terms of connectivity (road and rail) and infrastructure to support development (e.g. digital connectivity).

The wider economic infrastructure (housing, transport, energy, water, waste, flood defence and digital) are all important for the growth of the PUSH area. These all require significant infrastructure investment. It is important that the PUSH area benefits from balanced growth and this will require balanced investment in infrastructure in terms of geography and types of investment. The infrastructure needs to focus on both high growth potential to targeted industries in targeted locations but also raising the growth potential more broadly across the region (particularly where it is low e.g. the Isle of Wight). This will mean that the benefits of the Industrial Strategy will be felt more evenly. We need to ensure that growth improves quality of life for local people and also protects our unique habitats.

The following are some of the specific schemes that we would like to propose that the National Infrastructure Commission should focus on to achieve balanced growth in the PUSH area:

Transport

- A Solent metro which could support the delivery of new housing and development along the M27 corridor and in the two cities
- Improved strategic connections to London particularly the rail connections
- Improved highway and rail access to the two ports of Southampton and Portsmouth which would also have the benefit of improving access to the Isle of Wight. This has to include both the strategic route network and the final leg of the journey.
    - The strategic transport links of both the M3 and the A34 / M3 corridor are very important to the ongoing success of the ports and it is important that bottlenecks are removed
    - In terms of the final leg of the journey, for Southampton congestion on the M27 and M271 (and A33) has a negative impact on productivity and in Portsmouth significant investment is needed in

the road infrastructure where the M271 enters the city. This would improve access to the Port and to the Tipner and Horsea development sites

Housing

- The shortage of housing in the PUSH area is driven by the low delivery rates. This limits housing choice, affects prices and impacts on the ability of some to enter the housing market. This also impacts on the labour market and influences business decisions about locating and remaining in the area. Employees living long distance from their place of employment puts further pressure on the highways network. With ambitious targets for housing agreed for the PUSH area we need to make sure that there is investment in the infrastructure to support this housing.
- Development hubs which bring together employment opportunities and housing provide opportunities to reduce pressure on the existing city based infrastructure but will often require significant investment in their own right

Flood defence

- Flood defences to protect existing communities and unlocking new development and very important with 290 miles of coastline and a highly urbanised geography. Examples of two schemes that are of particular importance are the western bank of the River Itchen and along the Solent in Portsmouth but other schemes will be needed to allow for growth along the M27 corridor.

Energy

- The new QE Class Aircraft Carriers will be base-ported in Portsmouth. When the two ships are in port at the same time there is a concern whether there will be sufficient capacity to provide for both of them and what impact this will have on the wider area in terms of energy supply. It will be important this this issue is addressed.
- PUSH area is well placed to take advantage of renewable energy opportunities. With three Universities, 290 miles of coastline and a favourable climate there are significant opportunities to create a national cluster for renewable energy although this will require up-front investment to take advantage of this opportunity.

Digital

- There is a need for significantly enhanced digital connectivity (both fibre and 4G/5G) to ensure that all areas of the economy can access opportunities for growth. There are internet "not-spots" and this disadvantages some businesses and holds back growth. Digital connectivity along key rail routes is also poor with large sections offering no

connectivity (despite the availability of a conduit alongside the railway line). This key infrastructure needs to improve.

Water and waste

- With new housing and growth of the business sector in the PUSH area there will need to be investment to ensure that there is an adequate water supply and also that the waste and water can be treated. This provision will need to be done in a way that does not harm the unique environmental habitats in the PUSH area.

Since 2016 the authorities in the PUSH area have successfully worked together to deliver a Spatial Strategy position statement. This shows that the authorities can work cross boundaries and work collectively with statutory agencies like Network Rail, Highways England, the Environment Agency, Natural England, Southern Water and Portsmouth Water. Where regions / areas are already showing evidence of such cooperation this take away some of the risk in terms of future investment and should give the NIC some confidence in the area. We think the NIC should also put pressure on the Government to provide stronger support to the actual infrastructure providers so that they can deliver the strategic infrastructure that is needed.

I hope this provides you with a helpful understanding of what the PUSH area can contribute to the growth of the UK economy, but also the significant infrastructure investment that is needed to bring the economy up to the level of performance that is needed. We have exceptional assets that can help deliver the Industrial Strategy but this will require our infrastructure to be brought up to standard and enhanced.

Yours sincerely,

February 2017

Dear Sir/Madam,

National Infrastructure Commission: Call for Evidence

FSB welcomes the opportunity to respond to the above consultation.

FSB is the UK's leading business organisation. Established over 40 years ago to help our members succeed in business, we are a non-profit making and non-party political organisation that's led by our members, for our members.

Our mission is to help smaller businesses achieve their ambitions. As experts in business, we offer our members a wide range of vital business services, including advice, financial expertise, support and a powerful voice in government.

FSB is also the UK's leading business campaigner, focused on delivering change which supports smaller businesses to grow and succeed. Our lobbying arm starts with the work of our team in Westminster which focuses on UK and English policy issues. Further to this, our expert teams in Glasgow, Cardiff and Belfast work with governments, elected members and decision-makers in Scotland, Wales and Northern Ireland.

Small businesses rely on a range of different infrastructure to support their growth ambitions. This includes transport and digital networks, as well as energy supply. The evidence we have submitted is based on consultations with our membership, along with different surveys we have carried out to support our policy work.

We trust that you will find our comments helpful and that they will be taken into consideration.

Yours sincerely,

[signature redacted]

[name redacted], [job title redacted]

FSB

National Infrastructure Commission: Call for Evidence

February 2017

1.

What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of " highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

Small businesses have a variety of infrastructure needs which should be taken into account when considering the future of infrastructure investment and deployment. Small businesses provide significant numbers of employment opportunities across the UK, and account for a large percentage of annual GDP. Prioritising the needs of small businesses when considering future infrastructure will be important to delivering long term sustainable growth.

Transport

Businesses need access to comprehensive, well maintained transport networks, both for employees and customers to access their premises, but also to allow for the easy transfer of freight goods.

A significant proportion of recent investment has focussed on the strategic road network (SRN) and Network Rail's strategic network. This is clearly important in integrating city regions with each other and will be necessary in the long term to reducing regional disparities in productivity and growth. The University of Bath has suggested that for every 100 additional minutes of travel time to London, productivity reduced by around 6 per cent.[1] Clearly funding for the strategic network has an important economic impact and should be continued in future.

However, at the same time, many small businesses have limited interaction with the Strategic Network, as their businesses rely on accessing customers, employees and goods from a smaller geographic network. All journeys will start and finish on local roads, without necessarily interacting at all with the strategic network.

Small businesses are often unable to move location to improve their access to infrastructure, as the business premise will be based in the area the owner lives and where the owner will likely have professional and social networks. This reduces their ability or desire to relocate. Other small businesses rely on their local reputation, so are not readily able to close one premise and open in a new location. This contrasts to larger businesses which could relocate to be nearer to important infrastructure developments.

[1] Boddy, M. (2007) Meeting the productivity challenge in SW England

As a result, the most economically beneficial transport investment for many small businesses would be focussed on the local transport network around the area they are based – reducing bottlenecks and congestion via smaller scale projects. Improving the maintenance and upkeep of the local road network would also help smaller businesses.

Indeed, in a 2015 survey, 45 per cent of small businesses reported that congestion on the local road network was their main frustration with transport, compared to 26 per cent who said motorway congestion was their primary concern.

This investment would help rural areas as well, and create truly integrated economic regions which are able to grow and compete with one another. Many small businesses are based in the rural economy, which contributes £210 billion of GVA[2]. Investment in local transport would help those businesses access economic opportunities across a city region, expanding their capacity for growth.

Investment in local roads has suffered due to the lack of long term funding certainty for local government. Highways England has a five year funding settlement which allows for the development of a strategic plan. The Commission should assess whether longer term funding settlements for local authorities would help improve the planning and delivery of local transport improvements.

It also important that future investments in infrastructure do not happen in isolation. In order to deliver the greatest economic benefits, different transport options should be delivered as part of an integrated plan. Ensuring road, rail and public transport options are integrated will reduce journey times and enable businesses to access a wider pool of talent.

Freight

In the view of FSB, investment is also needed to more effectively manage freight, especially in urban areas. This is particularly important in urban areas where congestion creates additional costs for businesses by increasing travel time and reducing the certainty that goods will be delivered on time.

A long term freight strategy is required to explore new ways to improve capacity, along with ways to move freight off road networks and onto the rail network.

Digital

Digital connectivity, both via fixed line and mobile services, is critical to many small businesses around the country. FSB has carried out extensive research demonstrating how

[2] DEFRA, Rural Productivity Plan, August 2015. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/454866/10-point-plan-rural-productivity-pb14335.pdf

digital services are increasingly important to small businesses, with growing demand for using and offering digital services.[3,4]

Small businesses use the internet to communicate with suppliers, customers, employees, their bank and the Government. Being online allows many small businesses to sell goods and services in markets they would otherwise not be able to access, and for consumers across the world to search them out. Small businesses also increasingly see the internet as enabling them to use video content, cloud based services and remote work.

The internet allows small business owners to work from home or to work on the move. It has also enabled innovation and helped many small firms to transform their business through the use of digital technology. The internet has proved to be a powerful force which has transformed the operations of many different sectors, including banking, publishing, retail and tourism. The increased integration of telecoms services into businesses does however mean that business owners and their employees increasingly need access to reliable, ubiquitous, digital connectivity.

There are clear benefits to the wider UK economy if the demand and uptake of digital services by small businesses increase. The evidence presented from multiple sources shows that increasing the use of digital services will help small businesses to grow. The previous Government estimated that for every £1 of investment in broadband, the UK would see a £20 benefit.[5] McKinsey estimated in 2011 that small businesses could increase productivity by 10 per cent through doing more online.[6] Similarly, Booz and Co estimated that if all small businesses maximised their use of digital services, growth would increase by £18.8 billion per annum.[7]

More recently, Development Economics estimated that small businesses were missing out on over £20 billion a year in revenue from not having a website or making use of other digital channels.[8]

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[3] FSB, Reassured, Optimised, Transformed, September 2015. Available at http://www.fsb.org.uk/docs/default-source/Publications/reports/fsb-telecoms-report---september-2015(2).pdf?sfvrsn=0

[4] FSB, The Fourth Utility, July 2014. Available at http://www.fsb.org.uk/docs/default-source/fsb-org-uk/policy/assets/fsb-the-fourth-utility-paper.pdf?Status=Master&sfvrsn=1

[5] DCMS, UK Broadband Impact Study, November 2013. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/257006/UK_Broadband_Impact_Study_-_Impact_Report_-_Nov_2013_-_Final.pdf Accessed June 2015

[6] McKinsey, Global Institute, Internet Matters: The Net's sweeping impact on growth, jobs and prosperity, May 2011. Available at http://www.mckinsey.com/insights/high_tech_telecoms_internet/internet_matters Accessed July 2015

[7] Booz and Co, with Go ON UK, This is For Everyone, The Case for Universal Digitalisation. Available at http://www.go-on.co.uk/wp-content/uploads/2013/12/The-Booz-Report-Nov2012.pdf Accessed July 2015

[8] Do IT Digital, January 2017. Available at http://www.growthyorkshire.co.uk/small-businesses-could-gain-extra-20bn-if-they-do-it-digital/

It is clear that the internet is a key driver of growth in the modern UK economy. According to a report from the Boston Consulting Group (BCG), in 2010 the UK Internet economy contributed £187 billion to the overall UK economy, which equated to 8.3 per cent of GDP. This was a higher figure than that contributed by the construction or education sectors and is projected to rise to £347 billion by 2016 (12.4 percent of GDP). This compares to a 4.1 per cent average for the G20 nations.[9]

Despite the importance of digital infrastructure to businesses, small businesses continue to suffer from lower availability of superfast broadband compared to the residential market. In December 2016[10], Ofcom found that:

- 80% of small businesses (1.9 million) have access to superfast services in the UK, compared to 89% of all premises.

- This leaves almost 480,000 small businesses without access to superfast broadband. Overall, around 8% of small businesses (almost 192,000) in the UK are unable to access broadband services with download speeds of 10Mbit/s or higher, compared to around 5% of all premises. Most of these small businesses are in rural areas, where over 130,000 small businesses receive less than 10Mbit/s.

- Across the UK a whole, only around 67% of small businesses in business parks (230,000) have access to superfast broadband.

- In the context of currently planned networks deployment, Ofcom estimate that 10% of UK small businesses will not have access to superfast broadband by the end of 2017 (around 240,000 businesses) from around 20% currently.

The proposed Universal Service Obligation will help to improve the speeds available to small businesses, with some options also helping address other quality of service metrics, including, but not limited to upload speeds. The Government should quickly act to set out which option it will choose, and should be as ambitious as possible for the USO.

It is clear however that further investment in digital infrastructure would help small businesses increase their growth potential. As a priority, all small businesses need access to basic quality broadband so they are able to take advantage of the digital economy. Commercial investment will likely continue to focus on increasing the speeds available in commercially beneficial areas, so government interventions are likely required to ensure that businesses in smaller communities are not left further behind.

[9] Boston Consulting Group, Greasing the Wheels of the Internet Economy, March 2012. Available at https://www.bcg.com/documents/file100409.pdf Accessed July 2015

[10] Ofcom, Connected Nations, December 2016

Mobile

Mobile coverage is also becoming an increasingly critical business utility. In 2015, 70 per cent of the small businesses surveyed viewed access to mobile voice and data services as either being critical or very important to their small business.[11]

For those who currently use mobile services, the evidence is clear that they are using their mobile phone to maintain connectivity to their core business. This can provide them with the assurance that they can continue to operate their business whilst travelling or from working from home. This is particularly clear when the importance of mobile services are broken down by business owners who spend a lot of time outside of a primary business premise.

Among the small business owners who do not spend any time working in transit or from home, only 15 and 12 per cent respectively viewed mobile services as critical to their business. By contrast, business owners spending between 30-45 hours a week either working in transit or from home, 59 and 55 per cent said their mobile phone was critical to them. From this perspective, it is clear that mobile services provide business assurance for these business owners. In total, 54 per cent saw their mobile as being critical or very important in helping them to work from home. The reliability of networks will also therefore be important in allowing business owners to work from home or operate on the road.

Poor mobile voice and data coverage continues to be an issue for many business owners, meaning improvements in coverage would help small businesses increase their use of mobile services.

Energy

Energy investment in discussed in more detail in our response to question 20.

13.

How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

It is likely that there will be substantial changes in the way small business owners and employees travel to and from work in future, with substantial changes to the way freight and deliveries are made too. FSB does not have evidence to assess what the take up and impact of new technologies such as drones or autonomous vehicles will be.

Declining commercial space due to the use of permitted development rights, rising business rates costs and increasing commercial rents makes it likely that the availability and use of

[11] FSB, Reassured, Optimised, Transformed, May 2015. Available at http://www.fsb.org.uk/docs/default-source/Publications/reports/fsb-telecoms-report---september-2015(2).pdf?sfvrsn=0

commercial properties within city centres will decrease in the future. This will reduce the number of employees entering towns and cities at peak times and, where local high streets lose commercial properties, could mean that fewer customers also come into town centres on a frequent basis. The model of residential properties surrounding commercial and retail space in city centres, with travel patterns to match, could therefore change in future, with more people living in city centres, and employment opportunities being more evenly distributed throughout, and on the outskirts, of urban areas. This would obviously affect the travel patterns of both employees and customers of small businesses.

It is also likely that more and more employees of small businesses will work from home rather than coming into an office every day. As digital connectivity improves, and work patterns and expectations change, it is plausible that fewer employees will need to travel into cities and town centres to access employment on a daily basis. This would reduce demand at peak times but may have an off peak impact on local transport. This trend would however rely on improvements to digital connectivity to ensure that business owners are able to reliably access digital networks regardless of location.

14.

What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

FSB would like to see more investment made to the infrastructure supporting freight, with particular reference to ports and rail connectivity. We believe that there is a case for an integrated freight strategy to be developed, as this is an area which has been underserved in previous considerations regarding infrastructure.

15.

What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

As discussed above, for many small businesses, improvements to the local road network could deliver greater economic benefits compared to improvements to the SRN. It is important that the needs of rural communities are considered, as these areas continue to have a significant economic contribution to make. Focusing on the needs of cities, and on connecting different cities together could lead the surrounding economic hinterland with poor access to these markets, lessening the economic impact of any investments.

While local areas should play a key role in deciding what projects need to be taken forwards, these decisions should be taken in conjunction with other administrative bodies. Businesses

may well receive goods, attract customers or recruit staff from outside a local authority area, so it is important that transport investment considers the wider economic area rather than focussing on issues within an administrative area.

Local authorities and LEPs may also need more support in order to allocate resources in the most effective manner. Central Government, and the National Infrastructure Commission, could play a role in providing that support to ensure that local authorities prioritise investment in the most effective manner. We have also called for Highways England to play a more active role in supporting investment in the local road network.

20.

What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

In January 2017, FSB launched the report, 'The Price of Power: energising small businesses in the next UK carbon plan'. This report drew from data collected from two separate surveys of FSB members, the first survey exploring small business views around energy efficiency, the second exploring small business views on energy infrastructure investment.

Small businesses have a complex and varied relationship with the energy sector, operating as generators and investors, consumers, and suppliers of products and services.

FSB recognises that the way the UK generates, distributes and uses energy is facing the greatest transformation since the Industrial Revolution. Investment in new energy infrastructure comes at a time when, as a country, we are seeking to increase the proportion of energy generated from renewables and low carbon sources, as well as reducing the amount of energy we use in the first place. Significant progress must be made in both these areas if we are to meet our binding carbon targets, manage challenging fluctuations in daily demand, and reduce consumer costs.

As a country, we must now make difficult decisions about how and where we choose to invest in our critical energy infrastructure, balancing security, affordability and sustainability. The roll-out of new forms of low carbon energy generation needs to be managed carefully, balancing efficiency and equity.

The Government's National Infrastructure Delivery Plan predicts that £117 billion will be spent on energy infrastructure between 2016 and 2021, accounting for 57 per cent of the UK's entire investment in economic infrastructure.[12] The vast majority of this investment will be funded through the private sector, but, ultimately, the cost burden will be passed on to domestic and non-domestic energy customers, either directly through their energy bills or indirectly through taxation. These costs must be shared out fairly and equitably across the industry, tax payers and consumers, including small businesses.

For businesses – like households – what constitutes a fair cost burden depends on the opportunities and benefits they receive in return for their respective financial contribution. At its most basic, this could simply represent a reduction in energy costs, either immediately or in the longer term. However, energy bills are not the only important factor. As a group, small businesses are a diverse audience and, depending on their exact circumstances, will prioritise opportunities and risks in different ways. Potential business benefits associated with new infrastructure investment may

[12] Infrastructure & Projects Authority, National Infrastructure Delivery Plan 2016-21 (March 2016)

include carbon reduction and energy efficiency, microgeneration and investment opportunities, greater supply chain prospects, new market development, encouragement of innovation, demand management, greater market choice, job creation, an upskilled workforce, and long-term security and risk-reduction. So which energy technologies are most likely to provide these potential benefits and what infrastructure is required to support them? What do small businesses actually want to pay for?

FSB has called on Government to urgently produce a new Carbon Plan, setting out exactly how the UK will generate, distribute and use energy over the coming decades so that we meet binding carbon targets. And just as importantly, it must set out how this new infrastructure will be funded in the most equitable way, particularly for smaller businesses.

Small businesses do share some common, overarching themes when it comes to the direction of UK energy policy. Recent FSB research suggests that energy security is the biggest single concern for most small businesses. For many, this even outweighs concerns about costs and carbon emissions.[13]

- **86 per cent of FSB small businesses believe the UK is too reliant on imported energy.**
- **60 per cent of FSB small businesses believe security of supply is a more pressing issue to be addressed than cutting consumer costs or reducing emissions.**

SMALL BUSINESSES AS GENERATORS AND INVESTORS

According to the Committee on Climate Change, the UK has successfully reduced carbon emissions by 38 per cent since 1990 while growing our economy by over 60 per cent.[14] FSB believes that carbon reduction and economic growth should not be mutually exclusive. The right investment in the right infrastructure at the right time will enable the UK to continue this economic trend as we seek to reduce our carbon emissions even further. The Climate Change Act commits the UK to 80 per cent reduction in CO_2 emissions by 2050 (compared to 1990 levels). This provides a strong market steer and promotes investment in low carbon technologies, like solar and wind.

FSB research suggests that small businesses are optimistic about the role of renewable energy generation.

- **12 per cent of FSB small businesses already generate their own electricity, the vast majority of which is from solar panels.**
- **41 per cent of FSB small businesses believe renewable and low carbon energy will be cheaper than fossil fuel in future, compared to only 23 per cent who believe it will never be as cheap.**
- **27 per cent believe that a low carbon economy will create more opportunities than threats for their business, as opposed to just 14 per cent who believe the opposite.**

FSB wants to see a strong strategic UK policy direction that provides confidence and security to investors in new energy technologies, including generation, storage and efficiency. The UK needs a broad, measured and transparent strategy for promoting investment in the right places through a combination of different incentives including, but not limited to, subsidies and tax reliefs.

Subsidies and incentives

[13] FSB, The Price of Power: Energising Small Businesses in the Next UK Carbon Plan (2017)

[14] Committee on Climate Change, Meeting Carbon Budgets - 2016 Progress Report to Parliament (2016)

The Government provides two main subsidies for small businesses that wish to invest in non-domestic energy and heat generation – Feed-in Tariffs (FITs) and Renewable Heat Incentives (RHI). Many small businesses have taken advantage of these subsidies and FSB has welcomed the opportunities these can provide. However, such opportunities often depend on whether or not a particular business falls within the (often narrow) scope of a subsidy, which may set arbitrary parameters such as location, property type, turnover, etc. In this sense, subsidies are not universally fair.

Subsidies must also be viewed in the context of a number of other mechanisms that promote the development and roll-out of certain energy technologies by providing investor confidence (e.g. tax penalties and reliefs, legal obligations, access to finance, capacity market, binding carbon reduction targets, skills development, education and information, etc.). The relative contributions of each of these mechanisms may change over time, reflecting the ebb and flow of variables such as energy prices and technology development. It is important to keep these mechanisms under review as they all have the potential to both stimulate and subdue the market in different ways.

Since 2015, the Government has announced a number of cuts and restrictions to a variety of subsidies and incentives related to renewable generation and energy efficiency. It is not yet clear what impact these subsidy reductions will have on the overall development of new microgeneration capacity. However, early anecdotal evidence from FSB members suggests that the microgeneration industry is gravely concerned. In many cases, the subsidies on offer only just made these investments viable. A reduction in subsidy can have a major impact on this, particularly when it comes to decisions about capital expenditure and the emphasis on upfront costs. From this point of view, mains gas or even a diesel generator, would be considered a better business decision than, for instance, a biomass boiler.

FSB has major concerns about how recent subsidy withdrawal has been implemented. However, we also acknowledge that incentives don't necessarily benefit those that need them most, particularly small scale and community generation schemes, which, by their nature, take a comparatively long time to complete. These schemes often compete with larger commercial projects which, funded by liquid market capital, are able to progress more quickly. Therefore, incentives may promote schemes that offer the quickest return, rather than those in areas where alternative energy is needed most. So, in terms of fairness, incentives must promote investment in the right places, and across the right audiences. They must be simple, straightforward and worth the effort.

FSB recognises the important role of the Levy Control Framework in controlling consumer costs, with spending on energy subsidies capped at £7.6 billion by 2020-21. In light of a forecast overspend, Government has moved to reduce or remove a number of subsidies available for a number of technologies. However, there is little evidence that this decision took account of any kind of long-term, strategic aim based on the type of technology and energy infrastructure we, as a country, want to develop in order to meet our binding carbon targets. FSB believes that sudden changes to subsidy rules, and without a strategic plan to fall back on, Government has undermined investor confidence in microgeneration.

More broadly, FSB recognises the important role of binding international, European and domestic targets for carbon reduction and renewables, which create a long-term market pressure and provides a degree of confidence to investors. The most important of theses is the legally-binding UK Climate Change Act which commits successive Governments to reduce UK emissions by at least 80 per cent from 1990 levels by 2050.

Capacity

The roll-out of new technology, such as solar, must be done in a measured and consistent way that cost effectively builds, not just generating capacity over time, but also the underlying infrastructure upon which that capacity relies. This is particularly the case as UK generation moves away from the centralised transmission network (high voltage) towards the decentralised distribution network (low voltage). Problems are created when investment in new generation and underlying infrastructure are out of sync with each other. This is already being demonstrated today across the UK's growing distributed generation market.

In some circumstances, investment in microgeneration and community generation schemes are being delayed, or even prevented, by a lack of available capacity on the grid. FSB would like to see small businesses given an increased opportunity to supply energy to the grid, but also the opportunity to supply directly to customers locally. As it stands, a small energy generator may only make £0.04kWh exporting locally-generated energy to the grid. However, by selling directly to a local smart grid (e.g. adjacent village/housing estate) at market rates, they could make £0.11kWh.[15] This would transform the viability of local energy generation without the need for public subsidy or green levy on energy bills, encouraging small businesses to invest in peak capacity beyond their own consumption.

Ofgem should promote technology that takes pressure off the energy transmission and distribution networks, particularly highlighting the innovative and flexible opportunities that small business microgenerators can provide. As part of this, they should explore the feasibility of allowing direct sale of electricity by microgenerators.

There are a number of hurdles that need to be addressed in order to realise this microgeneration revolution:

- Amending regulations restricting the direct sale of power from any power station below 50MW would need to be amended.
- Establishing a light touch regulatory regime for sub-50MW retailers who would supply to local grids.
- Creating a separate category of light touch licence for community or business energy retailers selling to a defined local area with a limited number of customers.
- Developing a smart grid, with real time data available for distributed microgeneration schemes.
- Transitioning of DNOs to DSOs, responsible for managing and controlling supply and demand across their local distributed networks.

Distribution Network Operators (DNOs)

According to Ofgem, network costs are the second biggest costs associated with energy bills (after wholesale costs), accounting for between 20 and 25 per cent of the overall bill.[16] DNOs are responsible for assessing whether there is a need to reinforce the National Electricity Transmission System (NETS) as a result of any new microgeneration scheme being connected (Statement of Works).[17] This may lead DNOs to impose conditions and constraints on microgeneration schemes. As

[15] Make It Cheaper website, Business Energy Prices and Rates, accessible at www.makeitcheaper.com/business-energy/prices-per-kwh-unit.aspx

[16] Ofgem website, Understand your gas and electricity bills, accessible at www.ofgem.gov.uk/consumers/household-gas-and-electricity-guide/understand-your-gas-andelectricity-bills

[17] National Grid website, Thresholds for Statement of Works, accessible at www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=24678

the UK increasingly moves from transmission-level to distribution-level generation, it will be even more important for DNOs to understand how and where energy is being consumed and generated across the networks they manage.

FSB supports early proposals to develop a system in which fully-functional DSOs are responsible for balancing and controlling distributed networks. These should incentivise innovative storage, demand side and efficiency technologies to help balance supply and demand. In the shorter term, National Grid must boost opportunities for distribution level interconnection to enable greater potential for sharing and managing demand and supply between DNOs and, in future, DSOs.

Anecdotal evidence from FSB members also suggests a lack of clarity around how DNOs manage their reserve capacity, particularly as they seek to address uncertainty about future availability related to changes in local demography. This approach can potentially distort the calculation about the level of demand in a specific area, which is particularly important in a situation where a business applies to increase its generating capacity.

DNOs should work with smaller generators to provide innovative solutions to network capacity constraints and the burden of required reinforcement or upgrade costs. They should provide greater transparency around costs of non-contestable works and these costs should be broken down and explained to customers in more detail. They should highlight any areas that are contestable and open to competition, signposting small business customers to alternative providers. And they should provide real time information about available capacity, as well as committed generation. This should take account of planned re-enforcement works. FSB urges DNOs to provide dedicated account managers to help small business microgenerators and community schemes through the process of connection. We want to see DNOs working with small generators to provide innovative solutions to network capacity constraints and the burden of required reinforcement or upgrade costs. They should facilitate microgeneration partnerships and consortia, signpost to areas of available capacity, and provide flexible contract arrangements to promote investor confidence.

Costs of non-contestable works require greater transparency and should be broken down and explained to customers in more detail. DNOs should highlight any areas that are contestable and open to competition, signposting customers to alternative providers. Information about available capacity, as well as committed generation, should be available in real time and should take account of planned re-enforcement works.

Some DNOs have already started to implement some of these ways of working and provide good templates for others. We also note that Ofgem has tasked all DNOs with developing their own enforceable Code of Practice (COP). These should be published clearly on DNO websites and should be as consistent as possible across the industry.

More broadly, there remains a lack of clarity around the division of responsibilities between DNOs, National Grid and Ofgem. This makes it difficult to identify where delays are occurring in the planning, funding and implementation of microgeneration schemes. FSB would like to see improved clarity and delineation around these roles and responsibilities.

Behind-the-meter generation

Behind-the-meter generation and storage technology provides only black box information to energy suppliers and DNOs taken from meter readings. In reality, a whole sub-system of generation, usage and storage is happening behind the meter at particular sites. Currently, the charging scheme for electricity is based on a number of parameters, including how much a customer consumes, how much they generate and how much they store. In addition, these costs vary depending on the time

of day that these activities take place. None of this information is provided in a meter reading for behind-the-meter technologies. This potentially has a major impact on those who rely on the more traditional model of paying for energy and infrastructure through their metered usage. The decision to holistically manage on-site energy in this way and operate more off-grid is to be applauded. However, from a cost-benefit point of view, this tends to be an option reserved for larger and more energy-intensive industries, at least under current market arrangements. As more industries move to this kind of approach, there is a risk that charges related to the maintenance and improvement of energy infrastructure will be disproportionately passed on to smaller users who do not have the same opportunity to avoid these costs. Ofgem are reviewing this issue at the moment and it is imperative that they come up with a new model for charging that provides fairness for customers of all sizes during the transition to a more distributed energy system.[18]

SMALL BUSINESSES AS CONSUMERS

Following the completion of a recent Competitions and Markets Authority (CMA) investigation, FSB broadly welcomed remedies for improving the retail energy market, particularly the development of published, comparable prices for microbusinesses. However, the investigation did not extend to looking at how the retail market can empower customers to use less energy or choose how and where their energy is generated.

Energy efficiency

Energy reduction is the single best way that small businesses can save money on their bills, yet the post-CMA market is still not well placed to drive and support this behaviour change. FSB wants to see a new energy market that acknowledges a diverse customer base and enables smaller businesses to make holistic decisions. Business customers must be empowered to understand and choose what services they pay for, where they can find the best deal, where they can save energy, and where and how their energy is generated.

- **61 per cent of FSB small businesses describe their energy costs as either moderate (41.5%) or high (19.6%), with any potential for reduction ranging from 'useful' to 'critical' to their profitability.**
- **33 per cent of FSB small businesses believe that energy efficiency savings will offset the increasing cost of their energy, as opposed to just 23 per cent who don't think this will be the case.**
- **86 per cent of FSB small businesses acknowledge the direct benefits of energy efficiency. The majority of these think energy efficiency is important for saving money (78%), protecting the environment (70%) and increasing profits (67%).**
- **58 per cent of FSB small businesses have made changes to improve their energy efficiency. The most widely reported measures were the installation of more efficient lights, lamps and bulbs (40%), switch off/turn down policies (23%) and improved insulation (23%).**

So, small businesses need support and information to help make these savings wherever possible. In The Department for Energy and Climate Change (now part of the Department for Business, Energy and Industrial Strategy) estimated that the average SME could reduce its energy bill by 18-25 per cent by installing energy efficiency measures, with an average payback of less than 1.5 years.[19] But,

[18] Ofgem, Open Letter: Charging Arrangements for Embedded Generation (2016)

[19] Department of Energy and Climate Change, SME Guide to Energy Efficiency (2015)

like the domestic audience, it has been difficult to persuade small businesses to invest in significant energy performance improvements. Many small businesses do not feel empowered to make these savings because of practical constraints, a lack of information and available cash, or suitable motivation.

One of the mistakes that Government and the industry have made in the past is to assume that money saving is the primary – or even sole – driver for energy efficiency. This is a broad-brush misjudgement that has also been made in the retail energy market, where both domestic and business consumers have been reluctant to switch suppliers, even though they could save money. The opportunity to save money is obviously important to every business, but it must be balanced against the cost of the time and effort required to achieve this – the 'opportunity cost'. In addition, such decisions can be severely hampered by a lack of faith that investment (costly or inconvenient) will actually achieve the desired benefits.

The problem for Government and energy suppliers attempting to persuade small businesses to invest in efficiency is that they represent an extremely diverse group with very varied pressures and motivations. Yet, time and time again, the tactics for engaging with the small business community across a range of energy issues – efficiency, switching, smart meters etc. – rarely involve any meaningful segmentation or sub-division of this audience into more homogeneous groups.

Despite the high number of businesses recognising the value of energy efficiency measures, not all firms are taking action and far fewer are making significant changes. There is no silver bullet for engaging small businesses on energy efficiency. There is a clear need for market segmentation. A business that is not concerned about its energy bills may not be motivated by the potential for cost savings, but may be motivated by other factors – such as environmental responsibility, profit margins and attractiveness to customers. Likewise, although access to finance may not be the most widely reported barrier for most small businesses, it could still be a deal-breaker for those that it does impact.

Energy suppliers should provide a wider range of tariffs that allow businesses to choose where and how their energy is generated. They should explore ways of engaging small businesses in additional products and services related to generation and efficiency.

Smart meters

The national roll-out of smart meters across the UK, and the associated move to a smarter and more dynamic market, provides the greatest opportunity for customers to take control of their energy and reduce their consumption. If usage cannot be monitored, it cannot be managed.

However, simply installing this new technology won't automatically provide any benefits. Cost savings will come with the behaviour change that this technology empowers and the energy savings that come with this. The smart meter programme is believed to cost somewhere in the region of £12bn.[20] However, the Government believes this technology will eventually provide a net saving to customers of around £6bn in the longer term.[21] Without a clear strategy for ongoing customer engagement and empowerment, the costs and benefits of this new technology will not be equitably distributed. Therefore, the rollout of smart meters must be supported by ambitious and holistic industry plans for ongoing energy saving support and advice to small businesses.

[20] Smart Energy GB website, FAQs, accessible at www.smartenergygb.org/en/the-bigger-picture

[21] Energy UK website, How much will the smart meter roll-out cost me?, accessible at www.energy-uk.org.uk/customers/142-how-much-will-the-smart-meter-roll-out-costme.html

At a more strategic level, smart meters are the first step to building flexibility across the supply chain in the GB electricity system. They provide the foundation for a much smarter market, particularly with regard to energy grid management.

Demand Response, driven by monetary rewards and penalties for using energy at certain times, will benefit from the move towards real time data. In this regard, it is important to acknowledge that the average energy profile for businesses – in other words, the variation in energy use during the day – may be very different to that of domestic household customers. This could represent opportunities and threats in terms of the way this sub-market is devised. The ability of small businesses to take advantage of demand side response will depend on the development of a number of sectors and technologies, including storage, microgeneration, smart meters, smart products and equipment, aggregators and price signals. The Government should set out a more detailed strategy for Demand Response.

Time-of-use tariffs will undoubtedly take on increasing importance as grid infrastructure becomes more stressed. Some businesses are already accustomed to time of use charges, but many smaller firms will not be. Going forward, their ability to take advantage of these charges will be dependent on the equipment they rely on, the development of new technology and smart appliances, and the degree to which they can introduce flexibility into their day-to-day activities. It is clear that some businesses will be more able to take advantage of time of use charges than others, depending on the nature of their operation. Many businesses operate on different cycles to the average domestic customer. So, a one-size-fits-all approach to time of use charges will not work. In order to drive behaviour change, the market will need to provide not only a price disincentive against using energy at certain times, but also a clear pathway for achieving this. For instance, it may be prudent to consider a recommendation for all users above a certain energy threshold to implement storage and management systems that allow them to run 'off line' at certain times of the day.

Aggregators are likely to play an important role, both in managing demand response across a wide domestic and non-domestic customer base, and also providing those customers with the necessary information, products and services to enable them to take advantage of this sub-market. It is vital that small businesses have access to a trusted aggregator service and all the benefits this potentially provides. Some small businesses may be considering the opportunities to provide this service themselves, depending on how smart technology develops. Aggregators are, essentially, a form of TPI and, as this market grows, it will be important to learn lessons from the performance of TPIs in other markets, particularly acknowledging the problems caused by a lack of regulation in the energy retail market.

SMALL BUSINESSES AS SUPPLIERS OF PRODUCTS AND SERVICES

The UK Government has made it clear that new industries, such as nuclear, onshore oil and gas and renewables, are likely to make a significant contribution to the future supply of UK energy. Small businesses have a major role to play in these industry supply chains, providing products, services, skills and innovative solutions, either directly to individual customers or indirectly via larger industry and suppliers. However, small businesses have traditionally faced a number of supply chain issues:

- **Opportunity creation**
  The most significant barrier currently facing smaller supply chain businesses is the low number of appropriately sized contract opportunities that exist as a result of contract aggregations and use of frameworks which frequently exclude small suppliers from the market. This issue is often aggravated by the poor visibility of those appropriately sized opportunities that do exist. New

and emerging energy industries can provide leadership by pressing tier one suppliers to demand that all levels of their supply chain break down contracts into smaller lots, wherever practical, and by avoiding the temptation to aggregate contracts. Contract aggregation can reduce competition pressure through over reliance on a limited number of major suppliers. Long contracts can also effectively close the market and, thereby, reduce competition pressure.

FSB is not generally supportive of supplier portals as they have been prejudicial to the interests of small businesses. There are a number of reasons for this, including:

- Approved lists do not get refreshed at regular intervals, penalising new entrants.
- Approval processes are often unclear.

- **Process simplification**

  Small businesses face a number of supply chain burdens related to overly complicated processes. For instance, they are often required to fill out lengthy and complicated prequalification documents so potential procurers can score them against their assessment criteria. Lessons can be learned from the recently announced Lord Young reforms in response to the Public Contracts Regulations 2015. These were designed to open up public sector procurement to small firms and, though not directly mandated in the private sector, new and emerging energy industries have an opportunity to demonstrate what can be achieved. The reforms propose a range of measures, including simplified prequalification processes for smaller procurements below EU thresholds.

  Suppliers should set out their criteria in procurement adverts in a way that enables small firms to quickly and easily assess their own suitability. This enables small business owners to quickly identify which opportunities merit the time and effort to produce a full bid, and which do not.

- **Standards and accreditations**

  Industry clients can require small business suppliers to have any combination of accreditations from a wide range of schemes. Each accreditation requires time and resource to achieve and maintain. Where a firm works for multiple clients that require such accreditations, it is common for them to be required to hold a number of such qualifications which overlap, particularly in the field of health and safety (a key issue in the energy industry). While there is some value to be had from accreditation, there is also significant waste as a result of overlapping requirements.

  The overall burden of maintaining accreditations, and seeking new ones, can act as a barrier to smaller firms. New and emerging energy industries can help by requiring suppliers to take account of third party accreditations that small business suppliers already have, rather than insisting that all bidders are registered with a specific accreditation body as a blanket requirement. Smaller firms can also be excluded from supply chain contracts by disproportionate requirements. These are typically around insurance and turnover and which are excessive in proportion to the value and risk of the contract. New and emerging energy industries should ensure that requirements are proportionate and are communicated and implemented effectively through the supply chain. Energy generators should demand that all levels of energy industry supply chain break down contracts into smaller lots wherever practical, avoiding the temptation to aggregate contracts. They should introduce and monitor specific payment policies for small business suppliers, ideally following the lead of the Government pledge to pay within 10 days of receipt.

- **Payment practices**
  Poor payment practices are a massive problem for small suppliers. New and emerging energy industries can assist by putting in place and monitoring specific payment policies for small business suppliers, ideally following the lead of national government pledges to pay within 10 days of receipt. The industry can set the example in terms of robust implementation, monitoring and enforcement through its entire supply chain.

There is little precise data detailing the exact input that small business suppliers have across all aspects of the energy sector. Many operate as tier two (or below) suppliers of products and services to the energy generation and distribution sectors. The Government has acknowledged the importance of reducing transaction costs associated with small business supply chains, particularly in key sectors like manufacturing[22] and construction[23].

In 2014, the Department for Energy and Climate Change (DECC) released their Supply Chain Plan, setting out guidance for renewable projects of 300MW or more applying for subsidies through the Contracts for Difference scheme.[24] Projects over 300MW applying for a Contract for Difference are required to submit a supply chain plan as part of their application. This is designed to encourage the development of low carbon electricity generation supply chains and the promotion of innovation and skills. As a result, large generation projects must demonstrate their impact on the lower tiers of the supply chain.

FSB is supportive of Government's aims to promote open and competitive supply chains in the renewable energy sector. Government should examine the success of these supply chain plans at facilitating small business suppliers, and explore potential for reducing the threshold for these supply chain plans for projects below 300MW.

Across other industries, particularly emerging areas like nuclear and onshore oil and gas, there are further opportunities to embed expectations around small business supply chain opportunities. It is important for new and emerging energy industries to communicate supply chain opportunities to the small business community. These potential suppliers may have low levels of knowledge about these industries, particularly during the development and planning stages. These growing industries should ensure that regular training opportunities and supplier pre-engagement activities are available for smaller firms in the supply chain. This will also help project delivery by ensuring that capacity is built ahead of opportunities becoming available and by expanding the choice available to buyers.

[22] HM Government, Strengthening UK Manufacturing Supply Chains: An Action Plan for Government and Industry (2015)
[23] Department for Business, Innovation and Skills, Supply Chain Analysis into the Construction Industry (2013)
[24] Department of Energy and Climate Change, Supply Chain Plan Final Guidance (2014)

Call for Evidence for National Infrastructure Assessment.

Response from Friends of the Earth England, Wales and Northern Ireland.

Introduction

Friends of the Earth England, Wales and Northern Ireland (EWNI) represents more than 100,000 members in the UK, and is part of a Europe-wide network representing 30 national organisations. Worldwide we have more than 2 million members. We welcome the opportunity to submit views on the National Infrastructure Assessment.

While there are others who will make more technical comments, we are happy to be able to submit thoughts on the general scope and direction of the National Infrastructure Assessment's call for evidence, as well as to answer several specific questions.

General comments

The questions posed by the NIA Call for Evidence are broad in their scope and nature. As such it is essential that fundamental principles are placed at the heart of the Assessment. Chief among these must be the imperative to tackle climate change and to protect and restore the natural world, upon which all other economic and social activity depends.

In 2015 the then Prime Minister David Cameron, speaking at the International Climate talks in Paris said: "instead of making excuses tomorrow to our children and grandchildren, we should be taking action against climate change today". Friends of the Earth agrees. At the same time the natural world is in crisis. Abundance of wildlife is at critically low levels and many species are struggling. Since 1970 more than 56% of species in the UK have declined,[1] and 15% are extinct or threatened with extinction from Great Britain. In light of this, and the UK's commitment to keeping global temperature rises to 'well below 2 degrees' it is **crucial that the National Infrastructure Commission a duty upon it to adhere to decarbonisation and environmental protection**.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

Changes were made in 2006-2008 to the planning system to create a development consent regime to combine different permissions (Planning Act 2008). A significant campaign from NGOs and civil society challenged the proposals on the grounds of speed over quality, sustainable development outcomes including tackling climate change, democracy and people's right to be heard. The reform removed the testing of evidence through the public inquiry system, and the right to be heard at an inquiry, replacing it with an open floor hearing at an examination and issue specific hearings at the Commissioner's discretion. It also replaced Inspectors trained in inquiries to Commissioners appointed for other expertise.

The new Planning Act 2008 system of approving infrastructure has created a 'fast-track' system which has resulted in a failure to consider key environmental issues – for example the M4 expansion's failure to take air quality properly into account, instead relying on other policy instruments which may or may not come forward in the assessed timeframe (for instance ULEVs) or may be flawed such as demonstrated by 'dieselgate' and ClientEarth cases. One of the reasons

[1] http://www.wildlifetrusts.org/sites/default/files/state_of_nature_uk_report_pages_1_sept.pdf

matters are not being addressed during examinations is the amount of information and the strict curtailment of time to consider this information.

In effect the Government is promoting making big decisions on infrastructure quickly and in our view, badly. This is the first flaw in the current system – its inflexibility when issues arise in the examination and need to be dealt with but can't because of time, and the lack of resource given to local planning authorities to respond effectively to the proposals.

The second flaw is the way national policy is set out. The National Policy Statements are separate for different types of infrastructure, and take a very broad brush view that minimises in most cases environmental protection issues such as air quality or waste. The National Policy Statements that are in existence at the moment fail to *collectively* deliver a low carbon economy. For example the energy statements (EN) state a "need for all energy development" rather than setting out a strategic direction of travel. The national networks statement (NN) relies on other policy interventions e.g. to reduce carbon emissions from car travel on roads, rather than delivering those reductions of itself.

The third flaw is that they are not integrated with each other. The gap left by the removal of the Regional Spatial Strategies has still not been filled, with the duty to co-operate not a comparable or effective replacement. The recent strategic plans idea has been put together hurriedly, with no sense of how they fit within the existing framework of planning legislation, and their democratic accountability processes. Infrastructure really needs to be planned on a regional scale, and not piecemeal. All other European countries with effective infrastructure planning have regional planning. Planning is also place-based, and therefore the lack of engagement with local plans when making national policy leads to a lack of understanding of the geographical realities of places and infrastructures' interaction with that. Mapping is key to a better understanding of what is happening where, and where infrastructure is failing to deliver.

And the final flaw is the structure of the NIC itself. An essential element to the planning system in England is its public participation and democratic accountability procedures in town and country planning and in the national development consent regime (although they are weaker in the DCO regime). The NIC is not brought into statutory consultation and public participation procedures, and is not a democratic body (in comparison to a local council planning decision-making process for example). This is a major problem when considering that the NIC wishes to make recommendations which are then endorsed by Government to become 'Endorsed Recommendations' and then automatically become planning policy. Where is the environmental assessment of these proposals required? Is it site specifc? Will it engage the right to be heard? Will it engage Strategic Environmental Assessment (requiring the consideration of alternatives, reliance on evidence, and testing of approaches)?

Funding is also an issue. The levy on developments to deliver infrastructure (community infrastructure levy) for example is being thrown out completely in some areas (see Inspector's decision in Bradford) but in order to build sustainably, infrastructure such as transport, utilities and services must be planned in alongside new development, and in many cases, be ready for new development to plug into.

We are therefore concerned that there is a mismatch between local authorities who understand the local needs of their communities better than the NIC, and the NIC which is looking at the need for infrastructure on a national scale.

Friends of the Earth recommendations:

Firstly, plans at all levels should be required to make measurable contributions to the national Emissions Reduction Plan.

Next, the Planning Act 2008 should be amended to bring back senior Inspectors to run inquiries rather than Commissioners running examinations. In addition, there should be an ability to extend the running of examinations / inquiries beyond the current strict timetable for an additional 3-6 months to allow for complex projects to be properly scrutinised. There should be a statutory requirement that the relevant development plan is the local plan – to ensure integration between local planning and national infrastructure planning. There must be a cumulative carbon impact assessment which must be taken into account with the aim of delivering low carbon infrastructure. National Policy Statements should be revised more regularly through the parliamentary committee inquiry and consultative process. The NIC must be put on a formal footing and be covered by similar duties and responsibilities as planning authorities if it wishes to make recommendations that become planning policy, in particular with regard to public participation and environmental legislation.

The NIC should also consider setting up regional teams to become expert in the infrastructure needs e.g. of the South West, and the Government should create a means for regional infrastructure pools so that evidence on needs, blockages and solutions can be 'pooled in' from local plan processes and local government provision of services, and private companies providing infrastructure services and hardware, ensuring that infrastructure is planned efficiently, and is decentralised in line with the needs of a low carbon economy.

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

Fuel for heating and cooking in homes accounts for around 12% of UK greenhouse gas emissions.[2] At the same time around 12% of the UK population is estimated to be living in fuel poverty, while millions more suffer cold homes or higher-than-necessary energy bills. Cold, damps homes are thought to be a significant cause of ill-health too, forming a significant burden on the health care system with 25% of winter admissions related to cold. Improving the housing stock will have benefits not only in terms of reducing emissions, but also increased comfort and reduced health costs. Recent 'boiler on prescription' trials in Sunderland have shown that installing heating and energy efficiency improvements reduced visits to the GP by 28% and hospital outpatient appointments by 32%.[3]

The first and most essential aspect to decarbonising heat must be a large scale programme of energy efficiency, particularly in housing. This should include a nation-wide programme to retrofit old housing stock – bringing 26 million homes up to EPC band C or above - and the implementation of zero carbon home standards for all new buildings.

Energy efficiency is also one of the most cost-effective methods of decarbonising the UK economy. Sadly recent government policies have led to a collapse in key forms of domestic energy efficiency

[2]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/496942/2014_Final_Emissions_Statistics_Release.pdf
[3] https://www.gentoogroup.com/media/1061811/boiler-on-prescription-closing-report.pdf

measures (such as loft insulation).[4] For every £1 spent on energy efficiency a further £x is returned to the economy.

There is scope too for the delivery of energy efficiency programmes to be delivered at the local level, with benefits accruing locally. In Bath and NE Somerset for example it is estimated that 17% of households are in fuel poverty, well above the national average, while excessive cold costs the NHS there at least £3.8 million a year in acute admissions.[5] Giving local authorities or regions involvement in rolling out energy efficiency programmes could increase buy in and make targeting of priority households more successful.

New houses also need to tackle carbon emissions and fuel poverty. Government should implement planning policies to ensure that all new developments conform to zero-carbon standards, integrate access to active and public transport and maximise benefits for biodiversity.

For the future there is a need to explore the options and potential of synthetically produced methane or hydrogen gas being used in the gas grid. For this to work, large amounts of low carbon electricity (most likely renewables since H2 or synthetic gas production will be well placed to capitalise on periods where there are gluts of clean electricity) and/or carbon capture and storage technology will be necessary.

As a first step Friends of the Earth recommends:

1. Introduce a new national zero carbon homes standard for new build.
2. Publicly funded energy efficiency infrastructure programme to ensure 20 million homes are insulated to EPC band C or higher by 2030, starting with 4 million by 2020.
3. Decarbonise the electricity system as quickly as possible (see below). This is not only feasible but will encourage innovation in electricity-to-heat storage and open new avenues to decarbonise heating.
4. Support the development of electricity to heat storage and innovation.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

The most effective future power system for the UK will be a combination of high levels of renewables, with lots of energy storage (batteries, dams, hydrogen etc), interconnectors and demand side response to manage demand and supply, and decreasing amounts of natural gas as back-up.

While the question refers to 2050, early action is essential to tackle climate change. By 2030 the Committee on Climate Change estimates that the carbon intensity of the UK electricity supply should be reduced to around 50gCo2/kWh to avert dangerous climate change. Delaying decarbonisation of the power sector will make it far harder to stay within climate budgets.

Using DECCs energy pathways calculator, Friends of the Earth has estimated that to decarbonize to the lower level recommended by the CCC (50g C02/kWh), while moving towards a decarbonized heating and transport system, renewable electricity should account for around 75% of electricity generation in the UK by 2030, moving to a zero carbon grid shortly after. Large scale use of energy

[4] http://www.energybillrevolution.org/wp-content/uploads/2015/09/Respublica-After-the-Green-Deal.pdf
[5] http://www.bathnes.gov.uk/sites/default/files/esp_-_strategy_2012-2015_0.pdf

efficiency measures and a rapid shift to electric transport will also be required, increasing demand for clean electricity. Table 2 shows a possible electricity mix in for a high-electricity demand scenario 2030 (in TWh).

Table. 2 Sample UK electricity mix in 2030 (note demand ~50% greater than 2016.) Source: Clean British Energy 2012, FOE, based on DECC calculator.

Technology	Percentage	TWh	GWp renewables needed (2030)
Offshore Wind	42%	196	45-50 GWp
Gas	13%	60	Na
Onshore wind	13%	61	23 GWp
Gas with CCS	11%	51	Na
Solar	10%	45	45-50 GWp
Wave, tidal, geothermal, hydro	9%	45	Variable depending on technology.
Nuclear (residual)	2%	9.32	Na
Total	**100%**	**466**	

Focusing on renewables makes sense.

The carbon intensity of natural gas, while significantly less than coal, is still around 350-400gCo2/kWh, meaning that unabated natural gas cannot form a large proportion of the electricity supply (in TWh terms) if we are to decarbonize by 2030. Carbon Capture and Storage – while likely important for industrial processes - cannot necessarily be counted on to reduce carbon intensity at scale so soon.

It is unlikely too that there will be any new nuclear power constructed in the UK before 2025, or that there will be large additional amounts available in the time frame required before 2030. Given that many forms of renewable electricity are already cheaper than new nuclear and the likelihood that others (like offshore wind) will be within a few years, it therefore makes sense that renewable sources make up the bulk of new energy generation between now and 2030. Finally, while nuclear is low carbon, it still suffers from significant environmental and security issues associated with waste disposal and proliferation of nuclear material.

As well as being deployable and low-carbon, a renewable based-system will be affordable and maintain security of supply.

The cost of renewable energy is falling quickly. While fossil fuels continue to benefit from the failure to factor in the full costs incurred by their use, in many parts of the world onshore wind and solar are now the cheapest sources of new electricity.[6] In the UK, BEIS's (likely conservative) 2016 cost estimates show that new onshore wind is now effectively the cheapest form of new generation available.[7] Large scale solar in the UK will likely be competitive with new gas generation by around 2020, and cheaper shortly afterwards. By 2025 it is highly likely that offshore wind too will be cheaper than new nuclear generation and competitive with gas generation soon afterwards (see Table 1), even including the potential for increased costs of system balancing (currently estimated at up to £10/MWh by Committee on Climate Change).

[6] http://www.climatechangenews.com/2016/10/21/renewables-undercut-new-coal-plants-in-south-africa/
[7] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/566567/BEIS_Electricity_Generation_Cost_Report.pdf

Table 1. Projected LCOE (£/MWh). Source: BEIS 2016[8] (note: renewable costs subject to rapid change).

Year of Commissioning	2018	2020	2025	2030	Notes
CCGT Gas	61	66	82	99	
Onshore Wind >5MW	65	63	61	60	
Offshore Wind	114	106	100	96	Underestimate of cost reductions. £97/MWh achieved in 2017.[9] Government targeting £85/MWh by 2026.[10]
Nuclear			95	78	(35-year contract, all renewables are 15 year)
Large Scale Solar	71	67	63	60	Likely underestimate of cost reductions, as it is suggesting just over 10% cost reductions in decade 2020-2030.
Rooftop Solar Large	77	73	69	65	Likely underestimate of cost reductions, as it is suggesting just over 10% cost reductions in decade 2020-2030.
Rooftop Solar Domestic	131	128	121	114	Rooftop solar competes with retail electricity. Likely underestimate of cost reductions, suggesting just over 10% cost reductions in decade 2020-2030.

Nonetheless urgent government intervention is still needed to transition to this form of energy system, as it now is for all new energy generation. New onshore wind and solar remain locked out of the UK, as they lack a route to market, while onshore wind also faces a highly negative planning environment.

Offshore wind, which constitutes a major infrastructure opportunity, needs certainty and a market to drive cost reductions. Friends of the Earth is calling for 3-4GW to be built annually from 2020-2030. Rooftop solar (which could account for up to 10% of UK electricity) requires a transitional support arrangement as costs continue to fall.

Renewables will keep the lights on

An effective power system must also be reliable. While many renewables are recognized as cost-effective, increasingly it is being accepted that they can also provide reliable power, and form the basis of a clean energy system. According to the former Head of National Grid Stephen Holliday speaking in 2015, 'The idea of large power stations for baseload is outdated'.[11]

Fortunately, far from causing the lights to go out when the wind doesn't blow, energy systems with lots of variable renewables can be very reliable. Germany and Denmark have the two most reliable energy grids in Europe, with four times fewer outages (in terms of minutes of power loss) than the UK, and some of the highest amounts of renewables on the grid[12].

Studies by Poyry[13] for the Committee on Climate Change have shown that the UK can balance its grid and maintain using high levels of renewables (up to 94%), demand side management and small amounts (relative to overall generation) of natural gas.

[8] https://www.gov.uk/government/publications/beis-electricity-generation-costs-november-2016
[9] https://ore.catapult.org.uk/press-release/offshore-wind-target-become-lowest-cost-large-scale-clean-energy-source/
[10] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/572544/Response_to_LCF_Lessons_Learned_FINAL_18-11-16__2_.pdf
[11] http://energypost.eu/interview-steve-holliday-ceo-national-grid-idea-large-power-stations-baseload-power-outdated/?utm_campaign=shareaholic&utm_medium=twitter&utm_source=socialnetwork
[12] https://www.cleanenergywire.org/dossiers/energy-transition-and-germanys-power-grid
[13] https://www.theccc.org.uk/archive/aws/Renewables%20Review/232_Report_Analysing%20the%20technical%20constraints%20on%20renewable%20generation_v8_0.pdf

In the studied scenarios real weather data were taken from several of the past years and used to simulate what might happen in an electricity system powered largely by wind. Artificial years were also generated to stress-test the scenarios. These contained a large number of 'lulls' where winds dropped away, including prolonged 5-day lulls in winter. In these scenarios systems where up to 80% of the electricity system is renewable the grid can be managed with less than 10GW of additional flexible peaking capacity by 2050 (this may be gas with or without CCS, pumped storage or perhaps hydrogen generated during times of high renewable output). Higher renewable penetrations are possible with more. Other models show similar mixes of very high levels of renewables with residual amounts of fossil fuels (less than 20% by generation) to keep down the cost of balancing.[14]

The point is that while back-up *capacity* may need to be available, the more renewables there are, and the more diverse they are, then the less the back-up is actually used, gradually reducing the number of hours fossil fuels are burnt. Similarly interconnectors and demand side response reduce the number of hours for which back-up may be needed. Indeed, suitable and timely investment in a smart flexible energy will reduce the need and costs of this balancing capacity.

Research by Imperial College London and the Carbon Trust for BEIS suggest that an energy system with larger amounts of renewables incorporating demand side management, flexibility and energy storage could offer net savings of £17-£40 billion compared one without.[15] In this scenario particular benefit was gained by front-loading the development of demand side response measures (DSR) in the immediate future. This general finding is backed up by the National Infrastructure Committee's Smart Power report showing system gross savings of £8 billion per year by 2030 for a system build around interconnection, storage and flexibility.

Other recent studies by Aurora Research show that building 40 GW solar (around 10% of UK electricity demand) along with 8 GW of storage, will reduce the overall system costs compared to business as usual.[16]

The evidence therefore suggests that in the years ahead that a system based largely on renewables, with early investment in demand side response and storage measures, combined with greater flexibility provided by interconnectors will likely be the cheapest, cleanest option for a power system.

The renewables revolution is already happening. Alongside larger systems such as offshore wind farms or large solar installations, decentralised renewables like rooftop solar, small wind, hydro and other micro-renewables technologies can play a vital role in generating low carbon electricity, promoting community engagement or efficient onsite generation and the fostering of innovation and invention in low carbon products and services.

For these reasons it is vital to have an industrial policy and economic strategy which prioritises decarbonisation through renewable energy, and related technologies. This will mean an energy storage and management system which works to facilitate and incentivise the large amounts of variable but predictable renewable energy onto the grid, as well as looking to match demand more closely to supply through enhanced use of demand side management systems. This should be the focus of any future changes to the grid operation and structure – to facilitate decarbonisation through interconnectors, small and large scale energy storage and demand side measures.

[14] http://energydesk.greenpeace.org/2015/09/21/4-ways-the-uk-can-get-almost-all-its-power-from-renewables/
[15] An analysis of electricity system flexibility for Great Britain by Carbon Trust and Imperial College London, 2016.
[16] Intermittancy and the cost of integrating solar in the GB power market, by Aurora Energy Research, September 2016

To achieve a decarbonised energy system, Friends of the Earth recommends:

Industrial strategy and devolution

1. That any industrial strategy future-proofs UK industry to operate in a zero-carbon world. Transition to a zero-carbon economy should be prioritized and enshrined as a duty.
2. Give greater autonomy to city-regions and devolved administrations to benefit from and develop local energy assets, and to stimulate investment in renewable generation, efficiency, energy infrastructure and skills and low carbon transport.

Renewables

3. Commit to decarbonizing UK electricity supply to 50g/C02/kWh by 2030.
4. Commit to construct 3 GW offshore wind per year from 2020-2030. First phase 2020-25 would require approximately £1.3bn extra in CfD contracts, on top of £730mn committed.
5. Restore route to market for more mature renewables like onshore wind and solar that are currently shut out. (For example through auctions in CfD Pot 1, with special measures for communities).
6. Support the expansion and integration of rooftop solar and other decentralized renewables. Including transitional support mechanisms while costs continue to fall (i.e. FiT or tax breaks).
7. End the de-facto ban on onshore wind in England by removing unreasonably restrictive planning guidance; ensure Planning Authorities demonstrate support for the development of appropriate renewable technologies in their areas.

Storage and integration.

8. Implement the recommendations of the National Infrastructure Commission on Smart Energy to make the UK a world leader in energy storage and smart technology. Supportive policy, development funding and targets to ensure decentralized energy can thrive.
9. Reform the capacity market to ensure it incentivizes low carbon solutions – like energy storage and demand side management.

Transport

10. Support development of Electric Vehicles. All new vehicles to be Ultra Low Emission by 2025, where technically possible.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

The greater uptake of low-carbon vehicles is essential to decarbonising the UK's transport system. They are also essential to tackling local air quality issues which contribute to the deaths of 40,000 people and cost the economy £20 billion every year.[17]

Electric vehicles are more efficient than internal combustion engines, requiring less energy per km travelled. To achieve the necessary carbon reductions however it will be necessary to increase the supply of low carbon electricity to power them.

[17] https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution

The National Grid's Future Energy 'Gone Green' Scenarios estimate that by 2040 there may be 9.7 million EVs and Hybrid-electric vehicles on the roads, requiring an additional 24TWh of generation.[18] By 2030 the Committee on Climate Change estimates that ultra low emission vehicles (whether battery or plug-in hybrid) will need to account for 60% of all new vehicles sold.[19] These are likely to be conservative estimates however, given current trends in car ownership and manufacturing (in 2016 EVs and HEVs accounted for over 4% of the UK market and growing,[20] by 2040 it seems likely that they will be utterly dominant). Other countries such as the Netherlands and Norway have gone further, indicating that all new vehicles must be ULEV by 2030.

Nonetheless the point is that to replace the UK's entire fleet of cars (around 26 million) and vans would therefore require significant additional low carbon generation capacity, particularly in the post-2025 years. The most affordable additional sources are likely to be offshore wind and solar, with the potential for marine energy or other sources further in the future. Electrification of transport should therefore increase national ambition with regards to renewable electricity.

In addition to electricity consumption, EVs may play a role in grid balancing and energy storage. Trials are currently underway involving Nissan and ENEL to allow for vehicle-to-grid technology. The National Grid estimates that 18,000 Nissan EVs could have the same peaking power as a 180 MW power plant.[21]

At the local level, there are a number of significant barriers to the successful uptake of electric vehicles, including a lack of on-street charging systems and a shortage of high-speed chargers to facilitate longer journeys. There is a significant risk that without sufficient confidence in charging infrastructure, electric vehicles will be largely restricted to niche uses as 'second cars' or in commercial fleets.

Electric vehicles too will pose a challenge to local grid infrastructure, which may need to be reinforced to ensure sufficient capacity to charge vehicles. It will also require increased amounts of low-carbon electricity, particularly at night when they are likely to be charging. Fortunately this offers opportunities to integrate large amounts of low-marginal cost renewable electricity onto the grid which might otherwise need to be curtailed, and also for electric vehicles to themselves provide back-up to the grid. The development of electric vehicles should therefore go hand in hand with increased investment in the grid's capacity to supply them, and also in the generation of renewable electricity and the advancement of a 'smart' network.

The Modern Transport Bill (in consultation) also provides an opportunity for regions – including city regions and metro-mayor regions – to play a role in managing or innovating incentives and building infrastructure for Ultra Low Emission Vehicles, and in particular their integration with local smart grid initiatives, and we would urge the government to ensure that guidance and funding support is available to develop this vital regional infrastructure.

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

[18] National Grid Future Energy Scenarios 2016 (http://fes.nationalgrid.com/fes-document/)
[19] https://www.theccc.org.uk/wp-content/uploads/2013/12/CCC-EV-pathways_FINAL-REPORT_17-12-13-Final.pdf
[20] https://www.theguardian.com/business/2017/feb/06/new-uk-car-sales-electric-vehicle-drives-12-year-sales-high
[21] http://utilityweek.co.uk/news/nissan-launches-first-vehicle-to-grid-storage-trial/1242532#.WJ2ffW-LTIU

At minimum, the UK should aim to 'hold the line' at current levels of flood risk, and not allow the number of households at significant flood risk to rise further.

1 in 6 homes in England & Wales are currently at risk from flooding, 370,000 of them at significant risk – and the Government's own projections show that this number could rise to 1 million by the 2020s and 1.5 million by 2050, thanks to climate change.[22]

As we learn more about the risks of dangerous climate change, the scale of the increasing flood risk to the UK has become apparent. The Committee on Climate Change's latest research (prepared for the second Climate Change Risk Assessment, published January 2017), shows that 2,100km^2 of the UK is at risk of inundation from sea level rise if temperatures rise by 2 degrees – but that this rises to 4,100km^2 if we hit 4 degrees of global warming.[23]

Our first line of defence, therefore, it is to make sure that we do not exceed 2 degrees (and ideally 1.5 degrees) of global warming, by cutting our own emissions dramatically and by taking a leading role in international climate diplomacy.

Nevertheless, we are already seeing extreme weather happening more frequently: in winter 2015-16, the UK saw shocking flooding from Storm Desmond, with a record-breaking 16 inches of rain falling in two days at Thirlmere, and damage to homes and businesses in Leeds, Manchester, Cumbria and across the North. As the Committee on Climate Change said at the time: "*The devastating flooding this weekend is a timely reminder that climate change is expected to increase the frequency and magnitude of severe flooding across the UK.*"[24] Met Office research shows that when such storms blow in from the tropical west Atlantic, extreme rainfall is now seven times more likely than in a world without human emissions of greenhouse gases.[25] The 2015 floods cost the UK economy £5 billion.

It's clear, therefore, that the UK is not sufficiently resilient to cope with even with 1 degree of warming, let alone 2 or 4 degrees.

Yet current flood investment plans are insufficient. The Environment Agency's Long Term Investment Scenarios 2014 forecast that, even with allegedly 'optimum' investment levels, the number of households at significant flood risk would *still* increase by the 2060s. This is not acceptable.

No-one is under any illusions that tackling the risk to these (euphemistically-termed) 'residual risk' households will be easy. Some advocate greater uptake of Property Level Protection (PLP), though too much emphasis can be put on delegating responsibility to individual households when community level protection is often more efficient, and the means for guaranteeing uptake of PLP appear opaque, despite the Bonfield Review (Sept 2016). [26]

There is certainly a big role for changing land management practices to reduce flooding (see answer to Q26). But there's no real getting away from the need, also, to increase investment in hard flood defences, particularly for existing coastal settlements. Failure to do so is essentially a decision that a large-scale programme of resettlement will be needed for low-lying coastal cities like Hull. And despite much talk of leveraging private investment into flood defences – whether by insurance firms, water utilities or through Partnership Funding – there is simply no credible replacement for large-

[22] UK Climate Change Risk Assessment 2012 – technical appendices.
[23] Committee on Climate Change – Paul Sayers for the ASC: Projections of future flood risk in the UK. Oct 2015. https://www.theccc.org.uk/publication/sayers-for-the-asc-projections-of-future-flood-risk-in-the-uk/
[24] CCC, 2015. UK floods: Climate change likely to increase frequency and magnitude of severe flooding events. Dec 7th.
[25] Met Office, November 2015. Studying the causes of extreme weather in 2014.
[26] https://www.gov.uk/government/publications/improving-property-level-flood-resilience-bonfield-2016-action-plan

scale public financing. (Partnership Funding, indeed, runs the very real risk of increasing inequalities in flood defence provision, by allowing schemes to go ahead where large businesses are based, but neglecting cash-poor areas.) Flood defences are a classic public good: the Government cannot dodge the need to increase funding for them.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk? Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

Rewilding is an approach to land management that seeks to work with natural processes to restore ecosystems and reconnect society with the natural world. We believe rewilding has a crucial role to play in our efforts to reduce flood risk and adapt to the impacts of climate change. Rewilding projects are long lasting, involve communities in decision-making and improve the area for wildlife as well as people.

There are a range of rewilding practices that can help prevent freshwater flooding – from reforestation, to wetland restoration to species reintroduction. There is increasing evidence and support for such approaches, but it is clear that "it will need political leadership from the highest level to make it happen" (Katherine Pygott, Chartered Institution of Water and Environmental Management).

Friends of the Earth has previously prepared evidence on rewilding with Rewilding GB and we link to that evidence here.

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Fujitsu response to the National Infrastructure Commission's National Infrastructure Assessment Call for Evidence

General Contents

1.0 Introduction

Fujitsu is delighted to have the opportunity to respond to the National Infrastructure Commission's recent Call for Evidence on the long-term infrastructure challenges that the UK faces. Fujitsu has a long standing relationship with central and local government, with over 40 years of collaboration that has supported some of the UK's critical infrastructure. With our industry expertise along with our capabilities within technology and infrastructure services, we understand that infrastructure solutions offer a long lasting solution to the challenges faced today but also those likely to arise in the future.

With the digital age rapidly changing the way in which people and organisations operate, it is necessary that the Government is able to assess and understand the challenges that are likely to arise as a result of this over the next few decades. Technology stands to change the way in which people travel and work, whilst organisations will look to take advantage of improved supply chains and digital communications.

Our changing population expects digital services to be available across the public sector, departments and authorities must therefore find new ways to respond to the needs of their citizens and adapt both physical and digital infrastructure to address these changing behaviours.

Within Fujitsu's response, we have made recommendations that will provide the UK with the right infrastructure to meet the challenges of the digital age. We have included examples where Fujitsu are already delivering infrastructure developments, while making suggestions as to how the UK can invest over the next 30 years to establish a highly competitive, world leading digital economy.

2.0 Cross Cutting Issues for UK Infrastructure

2.1 What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

Fujitsu operates and delivers services across the entire length and breadth of the UK. In particular, we have significant experience in using technology to drive innovations in digital transformation, developing digital connectivity both in the UK and abroad. We are also driving innovation in critical public services such as the transport sector, energy infrastructure and water management. As such, rather than focusing on a single city or region, we believe it is important to consider the increasing interconnectedness of infrastructure across the UK to ensure that infrastructure investments continue to be of relevance despite significant technological change over the next few decades.

One key piece of infrastructure that has the potential to deliver high levels of value across the UK is the connectivity of 'islands and bridges'. This refers to the UK developing an infrastructure system that connects urban hubs and major UK cities easily. By increasing mobility between cities, the UK can benefit from a more efficient transport network, while increasing digital connectivity between cities can drive the digital economy and increase the UK's overall competitiveness. Furthermore, in order to achieve sustainable economic growth across the UK, Government must prioritise the ability to move quickly and efficiently within UK cities. If the UK can design an infrastructure system that prioritises passenger experience through the consideration of efficiency, sustainability, capacity and security, then this has the potential to greatly improve the competitiveness of the UK economy.

Fujitsu believes that existing infrastructure services can be innovated and improved across the whole of the UK. Throughout our response to this call for evidence, we will discuss the influence of Intelligent Mobility (IM) and the importance of the UK developing a smart, hyper-connected and multi-modal transportation network. Technology stands to radically alter the way in which goods and people can be transported and the UK's infrastructure investment strategy needs to reflect this, as well as being sufficiently flexible to allow new technologies to be integrated in the system.

2.2 How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

The overriding theme for the future of transport throughout the UK is Intelligent Mobility (IM). Intelligent Mobility is the user-centric optimised movement of people and goods across a smart, hyper-connected and multi-modal transportation network. IM has three major themes:

1) Improving digital capability to provide new ways to optimise supply and demand
2) Opening up the transport network to make end-to-end journeys more seamless
3) Improving access to the transport network

Infrastructure must support and contribute towards the economic competitiveness of the UK through providing a balance of efficiency and capacity whilst improving the safety and security of citizens and data.

For this vision to be realised, the transport network needs to move from being vehicle-centric to becoming person/package-centric. UK government, along with transport providers, must encompass or interact with systems in other domains (e.g. weather, event planning, construction) to provide a real-time experience that meets users' needs. For example, passengers must have access to information that reliably predicts the likelihood of a journey arriving on time, regardless of disruptions during a journey or a change from the planned to the actual mode of travel to arrive at the users selected destination (Catapult).

Intelligent Mobility goes beyond being solely an integrated intelligent transport network, it includes the necessary innovation in the operating and commercial models of all organisations- irrespective of industry or location. As a result, IM improves end-user experience while developing commercials opportunities that can benefit the UK's economic competitiveness. As people pass through the transport network, enhanced traveller connectivity means that third parties originating from all sectors will gain a new channel to reach their consumer base, which they will look to exploit in order to stay competitive within their own industry.

The UK has many challenges within transport that it must address to remain competitive within the global market. These challenges include an aging infrastructure system, crowded and over populated cities and with that- transport facilities that are under pressure along with greater congestion. However, the UK has an advantage through its 'tech savvy' population who are aware of the capabilities within digital technologies, the Internet of Things and potential developments within Artificial Intelligence. As a result. The UK has a great base for testing emerging technologies. Fujitsu recommends that development within these technologies should be encouraged for both UK and International companies operating within the UK, while successful trials can be extended towards a "full" implementation. Through this, the UK has a clear opportunity to benefit from the initial investment within IM, as well as enhancing its reputation as a good place to do business.

Fujitsu believes that we can only connect a truly hyper-connected World through transparency between the UK and its global partners and traders. The UK acts as a customs gateway for many goods on their way to/from Europe. This provides direct and indirect income to UK transport hubs and stimulates UK job investment. It is one aspect of valuable cooperation with the EC that will hopefully be retained post-Brexit. Furthermore, International passenger hubs similarly provide revenue and job opportunities in transport and other sectors such as hospitality and retail. People and freight movements are accompanied by extensive supporting data and the ICO statements about adoption of the GDPR. Therefore, Fujitsu believes that investment within UK infrastructure should encourage continued cooperation with the EU at both data and physical levels in order to improve the UK's overall competitiveness within an ever-competitive International market.

2.3 How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Planning for housing must be cognisant of transport needs of citizens, feeding into the transport models for the region. As a result of this, the transport service can commit to investments that evolve to meet the additional requirements that citizens now anticipate. It is critical that transport plans need to feed into energy supply plans that in turn, contribute towards the maintenance of housing across the UK, with citizens benefitting from more energy efficient and affordable housing.

Digital connectivity must also play a key influence in the design of housing and work spaces. Investing in high speed, flexible network architecture will improve connectivity across the UK. This will be a key challenge for the UK government, however, through the consideration of telecoms regulation and current UK digital infrastructure, Fujitsu believes that the UK can implement a world leading digital infrastructure.

2.3.1 Infrastructure built on sharing

Infrastructure services must be designed and managed with a focus on the sharing of information between government departments. Factors such as devolution can lead to multiple initiatives being undertaken at any one time, which may address the same issues. Digital technology now provides the ability for public sector organisations to effectively and swiftly share information with each other in ways that were previously not possible. It is also important that the Department for Transport is aware of transport-related projects and encourages the exchange of information between government departments and the adoption of approaches that are broadly compatible. Failure to do so will result in the slowdown of overall progress across UK government infrastructure developments.

As data models for various infrastructure domains are developed and evolved, scenario planning and appropriate interoperability between them should be facilitated to provide a responsive cross-domain national infrastructure. In other words, UK governments must be able to forward plan scenarios that change the ‘state of play’ for some of the UK’s critical infrastructure, whereby an unforeseen circumstance puts pressure on key infrastructure systems such as housing, energy management and transport. This can include challenges such as travel congestion management, flooding and effectively managing the demand for energy.

Cities and their delivery partners face complex choices about the kind of future that they can create in order to meet the needs of their citizens. Different cities will have different visions, reflecting the needs and circumstances of citizens and economic activities within the specific region. The former UK Department for Business Innovation and Skills (BIS) has commissioned the British Standards Institution (BSI) to develop a strategy for implementing smart cities and to also provide assurances for citizens that potential risks are being managed appropriately.

Fujitsu is currently planning and building Smart City services that provide a balance between environmental considerations and ease of living for citizens. Fujitsu’s vision for creating Smart Cities is to realise smarter energy usage, along with social infrastructures through the use of ICT, revitalise communities and develop a means of sustainably circulating social values through ICT (Fujitsu Smart Cities and Energy Management). At Fujitsu, we believe that the design, planning and introduction of Smart City technology across the UK is of

great importance for ensuring that UK cities are a better place to live for citizens, while being more prosperous and secure.

Case study – building a smart urban transport network

Barcelona's transport authority, Autoritat del Transport Metropolità (ATM), took the opportunity when updating their ticketing system to implement a comprehesive transportation management system.

Fujitsu partnered with La Caixa, Moventia, Indra to integrate the management of several means of transportation and real-time data, including adapting to a single fare model that develops logic models and adapts existing infrastructure within the city. This allows users to access real time information about the current state of the city's transport service. The system will also supply end users with the best routes depending on current conditions and incidents, with information being available to end users as it occurs. Information on the use of the service will be collected for each user with anonymous users becoming clients. Through this, journey patterns can be recorded and models can be generated that accurately predict end user behaviours.

2.3.2 Improving UK network coverage

In the digital age communication infrastructures are vital and endpoint services need to be capable of using a range of network protocols and transports to maximise connectivity in all situations, including a state of emergency. The NIC's own report "Connected Future" (2016) highlights the need for improved network connectivity, with the UK being ranked the 54th in the world for 4G, with an average user only being able to access 4G connectivity 53% of the time. If the UK is to be prepared for the arrival of Connected and Autonomous Vehicles (CAVs) and other innovative technologies as highlighted in the same NIC report, a large amount of investment is required to make UK network connectivity a world leading service. UK infrastructure must develop systems that act reliably, even when networks are not available for any reason.

2.3.3 CAV, ULEV and Vehicle Development

Infrastructure must be designed to take into account future transport needs, in particular those of Connected Autonomous Vehicles (CAVs).

Government has encouraged investment within CAVs, Ultra Low Emission Vehicles (ULEV) and Electric Vehicle activities. Ultra-low and zero emission vehicles, along with developments in renewable energy presents a huge opportunity for the UK's automotive sector. The Automotive industry is innovating rapidly as car makers seek to differentiate their products and to stay ahead of the competition. They are currently prioritising three key areas; mobility solutions, seamless information sharing within the supply chain and linkages to broader integrated transport solutions. However, whilst connected cars are the focus of today, the government should recognise how the automotive industry should also be looking forward to the future of mobility-as-a-service. Drivers will require an on-demand solution for car travel and a Hybrid IT cloud environment will need to be in place to support this digital transformation. As a result of this, infrastructure should be designed to consider the impact of driverless vehicles and the use of CAVs, both on a service and user basis.

It is likely that a lot of signage on roads in the future will be virtual, with warnings and information being delivered directly to vehicles depending on the situation on the road at the time, as opposed to the permanent, physical signs we see on today's roads. In this case it will be important to conduct an investigation into the information awareness of drivers. Connected vehicles that provide drivers with a significant amount of information during travel may cause a driver to miss a virtual sign due to the display in front of them or information overload. Cognitive and behavioural analysis of the provision of such a significant amount of information to drivers would be worth factoring into infrastructure considerations. Furthermore, other transport users with less automated or modern vehicles such as cyclists and pedestrians must also be considered. Wearables (including cycle helmets) may be able to assist and provide travellers with virtual signage but are unlikely to become universal. Therefore, particular consideration needs to be paid to areas where transport modes intersect, such as tramways with/on public roads and level crossings. The need to retain signage for 'traditional' users will limit the ability to move completely to driver displays and may mask behavioural traits of drivers. Fujitsu recognises the importance of this challenge to the UK's infrastructure and we are currently developing technology that could be used for driver behaviour data collection.

Ultimately, UK government must research positive and negative effects of new transport capabilities on both the system and its user needs. Failure to address negative effects will undermine public trust and engagement, thus undermining the ability of current and future initiatives to mature and deliver real benefits to citizens. It is encouraging to see that within 2016 Autumn Statement, laid out a number of areas for funding through the National Productivity Investment Fund (NPIF), including £100 million for new CAV testing infrastructure and £230 million to support ULEVs, with £80m being invested in charging infrastructure and £150m for supporting low emission buses and taxis. UK government must undertake this research and invest within future technologies before other international markets take the lead in infrastructure development.

2.3.4 Attracting Foreign Investment and skills from International Markets

Attracting foreign investment and skills remains greatly important to the development of UK infrastructure. The UK should leverage others' work whenever it is possible and appropriate. One example of this is the Co-operative Intelligent Transport Systems (C-ITS) work being undertaken by the European Commission (Europa report). This has produced information regarding a number of key considerations for infrastructure development, including; road safety, enhancing mobility in a multi-modal transport chain, improving the efficiency of logistic operations and reducing energy use while diminishing the environmental impact of road transport. Due to these developments in infrastructure design, it is critical that ongoing collaboration across borders is essential to minimise duplication of effort and encourage interoperability and collaboration at all levels.

3.0 Transport

3.1 How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

As infrastructure and journey services mature, there will be a continual shift towards tailored 'personal journeys' that take advantage of the flexibility and personal choices that they enable.

It is likely that such personal journeys will have elements of both individual and public travel. Where such journeys have elements that are common to a number of fellow travellers, infrastructure will need to accommodate a robust public transport system. Meanwhile, there will also be a need for efficient and secure infrastructure services that are used regularly by high volumes of individual passengers.

Government may look to deliver a system that monitors and estimates journey patterns, relaying this information to passengers and allowing them to complete their personal journeys. This will enable an individual traveller to use a fluid transport infrastructure, increasing efficiency and the overall mobility of the UK workforce. Journeys will combine personal vehicle usage (such as a car or an autonomous vehicle) from either a public or private transport provider which individuals will use to commute to a transport hub or major UK city. Passengers will then share journeys through train or coach to travel from one hub to another, before again requiring a small individual or shared vehicle (be that car or public transport) from the last hub to the final destination.

Investments within technology will result in the analysis of journeys at aggregate and personal levels that inform service providers of the likely demand of certain services and passenger journeys using predictive analytics. Furthermore, investment in analytical data capture should also include demand management systems that can be used to streamline the freight and haulage industry. This can monitor goods traffic with the individual legs of any journey being optimised. For example, parcels that are dispatched from several suppliers could be delivered to a home address as a single delivery, with the delivery time being available when the occupant confirms that they can receive delivery of the parcels. Fujitsu are currently contributing to the Transportation Systems Catapult-led initiative "Intelligent Mobility Planning, Action and Coordination Team (IM-PACT)" to manage the arrival of autonomous vehicles and the need to coordinate ICT, Telecomms, Data and Infrastructure in order to facilitate their application on UK roads.

One particular issue that is likely to arise through the large amount of granular data that will be generated through personalised travel is data security. It is vital that this data is used appropriately and transparently. If such data is compromised then it is likely to pose a significant threat to UK national critical infrastructure, therefore, as with all major projects in the digital age, it is a priority that security and privacy is addressed throughout the public and private sector development of future user centric transport systems.

3.2 What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Major investments are required within existing transport infrastructure to introduce features to support future vehicle systems, the underpinning digital service, data and communications infrastructures, privacy mechanisms and testing facilities as previously outlined in our findings.

There are a number of emerging trends within freight transport, including the concept of 'platooning' autonomous freight transport and the concept that freight journeys are made up of different sections. This means that journeys should all be capable of being multi-modal. Facilitating multi-modal journeys provided by a range of supplier types is vital. Currently, many discussions are held by interest groups linked to a single mode of transportation. There is a risk that this will lead to development of single-mode solutions. Multi-modal support provides overall system resilience (e.g. those selecting road for a journey leg could be guided to travel details for an alternative mode in the event of a major accident causing a road closure). Furthermore, deficiencies in connectivity and general infrastructure in rural and urban areas, including the availability of data, will impact the availability of services and potentially limit transport effectiveness.

3.2.1 Transport sharing for citizens within major urban areas

Autonomous taxi services and other transport services with passenger sharing capabilities will provide opportunities to reduce congestion and contribute towards an inner city environment that is more efficient and far less polluted. This also has the potential to reduce the need for some transport infrastructure such as parking facilities in densely populated urban areas. Furthermore, it is likely that changing transportation services within city centres will mean that many citizens will not need or wish to own their own vehicles. However, transport sharing schemes, a focus in inner city public transport and autonomous taxi services require considered investment and adequate coverage of an area in order to operate successfully.

3.2.2 Digital Ticketing and Digital Payment Systems

Digital ticketing and digital payment systems need to be available to create transport infrastructure that allows travel without the need to pay separately for different legs of the same journey. Multi-mode/any-mode transport should also be the norm with users able to monitor and budget their expenditure over multiple channels. Digital payment and contactless payment systems will become the norm, as we continue to operate in an ever increasing hyper-connected world, whereby our everyday lives operate through personalised digital devices. Fujitsu recognises that the mobile phone is likely to be the major channel used for digital payment and digital ticketing, however, people should not be stranded should their mobile lose power or the handset be lost.

3.2.3 Transport and Highways Infrastructure

The complexities of some urban area road layouts and traffic systems should be capable of being simplified by use of approaches such as journey planners, driver dashboards and 'vehicle to vehicle' (V2V) reporting of delays. There will also be a demand for investments within transport infrastructure that facilitates autonomous vehicles and vehicles that are built with artificial intelligence, allowing the vehicle to be responsive for its own movement while on a journey. This is especially relevant when critical transport infrastructure and busy highways are under pressure and require major event planning such as during sporting and festival events. As a result, incorporating links and infrastructure to other services such as hotels, restaurants and shopping facilities would be useful for all users and invaluable for commuters and visitors. Furthermore, particular emphasis needs to be paid to shared spaces and their safety implications.

It is now inevitable that the IoT will be hugely influential within UK transport and highways infrastructure. Government would benefit greatly from acknowledging this and investing in

infrastructure that accommodates a greatly increasing volume of data. Furthermore, focus should be applied to the implementation of an infrastructure system that utilises information received from sensors on both highways and transport vehicles that independently record transport usage and maintenance data. This information refers to data that can be distributed and shared for the benefit of Government departments and individual travellers - such as road closures due to repair work, rail repairs and expected impacts and delays of journeys. Another key consideration is the potential impact that this sharing of information may have on cyber security. Supplying a UK infrastructure system that accommodates increased capacity and records increasing levels of data is of great importance, however, the UK Government should plan how this data is shared and must endeavour to not compromise the overall security of information.

3.3 What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

The growth of digital technologies will result in dramatic changes across the whole of the UK transport service. The UK's transport infrastructure needs to be flexible and responsive enough to facilitate the introduction of new models by a range of players.

Fujitsu recognises that there will not be the same level of infrastructure in rural areas or those outside major conurbations. Where vehicle-to-infrastructure (V2I, whereby a vehicle can connect through a network service to interact with surrounding infrastructure) capability is not available in rural areas, vehicle-to-vehicle (V2V) may well be able to provide much of the functionality that is required for a connected transport system. For example, a cluster of vehicles could generate details of traffic jams for other citizens in the same region who are approaching a location. Where V2I capability is available, V2V capability should supplement this network service to create a more detailed and reactive transport infrastructure.

Digital technology is necessary for many of the foreseen developments in areas such as V2V, V2I and digital signalling. Whilst these developments cannot function without it, they provide new and valuable data that can be analysed and turned into actionable information. For example, digital signalling will provide details on movements and delays and can thus be harnessed to iteratively improve schedules and timekeeping as well as providing information that can be leveraged by Mobility as a Service (MaaS) and journey planning services. As in urban areas, journey planning is required but on longer journeys this could be supplemented with optional features such as details of places to take a break or if the traveller chooses to engage in a leisure pursuit.

3.4 What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

Road usage is still likely to run to capacity at peak times in some key areas. However, as indicated earlier in this document, the nature of that usage is likely to change towards greater use of shared vehicles and a move away from personal car ownership.

Journeys will also be personalised through tailoring. One opportunity for road user charging is the consideration of cost for consumers, with users being able to select preferred modes

of travel and costs for parts of a journey. This provides the ability for those with less resources or urgency to travel more cheaply than those who need or are able to avail themselves of premium services. This fundamental change is disruptive to the current transport taxation model based upon vehicle and fuel duties and new models based upon consumption are likely to be required and factored into costs. PAYG models provide some capability for fluctuation in costs but they must be predictable to MaaS users.

4.0 Energy

4.1 What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

Fujitsu recommends that implementing an infrastructure that precludes the use of natural gas is now critical to decarbonise heat, for both commercial and domestic users. Biomass generation may entail increased road transport (which may not be low or zero carbon) and this necessitates the use of a plant that is more complex and inherently less reliable than traditional gas boilers and/or expensive community heat distribution networks; furthermore, biomass may have other negative environmental impacts such as land use and air pollution that the UK government must consider when designing infrastructure for its citizens.

Fujitsu recommends that UK Government should prioritise reducing the demand for heat. This can be achieved through increasing the overall thermal performance of buildings used across the UK. This can be achieved through building regulations which could involve a requirement for increased levels of insulation, improved glazing performance and stricter ventilation requirements. There may also be a case for requiring increased building thermal mass along with heat storage and redistribution.

Low cost, zero carbon heat generation may also be driven by building regulations. For example, a change to regulations could incorporate a degree of passive solar heating in building design which, coupled with intelligent controls and a high standard of insulation, can provide a significant contribution. When it comes to supporting active heating, a decarbonised electricity grid supplying high-efficiency electrical heat pumps provides the most practical and flexible solution. Heat pumps are small and don't require fuel storage, this saves on overall space which can then be used for other functions such as occupancy. An example of this is in high-density residential housing developments where there is no mains gas in place- developers sometimes favour heat-pumps over gas boilers as there is no need for a gas tank.

Improving the design performance of the UK's domestic commercial building stock will take many years to implement. As a result government should take early decisions to set the desired changes in motion and achieve greater efficiencies within buildings across the UK. The UK as a whole will benefit from improved building design that is driven by building regulations but the reduction in demand for heat should also be promoted through

incentivising within or requiring a 'whole-life cost approach', in place of the lowest capital cost approach that is so often applied to building and infrastructure projects.

4.2 What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

Fujitsu is committed to reducing its impact on the environment and therefore welcomes a low and zero carbon power future for the UK. For Fujitsu, the cost of power is important but supply reliability is more important and our resilience in the event of power interruptions is essential. We invest in infrastructure that maintains the resilience of our data centres, but the highest level of resilience starts with a highly reliable electrical supply. Taking this model and applying it within the UK's power sector, it becomes clear that maintaining the United Kingdom's grid reliability and resilience should be a primary objective. High grid reliability should be achieved by a mix of generation assets that provide adequate capacity to meet UK electricity demand with sufficient margin to deal with demand peaks and generation outages. Low carbon base load generation capacity will no doubt involve a significant nuclear power capability. Furthermore, the United Kingdom's transmission and distribution networks must be designed, operated, maintained and upgraded to cater for the changes in supply and demand over time.

As a leader in digital solutions, Fujitsu believes that the power of technology can be employed for the benefit of businesses and society. Effective and intelligent control of supply and demand, incorporating responsive generation and energy storage are of critical importance for the UK Government to achieve the most effective zero carbon power sector by 2050. Furthermore; smart metering, flexible tariffs for citizens and demand side response should play a fundamental part in our zero carbon power future. Any increase in the integration of IT into the UK's power infrastructure will also require sophisticated cyber security measures that protect critical infrastructure as well as the data that infrastructure supports. Fujitsu have prioritised cyber security within their research and development operations. Fujitsu are investing within cyber security within the UK as well as globally and we would greatly appreciate the opportunity to showcase our capabilities and potential for cyber security when implemented within critical UK infrastructure.

4.3 What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

As highlighted in section 3.0 of this report, Fujitsu is actively investing in infrastructure that facilitates all-electric vehicles that are also equipped with intelligent technology that interacts with the landscape around the vehicle. Fujitsu therefore acknowledges that all-electric cars are likely to become the dominant solution for low carbon transportation (rather than hydrogen or hybrid solutions). This presents obvious challenges in respect of increasing electricity demand and thus generation as well as transmission and distribution capacity. Meanwhile, there is also a challenge to build infrastructure that facilitates an all-electric vehicle network. Increased generation demand should be met wherever practical

by distributed renewable generation to ensure that the bulk of primary energy is low-carbon and mitigate the need to increase transmission and distribution network capacity.

Electric vehicle take up also presents significant opportunities for UK Government. The potential for high-volume electric vehicle sales is already driving developments in battery technology. Meanwhile, economies of scale in battery manufacturing should improve the outlook for grid-scale electricity storage, thus improving the economics of intermittent renewable (solar, wind and tidal) generation, allowing off-peak power generation to be fed into the grid when it is needed most by industry and consumers. In turn, increased grid-scale energy storage capacity should reduce the need for fossil-fuel burning power stations to act as the stand by reserve for periods of high demand and low renewable power generation. Furthermore, the UK electric vehicle fleet, coupled with smart metering, presents the potential for utilising the energy storage potential of the electric vehicles in balancing the grid, i.e.; vehicle batteries can access power available on the National grid during “off-peak” times when they are charging (typically overnight) and may be available to act as a reserve during peak times. Government should promote distributed renewable power generation aimed at charging vehicles during traditionally off-peak periods along with financial incentives to encourage vehicle users to act in a way that supports the grid and effectively balances supply and demand. Such incentives might include time-of-day or grid-demand led price signalling alongside payments or credits for feeding back into the grid – all facilitated by smart metering controls for vehicle charging points with user-configurable options.

5.0 Conclusion

It is clear that technological developments, particularly around the Internet of Things and driverless vehicles, will heavily impact the way in which infrastructure planning must be made in the future. Infrastructure decisions that are made in the near future must be designed to accommodate technologies that are not yet widely in use but which industry expects will become prevalent in the next decade. This clearly necessitates the NIC and other Government organisations working closely with industry when considering infrastructure investment so as to understand what considerations should be made to effectively 'future-proof' infrastructure.

By effectively preparing UK infrastructure for future technologies, the UK will be an attractive investment destination for organisations that are looking to design and test such technologies. As such, effective infrastructure planning ought to take into consideration Government departments such as BEIS and DIT in order to effectively engage with industry.

Fujitsu is closely involved in working with public authorities and industry groups to design and implement the next generation of such technologies, both in the UK and abroad in Europe and Asia. We would welcome the opportunity to engage with the NIC closely as it considers future infrastructure investments.

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Greater London Authority and Transport for London submission to the National Infrastructure Assessment made on behalf of the Mayor of London February 2017

0. Introduction and Summary

0.1. The Greater London Authority (GLA) and Transport for London (TfL), welcomes the opportunity to input into the National Infrastructure Assessment. This submission has been coordinated across the GLA Group, including relevant directorates of the GLA (Infrastructure & Growth, Planning, Environment), and TfL.

0.2. The GLA and TfL are in the process of reviewing strategies and plans for London to reflect the Mayor's priorities. As such, the London Plan, Mayor's Transport Strategy, Environment Strategy and Economic Development Strategy are currently under review, whilst a new Strategic Infrastructure Investment Programme is also being developed for the capital, building on work completed developing the London Infrastructure Plan 2050 in 2014. As such in this interim period we encourage you to not only view these existing strategies, but the Mayor's vision document 'A City for all Londoners' and the updated TfL business plan, both released in late 2016. We would welcome the opportunity to brief the Commission further on these strategies as they are developed and have included contact details of relevant policy officers in this submission should you have further questions.

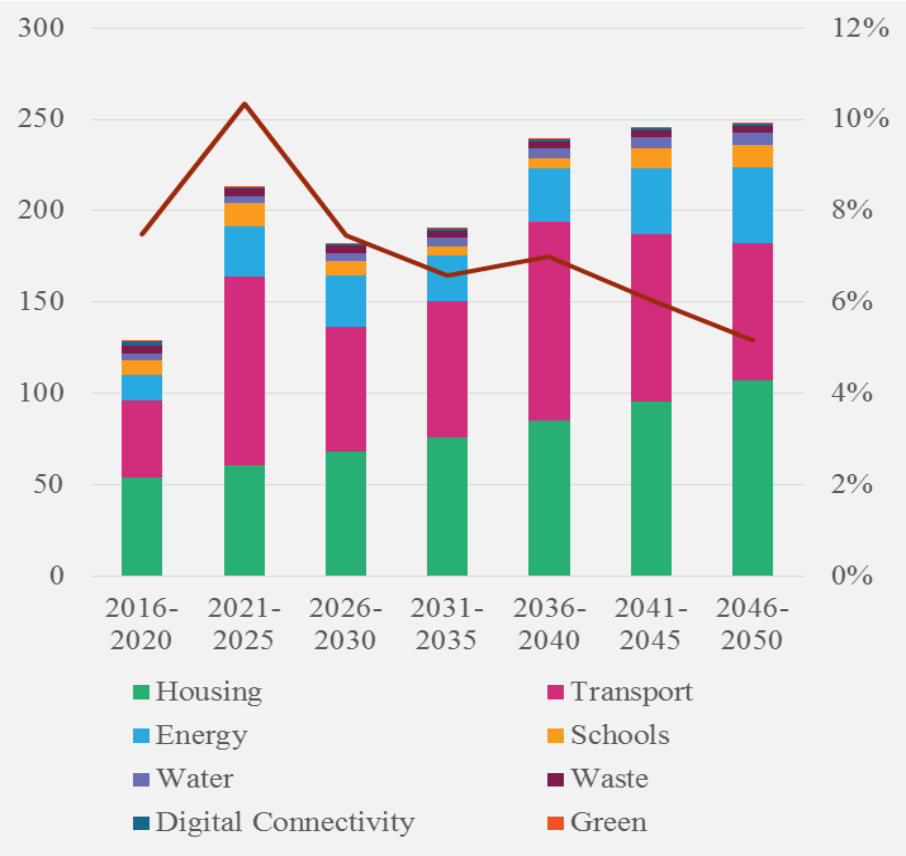
0.3. London has a significant infrastructure challenge ahead. The capital's population is projected to grow by 70,000 per year to reach 10.5 million by 2041, placing significant pressure on infrastructure systems. GLA forecasts suggest that in the range of 55,000 to 65,000 additional homes need to be built every year to support such high rates of population growth.

0.4. The scale of the challenge is significant – basic utilities (digital, water, and energy) will need to be connected and upgraded to service new homes and businesses, while meeting greenhouse gas reduction targets and improvements in air quality. Larger transport investments and upgrades are required to connect people with employment and to meet an increasing freight task as well as connect London to the rest of the world. This investment is required alongside new flood defence, green and social infrastructure such as healthcare and education.

0.5. The nature of infrastructure demand is also changing – in terms of transport, people are expected to use public transport and other sustainable modes more – meaning additional capacity is needed to meet an estimated 50% increase in trips. Changing demand is expected to also impact other sectors – energy, water, digital, green, education and health.

0.6. Our most recent cost estimates (completed July 2016) suggest that London will require £1.45 trillion in infrastructure investment to 2050, with the bulk of costs falling in the transport and affordable housing sectors. It is under these two sectors that the biggest funding gap is emerging out to 2050 (estimated at £175 billion) averaging at £5 billion per year. Without alternative funding sources, there is no obvious way of bridging this funding gap and delivering the infrastructure London needs. Fiscal devolution could be part of the solution, as discussed in the London Finance Commission's recent report 'Devolution: A Capital Idea' (released January 2017). Investment in some sectors, such as water, energy and digital can largely be funded through user charges. However, particular types of infrastructure – including green, flood defence, health and education infrastructure – face ongoing costs that will need to be met through government grants or other sources. Figure 1 shows a breakdown of infrastructure costs by sector out to 2050, prepared by consultants Arup in partnership with the GLA and TfL.

Figure 1: Total capital expenditure (£ bn) and % of London GVA (Arup analysis 2016)



0.7. The London Infrastructure Plan 2050 (LIP 2050), released in 2014, was the first time a strategy had been prepared setting out London's long term infrastructure requirements and issues likely to impact delivery. The LIP 2050 was widely welcomed by infrastructure providers, investors and business alike as setting out a realistic assessment of London's high level infrastructure requirements and it continues to act as a powerful evidence base for the Commission and other stakeholders to draw upon.

0.8. Since then, the GLA, together with TfL, has led on a number of initiatives to support improved planning, delivery and coordination of infrastructure throughout the capital. Initiatives have been targeted at not just identifying requirements across sectors, but addressing barriers to delivery – poor coordination, funding, regulation, skills and planning. Many of these initiatives are discussed in this submission.

0.9. The Mayor recognises that collective action is required to ensure London receives the infrastructure investment it requires, and as such is committed to working with Government, boroughs, infrastructure providers and others involved in delivering London's infrastructure.

Response to consultation questions:

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

1.1. Supporting growth sustainably requires coordinated planning and integrated infrastructure investment across all sectors. It requires efforts to not only invest in new infrastructure, but also efforts to make best use of what we already have – through innovation gains and efficiencies, alongside other efforts to reduce demand. Nevertheless, continued infrastructure investment is

essential to ensure that essential services keep pace with growth, including investment in transport, energy, water, waste, digital and green infrastructure networks.

1.2. In late 2016 the Mayor commissioned development of a Strategic Infrastructure Investment Programme for London (SIIP). The purpose of this programme is to identify London's strategic infrastructure requirements at key growth locations throughout London across all the sectors – identifying project requirements, challenges and opportunities impacting delivery. Whilst this piece of work is in an early phase, a clear emerging theme is that transport investment is essential in order to unlock the potential of London's key growth locations, however there are cases where investment in other sectors is also a major factor in supporting growth, and as such we argue the Commission view infrastructure investment on an integrated basis across sectors. The SIIP will be finalised in the spring of 2017, and outputs will provide an important evidence base for the Commission to consider. Below we have provided commentary on London's infrastructure requirements across the transport, digital, water and energy sectors.

Transport

1.3. Transport is fundamental to London's growth – it has enabled the city to be shaped as it is today, cementing its competitive positioning globally, supporting productivity and quality of life.

1.4. There is a need to deliver continued investment in existing networks, such as tube network capacity upgrades, but also large scale, transformative transport infrastructure investments, such as Crossrail 2, which will bring significant regional benefits, as well as the Bakerloo Line Extension initially to Lewisham to unlock regeneration in the Old Kent Road corridor. Investing in new high-quality radial rail capacity can deliver a step change in accessibility for these corridors. It can be a catalyst for enabling transformative land use change that promotes regeneration, developer investment in otherwise underutilised land and the introduction of new opportunities for communities beyond central London.

1.5. New river crossings are also being planned for east London. In the short term, the Mayor has prioritised the delivery of Silvertown Tunnel and the extension of the DLR Beckton branch to serve Thamesmead and enable its regeneration. In the longer term, as the population of east London grows, further new river crossings to improve connectivity and support economic growth may be required...

1.6. There is also a need for smaller scale transport infrastructure improvements. The recently released TfL Business Plan (December 2016), which includes further details of planned infrastructure investments in London, allocated additional funding for the Growth Fund. This is geared towards delivering schemes that unlock new development; initiatives to create a safer, cleaner and more attractive environment for walking and cycling; station capacity upgrades and bus priority measures. Such smaller scale investment will help offer an attractive alternative to the private car, helping to underpin sustainable growth in London. Investments made in London will bring benefits not only to London, but to the south-east and the UK more broadly and ensuring communities share in the benefits of that growth.

Digital

Broadband is now considered the fourth utility, essential to productivity of businesses and also an influencing factor of homebuyers. It is also vital to achieving social integration and mobility. The Mayor has made clear his commitment to improving connectivity in London in his manifesto – prioritising the targeting of 'notspots', ensuring the fast take-up of 5G technology, ensuring better access to public-sector property for digital infrastructure, and treating digital infrastructure with the same status as other key public utilities through the London Plan and other policy documents.

Water, wastewater and flood risk

1.7. Water is a vital resource for any city, and frequently one that is taken for granted. As London's population grows, greater stress will be put on both the city's supply of water and on its wastewater system – requiring creative new approaches, along with new infrastructure. The quality of London's watercourses and the risk of flooding, meanwhile, also need to be managed.

1.8. Thames Water projects a 10 per cent (213 megalitres per day) water deficit by 2025, rising to 26 per cent (522 megalitres per day) by 2050. That is equivalent to the demand for water from Birmingham, Leeds, Manchester, Liverpool, Nottingham and Newcastle today. At the same time, there is likely to be less available water: resulting either as a requirement to improve the quality of our rivers (less water abstraction) or because of climate change.

1.9. Key priorities for water include securing water supply out to 2050 through new investments and upgrades to existing networks but also demand side measures such as increasing the distribution of water meters, managing flood risk through improved drainage systems and investment in flood defence and also efforts to improve the quality of London's water supply. One example project in London is the Thames Tideway Tunnel, which is being built to prevent 39 million tonnes of diluted but untreated sewage being released into the River Thames every year.

1.10. The GLA has been working to progress an integrated approach to water management, recognising that such an approach to water management and breaking down organisational siloes will help improve the situation and introduce multiple benefits at a lower cost.

Energy

1.11. The supply of energy to homes and businesses is crucial to the functioning of our city, daily activities and economy. Population and economic growth in London is likely to lead to an increase in energy demand. This will mean more pressure on the supply of energy to the capital. Depending on the scale of additional supply required this investment could be significant.

1.12. In the London Infrastructure Plan 2050 we estimate that London will require a 20 per cent increase in energy supply to 2050 unless significant demand reduction is met through retrofit. We have undertaken scenario modelling to assess how the Mayor's ambition for a net zero carbon London by 2050 will be met. A key priority for the Mayor is developing the flagship scheme 'Energy for Londoners' which will cover all aspects of energy supply and efficiency. Examples of its remit include rolling out smart meters and other technologies, supporting solar and local community energy enterprises and retrofitting buildings. Establishment of Energy for Londoners will support achievement of the Mayor's goal of London becoming a zero carbon city by 2050.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

2.1. London accounts for 14% of the UK population and its highly competitive economy contributes 17% of jobs, 23% of GVA and nearly 30% of taxation. If London's economy succeeds, then this benefits the whole of the UK.

2.2. Imperative to the success of London and the country are well-functioning infrastructure networks. Transport networks play a pivotal role in optimising UK economic geography through their ability to bring about dynamic change in both labour market access and mobility and the connectivity of places. As noted in the 2006 Eddington Transport Study, good transport systems support the

productivity of urban areas, supporting deep and productive labour markets, and allowing businesses to reap the benefits of agglomeration. The study identified transport corridors as the arteries of domestic and international trade, boosting the competitiveness of the UK economy. It suggested economic success is dependent on transport investment in urban catchments, key inter-urban corridors and key international gateways.

2.3. International gateways play an important role in ensuring that the UK is able to trade goods and services effectively with the rest of the world. The UK's location and connectivity has attracted businesses and significant investment in a number of sectors. Connecting these gateways to domestic markets is arguably as important as the capacity and capability of the gateways themselves. As the number of passengers, goods and data moving through hubs increases, so does the need for investment in connecting infrastructure.

2.4. The international gateways located in London and in the Thames estuary play a vital role as gateways to the rest of the UK. London has always played a vital role, at the forefront of international trade, and this role and London's resilience will be every more important to respond to changing patterns of trade and investment that will occur as a result of the decision to leave the European Union. Given the Government's aim to focus on increasing the volumes of UK trade with a broad range of international markets, the strategic value and importance of the international gateways within London and in the Thames Gateway will be heightened.

2.5. London and the South East's **airports** are significant enablers of economic activity by supporting international business travel, leisure travel and air freight. The aviation sector is a significant employer and contributor to economic output. However, constraints on capacity need to be addressed to ensure growth in demand for aviation, particularly in south-east England, can be met. The Government's proposed expansion of Heathrow will need to be complemented with significant investment in surface infrastructure to move the increased number of passengers and freight using the airport in an efficient and sustainable way.

2.6. Ensuring road and rail connections serving **deep sea ports** have the capacity to accommodate forecast growth in trade is essential. For the port of Felixstowe, the largest container handling port in the UK by units, it is important that suitable rail routes have sufficient capacity to accommodate container freight so that such services are able to avoid congested parts of the rail network around North London, when additional rail capacity is needed for serving growing ports such as London Gateway. There is also a need to consider the strategic impacts of freight paths on broader transport networks. Allocation of freight train paths in London, which are not always used, reduces opportunities for high quality orbital passenger rail services, including on the North and West London Lines.

2.7. **International rail freight** is also increasing, including with the recent introduction of rail freight services between China and Barking Freight Terminal. It is an important alternative to sea, air and road freight options. There may be a case to encourage more international rail freight, particularly to reduce heavy goods vehicle movements. One way this could be done is to consolidate wholesale markets in East London around a link to HS1, such as Barking Freight Terminal.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

3.1. Transport infrastructure demand results from decisions people make about where and how they live, work, study, shop and spend their leisure time. It depends on where businesses locate to meet customer demand and how they design their supply chains. Such decisions take place in a complex environment over a variety of timescales and at different spatial levels, from the international to

national, regional, sub-regional and local. Travel decisions are determined by the opportunities people perceive are available to them. Transport infrastructure is one of the main factors that influence how people perceive these opportunities and therefore plays an important role in shaping their choices.

3.2. This is important from a policy making perspective because the patterns of land use and transport that result from people's decision making have wider effects (externalities) over time, both positively and negatively. These patterns influence the quality and location of housing development, the types of lifestyles on offer, the range and quality of employment and leisure opportunities available to people, and a whole range of environmental impacts from air quality to climate change effects. Taken together, these influence the sustainability of our cities and, related to this, their attractiveness as places to live, work and invest in, which will be important in determining their future economic prospects. For London, this is particularly important, given it competes for investment and talent internationally as the UK's only world city.

3.3. The quality of transport connectivity greatly influences the viability and success of housing development given the need for and value placed by people on connectivity when choosing where to live. It enables more efficient use of space through increased densities in the most accessible areas located near stations. The development industry is supportive of new high density developments in highly accessible locations, which in London are increasingly being designed to be car free, or with lower levels of parking provision. Such developments enable more sustainable lifestyles. It is therefore important to approach land use, housing and infrastructure planning holistically.

3.4. In London, the Mayor has powers to frame integrated policies for planning, transport and economic development. Integrating transport and land use planning at the city regional level has helped to create better places to live and work, and supported improved coordination of infrastructure investment, planning and delivery. The Mayor's powers have been used to good effect to encourage high-quality sustainable development within Opportunity Areas such as the Olympic Park and East London, and encourage higher growth in the more accessible parts of the city. These policies recognise the importance of transport infrastructure in enabling the agglomeration driven growth process at the heart of London's growing economy. Building on work undertaken to date, the Strategic Infrastructure Investment Programme currently being prepared for London will seek to improve the integration of infrastructure planning across sectors at key growth locations.

3.5. As well as large-scale projects such as Crossrail 2, for which enabling housing and employment growth is a key objective, smaller scale complementary measures and good design can ensure an attractive public realm that is easy to get around by walking and cycling and well served by public transport. This approach to "healthy streets" is key to ensuring Londoners benefit from better air quality and are more likely to engage in walking and cycling, resulting in health benefits. Infrastructure must also be accessible. TfL is also delivering the biggest boost to step-free access, with the number of step-free Tube stations to be increased by more than 30. This opens up more of the city to all residents.

3.6. It will be important to ensure that HS2 is properly integrated with local and regional transport networks in order to ensure that the benefits that accrue from this significant investment is maximised. For such transformative schemes, it is important that they are future-proofed to ensure that station interchanges remain fit for purpose, with the capacity required to accommodate long term growth.

3.7. The Government must continue to play an important role in addressing the 'market failures' that lead to poor economic outcomes. These include the factors that contribute to the long-term under-

supply of new housing in order to prevent reduced affordability of housing becoming a significant drag on economic growth.

3.8. There is also a need to continue to address issues within the planning system that prevent infrastructure and housing schemes being considered holistically. The relationship between the delivery of those schemes, the planning and compulsory purchase processes and the funding of those schemes needs to be considered. In addition, more fundamental reform is needed around land value capture so that the necessary infrastructure to support housing delivery can be properly funded.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Transport

4.1. Demand management approaches can help improve the efficiency of operation of transport infrastructure networks. Solutions aimed at managing use and increasing capacity or utilisation of existing infrastructure must be considered, for example through changes to operations, processes, technology or behaviour (including influencing travel mode choices) – these will often prove to be simpler and cheaper, offering better value for money than major upgrade works or new infrastructure. However, given the pressures of growth in London, both dimensions are key.

4.2. TfL already uses a range of approaches to manage demand, including through information and data provision (which has the additional benefit of improving customer experience), and pricing mechanisms, such as the congestion charge and peak/off-peak fares. For example, on the roads, TfL uses a number of communication channels to keep commuters informed at key congested hot spots through Travel Demand Management (TDM) activity especially where there is recurring congestion. The promotion of shoulder peak travel and encouraging greater levels of agile working, including working from home and more use of drop-in workspaces also offers potential. Management of freight and servicing activities is also necessary to address congestion.

4.3. However, such approaches will only go so far and can achieve some policy objectives. Whilst demand management helps to manage the capacity, it will not deliver improvements in connectivity that is necessary to enable growth. For example, in east London new river crossings are needed to enhance connectivity.

4.4. If existing finite transport infrastructure capacity is to be used as efficiently as possible, it is then necessary to consider bolder approaches. Devolution of VED would enable London to set rates that better target the particular challenges faced in London, including, potentially, congestion. This could also be a potential mitigation for wider changes to paying for road use, if such a policy were to be taken forward.

4.5. Improvements in one infrastructure sector can also help to manage demand in others. For example, improved communications infrastructure can allow more people to work remotely, reducing the demand on transport networks. At present, over 24 per cent of employed Londoners have adopted some form of flexible working all or part of the time. However, such changes in working arrangements can result in intensification of employment density (by making more efficient use of city centre floorspace) rather than actually reducing the overall level of transport demand into hubs like central London.

Energy

4.6. The GLA is investigating new and innovative ways to help deliver home retrofit of energy efficiency measures to reduce demand at the depth and scale needed. For example, we are considering trialling Energy Leap (based on the Dutch Energiesprong model) later this year, in a small number of social rented homes and in partnership with social landlords. This uses state-of-the-art methods of construction to bring homes to near net zero energy levels within a week, funded by guaranteed energy savings over 30 years.

4.7. The Mayor has two dedicated buildings energy efficiency programmes, RE:FIT (public buildings) and RE:NEW (homes). Both are award-winning programmes, each comprising an expert team providing end to end support. The current phase of RE:NEW ends later this year and we are looking at the potential for a successor programme to make a greater impact on home energy efficiency and also assist with tackling fuel poverty.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

Transport

5.1. In a rapidly growing city such as London, it is important to invest both in upgrades and maintenance of existing transport assets to prevent problems of crowding and congestion acting as constraints on growth. Maintenance, upgrades and new construction can be effectively balanced when decisions are based on an agreed and common set of metrics that enable the value of each to be fairly and consistently represented – for example using criteria on safety, reliability, environment, social benefits and whole life costs. This is normally done at a strategic level; however this has at times been criticised as being overly coarse because of the simplifications/rationalisations required to provide comparable criteria/metrics. Developing a suite of more detailed, and meaningful metrics, that treat all activities in a fair and consistent manner at a strategic level, in particular maintenance vs. new build is challenging.

5.2. Cost-benefit analysis techniques can be useful to assess the merits of different types of investment providing that the full benefits are captured including the dynamic effects of transformational new investment. However, these dynamic effects are less tangible for expenditure on maintenance activities. The challenge, in one part, stems from the commonly perceived purpose of each activity i.e.:

- Maintenance – to fix defects and ensure the asset keeps working
- New construction – to deliver social or economic improvements and benefits

5.3. It is this perception of the former that creates the challenge. We must change this perception to an understanding that maintenance is sustaining and protecting the benefits. However, frequently after the infrastructure/assets are constructed, the benefits are taken for granted and we revert to a 'maintenance' mind set. In some circumstances, maintenance and upgrades to existing infrastructure can achieve much higher cost-benefit ratios than building new capacity. Conversely, new transport connections can also unlock latent demand. This is one of the wider benefits of new links that is difficult to capture in appraisal.

5.4. To effectively balance maintenance with new construction we must understand and represent the benefits the infrastructure is providing and how these are impacted if we do not undertake maintenance. For the Transport for London Road Network (TLRN) we assess maintenance in terms of the impact on safety, reliability and environment if we do, do not do, the work. This helps us to understand the benefits that maintenance is providing and protecting, i.e. by preventing the assets

from deteriorating we are preventing the degradation of the benefits it was designed and constructed to provide.

5.5. In order to ensure that the level of maintenance is appropriate, this requires 'Levels of Service' to be defined for the infrastructure, which can be defined by assessing the benefits/value that delivers – e.g. what benefits are delivered by a deteriorated road compared to a well maintained road. Defining a range of Levels of Services, with associated benefits and costs, provides a basis for comparing maintenance with new construction at a strategic level – provided, that the benefits are described using a fair and common set of criteria across both areas. The levels of service for carriageway and footway for the TLRN have been defined using whole life cost analysis, engineering assessment and customer surveys. This has defined a range of acceptable Levels of Service for these assets that is used to compare investment priorities with other activities across TfL.

5.6. In cities that are not experiencing population and employment growth, investment in maintenance will be more predominant. Given that London is a growing city, with investment needed in new connections in order to unlock growth, there needs to be a mixture of both maintenance and new infrastructure investment. Where growth is taking place, such investment is not a zero sum game, as productive investment will generate returns either for the city or for Government through increased tax revenues.

5.7. Regular reviews of key infrastructure assets present an opportunity to identify opportunities for optimising, maintaining or repurposing ahead of building new. We are taking this approach with waste infrastructure. The GLA has produced a waste map (https://maps.london.gov.uk/webmaps/waste/) locating all London's waste facilities and their capacity. A next phase of work will be to identify opportunities to optimise under-capacity sites and re-orientate sites to support reuse, repair and remanufacturing activities. This exercise will also help to free up land for other land uses including housing and transport in response to London's growing population. This approach could be adopted in other sectors and locations.

5.8. Decision making on asset renewal or replacement should also be driven through a coherent Responsible Procurement policy that informs contract award for large scale development. Contract award criteria should give priority to circular procurement options that maximise value from products and services for as long as possible, keep long term expenditure down, and reduce financial and asset disposal risks. Where relevant suppliers should be required to apply circular economy outcomes in the delivery of projects and services, that include re-use, refurbishment and re-manufacturing.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Transport

6.1. There is significant scope for further integration of delivery services both in London and nationally. Benefits will be maximised where compromise can be struck to reduce the variety of specifications and implement common process and systems.

6.2. London has been at the forefront of collaborative contracting. The London Highway Alliance Contracts (LoHAC) developed jointly between TfL and boroughs are used by 19 of the 34 London highway authorities for the delivery of highways services. This has delivered significant benefits including:

- Improved efficiency through an improved utilisation of resources, sharing of overhead costs and optimisation of works programmes
- Improved resilience through the sharing of resources and opportunities for mutual aid
- Opportunities for a better and more consistent service to customers
- Improved relationships between authorities

6.3. Changes in technology and customer expectations are likely to further drive a requirement for collaboration between traditional highway maintenance service providers with related technology providers. This will help to ensure that infrastructure requirements related to initiatives such as smarter cites and autonomous vehicles can be delivered effectively.

6.4. TfL is supporting the Highways Maintenance Efficiency Programme (HMEP) Collaborative Contracting workstream. The work which is nearing completion provides guidance on how to promote and realise the benefits from collaborative working relationships and TfL commends the findings of this work. There is significant scope to improve the benefits of collaboration through consideration of these issues at the procurement stage.

Energy

6.5. The GLA is developing an Economic Case as part of, or adjunct to, the Strategic Outline Case for modification of the arrangements governing the provision of additional investment ahead of need for electricity distribution infrastructure. This Economic Case compares options for modification to the existing arrangements including an option to use a DevCo or similar model to provide and manage the investment. This new model for investment would improve collaboration between developers and utilities regarding the efficiency with which new infrastructure is installed, reduce developer and investor risk, thereby encouraging development and supporting local economic growth.

6.6. The GLA is also progressing a Licence Lite model. This involves the GLA obtaining a junior electricity supply licence whereby, with the support of a fully licensed supplier, it can purchase the output from low and zero carbon electricity generators and supply the electricity produced to public and commercial electricity users in London. The licence lite model will serve to make the electricity exported by smaller low and zero carbon electricity generators more competitive, to the benefit of consumers and the environment.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

7.1. The Government expects an increasing proportion of the cost of projects to be raised from funding sources at the sub-national level and has taken some steps to enable this, such as the devolution of business rates by 2020. Devolution of funding and responsibilities to the local government level presents a significant opportunity for cities to position themselves for success through more localised decision making. Devolving infrastructure development, delivery and operations offers clear benefits by better aligning risk and reward. In particular it links the responsibility for funding infrastructure with policy making at the local and regional level, which should incentivise more integrated, better quality decision making (for example, with planning, housing etc.). This will help overcome current constraints on growth and the capacity of cities to invest in the projects that can drive them forward.

7.2. While we support the Government's devolution intentions, we believe there is scope to go further. In 2016, the Mayor re-established the London Finance Commission (LFC) to review and assess existing arrangements for government funding of London, including capital and revenue, and

examine the potential for greater devolution of both taxation and the control of public expenditure. The Mayor has endorsed the recommendations of the LFC's report: 'Devolution: A Capital Idea', published on 27 January 2017.

7.3. The only way for London to make the required investments in infrastructure, and in turn support growth not only in London but the rest of the UK, is to have a stronger, more local, fiscal base. In view of this imperative, the Commission should consider how innovative mechanisms (including land pooling and taxation based mechanisms) could help scheme promoters in cities such as London capture the uplift in land values arising from their schemes. This should help deliver more overall investment and ensure those who benefit from the improved accessibility bear a reasonable share of the costs. TfL would be happy to discuss work it has undertaken to assess the potential for greater land value capture in London. The Commission's approach to prioritisation of schemes should take account of the proportion of scheme costs that can be met from these alternative funding sources.

7.4. However, it is unlikely central government will be able to absolve itself completely from infrastructure provision and funding. There will be transport initiatives which are of such scale, complexity and importance that they cannot be delivered by a single local authority on its own (or groups of authorities), including 'mega' projects with national benefits and requirements such as Crossrail 2. The Commission should consider the appropriate role of the national government in delivering nationally significant infrastructure in this context. This should include devolution of further funding streams (for example, the ability to capture land value uplift resulting from transport investment) and provision of greater financing powers so cities can invest in transport on the basis of their ability to then capture the benefits of growth that this catalyses locally.

7.5. As part of this, the Commission should address a broader question about how infrastructure is funded and financed, and the capacity and appetite of users and governments to pay for new infrastructure. It could look at the proportion of infrastructure costs paid by users through fares compared to government subsidies, how these proportions vary across different modes and regions, and whether these levels are appropriate. From there one can consider both the level of investment that is appropriate given infrastructure users' willingness to pay, as well as the other avenues for raising funding for infrastructure investment (for example through land value capture mechanisms, road user charging etc.). The Commission should seek to ensure that the funding of projects reflects the benefits delivered to different classes of beneficiaries, whilst ensuring optimal use of the infrastructure networks. If the benefits of growth could accrue more directly to the places that are accommodating the growth, this could help overcome some of the resistance towards it. Otherwise, there is likely to be resistance given actual and perceived adverse impacts of growth.

7.6. It should also consider how funding arrangements sit alongside the existing planning and compulsory purchase processes for major schemes where the processes encourage the early acquisition of land when innovative funding mechanisms may not make funding available until later in the development process.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

8.1. Funding generated by infrastructure projects (such as fares, user charges and local taxes) will frequently arrive over many years following construction when the majority of costs are incurred. Circumstances which lead to a project being able to be "funded" but not "financed" are more likely to be when the projects are large and capital intensive, where revenues are expected to be generated over a long period following the projects construction, or where there is a prolonged ramp-up in revenue. This can lead to a revenue "gap" meaning the financing of upfront

construction is difficult to secure on suitable terms. Further, there is a risk of variability of cash flows, which could be linked to broader economic drivers. Without government support – for example, through the UK Guarantees scheme – these factors may involve authorities being exposed to levels of economic risk that they cannot reasonably be expected to manage without the devolution of significant new funding streams.

8.2. Generally, cash-flow timing mismatches (between capital expenditure and revenues) should be addressed by borrowing under the Prudential Code. For large projects with long construction periods –borrowing capacity may be inefficiently constricted by the need to meet interest costs from current revenues. The Government could consider mechanisms to provide a principal and interest holiday during construction, with a stepped-up interest rate during operations. This could be considered alongside the introduction of new measures, such as land value capture mechanisms, where cash-flow timing mismatches are inherent. Market risks and cash-flow timing mismatches associated with land value capture (LVC) instruments can be managed to an extent by managing land value capture measures as a programme run at a corporate rather than project level, so that property market risks are diversified across projects and over time.

8.3. The ability to finance a project on suitable terms is more generally subject to market conditions. Evidence suggests there is strong domestic and international private sector appetite to invest in both debt and equity in well-structured, good quality infrastructure projects. The impact of Brexit on future access to finance from the European Investment Bank is not yet known.

8.4. The Government has recently consulted on a proposal to provide financing support to local authorities via a Local Infrastructure Rate. Subject to the final design of the measure, it could assist London with its borrowing for infrastructure.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

9.1. Ensuring that our infrastructure system is resilient to risks arising from interdependencies across sectors is important. Failure to address constraints in one sector can have flow on effects for others. An example of this would be Vauxhall, Nine-Elms, Battersea Opportunity Area in London – where a failure to plan for additional energy and sewerage capacity delayed the construction of homes, and had issues not been addressed, may have undermined the viability of the Northern Line Extension. It is for this reason that integrated planning across sectors is important. Such integrated analysis needs to be brought forward to the design and appraisal phase of infrastructure projects.

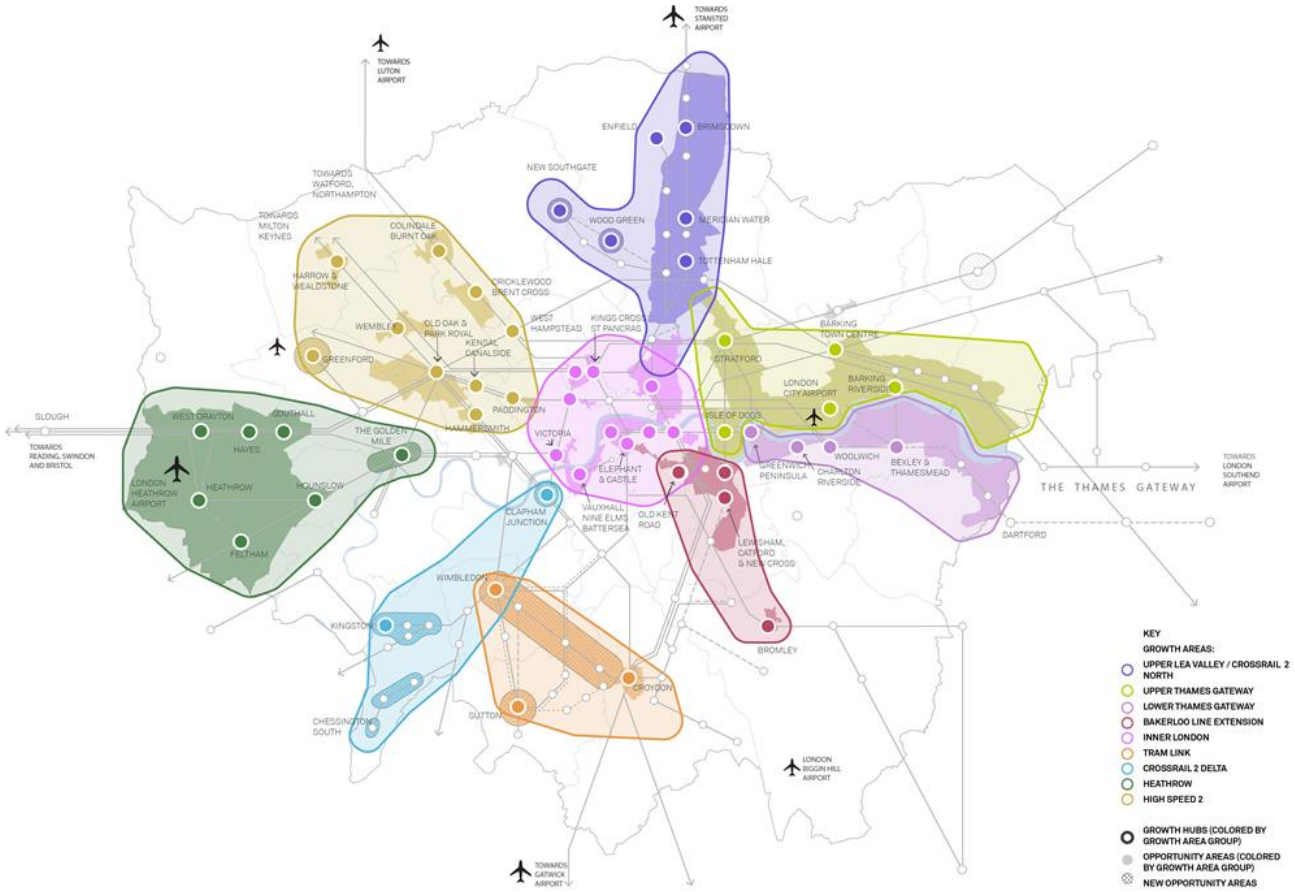
9.2. It is currently the case that interdependencies are often poorly considered as part of the appraisal process of large scale infrastructure schemes. Schemes are often viewed in isolation, or in the context of the sector in which they operate. The GLA's work developing a Strategic Infrastructure Investment Programme for London is a step towards improving how schemes are considered in a wider context. The GLA has identified nine key growth areas and is considering strategic infrastructure requirements across these. This process allows for joined up thinking, and the identification of risks that could undermine the potential for growth/viability of schemes. Figure 2 provides an overview of the nine key growth locations identified in the Strategic Infrastructure Investment Programme.

The SIIP will provide four main outputs:

- Identification of strategic objectives, opportunities and challenges at London's key growth areas
- Development of a Strategic Project list and gaps analysis
- Creation and analysis of integrated packages of infrastructure investment

- Development of a Project Assessment Framework to assess strategic projects in the first instance, to determine if they meet strategic objectives and align with Mayoral policy directions.

Figure 2: London's key growth locations as identified in the Strategic Infrastructure Investment Programme



Source: Arup, 2017

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

10.1. The barriers to utility companies delivering and managing their infrastructure sufficiently in advance of need and on a strategic basis can be a serious impediment to new housing developments, particularly large scale ones. In order to support regulated utilities it is essential that mechanisms be put in place to incentivise investment in new utility infrastructure in strategically identified locations.

10.2. Councils and partners across the Wider South East are confident that the following approaches will help utilities focus resources and invest confidently in preparation for future demand:

1. Better sharing of information between utilities and local authorities on the likely progress of developments:

Understanding the timing, build out rates and occupation of new development is important to effectively manage the delivery of necessary supporting infrastructure. Utility firms are proactive

with the development industry and local authorities and will welcome improving the exchange of information and development intelligence. Consistent and accessible data, including spatial information, would assist all providers form credible investment plans. The GLA is working to support this through its development of the London Infrastructure Mapping Application (http://maps.london.gov.uk/ima), released in 2015. This tool provides forward insight on the plans of infrastructure providers relative to London's development pipeline. This innovative tool has caught the attention of cities globally due to the way in which it leverages data to support improved coordination of infrastructure planning and delivery in what is a fragmented governance arrangement. The tool has strong potential to support improved collaboration and a reduction in disruption, reducing costs of delivery and the impact of roadworks. The GLA recently secured £250,000 in funding to further progress development of this tool, with Phase 2 development currently underway.

2. Utility and other infrastructure providers need to make efficient use of customer and taxpayers money, which means making the right investment at the right time:

This includes working with the development industry to ensure that fair contributions are made towards the infrastructure needed to support growth. Improved intelligence of site progress, phasing and understanding of site requirements will help to achieve this.

High level development agreements between local authorities, utilities, other infrastructure providers and developers on the timing of development would help agree approaches to infrastructure investment, and avoid blocking sites, both large and small, that might otherwise struggle to progress.

3. Improvements to the regulated environment to allow the right committed or actual investment at the right time:

Regulators should have regard to local and sub-regional plans, national policy and high growth areas including garden villages and towns when considering price reviews to ensure the emerging growth can be effectively planned. This should include how regulators allow flexibility to changing circumstances, such as acceleration of housing delivery. Regulators and infrastructure providers should be encouraged to emphasise the need for efficient and timely investments.

10.3. Cross-dependencies between utilities (perhaps particularly between water and energy) should also be considered and be included in strategic plans, as well as company plans and regulatory assessments. A collective approach to delivering utility infrastructure, which involves planning authorities, developers and utilities can encourage more development to be promoted through the local plan process and create a safer environment for investment (both for utility companies and developers alike)

10.4. There are a number of ways planning approval processes could be improved, particularly to better accommodate large scale infrastructure projects. Under current Development Consent Order (DCO), Transport and Works Act orders (TWAO) and other regulatory processes, some Orders can attempt to pin down specific issues and details at too early stage in the project design and delivery process. Sometimes conditions may be placed just to placate local objections or the scope of EIAs and TAs are broadened are beyond that strictly necessary. For some projects with design and build contracts, this can cause costs to escalate or implementation to become difficult, with the real prospect that the project becomes unaffordable and that a scheme of national importance cannot be implemented. In that scenario the multi-million pound cost to tax payers of getting the scheme through the approval process would be wasted.

10.5. The process needs to be managed in a manner that is proportional to the issues at stake and sufficiently flexible as the project develops. In most cases consent Orders should be akin to an

outline permission that authorises the development, allowing matters of detail to be agreed with the local planning authority at the appropriate time. This is essential for design and build contracts because the detail may simply not be available at that stage of the delivery process.

10.6. We welcome recent changes to give more certainty on the timing associated with decisions on Compulsory Purchase Orders, but more can be done to create certainty around the period for decision making on TWAOs. Further improvements could be made to the TWAO regime such as authorising non-railway related development and the scope for further deemed consents. It is also important to ensure that the key institutions that support the planning process for infrastructure are fully funded, resourced and trained to support the challenge of delivery of significant infrastructure and housing over the coming years. In particular this applies to the Planning Inspectorate and the Upper Tribunal.

10.7. There are also further changes that could be made to streamline and improve the compulsory purchase process, particularly around major projects. There are conflicts between the current guidance and the practicalities of delivering major projects which need to be addressed. A review of some of the requirements and procedural rules of the TWAO and DCO regimes may also create further efficiencies.

10.8. In terms of governance arrangements, mechanisms for agreeing strategic infrastructure priorities are important, and it is here that the London and wider-south east engagement is vital. The GLA and councils from the wider south east have participated in a number of summits to consider strategic land-use and transport planning issues. Through these summits, the following four broad priority themes have been discussed:

- Development of the new London Plan (including effective engagement and consultation)
- Tackling housing barriers
- Strategic infrastructure (including transport, waste and water)
- Developing a common understanding of evidence (to support plan-making and delivery)

For the third of these themes, there is scope to explore joint governance approaches to infrastructure planning either on a corridor basis or a wider South East infrastructure plan – based around the fact London's travel to work area goes beyond GLA boundaries. The West Anglia Taskforce is a good example of effective corridor-based cross-boundary governance.

10.9. As well as macro-planning exercises, Development Infrastructure Funding Studies (DIFS) at a more local level can help to identify infrastructure requirements in a joined up manner, alongside proper governance. Funding for transport improvements is an important factor, and strategic planning needs to consider where funding might come from, whether this would include new development which is supported by this infrastructure, and the implications of funding all other supporting infrastructure. If land value capture mechanisms are implemented, as discussed earlier, planning could also take into account the likely impacts on land value uplifts, and therefore taxation revenue.

10.10. Government also needs to ensure that direction is given on major schemes including through National Policy Statements that create long-term assurance required to encourage private capital investment where required and timely decision-making and delivery.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

11.1. The 2006 Stern Review on the Economics of Climate Change noted the central role of transport in the UK's future environmental sustainability. Since then, this has largely framed the

understanding of transport's role as an agent of environmental change. The Stern Review found that the benefit of actions in favour of sustainable development far outweighed the costs of not acting, and given the contribution of road transport to greenhouse gas emissions (and air pollution) a shift to more sustainable options was urgent.

11.2. The way that infrastructure contributes to protecting and enhancing the natural environment depends on the infrastructure itself. Thames Tideway is inherently a project that will enhance a core part of the natural environment by avoiding discharge of effluent to the Thames. Increased investment in public transport can help shift users away from other modes, such as private vehicles, reducing pollution and congestion and promote more sustainable land use through enabling more dense forms of housing development. By contrast, without adequate complementary measures, other infrastructure investments could catalyse increased activity, including through less sustainable patterns of development, resulting in adverse environmental impacts. TfL's contribution in this regard will similarly depend on the types of infrastructure it promotes, though with a focus on active travel and public transport, the interventions might more easily contribute to environmental protection and enhancement than some others.

11.3. The way infrastructure is designed will impact on its effect on the natural environment. The Commission should emphasise the importance of sustainable design. Sustainability and sustainable design should be integrated through the life of the project, from the current early design phase through to detailed design, construction and into operation. This has been key consideration in the development of Crossrail 2. Sustainability for Crossrail 2 is about building a railway that is fit for the future; one that meets the increasing demands for transport and economic growth in a way that recognises environmental limits and the needs of the people who live and work alongside it. It requires that the project design stages seek ways to build in environmental enhancement.

11.4. Less car dependent growth (achieved through an integrated planning approach) will deliver higher densities, resulting in lower land take, less congestion and lower levels of pollution.

11.5. While sustainable design might be the basis for seeking additional environmental benefits, environmental mitigation is the process through which potentially adverse change is prevented or limited. The NIA should include specific reference to the importance of environmental mitigation of potentially adverse environmental effects through the project lifecycle. Any new infrastructure initiatives arising from the NIA will of course be subject to environmental assessment processes.

11.6. The potential role of green infrastructure should be explored within the National Infrastructure Assessment. This is not only because there needs to be a consideration of how infrastructure contributes to the protection and enhancement of the natural environment, but because the natural environment itself can provide benefits and services that complement traditional infrastructure. We have defined urban green infrastructure as the network of green spaces (as well as features such as street trees and green roofs) that is planned, designed and managed to deliver a range of benefits, including: healthy living; mitigating flooding; improving air and water quality; cooling the urban environment; encouraging walking and cycling; an enhancing biodiversity and ecological resilience. Further information about our thinking on the role of green infrastructure can be found in the report Natural Capital: Investing in Green infrastructure for a Future London (accessible at https://www.london.gov.uk/sites/default/files/gitaskforcereport.hyperlink.pdf).

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

12.1. Currently the modelling and appraisal of wider impacts use techniques and approaches that are rapidly evolving and in many ways still experimental. Such analysis requires a series of assumptions to be made about the future rates of population and employment growth, background levels of

economic growth and car ownership and use. Further, there are difficulties in using standard cost-benefit approaches to determine value for money of transport infrastructure projects– as these are not able to capture the full range of productivity impacts arising from transformational schemes that enable significant dynamic land use change. This means there is inevitably significant uncertainty about the results.

12.2. Improvements could be made to current CBA techniques to make coverage of benefits more comprehensive. Two specific areas, already the subject of some changes, could be improved as follows:

i. For transport schemes, the requirement to produce an Appraisal Summary Table ensures that promoters demonstrate the likely impact of a proposed transport investment on a broad number of economic, social and environmental factors. If the further guidance on social and distributional impacts is followed (WebTAG Unit A4.2), then this provides an opportunity to assess the impacts of the scheme on noise, air quality, accidents, severance, accessibility and personal affordability in more detail, using an evidence-based approach. This approach could be applied to other infrastructure sectors.

ii. Carrying out logic mapping of outcomes that infrastructure projects are seeking to achieve would also assist in quantifying the benefits to society generally and to any specific target groups. A current emphasis on savings to the cost of public services could overlook the impact on social wellbeing. A large part of the rationale for policy intervention is to enhance the wellbeing of the client/target group so it is important to attempt to assess the worth of improvements or changes especially if these involve infrastructure. See Fujiwara and Dolan.

12.3. TfL is working with Government to find ways to address and where possible reduce these uncertainties. We support the Department for Transport's new draft WebTAG guidance on wider impacts of transport investment, published in September 2016, which responds to the 2014 Transport investment and economic performance (TIEP) report. It has a focus on improving transparency and giving more freedom to provide more context specific evidence of wider benefits. This guidance helpfully enables promoters to quantify the land value uplift from new residential and commercial development expected to be unlocked by transport investment following a clear methodology. TfL also welcomes research now underway for the DfT that seeks to better understand the impact of agglomeration elasticities on the results of Wider Economic Impact appraisal.

Case Study: The London Simulator Prototype: the GLA's partnership with Greenwood Strategic Advisors

The GLA has been working with Greenwood Strategic Advisors for approximately two years developing a dynamic systems model of London, which has the potential to provide an integrated way of appraising policy and investment options, individually and in combination.

The strength of the dynamic systems modelling approach lies in its ability to fairly quickly assess combinations of policies, infrastructure investments or other, and assess their potential outputs and outcomes on a number of key variables (such as the economy, emissions, population) simultaneously.

A range of inputs and conditions can be specified and tested through this model. In this regard, from the perspective of the policy-maker, the tool is attractive in its capability to provide a testbed for a range of policy objectives. To our knowledge no one has attempted to develop such an integrated, systems-based model of London – or any other major city – before.

12.4. New modelling tools such as ULTrA, provide a means of appraising investment that can assess changes in land use and also complementary land-use planning policies that maximise opportunities arising from the transport investment. However, the land-use transport interaction (LUTI) models that drive this tool require further development in order to improve their robustness. TfL provided more detail on this tool in its response to the DfT consultation on modelling the wider economic impacts of infrastructure projects.

12.5. The Mayor is exploring the applicability in London of the natural capital accounting methodology developed by the Natural Capital Committee. We are currently preparing a natural capital account for London which will be used to highlight the existing and potential value of the city's green infrastructure, which in turn will help to inform what strategic green infrastructure investments.

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

13.1. Transport of people, goods and services that makes cities work and a good transport system is a key requirement for maintaining London as an attractive city to invest and operate in. Within London, modelling forecasts suggest that there will be 32 million trips a day by 2041 compared to 26 million a day in 2014. There will be strong growth in public transport use from 9.5 million trips a day in 2014 to 12.3 million a day by 2041, which will outstrip planned and proposed capacity increases. Traffic congestion on the road network is forecast to cost London £9.3 billion by 2030, up by 71%. The mix of vehicles on our roads is changing – as a result of population growth and changes to consumer habits and more e-commerce, van traffic is expected to rise significantly. Traffic on the Highways England Strategic Road Network (SRN) is forecast to be between 27% and 57% higher in 2040 than 2013. As the London economy is a major driver of growth, the network around the Capital and the wider south east of England will become more congested. 90% of all freight in London is carried by road and the demand for road based freight activities is predicted to grow in the future. The growing popularity of e-commerce is expected to add to congestion with van trips in London projected to increase by 26% by 2031 (compared to 2011. Within London, there has been a trend of increased use of sustainable modes, which will need to play a greater role.

13.2. By 2031, there will be 30 million trips, with particularly fast growth forecast in rail demand, of between 45 and 50%. This means that even with the current investment, the network will be under increasing pressure and severe crowding is forecast to increase dramatically. Without new investment it is forecast that severe crowding will double by 2041.

13.3. The potential impacts of connected and autonomous vehicles (CAVs) are both numerous and difficult to predict. At this stage, any substantial changes to travel behaviours as a result of CAVs are not practical to factor into the forecasts above. At the London level, TfL will seek to ensure there is a clear framework is in place to manage their impacts, fully capture their benefits and achieve overall policy objectives. We are, however, able to identify areas of potential impacts of CAVs. These include large potential benefits such as widened access to travel to the young, old and disabled, as well as significantly improved safety, which could also help reduce the barriers to cycling. But there are potential drawbacks as well, such as a risk of poorly managed interactions with pedestrians, making it less attractive to travel on foot. More generally, if automation reduces the cost and/or increases the convenience of car travel, usage could increase, along with the associated congestion, emissions and inactivity. Having a framework in place to manage CAVs would reduce the risks of such adverse impacts from arising.

13.4. There could be benefits of automation to public transport networks, such as enabling new cost-effective services in areas of less concentrated demand. On the underground and suburban commuter lines, trains controlled by digital signalling systems are likely to become commonplace by

the 2030s. These will make possible closer headways between trains, enabling extra capacity to be provided to cater for population growth.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

15.1. Given the growing population and increasing demand for travel, for London to function, improving the capacity of public transport networks and new approaches to management of freight trips will be essential. The TfL Business Plan and forthcoming revised Mayor's Transport Strategy provides further details of our plans for investment to move people and freight in and around London.

15.2. Transport investment can be transformative to the economy by delivering wider economic impacts. In terms of the movement of people, the agglomeration benefits that arise from transport investment in London's Central Activities Zone are very large, as schemes including the Jubilee Line extension (and the land use changes at Canary Wharf in advance of the Elizabeth Line opening in late 2018) have demonstrated. Investment to reduce journey times also enables workers to move to more productive jobs by opening up new employment opportunities within a reasonable travel time. Despite mobile and remote working enabled by technology, the physical clustering of jobs in knowledge rich sectors is likely to remain as important as ever. The economies of agglomeration resulting from this unparalleled density of employment mean London drives UK productivity in a unique way that cannot be reproduced elsewhere.

15.3. In recent years there has been an ambitious programme of investment to both expand London's public transport system and renew and upgrade the existing assets. Crossrail and Thameslink will be fully open within the next four years and the programme of modernising the Underground is well underway.

15.4. There is a strong case for investment to get the most from London's existing railways - creating additional capacity on the network by introducing faster, more frequent, metro-style services and maximising the benefits of the heavy rail infrastructure that is already in place. One for the coming years is the re-signalling of the Circle, Metropolitan, District, Hammersmith and City Lines and the Deep Tube Programme, which will mean new rolling stock and signalling on the Piccadilly, Central and Bakerloo Lines. Commuter rail services into London, controlled by the Department for Transport, would also benefit from such enhancements.

15.5. This type of investment will keep London moving for the next decade or so – ensuring that the large and complex public transport network can handle growing demand and at the same time enable a shift away from car use. However, it is clear that a pipeline of further large scale strategic interventions to provide 'new infrastructure' are going to be needed to meet London's growth challenges beyond the next ten years.

15.6. Connecting areas with the potential to accommodate new housing to employment opportunities in central London will help drive long term productivity and economic growth. Enhanced public transport capacity and connections across the city offer the best mechanisms for bringing forward additional housing sites and increasing housing output. Many of the areas with the greatest capacity for development - and relatively close proximity to central London - have poor transport connectivity and this has directly limited private sector investment in housing. This includes many of London's 38 Opportunity Areas (OAs) such as the Upper Lee Valley and the six that lie within the Thames Gateway which represent London's main reservoirs of brownfield land.

15.7. Additional housing potential must also be unlocked in other areas – far more parts of London will need to play a much greater role in meeting the strategic housing needs of the Capital. Increasing housing output more widely in inner and outer London, including through the densification of town centres, linked to improved public transport accessibility, will be pivotal.

Case study: Major transport infrastructure projects currently being planned needed by 2036 and beyond:

Crossrail 2

Crossrail 2 would provide a major expansion of the system of radial transport links serving London's global employment centres. This would relieve the growth constraints that are expected by the time it is due to open in the early 2030s. By 2031, without investment, intense crowding pressures are expected at key interchanges, including Victoria, Waterloo, Vauxhall, Finsbury Park, Liverpool Street, Lewisham and Clapham Junction. As well as solving a series of critical transport bottlenecks, by relieving congestion on the most crowded tube lines, Crossrail 2 will connect the network serving London's global employment centres to major development areas, facilitating the delivery of large scale new housing provision which is essential for helping meet London's long term labour supply requirements.

As set out in previous TfL submissions to the Commission in early 2016, Crossrail 2 would also deliver significant benefits across a wide area extending well beyond London. Services on the South West Mainline into Waterloo are forecast to see demand growth of 40 per cent to 2043.

By unlocking additional mainline capacity from urban areas in Surrey and Hampshire into Waterloo and from Cambridge and beyond into Liverpool Street Crossrail 2 would enhance capacity and connectivity in a corridor stretching from Portsmouth and Southampton through to Cambridge and beyond, which contains a number of knowledge economy growth clusters. Furthermore, four-tracking of the West Anglia Main Line by 2026 as an early phase of Crossrail 2 could accelerate the delivery of up to 25,000 new homes. Crossrail 2 would also leverage the benefits of HS2 by facilitating the onwards dispersal of HS2 passengers arriving in Euston. When HS2 Phase 2 is completed in 2032 there will be 2 to 3 times as many passengers passing through Euston and Euston Square stations as today. Significant additional capacity will be required to relieve severe overcrowding.

Other sub-regional and local schemes:

Alongside Crossrail 2, TfL is developing a programme of sub-regional and local schemes, which will drive continued productivity growth, unlock thousands more jobs and homes, catalyse regeneration and ensure that different parts of London are able to fulfil their economic potential. They will help tackle key constraints on continued growth - in particular, connectivity gaps and the housing supply shortage. The TfL Business Plan (December 2016) sets out the investment priorities for the next five years and beyond. It includes key investment priorities –such as 'metroisation' of suburban rail networks; the Bakerloo Line Extension to deliver the regeneration of the Old Kent Road corridor; new river crossings in east London including an improved DLR connection to unlock significant growth in North Thamesmead; new Overground stations at Old Oak Common to enhance the connectivity to and from this key regeneration area in west London. The emerging Mayor's Transport Strategy will have a focus on 'healthy streets', through a balanced approach to provision for buses, cycles and pedestrians. This will be increasingly important for intra-urban travel.

15.8. London's excellent radial heavy rail connectivity to the wider south east has helped London succeed. There is no other form of transport that is capable of supporting and enabling the high

employment densities and large labour supply catchment areas necessary to make key service sectors within central London so successful. High quality, frequent radial rail services also reduce environmental impacts (supporting more sustainable travel patterns and mitigating impacts on air quality that might otherwise constrain permissions) and underpin attractive communities and places.

15.9. Existing patterns of development in outer London suburbs and in the wider South East counties beyond the GLA boundary do not generally support comprehensive public transport provision, with the exception of town centres, and there are much higher levels of car dependency, ownership and use than seen in central and inner London. However, through the integrated development of housing and new transport infrastructure on corridors with frequent commuter rail services and use of buses, there are clear opportunities for developing urban areas in a way that encourages higher population densities and more sustainable transport patterns that does not result in high numbers of additional car trips.

15.10. New planning designations could support more sustainable patterns of development. Creating Station Intensification Areas would encourage more higher density development to take place near rail stations. Working with planning authorities across multiple boundaries could see Growth Corridors (extending into the greater south east), where sustainable growth could be accommodated by enhancing rail capacity, for example by extending Crossrail from Abbey Wood to Ebbsfleet and Gravesend.

15.11. In terms of the movement of freight, TfL is seeking to ensure that adverse impacts of delivery and servicing including air pollution, noise and congestion are minimised whilst recognising that provision for these activities is necessary for the efficient functioning of London and ensuring London remains a good place to do business.

15.12. It is important to encourage the logistics industry to maximise opportunities for sustainable freight distribution by rail, water and cycling and walking for the 'last mile' of distribution. This requires a mixture of measures such as encouraging out of hours deliveries and freight consolidation centres. On the former, TfL is building on best practice developed with key retailers and rolling out the Freight Re-Timing Programme.

15.13. As part of TfL's Healthy Streets approach, we are supporting the quickest possible adoption of the cleanest vehicles standards through Ultra Low Emission Zone (ULEZ) expansion and tighter LEZ emission standards for freight vehicles. The introduction of a new Direct Vision Standard for HGVs is intended to encourage safer lorry design, which will reduce the number of cycle casualties within London.

16. What opportunities does 'mobility as a service' create for new road user charging? How would this affect road usage?

16.1. Mobility as a service' is the concept of bringing public transport together with motorised transport services (such as car sharing) within a single, unified platform for users to interact with, for example, through a smartphone app. While there may be some customer experience benefits for those using such a platform, the impact on car usage is harder to predict.

16.2. If such as service leads to fewer people owning cars, then those who give up their vehicle may make fewer car trips as a result, both because there is a strong relationship between car ownership and use, and because there would be a cost associated with every trip. However, there may still be a net increase in car trips if those who do not currently own a car start driving more. If this is the case, there could be an increase in negative impacts such as congestion and emissions, potentially enhancing the case for road charging. It may therefore be necessary to introduce wider road user

charging to ensure that connected and autonomous vehicles (CAVs) do not undermine wider goals for people to make sustainable travel choices and as part of a wider move towards changing the way we pay for road use.

16.3. Shared car services may also make certain types of charging schemes more feasible, such as those based on distance, as it may be easier to require commercial vehicles to provide the relevant information to calculate such a charge. For privately owned vehicles, a 'mobility as a service' app could provide a user interface for more sophisticated charging, though there could be issues around whether this would be widely adopted enough in practice to justify its use, and alternatives may be required.

16.4. There is the potential for greater blurring of distinctions between private and public forms of transport. It will be vital to have a strong framework in place to guide the application of mobility as a service within cities, so that this can form part of the wider solution to the challenges of increasing urban density, improving access to jobs and services, and addressing air quality and severance.

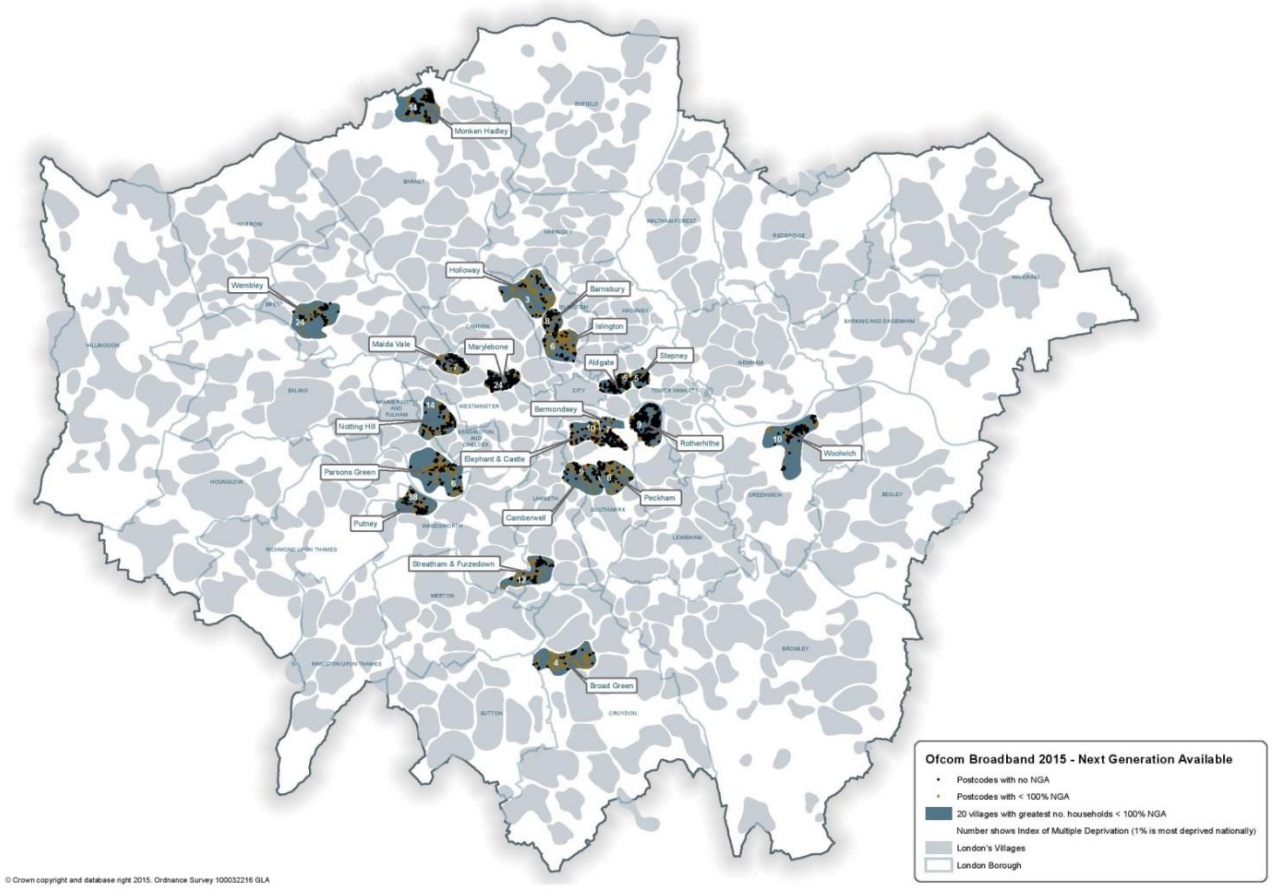
17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

17.1. Insufficient fibre being provided to properties is causing frustrations for Londoners and London businesses, and more work needs to be done addressing 'not-spots', as shown in Figure 3. This is a particular barrier for expanding London's technology sector, but increasingly relevant to every industry. London's digital industries and digital infrastructure are concentrated in specific districts. The Mayor wants to spread the benefits of these assets to communities outside the reach of mainstream services and, by supporting the investment case for full fibre, to unlock latent potential for growth in jobs and GVA.

17.2. Rather than prescribing a particular technology or speed, a supportive environment needs to be created to provide guidance and encouragement for developers to incorporate connectivity as part of any investment. The City of London and Central London Forward's work on standardising wayleaves for fixed connections provides a good example of voluntary standardisation that when used, benefits both property developers and connectivity providers.

17.3. Building regulations offer some guidance on connectivity requirements but further efforts can be made to provide property developers with information on how to 'future proof' their developments for ever increasing connectivity demands. Wired Score, seed funded by Greater London Authority to launch in London in 2015, have been providing some of London's largest commercial developments with advice on ensuring their properties are built to meet highest capacity flexible connectivity requirements. To meet this need the Mayor will be developing further guidance on connectivity as part of the London Plan alterations, and welcomes the opportunity to work with stakeholders in its development

Figure 3
Map of broadband availability by postcode with 'villages' mapped showing lowest availability mapped with lowest Multiple Deprivation Index



18. Is the existing digital communications regime going to deliver what is needed when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

18.1. Leased lines are available across the capital, but a wide variety of products at different price points are required in order to meet the needs of all Londoners and all types and size of business. Through increased competition in provision we will see products developed and deployed that can meet the needs of individuals and businesses now and well in to the future.

18.2. These issues will only be resolved by facilitating a wide range of supply and solutions, and working together to overcome barriers and challenges to smooth deployment. The GLA's experience in coordinating across London would be invaluable. We would welcome the opportunity to work with DCMS and BDUK to develop greater awareness of a wide range of suppliers available in London that are suitable for consumer and business connectivity.

18.3. In London we have tried a variety of methods to help facilitate improved connectivity. We recognise that demand aggregation is key to securing the investment in full fibre connectivity that London needs now and in the future. The prospect of pooling demand for better services has huge potential for shared offices, residential development, local authority housing. Equally, in business parks and industrial areas where the availability of NGA services is typically poor. Securing building or area wide commitment is not without its challenges however.

Case Study: digital initiatives being taken forward by the Mayor in 2017:

- Recruiting a pilot 'Not Spot team', which will be deployed to target not spot areas within boroughs
- Building on the work of City of London, the Mayor will develop a standardised wayleave for the mobile industry
- 5G trials
- The GLA and some London Boroughs are considering exploring a Digital Exchange model, based on a similar model pioneered in Brighton with support from DCMS's *Superconnected Cities* programme; the model offers a potential useful tool to address the structural obstacles in delivering full fibre while providing neutral aggregation points for new networks

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

19.1. Decarbonisation of heat supply can be enabled through the use of district heating networks by connecting increasing amounts of low and ultimately zero carbon heat sources (including secondary – please see link below) to heat consumers. We have recently completed a study utilising funding from the Carbon Neutral Cities Alliance to investigate the cost-effective retrofit of existing individually heating buildings to heat networks. A further consideration was the reduction in the operating temperature of the heat network to enable heat pumps to supply affordable heat in the future. The latter will allow the most cost effective use of low grade waste heat sources and an understanding of to what extent we need to retrofit our existing building stock to accommodate lower operating temperatures. Decarbonising heat will also have to align with targets to improve air quality in London.

19.2. Decisions need to be made on a national scale in the next 5 years to avoid lock-in to infrastructure that will not help London and the rest of the UK meet greenhouse gas emission reduction targets. This can include a clear, but adaptable pathway which is flexible but provides certainty (e.g. along the lines of the Thames 2100 pathway approach). This would require rapid investment in R&D pilot projects to provide greater certainty of unproven technologies and processes (e.g. determining the potential for a zero carbon hydrogen gas grid).

The following links may be of interest:

- Heat networks investment – London & Secondary Heat Study (available at https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/consultation-heat-networks-investment-project-hnip-0)
- Committee on Climate Change renewable heat study (available at https://www.theccc.org.uk/tag/renewable-heat/)
- London Plan Annual Energy Monitoring Report (https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/2015-energy-planning-monitoring-report)

20. What does the most cost effective zero carbon power sector looks like in 2050? How would this be achieved?

20.1. An effective zero carbon power sector is one that is predominantly sourced from renewables with effective storage to balance supply and demand. It will achieve zero carbon as quickly as possible whilst ensuring that power remains affordable and does not further disadvantage the fuel poor. We are currently modelling the impact of a decarbonising national electricity grid on London's zero carbon ambitions as well as the contribution of local electricity generation.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

21.1. We are working to model scenarios for low carbon vehicles roll-out and the potential impact this will have upon future energy demands and electricity grid balancing. Clean emissions from vehicles are vital for London to also contribute to meeting air quality targets. The findings are not yet ready for publication but form part of the Mayor's modelling around achieving net zero carbon London by 2050.

22. What are the most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

22.1. London faces a growing projected resource gap between supply and demand. Relative to other parts of the country London and wider South East face the most significant water resource pressures and per capita usage is still too high, with Londoners using more water per day than the national average (167 litres per person, per day, relative to 149 litres per person, per day, nationally, in 2009-10). A major new resource is likely to be required to help meet future demand. More work is needed to assess the contribution water recycling at a range of scales can contribute to filling the growing resource gap –improving understanding of the most appropriate and viable techniques - while also contributing to mitigating the growing risk of surface water flooding from overwhelmed drainage systems. Efficiency measures including household and commercial metering and leakage reduction including reducing risk of major trunk main failures also have a part to play.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

23.1. For new development an integrated water management approach is an effective in bringing together relevant parties and data to understand future demand and to set a framework for how water and wastewater should be managed for new growth. Such as strategy sets out objectives that aim to ensure sewer discharges and surface water to sewer from a development area are no greater than existing discharges and if feasible reduced, ideally to greenfield run off rates. It also aims to reduce the use of centralised water supply by investigating options for re-using water on site. It includes a strategic review of flood risk sources and water infrastructure coverage to determine the baseline constraints and conditions. A water balance exercise is also undertaken to determine the water available locally and the extent of change in water uses and wastewater and surface water generated as a result of development. This will involve key stakeholders working together, and will include for example the water company carrying out network capacity modelling using projected local population growth to ensure there is infrastructure capacity to meet demand or identify capacity constraints.

23.2. The resilience of the existing networks and infrastructure is also critically important alongside understanding capacity issues, particularly in a changing climate.

23.3. There is also great potential to reduce current capacity on drainage infrastructure through the attenuation or infiltration of rainwater using sustainable drainage systems (SuDS). Modelling commissioned by the GLA shows that SuDS have the potential to feasibly address (attenuate or remove) over 22 million cubic metres (70%) of water generated as runoff in London for a 1- in- 30 year storm. The Mayor's Sustainable Drainage Action Plan (available at https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/london-sustainable-drainage-action-plan) sets out how the GLA is aiming to bring about a step change in the retrofit of SuDS measures into the existing built environment.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

This response is linked to question 26. See below.

24.1. In the case of the tidal River Thames the GLA support and are a partner in the Thames Estuary 2100 Plan which takes a pathways approach to assessing changing flood risk over time.

24.2. In London, few catchments sit entirely within the GLA boundary. It is likely that fluvial flood risk can be managed at a strategic scale by interventions up catchment. Evidence suggests up-catchment strategic SuDS using natural flood management schemes could be more effective than hard engineered defences closer to the location at risk of flooding. Further evidence is needed in this area and locations where this could be tested area in the process of being identified/should be further identified.

24.3. Such measures invariably involve storage of water up-catchment. In some cases these natural storage areas will be quite large. This would make it suitable as an additional local resource for water supply – provided they can link in to nearby treatment works, or could augment flows upstream of major and potentially unsustainable abstractions. Such options need further investigation.

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

25.1. London has a well-established plan for dealing with tidal flood risk; London's most significant form of risk when considering potential impacts to people and property. Provided change in tidal flood risk over time remains within the projected range of the Plan, and provided partners play their part in implementing the plan, London should enjoy a high standard of protection.

25.2. London is less well protected from surface water flood risk. Wherever possible, ideally whenever major works to the highway, local road network, subsurface utilities or public spaces occurs, SuDS should be installed in some form to improve upon the existing drainage regime (see Q23 – LSDAP).

25.3. It is essential that new development contributes to improving this also. London faces considerable development pressure from much needed housing and commercial growth and infrastructure delivery. Further evidence is needed to understand how SuDS and associated water and green infrastructure can effectively deliver this, when set again very high dwellings per hectare densities when there is little site surface area for SuDS type storage or where space that is available has to compete with other utility needs such as energy generation, building services etc.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

26.1. Natural flood management can provide multiple societal benefits alongside reducing flood risk. However, to deliver significant city-wide resilience to reduce fluvial flood, assessment of opportunities at a river basin/catchment scale is likely to be required. We would be interested in investigating with the NIC solutions to the complex array of barriers that operate at a river catchment scale (such as the Thames Catchment). This would include considering planning, governance and funding issues where natural flood management solutions could be implemented beyond the boundaries of the GLA but bring benefits both to the local areas where the natural flood management solutions are implemented and downstream. We are currently undertaking natural capital accounting assessments in London to help improve our understanding of the value of green infrastructure in the capital and inform future investment decisions with the GLA area but

we are keen to explore how we could initiate strategic investment in natural solutions that reduce flood risk which occur beyond the current GLA boundaries.

26.2. We are interested in developing an approach based on testing new, novel and innovative approaches that could potentially be developed in selected catchments that impact on the GLA area. These 'pilots' would need to assess:

- How could green infrastructure most effectively contribute to both protecting and enhancing the natural environment and improving London's resilience to flood risk?
- Where could resilience opportunities provided by natural infrastructure and innovative multi-purpose technologies and practices in reducing environmental pollution and flood risk be implemented?
- What are the strategic cross-sector and cross-/boundary considerations for enabling and implementing natural infrastructure solutions and their resilience opportunities?
- Who are the main beneficiaries and how could they help fund interventions given the complex governance, operational and political environment?

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

28.1. In terms of incentives, a review and change of the definition of waste is necessary to allow movement of discarded or reusable materials like furniture and electrical products to move freely into secondary markets and supply chains. In addition, outcome-based metrics based on material value and CO_2 performance are needed alongside traditional weight based recycling targets to deliver the greatest economic, social and environmental benefits from our waste.

28.2. A VAT/tax exemption on reused materials and repair services may be one option available to drive mature reuse and remanufacturing markets and supply chains, supporting transition to the Circular Economy. The Commission may wish to explore the Swedish example https://www.theguardian.com/world/2016/sep/19/waste-not-want-not-sweden-tax-breaks-repairs. Producer responsibility legislation needs to reviewed to put in place incentives for manufactures to retain ownership over more products with built in maintenance and repair services for their customers.

28.3. The GLA and LWARB are looking to develop a Circular Economy Funding Instrument to support scale up and adoption of circular economy business models. A national equivalent that such a Fund could leverage would send a strong signal to the market for investment in materials innovation.

28.4. Landfill tax has been very effective in driving waste from landfill, however too much still goes to incineration ahead of recycling. Greater financial incentives and charges are needed to drive high value and high fossil carbon materials (namely plastic) out of the residual waste stream and into recycling.

28.5. Work undertaken for the GLA and London Waste and Recycling Board estimate transitioning to the circular economy will bring £7bn of benefits to London and 12,000 new jobs by 2036. See http://www.lwarb.gov.uk/what-we-do/accelerate-the-move-to-a-circular-economy-in-london/

GLOBAL GARDEN

CALL FOR EVIDENCE

GREEN INFRASTRUCTURE INVESTMENT

A proposal to the National Infrastructure Commission

for a 6-month scoping study for the development of a

Green Bond for London and the Thames valley

[Name redacted]
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10 February 2017

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CALL FOR EVIDENCE

This submission answers the questions posed in:

Cross-cutting issues:	1, 2, 3, Funding 7 and 8 Interdependencies 9 Planning system and governance 10 Protecting the natural environment 11 Cost : Benefit ratios 12
Transport	Electrification / agglomeration economics 14
Digital connectivity	Productivity 17
Energy	Low carbon electrification 21
Water and waste water (drainage and sewerage)	22, 23, 24
Flood risk management	25
Natural flood management	26
Circular economy	27

EXECUTIVE SUMMARY

The UK Municipal Bonds Agency (UKMBA) has access to £40bn held in reserves by local authorities. Under joint and several guarantees the UKMBA is able to utilise these funds to structure and originate Green Bonds.

In this paper, a financing model is presented based on the proposal for a Green Bond for London and the Thames valley investing in a portfolio of Green Infrastructure projects based on natural capital economics and employing natural flood management techniques. It has replication potential for catchment areas in the UK and internationally.

Questions have been raised which a Scoping Study would address that would provide certainty, clarity and purpose for local authorities, government regulators, water and energy utilities, and to investors and the public – thereby making a Green Bond potentially attractive to them all and casting the net far wider with the NIC providing both a breadth of scope and a wider perspective on how this initiative could be developed.

A request is made for NIC to fund a 6-month scoping study by Global Garden Ltd.

CONTENTS

1 Frequently Asked Questions

- What is the problem?
  Climate change and catchment area flooding has a UK £2.5bn funding requirement with global insurance assets at risk, particularly in cities. Sustainable infrastructure qualifying projects meeting Natural Capital Committee and National Infrastructure objectives need to be identified, scoped and aggregated into a portfolio to attract Green Bond investment.

- Who owns the problem?
  Environment Agency and local authorities in catchment areas who are in a position to issue Green Bonds through the UK Municipal Bonds Agency.

- Who will pay to fix the problem?
  Green Bond investors and insurers with a COP21 commitment seeking to invest $1tn p.a. in climate bonds with UN Environment Finance of $5-7tn.

- What would be the outcome?
  Sustainable growth in GVA for local authorities and in GDP for the UK with reduced operating risks for corporates with FSB reporting requirements.

- Where would the ROI come from?
  Re-allocation of statutory funding in existing Flood Levy in council tax, business rates and water bills into Natural Flood Management and the re-allocation of CAP funding to Payment for Ecosystem Services, post-Brexit.

- How will governance be assured?
  Through a catchment-based local Environment Agency [LEA] body acting as the Catchment System Operator with local authorities responsible for spatial landscape planning for natural capital assets, natural flood management, flood-plain building and regional infrastructure policy.

- How will it be manifested?
  By integrated planning ‘from the source to the sea’ and by interconnecting Green Infrastructure projects at an investable scale enabling sustainable investment in farming, Green Belt, town, city and estuary projects.

- What is the replication potential?
  A Green Bond for Green Infrastructure is applicable to 10 major catchment areas of the UK – and to catchment areas and megacities globally.

- What else could it lead to?
  The mainstream global banking application of natural capital accounting with Fintech disruptive potential using Blockchain to resister and trade in natural capital assets.

- What is needed?
  A 6-month study commissioned by the NIC with a Mandate to define the paradigm example of a Green Bond for London and the Thames valley.

2 National Infrastructure Commission and Natural Capital Committee

The January 2017 4th Report of the National Capital Committee [NCC] states:

'The Natural Capital Committee's terms of reference include an advisory role to the National Infrastructure Commission on 'green and blue infrastructure'. The NCC has engaged with the NIC at both senior and working levels to this end'.

The NCC 4th Report recommendations include:

'The need for ambitious objectives in the 25-Year Environment Plan; a clear governance framework for implementing the plan; using 'Pioneer' projects to test different initiatives; and a consistent approach to the valuation of natural capital and methods for measuring the impact of policy on natural capital'. And:

'The Pioneers require clear leadership, strong governance, clear reporting requirements and a valuation and accounting framework to help determine priorities, monitor progress and measure performance. They should provide a test bed for aspects of the 25-Year Environment Plan, promote learning about best practice, and establish templates that can be adopted throughout the country'.

Together with;

'A programme of investment in natural capital by the private and public sectors to deliver the government's 25-Year Environment Plan ambition' and 'resources and investment should be guided by valuations of the net benefits they generate' based on 'corporate natural capital valuation, accounting and reporting'. And:

'The NIC should incorporate natural capital, including its maintenance, restoration and recovery, into long term infrastructure plans; ensuring consistency with the objectives of the 25-Year Environment Plan' So that;

'Local authorities and major infrastructure providers should ensure that natural capital is protected and improved, consistent with the overall objective of the 25-Year Environment Plan. And also that;

'Natural capital catchment based approaches should be encouraged by OFWAT in the Periodic Review in 2019' as 'Water companies are key players in influencing natural capital within water catchments and the investments they are required to make as part of the Review process should help progress the overall objectives of the 25-Year Environment Plan'

Including: [Page 9. Section 1: Context]

Financing, which is central to delivering improvements in natural capital at scale.

Green Bond finance links Green Infrastructure with National Infrastructure.
This proposal for a Scoping Study meets both NCC and NIC objectives.
A Green Bond for London and the Thames valley is the pilot project.

3 Green Bond for London and the Thames valley: The problem.

The river Thames 'from a source to the sea' is the paradigm catchment example. Initial discussions have been held with Greater London Authority, Thames Water, and the Port of London Authority, hosted by the UK Municipal Bonds Agency.

Each of these bodies has different statutory reporting obligations to the government, to shareholders, and to regulators and they each independently have overlapping and conflicting responsibilities and plans and visions for their environmental investment strategies.

There is no coordinated catchment-based strategy; and it is clearly needed.

It is believed that the Greater London Authority would be keen for the NIC to consider implementing/supporting pilots on how natural flood management could help deliver significant city-wide resilience to reduce fluvial flood risk, including considering planning, governance and financing issues where natural flood management solutions could be implemented beyond the boundaries of the Greater London Authority.

Pilots could assess:

- *How green infrastructure could most effectively contribute to both protecting and enhancing the natural environment and improving London's resilience to flood risk at a catchment scale?*
- *Where could resilience opportunities provided by natural infrastructure and innovative multi-purpose technologies and practices in reducing environmental pollution and flood risk be implemented?*
- *What are the strategic cross-sector and cross-/boundary considerations for enabling and implementing natural infrastructure solutions and their resilience opportunities?*
- *Who are the main beneficiaries and how could they access finance to pay for interventions given the complex governance, operational and political environment?*

Thames Water is understood to seek clarification regarding:

- *What are the benefits to, and roles of, each of the proposed participants?*
- *It is not clear whether TW would be expected to buy or sell the bonds or take on some other role entirely, such a project managing the spend?*
- *If we were expected to buy or sell, the rates and terms on the Green Bond would have to be competitive against our usual market sources of debt financing, or we won't be acting in the best interests of the shareholders or customers.*

The Port of London Authority has stated:

- *We are not aware of any work the value of the resources that the Tidal Thames holds or could provide; and seek better definition of the purpose.*

Answers to these questions would provide certainty, clarity and purpose for local authorities, government regulators, and water and energy utilities.

4 Policy support

Over the last 5 years the Environment Agency has been developing a *Catchment Based Approach* (CaBA). This began with a trial phase between 2011 and 2013 in 25 catchment 'pilots' across the country to test and prove the concept. The insights and lessons learned from the catchment pilots enabled Defra to publish their *Catchment Based Approach Policy Framework* with other key resources that include a *Guide to Collaborative Catchment Management*, and appendices, one on *methods and tools*, and the other on *case studies*. A community designed and government supported CaBA *website* identifies, show cases and shares current best practice. The *Catchment Data Explorer* is a collaborative endeavor between the Environment Agency and CaBA stakeholders to improve access to data and information. Since 2013, more than 1,500 organisations from the public, private and voluntary sectors have committed to the approach. Over 100 'Catchment Partnerships' are now operating across the country with full national coverage. The Catchment Partnerships are supported by a dedicated network of Environment Agency catchment coordinators.

Defra started out on this course with the premise that by connecting local people with local problems, then more local ownership can lead to a commitment to take the right action, in the right place, at the right time. Defra wanted to test if:

1. Better local engagement leads to more commitment for local action

2. Better access to data and information leads to more informed decision making

3. Better collaborative governance for collective action unlocks, mobilises and leverages wider investment in catchment management

Defra have tested and proven 1 and 2. Defra are now keen to test 3.

A model based on testing new, novel and innovative approaches will be developed in selected catchments in the Greater London Authority. These pilots will assess:

- How should infrastructure most effectively contribute to protecting and enhancing the natural environment?
- What are the resilience opportunities provided by natural infrastructure and innovative multi-purpose technologies and practices in reducing environmental pollution and flood risk?
- What are the strategic cross-sector considerations for enabling and implementing natural infrastructure solutions and their resilience opportunities?
- How could these initiatives be financed and who will pay?

This proposal will address the barriers to catchment scale planning, governance and financing issues to initiate natural capital accounting procedures for investments in natural infrastructure.

5 Governance and the Catchment System Operator

The governance issue concerns how such collaboration between a whole set of local authorities in the Thames valley: Oxfordshire, Buckinghamshire, Berkshire, Wiltshire, Surrey, Hertfordshire, Kent, Essex and the GLA could be arranged to deliver London city-wide and catchment-area wide resilience to the South-East.

Prof. Dieter Helm has proposed a Catchment System Operator with legal powers to manage all these natural capital investments in sustainability, and reform in Water regulation – what's next? At present, complex funding sources include:

Defra
Environment Agency
Agriculture drainage rates
Internal Drainage Board
Regional Flood and Coastal Committees
DCLG Formula Grants

However, the Environment Agency already possesses ecosystem knowledge of the infrastructure investment and the flood management requirements of the local catchment area. It is suggested that no new agency needs to be established. A **Local Environment Agency [LEA]** could be organised in each major catchment area with the authority to act as the **Catchment System Operator.**

The LEA would receive its funding from the local Green Bond issuers e.g. Greater London Authority and from the co-issuer set of catchment area local authorities. The water companies – and others such as NGOs - would act as commissioned project managers. The water companies could also potentially act as co-issuers of the bond and also as sellers of the bond to their corporate customers. [Thames Water noted that the governance issue involved in this requires consideration].

Dieter Helm also argues for a British Agriculture Policy, post-Brexit, re-balancing Pillar One payments between landowners and tenant farmers towards environmental schemes in Pillar Two, and then transitioning to direct payments under the 25-Year Environment Plan. This Green Bond proposal is to turn Common Agriculture Policy [CAP] funding into Payment for Ecosystem Services [PES] to finance Green Infrastructure; thus enabling investment in sustainable farming, and rural affairs and city resilience on a catchment area scale. "Someone has to do this, to be in charge of the public good". [Helm].

Green Bonds for Green Infrastructure will enable LEA's to act as the local catchment system operator; re-deploying statutory flood funding at no net cost, creating ROI for insurance investors where none exists at present.

6 Spatial planning

The National Planning Policy Framework says that one of the roles of the planning system in sustainable development is: "**an environmental role** – contributing to protecting and enhancing our natural, built and historic environment; and, as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate and adapt to climate change including moving to a low carbon economy."

Spatial planning on the catchment area scale is required. At present, developers of planning applications face a multiplicity of different planning policies at every level; governmental, regional LEPs and local authorities and parish councils.

Urban Intelligence Ltd http://www.urbanintelligence.co.uk has aggregated planning policy information from across all the local authorities and development corporations of Greater London. [Appendix 1: Map]. To bring clarity and consistency to the information they have curated it within a searchable database that allows architects, planners, developers, surveyors and legal teams access to specific, up-to-date policy information in an instant: the ability to source the exact paragraph of significance, not just a 300 page pdf document.

No longer will professionals be required to jump from council website to council website, from GIS system to PDF map in order to understand the spatial implications of planning policy. Instead, they are able to pan freely across vast geographies, across local authority boundaries, along catchment areas and through greenbelts down to the pixel level to gain a holistic understanding of planning policy and how a development or an infrastructure project might impact the wider context.

Having all this information together in one place, for the first time, offers revolutionary opportunities. Joint and Strategic planning, across formerly separate planning authorities is more achievable. Policy information is easily referenced. LPAs have cross-boundary spatial data to identify inconsistencies. No longer will decisions be segregated; ignoring the wider planning implications. What does all of this mean for the catchment planning system and beyond?

- If the public and private sector are using the same system, the planning application process can be streamlined with direct links to referenced policies within applications.
- Large infrastructure projects that cross between many jurisdictions now have a simple access point to co-ordinate complex planning scenarios..
- All this spatial data is easily cross-referenced with demographic data, transport data, natural capital and environmental flood risk data for a catchment-based, cross-boundary process that is responsive to changing economic and social values and pressures.

The planning tool is free for the LEA/CSO to design a Green Infrastructure strategy for London and the Thames valley, and will be paid for by developers, thereby contributing to ROI as part of development consent.

7 Finance and flood risk

At COP2 investors with $11.2tn assets under management undertook to work with Climate Bonds Initiative to grow the Green Bond market, with insurers specifically aiming to multiply x10 climate-related investments by 2020. The investment required to stay under 2 degrees is $1 trillion p.a. in a global bond market turning over $100 trillion. But the total currently invested globally amounts to just $118bn and every Green Bond has been oversubscribed. Attention is increasingly on civic authorities to develop Municipal Green Bonds and there is demand for catchment area projects, particularly for flood mitigation, and the application of natural capital valuations with propositions meeting investment criteria for scale, creditworthiness and ROI.

The Cumbria floods cost Defra £70m with a further £230m allocated and the National Flood Resilience Review estimates flood infrastructure investment required nationally at **£2.5bn**. The Office for National Statistics [ONS] will include natural capital in the national accounts by 2020, and estimates the 25-year asset value at £1.6 trillion, broadly equivalent to the UK national debt (£1.4tn) and annual GDP (£1.6tn) with a combined value for carbon sequestration and recreation in woodland of £2.4bn: 13x greater than the annual value for timber.

However, the 2015 Cumbria floods showed substantial financial under-provision for flood resilience with PwC and KPMG estimating losses up to **£6bn** including self-insured, military and strategic installations, local authority assets and un-insured domestic property. Corporate operations and nationally critical strategic defence assets [Sellafield, BAE Systems] were impaired, not directly, but by the 'cascade effects' of disruption to supply chains and delivery logistics and damage to rail, road and utility infrastructure and domestic homes and property. Consequently, there has been a direct and negative impact on the confidence of financial and corporate investors to invest in the region and, given the likelihood of a downgrading of future income from council tax and business rates, a downgrading of confidence in Cumbria achieving its SEP growth targets.

Locally, Flood Re enables homeowners to obtain affordable insurance with the government subsidising the excess. It is not a source of funds for flood prevention and individual insurers have no incentive to invest directly in any flood prevention measures. Any reduction in risk would quickly be reflected in lower premiums in a competitive market where 'free-loaders' with lower costs gain market share. Insurers also have responsibility to shareholders who require a monetised return on investment. However, all insurers can get a guaranteed ROI from the investment market in the coupon from municipal bonds issued by local authorities and cities that can reduce the risk at a system-wide scale on behalf of taxpayers.

CISL ClimateWise global insurers are collectively campaigning regulators to actively mitigate climate change in the transition to a zero-carbon economy and will be the leading buyers of this Green Bond.

> **ROI in this Green Bond is based on improved resilience in the natural environment that enables corporate and insurance investment in the catchment area economy, adding jobs, which in turn enables the achievement of local authority Gross Value Added, which produces increased tax returns, and thereby the ROI to insurance bondholders.**

8 UK Municipal Bond Agency

UKMBA has been formed by the Local Government Association to enable local authorities to obtain a lower cost of borrowing from the finance market through the economies of scale of large, liquid bond issues.

UKMBA can facilitate inter-local authority joint-and-several guaranteed borrowing to help recycle their estimated **£40bn held in reserves** at rates lower than those of the Public Works Loan Board.

Municipal Bonds have a long history of use by cities to raise the finance for public works. UKMBA, with the support of major international banks, provides a means for aggregated environmental project investment by local authorities through the issue of Green Bonds.

> **UKMBA can act to originate and structure a municipal Green Bond for London and the Thames valley and arrange its introduction and syndication in the global financial market.**

9 Valuation

The Committee on Climate Change Risk Assessment Synthesis Report described the cross-cutting issues and priorities for the UK to mitigate the probability of major infrastructure damage caused by flooding and droughts both at the national and catchment area scale and its cost implications for manifesto commitments with regard to the UK environmental strategy, and its international commitments.

Cross-referencing with NHS health and well-being data and NERC's Valuing Nature Network enables maps of investment value in hotspots of risk at scales from the street to the city to the region. The Future Cities Catapult and Ecosystem Knowledge Network Building Prosperous Cities emphasise the key role of spatial planning for developing ecotowns and treating both the rural and the urban environment as part of an integrated economic and natural ecosystem. Ecotowns, in particular SuDS, enable substantial savings in water and energy.

Specifically, the 3rd Report of the Natural Capital Committee showed health and well-being strongly correlated with lower air pollution and the amenity of local parks and gardens and access to woodlands. The value of planting woodland close to conurbations was stated as **>£546m** p.a. with **£2.1bn** in averted health costs. The NCC provides a natural capital valuation methodology for urban and rural landscape planning of projects on a regional and catchment scale.

The i-Tree survey for London describes a value of **£133m p.a**. for trees in London for carbon sequestration, air pollution reduction, water storage preventing run-off, plus the amenity and well-being value. But a plan to plant 2m trees is halted.

> **These very substantial financial values are currently accounted for by the GLA with an asset value of £1. Parks and gardens and trees have high maintenance costs and are financially treated as a liability. But they are a valuable and investable asset for a Green Bond.**

10 Corporate Reporting

The 2007/8 financial market collapse has lead to a redefinition of financial responsibilities, including UN Global Compact, CSR Europe, the EU Directive on Non Financial and Diversity Disclosure and the UNEP Inquiry into the Design of a Sustainable Finance System, contributing to UN Sustainable Development Goals.

Insurers see a strategic risk to capital markets sustainability and financial institutions such as pension funds and insurance companies have a fiduciary duty to ensure they are confident in their investments in companies.

Mark Carney, in the Financial Stability Board Task Force on Climate-related Financial Disclosure has described a requirement for corporates to report not just on their impact on climate change, but of the impact of climate change on them. It significantly shifts the emphasis onto statements of risks – and their mitigation.

It is known that corporate stock valuations are based on a flawed pricing system jeopardising future prosperity – in which financial asset managers are investing. The scale of the climate threat to corporate sustainability potentially renders significant sectors of the global economy uninsurable and uninvestable without breaching fiduciary duty. But corporates have little control outside their own corporate reporting remit. Supply chains are diffuse and complex, with many tiered parties. In particular, water, on which all corporate supply chains depend, is notoriously under-valued and poorly priced.

It is invidious for a single corporate to revalue [and pay more] for assets that others can continue to use and exploit at less cost.

> **But local authorities and cities can issue municipal Green Bonds that provide a natural capital price platform for the maintenance of critical Green Infrastructure resources, particularly water, soils and natural flood alleviation measures on which corporate sustainability and inward investment, and GVA and GDP, fundamentally depend.**

Corporates investing in this Green Bond using the Natural Capital Protocol will have good evidence to show their stakeholders they have invested reliably in sustainability, and on a level playing field. All other corporates in the region will be paying the same taxes, pro rata. They will meet the FSB reporting requirements.

It will attract other corporates into the region for the exactly same reason; they will be supported by their financial investors who are mandated to require this corporate reporting and will reward it with investment - thereby enhancing the probability of the local authorities achieving their GVA targets.

Major London projects: Old Oak Common, Old Kent Road, require water run-off, drainage, water retention and recycling solutions both locally and at catchment scale which incoming corporates will need to report on to their investors.

> **If corporates invest in a catchment area Green Bond which helps to secure their resilience the bond transforms a known risk and financial liability into the opposite: an asset on their balance sheet. Their creditworthiness and credit rating will be enhanced.**

11 Climate Bonds Initiative: Green Bond Taxonomy of Eligible Projects

CBI Taxonomy describes themes in carbon reduction that qualify for certification:

- Water: SUDS, Waste Water Treatment and Flood Alleviation
- Sustainable Agriculture, Forestry, Woodland, By-products
- Air Quality and Water Quality improvement, Pollution reduction
- Waste, Recycling, Renewable Energy, Circular Economy projects
- Energy Efficient Buildings and Industrial Processes
- Electrified Transport [rail, bus, car – and agglomeration economics]
- Broadband, Internet of Things [IoT], Big City data
- Recreation and well-being, ecotourism and landscape conservation

Individually, many of these environmental projects are valued as high risk and investable only by corporates, venture capital investors or NGOs; not by bonds. But a portfolio of these Eligible Projects is bond investable. Oxfordshire LEP has a Strategic Environmental Economic Investment Plan for projects essential for its own sustainable SEP, and is seeking funding, which other LA's can add to.

> **Aggregation of a range of eligible projects across a catchment area in a multi-sector municipal Green Bond helps reach investment grade and scale whilst the scope of the themes diversifies and reduces the insurance risk profile across the set.**

The larger the financial scale of the portfolio the lower the proportion of investor management costs and fees, borne by the issuer, so financial scaling-up by aggregation of projects is cost-effective for the issuer and for a risk-weighted credit rating. Local Authority and regional municipal bonds are quasi-sovereign debt and have a higher credit rating, and therefore lower transaction costs.

12 Return on Investment

ROI for a municipal Green Bond is from existing statutory income from:

- Council Tax [Flood Levy]
- Business Rates [Flood Levy and CIL Planning Consents]
- Water Bills [Flood Levy] [via OFWAT – and retail competition]
- EU Common Agriculture Policy subsidies [via PES post-Brexit]
- EU Maritime and Fisheries Fund [post-Brexit]
- EU Regional Development Funding [post-Brexit]
- Government spending: [Local Authority Ask and GVA]
- Third Parties, NGO and public personal investment

Council tax bills, business rates and collaboration with water utilities, as co-issuers, will enable direct communication with consumers using new marketing and social media in bills with appealing natural capital vocabulary and imagery - while new corporate marketing opportunities with the opening of retail competition by Ofwat adds further to ROI.

13 Public Engagement: Sales and Marketing & PR

Upland landowners and farmers resent paying for flood insurance, but would welcome payment for managing Natural Flood Management schemes and Savills plc will readily sell enhanced Payment for Ecosystem Services [PES] upland valuations to farmers, landowners, estate managers and its agribusiness clients and to corporate developers of housing and regional infrastructure.

Downstream landowners and house-owners (who obviously resent being flooded) would welcome architectural investment in flood-resilient housing, better health and well-being – and, particularly, for new job creation in the rural economy.

London & Partners, the official promotional company for London and the GLA has a mission to attract inward investment and enable companies to grow and thrive. Future economic growth, post-Brexit, relies on the whole South-East region attracting inward investment; and it critically depends on a resilient infrastructure. The bond will ensure that resilience and it will provide a powerful incentive for companies requiring sustainability reassurance to invest in the region.

14 Retail bond for the public

A retail derivative of the bond marketed to the public would have great value for engendering a real sense of personal ownership, engagement, and stewardship of natural capital assets; particularly of local parks and gardens, trees and rivers.

Communities would see the benefit of an integrated investment strategy for their region, and investment in local natural capital assets reinvigorating the economy.

A retail bond, widely publicised, will enable personal bondholders to gain a tangible financial return through an ISA or equivalent pension saving fund.

The public good, including the commercial and the aesthetic and cultural values of the regional catchment landscape, is best protected by the local authorities – crucially, with local participation in it by local communities.

15 Job creation

There are abundant job-creation prospects and new employment opportunities in the emerging natural capital industry both academically in research, conferences and papers and, particularly, in catchment area project portfolio management.

Natural Capital can be seen as a Disruptive Technology in financial services [Fintech] with the potential to use Blockchain for the registration of assets for fund transfers. It has huge implications globally for environmental asset management.

Locally, there is significant potential for attracting greater tourism in the UK with visitors to regenerated wetlands and rivers and woodlands, forests and uplands.

Widespread corporate and public engagement will be politically crucial in describing, in colloquial language, an attractive vision for the environment in the UK that is both sustainable and deliverable and demonstrably provides more well-paid jobs in a competitive global economy, post-Brexit.

16 Complementary Reports and Reviews

Aldersgate Group
The Aldersgate Group is an alliance of leaders from business, politics and civil society that drives action for a sustainable economy. In a series of reports it has described major strategic opportunities. In particular:

25-Year Environment Plan to improve UK's natural capital assets and resilience to flooding
UK must do more to realize growth opportunities in natural capital
Accounting and investment strategy must protect and enhance UK natural capital
We need a repayment plan for nature

In addition, Aldersgate published Three Years of the Green Investment Bank: What Next?: timely now with the re-positioning of the GIB - and the excellent opportunity it has to act as a major investor in natural capital based Green Bonds.

Defra
Smarter Environmental Regulation Review This review presaged the soon-to-be published **Defra review: Smarter Environmental Legislation** which will describe a framework for environmental policy, post-Brexit, which is:

- Principled: mainstream, outcome-focused, evidence-based, credible
- Systemic: In the 25-Year Environment Plan
- Cross-departmental: BEIS, Transport, Energy, Health, HM Treasury
- Embedded in industry sectors by design
- Networked in an integrated planning system locally and nationally
- Universal with a primary duty to protect the environment [e.g. H & S Act]
- Data-based, smart and accessible locally, nationally, internationally

Green Alliance and National Trust
New markets for land and nature: How Natural Infrastructure Schemes could pay for a better environment describes a mechanism to bring new income streams into farming and land-use based on contracts with downstream businesses and public sector organisations through Payment for Ecosystem Services [PES]. Green Alliance calculates the cost of river flooding and water contamination to water companies, local authorities, public agencies and infrastructure operators at just under £2.4 billion a year. Contracting to avoid just a quarter of these costs could release as much as £120 million **for each** of England's 100 catchments over a 20-year catchment scale scheme.

National Farmers Union
The NFU is developing a scheme for a catchment fund involving farmers and Local Nature Partnerships to try to create a 'fund of funds' to finance a regional catchment based approach; but the key problem is brokerage.

Water Industry Reports
Upstream Thinking is South West Water's multi-award-winning catchment management scheme delivered through a partnership of South West Water, the Devon Wildlife Trust, the Cornwall Wildlife Trust, the Westcountry Rivers Trust and the Exmoor National Park Authority; while *www.**water**.org.**uk/water-resources-long-term-planning**-framework* describes the scale of the challenge.

17 25-Year Environment Plan

The Defra 25-Year Environment Plan Recommendation 8 calls for innovative financial methods for the funding and delivery of resilience. This Green Bond for London and the Thames valley provides a pilot project template for its funding, and for its replication across 10 major [and 97 minor] catchments in the UK.

18 City of London Green Finance Initiative

Global replication has significant invisible export earnings potential through the City of London Green Finance Initiative, demonstrating an investable combination of financial scale with creditworthy and credit-rated issuers, and reliable ROI.

19 Green Bond IP

Global Garden Ltd won the Defra Special Prize for Financial Innovation for an Investability Algorithm for a Green Bond for Cumbria which together with the work of Prof Tony Allan at King's College, London, and Prof Francesca Medda at UCL establishes a sound intellectual framework for a Green Bond construction.

There is world-class expertise and valuable Intellectual Property in the UK in natural capital knowledge and in Green Bond financing that can be harnessed and leveraged and replicated globally.

IP will be protected by Global Garden Ltd / plc to commercially exploit and develop this globally significant prime-mover advantage for the UK.

20 Green Bond for London and the Thames valley: investment model

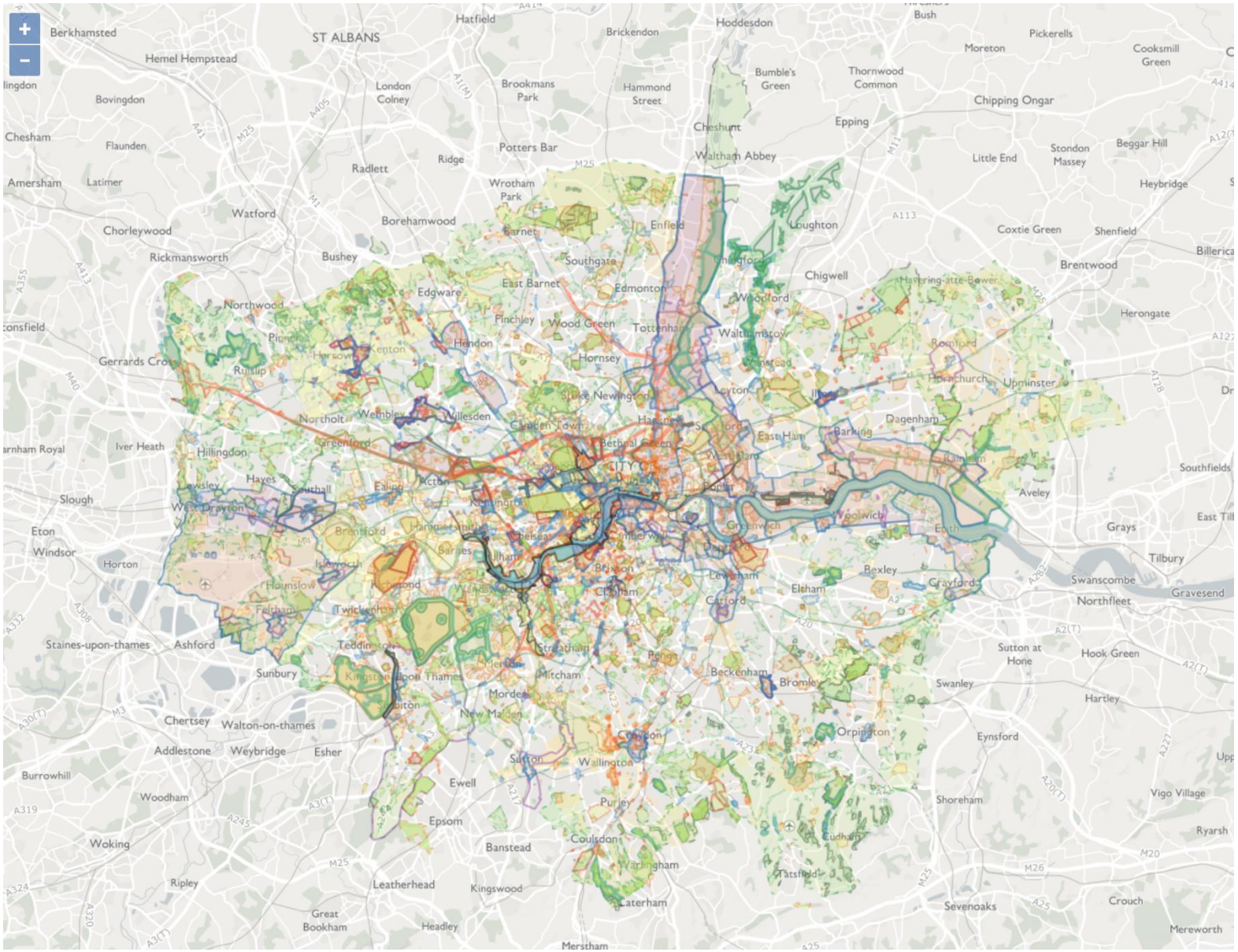
It is recognised by the C40 organisation, connecting megacities together to share technical expertise and good practice that, as globally-trading economic centres with rapidly expanding populations, cities are reliant on sustainable upstream ecosystem services; particularly water, on which their downstream sustainable growth depends - and they need to find the funding to ensure it.

Conclusion

A Green Bond for London and the Thames valley has replication potential for the financing of Green Infrastructure across catchment areas and for sustainable megacities worldwide, reducing both flood risk and global warming by enabling civic and public engagement both locally and at scale.

[Name redacted]

Appendix 1: Interactive text and spatial planning tool: Greater London map


Berkhamsted
ST ALBANS
Hatfield
Brickendon
Hoddesdon
Bush
Pickerells
Moreton
Cooksmill Green
Hemel Hempstead
London Colney
Brookmans Park
Hammond Street
Bumble's Green
Thornwood Common
Chipping Ongar
Bovingdon
Chesham
Flaunden
Cheshunt
Epping
Waltham Abbey
Little End
Stondon Massey
Beggar Hill
Heybridge
Amersham
Latimer
Radlett
Ridge
Potters Bar
Wrotham Park
Watford
Borehamwood
Barnet
Enfield
Loughton
Coxtie Green
Shenfield
Brentwood
Billerica
Chorleywood
Rickmansworth
Bushey
Southgate
Chigwell
Havering-atte-Bower
Northwood
Edgware
East Barnet
Edmonton
Woodford
Herongate
Finchley
Wood Green
Tottenham
Walthamstow
Pinner
Hendon
Romford
Gerrards Cross
Ruislip
Hornsey
Upminster
Stoke Newington
Leyton
Hornchurch
Northolt
Wembley
Willesden
Dagenham
Greenford
Bethnal Green
East Ham
Barking
Iver Heath
Hillingdon
Southfields
Hayes
Ealing
Aveley
Slough
West Drayton
Southall
Woolwich
Eton
Windsor
Brentford
Grays
Tilbury
Horton
Barnes
Bexley
Swanscombe
Hounslow
Elham
Gravesend
Twickenham
Northfleet
Staines-upon-thames
Ashford
Sutton at Hone
Hook Green
Sunbury
Mitcham
Beckenham
Bromley
Swanley
Hartley
Chertsey
Walton-on-thames
Morden
New Malden
Orpington
Addlestone
Weybridge
Esher
Sutton
Wallington
Eynsford
Burrowhill
Ewell
Shoreham
Woodham
Epsom
Purley
Vigo Village
Woking
Banstead
Coulsdon
Ryarsh
Ripley
Leatherhead
Kingswood
Tatsfield
Great Bookham
Headley
Caterham
Sevenoaks
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[Email address redacted]

[Telephone number redacted]
10th February 2017

Dear Sir/Madam

National Infrastructure Assessment Call for Evidence

Thank you for consulting Gloucestershire County Council (GCC) on the above matter. This is an officer level response and includes comments from the Gloucestershire Economic Growth Joint Committee (GEGJC) representing the seven Gloucestershire councils within the county, and GFirst - the Gloucestershire LEP.

We have the following officer level responses to the questions posed.

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

The highest value infrastructure investments in the Gloucestershire which will support long-term sustainable growth in the region include:

- A417 Missing Link part of SRN) Missing Link improvement to improve access between M5 to M4 (This scheme is within the Government's Road Investment Strategy for scheme development during the RIS1 period, with construction during the RIS2 period.
- Upgrade of Cheltenham Spa rail and Gloucester rail stations
- West of Cheltenham relief road
- Upgrade of primary radial bus corridors between Cheltenham and Gloucester to enable bus rapid transit between primary urban centres and major employers including access to multi-modal interchange sites accessed from SRN
- M5 Junction 10 all movements junction improvement

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

Global markets play a significant role in meeting the UK's day to day needs. Equally our ability to trade competitively across national boundaries will become an even greater priority in the coming years.

Infrastructure as an investment has a positive impact on the UK's international competitiveness. International gateways are important for passengers, freight and data. The capacity and reliability of infrastructure (strategic road network, digital communications etc) is critical to the performance and competitiveness of businesses across the logistics sector. Unreliable infrastructure constrains growth and economic success.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Need better resourced and understanding of all infrastructure requirements at the local plan stage. IDPs (Infrastructure Delivery Plans, or sometimes Infrastructure Development Plans) are prepared as evidence to Local Plans, but vary significantly in terms of analysis and understanding. They should be seen as critical for infrastructure delivery, and feed in at every stage of planned development, including at the application stage. They could be incorporated into local plans and neighbourhood plans to guide infrastructure alongside housing growth.

IDPs could be used to achieve consensus as to timing and delivery of infrastructure.

Better places will include appropriate provision and enhancement of green space which is known to attract investment, workers and residents to a location. Places with good access to green space are also healthier. The relevant government website pages on this topic are:

https://www.gov.uk/government/publications/planning-guidance-and-green-infrastructure

https://www.gov.uk/government/publications/future-of-cities-green-infrastructure-and-health

http://planningguidance.communities.gov.uk/blog/guidance/natural-environment/green-infrastructure/

Locally, the Gloucestershire Nature Partnership has produced a green infrastructure framework which also covers this matter which is available on the LNP's website at http://gloucestershirenature.org.uk/index.php .

This observation is also relevant to question 9.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

Nothing to add

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

Nothing to add

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Nothing to add

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

Recognition of the long-term investment in infrastructure which creates the conditions for economic growth. Infrastructure assessments and analyses (IDPs for example) require better understanding by LPAs and the development industry, and should be appropriately resourced and compiled with the required expertise. There is a need for upskilling of most of the key partners involved here.

Funding policy should include making sure sustainable drainage systems and green spaces are adequately managed through an appropriate case by case mix of developer and occupier/user contributions. This is linked to our observation under question 3.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

Identified infrastructure e.g. in IDPs should be based on ensuring fairness, inclusiveness, environmental protection, acceptance and resilience. Avoiding necessary infrastructure, or where infrastructure is not financed will adversely affect the most vulnerable groups of users (such as the

elderly, fuel poor households, single parents, families with multiple children) or lead to the exclusion of already marginalised groups.

Government interventions should possibly focus on inclusive infrastructure and the knowhow to use it (i.e. the provision of certain infrastructure services such as high-speed broadband) - this allows online access to infrastructure services requires the use of a smart appliance such as a laptop, mobile phone or tablet. The smart city concept (or smart town/village) relies on certain infrastructure that could benefit from interventions.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

Cross reference Question 3.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

The planning system requires an understanding of both needs and a pipeline of future infrastructure projects would signpost future activities and so provide greater certainty to all involved with infrastructure provision. IDPs go some way to assessing needs, but see comments above on varying quality and resources/understanding needed to keep them up-to-date. Pipeline of infrastructure is less specific but creates signposts to future infrastructure requirements, to assist planning and providers of infrastructure to act at the appropriate time, creating incentive for innovation and possible solutions.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

There are many reference and evidence documents on protecting and enhancing the natural environment through development. The relevant government website pages on this topic are:

http://planningguidance.communities.gov.uk/blog/guidance/natural-environment/green-infrastructure/

http://planningguidance.communities.gov.uk/blog/guidance/natural-environment/biodiversity-ecosystems-and-green-infrastructure/

Particularly relevant is the CIRIA initiative on net biodiversity gain and the biodiversity challenge. Further details are to be found at:

http://www.ciria.org/News/blog/Biodiversity_Net_Gain_is_the_next_big_thing.aspx

http://www.ciria.org/Research/Project_proposals2/Achieving_biodiversity_No_Net_Loss.aspx

The good practice guide referred to is possibly already published and available from CIRIA and has involved input from many organisations.

The Environment Bank promotes biodiversity accounting and offsetting. Although these techniques are imperfect they can be most useful as a methodology for the largest infrastructure projects. The methodology does not encompass all matters on the natural environment that particularly those of value to local communities. It has some merit however in scoping costs and options for biodiversity compensation and enhancement when this cannot be achieved on a development site or adjacent to it. Further information is available at http://www.environmentbank.com/library.php .

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

Nothing to add.

Transport – Questions 13 - 16

To preface Gloucestershire County Council's officer response we would note that these questions merit substantial research which the Infrastructure Commission may wish to instigate.

Gloucestershire is expected to receive significant amounts of development up to 2050, although neither its adopted Local Transport Plan nor any of the applicable Local Plans extend to cover this time period. Neighbouring English counties will also deliver large development sites, some in the form of new villages and towns. This will create large new volumes of movement and new desire lines. Gloucestershire will be impacted by development that is allocated outside of its boundaries and its control. However, the development impacts will be strongly felt within it.

This will raise issues of national and regional transport and land use infrastructure planning which are not addressed through more local approaches. Growth in neighbouring counties will impact directly on Gloucestershire's road and other transport network. Neighbouring authorities may be better placed to mitigate growth impacts on cities within other counties through bus priority measures and segregated cycle lanes in association.

The existence of county boundaries and county land use and transport planning can in part obscure these facts. The scale of development and increase in transport demand across England requires a cross cutting regional and national approach. The impacts of development can be underplayed because of cross boundary effects and emerging transport behaviours at the margins, e.g Swindon Villages, Cotswold Village.

Therefore, a national and regional perspective on the transport infrastructure requirements is welcomed.

From a transport perspective the questions that we need to frame answers to are questions 13-16 below

13. How will travel patterns change between now and 2050?

- What will be the impact of the adoption of new technologies?
- Note: "travel patterns" include both the frequency and distance of trips taken, and the mode of transport used. This covers personal and commercial travel, including freight.

Travel patterns may not change significantly between now and 2050 – however in Gloucestershire we expect:

- A removal of the traditional 'peak' travel periods with peak demand spreading to cover much of the day
- The County has 2 main urban areas, namely Cheltenham and Gloucester, with the urban centres located just 15km apart. This will lead to increased poly centrism especially within this part of the Severn Vale, leading to some new trip desire lines and more complex short/ medium trips
- For local trips we would expect significant mode shift away from the private car to cycle and bus especially within, to and from the Central Severn Vale
- Increased cycle related congestion and road safety concerns
- Innovative solutions to trip demand lessening need for private car use and ownership
- Fewer longer distance commute trips as technology improves and the need to travel to the office alters
- Even with improvements in technology and increased home working the need for social interaction and to 'get out of the house' will create travel demand.
- International travel will grow as alternative fuels are developed to enable more sustainable longer distance travel.
- A significant increase in rail usage, not just for longer distance journeys but local trips within the County too. Passenger numbers have significantly increased over the past decade.
- Access to airports (Bristol, Birmingham and Cardiff) will remain very important.
- Gloucestershire is between the primary freight interchanges and its transport network and environment will be impacted by freight movement increases.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

- Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

  - Gloucestershire's economic growth is focussed within the M5 corridor to access the strategic road network. The county has two primary urban centres (Cheltenham and Gloucester) and work trips have been largely self contained within the county. However, with neighbouring regional centres (Bristol, Birmingham, Swindon and Cardiff) expanding, Gloucestershire may provide a higher quality of life due to its semi-rural nature, and thus appeal to families and senior managers who will commute to these regional centres.

  - A significant high value transport investment is in the measures which enable local trips to be taken away from sole occupancy car use on the highway network and transferred to public transport, walking and cycling. Nationally and locally (within Gloucestershire) significant proportions of all trips are not by car. It is vital that a range of measures, which may or may not include large infrastructure projects, is identified and funded to maintain and increase these mode trip rates away from the private car in order to optimise the capacity of the highway and other transport networks.

  - For those living and working within the Cheltenham / Gloucester urban centre, walk, cycle, bus linkages and travel demand technologies will enable efficient travel between centres. Development within the Central Severn Vale as directed by the emerging Joint Core Strategy will depend on significant mode shift to these modes to prevent transport failure.

  - Gloucestershire's high value transport investments identified in the adopted LTP (non committed) include:

    - A417 Missing Link

    - Cheltenham to Gloucester cycle link (part of the Strategic Road Network and promoted by Highways England)

    - Cheltenham to Bishops Cleeve cycle link

    - Upgrade of Cheltenham Spa rail station

    - Upgrade of Gloucester rail station

    - Strategic park and ride expansion at Arle Court, Cheltenham

- Gloucestershire's high value transport investments identified in emerging Local Plan Transport Strategies include:

    - West of Cheltenham relief road

    - Upgrade of primary radial bus corridors between Cheltenham and Gloucester to enable bus rapid transit between primary urban centres and major employers including access to multi-modal interchange sites accessed from SRN

- Traffic signal upgrade in urban Cheltenham and Gloucester (Integrated smart signals – virtual scoot system or similar) and expansion of Urban Traffic Centre (not necessary within county)
- Multi-operators, multi-mode smart ticketing system to enable mobility as a service on regional or sub-national basis
- Intelligent demand responsive rapid vehicle access for rural centres as part of mobility as a service mantra

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

- Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

- Gloucestershire is well connected to the wider Strategic Road Network via the M5, M50 and A417 (M4).
- Gloucestershire's high value highway investments identified in the adopted LTP (non committed) include:
- M5 Junction 10 all movements junction improvement
- A417 (part of SRN) Missing Link improvement to improve access between M5 to M4 (This scheme is within the Government's Road Investment Strategy for scheme development during the RIS1 period, with construction during the RIS2 period.

- Gloucestershire high value highway investments identified in emerging Local Plan Transport Strategies include:
  - A46 (part of SRN) offline improvement at Ashchurch to upgrade the A46 between the M69 at Coventry and M5 Junction 9.
  - New Severn River Crossing linking M5 to A48. A Forest to M48 link through Chepstow which would benefit people seeking the attraction of rural Gloucestershire as a desirable place to live. It also sits alongside any M5/M48 proposal and how that would influence traffic movements on the network.
  - Full upgrade of M5 to enable smart motorway running linked to Urban Traffic Centre to provide real time travel information for local network to advise on optimal egress from SRN where there are alternative route options e.g. junctions M5 12, 11a, 11 and 10 (when upgraded to all movements junction) to inform any journey times on the local network when accessing the Forest of Dean at the single access point provided by the A40 at Over to ensure the most efficient route option is used.
  - The smart motorway investment will also enable autonomous vehicle operation along the motorway network including autonomous HGV platooning.

- Rail connectivity is inconsistent across the County. Cheltenham Spa station provides high frequency connectivity to the national rail network particularly on a north south axis, but Gloucester station is located off the main line and requires operators to reverse back to the mainline which incurs a time delay. Connectivity between Lydney in the Forest of Dean and the Greater Bristol area is poor as the rail infrastructure for direct services doesn't exist. Similarly there are no direct rail routes connecting Cheltenham and Gloucester with the Oxford to Cambridge corridor. Improving the type of trains operating on the local rail network to electric will reduce journey delay and the environmental impact caused by diesel engines.
    - Gloucestershire high value rail investments identified in LTP (non committed) include:
    - Electrification of Bristol to Birmingham mainline
    - Electrification of Great Western line including Kemble spur
    - New Railway station(s) between Gloucester and Yate linked to extended MetroWest urban rail scheme and additional services between Bristol and Gloucester/Cheltenham
    - Full station upgrade of Kemble station to Cirencester Parkway
    - Improve infrastructure and services on the North Cotswold line
    - Work with stakeholders to reinstate the rail link between Stratford and Honeybourne
    - Service improvements on the Gloucester- Cheltenham – Ashchurch for Tewkesbury - Worcester corridor as well as on the Gloucester to Lydney and south Wales route.
    - Station improvements
- Gloucestershire's high value rail investments identified in emerging Local Plan Transport Strategies includes the electrification of South Cotswold Line

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

- The concept of mobility as a service will enable road user charging.
- From a Gloucestershire perspective a previous study concluded that a localised charging scheme is unlikely to work.
- From an officer perspective it is felt that road user charging would be most effective when applied to the motorway network linked to autonomous vehicle platooning and a charging system linked to time and distance travelled.
- The impact of some trip transfer away from the motorway will be on local road networks and communities

- The hypothecation of revenue generated through road user charging on the motorway network could then provide a continued revenue source to reduce the need for Government funding. Funding previous allocated to Highways England could then be switched to improving the local highway network and improving urban transport solutions

Digital Communications

Question 17

What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

The role of digital communications infrastructure in collecting data and managing demand in other sectors is fundamentally important to deliver to 'smarter' infrastructure across the sectors. Good digital capacity is needed to complement transport demand measures. As more people and organisations apply flexible working access to digital connectivity becomes a vital component economic growth.

The biggest is mobile connectivity to assist the public and also public and private services and availability of service should be the norm The lead-in time to provide the required standard of connectivity (4G, 5G etc) can be substantial. Consequently there exist too many 'not-spots' and very intermittent coverage, which is not conducive to today's ways of doing business via multi-function smartphones.

Decisions are needed early in the process to ensure that the technology stays ahead of standard. The UK must become well placed to take advantage of 5G capacity when it becomes available.

Question 18

Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this? Note: the existing "regime" refers to the current market, competition and planning frameworks. "Digital communications" includes both fixed and mobile connectivity.

There is a long way to go before it can be considered as a utility. See above – there is a struggle with mobile connectivity which means that areas are playing catch up to meet standards, and authorities promoting broadband are often playing catch up. The industry is supposed to respond to needs through licensing arrangements.

In GCC the roll-out of broadband provision has aimed to deliver speeds of 30mbps in line with EU targets. This will ensure that the area does not fall below EU targets, but we are aware that other

areas may be aiming e.g. for 24mbps minimum. The importance of upload speeds as well as download speeds, and level of access and capability also need to be recognised.

Nationally, there is a question as to whether we are providing sufficient resources to deliver broadband infrastructure to meet the demands of the future, to enable the UK to be connected and compete globally. There are still issues about current availability of broadband and mobile services both in urban and harder to reach rural areas.

Due to large housing numbers coming forward over coming years there is concern that current measures will not be enough as locations continue to grow homes and businesses. The Government must establish deployment of digital infrastructure – both fixed and mobile – as a priority in national policy and work with local planning authorities to encourage prioritisation in local planning policy.

Flood Risk Management

Question 25

What level of flood resilience should the UK aim to achieve, balancing costs development pressure and the long term risks posed by climate change.

The improving and raising of river defences along the River Severn in the vicinity of Gloucester City Centre at a cost of c. £5 million. This scheme would have a positive impact to revitalise an area of the city centre where regeneration developments are constrained by it being in Flood Zones 2 and 3 and provide opportunity for residential development on land that is presently unsuitable/unviable. The scheme has already been modelled and agreed in principle by the EA but lacks funding.
Currently, flood defence grant is determined by a business case based on the number of existing properties at risk, this business case does not take account of opportunity to promote new development, hence it requires an alternative funding source.

Question 26

What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

Gloucestershire recognises that it is not possible to prevent flooding in all cases. The Pitt Review delivered a number of recommendations following the 2007 floods, including delivering flooding advice for local householders and businesses, as well as supporting communities to be more reliant during emergencies. Gloucestershire Local Resilience Forum (LRF) has developed a comprehensive multi-agency flood-plan, linking to district plans.

Flood Wardens have been established in high risk areas and advice has been delivered used a number of media: see http://glosprepared.co.uk/

Comprehensive resilience planning is likely to have a mitigating effect on inevitable flooding and will reduce the impact on households.

If you would like to discuss any of the points raised above please do not hesitate to contact me.

Yours faithfully

[Name redacted]

[Job title redacted]

Gravesham Borough Council response to National Infrastructure Assessment call for evidence.

Response sent by [name redacted] [email redacted][telephone number redacted]

Acting Leader of the Council

Response to National Infrastructure Commission Call for Evidence on National Infrastructure Assessment

Gravesham is a district located on the south side of the River Thames east of the Dartford Crossing. It encompasses major riverside regeneration areas (e.g. parts of Ebbsfleet Development Corporation area) as well as an extensive Green Belt, which includes AoNB, RAMSAR/SPA, and flood risk areas.

The Borough is crossed east-west by 3 railway lines, including High Speed 1, and the A2 trunk road, which has 4 lanes and hard shoulders. The latter serves the rest of North Kent as well as being a secondary route to Dover and the Channel Tunnel.

The Borough has full experience of dealing with major infrastructure projects which have included High Speed 1, widening (which included moving) the A2, Lower Thames crossing proposals as well as the whole process of trying to get development going on major sites.

Gravesham is the Local Plan Authority for its area, with Kent County Council as the transport authority. However, the Medway Authority borders to the east, the GLA (with TfL) is only a short distance to the west, which is significant for transport given the scale of commuting flows into London.

The Borough Council notes the response submitted by Kent & Medway Economic Partnership (KMEP) with which it has overall agreement, but also some major areas of significant disagreement.

The Borough Council has made it clear that it opposes a Lower Thames Crossing east of Gravesend, most fundamentally because it does not effectively address the primary issue; capacity at Dartford Crossing. Highways England's own technical work showed that a crossing east of Gravesend does not deal with that issue in the longer term as so much demand wishes to go round London. That is quite apart from the environmental implications.

The port of Dover has concerns over lorry traffic and routes to the north and a more direct route looks attractive from mid and east Kent. The real challenge for Kent as a whole is the scale of future housing demand – and the jobs needed to support the population - combined with the pressures coming out of London. The current transport system, in West Kent at least, is at capacity in the peaks and has little scope to take more demand without major investment. For example the rail system is constrained by central London terminal capacity, and only HS1 has some limited extra space. A2/M20/M25 motorways are similarly limited.

Any such major transport investment has to balance the benefits of economic growth with impact on the environment, including air quality.

As the questions in the consultation document make clear this also about water supply, waste water treatment, schools and a host of other services. Looking to the future it is obvious that current

trends cannot simply be extrapolated in the South East at least, as the infrastructure capacity does not exist. Long term those trends may change, as for example has happened in retailing.

Back in the mid 1990's local technical work showed that to achieve the regeneration projects on the basis of what is now Ebbsfleet International Station, public transport needed to play a major role. Hence, the Fastrack bus system, which still forms a key part of Ebbsfleet Development Corporation's emerging strategy 20 years later. It is also necessary to look at the macro distribution of jobs since more balanced travel patterns would be better from, the point of view of national productivity.

Many small-scale projects are as important as the big scale ones as they easier to delivery and produce immediate results. A local example is the extra capacity produced by making Gravesend a three platform station. There is no magic bullet but rather a steady approach to delivery of many projects.

The Borough Council would argue that a number of steps are essential:

- Smaller scale projects – which are more flexible and deliverable;
- Emphasis on public transport;
- Looking nationally – back the Dover lorries example - if they are going up north what are they doing in the south east in the first place?
- Take seriously the environmental constraints – in particular air quality.

Locally the objectives must be to:

- Enhance Thames crossing capacity at Dartford;
- Extend Crossrail 1 to Gravesend;
- Improve A2 junctions;
- Invest in local public transport initiatives (Fastrack but also bus, walking and cycling).

Worthing Town Hall
Chapel Road
Worthing
West Sussex
BN11 1HA

Lord Andrew Adonis
Chairman
National Infrastructure Commission
11 Philpot Lane
London
EC3M 8UD

11 May 2017

Dear Lord Adonis

Greater Brighton City Region: Rail and Road Infrastructure Priorities

We understand that, following discussions between the National Infrastructure Commission and the South East England Councils in January 2017, the attached *South East Road and Rail Requirements* map was submitted as part of the call for evidence to inform the upcoming National Infrastructure Assessment.

[job title redacted]

While we acknowledge that the call for evidence closed on 10 February 2017, I am writing to you as [redacted] the Greater Brighton Economic Board to provide supplementary information on the strategic rail and road priorities that are critical to our City Region economy.

The Greater Brighton Economic Board brings together business, education and local authority leaders to protect and grow the City Region economy. Stretching along the coast from Worthing to Newhaven and northwards to East Grinstead, our City Region is home to just under 700,000 people and 35,000 active business units. We welcome approximately 18 million tourist visitors a year. Our City Region, which has been rated in the top 5 for jobs growth in the last 10 years, provides over 278,000 jobs and a further 37,000 more jobs are expected to be created by 2030. We contribute over £19 billion to national GVA.

North-South Connections: The M23/Brighton Main Line Corridor

The importance of the railway service to our economy is unequivocal. It is essential for our commuters, learners and leisure travellers and connectivity, particularly to Gatwick and to London, is a key component to attracting businesses to locate and stay here. However, the

infrastructure is not fit for purpose and the Brighton Main Line (BML) in particular has suffered from long-standing capacity and reliability issues. Train services on the BML are among the busiest in the country, levels of on-time performance are among the lowest nationally and, according to the latest National Rail Passenger Survey, Southern (along with Southeastern) scores the lowest ratings for overall passenger satisfaction. We need an efficient and reliable railway service to maintain our competitiveness, drive our economic growth and boost employment.

While we are disappointed that the recently released London South Coast Rail Corridor Study does not support the case for any new live solutions to relieve congestion on the London to Brighton Mainline, we would like to take this opportunity to reiterate our support for the BML Upgrade project recommended in the report. This would increase capacity and reliability in the long-term, providing the infrastructure not just to support our planned growth but to transform our economy. Network Rail has identified this as its single top priority for investment and we ask you to recognise the importance of this critical route when setting your recommended priorities for action and investment.

Performance on the BML has been particularly compromised in recent months, as a result of the ongoing industrial action on Southern services. This is having a harming effect on our residents' wellbeing and livelihoods, on our businesses and on investor confidence. We are encouraged to see that fresh talks between GTR/Southern and ASLEF are now underway and that ASLEF have suspended all industrial action, allowing for a good service to be resumed. We have written to the Secretary of State for Transport, to urge Government to encourage the relevant parties to work together to resolve the dispute expediently and ultimately move forward.

East-West Connections: The A27/A259 Coastal Corridor

Our City Region has a dense rail network that plays an urban "metro" role, between Lewes and Worthing and as far north as Haywards Heath, and enables local economic activity. The rail network's potential role in facilitating longer intra-regional journeys needs examination. This includes consideration of the wider impact of reinstating the Lewes-Uckfield line, which has the potential to increase local connectivity as well as provide additional route capacity and resilience for the north-south corridor.

The A259 and A27 are the key road corridors for east-west journeys. Reliability, particularly of the A27 and its feeder roads, needs to be enhanced as these routes are prone to congestion and poor network resilience, with resulting impacts on the economy and quality of life.

Shoreham and Newhaven Ports:

Bottlenecks around our two ports, in Shoreham and in Newhaven, need to be removed. Allowing through traffic to move more quickly and efficiently through the area would reduce environmental impacts and improve connectivity for the port hinterland. Enabling port gateways through additional hinterland investment reduces the negative impacts of port activities in urban areas while maximising economic opportunities.

We hope that you find our comments helpful. We look forward to contributing to the National Infrastructure Assessment further, as part of the consultation on the Visions & Priorities Document that is due to be released this Summer, to help ensure that local infrastructure needs are effectively incorporated within national UK infrastructure policy.

Yours sincerely

[redacted]

[signature redacted]

[name redacted]

[job title redacted]

My ref:
Your ref:

Date: 10 February 2017

Contact: [Name redacted]
Direct dial: [Phone number redacted]
[Email address redacted]

BY E-MAIL

Greater Cambridge City Deal

Shire Hall
Castle Hill
Cambridge
CB3 0AP

NIA Call for Evidence
National Infrastructure Commission
11 Philpot Lane
London
EC3M 8UD

Dear Sir/Madam,

Thank you for providing the opportunity to contribute to the National Infrastructure Assessment Call for Evidence. Please find below a response in my capacity as [Job title redacted], which is an ambitious programme to deliver the infrastructure and investment needed to unleash the next wave of the Cambridge Phenomenon. This response draws on the experiences of senior officers working to deliver sustainable growth in Greater Cambridge and reflects key transport strategies and plans for the area. It focuses on question 1 of the Call for Evidence and in particular on the electricity and transport infrastructure needs of this fast-growing area. Cambridge City Council is engaging with the National Infrastructure Commission and I would like to follow up this response with a meeting to discuss infrastructure needs and investment in Greater Cambridge.

Overview of the Greater Cambridge City Deal partnership

The Greater Cambridge City Deal is an agreement between a partnership of local organisations and Central Government, to help secure future economic growth and quality of life in the Greater Cambridge city-region. It is the largest of several City Deal programmes taking place in the UK.

In 2014, the Greater Cambridge City Deal partnership successfully agreed powers and funding from Central Government, for infrastructure improvements to help address these issues and secure future prosperity and quality of life for the people of Cambridge and South Cambridgeshire, or Greater Cambridge. This, matched with significant local funding, is helping us to deliver the infrastructure needed for 33 500 new homes and 44 000 new jobs in our City region by 2031, an increase of almost 30%. The Greater Cambridge City Deal and Cambridgeshire and Peterborough Combined Authority Gainshare Deals provide a helpful source of infrastructure

investment funding to support this growth. Yet it is expected that further investment and timely delivery, for example by Network Rail, Highways England, rail operators and others is needed to deliver the rail, road, energy and digital infrastructure needed for continued growth, including economic growth in high-value sectors benefitting the UK as a whole.

Electricity networks

Q1. What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?
Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

A key element required to support long term sustainable growth in the Greater Cambridge area is the urgent need to upgrade the electricity grid serving the area, which has seen a significant growth in renewable and low carbon energy generation and increased demand for electrical supply capacity as part of the wider growth agenda. Major new developments are often accompanied by new energy generation capacity in order to meet carbon reduction requirements and, in some cases, to meet funding requirements. Investment in the electricity grid has not kept pace with the increased generation. Fault level limits at local grids mean that restrictions are being placed on new generation connections, many of the grid substations in the area are nearing supply capacity limits and the Burwell Super Grid has reached its generation capacity limits and requires a new Super Grid Transformer (SGT). As a result, developers are often facing delays and unforeseen grid reinforcement costs during the construction phase of projects (see case study below). Regulatory restrictions mean that district network operators (DNO) are unable to plan proactively to meet growth demands, instead having to take a more reactive approach to grid reinforcement. Due to the long lead in times to deliver upgrades, this has the potential to impact on the delivery of the growth agenda.

Case Study:

- Southern Cluster developments

There is a shortfall of electrical supply capacity infrastructure on the Southern Fringe of Cambridge affecting a number of developments coming forward in the Southern Cluster in the next 5-10 year timescale. There are likely to be some 6-8 major developments of significant size requiring considerable supply capacity and demand availability during this period.

A consultancy called Northmores has been appointed by Cambridge University Hospitals NHS Trust to establish a forum to inform the electrical infrastructure growth needed to support development in the southern cluster, including development at Addenbrooke's Hospital, the Cambridge Biomedical Campus and other research parks in South Cambridgeshire (e.g. Spicers, Babraham Research Institute, Granta Park and the Genome Campus) and development at Marshalls (residential development). The forum will work with UK Power Networks (UKPN) to inform the level of additional

supply capacity and associated grid infrastructure enhancements necessary to support the growth of the Southern Cluster. However, following the first meeting of the forum on 30/1/2017, it has become apparent that even with funding in place, it may take around 8 years for these upgrades to take place, which will slow the pace of delivery at these key research centres, which are drivers of the UK economy.

Approach moving forward

While temporary measures are being put in place by UKPN to allow new generation connections, and to increase supply capacity for some sites, it is clear from the delays facing the Southern Cluster that a more strategic long-term approach is needed to enable the DNO and the National Grid to better align their infrastructure planning processes with the strategic planning process undertaken by the Cambridgeshire local planning authorities, and indeed planning authorities across the UK. This would help authorities identify possible funding sources to help bring forward necessary infrastructure in a timely manner. It is considered that for this to happen, a number of national measures need to be put in place, including:

- Greater Government policy and fiscal support for the modernisation/upgrading of electricity infrastructure across the country;
- A review of the regulatory requirements placed on DNO to enable them to plan more proactively for growth and for grid infrastructure reinforcements to be brought forward more quickly. One of the key issues would seem to be regulatory restrictions placed on DNO so that even when funding is available to proceed with infrastructure reinforcement and upgrades, these upgrades can only take place where there is an issue with the performance of the local network as a whole (known as ER P2/6 compliance). As a result, developers have no certainty that grid capacity will be available in line with their growth and development plans. A mechanism also needs to be put in place to speed up the planning, procurement and delivery of reinforcement projects.
- At present, many local planning authorities struggle to get input from DNO as part of their work on infrastructure planning, which is a key mechanism to deliver the infrastructure required to support growth. A duty should be placed on DNO and the National Grid to work proactively with local planning authorities and their delivery partners to plan for the infrastructure capacity needed to both supply new development and enable an increase in decentralised renewable and low carbon energy generation that accompanies many new developments and which plays an important role in meeting national renewable energy targets. Cambridgeshire authorities are in the process of setting up a Utilities Forum in order to establish more effective engagement and communication between local authorities and the relevant utilities providers to identify, understand and act upon relevant planning and growth issues. To date meetings have been set up with the National Grid, as well as Anglian Water and Cambridge Water, and we are in the process of setting up a meeting with UKPN. If successful, this approach could help provide a more proactive, strategic approach to planning for infrastructure requirements to support the growth agenda and speed up delivery. However, if the approach is to work, it will require high level commitment from the utilities providers as well as more flexibility in the regulatory requirements governing infrastructure provision.

Transport infrastructure

The following transport infrastructure improvements, from the Local Transport Plans, are considered necessary to support sustainable growth and improved connectivity:

1. *Road improvements*

A428 Caxton Gibbet to Black Cat capacity improvements.
As part of the Oxford to Cambridge Expressway, Scheme to address congestion on the A428 St Neots Southern Bypass and on the A1 between its junctions with the A428 at St Neots and the A421 at the Black Cat roundabout. The scheme would provide an offline improvement taking the A428 directly into the Black Cat roundabout without requiring traffic to use the A1. The scheme would incorporate the A1 / A421 Black Cat roundabout scheme detailed above, and the A428 / A1198 Caxton Gibbet roundabout scheme detailed

M11- Improvements to the M11, particularly managed motorway between junctions 11 and 13, including bus priority on slip roads at Junctions 11 and 13 and full connection between the M11, A14 and A428 at Junction 14.

A505 – potential capacity improvements, particularly between M11 and A11.

2. *Rail improvements*

Cambridge South station.
A new station at Addenbrooke's to serve the Cambridge Biomedical campus. Additional track capacity is likely to be needed between Cambridge Station and Shelford junction to facilitate this work, but growth in patronage on the railway and future growth are likely to necessitate such work. The station could be served by trains to London Kings Cross, London Liverpool Street and Stansted Airport, and trains on the Thameslink core route through central London. In addition, East West Rail services could serve the station.

East-West Rail
High-speed rail connection between Cambridge and Oxford.

Cambridge to Ipswich service increase in frequency to half hourly.
Additional double track capacity between Cambridge and Newmarket may be required to allow trains to pass. Development of new stations to the East of Cambridge, for example at Fulbourn to increase rail commuting.

Ely area rail infrastructure improvements.
Increased capacity through Ely North junction for freight and passenger trains. Double tracking of the Ely to Soham line.

Electrification of rural rail routes in Cambridgeshire and surrounding counties.
Felixstowe to Nuneaton (Newmarket to Peterborough in strategy area).
Cambridge to Newmarket.
Ely to Norwich.

Electrification will allow electrically powered freight trains to serve Felixstowe Port from the north. It will also allow passenger services between Cambridge and Ipswich, Cambridge and Norwich, Peterborough and Ipswich and Stansted Airport and Birmingham New Street to be run using more widely available and flexible electric powered rolling stock.

Waterbeach Station relocation.
A relocated Waterbeach station to serve the village and the new town, with platforms (capable of taking 12-carriage Thameslink trains or 10-carriage InterCity Express trains).

3. *Infrastructure needed for key growth site at Waterbeach Barracks*

Development related schemes		
Waterbeach Barracks new town (8-9000 new homes). Also supports development in Ely (about 3000 new homes)		
Waterbeach Station relocation. A relocated Waterbeach station to serve the village and the new town, with platforms (capable of taking 12-carriage Thameslink trains or 10-carriage InterCity Express trains).	Mid to late 2020s	£25M
Waterbeach Barracks Busway. A busway link from the station and town centre to north Cambridge including a fully segregated crossing of the A14 Trunk Road.	Mid to late 2020s	£32M
A10 corridor outer Park & Ride site. Park & Ride site on A10 to intercept traffic from the north of Waterbeach, served by new busway link to Cambridge. Alignment to be determined.	Mid to late 2020s	£8M
A10 capacity improvements. Additional capacity for general traffic between the northernmost access to the new town and the Milton Interchange of the A10 with the A14.	Mid to late 2020s	£45M
A14 / A10 Milton Interchange improvements. Additional capacity at the Milton Interchange for movements between the A10 and A14, and the A14 and the A10.	Mid to late 2020s	£40M
Mitigation of local impacts. Delivery or funding of any measures required to mitigate	Mid to late 2020s	To be determined

the traffic impact of the new town on Horningsea, Fen Ditton, Milton and Landbeach.		
Wider Waterbeach pedestrian / cycle network. A comprehensive network of high quality pedestrian / cycle routes linking the town with key destinations in Cambridge and the surrounding villages.	Mid to late 2020s	£12M

The Greater Cambridge City Deal is investing in transport infrastructure that markedly improves connectivity between new homes and the Enterprise zone at Cambourne (5850 new homes planned at Cambourne West and Bourn Airfield) and between Cambridge and the research clusters towards Haverhill.

I hope that you find these comments helpful and, as notes above, would like to discuss them further.

Yours sincerely,

[Name redacted]

[Job title redacted]

cc. [Name redacted], [Job title redacted]

GREATER CAMBRIDGE
GREATER PETERBOROUGH
ENTERPRISE PARTNERSHIP
DEFINING THE FUTURE

NIAEvidence@nic.gsi.gov.uk

10th February 2017

Dear Sir/Madam,

CALL FOR EVIDENCE

I am writing in response to the Commission's Call for Evidence. The Greater Cambridge Greater Peterborough Enterprise Partnership exists to drive sustainable economic growth across our area. Supporting and fostering the right 'eco-system' is crucial to drive that economic growth. Through our work bringing together businesses, local authorities and academia we have a fresh perspective on the challenges of infrastructure delivery. We have also worked directly with the Commission on the Oxford to Cambridge Corridor, and are delighted that the importance of that area is recognised by the Commission.

The Enterprise Partnership is currently reviewing its Strategic Economic Plan. We are happy to work alongside the Commission in sharing our refreshed evidence base to guide infrastructure decisions. The view expressed below on high value infrastructure investments are based on current evidence so may evolve as the Plan is reviewed, and particularly reflect an economic focus (our public sector partners will respond in particular on social and environmental implications, such as available school places to attract inward investment).

Comments are grouped under specific questions from the consultation.

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

The GCGP area is one of the fastest growing in the country, both economically and population. Long term forecasts predict this to continue (provided that the right infrastructure is in place). It is also one of the UK's globally competitive locations (especially for life sciences and technology). If supported, innovation from the GCGP area will define many new sectors of economic activity, as it has done for the past decades.

Government has recognized the pressure that the growth has placed on existing capacity and has made significant infrastructure investments including £500m Greater Cambridge City Deal (mainly transport funding to enable rapid planned growth of Cambridge), the £1.5bn A14 Improvement Scheme, and commitments to Oxford to Cambridge Corridor and the A428. GCGP itself has made significant infrastructure investments using it's £109m Local Growth Fund, both addressing traffic bottlenecks but also skills provision and commercial premises.

There remain serious concerns that the pace of growth has over-reached available infrastructure. This is not just 'hard' infrastructure such as the road, rail, utilities, but also housing availability, digital connectivity, skills and social infrastructure. We have anecdotal evidence from businesses that these conditions are starting to have a negative drag on growth and investment decisions. This is of utmost concern in an area that drives UK inward investment and attracts some of the best talent

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internationally. The (poor quality) available infrastructure is also doing little to spread the comparative advantages of our most economically successful areas to surrounding locations (GCGP having some of the most deprived Wards in the UK as well as some of the least deprived, according to the Government's Index of Multiple Deprivation).

At the broad spatial level, key infrastructure improvements to 2050 are to east-west movements both within and beyond GCGP area (e.g. the A428, East-West Rail/Oxford to Cambridge Expressway, A47), access to/from Greater Cambridge including the ring of market towns that will become increasing important in terms of a network supporting growth, enabling growth of Greater Peterborough including a new University, rail capacity including to/from London (e.g. Ely Area Improvements, West Anglian Main Line 4-tracking, new stations across the area), facilitating surface access to London Stansted Airport, improving access to low productivity/low growth areas, and the A14's role as the key strategic freight route from the Midlands Engine/Northern Powerhouse to UK's busiest container port on the East Coast. These are described in more detail our current Strategic Economic Plan, found here: http://www.gcgp.co.uk/local-growth-strategy/

GCGP are currently also exploring key utilities constraints on growth. We have clear evidence that the electricity network is constraining new connections of renewable generation and also starting to have an impact on housing developments. As a mainly low-lying area the area is prone to expensive costs for potable water supply, there is a lack of future water supply without significant transfers from other areas, and risks of tidal flooding (which also constrains thinking on new housing locations). Digital connectivity is poor.

Housing unaffordability in the area is both a response to the pace of economic growth, attractiveness of parts of the area for housing as an 'investment', and the additional costs of development highlighted above. This is despite the relatively high level of planned provision.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

The GCGP area needs to improve its productivity to continue to compete internationally. Current infrastructure is holding back that productivity, increasingly so for digital connectivity. Inward investment in the GCGP is a mix of both business comparative advantage through clustering/access to innovation and quality of life, so the right infrastructure is needed to address both.

High growth businesses tell us that access to international gateways is vitally important to their continued growth and to attract them to the GCGP area. GCGP is supporting London Stansted in its aspirations for growth including attracting long-haul routes. We also recognize the growth of activity in the GCGP area has the potential to negatively affect access to the Port of Felixstowe through local traffic using the strategic A14, and capacity challenges on the rail between freight and passenger train paths.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and

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housing be incorporated into this?

One striking feature of the GCGP area is the appetite for, and advance planning of, significant growth. Cambridge and Peterborough vie with neighbouring Milton Keynes to be the fastest growing UK city on a year by year basis. This includes Green Belt releases to enable growth of Cambridge, further new neighbourhoods of Peterborough, new settlements on ex-MoD land, and recent thinking around Garden Villages (South Kesteven District) and Garden Towns (Fenland District). However, there seems to be disconnect between the planning and public scrutiny of growth via the Local Planning system, and the future investment decisions/funding of major infrastructure providers. Investment planning cycles and processes of public and private utilities are not well integrated into the Town Planning process.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

GCGP has been effective in leveraging private sector investment to assist its investments. Longer-term funding allocations to Local Enterprise Partnerships would enable better relationships to be brokered with the private sector, reducing uncertainty costs.

Allowing local authorities to retain business rates from 2021 will start to link investment risk of infrastructure with actual reward through generation of future receipts. The system must be set up to properly incentivize local authorities and partners to grow the business base (i.e. would have concerns over excessive top-slicing of high performers to underpin system). Businesses should have a sufficient voice in influencing the allocation of business rate receipts. Enterprise Zones demonstrate that this model can work.

All too often, insufficient revenue funds are available to enable project promoters to test infrastructure ideas and develop well-rounded proposals. This leads to a 'feast and famine' model linked to intermittent Government funding rounds.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

GCGP would like to see improvements that allow credible future growth to be taken into account (rather than criteria that rely on presence in an approved Local Plan). In addition, 'wider economic benefits' need a more precise methodology to add value to the techniques.

We look forward to a successful cooperation.

Yours sincerely,

[signature, name and title redacted]

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Sent by email: NIAEvidence@nic.gsi.gov.uk

10th February 2017

Dear Sir/Madam

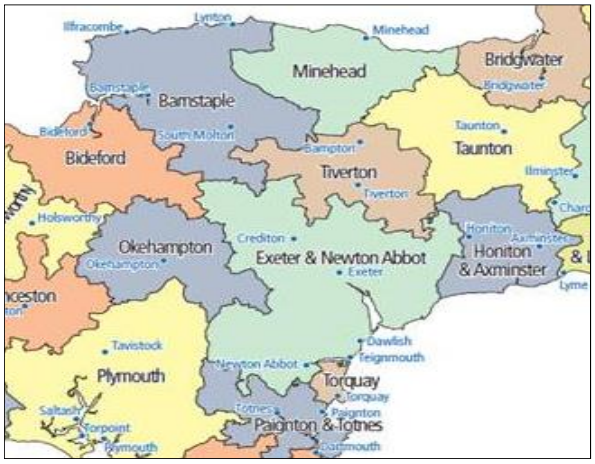
The National Infrastructure Assessment – Call for Evidence

Thank you for the opportunity of responding to this call for evidence. The Greater Exeter area is located in the South West of England and is comprised of the four Districts of Exeter City, East Devon, Mid Devon and Teignbridge. It lies at the nexus of strategic road (M5/A30/A38/A380) and rail networks (Great Western Main Line/Exeter-Waterloo/Exmouth and Barnstaple branch lines).

The area has recorded significant growth rates, in terms of the delivery of new homes and jobs, over the past 10-15 years. We deliver over 2,000 new homes per annum and between 2004 and 2014 the number of people employed in Exeter rose by nearly 30,000.

Exeter is the last place as you come south and west from London to register above national average levels of productivity. In 2015, productivity per job in Exeter (£44,224) was 25% higher than productivity across the wider Devon and Somerset area. The area is well placed to act as a major economic driver to propel growth further in to the South West peninsular.

The Exeter Travel to Work Area has expanded significantly over the past decade as is illustrated by the plans below;



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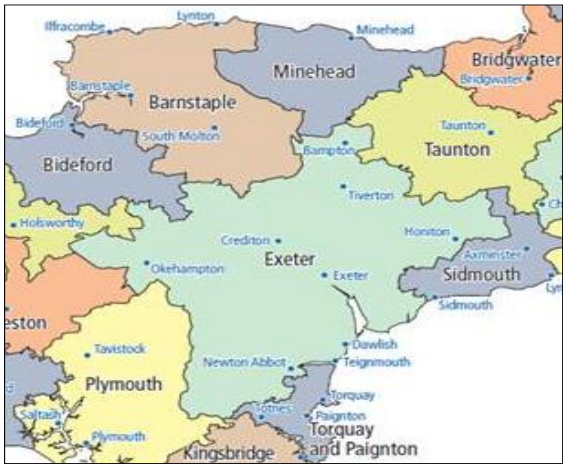

2011

In recognition of the alignment between housing and labour markets the partners are moving forward with the production of a new strategic plan for the sub-region. This will cover the period to 2040.

East Devon www.eastdevon.gov.uk

Exeter City Council

Teignbridge DISTRICT COUNCIL South Devon

Mid Devon DISTRICT COUNCIL

This response is based on our experiences of delivering a major growth programme within a very high quality environment. Our approach to date has been infrastructure-led, ensuring that a range of supporting infrastructure is delivered at the earliest opportunity in the development process, helping to de-risk the development process and to safeguard natural capital including internationally protected habitat sites.

As a partnership we have been proactive in helping to secure the roll out of two district heating networks. Two further networks are planned, a large scale PV programme has been undertaken, a municipal energy company has been established and plans are being brought forward to harness hydro power. We see this transition to decentralised energy networks as a major way of improving resilience as part of an energy mix that will include biomass, solar thermal & PV, hydro and energy from waste.

The response picks up on a number of themes and, ultimately, frustrations where we can see improvements to how the system of identifying, planning, funding and delivering infrastructure improvements can be improved. Particularly this includes;

- Connectivity to national and international markets – including improvements to A303/30, rail journey times to London and supporting the role of Exeter International Airport.
- Resilience of existing networks – there have been high profile examples of where the rail network in particular has been very vulnerable to the effect of flooding and tidal surge.
- Predictability of journey times - this applies both in an urban setting and in terms of addressing the seasonality of demand, linked to significance of the tourism industry.
- Alignment of capital investment plans and funding streams – to ensure that the growth programme is both understood and supported by coherent investment plans including those of the utilities companies.
- Greater decentralisation and flexibility to bring forward resilient and diverse solutions locally

We have world leading expertise in data analytics and climate change (Exeter is home to the Met Office). We see a major opportunity to utilise this expertise to improve the way in which we plan to accommodate growth and meet accompanying infrastructure challenges. The Exeter City Futures programme has significant aspirations for the City to be congestion free and energy independent. This demands bringing forward new and innovative solutions to major infrastructure challenges.

The partners would be very happy to host a visit from the Commission in order to gain a fuller insight in to the issues and solutions identified in to this response.

1. What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

East Devon www.eastdevon.gov.uk
Exeter City Council
Teignbridge DISTRICT COUNCIL South Devon
Mid Devon DISTRICT COUNCIL

There is a well evidenced (PRTF Productivity and Wider Impact Economic Study April 2015) productivity gradient such that there is 6% drop in productivity with every 100 minutes travelled from London. Improving strategic connectivity through infrastructure improvements therefore represents a high value proposition. It should also be recognised that the economic impact report accompanying the Government's flagship infrastructure investment (HS2) reveals that this will actually have a net negative effect for Devon.

Study work undertaken in conjunction with the Local Economic Partnership estimate the wider economic impact of improving the A303 corridor as some £41.7bn over 60 years. The Peninsular Rail Task Force published its 20 year blueprint in November 2016. This report identifies that a transport economic benefit of £7.2bn over 60 years is available through improving rail journey times to Paddington from Penzance by 26 minutes.

Of particular significance for the growth of the Greater Exeter area is the improvement of the Exeter/Waterloo line. This would be to both enhance frequency of services in the Devon Metro area and to reduce journey times to Waterloo by 30 minutes. Benefits over a 60 year period from this are calculated at £677m. Equally investing in measure to ensure the resilience of the Dawlish/Teignmouth section of the mainline in the event of extreme weather events is essential. Network Rail warns that a closure of the line of between 2 and 7 days every 6 months and significant weeks of closure will every 4 years by 2065.

Ensuring that natural capital is maintained and enhanced is an important part of future economic prosperity. Growth in the Greater Exeter areas has the potential to impact upon habitats that are afforded the highest protection at national and European levels. In order to permit development, the Local Authorities are legally obligated to ensure that the integrity of these sites is maintained through bringing forward a range of onsite and offsite measures. The estimated cost of delivering this mitigation strategy is circa £20m over the period 2026. This alongside the wider delivery of green infrastructure represents an essential ingredient of a wider growth and investment programme.

Growth in Greater Exeter is also dependent upon the provision of new, expanded and refurbished schools. Current Local Plans / Core Strategies in Exeter, East Devon and Teignbridge provide for approximately 2500 dwellings to be built per annum and for associated school places to be provided. There is likely to be a need to provide for a similar, if not greater, number of new dwellings going forward. This will give rise to the need for further new primary and secondary schools, as well as further expansion and refurbishment of existing schools, the cost of which will run into tens of millions of pounds.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

Exeter International Airport is a significant asset for the sub-region which provides direct access to national and international markets including a direct flight to London City Airport. The area will only benefit marginally from the electrification of the Greater Western mainline between Paddington and South Wales and HS2 will have a net negative effect on Devon economically. Therefore bolstering the role of regional Airports such as Exeter provide a relatively quick and cost effective means of enhancing strategic connectivity. Measures can include enhancing the existing Regional Air Connectivity Fund, ensuring the availability of slots at key hub Airports and improving surface access.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

We have significant experience of conceiving, planning and delivering a major growth programme. A key challenge has been to ensure that this is infrastructure-led, for example by ensuring that critical infrastructure improvements, such as new schools, are in situ at the earliest opportunity and before existing schools reach capacity. We consider that there are three key ingredients to achieving this;

1) A clear programme of development

This needs be underpinned by a statutory plan and suite of policies. Clarity around the staged enhancements anticipated by the Code for Sustainable Homes allowed a district heating network to be negotiated to serve the Cranbrook new community for example. This will enable the costs effective delivery of zero carbon housing but it depends on a clear and long term policy framework at both national and local levels.

2) Ability to forward fund

The ability to match required infrastructure improvements with the timing of financial receipts, for example through developer obligations, is rarely precise or in the right order. The Homes and Communities Agency has proved to be a sturdy partner in making funding available upfront which has helped to de-risk this scenario and to allow development to proceed. This has been an essential tool with which to improve cash flow.

3) Co-ordinated investment plans

The Capital Investment Plans for utility companies rarely align with strategic planning horizons. Locally we have had experience of coordinating wider investment through a local Growth Board. Companies such as BT, South West Water and Western Power Distribution have been invited to attend the Board when it has become clear that a lack of investment had the potential to become a barrier to the delivery of growth in terms of new commercial and housing development. This suggests that overall the way in which capital investment plans are aligned with development plans

can be improved, maybe through some form of local infrastructure commission or an enhanced role for regulators such as Ofwat.

Development should be designed to include Green Infrastructure, spaces for recreation, and to avoid car domination. Traditionally, housing development has been more successful in achieving this than has employment and retail development. For example, shared mobility networks could reduce the need for parking, making more land available for amenity space, as well as a larger developable area.[1] Shared mobility networks are essential if new employment and retail developments are to be delivered in Exeter City Centre. Out of centre locations which are less congested and where car parking is more freely and cheaply available have a competitive advantage over the City Centre, but cars dominate in these out of centre locations as a consequence. If we want to create environments where people don't have to drive between one land use and another, or even between different retail sheds in the same vicinity (as is necessary at Cribbs Causeway for example), we need to invest in improving access to our city and town centres so that people can undertake a variety of everyday tasks in the same places.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

Demand management is a valuable tool in counteracting the rebound effect in transport, whereby road capacity freed up by attracting existing drivers to public transport, for example, is likely to be filled by new users. Charging for road use or parking could be used to create more of a level playing field between single-occupancy car use and other modes. This level playing field will become more necessary as "Mobility as a service" develops.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

The prime example in the Greater Exeter area relates to the resilience of the rail network. If flood and sea wall defences are not maintained it will inevitably lead to the severance of the line and major disruption with increasing frequency and disruption. We would argue that investing heavily in HS2, which will have a net negative effect on the Devon economy, without having a clear investment plan in

[1] See "Making Better Places", http://www.wsp-pb.com/Globaln/UK/WSPPB-Farrells-AV-whitepaper.pdf

place to safeguard the rail line through south Devon is an example of where the balance between new investment and safeguarding existing assets is out of kilter.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

The question appears to recognise that the distinction between capital and revenue is not always helpful, at least in relation to income. Flexibility between the two is needed in relation to expenditure as well. A "user pays" approach has the advantage that it generates a funding stream from which assets can be maintained. Crowd funding may provide opportunities to provide infrastructure which, while not essential, is desired by a large number of people.

If local authorities had greater fiscal autonomy from central government, as is normal in other countries, there are many ways in which infrastructure might be more imaginatively or innovatively delivered. For example, local authorities might choose to establish local sales taxes to deliver the kinds of infrastructure improvements delivered by Oklahoma City through its 'penny sales tax'[2].

Greater regulatory freedoms would also assist local authorities to deliver infrastructure. At the moment, local authorities are expressly prohibited from borrowing against future Community Infrastructure Levy receipts by the CIL Regulations. If this restriction were to be relaxed, local authorities would be better placed to deliver infrastructure upfront when it's needed.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

A key challenge from a Local Authority perspective is that whilst the need is to deliver infrastructure upfront, the majority of revenues (including the Community Infrastructure Levy and New Homes Bonus) accrue after development has taken place. Forward funding, including the ability to borrow against future CIL receipts, would be a key means of improving the funding regime for delivering infrastructure.

A further scenario which has acted as brake to the delivery of growth relates to the delivery of upgrades to power distribution networks. This has been a particular barrier in relation to new employment sites. Because upgrades in capacity are delivered in relatively large increments, for example through the installation of a new

[2] Oklahoma City MAPS Project – see: https://www.okc.gov/government/maps-3/maps-history

sub-station, the development that tips the balance in to requiring this upgrade can be caught with a disproportionate cost event if further development is expected to come forward over time to help meet this. This again points to the challenge of the relative short timescales employed in utilities planning relative to development plans.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

For the past decade a Growth Board has been meeting every quarter to help coordinate the delivery of the major growth programme centred on Exeter and extending in to East Devon and Teignbridge. This has helped to bring key partners such as Highways England and the private sector developers together with a focus on identifying and overcoming barriers to delivery.

We are now moving forward with the production of a strategic plan for the Greater Exeter functional economic area. Alongside this a new Growth and Development Board is in the process of being constituted as a formal joint committee. This will help to prioritise investment and demonstrates the importance of working effectively across administrative boundaries.

The whole viability assessment process is not currently fit for purpose. Local authorities are ill-equipped to challenge developers' claims that delivery of infrastructure is not viable. In addition, CIL rates and developer contributions are based on excessive assumptions on land values, minimising the adopted CIL rates and section 106 contributions. These issues cause significant difficulty in securing sufficient funding to deliver the infrastructure required, meaning development impact is often not appropriately mitigated. To avoid this, the planning system needs to be better equipped to either control or capture land value uplift.

Regulation 60 of the Community Infrastructure Levy (CIL) Regulations makes provision for a percentage of CIL receipts to be used to pay borrowing costs. Currently however the percentage of CIL that can be used to pay back loans, as prescribed within the Regulations is set to zero. There is also provision for the Secretary of State to change this and allow repayments, specifying the percentage that could be applied.

Generally, infrastructure needs to provided up front to enable growth. Not being able to apply the CIL funds in this way is an impediment to growth. Therefore, there should be a change to the Regulations to allow repayments on loans. Given the favourable credit status of public authorities, forward funding of infrastructure through

prudential borrowing at low cost could be used more to deliver infrastructure in advance of above-inflation cost increases. Our experience from the new community of Cranbrook is that front loading infrastructure funding has increased the rate of housing construction.

Local authorities need real power to control phasing of development through the planning system, to ensure that infrastructure is in place to enable the delivery of successful new communities and workplaces. Local authorities might be better placed to control development if compulsory purchase procedures were less complex and if local authorities were better equipped, tasked and empowered to take on a 'direct development' role.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

The delivery of green and blue infrastructure is an intrinsic part of protecting and enhancing the natural environment and needs to be integrated in to investment and development plans from the outset. Formalising biodiversity offsetting arrangements would help to enhance this approach as would a greater appreciation of the need to ensure resilience in the face of forthcoming climate change and more extreme weather events.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs.
"Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

As part of the process of drawing up a Greater Exeter Strategic Plan, the partners have participated in workshops with other stakeholders, facilitated by the University of the West of England, to consider the impact of development patterns on travel in a number of scenarios, featuring different levels of –

- Affordability of travel
- Advances in technology
- Spatial distribution of activity centres

The purpose of the workshops was not to predict exactly **how** travel patterns would change, but what the implications would be of a range of scenarios. What is clear is that the future is uncertain and, particularly for travel within a local area, flexibility is key. This favours the following approach–

- For travel modes reliant on fixed infrastructure, it is logical to build on what we already have. As described above, Greater Exeter is located at the hub of a rail network covering a wide range of destinations both locally and further afield, but which is constrained by limited capacity and poor resilience. Investment in the network should be targeted at resolving these deficiencies.
- Aside from this, the uncertainty as to future travel patterns within the Greater Exeter area requires that we also invest in modes with a low requirement for fixed infrastructure, such as the active travel modes and shared transport (including a range of options covering conventional buses, car clubs, and on-demand services). The emergence of autonomous vehicles provides new opportunities for shared on-demand mobility within a defined area.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

Greater Exeter has been served well by traditional modes of transport, including its rail system and a comprehensive interurban bus network focused on Exeter city centre and the coastal and market towns. However, new patterns of development require this traditional approach to be challenged. For example, the concentration of residential and employment development on the eastern edge of Exeter provides an opportunity for a new network focused on that area, including scope for an on-demand shared mobility solution, with the opportunity of taking advantage of advances in autonomous vehicles.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

Exeter's hinterland is highly rural, making it difficult to serve comprehensively using conventional public transport. Aggregating journeys through park and ride (for people) or freight consolidation (for goods) provide elements of a solution. Within

rural areas, shared mobility has potential for reducing dependence on both conventional services and the private car, and could provide a step change in the economic and social activity of those living in the countryside who currently find travel problematic.

For longer distance travel, the strategic road and rail networks are continuing to experience continuous growth in traffic, and as described above, the construction of HS2 will place the South West peninsular at a greater relative disadvantage. It is therefore imperative that progress is made with the following major projects –

- Dualling the entire A303/A30 corridor to Exeter, including the section west of Ilminster. Failure to do this leaves Greater Exeter and the entire peninsula dependent on the M5 south of Taunton as its sole dual carriageway link.
- Upgrading the Exeter to Waterloo rail line to provide a second intercity link, to complement the Great Western main line in the same way that the Chiltern railway has provided a second line to the Midlands. Selective dualling is necessary to enable a half hourly frequency throughout, and the improved journey times described above.

The Exeter Travel to Work Area is second only to Cambridge in terms of the level of net in-commuting. Servicing a predominantly rural area with high quality and frequent public transport services is a challenge which demands innovative responses. Shared mobility has the potential to reduce the dependence on both conventional services and the private car.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

Mobility as a service has significant potential to address some of the above issues in relation to Greater Exeter. The way forward is likely to be a package of measures spanning several transport modes. MAAS provides the opportunity to join up modes to provide individuals with attractive, efficient and affordable ways of getting around. Use of private vehicles is subject to a different financial structure from other modes, in that it requires considerable up-front investment in a car (which itself excludes some members of society) followed by relatively low costs at point of use which gives it an advantage over public transport modes. If a MAAS provider is to offer a genuine range of choices, some financial mechanism like road user charging would be necessary to create a level playing field, nudging users away from single occupancy vehicles which make inefficient use of scarce road space. Another benefit for public authorities is that it would enable a share of the provider's income, recovered through road charges, to be reinvested to maintain and improve the network.

Digital communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

Exeter wants to be an analytical city and a leading global location for applied environmental sciences. Achieving this ambition would be greatly assisted by 5G infrastructure. We believe that decisions need to be made now to prioritise the roll out of this infrastructure in key locations and to achieve the ambitions of the wider Industrial Strategy.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Note: the existing "regime" refers to the current market, competition and planning frameworks. "Digital communications" includes both fixed and mobile connectivity.

We have had mixed experience of how the current regime has supported the roll out of digital communications to support the growth of the area. BT have rolled out a new fibre spine to serve a new Science Park and strategic business park at a very early in the development process effectively meaning that these were pre-fibred. However existing industrial estates in Exeter continue to struggle with connectivity.

At the Cranbrook new community each property has a fibre connection. But the way that this was secured through a commercial arrangement was to the exclusion of other providers including Openreach thereby over limiting overall choice. Equally despite repeated attempts it has proven very difficult to address a lack of mobile phone connectivity through either encouraging the mobile operators to upgrade their networks or working with developers to bring forward more innovative technologies such as small cell networks.

This suggests that the alignment between development plans and planned upgrades to digital networks is far from systematic.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

The Greater Exeter area has a significant track record of planning and delivering decentralised heat networks. We now have two operational networks with the potential to deliver two more which will be facilitated through the recent establishment of a municipal energy company. The energy mix includes gas, biomass CHP, Energy from Waste and solar thermal and we are now looking to

harness waste heat sources including from a major transformer station and supercomputer.

The roll out of these network is a considerable step towards a more decentralised, diverse and resilient energy mix but has taken considerable time and effort to realise. There is now an acceptance from housing developers that district heating represents a realistic alternative to gas fired central heating. But this has been hard won and there remain barriers, including differential treatment of heat pipe networks in terms of business rates and the abolition of the proposed allowable solutions regime, that mitigate against further progress.

Clear strategic policies are required in order to realise these outcomes. Grid constraints have actually helped to facilitate private wire connections in order to make local of the electricity generated form combined heat and power plants.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

We believe that the a effective zero carbon power sector will be;

Decentralised – helping to ensure that energy is both generated and consumed locally, for example through microgrids
Diverse – harnessing a wide range of technologies including energy that would otherwise be wasted
Smart- whereby both production,consumption and storage is informed, for example by forthcoming weather patterns, which help to smooth peak demand

There is a significant role for municipal companies in helping to achieve these outcomes including encouraging investment in local energy networks and wider energy efficiency measure such as highly insulated buildings.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Water and wastewater (drainage and sewerage):

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

Note: "demand" includes domestic, commercial, power generation and other major sources of demand.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

It is essential that Capital Investment Plans match wider development plans and associated trajectories. In effect, a less lean approach to sewerage capacity will facilitate timely delivery of development by overcoming the most significant under capacity risks. In order to build houses, we need to back ourselves that they will be built and prepare accordingly.

Note: this can include, but is not necessarily limited to, governance frameworks across the country.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

Flood risk management:

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

Where flood risk is severe, then public sewerage systems need to be upgraded to provide at least a 1 in 75years protection, not I in 30years as at present. Flood schemes are normally designed to a 1 in 100yr event.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

We're in a position where public highway drainage is ordinarily separated from private development drainage. In SUDS terms, potentially two swales, one for the road and one for the houses. A model for overcoming this is needed.

Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

Note: A "circular economy" is an alternative to a traditional 'linear economy' (i.e. make, use, dispose) in which products are designed and packaged to minimise waste, and resources are kept in use for as long as possible, e.g. through re-use, recycling and greater recovery of materials through the waste management process.

Please do not hesitate to contact me should you require any further information.

Yours faithfully

[name redacted]

[job title redacted]

[email address redacted]

[telephone number redacted]

National Infrastructure Commission

National Infrastructure Assessment: Call for Evidence

Response on behalf of the Greater Lincolnshire Local Enterprise Partnership & Lincolnshire County Council

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

Sustainable growth is all about business and housing growth.

One third of Lincolnshire businesses tell us that their business growth is constrained by poor transport infrastructure, one third of Lincolnshire businesses tell us that they are concerned about the risk of flooding, and a quarter of businesses tell us that their growth is constrained by a lack of access to finance.

Our dialogue with housing developers tells us that they will invest where the market gives them the opportunity for a reasonable return. In areas like Lincolnshire where the market is fragile, then the additional cost of flood defence and transport improvements can make developments inviable.

Unviable developments, whether commercial or domestic, are a missed opportunity for UKplc.

- Economic growth is important because it leads to higher average incomes, lower unemployment, increased investment, and lower government borrowing which in turn leads to improved public services.
- Housing growth is important because it increases the availability and affordability of homes, increases people's ability to move to jobs, makes local services like schools and doctors' surgeries more viable, and gives people more money to spend on other things

That is where we believe that the NIC's efforts would be best focused; on the investments that will address these higher value benefits. These are:

- Improving transport networks both by improving infrastructure and reducing journeys through better use of digital infrastructure
- Defining the balance between public and private benefit of flood risk management schemes, and recommending shared financial approaches

Lincolnshire County Council is keen to work with the NIC on enquiries that address these issues. In particular we would highlight two areas where infrastructure investment offers opportunities to make a difference to the national economy.

- Flood risk management is important at local, regional;, and national level. SUDS management in a new housing development is patently a local issue.

Making better use of waterway corridors, like the River Trent which passes through the West and East Midlands on its way to the sea at the River Humber, to transport goods and trigger investment is a regional issue.

- However, flood management along the East Coast, as a way of protecting the countryside and communities but especially as a way of securing the nation's food supply, is an important national issue. A nation with an unprotected food supply is a vulnerable nation, and we know that international investment will not take place in a vulnerable nation.

- The NIC has already identified the benefit of investment in important road corridors. The Oxford/Cambridge corridor has clearly been identified a way of promoting investment in the nation's technology sector; one of the country's best exporting opportunities. Strategic infrastructure to support the growth of food sector –not only food production but also the knowledge based businesses that support the sector- will enable the UK to enhance its role as one of the most advanced centres of food production in the world.

- The A47/A17/A52(A50) corridor is as important to the food sector as the Cambridge/Oxford corridor is to technology. And food is as important to the country's security and export as technology. Increased pressure on global food producing areas from climate change and population growth will place a growing emphasis on the need to secure the UK's food security, and the combination of effective water management (both supply and risk management) with distribution infrastructure represent a key opportunity for the UK economy as a whole. At present the UK imports about 40% of its food: the Greater Lincolnshire LEP's ambitions to treble the areas exports of food and drink provide a significant opportunity to address emerging issues of future food security.

Current priorities and future planning

At present Greater Lincoln is the main economic driver of a large sparsely populated rural county. Like many small sized city areas (pop. 80 K – 130 K) it requires balancing investment to promote growth (e.g. Lincoln Eastern Bypass) and to mitigate environmental impact. LEB is funded and consented but benefits need to be locked in via:

- Traffic calming (air quality)
- Improved public realm (visitor attraction)
- Public transport (modal shift)

In addition, a Lincoln Southern Bypass is needed to complete an orbital route around Lincoln (see GLSIDP):

- Capital cost = £ 74 m
- Funding gap = £ 62 m
- Housing impact = + 2,200
- Net GVA impact = £ 36 m

- Jobs (net FTE) = c. 600

Central Lincolnshire is waiting for the Inspector's Report for its Local Plan, details of which can be found at: www.n-kesteven.gov.uk/central-lincolnshire/local-plan/

Agri-food production and processing is a major part of the economy, contributing £187m to the national economy every year, including up to 25% of the UK's vegetable production, 70% of its fish production and processing, and 10% of all English agriculture. Further details can be found in the LEP's Agri-food Sector Plan (2014) at: https://www.greaterlincolnshirelep.co.uk/documents/agri-food-sector-plan/

In both cases the bulk of these activities are necessarily located in the extensive coastal plain, which is maintained as productive land and protected from coastal inundation by an extensive system of water management and coastal defence infrastructure. The Shoreline Management Plans for the East Coast (Flamborough Head to Gibraltar Point) https://www.nelincs.gov.uk/planning-and-development/planning-policy/the-local-plan/the-new-local-plan/pre-submission-draft-local-plan/humber-estuary-coastal-authorities-group-flamborough-head-gibraltar-shoreline-management-plan-2010/ and for the Wash http://eacg.org.uk/smp4.asp detail these systems from a flood risk management perspectives, but include outlines cases for continued investment in coastal management on the basis of economic and social benefits. These were completed in 2010.

In Lincolnshire a more detailed study of the coastal areas with greater focus on economic and social aspects was undertaken in 2008-2010 for the purposes of spatial planning, and now forms part of the evidence base for LPA Local Plans. https://www.lincolnshire.gov.uk/residents/environment-and-planning/environment/lincolnshire-coastal-study/ (see esp. Task 1 – evidence base).

The Environment Agency and local partners are currently reviewing the long-term future of coastal management, which currently costs in the region of £10m per year, with a view to reaching a sustainable methodology which protects key economic, social and environmental assets in the coastal plain, while providing the longer term security required to maintain and grow investment and business opportunity in key sectors such as the visitor economy, agri-food and associated services.

The Humber Estuary Strategy is being developed concurrently to perform the same function for the ports, transport and industrial infrastructure in the north of Greater Lincolnshire.

Together, these initiatives form part of a broader strategic approach on the part of the Greater Lincolnshire LEP and the Lincolnshire Flood Risk Management Partnership (details provided below) where water management is considered as an element of effective resource management in the interests of securing and driving economic growth.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

Securing continued operation of east coast port facilities
Enabling movement of water to where it is needed on a strategic level to sustain and grow food production and processing (details of Water Resources East provided below)
Securing the UK land base for domestic food production and processing

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Infrastructure should be designed, planned and delivered in partnership with local people and their representatives, with reference to statutory adopted Local Plans and Infrastructure Delivery Plans (IDP) at district and LEP level. Master planning of large housing development (e.g. sustainable urban extensions) requires incorporation of low impact technologies such as SUDs and solar tiles in addition to communal facilities such as car-pooling. Connecting these communities with sustainable choices – for example around travel: car clubs/ public transport/walking and cycling opportunities can enable behaviour change. Central Lincolnshire is promoting 8 SUEs via its Local Plan.
Furthermore, it is critical that infrastructure should recognise the need and plan effectively for a low carbon future and a future that recognises climate risks and plans and designs accordingly. Government should seek to institute long term, settled policy framework recognising carbon budgets agreed under Climate Change Act.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Demand management should be underpinned by fiscal incentives/disincentives to promote behavioural change. The educational approach to achieving better outcomes is too uncertain and long term. Targeting activities which generate negative externalities (pollution, congestion etc) will require more robust policy intervention backed by available empirical evidence e.g. Local Transport Plans.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Opportunities around collaboration between business and academia in developing and driving new technologies.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

In terms of flood risk and water management infrastructure, current funding rules tend to operate on a project by project basis, with benefits calculated strictly in relation to the individual project in question. This makes it difficult to consider one piece of infrastructure in the context of the broader system of which it is a part, and

militates against truly strategic solutions providing benefit beyond the immediate area and making a difference to the national economy.

In addition, at present, national flood risk funding is very limited in the extent to which it can be used to protect economic assets, and cannot be used to protect future benefits realised by unlocking potential for growth. While this can, to an extent, be offset by accessing alternative sources of funding, these often still come from the public sector and are subject to considerable limitations. Securing sustainable funding from non-governmental sources that is geared to releasing growth potential remains highly challenging.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

Inefficient delivery of infrastructure is a systemic failure as well as a symptom of "fiscal consolidation". Most infrastructure is needed at the local level and should be funded and delivered locally. This will require structural change allowing:

- LEP areas to prioritise needs and delivery through statutory IDPs, aligned with adopted Local Plans
- Local authorities to raise finance using prudential borrowing, bonds or pension funds as appropriate
- More local involvement in the agreement of private utility capital investment programmes

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

For most cost effective (in the broadest sense) investment an eco-systems services approach needs to be a principle adopted and integrated. In doing so we will have infrastructure that contributes to a wide range of policy objectives.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

CBA is not a panacea for guiding resource allocation. The value of a cost–benefit analysis depends on the accuracy of the individual cost and benefit estimates. Comparative studies indicate that such estimates are often flawed. Causes of these inaccuracies include:

- Overreliance on data from past projects (often differing markedly in function or size and the skill levels of the team members)
- Use of subjective impressions in assessment
- Inappropriate use of case studies to derive money cost of the intangible elements
- Confirmation bias among project supporters (looking for reasons to proceed).

For some environmental effects cost-benefit analysis can be substituted with cost-effectiveness analysis. This is especially true when there is only one type of physical outcome that is sought, such as the reduction of energy use by increasing energy efficiency. Using cost-effectiveness analysis is less laborious and time-consuming as it does not involve the monetization of outcomes, which can be difficult in some cases.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Transport is set to see substantial change over the coming decades driven by new and innovative emerging technologies. Already the growth of the home delivery market has seen increases in the number of 'white vans' on the roads and the emergence of Uber and its associated ride-hailing app is challenging the traditional taxi industry. As for vehicle development, the number of electric vehicles being sold continues to rise (albeit still a very low proportion of the overall fleet) and already there are self-parking cars and autonomous emergency braking systems. On the freight side, there are trials of automated HGV 'platoons' and deliveries by drone. The transition towards CAVs (Connect and Autonomous Vehicles) continues to grow in importance as evidenced by the interest and involvement of private companies such as Google, Tesla and the majority of the major car manufacturers who are all investing heavily in developing this technology.

The speed at which this change to travel behaviour becomes mainstream will also be as much about society's readiness to accept such change as it is about technological advancement. For the last hundred years or more, car ownership has been seen as a status symbol, bringing with it personal and flexible mobility. It has almost come to be seen as a necessity of modern life, particularly for those living outside of the larger cities where public transport is not a viable option. Moving society away from this view will be a considerable challenge. Whilst CAVs may bring many advantages such as reduced accident numbers, improvements to air quality and health benefits, there will be a natural reluctance to anything which involves a loss of personal freedom. It also represents a threat to those who drive for a living in the logistics and bus/taxi industries. However, there may be signs that this is changing particularly among the younger generation who are growing up in a more technologically advanced world and who are perhaps more open to new mobility solutions.

Consequently, all of the above makes trying to forecast future changes in travel patterns (and the pace at which they will happen) a considerable challenge. New types of demand will emerge whilst old types of traditional demand may lessen or disappear.

In a policy neutral world, one can reasonably expect the following to occur up until 2050:

- Increased commuting journeys (number and distance) as unaffordable housing forces relocation of staff further away from place of work (cf East Coast Main Line effect and concept of "Greater South East")
- HS2 if implemented will encourage long distance commuting
- Reduced bus patronage in rural areas
- Increased car useage (requires predict and provide road policy)
- Levelling off of rail patronage as price and congestion ration availability and attractiveness
- Increased use of internet shopping will result in more delivery traffic (driverless or manned)

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

16. What opportunities does ‘mobility as a service’ create for road user charging? How would this affect road usage?

The emergence of 'Mobility as a Service' (MaaS) as a way in which the movement of people and goods is managed through the greater use of technology linked to the provision of transport related services is fundamental to any future forecasts. However, this is very much an emerging area and the subject of much research and investigation by a range of bodies and academics. One of the findings of the Transport Systems Catapult report 'Exploring the Opportunity for Mobility as a Service in UK' (July 2016) was:

- *The impact of MaaS is unknown. MaaS could result in more journeys and distances travelled by car or potentially less; it could support national and local transport policy or challenge it but further research is needed.*

On the more positive side, MaaS also has the potential to provide transport authorities/organisations with substantial data with which to manage transport systems and plan future enhancements. The uncertainty around the future demand for movement is again highlighted by the establishment by Research Councils UK of the 'Commission for Travel Demand'. The Commission is comprised of a mixture of academics and practitioners. Over the coming year, it will explore the changing demand for travel and look at how this demand can be shaped in the future in a way consistent with environmental obligations.

If predicting the demand for travel is unclear at national level, it becomes even more uncertain in a rural area such as Lincolnshire. The predominantly sparsely distributed population, coupled with limit public transport alternatives, leads to a heavy reliance on the private car for travel. Quite how ready the population of Lincolnshire are to move towards a MaaS type approach (i.e. no longer own their

own vehicle) is difficult to assess. In a similar way, industries such as the economically important agri-food industry in the south of the county will remain reliant on the movement by road of large volumes of raw materials and finished products.

Hence, there will still remain a need for transport infrastructure investment across Lincolnshire to remove longer distance cars (whether private or autonomous) and HGVs (whether single or platooned) from strategic routes passing through the towns and villages across the county. This will offer an improved environment locally and opportunities for place-making enhancements to support health and social aspirations, whilst enabling growth.

In addition, going forward rail will continue to have an important role to play. The rail network in Lincolnshire is in need of improvement to enable enhanced services to be provided. Initiatives such as line speed improvements, electrification (with its accompanying carbon reduction benefits) and the roll out of the 'Digital Railway', together with schemes to address specific problem locations such as the flat crossing of the East Coast Main Line outside Newark by the Nottingham-Lincoln line, will all contribute to providing the necessary capacity as the demand for rail travel continues to grow.

Digital communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

See response below

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Available and reliable superfast broadband is critical in a modern economy.

Our experience is that there are three interconnected but distinct concerns that would benefit from further analysis by the NIC.

1. Provision of superfast broadband across the country. Our experience as one of the first rural counties to complete the roll-out of our BDUK superfast broadband programme is that there is a need to improve the relationship between installing the broadband network and improving communities' ability to connect up to the network. We have witnessed communities with a lack of knowledge about the availability of superfast broadband, and more worringly we have witnessed businesses signing up to superfast broadband but experiencing a significant delay in the period between signing up for a broadband service and it being activated. Is there a role for the regulator in this?

2. Tackling "the final 5%". As superfast broadband becomes an increasing part of modern business transactions, the need for universal superfast broadband services becomes more acute. However, our human tendencies are such that if there is a small number of businesses or communities that are not connected, then we believe that most people cannot access the service ! A concerted push from service providers and the media is required in addition to innovative solutions to infrastructure problems. Whilst it is less of an apparent concern for the NIC, the use of public perception as a tool for promoting (rather than hindering) growth may merit exploration. The government's behavioural Insight Team may be able to offer some useful advice.

3. Finally, terms like "superfast" broadband are often used generically. However, work that we have done with four digital business clusters in Lincolnshire show that there is a difference between (i) superfast broadband for domestic use/use with non-digital businesses, and (ii) superfast broadband for the benefit of digital businesses. The capability of superfast broadband for digital businesses will be substantially higher than that for domestic customers, and without an understanding of the need for a higher grade of superfast broadband for digital businesses then policy makers run the risk of focusing digital businesses within highly urbanised areas, thus reducing the opportunity for the vitality of market towns and villages and the industrial linkage that accompanies the relationship between rural digital businesses and broader rural business.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

As the current BEIS/Ofgem call for evidence on 'A smart, flexible energy system' recognises we are at a critical stage in designing and planning generation, distribution and consumption of energy. That consultation asks all the right questions. An effective 2050 zero carbon power sector will have a settled, long term policy framework that enables distributed generation; utilises the opportunities from energy storage at all scales (from domestic to grid); enables a competitive, innovative market place.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Water and wastewater (drainage and sewerage):

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

Provision of strategic infrastructure to achieve storage and management of water in times of excess, with release in times of scarcity. This requires further development of existing multi-stakeholder approaches to ensure multiple benefits to flood risk management, water resource management and environmental enhancement, leading to efficiencies across sectors.

The East of England is the driest part of the UK and the fastest growing. Agriculture, technology, manufacturing, the environment and tourism are all key elements of the regional economy. Future success depends on providing enough water for people and business while simultaneously protecting the environment. Water resource systems in the region are under pressure from climate change, pollution and growth. Action to restore abstraction to more sustainable levels is further reducing supplies while severe or extreme drought threatens to exacerbate the effect of any shortage. In South Lincolnshire, the South Lincolnshire Water Partnership (SLWP) and the Water Resources East (WRE) project are working together to find affordable, reliable and sustainable solutions for meeting these challenges. This means:

a. Securing resources for agriculture and the food processing industries, fenland habitat restoration, public water supply and for improved navigation across fenland waterways, and
b. Enhancing levels of flood protection, both within the South Lincolnshire Fens and in the adjacent upland areas

See:

http://waterresourceseast.com/

A vision to see water as a resource and deliver economic benefits across sectors whilst addressing these issues has been taken on by the GLLEP's Water Management Plan (2016). This focuses on opportunities for managing water that directly support economic growth, and seeks to drive links with organisations responsible for water supply and management. A fundamental principle of the LEP's approach is to integrate activities in flood risk management and water resource management. By placing this in a coherent plan, it is intended that this will incentivise investment in the LEP's priority sectors. This will enable effective water management to be a positive contributor to economic growth.

https://www.greaterlincolnshirelep.co.uk/documents/water-management-plan/

Consideration should be given to minerals planning, particularly restoration which can form part of broader water supply and storage requirements whiclst potentially delivering multiple benefits to the local economy through the agri-food sector, nature conservation, flood risk management and tourism.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

There remains a need for a clear, properly resourced responsibility for drainage systems (eg SuDS) in the long term. With regard to sewerage capacity, it is essential that engagement with the water industry is integrated into the local

planning process as a key consideration in planning for supply and demand, and in design. Account should also be taken of recent legislative changes in relation to SuDS, as well as forthcoming industry changes concerning water supply.

In governance terms, effective engagement can be promoted as a normal way of working through effective partnership arrangements, or, for specific programmes of work, by establishing local and / or regional stakeholder groups to encourage cross boundary working on wider issues, making investment savings and efficiencies such as that being championed by WRE above.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

Water resource management, flood risk management and environmental management must be seen as integral parts of a single water management regime informing local and national planning policy, and closely linked into present and future plans for growth.

Since 2010 Lincolnshire has developed a strong partnership approach to flood risk management, set out in a joint Flood Risk and Drainage Management Strategy with a common works programme that brings together the operational and strategic forward plans of all risk management authorities within the area. This is expressed in a joint Flood Risk and Drainage Management Strategy (2012) which can be accessed below:

https://www.lincolnshire.gov.uk/residents/environment-and-planning/flood-risk-management/implementing-a-strategy-to-manage-flood-risk-countywide-and-locally/103045.article

Continuously enhanced, this joint strategy has been widened in scope since 2012, leading to the Water Management Plan developed jointly with the Greater Lincolnshire LEP (described above). In turn, this has opened up opportunities to engage across boundaries with multi-agency strategic initiatives, such as Water Resources East, of which the Black Sluice Catchment pilot is an integral part. The purpose of this pilot is to explore in detail the potential opportunities of whole-catchment water management across large areas, and directly delivers a number of the core objectives of Greater Lincolnshire's Strategic Economic Plan

It has been identified there is still a need to address water management systems which currently attract little funding through existing asset funding regimes. One opportunity to explore is through the potential offered by a whole-catchment approach in the area, linking asset management, flood risk, water and environmental management principles.

A framework of assessment is to be established for risk management authorities and other local delivery partners to use in order to deliver a partnership approach to water management on a catchment scale, and how to apply this in practice. The work focuses on all issues relevant to the movement and management of water in a defined catchment or area. This work offers a unique opportunity to assess the most

appropriate authority to lead on asset management, delivering efficiencies and enhancing opportunities for reinvestment locally. It will provide a foundation for all organisations which have an interest in the catchment. This can range from RMAs to volunteer groups and the general public to understand and agree how a catchment is too be managed, by:

- Developing an approach to understand and align flood risk and water level management within a system to achieve multiple benefits.
- Take a local level review of all benefits and costs of asset systems.
- Look at partnership management options for unfunded or part-funded systems, including asset transfer, Internal Drainage Board (IDB) boundary changes and the impact of limited resources, promoting efficiencies and ensuring options are fit for purpose.
- Draw this together in an operations-focused document to assess the best management options for a system that is aligned with strategic plans already in place.

Flood risk management:

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

A broad scale approach needs to be taken to deliver maximum resilience delivering the best possible social, economic and environmental benefits, in particular to facilitate growth opportunities where these are currently held back, and where appropriate, informed mitigation and preparation for risk management can also be taken. We would draw attention particularly to comments made above on coastal management, which in Lincolnshire forms a significant component of overall flood risk. This is a consequence of 40% of the county's land area lying at or below sea level, corresponding with those areas that are most productive for the agri-food industry and offer much of the potential for the visitor economy.

To maximise national funding opportunities and seek local funding options there is a clear need to ensure consideration of water supply and flood risk is fully integrated into the planning process and where possible seek multi stakeholder involvement to deliver broad benefits rather than individual approach to issues.

Full account should be taken of the change in roles and statutory responsibilities for flood risk management in England and Wales are set out in the Flood and Water Management Act 2010 and Flood Risk Regulations 2009 for LLFAs and the Environment Agency in its strategic overview of all sources of flooding in England. and is the lead Risk Management Authority for flooding from main rivers and sea. In doing so it is important to establish the relative risk to communities of flooding from 'all sources' in combination to enable proactive decision making something that is being piloted in Lincolnshire with the Communities @ Risk Project.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

This can mean less hard engineering (though in many cases extensive re-engineering necessary to achieve a more 'natural' aspect to the water system; natural flood management, properly implemented, means significantly less maintenance work required and can deliver broad scale risk reduction over a wide geographical area.

Natural Flood Risk Management has its merits in the right areas and 'slowing the flow' initiatives are proving effective. To be really innovative and forward thinking natural flood risk management schemes should not necessarily be looked at in isolation and all opportunities should be explored to establish multiple benefits for a variety of stakeholders and support economic objectives of an area. As detailed above the WRE initiative can be used as a good exemplar, as can re-naturalisation schemes applied to certain upland chalk stream habitats in the Lincolnshire Wolds.

http://www.lincswolds.org.uk/chalk-streams/the-lincolnshire-chalk-streams-project

It is important to prevent new housing developments from connecting to old and already over-capacity sewer systems. It is a call that has been made repeatedly since it was formally recommended in the 2007 Pitt Review. The Flood and Water Management Act, which followed the review, contained a requirement for SuDS to be prioritised but this not been implemented nationally due to tensions with growth / housing need.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

There is a need for clear policy signals recognising that circular economy is the desired direction of travel. That should be linked to strong regulatory framework with appropriate targets and enforced product design standards that ensure products can be disassembled and re-used.

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Greater Manchester Local Enterprise Partnership

GMCA GREATER MANCHESTER COMBINED AUTHORITY

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Lord Adonis – Chairman
National Infrastructure Commission
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Dear Andrew

NATIONAL INFRASTRUCTURE COMMISSION CALL FOR EVIDENCE

[Job title redacted]

We are writing in our roles as the [redacted] of the Greater Manchester Local Enterprise Partnership (LEP) and the Greater Manchester Combined Authority (GMCA).

We welcome the establishment of the National Infrastructure Commission (NIC) which comes at a pivotal time in Greater Manchester's history. We have recently consulted on the first draft of the Greater Manchester Spatial Framework (GMSF) a plan for new homes, jobs and infrastructure looking ahead 20 years and are preparing for the transfer of new powers from central government to the Mayor of Greater Manchester on the 4th May.

The Greater Manchester Infrastructure Advisory Group (IAG) was established by the LEP in June 2014. The group includes representatives from United Utilities, BT, Electricity North West, National Grid UK Gas Distribution, Environment Agency, Highways England and Transport for Greater Manchester and the Homes and Community Agency. Since the groups inception we have collaborated on a number of projects, most notably the creation of a shared geographical mapping system to support joint working and understanding of infrastructure issues. This can be viewed at: http://mappinggm.org.uk/

Our response to this consultation is guided by the discussions that have taken place with the IAG and recent engagement with stakeholders and communities undertaken during the Greater Manchester Spatial Framework consultation.

Strategic context: our ambition and the importance of infrastructure

Our ambition is for Greater Manchester to become a financially self-sustaining city, sitting at the heart of the Northern Powerhouse with the size, the assets, the skilled population and political and economic influence to rival any global city. A place where no one is held back and no one is left behind: all will be able to contribute to and benefit fully from the continued success of Greater Manchester.

We have been working hard to turn that vision into a reality. Our priorities around growth and reform are widely recognised to be distinctive, evidenced and wholly appropriate for the long term success of the area. Sitting at the heart of the Northern Powerhouse Greater Manchester has unrivalled potential to become a national engine of growth for the North and the UK as a whole.

There are three "golden threads" that run through every aspect of the GM strategic approach: Assets, People and Place.

Our Assets

We are driving growth and productivity through a particular emphasis on high value sectors, building upon assets that are or have potential to be world-leading and globally distinctive. We are focusing on key sector strengths and specialisms, identifying global market opportunities that enable us to leverage those sectors and assets, and targeting investment on the strategic interventions required to elevate our performance, global status and profile. Modern connections such as transport and broadband are of fundamental importance to driving agglomerations and widening catchment areas so that companies have access to the supply chains and the human capital that they need to expand, [redacted] and compete on a global stage.

At a pan-regional level, the Northern Transport Strategy promotes a coherent and integrated approach to transport planning across all modes – including rail, roads and freight - to bring together the great towns and cities of the North, and the talent and potential of over 15 million people with an economic output of £300bn, to create a powerful unified economy able to compete with the world's strongest regions. In particular, the delivery of high-speed rail infrastructure both between the North and London and across the North is of fundamental importance to delivering growth objectives. The progress made with Rail North, to ensure greater local control over rail franchising, has ensured that franchise specifications properly reflect priorities for the North and will support the growth ambitions of the northern authorities.

And at city region level Greater Manchester has long understood the importance of investing in transport infrastructure and services to support long-term sustainable economic growth and access to opportunity for all. Good local transport connections are the foundation of an efficient transport network, with links to public transport stations and stops playing an essential part of longer trips.

But our approach goes beyond transport: continued growth requires an integrated, whole-system approach to infrastructure. Our existing network of digital, energy,

greenspaces, transport and water management system are a vital part of a prosperous and forward looking local economy: we must upgrade and renew this network to underpin growth and make our neighbourhoods even more desirable places in which to live. Significant increases in the capacity of all forms of infrastructure will be required if we are to capture and maximise our existing economic assets and the local benefits that strategic investment, such as in HS2, East-West connectivity and Manchester Airport will bring and move the entire northern economy forward in the future.

Our assets must also be resilient. The GMCA is a member of the United Nations Making Cities Resilient campaign and Greater Manchester has been recognised as a "role model for total resilience". The provision and management of resilient infrastructure will ensure that we can compete in the global economy, contribute to reducing climate change emissions and be resilient to future local and global extreme events. Strategic infrastructure investment should be co-ordinated and a risk-informed decision making process is key in avoiding the creation of new risks and minimising the aggregation of risks.

Our People

We are removing the barriers that prevent people from playing a full part in the economic success of the nation, so that no-one is left behind, reforming the way that public services are delivered and tailoring them to the needs of individual places. Skills services, work programmes, health and social care provision, criminal justice services and education are being redesigned and integrated at place level, ensuring that they deliver better outcomes for our residents in line with locally determined priorities. Infrastructure is a critical enabler of such reform.

We are working to improve transport connections to provide people with better access to the opportunities that growth will bring, and to health care and other essential services. Re-regulation of buses provides an unprecedented opportunity to control and plan the provision of bus services, including fares, routes, frequency and ticketing. It is an important component of our approach to growth and reform, essential to driving social mobility by ensuring that bus services connect people to jobs as well as to get to the education, training and other support many of our residents will need to access the jobs created.

Digital connectivity is a critical utility and access to digital services is a key element of our reform agenda and we welcome the significant shift in Government policy towards fibre investment signalled in the Autumn Statement. The UK is well behind its international competitors in the delivery of full fibre infrastructure to the premises. Portugal and Spain has 60% coverage compare to 2% in the UK. This is already impacting on our reputation as digital leaders and in the medium to long term will impact on international inward investment decision making unless it is addressed.

Poor digital connectivity and slow broadband speed are not limited to rural areas, even within Manchester city centre and inside the M60 boundary there are locations where superfast broad band is available to less than 33% of premises. In line with

the Government policy objective stated in the last Autumn Statement, in Greater Manchester we aim to find the quickest route to achieve a full fibre infrastructure working with the grain of the market.

In this context we welcome the opportunities to accelerate investment through the Government's Digital Infrastructure Investment Fund, whilst recognising though the £400m funding allocation for the whole of the UK is relatively small compared with the size of the task and will therefore have to be targeted at Cities to deliver the best return on investment. Further investment will be needed in fibre moving forward in order for Greater Manchester to remain competitive with peer cities in Europe. The public sector has an important role in facilitating this through aggregation of demand.

Our Places

We are creating the essential conditions so that places become an attractive environment in which to live, work and invest. We are investing in our infrastructure and assets, both new and existing, to create the conditions for growth and places where businesses are encouraged to set up and trade. We are accelerating the pace of housing development, and improving the quality and choice of our housing offer to establish functional housing markets that can both meet the housing demands of existing and prospective residents and enable reductions in dependency of expensive, reactive public services. We are growing the amenities at the heart of our city region to enable us to compete with the best international cities in terms of the quality of life we can offer.

We need to manage growth so that it delivers prosperity and ensures that Greater Manchester is a better place to live, work and visit. It is our aspiration that Greater Manchester becomes as well known for the quality of its environment as for its economic success. Underpinning the GM strategic approach is the informed, integrated way we are approaching strategic planning across the city region. The Greater Manchester Spatial Framework (GMSF) will enable us to manage our land supply in the most effective way to achieve our vision and is based on a clear understanding of the role of places and the connections between them.

We are planning for GVA growth of 2.5% year on year, giving an uplift of £5bn above baseline conditions by 2035 an additional 199,700 jobs and population growth of 294,800, which translates into 227,200 net new homes. The GMSF is being prepared to make sure that investment and growth in houses and jobs happens but also benefits our residents and makes Greater Manchester a better place to live and work. We need to be able to plan for schools, green spaces, roads and health facilities alongside new homes, offices and factories. If we don't do this, it won't happen.

Whilst there will continue to be a strong and continuing emphasis on directing new housing and employment development to brownfield land in urban locations, the GMSF clearly demonstrates that, given the level of growth that Greater Manchester will need to accommodate, a number of new housing and employment sites will need to be identified, including some proposed release of land from the Green Belt. Some

of these sites can and will only be released when the critical infrastructure required, including transport infrastructure, has been put in place.

The main issue raised by residents during the GMSF consultation was the capacity of existing infrastructure to cope with any more growth not only transport but schools, heath, drains, flood defences and access to greenspace. There is a very real problem caused by our inability to plan effectively in advance of development. This acts as a drag anchor on growth and our ability to bring forward the homes we need. The current "first developer pays" approach is a fundamental block on the delivery of new housing, particularly in areas of low or marginal value. This issue, essentially a consequence of how the regulated monopolies work is an example of a regulatory principle getting in the way of the delivery of a key Government priority.

The GMCA has already made clear its intention to capture a proportion of increased land values that will result from the release of land for development, and to direct these funds towards the infrastructure associated with the delivery of our growth strategy. But first we need to invest to and then recover that initial investment. The Mayoral / Combined Authority model is part or an evolved devolution deal and through this we have the ability to work with Infrastructure providers to shape investment.

The natural environment and healthy ecosystems are the foundations upon which we all live and future prosperity depends. Regenerating and managing the natural environment has created jobs and made Greater Manchester a better place to invest and live in. The floods on Boxing day 2015 demonstrate interconnectivity between people, infrastructure and catchments across Greater Manchester. The state has a role in setting positive direction and enabling catchment management. The management of existing infrastructure can also be examined and new approaches explored which contribute to protecting and enhancing the natural environment. We are working with Defra through the pioneer initiative to ensure that the Governments 25 year plan for the environment delivers measurable outcomes for urban areas and people.

The National Infrastructure Plan (2016-21) produced annually sets an aim "to *bring together the government's plans for economic infrastructure over the next 5 years with those to support delivery of housing and social infrastructure*". We believe this is the right aim but the plan as currently constructed lacks the spatiality required to support devolution, flexibility to respond to different drivers of growth in different localities across the UK. The granularity is limited to a long list of broad objectives and projects with the finest spatial granularity picked up in the chapter on English regions. This is a missed opportunity to support devolved powers in England.

Our detailed response to the consultation questions is outlined in Appendix A (see the attached). We believe that the issues raised can be addressed through the following eight recommendations:

1. The infrastructure assessment scenario and National Infrastructure Plan should reflect the Government's Northern Powerhouse Strategy and existing

Government commitments to that Strategy, which will both drive a requirement for additional infrastructure provision and be driven by that additional infrastructure provision.

2. The Mayoral / Combined Authority model is part or an evolved devolution deal and through this we have the ability to work with Infrastructure providers to shape investment and ensure that robust resilience plans are in place and endorsed by the infrastructure providers.

3. Regulated utilities should be subject to a statutory duty to co-operate to ensure that infrastructure providers and the regulators e.g. Ofcom, Ofwat and Ofgem are required to actively engaged with the Greater Manchester Mayor and Combined Authority to ensure that future investment plans are consistent with the future development strategy for larger than local geographical l areas.

4. To actively promote collaboration and synchronisation of investments plans between the Mayor/GMCA and the main infrastructure providers: Highways England, United Utilities, the Environment Agency, National Grid, United Utilities and BT Open Reach;

5. Establish a new long-term funding mechanism for infrastructure to ensure timely delivery and capture of developer contributions;

6. Encouraging early dialogue between developers and infrastructure providers to identify the infrastructure needs arising from new development and ensuring that these are addressed through appropriate planning, investment, building design, utility networks and connections in time to serve the proposed development and

7. Ensure that national planning policy and legislation supports the phasing and infrastructure 'pooling' for sites in multiple ownership and / or where build out will be delivered by different developers.

8. http://mappinggm.org.uk/about.htm is a powerful collaborative tool that supports joint working and the integration of development planning with infrastructure investment. However, further work is needed to develop this further better integrate data on capacity and future demand.

We look forward to working with you and actively engaging with the commission in the future.

Yours sincerely

[redacted] [signature redacted]

[redacted] [name redacted]

[redacted] [job title redacted]

[redacted] [signature redacted]

[redacted] [name redacted]

[redacted] [job title redacted]

APPENDIX A

[redacted]

Population and Infrastructure

Question 3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between in[redacted] and housing be incorporated into this?

The background paper produced by the commission titled *"the Impact of Population Change and demography on Future Infrastructure Dema[redacted]* highlighted a number of issues, which we recognise:

(1) Historic errors in population forecasting have bee[redacted] 'shocks'
(2) Total population trends since 1851 revert to trend overtime
(3) Peoples demand for Infrastructure is not uniform or fixed, so overall population growth is not the only factor that needs to be taken into [redacted]
(4) Infrastructure is inherently spatial

The Greater Manchester population is now at the same levels as the late 1960s before population decline corresponded with jobs losses. This is positive, a city that is not growing is declining. However, whilst the overall population may be similar, how people travel to jobs or leisure is very different with growth in commuting, public transport and use of electricity. The population is also ageing with more single person households and unprecedented pressures on social care.

Looking ahead, our population growth forecasts take into account the latest population projections (released 27th May 2016) and the sub national household projections (released 13 July 2016). We also modelled various scenarios using different rates (general population creating new households and in doing so requiring new homes) including the impact of the recommendations last spring made to the Government by an expert panel set up to advise them on planning and housing delivery.

The commissions evidence paper acknowledges that *"the direction of causation between population and infrastructure demand is not necessarily one-way"* but identifies the interaction between infrastructure and housing as most significant. *"Ultimately, people can only live where there is housing. Housing, in turn, requires infrastructure."* We have recent experience of the issues that this raises as the vast majority of objections raised by residents during the 11 week GMSF consultation period relate to the condition of existing infrastructure: school places, transport, flooding, health facilities.

It's essential that population projections are robust and credible. It is concerning that the proposed methodology does not include a variant for continued high migration. ONS MYE in 2012 and 2013 significantly underestimated population growth in Manchester as a result of assumptions that forecast a reduction in international immigrants and an increase in internal emigrants. These assumptions ran counter to the high levels of international migration recorded through school registrations and

National Insurance registrations in Manchester but were carried forward by ONS into the methodology used for 2012 and 2014 sub-national population projections. As a result, current ONS projections forecast a loss of 1,000 people each year due to fewer people arriving in the city from abroad and more people leaving to live elsewhere in the UK. In contrast, MCC's own forecasting model, which uses administrative data (such as geo-demographic profiling and data on students, child benefit, state pensions and the electorate, along with NHS, pre-school and National Insurance data) to quality assure and adjust ONS figures from 2001 and 2014 and sets net migration at an average growth rate of 6,000 per annum.

Whilst it is recognised that there will always be some discrepancy between local forecasting models and national projections they do demonstrate that the NIC should consider including a "high migration population variant" within the modelling.

The inclusion of a variant to reflect lower growth in London and higher growth elsewhere in the country is welcome, this is essentially a 'policy off' position. If the Government is serious about rebalancing the economy then this needs to be reflected within the National Infrastructure Plan supported by a corresponding level of investment. Government intervention and support can help places grow sustainably and a bold plan for inclusive growth needs a bold plan for infrastructure investment.

Infrastructure Planning, Funding and Investment

Question 7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

Question 8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

It is notoriously difficult for the planning system to capture land value uplift to support increased demand as a result of new development with existing mechanisms such as S106 agreements and the Community Infrastructure Levy (CIL) designed on the whole as post development payments / or at least payments that are staged to co-inside with development. This may be fine for site specific infrastructure spending such as a new highway junction but has limitations where significant new investment is required or as an approach to convince local residents that the existing infrastructure issues will be resolved.

As an example, of the ten Greater Manchester authorities, only one has an adopted CIL charging schedule in place, and six authorities have no proposals to progress CIL at the present time. The primary reason is viability. Development viability across

large areas of Greater Manchester is marginal, and even where development is viable there is typically a limited surplus above developer profit. The need to allow a sufficient viability buffer in rate setting compounds this issue in areas where viability is marginal, and implies a low or nil rate across large parts of the sub-region. This will necessarily limit the scale of investment that CIL can generate and means that CIL cannot of itself be an effective mechanism to fund Greater Manchester's strategic infrastructure requirements.

The National Planning Policy Framework (NPPF) defines viability as where a development, when taking account of the normal cost of development and mitigation, provides "*competitive returns to a willing land owner and willing developer*" (paragraph 173). This definition of viability therefore necessarily requires an assumption to be made regarding what constitutes a competitive return. In current market conditions, a profit level of between 17.5 – 20% of gross development value is typically interpreted as a competitive developer return. This is borne out in evidence submitted by developers, in strategic assessments of viability commissioned by local authorities, and in the recommendations of Planning Inspectors and decisions of the Secretary of State. It must however be recognised that there can be considerable variation in what constitutes a competitive return, across spatial areas, and across developers.

Greater Manchester recognises the importance of infrastructure and the GMLEP established the GMIAG about 18 months ago following a preliminary study into the challenge of delivering the necessary infrastructure to support the GMSF. The identification, planning, design, delivery and operation of critical city infrastructure is challenging for a number of reasons. Infrastructure is owned and operated by numerous private sector companies, many of whom are required to satisfy the needs of their shareholders and the financial markets. These companies are regulated by a number of organisations such as Ofgen and Ofwat. These utility companies plan their future capital and maintenance work over different time horizons. These infrastructure investment plans need to be approved by their regulators. Our cities and towns do not have governance over the infrastructure that is critical to their success and survival.

Whilst the utilities do collaborate with GMCA when formulating their investment plans, this is not a particularly rigorous process and varies depending on the particular utility and its regulatory environment. The good news is that relationships between Greater Manchester and its utilities are strong, which is evidenced by everyone's willingness to support the GMIAG.

The ideal situation is that infrastructure is provided either in time for or ahead of development need. However, this is complicated by the regulators who, in their capacity of making sure that Infrastructure Providers give their customers a value for money service, do not encourage Infrastructure Providers to "invest ahead of needs".

Utility companies do invest in infrastructure with a primary focus on maintaining existing assets rather than responding to new development. Another complicating factor is that the electricity distribution, water and wastewater markets are all run by private companies who have a monopoly for a specific area. The prices they can

charge for their services are regulated as a condition of their licence (by Ofgem for electricity and Ofwat for water working on 5 year investment cycles.

Sometimes connections cannot be completed until the network is enhanced (or reinforced) to ensure a secure supply is maintained for everyone. Where investment in the network is needed, the connecting customer pays for any assets which they alone will use and a share of any reinforcement they've triggered. The remaining reinforcement costs are recovered from all other customers through the billing system.

Telecommunications are slightly different. There are no real regulatory frameworks or rules which limit the ability to forward invest in infrastructure. It's essentially for commercial reasons that a telecommunications company don't choose to do this. Instead they respond to confirmed need (outline planning permission). Unlike other utility infrastructure providers (Gas, Water, Electricity) where the distribution network is owned and built by a single operator in a geography (and subject to capital investment cycles), Telecoms is competitive. It is the developer's choice on which telecommunications provider to use and a provider should always be able to build telecoms infrastructure in the time between planning permission being granted and houses being ready for occupation.

The main issues identified through the Greater Manchester Infrastructure Advisory Group can be summarised as:

- There is a cost to connecting to existing electricity, gas of drainage / water networks. On some occasions connections cannot be completed until the network is enhanced. Where investment in the network is needed, the first customer connecting will need to pay some of the cost, with the rest being shared between all other users of the network.

- Connection customers should pay a fair price for the cost of the work required to connect them and there are a number of rules in place that ensure this is the case. However, it's equally important that bills are kept as low as possible for all. The cost of running the network, including building new infrastructure to meet increasing demand for electricity, is spread across all customers of the network. This type of investment could make it easier to connect in certain areas.

- Utilities operate on a 'first developer pays' principle. This is because under the terms of their licenses they are not allowed to speculatively invest in infrastructure which is not already within their 5-year or 8-year investment plan, and they therefore have to recover the full cost of all of the new or improved infrastructure created. This can lead to circumstances where a developer on a major development who only has an interest in part of the site may be asked to pay for the full costs of delivering the infrastructure that will service the entire site, despite only having an interest in part of it.

- The prices are reviewed through a price review process. This involves the relevant regulator assessing the companies' business plans etc and then

setting a price that will allow them to earn enough revenue to cover their costs. It does not set their profit levels, so that they have an incentive to minimise costs (and hence maximise profits).

- Part of the companies' role is ensuring adequate infrastructure is in place. The price the regulators will allow them to charge factors in infrastructure investment. However, the companies' overriding duty is to look after (existing) consumers' interests, and so the regulators work to ensure that they invest efficiently and appropriately.

- We understand that in general, Ofgem takes a much less prescriptive approach than Ofwat when conducting its price reviews.

- Basic infrastructure can take a long time to procure and deliver e.g. a primary substation can take two years. Therefore, investor and developer interested in developing a site, usually in response to market needs, could be faced with unreasonable/unrealistic programmes to bring a housing or commercial development to the market. Theoretically, a DNO is allowed to "invest ahead of need" where it is efficient to do so, but in reality this is not a common practice. One of the main reasons for this is that any such investment will be assessed for efficiency after the fact. Ofgem have yet to consult upon, develop or determine the rules for assessing efficiency. Therefore, one of the challenges for investing ahead of need is the risk of stranded assets i.e. the investment has taken place but the planned development doesn't take place or is delayed.

- The question is essentially on of risk and certainty, who underwrites the risk that the demand/ development will happen and how is any forward investment is paid for and paid back.

- Different utilities operate on different investment timetables often using different growth projection and rules. Often it is at the planning application stage that investments are triggered. Communities facing new development in areas with existing infrastructure issues are demanding certainty that the development will not make the situation worse.

- There are no requirements for the statutory utilities to link their infrastructure investment with our economic growth plans, leading to the associated economic and social consequences. To echo the response from the core cities group of local authorities, *"because the UK has system regulators; Ofgem, Ofcom, Ofwat, Environment Agency, Natural Resources Wales, central and local government, this makes the coordination difficult. Core Cities have long advocated that we can take the local lead, responding to the local circumstances of each of our cities and its region. However, currently we have no mechanism to enable this to happen; if we did have a mechanism, we suggest that we would enable the provision of more interconnected diverse future proofed infrastructure investment quicker."*

- We cannot afford to be taking critical city infrastructure for granted, we need to prepare well thought out and co-ordinated investment and delivery plans which support growth and a smart city approach to provide the resilience needed to support future growth and development.

Resilience

Question 9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Resilience looks at two factors: the acute shocks such as floods, disease outbreaks or malicious attacks that threaten to take the city off track and away from its projected course of wellbeing and growth; together with chronic stresses that weaken the fabric of a city on a day to day or cyclical basis such as high unemployment or ageing infrastructure. A number of risks identified on the Greater Manchester community risk register include a spatial dimension most notably: flooding, severe weather, transport, environmental pollution, and industrial hazards. Our ambition is for Greater Manchester to be highly resilient and adaptable and able to meet its ambitions whilst ensuring it is safe and secure and is addressing key vulnerabilities.

The GMCA is a member of the United Nations Making Cities Resilient campaign and Greater Manchester has been recognised as a "role model for total resilience". Greater Manchester is also one of 100 cities in the world to be part of the Rockefeller Foundation's 100 Resilient Cities network which aims to help cities across the world prepare to meet the physical, social and economic challenges that exist as part of 21st century life.

It is vital that Greater Manchester is able to manage the impacts of such changes in the climate, and related extreme weather events such as heatwaves, rainstorms and droughts. Such impacts could include damage to critical infrastructure such as transport, utilities, schools and hospitals, disruption of services, and lower economic growth. The areas at greatest risk of flooding are often populated by deprived communities, and it is the most vulnerable in society who are most likely to suffer from higher temperatures, so successfully mitigating the impacts of climate change or reducing other underlying stresses is essential for delivering a socially equitable and resilient Greater Manchester. Greater Manchester is committed to avoiding the creation of new risks and minimising the aggregation of risks in the course of new development.

The provision and management of resilient infrastructure will ensure that the UK can compete in the global economy, contribute to reducing climate change emissions and be resilient to future local and global extreme events. Strategic infrastructure investment should be co-ordinated and a risk-informed decision making process is key in avoiding the creation of new risks and minimising the aggregation of risks in the course of new development. Currently this does not always happen successfully in the UK and is on occasion ad hoc.

There are potentially 3 linked areas of focus which would improve increase infrastructure resilience collectively (as well as individually):

- Ensure, at an appropriate spatial scale (city regions and their surrounding environment, social and economic catchments) under take proper risk mapping. This need to map hazards (now and in the future informed by climate change projections) as well as exposed infrastructures. Ideally this needs to be collective and cross infrastructure types and include a level of detail of assets and locations sufficient to understand resultant risks and vulnerabilities

- Linked to the above, ensure (require) a sharing and support of this by infrastructure and other relevant parties. So some critical risks and interdependencies are not easily determined using public information on infrastructure alone. There needs to be the detail and a collaborative mapping. We should not ignore security or commercial sensitivity issues – but these could be addressed via utilising protected areas – my suggestion would be (and its cabinet office approved) use similar to http://mappinggm.org.uk/ and host info in closed secure areas.

- Another possibility is resilience direct, which most if not all providers and partners will have access to. But there is other much more sensitive info on there and access once granted is wide ranging so it limits other manipulation (i.e. by academic experts due to security/data protection reasons).

The Natural Environment Including Water Management

Question 11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Question 24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

The natural environment and healthy ecosystems are the foundations upon which we all live and future prosperity depends. In the most recent review of UK biodiversity, the UK's Natural Ecosystem Assessment (NEA) states that 40% of our most important habitats and 30% of our rarest species were still declining. The situation in Greater Manchester is better than the national average - albeit started from a low base as a legacy of industrialisations. National declines in some species are not matched in Greater Manchester, some species numbers are improving, there is more tree cover, cleaner rivers and canals and there are a high number of local wildlife sites that were formerly barren post-industrial land.

Regenerating and managing the natural environment has created jobs and made Greater Manchester a better place to invest and live in. The floods on Boxing day 2015 demonstrate interconnectivity between people, infrastructure and catchments across Greater Manchester. The state has a role in setting positive direction and enabling catchment management. The management of existing infrastructure can also be examined and new approaches explored which contribute to protecting and enhancing the natural environment. For example, through the Natural Course EU

LIFE Integrated Project partners are exploring how the management of transport infrastructure can be re-designed to reduce negative impacts on the water environment. We are also working with Defra as one of the urban pioneers to test how the Government's 25 year plan for the environment can be delivered in an urban setting.

Natural Flood Management (NFM) schemes provide a cost-effective means of "slowing the flow" in relation to fluvial flood events and to building resilience within the urban environment and helping to reduce the risk of surface water flooding. NFM interventions offer the best results when they are aligned with more traditional solutions. For example, within Greater Manchester engineered flood defence works are planned for the towns of Rochdale and Littleborough alongside NFM measures in the upper parts of the River Roch catchment. Together these schemes will offer greater resilience to communities across the district of Rochdale.

Delivering a catchment based approach, as required by Government under the EU Water Framework Directive, benefits from effective management and enhancement of Natural Capital assets so as to deliver multiple benefits for the water environment. For example, Green Infrastructure investments can be introduced to "slow the flow" of run-off and to reduce the impact of urban and rural pollution from diffuse sources. Natural Capital interventions offer the greatest returns when they are implemented alongside, and as a complement to, more traditional engineered solutions. For example, within Greater Manchester a street tree planting project has been delivered in Howard Street Salford to explore the multiple benefits from natural solutions

Energy and Electric Vehicles

Question 19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

Question 20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

Question 21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

As raised through the consultation on the Department for Business, Energy and Industrial Strategy (BEIS) Heat Network Investment Programme, providing upfront capital either through grants or low cost, long term loans are essential for assisting projects which are commercially viable but which struggle to access finance. Such grants/ loans need to be available for both public and private sector recipients, even if they need to flow via local authorities etc rather than go direct to private enterprises. Such financing mechanisms are essential for bridging the gap between short term commercial interests and long term project lifetimes.

In addition to any new interventions, government policy needs to stabilise as energy projects in particular are struggling to secure investment as uncertainty around subsidies etc means investors are not willing to commit to long term projects.

To reduce the demand in heat it is advisable to improve the fabric of existing housing and building stock, e.g. through external wall insulation, cavity wall insulation. Large scale and long term strategic projects, e.g. area based, providing competitive prices are needed to attract the market and to drive industry in this sector.

Further reduction of demand for heat could be achieved through Government support of mass trailing of new and innovative technology that allows consumers to understand their heating requirements (and costs) – HEMS and to allow them to make informed choices on how and when they utilise heating.

Consideration needs to be given to what 'effective zero carbon power' means as could relate to cost, technical or environmental efficiency. By 2050 the sector needs to be a mix of renewable, nuclear and controllable balancing plant, both active (generators) and storage (battery and H2), combined with a dynamic control architecture and greater use of predictive methods.

Controllable balancing plant could be renewably fuelled although it is likely that gas will still be required. In order for this to be zero carbon, CCS will be required.
To provide capacity as scale, controllable balancing plant will need to be employed in both the domestic and non domestic sectors (industry, commercial, public)

Low carbon vehicles can vary and each technology has different implications for energy production, transmission, distribution etc. As an example, H2 vehicles require fuel and fuelling points, and their widespread adoption will require appropriate infrastructure to allow this.

Fast charging opportunities will place severe strain on the generation and distribution systems unless controlled and smoothed. Such active control could be supported through the vehicles themselves which could act as storage and be controlled to help balance demands on the network.

Concentration of slow charging points (such as in park and ride areas) will also need to be managed carefully to ensure longer term strain is managed on the network as the uptake of electric vehicles to expected on increase significantly.

Digital Infrastructure

Question 18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Digital connectivity is a critical utility for our businesses, organisations and citizens – our vision is for "always on" unlimited bandwidth available on a competitive basis at the infrastructure and retail level. To achieve this there is a need to galvanise the wider provider market outside of BT and Virgin Media to invest on a commercial basis in fibre infrastructure. We are therefore looking for the Government's Digital Infrastructure Investment Fund to support investment in fibre by smaller provider to provide a more competitive market.

We welcome the significant shift in Government policy towards fibre investment signalled in the Autumn Statement. The UK is well behind its international competitors in the delivery of full fibre infrastructure to the premises. Portugal and Spain has 60% coverage compare to 2% in the UK. This is already impacting on our reputation as digital leaders and in the medium to long term will impact on international inward investment decision making unless it is addressed.

In the recent NESTA Digital City Index confirmed none of the UK cities surveyed scored highly on digital infrastructure because of this. Slow broadband speed are not limited to rural areas, event within the city centre there are locations where superfast broad band is available to less than 33% of premises: please see: http://mappinggm.org.uk/gmodin/#os_maps_light/12/53.5036/-2.2783

In line with the Government policy objective stated in the last Autumn Statement, in Greater Manchester we aim to find the quickest route to achieve a full fibre infrastructure working with the grain of the market. In this context we welcome the opportunities to accelerate investment through the Government's Digital Infrastructure Investment Fund, whilst recognising though the £400m funding allocation for the whole of the UK is relatively small compared with the size of the task and will therefore have to be targeted at Cities to deliver the best return on investment. Further investment will be needed in fibre moving forward in order for Greater Manchester to remain competitive with peer cities in Europe. The public sector has an important role in facilitating this through aggregation of demand.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?
Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

Greater Manchester is growing rapidly and this raises a number of challenges. Currently, 7 million people live within one hour's drive-time of the Greater Manchester regional centre[1] and there's over 9,000km of roads in the conurbation[2]. Greater Manchester, and the wider Northern area, is also a key freight and logistics hub. There are currently over 650 freight distribution sites in the North, with 133,000 people employed at these sites[3]. Private sector investment in the North already accounts for some 65km of quays at ports, 12 million square metres of large warehouses, around 190 freight locomotives and 130,000 HGVs[4]. However, the freight and logistics sector is almost entirely private sector led, with very little input from transport authorities.

[1] New Economy (2016) Logistics Deep Dive
[2] DSD Transport Statistics Report 2015
[3] Transport for the North (2015) The Northern Powerhouse: One Agenda, One Economy, One North
[4] Transport for the North (2016) Freight and Logistics report

Congestion is an externality of this growth and the cost of congestion in Greater Manchester is estimated to be £1.4 billion each year[5]. To date, we have made efforts to mitigate congestion levels, some of which have been successful, with initiatives in active travel, new interchanges in town centres and continuing investment in the growing Metrolink network. However, more work is required to enable people to choose sustainable modes and move away from private vehicle as the default choice.

Poor air quality, including pollution from transport emissions, is having a severe impact on the health of residents and visitors across the conurbation. Public health officials tell us that long-term exposure to out-door air pollution contributes towards illness and death from respiratory and cardiovascular diseases.

To improve air quality across the conurbation, Greater Manchester is investing in an expanding electric vehicle charging network, which currently consists of over 300 charges points, we are also delivering active travel plans. In future, bus reform will enable the city region and transport authority to specify vehicle types and emission levels to be used in the conurbation, including the use of hybrid electric buses, enabling a greater control over the emissions pollution from public transport vehicles. However, the power supply for the charging network will be a key consideration in future. As more chargers are installed, particularly in the regional and district centres, the city region will have to balance supply with growing demand. Alongside this, electrification of rail services and the development and deployment of Connected and Autonomous Vehicles in the conurbation could also strain the network.

Other solutions could include Connected and Autonomous Vehicles (CAV). Over one million vehicles currently in the UK have some form of connected components[6]. The ways in which city regions, cities, and transport authorities utilise these connected components to better understand transport movements, customer needs, and travel expectations in future, will affect service investment and provision.

Further research is required, with input from cities and city regions, to determine new models of transport service delivery and infrastructure investment to ensure schemes and initiatives will meet customer needs and requirements, whilst also utilising new technologies to improve efficiency and exploit existing capacity across the transport network.

Shared mobility, and, by extension, Mobility as a Service (MaaS) is another potential solution and could enable residents and visitors to utilise a variety of modes, including CAV, to access education, employment and leisure opportunities, without the need to own a private vehicle. However, the practical impact of MaaS is still unknown. MaaS could result in more journeys being travelled, over longer or shorter distances, and may challenge current transport planning perspectives, particularly in relation to peak hours, fixed route services and first/last mile transport[7].

[5] Transport for Greater Manchester. (2016) 2040 Transport Strategy
[6] Centre for Connected and Autonomous Vehicles (2016)
[7] Transport Systems Catapult (2016) Mobility as a Service: Exploring the opportunity for Mobility as a Service in the UK

No MaaS system has been trialled, succeeded and rolled out at scale in a city or city region across around the world. The coordination, collaboration and initial investment required would need policy, institutional and regulatory support which can often be slow and cumbersome to implement. Many MaaS related services operate individually already, but require a central organisation to provide the structure to bring together these services and create an integrated system which supports and meets customer needs and expectations. Continuous innovation and technological development would ensure the MaaS system has a wide range of mobility services on offer.

Through TfGM we have recently secured funding through two European competitions to develop and trial models for MaaS implementation. Through collaboration with other cities internationally and research and insight into business models and customer expectations, Greater Manchester is striving to be at the forefront of opportunities that would positively impact travellers.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?
Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

High quality transport links can offer new opportunities for residents and visitors to access employment, education and leisure options in Greater Manchester's regional centre. The following case study highlights transport investment which has enabled more residents to access the regional centre and other districts.

Metrolink
The hugely successful Metrolink network is the largest light rail network in the UK, covering over 93km of Greater Manchester, across 93 stops and 7 of the 10 districts.

Alongside expansions to existing lines and improving overall connectivity, the most recent Metrolink expansion also included new park and ride sites, offering interchange points and more opportunities for residents and visitors to access the regional centre without the use of a private vehicle.

The current service delivery model of frequent and reliable services for travellers, and information is presented via Passenger Information Displays to enable customers to receive real-time information for their service. The Metrolink network also allows customers to travel sustainably, as it is emission free at the point of use and also runs entirely on green energy (61% of which comes from wind power).

Alongside improved frequencies and reliability, the Metrolink network has improved overall accessibility for passengers who wish to access healthcare, employment and education opportunities. Evaluation of the Phase 3 expansion indicates that half of 16-70 years olds within 1km of the Phase 3 lines have experienced a change in public transport accessibility to employment of 10% or more. This rises to 60% among people living in the 10% more deprived wards in the corridors.

To complete the current expansion, 2017 will see the opening of the Second City Crossing, which will significantly increase capacity into and through the regional centre. The next expansion, the Trafford Park Line, will be completed in 2020/21 and will service the Trafford Park area, which is home to over 1,400 businesses and 35,000 employees. The new line will offer a sustainable alternative to car travel and will improve the existing public transport offer in the area, enabling better access for city region residents to employment opportunities in Trafford Park.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area? *Note: this includes travel in and between rural areas, as well as between urban areas and international travel.*

Integrated transport investment

Transport for the North, a sub-national transport body as of 2017, is building a strategic overview of Northern transport. Collaborative work with central government to ensure short- and long-term opportunities are exploited would enable the North to create an integrated, reliable network which is fit for purpose today and in the future. The North requires urgent, significant investment in transport infrastructure, not lest the rail networks between cities and conurbations to ensure productivity is exploited and maximised, and to rebalance the national economy. High Speed 2 (HS2) will offer connections between the North and South, but improvements across the Northern area are also required.

Northern Powerhouse Rail (HS3) could cut journey times between Manchester and Leeds by up to 40%[8]. Along with improvements to transport hubs, such as Manchester Piccadilly, to connect HS2 and Northern Powerhouse Rail, and investments in the road network to increase capacity, transport across the North will offer a variety of modes and connections for residents and visitors.

Enhancements should be prioritised where needed, for example, improvements to connections with Manchester Airport. The M56 access to the airport currently receives over 120,000 vehicles per day[9], creating significant levels of congestion. Investment could be maximised by combining new developments with enhancements to existing infrastructure, to improve journey times between major cities. Manchester Airport is the North's gateway to over 200 destinations worldwide. Ensuring this transport hub has a variety of modes with adequate capacity, which offer frequent and reliable connections to other cities nationally is vital to fully exploit future growth and opportunities.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

As previously mentioned, MaaS could enable a review of city region level transport planning and service delivery, potentially offering residents and visitor's accessible, reliable transport without the need to own a private vehicle, and a single body is

[8] National Infrastructure Commission (2016) High Speed North
[9] National Infrastructure Commission (2016) High Speed North

required to administrate, aggregate and coordinate resources and operators effectively. However, how users choose to access transport will continue to have repercussions on other transport users and the wider city environment.
Road user charging in relation to MaaS requires significantly more research before practical application and is not currently being investigated in Greater Manchester.

National Infrastructure Assessment

Consultation

February 2017

GREENGAUGE21

Overview

Greengauge 21 is delighted to respond to the Commission's call for evidence to provide input into the development of its National Infrastructure Assessment that will set the Commission's position on long-term infrastructure needs over a 30-year time horizon.

We provide evidence to support the following contention: the creation of a truly national high-speed rail (HSR) network is the most important and valuable of candidate transport programmes and it is the investment best-placed to meet the National Infrastructure Commission's objectives, which are:

i. to support sustainable economic growth across all regions of the UK
ii. to improve competitiveness
iii. to improve quality of life.

Private sector developments are signs of economic confidence. Built around the transformation in travel opportunities that HSR can bring – they are already arising in 'the provinces' – not the capital.

The advantage of a truly national strategy for HSR will be that such effects can be spread more widely and inclusively across the nation.

The strategic aim is to bring to the whole of the nation – as appropriate and affordable – the connectivity and capacity gains to rail that HSR provides. This means that the national strategy should be thought of as being an inter-city or inter-regional rail strategy including – but not restricted to – new-build HSR, and with explicit consideration given to improving connectivity to places that are often regarded as peripheral or second tier. The strategy would focus on the outputs of HSR, in terms of services (which should precede considerations of infrastructure) and enhanced connectivity and capacity, with a central focus on the relative merits of upgrade and new-build and combinations thereof.

Despite the excellent progress being achieved in implementing HS2, the best value from high-speed rail is not yet being achieved. This is because its development is not set in the context of a longer term (2050) HSR plan at a national (UK) level. Businesses invest and economies prosper when they can see how current uncertainties – such as an outlook of ever-growing congestion and travel time unreliability – will be overcome.

The rail sector currently makes its plans through a set of detailed 5-year time horizon programmes. It will not duplicate effort if the NIC through its National Infrastructure Assessment sets out a long term (2050) vision for high-speed rail, including the implications for the existing rail network – which may include opportunities to save on expenditure on the existing network as well as how best to align it with HSR plans.

Background

Greengauge 21 has been guided since 2007 by its Public Interest Group. This group offers a means for local, regional and devolved public authorities to come together to help guide research and planning activities that Greengauge 21 undertakes. So we are in a good position to answer the NIC's call for evidence (possibly uniquely in relation to HSR and rail) at a national level (rather than on behalf of a particular city or region) and do so informed by the views and priorities of the English regions, cities and the devolved nations. We responded to an earlier NIC consultation on critical infrastructure challenges in London and the North in January 2016.

We note the National Infrastructure Commission's consultation guidance that we should exclude from consideration projects that are already in the pipeline. In the High Speed Rail context, what qualifies as 'in the pipeline' might itself be a discussion point but we have taken it to include HS2 Phase 1 (as it is expected to be defined though Royal Assent to its Parliamentary Bill early this year) and HS2 Phase 2A – the extension of Phase 1 to Crewe (for which a new Parliamentary Bill is expected to be deposited later in 2017).

We provide responses to Questions 1–15 and we have devoted most attention to the questions that relate to need (which we discuss in relation to the NIC's three core objectives) and those which relate to a national strategy and programme for HSR (as distinct from progressing any specific project), which we believe is important to facilitate the wider economic benefits that HSR can bring. And given the importance of transport to the wider objectives of the NIC, we have responded to the cross-cutting questions that the NIC has set, as well as those specifically concerned with transport.

The inter-relation between infrastructure investment in transport and other sectors

Greengauge 21 has identified the opportunity to use HSR infrastructure to address challenges in related infrastructure areas of interest to the Commission – specifically digital communications, energy and water networks, and flood risk management.

These inter-relations and opportunities were first noted in the **Greengauge 21 Manifesto** for high-speed rail of January 2006. It pointed to the scope for HSR infrastructure to be designed to accommodate adjoining provision for water transmission in order to meet the need for inter-regional (flood basin) water transfers, for example. We note too that HS2 Ltd has plans to explore fibre optics infrastructure for Phase 2.

We would point to a further example, which is the possibility of integrating plans for HSR to Scotland with the planned major multi-£bn electricity power grid upgrade investment across **Morecambe Bay**. This offers the opportunity for integration with a rail link that could reduce the relative isolation of Barrow-in-Furness and the Cumbrian Coastal communities; serve as a useful shortening of the route for nuclear industry fuel and energy sector construction traffic; benefit passenger rail connectivity; and provide a freight diversionary route for cross Anglo-Scottish border railfreight to create more high speed capacity on the West Coast Main Line across Cumbria, reducing the cost of cross border (Anglo-Scottish) high speed rail.

Another inter-relationship with the energy sector (and meeting climate change targets) should be mentioned. Our studies have shown that a crucial determinant of the carbon impact of high-speed rail is the extent to which electrical power generation has been de-carbonised. On the basis of current plans and performance in this regard, **we concluded** in 2012 that it could be appropriate to restrict operating speeds to 300km/h in the early years of HS2 operation. The faster electrical power generation is de-carbonised, the faster high-speed rail services can be operated.

Responses to the NIC's Cross-cutting questions

Q1. What are the highest value infrastructure investments that would support long term sustainable growth?

Infrastructure investment that best supports national long term sustainable growth in Britain has to:

- help overcome historic factors that have led to low productivity and substantial regional economic imbalances and large disparities in income levels
- take into account the likely changes brought about by Brexit (and give due consideration to other major policy shifts in trading partner nations and relationships)
- recognise that the nation has major short-comings in housing and health provision, and anticipate how these might be put right alongside the highest value infrastructure investments
- protect, nurture and enhance valued quality of life factors including social preferences and environmental conditions
- reinvigorate urban development – because of its agglomeration benefits and because to do otherwise in any significant growth scenarios will undo the adopted national pattern of rural protection/town planning and reduce the nation's food production capacity.

Few initiatives can address all of these requirements to any significant extent, but investment that allows people and freight to travel more speedily, safely and reliably – and with diminished adverse environmental impacts – between the major cities and all of the regions (and devolved nations) can do so. This is especially the case if, as a by-product of the new infrastructure needed, within-conurbation or city region transportation systems can be enhanced cost-effectively. For this reason, we contend that a high-speed rail programme should be considered as potentially the highest value infrastructure investment that supports long term sustainable growth across the nation as a whole.

Q2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

The **UK's international competitiveness** has very often, in recent years, been discussed in terms of London's international competitiveness. London is the national 'HQ' for government, for tourism, for cultural attractions, for finance, for the new 'tech' sector, for retail, for business services, for property development… and of course it also has the major international gateways for air travel (for both passengers and freight), has its own major new container port, and is the only city with direct rail connections to continental Europe. No other developed country (city states aside) has **such a high concentration** of its key economic assets vested in a single location (supported by its surrounding wider south east England hinterland). London has it all.

It follows that to strengthen the UK's international competitiveness, it is necessary both to **protect the current strengths** of the capital and to **build the competitiveness** of the remainder of the country.

London is in danger of losing some of its attraction and, hence, competitiveness because of its very high house prices and a loss of some of its quality of life appeal, with intense pressure on its transportation systems (notwithstanding investment in Thameslink, the Overground and Crossrail) and increased risks to human health through air quality degradation, amongst other effects. And the economic risks associated with Brexit may fall disproportionately upon London should the borderless status of financial services be altered by changes in the regulatory environment.[1] [2]

Rather than continue with the current development model for the national capital (with land and development values progressively exploited to fund infrastructure), an approach which places more emphasis and value on quality of life alongside employment and population growth would help its competitiveness on a **per capita** basis. This would foster a greater emphasis on mixed development that reduces the demand for travel and would relieve unwanted intense development pressure within London and across its wide south east of England catchment.

This has the potential to be an entirely benign strategic market correction that would support what is best for London and would need to be seen in the context of wider policy for a more competitive UK.

The natural counterpart to such a change for London – reflected and implemented through Mayoral, pan-regional and LEP planning instruments – is infrastructure development that **generates demand in the other parts** of the UK. This is the key to reducing the cost of development and increasing productivity through the lower cost base available across the regions which continue to offer high quality of life, but suffer a 'graduate drain' to the south east and lack the connectivity which makes development

1. See Commons library briefing paper, **Brexit and financial services**
2. See Reuters news item **HSBC, UBS to shift 1,000 jobs each from UK in Brexit blow to London**

truly appealing. Strengthening and re-building international competitiveness will take different forms in each region, building on existing economic capabilities that are (or have the prospect of being) globally competitive[3]. This will require investment in skills and innovation as well as infrastructure.

Achieving this shift in spatial demand requires attention to the connectivity of cities and regions with London and – because connectivity between even relatively close regional cities is so poor – very much better connectivity within and between the UK's cities and regions[4]. Connectivity with London, unsurprisingly given its dominance across the economic sectors, is under intense capacity pressure and cannot be ignored. It is immensely important – all the more so as the function of the City and its financial service sector has to engage more directly, post-Brexit, with the challenge of national industrial regeneration as is being pursued through the new **National Industrial Strategy**.

The best way to achieve these connectivity enhancements is through a national HSR programme. The benefits to competitiveness need to be measured under scenarios which cover varying rates of progress in regional development as allowed for in the Nimrod model[5]. Assessments of transport investments need to measure productivity gains (including those from agglomeration benefits, such as wider labour markets and increased employment opportunities; from the ability to use time productively while travelling; from shorter and more reliable time spent making face to face business contacts; and from the opportunity that distributed development brings to reduce unemployment, achieve higher quality of life and a more balanced society).

Transport for the North[6] has highlighted a continuum of evidence that enhancing connectivity between city regions, within city regions and to international gateways and London needs to be an integral part of any strategy to accelerate economic growth. Over the last decade, Core Cities, the Northern Way, Eddington and the House of Commons Transport Committee have all come to this general policy prescription in exploring the links between transport and productivity growth.

The role of international gateways for passengers and freight is hugely important yet – in respect of ports and surface access to airports – remains largely untouched by national policy.

Brexit demands a new emphasis on international connectivity (and not just at Heathrow) as Britain seeks to strike new international trade agreements.

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3. **The Independent Economic Review** carried out for Transport for the North (2016) provides a good model, and this approach is of course reflected in the new Government thinking on industrial strategy.

4. See the **HS2 Strategic Case 2015 update**; Tables 5 and 6 show the relative dominance of London flows for business travel (so Bath – London volumes are nearly twice the scale of the largest English city-city non London business travel flow (Manchester – Leeds)). And see Chapter 6 for an explanation of the knowledge-based industries that are most likely to drive productivity and economic growth and their relation to cities and to the connectivity gains that HSR brings.

5. See discussion of the Nimrod model in the **strategic analysis of the future of national infrastructure** published in the ICE proceedings February 2017.

6. Transport for the North. One North: A Proposition for an Inter Connected North. July 2014.

Taking ports policy first, it is time to seek a major shift in the role of Britain's ports and establish port facilities that will challenge and out-perform continental-based ports so that EU-level tariffs on non-EU trade can be avoided[7]. The level of investment this will entail should not be under-estimated. It will require the creation of not just larger ports, but also the development of port-centric logistics and much better port access transport, particularly by rail, given the container volumes involved. New linkages will also be needed between the major British points of entry and production/consumption centres (both nationally and abroad).

The capacity challenge at our major ports could be met by private sector investment, building on developments at Felixstowe, Southampton, London Gateway, Liverpool and elsewhere. And with west and east facing ports, the UK is very well placed to grow and reshape its maritime connectivity. But upscaling in the way described here, post-Brexit, will need a policy commitment from Government and incentives, perhaps in the form of enterprise zone and freeport status. Freeports offer warehouses in tax-free zones. Goods entering freeports are not subject to customs duties and goods sold are not subject to value added tax. No withholding tax is collected on capital gains, though sellers could be required to report to HMRC.

The challenge of congested surface access particularly by rail for the sustainable distribution of large volumes of containers also cannot be ignored, especially in those instances (such as London and Liverpool) where ports are located within very established major urban areas. The example of the Kennedy Tunnel in Antwerp and Dublin, which invested in a new port access road tunnel following a **strategic review started in 1992**, points a possible way forward. Otherwise the easiest strategy is for ports to grow away from centres and put development pressure on rural land around cities.

The major gap in the high gauge clearances needed for maritime container transport on the national rail network is east-west across the Pennines which can be resolved as part of Northern Powerhouse Rail. The bigger strategic challenge is lack of capacity, especially where long distance passenger and local and regional services and freight are all competing for space on the strategic network – and this includes on HS1. A comprehensive examination of how railfreight might develop in the post-Brexit world is needed. This needs to cover volumes, time criticality and routings and include consideration of a switch to electric haulage, alternative routes, suitable full length freight loops, three/four-tracking as well as off-line bypasses – as well as an examination of the way that high-speed rail can bring capacity relief to existing main lines.

A congested Heathrow with limited air and surface access by rail from the regions has led to a dependency across the regions on global access to new and emerging international markets being made via hub airports on the continent. Advancing the 3rd runway and maximising the potential of the international gateway airports in the regions and nations of the UK will have a critical part to play. It also requires new thinking about long term plans for surface access to all our major airports if they are to reach their full potential.[8]

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7. The same logic also applies to the need to strengthen access to UK-based international airports to provide an alternative to hubbing through continent-based airports such as Schiphol and Frankfurt.

8. See for example the **Independent International Connectivity Commission Report**, February 2017, commissioned by Transport for the North.

Looking at Heathrow's world hub competitors, the success of direct rail services from widespread locations into Schiphol, Charles De Gaulle and Frankfurt Airports can be readily seen. This is how these world hub airports have come to serve nations, not just a capital or major city. The UK's world hub airport merits the equivalent.[9]

The new western rail access at Heathrow should be upgraded so that it can provide direct services from the South-West, South Wales, Oxford and the West Midlands (and potentially the North West), and from the East Midlands and Cambridge via Bedford using the new east-west rail link. And a southern link should not be restricted to the airport's immediate catchment but be designed to connect the major travel generators in Surrey, Hampshire and Dorset. Regions further from Heathrow (and Scotland and Northern Ireland) should be afforded the direct air link access that the Secretary of State for Transport announced at the time of the Runway 3 decision in 2016.

Now is also the time for a link to HS1 to be put back on the agenda so that Heathrow has high-speed direct access from Paris, Brussels, Amsterdam and Frankfurt. An extended catchment strengthens the airport's attraction for the most attractive long-haul flights, to the wider benefit of UK competitiveness. The connections will also assist business growth and retention in the M4/M3 corridors.

Along with Crossrail's connections to London's West End, the City, Docklands and north Kent/Essex, it is clear that it is time to recognise Heathrow's role as a rail hub. And the case for creating the necessary infrastructure is not something to insist on the airport-owner providing as a planning agreement obligation. There is a rich mix of M25-style rail journeys and de-congestion benefits that a rail hub will bring regardless of airport access. The funding mix needs to reflect this point.[10]

Planning better rail connectivity **west of London should not be delayed**: the rational development of rail transport west of London as outlined above relies on having a hub rail facility at Heathrow. While the airport access component is crucial for international competitiveness, the investment case for these links exists quite separately, just as did the case for building the M25, 30 years ago.

In the North, there are similar opportunities to transform surface access to Manchester Airport by developing a rail hub capability and removing the current capacity constraints of the Airport station's terminus platforms. These opportunities include Northern Powerhouse Rail and implementation of the protected western rail access scheme which could be implemented well ahead of the arrival of HS2 Phase 2B. And looking ahead to 2050 we see Stansted linked into the national high speed rail network too.

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9. See the **Mawhinney Review** which called for a strategic approach to this question. **Before** (and **after**) HS2 Ltd abandoned its planned links to Heathrow, Greengauge 21 published a series of reports on Heathrow Access that addressed the challenge of developing wider rail access to the airport.

10. The NIC could usefully highlight the inconsistency between the aviation and rail sector regulatory standpoints on funding rail access to airports and propose a resolution which ends the treatment of airports and their expansion as being equivalent to other kinds of development such as retail.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

The approach here should be through:

1. a much greater emphasis on devolution
2. the development of a national spatial strategy[11]
3. learning what has worked well elsewhere[12]
4. linking HSR to city region networks.

Without connectivity to get to other places easily without using a private car, the urge to continue high levels of car ownership will continue, distorting the design of urban areas and their transport networks. This in turn leads to sprawl rather than the densification of urban areas needed for sustainability reasons.[13]

Greater devolution of powers, funding and responsibilities is under way, but painfully slowly. The existence of a national spatial strategy and through it the mechanism to provide a framework for housing development should help accelerate this proces[14]. In practice, a national spatial strategy should both inform and be informed by a national infrastructure plan. The NIC's development of a 2050 infrastructure plan is therefore an important building block towards the future potential development of a national spatial strategy. A national spatial plan would also be informed by fostering initiatives such as the one initiated by IPPR North and the RTPI aimed at developing a Great North Plan.[15]

With regard to interaction with housing, it may be necessary for the NIC to address the housing crisis and point to it being a prime example of market failure, as well as the source of significant inflationary pressure that affects all areas of the economy and damages competitiveness. Experts in the field see no major resolution to the problem without some fundamental interventions that are not on current Government agendas.[16]

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11. Noting that these already exist for Northern Ireland, Scotland and Wales (but not England).

12. See for example, Sir Peter Hall's book of 2014, *Good Cities, Better Lives* (Routledge) which reviews the best post-war European experience in housing, transport and sustainable development of attractive urban areas.

13. *Smart Growth* by Jon Reeds, Green Books, 2011.

14. *The Interim Prospectus of The Common Futures Network* as submitted to the NIC provides some of the evidence on the case for a national spatial strategy. We would advocate that such a proposal is considered not just as a paper-based plan, but in an open and accessible electronic format to which registered correspondents (public agencies and private companies – such as property developers) can introduce and keep up to date relevant data. The scope for using such a facility to aid the industrial strategy is, we believe, significant.

15. See **Blueprint for a Great North Plan**. This sets out a series of principles to guide how the Plan should be developed; identifies the suite of documents that might together comprise the Great North Plan; suggests the different themes or 'layers' of planning that need to be fitted together through collaborative action; and proposes a process for the next steps in moving from blueprint to plan.

16. See, for example, *Housing: Where's the Plan*, Kate Barker, London Publishing Partnership, 2014.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Given constraints on resources, demand management needs to play an important role in optimising sustainable growth for a given level of infrastructure investment. Research suggests that travel demand management measures could reduce national traffic levels by around 11%[17]. This was supported by the Sustainable Travel Demonstration Towns programme, which resulted in a decrease in car trips of between 11 and 13%. Demand management has a second, broader, role to play in rationing carbon resources and in meeting the UK's climate change obligations. Poor **air quality**, for instance on the M1 in South Yorkshire could see a reduction in permissible speeds of 10 mph, and it would seem inevitable as the links between poor health outcomes (including premature death) and the vehicular source of poor air quality become more widely understood, that demand management – in some cases instead of capacity expansion – will need to be considered. With air quality and carbon effects of growing importance, a strategy for setting fuel prices through differential policies across diesel/petrol/electric needs to be developed, and the habit of perpetual non-application of the annual fuel duty escalator re-considered.

In practice, the challenges of using pricing as a demand management tool are intensified as wider disposable income ranges inevitably trigger questions of fairness and acceptability. On rail, it has been found possible to respond to very diverse levels of willingness to pay: Britain has both some of the highest fares in Europe and the lowest[18], and there is the key advantage that the pricing mechanism is under government regulatory control.

Transport capacity is in scarce supply (in urban areas, and elsewhere) and emerging and disruptive technologies (Uber; autonomous vehicles of various sorts; drones for delivery) can generate additional demand, stretching capacities yet further. This should be seen as a further incentive to revisit charging systems for use of infrastructure in order to achieve best overall outcomes.

17. See **Traffic Demand Management**.
18. See Mark Smith in *RAIL*, issue 818 January 2017.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

There is a very substantial level of catch-up needed to get roads to a state of good repair, and nationally funding should be directed more to this area and less to new or expanded road network capacity. The well-documented issues with infrastructure in the US, especially road, are a clear reminder that if maintenance is neglected the reliability and ultimately the very existence of key structures and roads is threatened, posing huge economic risks.[19]

The established HLOS/SOFA process for rail – where the balance of enhancement is considered alongside maintenance and renewals – could be fully extended with advantage to the highways sector with the role of independent oversight via ORR reinforced.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Britain is currently attracting a wide range of international interest in delivering its forthcoming infrastructure programme. This combines with its long-standing ability to serve wider geographies from a UK base – such that many international companies are happy to locate their HQs for geographies as substantial as Europe, Middle East and Africa in the UK. Clearly part of this rationale is negatively impacted by the Brexit vote.

So the requirement is to counter this adverse effect, and this can be achieved by:

1. Adopting confident procurement practices that encourage innovation, partnering and appropriate risk-sharing, so that the supply chain seeks out UK opportunities as a means to enhance delivery and reputation and gain competitive advantage

2. Putting public sector funds into STEM training, preferably through devolved agencies that can match their focus to regionally-based leading-edge industries

3. Further strengthening the NIC programme, seeking to gain widespread popular support and understanding through a major 'reach-out programme', and ensuring that it is made as free as practical from shifting political and national budgetary stand-points.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

As the **Rail Delivery Group** has pointed out, rail is now self-financing in respect of maintenance and repair of existing assets. A sensible roads policy aim would be to get to a similar position, with road users being set charges that meet marginal long run social costs – that is the maintenance and repair of existing national highways assets and externalities such as costs falling to health, social services and the environment.

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19. See ASCE **Infrastructure report card**.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

The up-front planning and political risk around a project such as HS2 makes it fundamentally unsuited to third party funding. But it is amenable to concessioning as a means to recoup much of the public sector outlay. Greengauge 21 **commissioned PwC** to examine funding options for high-speed rail in 2011. Their report sets out the first published analysis of what the Government could expect to see as a financial return if it elected to sell (or, more precisely, concession) the infrastructure of High Speed 2 (HS2), in the same way as a 30-year concession was sold for the 109 km-long HS1. PwC's figures showed that HS2 could produce between £6bn and £7bn as a return on the same basis soon after project opening.[20]

The report also suggested that there are potentially further cash returns over the lifetime of the project. The Exchequer will receive, over time, estimated extra tax receipts on the profits earned by the infrastructure concession holder and rail operating franchises worth £1.5–2bn and, at the end of the initial concession period, HS2 could be sold again, generating a further return to the taxpayer.

It should also be noted that extensions of HS2, once it is past its proof-of-concept stage (that is, investment has proven deliverable within budget and to timescale and there is an established stream of track access charge revenues), could be amenable to co-financing, as is the case with the Tours – **Bordeaux LGV PPP** – currently at the construction stage).

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

One of the risks facing the national rail (and road) network is the effect of climate change – and in particular increased risk of flooding (of various types). Greengauge 21 has identified an example of where the creation of new alignments would bring **major resilience benefits** – which, while on their own possibly insufficient to justify the investment needed – can, in conjunction with providing enhanced connectivity to growth locations and integration with existing rail services, make for a sound investment case.

20. The HS1 concession was let for £2.1bn for a 30-year period but is potentially now going to be **sold on for £3.6bn** (a sum that may be contrasted with its £5.6bn construction cost), so if the same analysis was repeated, the value of concessioning HS2 Phase 1 to HM Treasury would be potentially £10–12bn.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

The planning system (if by that is meant the professional/public authority response to planning applications) is working well – with consents agreed in record times. But clearly there are sometimes excessive costs and significant delays in obtaining major project approvals, and converting approvals into delivery can be disconcertingly slow.

The largest transport sector plans require extended public consultation and this is not unusual in advanced developed economies such as those in Western Europe (as required by the Arhus convention). It would be wrong to suppose that developments proceed more swiftly in other countries[21]. Planning delays slowed down completion of Germany's HSR network for over 10 years and extension of TGVs along the Cote d'Azur has effectively been abandoned for planning reasons.

One area of particular concern can be addressed at NIC-level, and that concerns the problem of interaction between major infrastructure investments. In many instances, the lengthy period between approval and completion (about 10 years in the case of London's Crossrail, for example) virtually guarantees that there will be some interaction with another major project (or two, or more).

In the Crossrail case, after its funding approval, HS2 was developed and its interface with Crossrail became a key design feature. But the adaptation to Crossrail[22] that would be needed to make the task of implementing HS2 easier (less costly, less disruptive and faster) was not forthcoming because of the perceived risk to Crossrail completing on time and budget.

Overall, taking the two projects together, it is clear that it would have been possible to find a better solution (and Greengauge 21 identified the opportunity at a workshop held within a few months of the publication of the HS2 alignment in summer 2010), but each project has its own governance arrangements, budget and timescales so this wasn't forth-coming. Such interactions are not exceptional and will become increasingly common. That is why we have advocated that Transport for the North takes a responsibility for HS2 Phase 2B along with its Northern Powerhouse Rail plan. Elsewhere, a NIC-level Programme Board is needed to resolve such matters in future.

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21. Examples would be the development of the French TGV network from Marseilles to Nice, first identified in a master plan of 1983 but not yet constructed; or the major delays to and lengthy protests against large infrastructure projects in Germany (the short section of high-speed line and major station rebuild at Stüttgart and the construction of a new runway at Frankfurt Airport, for example); or the five years that have elapsed since Amtrak identified high-speed proposals on the North East Corridor of the USA during which time a 'programmatic' level Environmental Impact Assessment has been carried out with multiple stage consultations.

22. Addition of a second west side route to divert suburban services from the West Coast Main line into Crossrail, adding to Crossrail project benefits, creating the opportunity to find a better location for a Crossrail depot and reducing the disruption and need for land-take at Euston and hence HS2 costs.

We see that the work the NIC is doing through the National Needs Assessment is a critical opportunity to make a start in formulating a **strategic analysis of the future of national infrastructure** (as published in the ICE proceedings of February 2017) where key questions of project inter-relationships and mechanisms to ensure that projects deliver against multiple objectives can begin to be understood and explored.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

There are three fundamental points to make here on this most important topic of protecting natural capital and resisting its erosion:

1. There are circumstances where major infrastructure is being proposed where some disruption and significant impacts to the natural environment/capital is inevitable, and in these cases, consideration must be given to accommodating the infrastructure requirements of other sectors and agencies to avoid subsequent separate incursions and intrusions into the natural environment. This should be a pre-requisite of qualification for inclusion within the National Infrastructure Assessment. A good example is the possibility of a road tunnel through/under the Peak District National Park to better link the cities of Sheffield and Manchester, where despite the specific recommendation of the **One North Report of July 2014**, this is **not** being considered as a multi-modal facility with the option of rail tunnel (and even Eurotunnel-style shuttle operation). Only road connections have been considered so far by Highways England which is leading on this project.

2. The creation of new environmental capital for the future, eg. by creation of new woodland and other habitats is likely to be an increasing feature of infrastructure development – road as well as rail.

3. The principle of a continued preference for brown field and city-based expansion through urban strengthening remains the best approach to minimise commuting and encroachment on undeveloped areas of land and its natural capital.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Because cost-benefit analysis techniques are best developed for the transport sector, they provide a more rigorous quantified assessment tool than is available in others sectors. This has the effect, in practice, of placing a higher bar for technical compliance in the evidence base for funders of transport sector projects.

The substantial legacy of previous transport project appraisals is both a strength and weakness. The use of consistent parameters subject to progressive and managed evolution allows for transport project benefit:cost ratios almost to assume the tenor of a currency. But over time, the need to measure different kinds of benefits – for instance, the addition of capacity to overcrowded and congested networks – may suffer from the imposition of generalised tools developed in earlier eras with 'free-flowing' network conditions which no longer apply to road or rail or indeed airspace (except at off-peak times). Within the transport sector, there is evidence that significant improvements in

connectivity can have more-than-proportionate effects on quality of life and economic performance outcomes[23]. These 'threshold effects' of large investments in altering economic behaviour should be given more weight within the appraisal process.

Responses to the NIC's transport questions

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

In terms of future travel patterns, DfT provides excellent statistics on long term trends that can form a suitable starting point. Over time, people in Britain are making slightly fewer trips and travelling longer distances. Car ownership and usage is trending differentially in the largest cities (especially London where they are falling). Freight traffic by road is growing strongly and consistently (fostered by the shift to internet shopping) – and on rail likewise but only in two distinct markets – aggregates for construction and intermodal traffic to/from ports.

Achieving more productive regions beyond London and the South East will generate more travel demand and traffic – and there is evidence of higher elasticities of transport demand in the North compared with the South[24]. This adds to the case for more sustainable patterns of development across the regions, allied to high capacity urban transit provision.

International tourism, both inbound and outbound, is likely to have an increasing effect on patterns of travel demand and while currently a small part of overall travel (except for airlines) will experience some of the strongest areas of growth.

There is no evidence that increasing availability of **new technologies** through broad-band and mobile electronic communications devices is reducing the demand for longer distance journeys, but there is trend evidence that journey to work volumes, while still growing and with lengthier journeys – are not increasing in line with job growth. The latter reflects an increased propensity towards self-employment and to flexible working arrangements that can be expected to continue, as the balance of employment opportunities adapts in response to technological innovation.

The widely expected introduction of autonomous technologies will lead to changes in ways that have not been studied well enough to date in terms of holistic effects. The challenges in terms of individual/small group travel and logistics services by road are significant, especially in the realms of insurance and accident liabilities, human-machine behavioural interfaces, personal security against terrorist and other abuses of the technologies, and in terms of impacts on congestion and infrastructure capacity.

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23. See Urban Studies research article: **Traffic Congestion's Economic Impacts: Evidence from US Metropolitan Regions**.

24. The Northern Way Transport Compact: The Economic Case for Transport Investment in the North, March 2011.

Clearly, autonomous vehicles are seen as a threat by the automotive industry – hence their rapid adoption of development programmes in this area, which are being progressed initially as an extension of existing driver assistance facilities. Autonomous vehicles offer a number of potential social and quality of life advantages – for instance non-emergency ambulance travel. But claims that they could be some kind of solution to urban congestion and to the need for parking space provision are probably unduly optimistic. Indeed, analysis of driver behaviour, including at the pinch-points of the road network (junctions) where practice (especially in major urban areas on congested networks) is observably in breach of safety guidelines on breaking distances, suggests that the introduction of AVs will more likely reduce network capacity if they are to operate at acceptable safety standards – noting that these are likely to need to be set at more stringent levels than drivers impose on themselves.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

The UK lags most European countries in both the provision and density of urban rail systems, and in stark contrast to (say) France where there has been a programme of urban transit investment lasting 40 years. With a lot of focus on vehicle automation, there is a significant risk that the virtues of high capacity transit systems will be overlooked, in the belief that fully autonomous car-sized systems will be able to use existing road networks more efficiently. Urban transit systems still offer the best value because they:

i. are compatible with high quality urban streets and spaces

ii. reduce dependence on less energy-efficient and more polluting travel modes

iii. provide sufficient capacity for travel peaks

iv. offer reliable connectivity with high levels of travel time predictability, which has a productivity benefit to the urban economy.

With city/conurbation level autonomy having receded each decade since 1968 when the first city-based Passenger Transport Executives were formed, the scope for the public sector to make informed decisions in answer to Question 14 is limited. Choices on urban rail network usage are generally determined centrally by DfT, following consultation, in franchise specifications.

Only one new Light Rail system has been introduced in the UK in the last ten years (in Edinburgh, where ridership has exceeded forecasts). This is in contrast with (say) the USA where 16 cities have started urban rail transit schemes since 2000.

Better use of existing rail networks for access to urban centres can be achieved as a by-product of high-speed rail (freeing up network capacity by removing non-stop inter city services) – and since this benefit has in effect been ignored in the business case for HSR, this can represent a very cost-effective approach.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

The evidence available shows that high-speed rail can best achieve sustainable long term growth, offering a positive, 'good' economic return, out-performing other transport alternatives.

DfT started to look at inter-regional transport policy issues with its multi-modal studies in the early 2000s, followed by the sustainable transport studies ('TASTs' and 'DASTs') until their abandonment in 2010 before a coherent picture or set of conclusions emerged.[25]

But one piece of work was completed at this time. Triggered by an unsuccessful rail franchise bid that had been made against a 20-year time horizon and had recognised the network capacity challenges that lay ahead, the shadow Strategic Rail Authority commissioned consultants to look at north-south high-speed rail in Britain. Led by Atkins, this work was eventually published by DfT in January 2004[26]. The consultants had been asked if there was a case for north-south high-speed rail in Britain and if so how such an investment would perform in cost benefit terms compared with alternative investment policies. The comparison was made with conventional rail upgrades, with building new non-high speed rail lines and with expanding the motorway network. High-speed rail performed best, delivering the highest benefit cost ratios of these options.

While the Atkins study had initially concentrated on a new line between London, the West Midlands and the North West (Manchester), it also examined network configuration and concluded that a second north south line should also be built, on the eastern side of the country, linking London and Newcastle.

Ministers were not minded to act on these conclusions, where the imperative to act rested on a projection of continuing demand growth and a forecast that by the mid-2020s the West Coast Main Line (followed a few years later by the Midland Main Line and the East Coast Main Line) would be unable to accommodate any more trains. In effect the strategic national rail network linking the country's major cities would be full – but 20 years hence.

In fact, demand grew more strongly than had been assumed in these studies and the West Coast Main Line is in effect full (in the sense that no more trains can be operated) already. There remain some further train lengthening options that could be instigated between now and the projected opening of HS2 Phase 1 in 2026. But it is notable that from the outset, the case for high-speed rail clearly rested on questions of capacity.

25. Towards (and developing) a sustainable transport system, respectively.
26. See ***A Vision for the High Speed Line***.

In December 2006, the Eddington Transport study was published on behalf of DfT and HM Treasury. It is still regarded as the most comprehensive examination of the relationship between transport investment and the economy. It was widely held to have rejected high-speed rail, but as **Sir Rod Eddington made clear in 2007** in evidence to an ensuing Transport Select Committee he was in fact a supporter of HSR using proven technology.

In a climate of Government inaction and scepticism, Greengauge 21 was formed and established a Public Interest Group that carried out the next major piece of work on high-speed rail in Britain. Released as the report ***Fast Forward*** in September 2009, this report provided evidence on the economic value of high-speed rail as a national network, with benefit:cost ratios identified for key route segments – see summary table, below. Contemporaneous work by Network Rail ('New Lines') found a positive cost benefit ratio for a high-speed line from London to Manchester and Glasgow.[27]

Corridor	HS-NW		HS-NE		HS-TP	HS-WW	HSR Network
New HSR infrastructure	London–Birmingham / Manchester [a]	Manchester–Glasgow / Edinburgh	London–Leeds / Newcastle	Newcastle–Edinburgh	Manchester–Sheffield	West of Didcot (part)	**All**
Benefit : Cost Ratio	2.9 : 1	7.6 : 1	2.0 : 1	1 : 1	1.3 : 1	2.8 : 1	**3.5 : 1**
Net Present Value (£bn, 2002 prices)	£24bn	£23bn	£15bn	£0bn	£1bn	£3bn	**£63bn**

[a] This includes the costs and benefits of the connections to Heathrow and HS-CT.

Note: NPVs do not total because of phasing assumptions

By then, all of the national political parties had expressed their support for high-speed rail, and HS2 Ltd had been created and was to report in March 2010 with its conclusions on how a HSR line could be best built between London, the West Midlands and beyond.[28]

In our view, the initial infrastructure investment that would best support long term sustainable growth has been properly identified through these developments, and, through HS2 Ltd, implementation is underway. But the best value from high-speed rail is not being achieved because of the lack of a longer term (2050) plan set at a national level. Businesses invest and economies prosper when they can see how current uncertainties – such as an outlook of ever-growing congestion and travel time unreliability – will be overcome. The development of such a plan with a staged implementation strategy would help:

i. plan the best use of HS2 (including its onward connections, a matter set to be examined systematically during 2017) and

ii. best support sustainable growth nationally.

27. This work was funded by: ATOC, Association of North East Councils, BAA, Birmingham City Council, City of London Corporation, Edinburgh City Council, England's Regional Development Agencies, Glasgow City Council, GMPTE, Network Rail, Newcastle City Council, Northern Way, PTEg, Railway Industry Association, Strathclyde Passenger Transport, Sestran, Sheffield City Region, Transport for London.

28. Department for Transport High Speed Two, HMSO Cmnd 7827.

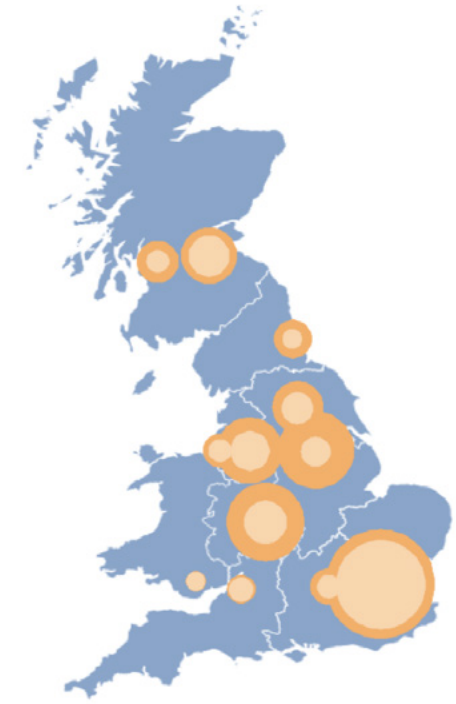
In short, Greengauge 21's contention is that a 2050 strategy with its associated plans is the investment that will best support sustainable growth rather than a further specific piece of infrastructure.

The Fast Forward report provided an initial view on what a long term 2050 strategy for national high-speed rail might look like, and this is shown in the diagram below.

This diagram was produced ahead of HS2 Ltd publishing its plans for the first phase of HS2, but this was anticipated reasonably accurately in terms of the lines coded red in the diagram ('existing or planned'). It can be seen that it was anticipated that HSR would be adopted through a combination of new alignments (coded black) and upgrades to existing lines (coded in green). A key focus was connectivity to airports as was interconnectivity between the various high-speed lines.

It is Greengauge 21's intention to update this work during the course of 2017 to take account of Phases 1 and 2A of HS2 and emerging priorities from the regions and devolved nations. This could form a useful input to the NIC's work on its Assessment.

With major regional economic variations, and a diverse set of plausible scenarios for regional population change[29] (and thus travel demand), the spatial distributional impacts of HSR is an important issue: there have been concerns that its effects will be to strengthen London's economy at the expense of the regional economies. The transformational impact of HSR on spatial economies was studied by KPMG in work undertaken for Greengauge 21 in 2010[30]. This showed very clearly that the accessibility gain – and the projected economic uplift from improved business connectivity – was most strongly felt in the regions/devolved nations, not London.



Existing business connectivity score

Business connectivity score in High Speed Rail Scenario

Source: KPMG analysis for Greengauge 21, 2010.

It is true the evidence from other countries is mixed on this point[31], but the scope for consequential shifts in development patterns and economic activity arising from transport investments is not permitted to enter transport economic appraisals (although it will now be allowed in strategic cases, under the latest DfT appraisal guidance). Yet the evidence of regional economic upturn is now starting to emerge on the ground in Britain as HS2 Phase 1 nears Parliamentary consent. In Birmingham, the decision to locate a large part of **HSBC's UK activity** in the city has been partly attributed by the company to HS2.This experience is consistent in its timing – well in advance of service start-up – with the impact of the development of the TGV network in France.

29. Figure 4 ice proceedings Feb 2017.
30. See KPMG report for Greengauge 21, **Consequences for employment and economic growth**.
31. See 2006 Greengauge 21 report, **High-Speed Trains and the Development and Regeneration of Cities**.

Private sector developments are signs of economic confidence built around the transformation in travel opportunities that HSR can bring – and they are arising in 'the provinces' – not the capital. The advantage of an overall strategy for HSR will be that such effects can be spread more widely and inclusively across the nation. The aim would be to bring the whole of the nation – in appropriate and affordable degree – the level of connectivity and capacity gains to rail that HSR provides. This means that the national strategy should be thought of as being an inter-city or inter-regional rail strategy including – but not restricted to – new-build HSR, and with explicit consideration given to improving connectivity to places that are often regarded as peripheral or second tier. The strategy would focus on the outputs of HSR, in terms of services (which should precede considerations of infrastructure) and enhanced connectivity and capacity, with a central focus on the relative merits of upgrade and new-build and combinations thereof.

Greengauge 21
February 2017

Greenpeace submission to National Infrastructure Assessment call for evidence

The call for evidence is welcome

Greenpeace overall comment is that all Infrastructure needs to be compatible with a zero greenhouse gas emissions energy system (power, heat, transport) given the need to hit global temperature targets of 'well below' 2 degrees Centigrade. We assume that some sectors like agriculture and waste will be hard to eliminate such emissions from. Some infrastructure is less compatible than others – a further runway at Heathrow, with associated transport infrastructure, isn't. This in turn means that the highest value infrastructure is that which supports a low energy low emission society.

All infrastructure should also minimise impact on biodiversity and natural environment, which needs to be a key criterion with respect to choices of infrastructure provision.

Turning to specific observations on the questions in turn:

Question 1: "Long term sustainable growth" means low or zero emission. Otherwise, by definition, it is not sustainable. Infrastructure that cannot pass this test will need to be replaced/not used, and is therefore low value.

Question 2: Almost all international gateways for the UK involve aviation and shipping which will need to be low or zero carbon (see above). In the absence of clear routes to zero emission travel in those modes, growth is not sustainable and ultimately of low value. No assumptions should be made that freight and passenger travel can expand unconstrained in aviation and shipping.

Question 4: the introduction to this question includes the effect of the rebound effect and mentions the canard about lower prices leading to increased overall consumption. As UKERC demonstrated a decade ago[1], such overconsumption 'backfire' of efficiency policy is most unlikely in a developed economy in mature sectors. It should not be treated as a serious proposition for UK.

Question 13: demand for future road space is unclear owing the development of several converging factors.

a) Limits imposed by air pollution in urban centres along with
b) Electric vehicle availability and new transport models like zipcar or carplus
c) Attitudinal shift in younger generations toward car ownership and transport services (e.g. Uber) leading to declining car use, at least in major cities[2]
d) Imminent arrival of autonomous vehicles
e) Absence of clear low carbon options for HGVs despite carbon constraint

The question rightly asks about travel patterns, because given these listed factors, assuming that better infrastructure provison involves building more roads would be premature and not well

[1] http://www.ukerc.ac.uk/programmes/technology-and-policy-assessment/the-rebound-effect-report.html
[2] https://www.transportxtra.com/shop/books/?id=375

founded, even in the absence of carbon constraints. Trends for freight usage of roads are increasing it is true, but the limits imposed by (a) earlier in this para will bite on those delivery systems.

Question 15: Greenpeace has long advocated road user charging and better public transport[3] as both an equitable approach and one that assists the public purse given the continued decline in revenues from transport as vehicles become more efficient. The 'uberisation' of transport in cities affects financial charging delivery but does not fundamentally alter the conclusion that road user charging will become essential unless HMG can find other major sources of revenue.

Question 19: The next step on heat decarbonisation infrastructure needs to be a decision to go-ahead in this Parliament with large scale pilots[4] of the contending technologies that can be widely applied. These technologies include hydrogen production distribution and use (in home and commercial premises), electrification using ground source and water-source heat pumps, and district heating with hybrid systems for heat supply. These larger scale pilots are needed for understanding the technical challenges at reasonable scale, and for cost discovery. The right solution for decarbonisation of heat may well not be the same for all parts of the UK, given that the most cost effective in some places may be local e.g. geothermal, industrial waste heat.

Alongside technical pilots there will need to be institutional innovation such as a heat regulator to determine what projects are appropriate for development, and what charging arrangements should apply.

Question 20: Given the declining cost of renewables, in particular solar and wind, the most likely low cost system is likely to be predominantly renewables based, with system features of interconnection, storage and demand response. Such a system would need to interweave significant local generation with large scale generation assets. Indeed in 2010 an EU wide analysis by, amongst others, Imperial College and MacKinsey[5], demonstrated that a high renewables electricity system (80%) was of essentially similar cost to that of a much lower RE penetration (around 40%). At the time, estimates of costs for 100% renewables system were about 10% higher[6] than those of 80% penetration (with 10% nuclear, 10% CCS), but since then we have seen very sharp drops in cost of storage and solar and wind, enabling a fully interconnected Europe to be cheaper than then imagined. Greenpeace is not aware of a similar modelling exercise undertaken since. Certainly the uncertain future and high cost of nuclear new build, and the essentially unknown costs and stuttering of UK CCS policy, suggests that any system not based predominantly on renewables faces high delivery and cost risks. The major scalable renewable technology, offshore wind, looks likely to have a sharp downward turn in costs at the next auction round later this year given cost decreases in auctions in Netherlands[7] and Denmark[8]. In both cases these windfarms will be generating power at lower cost per MWh than new gas plant. Longer term storage options will not be confined to

[3] http://www.greenpeace.org.uk/sites/files/gpuk/IPPR_Low_Res_web_A4.pdf
[4] http://www.green-alliance.org.uk/UK_low_carbon_investment_priorities.php p13
[5] http://www.roadmap2050.eu/project/roadmap-2050
[6] Matt Philips, ECF, Pers Comm
[7] https://www.government.nl/latest/news/2016/12/12/dutch-consortium-to-construct-second-borssele-offshore-wind-farm
[8] http://energydesk.greenpeace.org/2016/11/15/offshore-wind-power-vattenfall-denmark-record/

batteries and include the rapidly developing power-to-gas technologies[9]. Indeed in advance of these new technical developments, analysis of system costs of integrating renewables have been undertaken by Imperial[10] and Aurora[11] and far from being prohibitive, add only a little to costs. Certainly the 'intermittency' penalty is nowhere near enough to justify the much higher costs from e.g. Hinkley Point, contrary to government claims.

Question 21: There is an absence of systematic appraisal of the implications of large scale electrification of transport. However there have been some experiments in the Low Carbon Network Fund research project[12] funded by Ofgem with £500mn public money. We are not aware of any proper analysis or publication revealing insights from these funds, and urge NIC to get this info from Ofgem. Secondly the power storage potential of electric vehicles is considerable and already Nissan are investigating the use of vehicles to support grid operations ('vehicle-to-grid power') allowing for better and more efficient infrastructure solutions[13].

[9] https://www.theguardian.com/environment/2017/jan/19/reasons-to-be-cheerful-full-switch-low-carbon-energy-in-sight
[10] https://documents.theccc.org.uk/wp-content/uploads/2015/10/CCC_Externalities_report_Imperial_Final_21Oct20151.pdf
[11] http://eciu.net/blog/2016/whatever-happened-to-the-hidden-costs-of-renewables
[12] https://www.ofgem.gov.uk/electricity/distribution-networks/network-innovation/low-carbon-networks-fund
[13] http://www.newspress.co.uk/public/ViewPressRelease.aspx?pr=68198&pr_ref=32775

HAMPSHIRE
chamber of commerce

A powerful voice for your business

RESPONSE BY HAMPSHIRE CHAMBER OF COMMERCE
TO THE CALL FOR EVIDENCE
FOR THE FIRST NATIONAL INFRASTRUCTURE ASSESSMENT
BY THE NATIONAL INFRASTRUCTURE COMMISSION
OCTOBER 2016

The National Infrastructure Commission (NIC) was established in 2015 to provide the government with impartial, expert advice on major long-term infrastructure challenges and, as an executive agency of HM Treasury, to produce a National Infrastructure Assessment (NIA) once in a Parliament. The NIC's objectives are to support sustainable economic growth across all regions of the UK, improve competitiveness and improve quality of life.

This response by Hampshire Chamber of Commerce to the NIC's Call for Evidence for the first National Infrastructure Assessment (NIA) sets out the business community's priorities for long term economic infrastructure investment to benefit Hampshire's economy for the next 30 years. As a key participant in the engagement of the local business community, Hampshire Chamber of Commerce makes this submission along with local authorities, Local Enterprise Partnerships and other organisations invited by NIC to share their plans relevant to economic growth in their area.

The Chamber's submission is based on the views of Hampshire Chamber business members from its area committees and two sector committees and answers question one by suggesting the highest value infrastructure investments that would support long term sustainable economic growth in our region. In answering this question, the submission covers the seven themes in the same order as identified in the NIA Call for Evidence, October 2016, namely: transport, digital communication, energy, water and waste water, flood risk management, solid waste and cross-cutting issues.

TRANSPORT

a) Logistics connectivity and freight capacity

The three international gateways in south Hampshire which function as significant national infrastructure assets are Southampton International Airport, the port of Southampton and the Portsmouth Naval Base and Commercial Port. Highways England's Strategic Road Network recognises ABP Southampton Port as a nationally significant international gateway. It is the UK's number one export port handling over one quarter of the UK's seaborne trade with non-EU countries, exporting £40 billion of British manufactured goods including £36 billion of exports destined for markets outside of the EU.

It is clear from these statistics that the Port's future role in the national economy will become even more significant after Brexit, especially as it has already outperformed forecasts for growth in trade by 2020 for the cruise sector and by 2030 for the automotive sector.

b) Road Transport infrastructure schemes

It is crucial, therefore, that transport infrastructure schemes to improve access to the Port of Southampton and support its future expansion are implemented as early as possible, such as M3J9 / A34 at Winnall, M271/A35 Redbridge Roundabout, as well as the Millbrook Roundabout at Dock Gate 20 which is not yet committed. Local businesses and residents already judge as unacceptable the existing delays on Port routes into the city when cruise liners are also berthed in Southampton.

c) Rail Freight Interchange north of Southampton

A major road/rail logistics and freight interchange depot is needed for Southampton in the Nursling area to help improve cargo handling for Southampton Docks, thereby reducing the requirement for HGVs to travel into the city which is already preparing its Clean Air Strategy/Zone.

d) **Passenger Transport Connectivity**

Transport connectivity challenges within the Solent area are partly due to the geography. In particular Portsmouth to Southampton rail connectivity is slow (45 - 60 minutes for a 20 mile journey), as is rail connectivity to Southampton airport from Portsmouth and the east, with preference often given to travelling via Gatwick airport as a result of this.

e) Solent Metro

The proposal for a Solent Metro service is to provide an integrated public transport solution East/West across South Hampshire to encourage a modal shift away from using the M27 motorway like a local road. The intention is to free up highway capacity to improve total delay to vehicles which is costly in terms of productivity and competition for business, as well as for the environment.

f) Heathrow Southern Railway

When compared to other locations with similar proximity to London, rail connectivity to London and Heathrow Airport from the Solent region is slow. The Heathrow Southern Railway proposal is the privately funded solution that will transform Heathrow's rail access from the south and help with capacity on trains into London. Even before the third runway, Heathrow airport is forecast to handle as many as 90 million passengers a year by 2030, up from 75 million today. Rail connections from central London to Heathrow are good, but from the South and South West travelling by road remains the more convenient and often the speedier option.

Heathrow Southern Railway will provide new direct links from Basingstoke and Guildford via Woking to Heathrow, Old Oak Common and Paddington (for interchanges with HS2 and Crossrail); as well as from Waterloo, Clapham Junction, Putney, Richmond and Twickenham to Heathrow. The result will be comprehensive, easy rail connections across Southern England that can be completed by 2025, including only a short stretch of new railway alongside the M25. When compared to roads, Heathrow Southern Railway will offer faster, more reliable journeys, a lower environmental cost and better air quality, as well as much improved national rail connectivity for the international air passenger arriving at Heathrow to do business in the UK.

g) Basingstoke Rapid Transit proposal

A Rapid Transit Scheme would be of significant benefit to the Basingstoke town economy. It would enable the connection of residential areas and employment sites with a real alternative to the car and would help manage Basingstoke's traffic congestion, which is perceived as one of the town's most significant barriers to prosperity.

h) Bus Rapid Transit Extension – Gosport / Fareham

Improved productivity comes from locating new housing and commercial development close to good quality public transport, cycle and pedestrian links and the facilities residents and users require. In this respect, it is essential that plans are made for extending the existing Bus Rapid Transport system to its wider area starting with continuation south to the congested Gosport peninsular, then north from Fareham to the Welborne Garden Village currently being planned.

i) **Welborne and M27/Junction 10**

Lack of funding is causing unacceptable delays on a solution for Junction 10 on the M27 which is needed for plans to progress for the Welborne garden village and employment land near Fareham.

DIGITAL COMMUNICATION

j) Multi-charging to reduce the cost

To meet existing requirements for better broadband speeds in business parks and rural communities across Hampshire, consideration should be given to the introduction of multi charging for neighbouring broadband customers to reduce the cost.

k) Planning measures for a utility service

To meet future needs, the fastest broadband speeds should now be provided as a utility service for all new business and residential developments through the use of Section 106 planning measures.

l) Broadband – delivering what is needed

Broadband is of such social and economic importance that it has become an essential utility and, per force, should be treated as such. From a business perspective improvements in broadband speeds are imperative to ensure global competitiveness. In this context it is disappointing to note that the UK's global ranking fell from 17th to 19th during 2016 (per the Akamai Speed of the Internet Study).

There are approximately 7,860 businesses in the New Forest rural area and 65,000 in Hampshire, excluding any micro-businesses which are not VAT registered. There still remains a significant number of broadband users in rural areas that either receive download speeds of less than 2Mbps, or continue to fall short of the so-called SFBB target of >24Mbps. Urban areas benefit disproportionately as illustrated by Southampton with no-one who receives less than 2Mbps, whereas the New Forest has 3,077 people. By the same token, Portsmouth has just 2,851 people who receive less than 24Mbps and Test Valley has 18,077.

These comments serve to shed a degree of light on the glaring disparity between home-workers and SMEs, in particular in rural and urban locations. This is an example of the large gap between policy and practicality on infrastructure, which is holding up productivity in the UK.

ENERGY

m) Electricity Interconnector between France and England

The early installation of the interconnector between France and Fareham in Hampshire to link the electricity transmission systems of Great Britain and France will help to sustain energy supply, as well as the upgrading of the electricity cables by SSE to protect future supplies of electricity.

n) Automated Network Management

We should take advantage of the speciality in sensors that we have locally to create ANMs – automated network management. We also have a wealth of talent in battery storage and development of this should be supported by the Solent LEP and Universities.

o) Tidal energy

The Port of Southampton has the natural advantage of a double high tide which benefits shipping. It could also provide the unique advantage of tidal energy, the development of which should get top priority, given that Southampton is also one of five cities, and the only port, identified as having the worst air pollution.

p) **Energise Solent**

Energise Solent is delivering the Energy Strategy for the Solent region. This initiative, backed by Hampshire Chamber of Commerce, Solent Local Enterprise Partnership, Partnership for Urban South Hampshire and Future South is seeking to provide inward investment in the region and enable a significant portion of the 98% of the spending on energy within the region to be kept within the region for the benefits of sustainable growth. The initiative is seeking the construction of new energy generation capabilities including in community renewables, district heating schemes, wood fuels (particularly for those living off the gas grid), combined heat and power plants and offshore renewables.

Alongside new generating capacity Energise Solent is seeking to invest in new demand management and reduction programmes and in particular is encouraging new battery storage technology. Initially, we have a ‘shovel ready’ proposal to apply battery storage alongside a 1MW solar farm within the Eastleigh Borough Council area.

WATER AND WASTE WATER

q) Incentivising water efficiency

Southern Water is working with developers, local authorities and regulators to trial a variable infrastructure charge. This will see the connection fees waived if a developer proves they have installed water efficiency devices in each new home. If this pilot is successful, then the water company will look to extend this approach across the South East region.

The Universal Metering Programme gave Southern Water access to a vast amount of data on customers' consumption habits – meaning the company can continue to target water efficiency support in areas with higher consumption. Hampshire Chamber of Commerce is actively promoting the programme of water efficiency visits – including retrofitting water efficient devices and encouraging behaviour change for small businesses.

An independent Green Alliance report estimated that ambitious water efficiency programmes could save customers almost £80 per year through reduced water and energy bills, with up to £20 of this coming from reduced energy consumption. The concept of linking lower water consumption with reduced energy bills helped inform Southern Water's messaging, namely save water, energy and money. Demand reduction could also help reduce bills by reducing the need for, or deferring, capital investment.

FLOOD RISK MANAGEMENT

r) Urban Regeneration with Flood Protection

Urban areas at risk of flooding and in need of regeneration should be redeveloped as a priority with an appropriate element of protection from flood risk designed into the new scheme. The current regeneration proposal for Chapel Riverside in Southampton is a good example of this.

SOLID WASTE

s) **Use the waste hierarchy**

The waste hierarchy sets out five steps to dealing with waste in the most sustainable manner possible. It gives top priority to **preventing waste** in the first place. When waste is created, it gives priority to **preparing it for re-use,** then **recycling**, then other **recovery** such as energy recovery and, last of all, **disposal** (for example landfill). For items correctly disposed of by individuals or businesses, the awarding of tokens, coupons, or electronic credits which can be exchanged for goods with participating retailers could be a successful way of encouraging a change in behavior towards a more circular economy.

CROSS-CUTTING ISSUES

- The increase in population in Hampshire over the next 30 years and how to judge its effect on the capacity of infrastructure.

- The increase of business rates collected by local authorities and how to ensure their accountability for the infrastructure they supply.

CONCLUSION

Hampshire Chamber of Commerce looks forward to further engagement on behalf of business with the roundtables and seminars being planned as part of the NIC's open and transparent programme of engagement to support this call for evidence on the NIC's first National Infrastructure Assessment.

Hampshire Chamber of Commerce
Email: Tel:

Hampshire Chamber of Commerce is one of the largest business representational groups in the UK. It represents the voice of local business across the county to the Enterprise M3 LEP and the Solent LEP via the Hampshire & Isle of Wight Business Alliance of which it is the founding partner. This substantial Hampshire Chamber business network engages businesses of all sizes and in all sectors, whether throughout Hampshire with its two sector committees for Planning & Transport and Professional Services, or in local groupings via its seven Area Committees for Southampton, Eastleigh, Portsmouth, Rushmoor & Hart, Basingstoke, Andover and Winchester, as well as six affiliated membership organisations in Alton, Alresford, Andover Town Centre, Romsey, Stockbridge and Lymington. It is also the lead organisation for Creative South and Future South.

P1.1/pf/064

17 February 2017

NIA Call for Evidence
National Infrastructure Commission
11 Philpot Lane
London
EC3M 8UD

Hampshire County Council

[redacted]
[name redacted]
[job title redacted]

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Dear Sir,

NATIONAL INFRASTRUCTURE ASSESSMENT CALL FOR EVIDENCE
Response from Hampshire County Council

We were pleased to assist the Commission in arranging and hosting its South East stakeholders meeting, which took place at our offices in Winchester on 20 January. During that day we discussed with the Commission the key priorities for Hampshire concerning future economic infrastructure, including the county's strategic transport infrastructure priorities, as well as our concern that the current difficulties in funding and delivering timely local infrastructure is adding pressure to more costly strategic national infrastructure. We would ask that the points raised on 20 January, including wider South East issues, as summarised in Appendix 1, are taken into careful consideration alongside our response to the Call for Evidence which stresses the need to streamline funding and planning for infrastructure.

Hampshire County Council is strongly committed to promoting economic growth and meeting the needs of its expanding communities, whilst also wishing to care for its natural environment which is itself an important economic asset. The Council works closely with its partners, including 13 local planning authorities, to encourage a more strategic approach to planning and development. It is acutely aware of the interdependencies that exist between local, regional and national infrastructure. It considers improving the strategic transport links summarised in this response [redacted] securing better digital connectivity and greater environmental [redacted] long term prosperity of our 1.34 million residents [redacted] connections; faster rail services to & from Londo[redacted] western access to Heathrow Airport; and impro[redacted] road network are all reasons why the County C[redacted] actively involved in working to establish a Sub National Transport [redacted] the South [redacted] why it is so keen to engage with the National Infrastructure Commission.

Whilst the focus of the Commission is rightly on national economic infrastructure, we believe it is important for it to take account of the funding and planning constraints affecting upper tier local authorities, and also major infrastructure providers. Like many county councils, Hampshire County Council faces a growing infrastructure deficit which will have an increasingly [redacted]

For example, during the regional visit last month the Commission visited a major developmen[redacted]looville) located in southern Hampshire. This i[redacted]hich already runs at full capacity during peak hours. With the County Council now struggling to fund critical local infrastructure, including roads to support such major new development sites, further pressure is likely to be added to the national strategic network, such as the M27. This in turn, is likely to have more severe consequences for the wider economy. Therefore, we hope that the National Infrastructure Assessment will take account of the need for appropriate infrastructure at all spatial levels, so as to better manage demand and maximise the economic efficiency of those assets.

Hampshire County Council is acutely aware of how important the county's strategic road network is to the local, regional and national economy, particularly the A34/ M3 corridor and the M27. A key priority for us is to secure delivery of improvements to Junction 9 of the M3 as soon as possible and to secure the upgrade of the A34. We are also conscious of the importance of the potential expansion of the port of Southampton to the UK and the need to address the constraints on surface access to this vital international trade gateway. Therefore, we would like to ask the Commission to consider undertaking a study of the national economic benefits of investing in the strategic transport corridor between the international port of Southampton and the Midlands, including road and rail links. The importance of this strategic transport corridor was repeatedly emphasised by various South East local authority leaders and private sector partners who attended the NIC's South East stakeholder meeting and it is a priority that is strongly shared by the Hampshire County Council.

We trust the attached response and accompanying note will be helpful. Hampshire County Council would be pleased to provide further assistance and information on any area covered in our response that may be of particular interest to the Commission.

Yours sincerely

[redacted]

[signature redacted]

[name redacted]

[job title redacted]

Hampshire County Council

Enclosures:
- Summary note and maps from NIC meeting on 20th January 2017
- County Council's response to the Call for Evidence.

Response by Hampshire County Council to the National Infrastructure Commission's Call for Evidence – Feb 2017

Background / Contextual Information about Hampshire

Hampshire's economy, which is heavily road dependent, is currently worth £36.5bn (£47.8bn when including the Portsmouth and Southampton), is projected to grow by around 2% per annum over the longer term. It is part of the highly competitive South East region which, during 2002 – 2012, returned a net profit of £80bn to the Treasury, exceeding contributions from London.

However, Hampshire's own productivity levels lag behind the rest of the South East and its growing infrastructure deficit acts as a brake on further growth. Both its two Local Enterprise Partnerships (Enterprise M3 and Solent) agree that targeted investment in strategic infrastructure is needed in order to help Hampshire reach its full economic potential and to enable it to maximise advantages from its economic assets and strategic location, including its close proximity to London, Heathrow, Gatwick and the fact it is UK's gateway to global markets using the International Port of Southampton.

Hampshire is one of the largest counties, covering 1,400 square miles, 85% of which is rural and with one third of its area within a National Park or designated Area of Outstanding Natural Beauty. The vast majority of Hampshire's residents live in urban settlements, the main concentrations being in the north east of the county (Farnborough / Aldershot), with free standing towns in rural hinterlands through the centre and north west of the county eg Basingstoke, Winchester, and Andover, and the peninsular land which characterises the main concentration of urban land in the towns of south Hampshire, between the two cities of Portsmouth and Southampton.

Hampshire's large rural geography and its growing population, which currently stands at 1.35m but is expected to grow by a further 13.5% by 2039, coupled with its high housing costs, vulnerability to complex flooding, and its congested transport network, all contribute to its socio-economic challenges.

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?
Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

Hampshire's long-term sustainable growth is heavily dependent on improving its connectivity, both digital and mobile communications and its physical connections through better road and rail infrastructure in the county and beyond. Hampshire's widespread geography, including its large rural areas, is partly why better connections and links to its strategic hubs are so important. Given the area's growing infrastructure deficit such targeted, high value investment, as summarised below, is crucial if the

county is to meet the needs of its growing population and maintain its economic competitiveness and national contributions to the Exchequer.

This case for was put to the Commission, as part of the wider South East regional discussions, which took place in Hampshire on 20th January – see **Appendix 1.**

The highest value infrastructure investments to support long-term sustainable growth in Hampshire and its wider region are summarised below:

- Improve strategic routes between the Port of Southampton and the Midlands, including the upgrade of A34 to motorway and better rail routes for freight which avoid causing delays to passenger rail services.

- A road link between M4 with M3 to help accommodate growth, including significant housing growth planned to the west of Basingstoke

- Southern access to Heathrow

- Improve rail connections between Hampshire and London (both capacity of trains and the speed of journeys)

- CrossRail 2 to relieve pressure on services into London

- Urban Mass Transit (bus and light rail links in South Hampshire, including between the cities of Portsmouth & Southampton)

Hampshire's call for improved surface access to international gateways located within its area, such as the international port of Southampton, or within close proximity to Hampshire, such as better access to Heathrow airport, was strongly endorsed by other South East authorities and private sector partners who attended the NIC's regional event on 20th January 2017.

It should also be noted that businesses frequently cite uncertainty about the provision of infrastructure which is needed to support new development (together with skills shortages) as the main barrier to economic growth and inward investment. Poor connectivity is curtailing employment opportunities and stifling the area's productivity which currently lags behind both the national and regional average.

Overall, Hampshire is home to over 40 key development sites which have either been allocated or have planning permission for significant employment or mixed use development. These sites support the planned growth in housing provision across the county and their delivery is critical to providing jobs for our growing population, supporting the economy and ensuring that Hampshire continues to prosper. A map showing the location of these sites and their development potential can be found on our Invest in Hampshire website.

It is also important to take into consideration the fact that Hampshire, like other counties, face a growing infrastructure deficit, which is why it has called on the Government to reverse the 2012 planning reforms that restricted the pooling of S106 developer contributions and why it continues to put forward proposals that could radically improve

the delivery of local strategic infrastructure which has a direct impact on wider national infrastructure. For example, given the failings of the Community Infrastructure Levy and current S106 developer funding arrangements, we believe serious consideration should be given to replacing the current system with a Strategic Infrastructure Tariff. This would help ensure delivery costs are covered at the point of uplift in land values and, critically, would provide the certainty that is needed to fund up-front key infrastructure, such as local roads and schools. It would enable the establishment of county wide (or sub regional) Infrastructure Funds which could also involve the retention of first time sale Stamp Duty, thus ensuring those receipts are used to fund infrastructure that is associated with new developments.

There is also no doubt that greater certainty over timely and adequate provision of infrastructure is vital to lever in private sector funding and to overcome public hostility to new development. Furthermore, whilst county councils struggle with local infrastructure funding deficits, greater pressure is being placed on more costly national infrastructure which will be of direct concern to the Treasury.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

In order to help maximise the UK's international competitiveness better infrastructure is needed to enable the efficient flow of people, goods and services. Hampshire's strategic transport network faces severe capacity constraints, rising levels of congestion, partly exacerbated by funding pressures facing the local highway network, all of which disrupt the efficient flow of movement. With added growth pressures in the area, the increasing unreliability of the strategic network which runs through Hampshire to major international gateways, adds to the expense of goods and thus undermines the UK's international competitiveness.

There are 4 significant international gateways within close proximity to Hampshire, namely Heathrow, Gatwick, and the international sea ports of Southampton and Portsmouth. The flow of goods, people and services through these gateways is hugely significant in number and value to the UK with, for example, the Port of Southampton already generating £1bn of GVA for the UK economy, and handling £71bn of International trade. The port currently handles 40% (£36bn) of the UK's exports to non EU countries and has major ambitions to expand. However, its expansion is partly held back by constraints of the strategic transport corridor leading down from the Midlands. The draft Port of Southampton Master Plan (2016 -2035) identifies current and future levels of growth if exports were neither constrained by land availability or the transport network. It cites the potential to double trade volumes over the next 20 years in high value trade exports, including luxury vehicles for export which are produced in the Midlands or the North of England but are dependant on efficient transport down through the South to the Port for export.

Realising the full economic potential of UK's international gateways, including the local, regional and national benefits they can provide, is heavily dependant on improving surface access to those assets. It is why Hampshire's strategic transport investment priorities are largely focussed on its international gateways [see above] and why it welcomes regional calls for the Commission to undertake a study on this important issue

and would especially welcome a study on the economic benefits of improving the strategic corridor between Southampton and the Midlands.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Prosperous and sustainable communities depend upon effective strategic planning. The country's housing needs will remain unresolved unless strategic planning is properly embedded at a sub regional level, to ensure those needs are considered alongside strategic and local infrastructure requirements.

A strategic approach and more certainty over funding to deliver timely infrastructure is needed to encourage and support growth. As indicated earlier proposed housing developments will continue to be opposed and delayed if there is little or no confidence of the associated required infrastructure being delivered. Economic growth and inward investment also depend on certainty over the planning and delivery of infrastructure, particularly digital and mobile communications and transport infrastructure.

We strongly endorse the view of Enterprise M3 LEP which calls for a coordinated and integrated approach to infrastructure to unlock and regenerate key sites by accelerating housing growth through the delivery of upfront infrastructure. This needs to include roads, schools and digital communications, as well as environmental infrastructure such as effective flood defences and energy security.

The introduction of the Community Infrastructure Levy and pooling restrictions on Section 106 developer funds has exacerbated Hampshire's growing infrastructure deficit, especially given the distributed nature of development across the county where 50% of new housing will come from small or medium sites. The County Council can provide detailed evidence on request to illustrate how those changes have led to significantly less funding being secured. Previously it operated a successful tariff system through Section 106 which enabled the County Council to secure significant levels of funding for education and transport infrastructure, both of which are vital for housing and economic growth. We are still awaiting an announcement from the Government about the future of CIL, following its review but this been delayed till the Autumn Statement. In the meantime, the County Council's own infrastructure deficit, which around £1 billion continues to grow, making it harder to deliver local infrastructure and therefore adding to pressure on national strategic infrastructure. [see response to Q 10]

Statutory spatial plans across county wide areas would help address the current challenges of effective planning and delivery of key infrastructure in two-tier areas, it is the county councils rather than the local planning authorities who are the main providers of strategic infrastructure needed for new developments.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase

when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

Demand management, if applied in an intelligent and evidence based way, can be highly effective in terms of making better use of infrastructure for a wide range of utilities. However it is not a silver bullet and should form part of a mixed approach to the planning and delivery of infrastructure solutions. For example, energy reduction and waste prevention initiatives can help manage demand to a certain extent but each involves variables which carry risks, such as behavioural change for waste prevention which cannot be assumed or accurately predicted for the planning of waste management infrastructure. Similarly there can be mixed responses to pricing initiatives or compulsory water metering which aim to curb usage.

Therefore, regulators should review the current approach being taken by infrastructure providers to provide a more balanced approach that will secure future supply rather than an overly heavy reliance on demand management techniques above.

In terms of transport it should be noted that many demand management activities, such as smarter travel, require revenue support which is becoming increasingly difficult for local authorities to access.

Smarter travel – we have significant experience of delivering and achieving behaviour change in travel. Our experience is that this can lead to around 10% better use of infrastructure through shifting time of travel, mode or reducing the need to travel. The Department of Transport evaluations show benefit to cost ratios of 8:1 through initiatives delivered in Hampshire, including the My Journey initiative. Unfortunately, having been unsuccessful in DfT's competitive Access Fund bid process, it is now uncertain as to whether Hampshire will be able to maintain this level of impact going forward.

Rationing and Pricing – pricing can clearly be used as an incentive or disincentive to travel or as a rationing tool to allow highest value trips to be prioritised. There are extensive studies which make a rational case for pricing mechanisms to be used in transport. However, if applied as disincentives they tend to be very unpopular and are rarely initiated in the UK. There may be a case to assess the full potential of pricing incentives, particularly pricing mechanisms for rail travel. The current UK rail pricing system is based on a London season ticketing model. It is inflexible and unintelligent in terms of pricing which could be used to reward those who travel less. Currently there are no part time worker season tickets or carnet tickets and counter peak journeys are charged at the same rate as London bound journeys.

An example of rationing is the Southampton Port Vehicle Booking System (VBS). Following congestion at port entrances caused by HGVs all arriving at the same time the port implemented the first UK HGV booking system. Whilst there was a nominal administrative charge for each HGV, the rationing of access to a certain time slot meant that congestion at the port gates was eliminated almost overnight.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

The maintenance of existing assets should be based on asset management principles. Hampshire County Council considers this essential to ensure and maintain the economic vitality of the region. Existing infrastructure should be categorised by hierarchy, with funding allocated in a way that maintains or repairs the asset in accordance with that hierarchy.

It is a complex task to compare new infrastructure with the maintenance need for existing infrastructure, however a possible answer may lie around asset management. By applying a consistent lifecycle planning approach to both new and existing infrastructure projects, it may allow like for like comparisons of the cost benefit analysis for either type of project.

The economic value of maintaining strategic infrastructure assets is not appropriately reflected in the funding opportunities available to local authorities. The County Council's experience of developing WEBTAG (DfT standard) appraisals of maintenance schemes is that they offer by far the highest value returns and far outweigh investment in new infrastructure.

Hampshire has many high value strategic assets that were built in the post war period, many of which re now reaching the end of their life or need significant investment to repair them. An example is Redbridge Causeway at the bottom of the M271 which is in need of urgent repair at the cost of around £20m. It is close to the main entrance to the Port of Southampton and is needed to support future expansion of Dibden Bay. The alternative diversion route would add another 10 miles to the journey, involving a motorway already running at full capacity during peak times.

There is also much merit in devolving the maintenance of some national infrastructure assets to a more local level. For example, one highway maintenance contract for Hampshire might deliver more efficiencies than both Highways England and the County Council having their own separate contracts. This links to the need for far greater integration of critical highway routes, both in terms of maintenance and management, such as the M27 in Hampshire and the nearby locally managed network. Therefore we would welcome a review of how the UK's 'strategic' network is defined and potentially establishing a new, integrated, Major Road Network to better maximise the efficiency of this critical economic infrastructure so it can meet future demands.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

The establishment of Sub National Transport Bodies, such as the emerging Transport for the South East, should improve co-ordination and secure greater collaboration between strategic transport infrastructure providers such as Network Rail, Highways England and local highway authorities. The hope is that this will better align national investment programmes with strategic infrastructure priorities identified as necessary to drive forward economic growth in the sub regions. However, there is concern amongst local authorities about the time constraints to inform these national investment programmes.

There is also a need for greater collaboration between utility companies and developers, and for utility companies, such as broadband providers, to actively engage in the earliest stages of the planning process. All utility companies should be encouraged to take a

longer term, planned approach to infrastructure provision rather than their current reactive approach. Whilst the Housing White Paper makes reference to the need to secure timely utility connections so that developments are not delayed, it does not go far enough in stating the Government will monitor performance and, if necessary, will consider obligating utility companies to take account of proposed developments. Hampshire County Council can provide evidence to show it is already is necessary in order to avoid delays in delivery on the ground and expensive retro fitting of broadband.

Given the lead in times for providing significant additional utilities infrastructure there is an inevitable delay in bringing forward larger, more complex developments. This risk could be mitigated if national policy was amended as suggested above to ensure a smoother transition from allocation to delivery.

Therefore we think there is a strong case for the role of regulators, such as Ofgem and Ofwat, to be reviewed and to introduce a duty on them and infrastructure providers to take account of future economic and housing growth projections. Compliance with such a duty by the utility companies would better shape their longer-term investment plans. This would ensure a more balanced approach to managing price expectations of existing customers and with investing in new infrastructure that is needed to future growth. [See Q10]

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?
Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

There is a growing need to streamline funding policies to enable more effective delivery of infrastructure services. New developments should mitigate against the cost of the required infrastructure. This should be funded from the uplift in land values as the development happens through the application of a strategic infrastructure tariff which would provide both clarity and certainty for developers and infrastructure providers alike (please see Q1 and Q10).

This links to the need to streamline the planning system where there is a massive disconnect in two tier areas, with the current system failing to take adequate account of the responsibility that upper tier authorities have as the primary infrastructure providers responsible for waste management, highways, education and social care. This means that most upper tier authorities face a growing infrastructure deficit. For example, following on from Hampshire's Strategic Infrastructure Statement, the County Council undertook more detailed work last year to calculate its infrastructure deficit using all the local infrastructure development plans that take into account assumed local authority and developer funding and which still showed a deficit of £0.9 billion for the current local plan period.

As funding policies have evolved over time in response to changing political, economic and social influences it has left the current infrastructure funding model inadequate for various reasons, including the short term funding horizons and the short-term strategies applied, as well as the inadequate levels of funding which fail to match well evidenced needs, as well as the use of competitive bidding processes which are highly resource intensive.

Most major transport schemes are currently funded through LEP's on a year by year basis. This leaves the LEPs, or the bodies submitting the bids at risk should the funding be withdrawn. There is also uncertainty as to whether there will even be another round of Local Growth Funding.

Government strategies for transport and infrastructure rarely survive more than one Parliamentary term. This makes it harder to effectively support long term planning or development of the larger schemes or to align funding policies with longer term national infrastructure investment plans eg Network Rail's Control Periods or Highways England's Road Investment Strategies.

There are significant risks in developing infrastructure schemes. For example major transport schemes will typically incur 10% to 15% of costs in just the feasibility and bidding stages. This is a significant barrier to authorities bringing forward schemes, particularly the larger and more transformational schemes. The local large majors fund has gone some way to addressing this but could be improved if local highway authorities were able to make direct bids to the Department for Transport.

The competitive funding processes and appraisal systems that apply to schemes provide a level of rigour but are biased to certain types of infrastructure and do not fully evaluate the economic benefits. A good example of this would be the cost benefit of flood mitigation schemes against the risk of groundwater flooding in large rural counties. Currently the economic impact of such flooding, which in Hampshire's case has previously led to the closure of major roads for up to two months, is not taken into account as the funding formula is skewed in favour of high density areas/

There are comparatively few sources of revenue funding for infrastructure or to support borrowing for investment. There are also limited sources of funding for the effective and intelligent use of existing infrastructure.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

Yes there are many problems in trying to finance up-front infrastructure due to the flaws in the current funding and planning arrangements. It is why the County Council is calling for the introduction of a Strategic Infrastructure Tariff that would help overcome cash flow difficulties associated with the timely delivery of infrastructure to support new development. As explained previously a Strategic Infrastructure Tariff would provide the necessary security for strategic authorities to step in and make full use of their borrowing powers in the certainty that they will be able to manage the debt. [see answers to Questions 1, 7 & 10]

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

There needs to be far more strategic planning across wider geographies to better align infrastructure priorities of a wider range of strategic bodies, from Network Rail to NHS clinical health commissioning groups.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

Streamlining current planning and governance arrangements would speed up delivery of infrastructure and better maximise efficiencies. For example, most transport funding is currently routed through Local Enterprise Partnerships requiring local highway authorities to participate in complex bidding processes.

We have identified a number of ways to improve planning and delivery of infrastructure which are summarised below:

(a) Reform CIL & S106 arrangements to secure developer funding and support more timely delivery of vital infrastructure

As indicated above Hampshire County Council is extremely concerned about the impact the CIL regime and the restrictions on Section 106 Agreements is having on the level of funding that is now being secured from developers, particularly for strategic infrastructure, where there is a growing infrastructure gap. A specific problem remains the upper limit on the number of agreements that can be pooled for any single piece of infrastructure. The County Council can evidence how the implementation of CIL, or in one case the decision of a district council not to put in place a CIL regime at all, is seriously reducing the funding available to support infrastructure at the County Council level.

Previously the County Council had a successful tariff system for both education and transport infrastructure, enabling it to secure significant funding for infrastructure to support housing and economic growth. Whilst there were issues with Section 106 funding regime, notably in relation to trigger points at which staged payments became due and required some form of cash flow management, significantly larger sums were secured through that regime than can currently be secured through CIL.

The fact that CIL payments are required up front works against normal development viability. Whereas the Section 106 regime is more realistic and could support the notion of a revolving Infrastructure Fund to manage cash flow. It is primarily the difficulties in servicing debt associated with borrowing which is a major barrier to strategic authorities in delivering timelier infrastructure. However, if the system were reformed to provide surety over future receipts, local authorities would be more likely to step in to pay any borrowing, particularly if those changes were to replace the restrictive S106 arrangements with a Strategic Infrastructure Tariff and the retention of first time sale stamp duty. .

The distributed nature of development across the Hampshire and Isle of Wight (HIOW) area, where 50% of the housing will come from medium and small sites, makes the current pooling restrictions on Section 106 Agreements even more problematic. This is illustrated by an appeal decision where the Section 106 pooling

meant the impact of a development on school places could not be properly mitigated and would have been a reason for refusal of the application.

The County Council has strongly urged DCLG to remove the restriction on pooling of Section 106 contributions to enable more infrastructure funding to be secured in order to reduce the growing gap in infrastructure funding which will otherwise fall on the public purse.

(b) More Effective Use of Developer Funding through Strategic Planning

The County Council recognise the importance of ensuring developer funding is used effectively to support sustainable development. Government should encourage the identification of strategic infrastructure needs through strategic planning frameworks across whole county areas and encourage joint planning between local planning authorities and upper tier authorities who are key providers of strategic infrastructure, with capacity to lever in further private sector investment. In the case of Hampshire this would build on the County Council's previously published strategic infrastructure strategy and local district infrastructure delivery plans.

It is also worth noting that the current CIL charging schedules, where they exist in Hampshire, do not secure provision from employment or economic development. Whereas under the previous funding regime, Section 106 contributions were secured to support this. The County Council remains very keen to support economic growth and help raise productivity but this is dependent on being able to fund and deliver the required infrastructure associated with such economic growth.

The experience in Hampshire is that CIL, due to the focus on viability, is not yielding the levels of funding that were previously secured by Section 106. There is an inability for local authorities to capture the value that is created by a planning permission, and as a result only a small proportion of the infrastructure needed to support growth is being funded. Strategic sub-regional infrastructure, such as waste disposal infrastructure, is not currently receiving any funding from development – despite the fact that every new development will create waste and therefore add to the growing waste bill.

Introducing a Strategic Infrastructure Tariff would radically improve the delivery more timely strategic infrastructure and would provide the certainty needed to ensure viability. At a minimum the Government should remove the current restrictions on pooling of S106 developer funds for the reasons explained above.

(c) Use of Greenbelt and Green Infrastructure

The nature of Hampshire with its international habitat designations means that any development in south Hampshire or in north east and central northern Hampshire is required to mitigate the impact on the Solent Special Protection Area (SPA) or the Thames Basins Heaths SPA.

Experience in the north of the county shows that land suitable as mitigation land for development is attracting premium values and is therefore increasingly difficult to secure. This is putting a very significant constraint on the delivery of further development in and around this area.

In the south of the county there are similar challenges because of the cumulative impact of development on the Solent SPA. There is also much concern amongst

residents, particularly in southern Hampshire, that the pressure for more development will erode the strategic gaps between local settlements, leading to a coalescence of urban development in a belt between Southampton and Portsmouth.

It is the County Council's contention that if there were an ability locally to designate a greenbelt it would support the provision of multi-functional countryside and green infrastructure and also offer a type of protection to the open landscape character of strategic gaps. Such a change in policy could significantly contribute towards more development as it would make local communities less resistant to the principle of development if it were to be combined with protecting those important and treasured open areas. We also believe that such a designation would eliminate any residual "hope" value for future development, thus making acquisition for mitigation land more realistic and viable and thus speed up delivery of new development.

Therefore we believe it would be helpful to have responsibility to prepare first proposals for a greenbelt, which would include green infrastructure provision in Hampshire. Such proposals would then be taken forward, tested, and adopted through the normal district local plan process. The strategic framework document, which would bring forward the initial proposals, would form a useful strategic planning framework for the whole area and would indicate the distribution of housing and the strategic infrastructure to support that. Whilst the primacy of local plans could be retained, a strategic infrastructure framework would better support the duties to co-operate and offer a comprehensive plan for the overall area which would then be tested and taken forward through local plans.

(d) The Role of Regulators and Statutory Utilities in the Planning Process

As previously explained we think the role of regulators should be reviewed with a view to requiring providers to take account of economic and housing growth projections in their long term planning.

We also believe there should be a duty on all utility companies to participate in the early stages of the planning process. Our experience in Hampshire has shown that reluctance by statutory utilities to get involved at the early stage of the plan making process has led to delays and additional costs. The lack of early engagement causes mistrust amongst local communities and makes the planning process more confrontational than it need be. All too often local planning authorities are challenged by communities and accused of not tackling what they consider to be an existing utilities infrastructure deficiency (with water, sewage, health care being main culprits) whilst those utility agencies remain largely silent. Although the lack of engagement doesn't always add greatly to the timescale in determining an application, it can substantially add to the timescale in terms of delivering the housing on the ground.

Developers may well be able to provide more evidence about the how utility providers reactive approach, as opposed to taking a longer term planned approach to future infrastructure provision, causes delays in the system. What is clear to us is that the lack of engagement often compounds delivery problems further down the line where strategic infrastructure thresholds are crossed.

Given the lead-in times for the provision of significant additional utilities infrastructure there is inevitably a delay in bringing forward more complex or larger developments. This risk could be mitigated if national policy were to require utilities to engage earlier in the planning process and help ensure a smoother journey from allocation to delivery.

(e) Superfast Broadband on New Developments

Getting sites connected to essential superfast broadband remains problematic. A recent appeal in Basingstoke found against the local planning authority on broadband, with the Inspector determining that broadband connection is a matter for prospective householders, and not a planning consideration. However, in reality the failure to get sites connected to broadband at construction simply leads to residents applying pressure on the local authorities to secure access. This results in extended costs falling on the public purse to pay for more expensive retrofitting at a later date.

The provision of superfast broadband on new major developments should be a requirement within the planning process. The lack of superfast broadband on new developments impacts negatively on community resilience, education and business activity. Hampshire County Council has had to intervene to help residents of a new estate at Abbotswood, near Romsey get access to superfast broadband. That development will provide 800 homes but residents were surprised and disappointed that their new homes did not come with high speed broadband connection and that this had not been automatically dealt with by either the developers or the broadband providers. Since then Hampshire County Council has worked with the developer consortium to get superfast broadband retro-fitted but this was at a significant cost to the public purse.

Hampshire's broadband support programme 'Getting Connected' was launched in 2015, aiming to ensure that Superfast broadband services are available on major new housing developments across Hampshire but a change in national policy, as outline above, would be a significant help.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

This should be done by applying the Best Practicable Environmental Option (BPEO) wherever possible. A good example of this is the use of sustainable drainage systems (SuDs) which allow for landscape, biodiversity, amenities as well as dealing with surface water problems.

There should also be more effective use of environmental designations, including Green Belt, to provide more multi-functional green spaces.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

The weakness of current cost benefit analysis techniques is that they are unable to take account of the less clearly defined or visible benefits. For example, an ancient woodland could by its very nature be considered to be priceless or of great value to a community but, in planning and development terms it could be viewed as a constraint rather than a

valuable asset. Cost benefit techniques might be improved if they were to consider those less clearly defined benefits by applying relative differentials in terms of value.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

Travel demand will continue to be closely linked to land usage, with commuting between residential and employment areas still likely to dominate transport systems. Increased mobile and home based working will lead to peak spreading as the workforce becomes increasingly flexible, and reduce the impact of housing and employment growth so that the capacity of the network is more effectively utilized. On-demand services, including internet shopping and home delivery, will radically transform retail and reduce shopping trips, but non-work travel is likely to remain stable or increase as traditional town centres and retail parks switch to recreational services or provide window shopping for on-line services. On-demand and car sharing services will offer an alternative to traditional public transport across the network, eroding their traditional business models and requiring them to adapt to compete effectively.

New transport technologies will provide increasing traveller information to support customer choice and improve journey time reliability. In-car navigation and information systems, and semi-autonomous driver aides, will make road travel safer and reduce congestion, and new added value service like pre-booked parking will be available. Fully autonomous vehicles will operate on sections of the network, but their adoption will be limited by legacy vehicles and the complex nature of the urban environment.

Car ownership is expected to change, and a switch to electric and hybrid technology is likely to require a radical rethink of existing taxation systems to provide revenue for highway maintenance and operations. A pay-as-you-go system with variable charging based on peak and off-peak usage and premium routes seems likely.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

Hampshire geography, with its polycentric settlement patterns, is complex. However, for large urban areas Mass Rapid Transit systems, potentially complimented by Park and Ride facilities, are likely to be high value transport investments.

Major urban areas also need for more permeable urban centres which support more active transport, including walking and cycling.

Integrated traffic management systems, utilising the latest digital technologies, should be used to optimise traffic flows and parking.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

Where there are centres within close proximity inter urban Mass Rapid Transit schemes may have a role, alongside heavy rail and express bus systems.

Further integration of the maintenance and management of the highway network is also needed to improve capacity and efficiency. [see call for a Major Road Network under Q.5]

More generally, In addition to improving the maintenance and efficiency of existing assets, the highest value transport schemes outside of urban areas tend to be those that address pinch points followed by transport links serving a strategic transport function.

This thinking is well documented and evidenced in the Eddington Transport Study (2006) which provided advice to the Labour Government about long-term links between transport and the UK's economic productivity, growth and stability, within the context of sustainable development. His core recommendation was to invest in transport infrastructure in areas with strong or influential economies, such as the Hampshire and the South East, and to investment first into removing pinch points (such as Junction 9 of the M3) and to support key strategic links, such as the Southampton Port to Midlands strategic corridor.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

Digital communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

There is a need to improve mobile phone coverage and encourage preparation for 5G to take account of increasing dependence on mobile communications, including Smart phones and tablets.

It is also important the Superfast Broadband Programme is completed to secure access for all and ensure communities in more rural areas are not left behind.

The call for a 'digital first' approach to all future investment to improve resilience and reach was made by Enterprise M3 LEP and other South East partners at the NIC's recent meeting – see Appendix 1. It was argued that digital requirements should be mainstreamed across all sectors and form part of all public investment plans to deliver 'digital ready' homes, 'smart' towns & cities and 'smart' transport networks.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Note: the existing "regime" refers to the current market, competition and planning frameworks. "Digital communications" includes both fixed and mobile connectivity.

Please note earlier comments regarding changes to the planning system in respect of broadband and other utility companies. The current regime does not do enough to ensure that the digital infrastructure is being strategically planned and delivered in a timely manner in tandem with new development.

Hampshire County Council also remains extremely concerned about the poor connections in rural areas. For example Hampshire and its neighbouring counties all have ambitious plans for superfast broadband coverage (over 95% in most cases) but it cannot be acceptable to have hundreds of thousands of homes and businesses unable to access the digital economy.

The Government needs to take a proactive role in creating a regulatory and tax environment which encourages investment in superfast and ultrafast broadband infrastructure, as well as other mobile and digital communications, to ensure communities are not left behind. It also extremely important that the Government ensures these technological advances help with the transformation of public services, particularly with health and social care and build on existing technologies such as Telecare.

There are also opportunities to be secured through better communications infrastructure with the Smart grid roll out.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

The highest value solution would be a combination of district heating networks (urban and commercial) and individual electric heat (rural) alongside thermal storage. These will need to be combined with efficiency measures. The main issue is not having a clear national energy pathway which is creating a lack of confidence in the market development of the necessary networks, technology and investments. A transition away from gas will also be a significant challenge and again will require clear policy that encourages certainty and investment. Decisions need to be made immediately in order to achieve any 2050 targets. Key to success will be public engagement and leadership through a clear policy framework.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

The third UK Carbon Budget which runs from 2018-2022 is 35% reduction from the 1990 base year by 2020. The 35% target was achieved in 2014 and national carbon emissions continue to show a downward trend[1]. In 2015, 17% of the UK's electricity generation came from renewables sources.

An effective zero carbon power sector should be flexible and on-demand. It will have at its heart, energy efficiency technologies such as cogeneration, and would be using predominantly low carbon and renewable energy technologies to generate electricity. This would be achieved by putting in place a well resourced phased strategy. This would include adequately funded research and development to enable new technologies to be developed. It would also include a supported route to market particularly for technologies that are already being used in other countries.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Although the electric vehicle market has more than doubled in the last three years the uptake of electric vehicles and the demand for charge points was initially lower then expected. However, it is expected that as the price of electric vehicles drop, its uptake will continue to increase.
This could lead to an increased variance in the demand of electricity as at any point in time a number of electric vehicles could be charging and therefore increase the load. However, if as intended, most electric vehicles are charged at home during the night then the demand will be predominantly at night time and easier to manage in relation to destination site charging.
Energy storage will need to provide a balancing effect for additional charging loads coupled with smart tariff arrangement to reduce energy peak loads. Phasing of overnight charging loads using smart grid technology would be essential in removing night time charging peaks and balancing demand.
Ideally new housing and commercial construction projects should include charging points as the cost of the charge point is relatively small during construction and the inclusion of an on and off street EV charging strategy should feature in development plans. This would remove any negative perception of charging point availability for potential EV buyers and increase the rate of change to EV vehicle adoption.

Water and wastewater (drainage and sewerage):

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

Note: "demand" includes domestic, commercial, power generation and other major sources of demand.

[1] Committee on Climate Change- How the UK is progressing

Please see comments under Q4 regarding the need to balance demand management with supply capacity.

There should be improved use of ‘grey water’.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

Note: this can include, but is not necessarily limited to, governance frameworks across the country.

See above.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

There needs to be better integration at local level between Lead Local Flood Authorities and the Environment Agency (EA).

Government should also take steps to clarify the primary role of the EA which is about improving flood resilience, rather than biodiversity. Currently its effectiveness can be undermined by inconsistent and/or conflicting approaches to policy and partnership working.

Flood risk management:

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

It would be difficult to define a set level of flood resilience across the whole of the country and would not allow for local approaches and choices within individual communities. The nature of flooding is such that an area may be affected by relatively regular flooding that they would want to have some form of resilience against. Different sources of flooding can have very different characteristics and impacts (e.g. short term flash surface water flooding as opposed to longer term groundwater flooding). The methods for improving flood resilience and the level of resilience sought will therefore vary depending on the different types of flood event and their wider community and socio-economic impacts. There isn’t a ‘one size fits all’ approach to levels of resilience - flood risk authorities need to develop their own resilience plans based on the types of flooding experienced in their catchments and national funding mechanisms need to be sufficiently flexible to recognise the wider impacts from different sources of flooding, particularly with regard to socio-economic impacts in addition to properties affected.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

It is accepted that it is not possible to build defence schemes to mitigate flooding everywhere and that flooding will always occur. Formal built defences also need to be maintained and while the ongoing costs of this are considered within the initial cost-benefit analysis, over time there will be an increasing burden on the public purse. The merits of natural flood risk management are that they generally utilise natural processes to reduce flood risk and therefore involve less construction and ongoing maintenance. However, these systems involve changes in land management practices that, to have any benefit, need to be continued. Implementing and maintain these changes in practice will be a significant challenge when dealing with private land owners. There appears to be great potential but the overall benefits of NFM are not yet well understood and are difficult to quantify without extensive (and expensive) modelling. As a result the ability for such schemes to realise flood defence funding is not clear. HCC is currently developing a catchment approach to identifying options for flood mitigation, recognising that management measures in one part of a catchment will be necessary to mitigate flooding in another. This has highlighted the need to work in cooperation with neighbouring LLFAs to address wider flooding issues.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

The corner stone financial mechanism in the UK for waste is the Landfill Tax which, since its introduction in 1996, has been effective in driving waste up the waste hierarchy and away from landfill. The rapid increase in the tax during the 2000's enabled alternative solutions, both recycling and energy recovery to become financially viable and thus gain market share. However, since 2014, when the Landfill Tax escalator was reduced to an annual RPI linked increase, its effectiveness has waned as landfill costs have reached a height that makes export of Refuse Derived Fuel (RDF) to the continent a viable option.

This has an impact on the business model for landfill which, whilst at the bottom of the hierarchy remains the disposal option of last resort, means that new landfill capacity is not being brought on line to replace used void space. It would also appear increasingly difficult to make a business case for energy recovery since the Government withdrew its Waste Infrastructure Credits scheme, leading to the cancellation of several projects.

Getting significant waste infrastructure projects off the ground has, in most cases, required local government to underpin the project with feedstock to make it bankable. This in turn ties local authorities in to long term contracts (c. 20-25 yrs) in order to make the infrastructure affordable and thus limits the ability of said authority, or group of

authorities, to subsequently adopt new technological advances that occur during the contract life time. These contracts frequently include minimum tonnage requirements which presents a further problem when regulatory requirements change mid term i.e. EU set recycling targets will drive an increase in material separation for recycling but can lead to authorities being in breach of their minimum contractual tonnage requirements for disposal infrastructure such as Energy Recovery Facilities (ERFs). This in turn limits the extent to which it is possible for local authorities to maximise the use of the waste hierarchy in tonnage terms. Therefore there are significant tensions within financial and regulatory systems which work against, rather than with each other.

Furthermore the predominant focus on waste in the UK, and England especially, seems to be on that area over which local authorities have responsibility i.e. Household Waste which is only 13.7%[2] of the total waste arisings in the UK. Whilst there are producer responsibility systems in place i.e. for packaging and for waste electrical and electronic equipment (WEEE), there is little to no benefit received by Local Authorities for their roles in this i.e. provision of free collection services such as kerbside collections of recyclables for packaging materials or free reception of WEEE at Household waste recycling Centres (HWRCs) that enables producers to meet their targets.

Whilst currently there are no individually imposed recycling targets on Local Authorities, there are mechanisms with the Localism Act for penalties to be imposed should UK Plc fail to meet the EU targets (50% recycling by 2020) should they still be applicable. However, the current focus for Local Authorities is maintaining a service in the face of ever more serve cuts in funding. Where Local Authorities look to innovate such as charging at HWRCs this meets with resistance from central government either in the form of regulation such as that prohibiting access charges or in statements which sow confusion by defining certain wastes as “DIY” which has no legal definition in any existing regulations. By limiting the ability of Local Authorities to change the funding mechanisms for their services, albeit through a mechanism that may require service users (i.e. customers) to make additional contributions, government is leaving Local Authorities with stark choices over whether they can continue to provide those services. This is in spite of the fact that when consulted over 50% of residents supported paying a nominal fee to use their local HWRC rather than lose it. Charing for disposal of certain, less common waste streams is also in line with the “producer pays” principle.

Restriction on charging has some significant potential implications with regard to UK Plc’s future ability to achieve its recycling objectives as closure of even part of the HWRC network across the UK, as a result of funding restrictions, will impact on the separate collection of materials such as metal, cardboard, wood, green waste and WEEE. The alternative option open to residents would be to use commercial waste outlets, such as skip hire companies, where, under the current reporting systems, the data would be much harder to monitor and record.

A potential extension of the existing Producer Responsibility concept, with some extended producer responsibility initiatives outlined in the proposed Circular Economy packages, would be that of Consumer Responsibility. This would be a mechanism of “pay-as-you-throw” or ”save as you recycle” which would require all waste collections, irrespective of what sector it originates in, to be recorded through on-vehicle weighting with charges applied as appropriate. The charges could then be set to better reflect the costs associated with waste disposal actions i.e. recycling being cheaper than residual

[2] UK Statistics on Waste - Dec 2016

disposal and the income used to invest in the necessary infrastructure.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

Note: A "circular economy" is an alternative to a traditional 'linear economy' (i.e. make, use, dispose) in which products are designed and packaged to minimise waste, and resources are kept in use for as long as possible, e.g. through re-use, recycling and greater recovery of materials through the waste management process.

Achieving a circular economy will require a significant re-thinking of the existing waste systems. Materials are, to the most part, the same whatever waste stream they arise in (household, commercial or industrial) and should be treated and collected together for maximum economies of scale. This is not the situation at present where the different waste streams (household, commercial or industrial) are generally collected separately and fall under different regulatory influences. Material streams will need to be valued for their potential as a secondary resource to displace virgin materials, where possible, rather than the present system which is based around where the waste arises not necessarily what materials it contains. An example of this is the differing approach to building materials recycled by the construction sector, and the recycling of incinerator bottom ash from Energy Recovery facilities (ERFs) in to an aggregate. Tackling these issues will require a significant increase in the amount of data and information available on existing waste streams. Local Authorities provide government with fairly comprehensive data via WasteDataFlow, however the same can not be said of other waste streams where the availability of data is reliant on that provided during waste transfers etc. such as the transfer note or e-doc. This data is severely limited in that it is based on the European Waste Catalogue (EWC) codes that define waste by its place of origin rather than content. Understanding what materials occur where within the waste streams is crucial to ensuring that it is managed and handled to maximise its ability to be re-used or recycled at the highest potential value possible.

Recognising this lack of data, Hampshire County Council developed a material flow planning (MFP) methodology of estimating commercial waste material arisings in Hampshire and across the "South East 7" area (Kent to Hampshire geography). This model, which has been peer reviewed, uses available information (waste composition and business data) to generate an estimate of the materials that might be found in wastes streams of industries as defined by the Standard Industrial Classification system (SIC). This methodology, which has been presented to government, could be used to generate a national estimation of materials arising within the industrial and commercial waste streams. The Household waste sector is already well reported. In order to stimulate a circular economy it will be vital to understand what material resources are available in within the economy as a whole. Secondary materials from wastes would be a necessary contributor to a national materials database that would be a significant enabler for the circular economy.

By engaging with stakeholders up and down (or around) the supply chain, products can be designed with re-use and /or recycling in mind, such that they can be easily disassembled enabling components to be replaced where broken or upgraded, the materials that they are made of can be recycled for use in the next generation future products. This would also drive the use of single material packaging rather than multi-material packaging (drinks cartons, food pouches) which are extremely difficult to recycle, even if they provide product protection or longevity benefits. A standardised

approach to analysis could be developed to enable the pros and cons of using certain materials or multiple materials in products or packaging allowing organisations to determine the best solution for each circumstance.

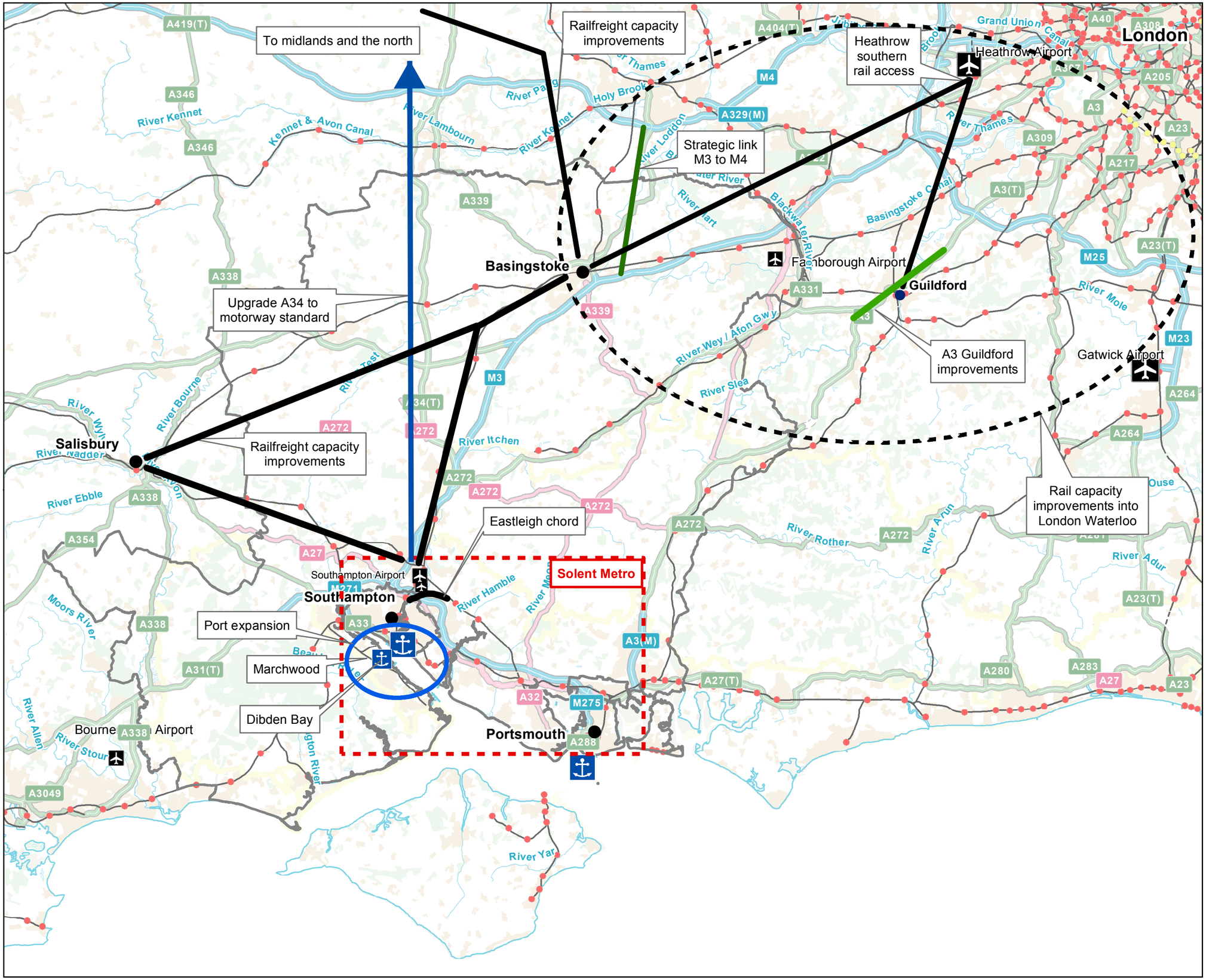
Another mechanism to drive the circular economy is to move away form the ownership model that has been propagated by producers over the last 30 years or more. Moving back to a leasing system for high value products i.e. household appliances, communications equipment and cars (already underway through the current financing arrangements), would allow brands to change the relationship with their customers, seeking loyalty and longevity in the arrangement by replacing current products with next generation ones through existing agreements. The current model of short term product life before release of the next generation, whilst generating profits for the producers in renewed sales does not encourage these products to be designed and built for disassembly or upgrade as they are only expected to have a short shelf life before becoming obsolete.

This change in consumer model might be easier to transition to were consumers financially liable for their waste disposal. Leasing a large household appliance with take back by retailer included in the agreement might be preferable to out right ownership if the consumer is liable for the full end of life disposal costs (collection, disassembly etc.) associated with that product.

[For clarification or further information on any of points above please email [e-mail address redacted] Tel [phone number redacted]

Hampshire Strategic Transport Infrastructure Needs

January 2017



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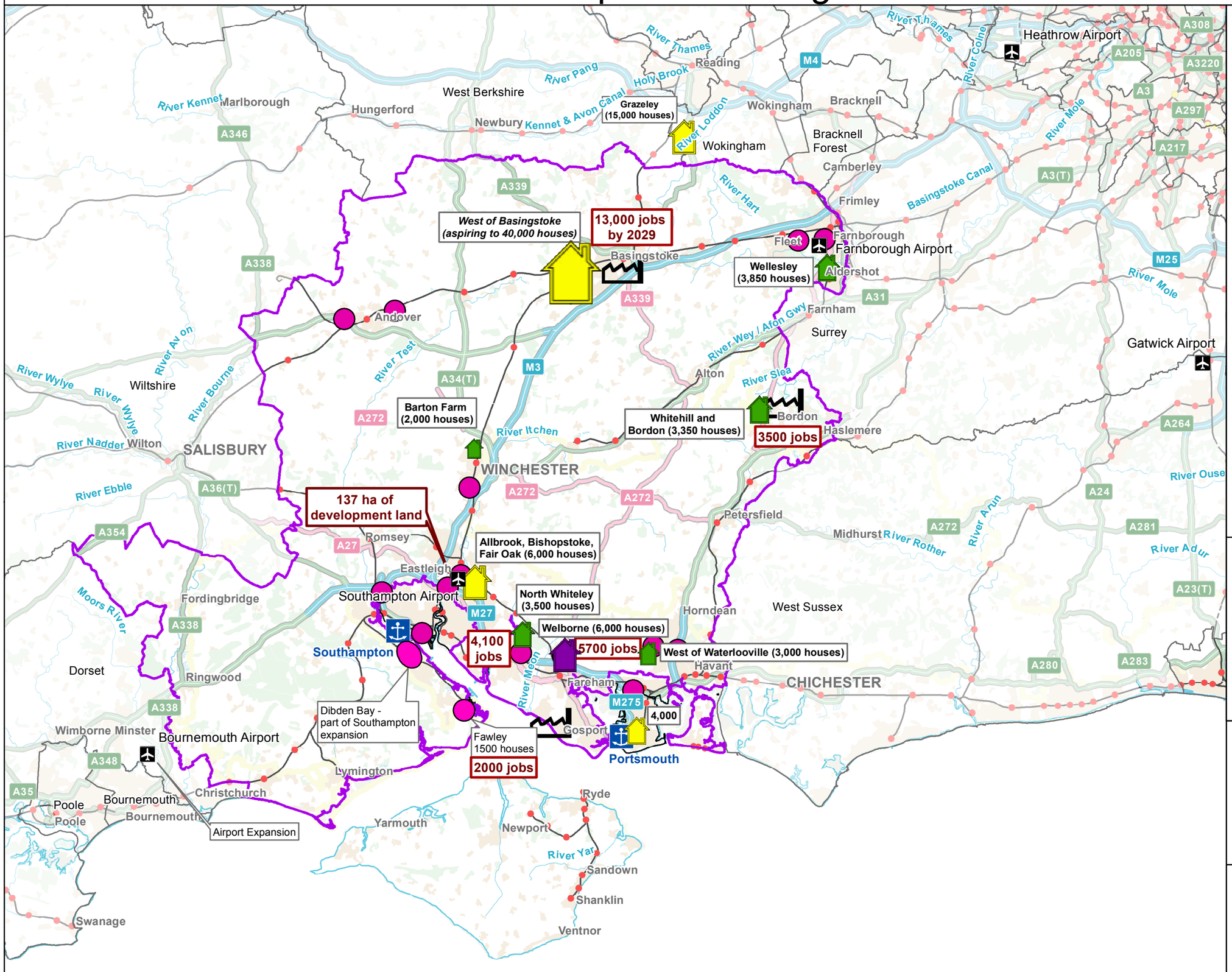
Hampshire Strategic Growth



Legend

Housing Development Sites

Category

- Broad Locations of Major Development
- Development with Permission
- Planned Development
- Enterprise Zones
- Commercial Development Sites
- Ports
- Airports

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Scale:
1:412,572

Date:
16.01.2017

Hampshire County Council
Research and Intelligence Group

Appendix 1 to Hampshire County Council's response to the National Infrastructure Commission's Call for Evidence, February 2017

Summary of points raised with the NIC during its visit to Hampshire on 20th January 2017.

Following the SE stakeholder meeting (see below), Hampshire County Council escorted the National Infrastructure Commission delegation, led by Commissioner Sadie Morgan, to a 'water-themed' site visit at the major development site, West of Waterlooville. During the journey the County Council briefed the Commission on the current pressures facing the county's strategic transport network; how those pressures will be exacerbated by future growth and development particularly as funding for local infrastructure, including local roads, is now significantly lower since changes to the planning system in 2012; and it drew attention to the County Council's main strategic transport 'asks', as summarised below.
(see maps 1 and 2 attached).

- Connections between the Port of Southampton and the Midlands, in terms of both A34 upgrade to motorway standard and improved rail routes for freight.
- A road link between M4 with M3 to help accommodate growth, including significant housing growth west of Basingstoke
- Southern Access to Heathrow
- Improve rail connections between Hampshire and London (capacity and speed)
- CrossRail 2 to relieve pressure on services into London
- Urban Mass Transit System (bus and light rail links in South Hampshire, including between the cities of Portsmouth & Southampton)

Given Hampshire's strategic location as a gateway between the Midlands and the south coast, and its close proximity to London and Heathrow, it was argued that the above 'asks' would also benefit the wider South East region and the national economy.

Attention was drawn to scale and size of the county ie the third most populous county, covering 1,400 square miles, and its rural nature with 85% being defined as rural, all of which adds to the challenge of delivering timely 'economic' infrastructure. The NIC also heard how the County Council is responsible for serving a population of 1.34 million and managing over 5,200 miles of road, spending over £60m a year on maintaining the local road network.

It noted that Hampshire has more cars than any other county, with two thirds of its commuters travelling by car, which is partly why its road network (including its motorways) is considered to be the lifeblood of the economy. Particular attention was drawn to the major congestion along the A34/M3/M27 corridors, which is often at full capacity during peak hours.

The growing importance of rail infrastructure was also highlighted, both in terms of freight considered critical to the UK car industry and also for residents' daily commute. The Commission heard of about the public demand for faster rail services to London, with more capacity.

Additional investment in Hampshire's strategic transport network is needed to help bring its productivity levels up to the South East average. Its growth potential - as an economic gateway to global trade through the Port of Southampton and its proximity to Heathrow and Gatwick – will only be realised with more timely delivery of major strategic transport schemes. [see map 2].

The example was given that Winchester is only 50 miles from Heathrow Airport and yet none of Hampshire's residents have direct rail access to the airport. Train journey times between London and Portsmouth remain similar to times during the Victorian era, causing many people to travel by road, thus adding to congestion on the motorways. It also takes 65 minutes by train to travel just 20 miles between Portsmouth and Southampton and can take anything between 30 minutes to two hours to travel by car. The importance of delivering the light rail Solent Metro scheme was raised as this would benefit the whole of the South Hampshire area.

Other significant points raised during the South East Stakeholders' meeting

South East Regional Overview: The importance of the region's strategic location, its global transport hubs, and the huge economic contribution it makes to the Treasury was stressed throughout the discussions. The need for greater strategic planning powers and funding for infrastructure at a regional level was also echoed throughout the meeting, with a desire to see both the planning and funding of infrastructure streamlined.

The SE's economy is bigger than the eight core cities' combined, and bigger than Scotland & Wales' combined. Between 2002 -2012 the region was the single biggest net contributor to the Treasury, contributing £6bn more than London. Yet its rapidly rising growing infrastructure deficit, now estimated by LGC Futures to be around £15.4bn, means its future success is at risk and can no longer be taken for granted by the Treasury.

Whilst the region's links with London in terms of its contribution to the capital's workforce and meeting housing demands, the need to recognise the South East's distinct challenges and its own significant growth potential was stressed.

The South East discussion covered all aspects of 'economic' infrastructure being assessed by the NIC as part of its forthcoming national infrastructure assessment. This ranges from flood defences to mobile communications and major transport schemes required to support the nation's prosperity over the next 30 year period. The Commission was also keen to hear regional views on the interdependencies and cross cutting themes, such as the planning and funding of sustainable growth.

The South East meeting was attended by leaders and senior officers from the region's strategic authorities, national agencies, and the private sector. The agenda was split into two parts a) environmental security and b) connectivity.

How to improve the South East's Connectivity

Strategic Road and Rail Infrastructure (see map 3)
National prosperity is heavily dependent upon the South East's economy remaining buoyant. Poor transport is known to be the single biggest barrier to economic growth and investment in the South East's transport network has not kept pace with the growth in demand and the network is now creaking and facing serious capacity issues.

In addition to future economic growth, the ability to bring forward housing development is also heavily dependant on planning and funding mechanisms to deliver transport infrastructure.

The discussion drew on findings from the SEEC and SESL reports Mind the Gap (2014) and Missing Links (2016) and also made reference to further evidence put forward in a recent report commissioned by Solent, Thames Valley, Enterprise M3 and Coast to Capital LEPs.

Key road and rail infrastructure asks, as recommended by SEEC and SESL, were discussed (see map) and include investment to address:

- Severe congestion on parts of the local and strategic road networks e.g. M25, A27, M2, M3/A34 corridor
- Lack of capacity on radial train routes to London
- Speed up rail journey times to London
- Provide orbital connectivity around London e.g. North Downs line linking Reading to Gatwick and beyond

There was a strong call for national infrastructure plans to recognise more fully the South East n as a key gateway to international markets. There was a plea for the Commission to support calls for better connections between the region's major transport hubs, including London Heathrow, Gatwick, and its international ports.

The NIC heard about the potential benefits that improved road and rail links between the international Port of Southampton and the Midlands could bring to the economy. It noted the size of operations at the Port of Southampton, its ambitions to expand, and the implications for associated transport infrastructure. It also noted comments about the urgent need to reduce congestion along the A34/M3 corridor in light of future growth pressures and economic activity.

Stakeholders spoke about the impact the expansion of Heathrow is likely to have on the region and called for the Western Rail Access to be brought forward as soon as possible and to advance studies for Southern Rail Access.

The meeting highlighted the recent progress to develop a 'Transport for the South East' sub national transport body (STB), which is expected to run in shadow form from June 2017. This body will work to secure investment for major schemes and better align national schemes with regional and local priorities. Local leaders spoke of the need for the STB to be given sufficient 'teeth' to bring real benefits to local residents by directly influencing Network Rail and Highways England investment plans.

The case for reviewing how 'strategic' roads are defined and funded was made, noting the disparity between the level of funding Highways England receives and the level of funding (per mile of road) which local highway authorities receive.

Mobile and Digital

In addition to transport infrastructure the meeting noted how the region's economic competitiveness also is largely depends upon addressing gaps in the digital coverage for fibre and wireless communications. There was a call for OFCOM to publish regional maps for England to aid strategic planning of digital and broadband infrastructure, and a call for developer incentives to include digital connectivity in all major planning proposals.

A 'digital first' approach to future investment in needed to improve resilience and reach. Digital requirements should be mainstreamed across all sectors and form part of all public investment plans to deliver 'digital ready' homes, 'smart' towns & cities and 'smart' transport networks.

How to improve the South East's Environmental Security

The stakeholder meeting also discussed how the region's growing economy and rising population, combined with climate change, poses a risk to its future environmental security. It was noted that the Environment Agency have already identified the whole of the SE region as "an area under serious water stress".

Further investment in funding and skills is required to secure **future water supply** (quality & quantity), more effective drainage and flood defences.

SE's flood defences need more investment and, if there is to be "an economy that works for all", more needs to be done to address the urban versus rural issues. For example the current funding mechanisms for flood defences work against more sparsely populated rural counties and do not take account of the wider socio-economic impact of flooding. (For example Hampshire is vulnerable to coastal, fluvial and groundwater flooding. The winter floods of 2012/13 not only had a direct impact on its communities, such as the evacuation of 150 families from their homes, but the floods also caused significant damage to the local highway network and key strategic routes, including the A32 and A272 which were closed for up to eight weeks. Those closures not only affected local communities but also had a significant adverse impact on the wider economy, but such economic impacts are not adequately reflected in the current funding formula).

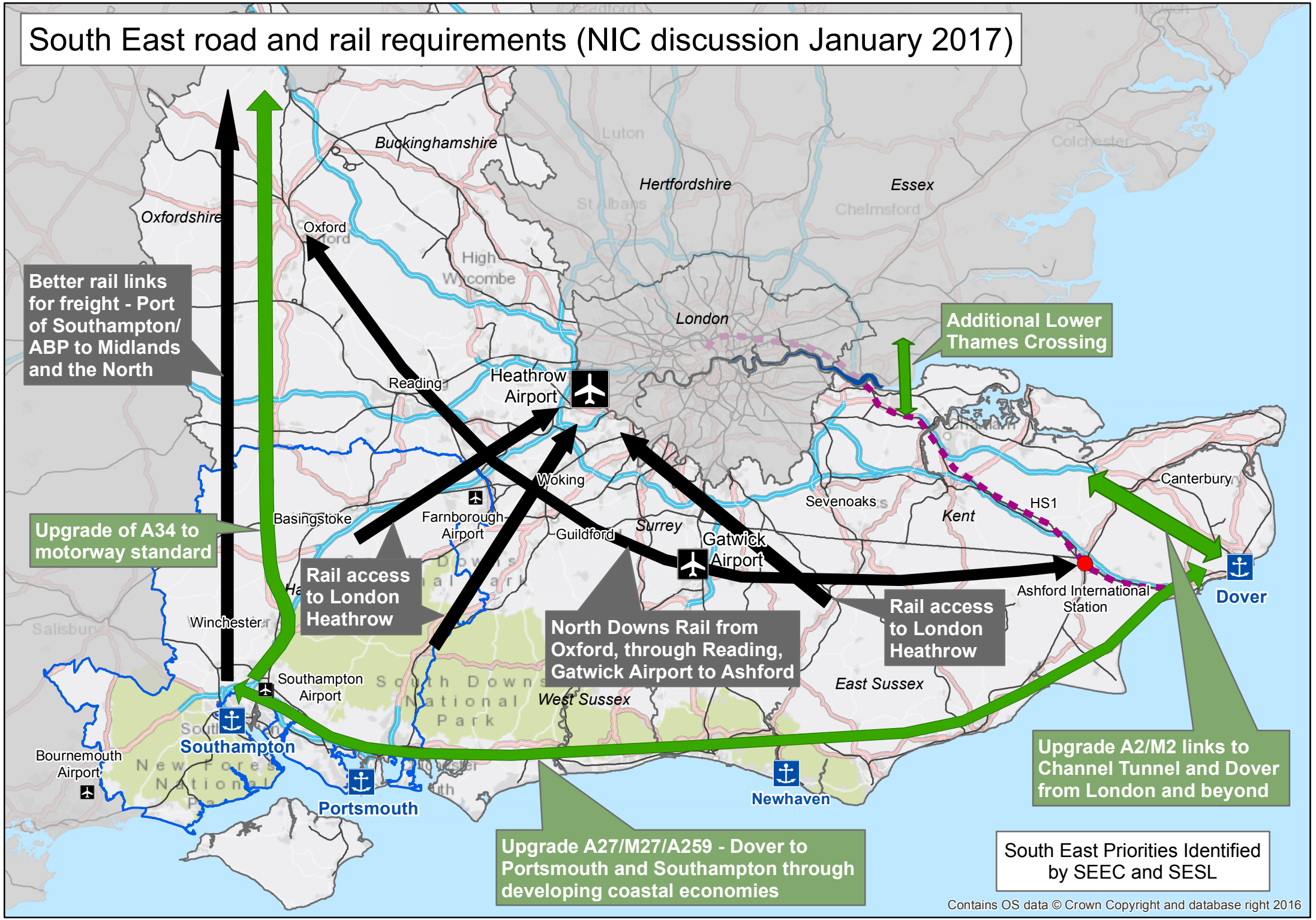
SE's future energy security is challenged by the high costs of distribution & transmission in rural areas; the lack of grid capacity to provide for more alternative sources of energy; fragmented and inconsistent energy policies; and the failure to consider energy issues at the early stages of the development planning process.

Stakeholders suggested there should be more intelligent, evidenced-based energy planning; energy statements should be required for new developments over 100 units; the efficiency of existing stock should be improved and more should be done to encourage local energy generation to better manage demand.

On waste management there was a strong call for greater certainty over long-term financing, noting that local councils need to plan finances over thirty years for 'energy from waste' plants whereas central government plans over a five year period.

[For further information please email [e-mail address redacted]

South East road and rail requirements (NIC discussion January 2017)



South East Priorities Identified by SEEC and SESL

[name redacted]

From: [e-mail address redacted] on behalf of [e-mail address redacted]
Sent: 19 January 2017 11:55
To: NIA Evidence
Subject: NIC - Call for Evidence - HSE response

Dear Commission Secretariat,

Please find below a response from HSE to the Commission's National Infrastructure Assessment (NIA) Call for Evidence. HSE only has comments to make on questions 9 and 10.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing independence across sectors?

The interdependencies need to be recognised between linear utility infrastructures e.g. there are an increasing number of offshore wind farms (green infrastructure) which have onshore cables which cross existing pipeline routes (energy infrastructure).

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

In responding to HSE's submission to the earlier consultation on process and methodology, the National Infrastructure Commission (NIC) acknowledged that existing land use planning and hazardous substances consent requirements may be relevant for the NIC to consider. Any new infrastructure should be appropriately separated from current and future major hazards.

When considering what changes could be made to the planning system, HSE asks the NIC to consider how to improve the parts of the current system that do not appear to be working effectively and which could also impact on infrastructure projects. For example, HSE's recent input into a Nationally Significant Infrastructure Project (NSIP) indicates that the lack of an effective process to remove hazardous substances consents that are no longer in use can have a significant impact on an NSIP proposal.

We also believe it important that the HSE Explosives Inspectorate is consulted at a very early stage of any infrastructure considerations. This is to ensure the conduct of specialist review and provision of advice on development proposals that might be affected by the presence and activities of a nearby licensed explosives facility, thereby avoiding any potential barriers to progression of the proposals.

Kind regards,

[name redacted]

[name redacted]

[job title redacted]

[address redacted]

[phone number redacted] [e-mail address redacted]

Please note that my phone number has changed

[2]

HSE is engaging with stakeholders to shape a new strategy for occupational safety and health in Great Britain Find out more[3] and join the conversation #HelpGBWorkWell

www.hse.gov.uk | http://hse.gov.uk/landuseplanning

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Interested in Occupational Health and Safety information?

Please visit the HSE website at the following address to keep yourself up to date

www.hse.gov.uk

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[Address redacted]

[Name redacted]
[Job title redacted]

[Phone number redacted]

[Fax number redacted]

[Email address redacted]

[Phone number redacted]
[Fax number redacted]

10 February 2017

Sent by email to NIAEvidence@nic.gsi.gov.uk

Dear Sir/Madam

National Infrastructure Assessment – Call for Evidence

I am pleased to submit the response to the National Infrastructure Commission's Call for Evidence on behalf of the Heart of the South West Devolution Partnership.

The Partnership consists of Devon and Somerset county councils, all 13 district councils in Devon and Somerset, Plymouth and Torbay unitary councils, the Local Enterprise Partnership, 2 National Parks and the 3 Clinical Commissioning Groups. As a partnership, we are united by a common ambition to raise productivity levels in the Heart of the South West.

In February 2016, we submitted a Prospectus for Productivity[1] to Government setting out our strategic challenges and opportunities. Our area has suffered from historically poor levels of productivity, with the gap nationally being as much as 26% between parts of our area and the South-East region. Recent growth statistics suggest that this gap may be widening.

The lack of investment in strategic infrastructure puts us at a disadvantage when seeking to attract inward investment. We have major capacity issues on our road and rail networks; we require the pace of Superfast Broadband to be accelerated and we have issues around the resilience of our infrastructure.

Although we have challenges to overcome we do have 'New World' potential with the opportunity to deliver on virtually all Pillars of the Government's Industrial Strategy. We have opportunities in sectors such as Nuclear, Marine, Aerospace and Advanced Engineering and Data Analytics. These opportunities, coupled with targeted research and development could transform our region and benefit the whole of the UK.

[1] Heart-of-the-South-West-Prospectus.pdf

We are pleased that the Industrial Strategy gives such a high priority to upgrading infrastructure as a key enabler of productivity. We want our area to be part of the solution and we believe the National Infrastructure Commission, through a weighted assessment process can play a key role in re-balancing investment in traditionally underfunded regions such as ours and unlock the potential within the Heart of the South West to turn around decades of low productivity.

The Partnership would be pleased to discuss in further detail any aspect of our submission.

Yours faithfully

[Signature redacted]
[Name redacted]

Devolution
for the Heart of the South West

National Infrastructure Assessment

Call for Evidence

Response of
Heart of the South West Devolution Partnership

10 February 2017

Context

The Heart of the South West Devolution Partnership consists of Devon and Somerset county councils, all 13 district councils in Devon and Somerset, Plymouth and Torbay unitary councils, the Local Enterprise Partnership, 2 National Parks and the 3 Clinical Commissioning Groups. As a partnership, we are united by a common ambition to raise productivity levels in the Heart of the South West. In February 2016, we submitted a Prospectus for Productivity[1] to Government setting out our strategic challenges and opportunities.

Our area has suffered from historically poor levels of productivity, with the gap nationally being as much as 26% between our area and the South-East region. Recent growth statistics suggest that this gap may be widening.

One of the biggest challenges we face is peripherality and connectivity with the rest of the UK and beyond. For example, Plymouth is an additional **2 hours in travel time** from Bristol, which is generally considered the South West. This factor is often overlooked from a national perspective and the situation has been exacerbated over decades by longstanding chronic under-investment of our physical infrastructure, an over-reliance on a few key routes (road and rail) leading to issues around capacity and resilience, and the lack of an agreed, long term, sequenced and integrated strategic investment plan for our area which can provide the necessary cost-benefit evidence. The lack of investment in strategic infrastructure puts us at a disadvantage when seeking to attract inward investment as we can't always meet the requirements and expectations of businesses. This, in turn, stifles our economic growth and prevents us from achieving our full potential.

Through our Prospectus for Productivity and the associated Productivity Plan that we are currently developing, the HotSW partnership is creating the vision and strategies that will transform our economy and communities, but we need the help of Government and the Commission to realise our ambition. We welcome the role of the National Infrastructure Commission in taking a cross cutting approach to this vital challenge and see it as an opportunity to help us overcome the local barriers that prevent us from fulfilling our economic potential to become the driver of growth across the South West region, and a significant national contributor.

In responding to this call for evidence we have made links to the Government's Green Paper 'Building our Industrial Strategy' 2017 and our ongoing work in partnership to tackle the region's productivity challenge. We are pleased that the Industrial Strategy gives such a high priority to upgrading infrastructure as a key enabler of productivity and recognises the need to drive growth across the whole country.

Our area has 'New World' potential in terms of future employment and productivity, with significant and genuine opportunities to deliver on virtually all Pillars of the Industrial Strategy. We refer to them as 'Golden Opportunities:

- Nuclear – Hinkley Point will be the first of a new generation of nuclear power stations;
- Marine – supporting our national strategic defence capability with the largest naval base in Western Europe, and a major potential to exploit our 230 miles

[1] Heart-of-the-South-West-Prospectus.pdf

of coastline and 6 major ports to become a centre of excellence for marine technology;
- Aerospace and advanced engineering – 14 of the world's top 15 aerospace and advanced engineering companies are located in the South West;
- Data Analytics – Metrological Centre's new Supercomputer in Exeter and the redevelopment of the UK Hydrographic Office in Taunton make the HotSW provide the opportunity to develop as a global centre for data analytics.

These opportunities, coupled with targeted research and development investment and infrastructure funding could transform our region and benefit the whole of the UK.

We believe the National Infrastructure Commission, through a weighted assessment process, can take a truly regional approach to rebalancing infrastructure investment and unlock areas such as ours to turn around decades of low productivity.

Cross Cutting Issues

Question 1: What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

Our infrastructure, especially transport links, broadband, mobile connectivity and the energy grid need to be upgraded and made more resilient. Our economy has major opportunities to compete in global markets but poor infrastructure and connectivity present major barriers to our future transformation. Local studies also estimate significant returns on investment from infrastructure improvements for both road and rail. For example:

- The wider economic impact of improving the A303 corridor is estimated to be £41.7bn over 60 years[2]
- The economic benefit of improving rail journey times to Paddington from Penzance by 26 mins is estimated to be worth £7.2bn of GVA over 60 years, and benefits of £677m could result from improving the journey time from Exeter to Waterloo by 30 minutes[3]

The Partnership has jointly identified the following infrastructure investments as priorities to support our ambitions to increase productivity and underpin sustainable growth:

Road

- A361 North Devon link road
- A303/A358/A30 improvements
- A38 Devon Expressway (and inclusion of Plymouth on the Strategic National Corridor network)
- Addressing future capacity and ongoing safety and reliability issues of the M5 and key junctions, and extension of the motorway network to serve Plymouth

One of the key reasons for our poor levels of productivity gap is the peripherality of the South-West Peninsula and consequently the distance between businesses and their markets. Research shows that there is a clear relationship between productivity levels and travel time from London, with a 6% productivity gap per 100 minutes'

[2] A303 Prospectus and Wider Economic Impact 2013

[3] Economic Impact of Rail Network Improvements

travel time. Approximate travel times to London by road vary from just under 3 hours to 4 hours.

Furthermore, the structure of our economy, with around 75% being small or micro businesses, and a relatively low density of development, mean that we do not benefit from the agglomeration effects experienced in areas such as London and the South-East, or the Midlands. Improved connectivity is essential to overcome the real and sometimes perceived issues of peripherality facing our businesses.

Traffic models predict that as conditions on the M5 deteriorate, motorists will select the A358/A303 alternative route. The improvements to A303 at Stonehenge will further exacerbate this issue. Therefore, the strategic investment assessment process must anticipate and assess the wider impacts of behavioural change by drivers.

Rail

The Peninsula Rail Task Force 'Closing the Gap 2016'[4] recommendations

- A resilient network which is not susceptible to regular disruption due to adverse weather
- Faster journey times to London, the South East, the Midlands and the North
- Greater train capacity and facilities to enable travel time to be used productively

The HotSW Partnership fully supports the priorities set out within The PRTF 'Closing the Gap' 20-year plan. The events in Dawlish and Teignmouth in 2014 highlight that our rail network is highly vulnerable to impacts of extreme weather events and urgent action is required to address resilience and improve the connectivity to London and other major cities to unlock business potential. It was estimated that these events cost the South West Peninsula's economy over £1.2bn.

Digital

- Match funding and co-production to deliver 100% superfast broadband coverage
- Co-production with our two National Parks to act as test beds for integrated land management and improve rural productivity

Whilst the Connecting Devon and Somerset Programme has made good progress in driving the delivery of digital connectivity, Next Generation Access broadband infrastructure requires high levels of investment which are secured by very long term returns of around 20 years. This may point to a different investment model using equity investment. CDS' recent experience suggested a good appetite in the market for investment in NGA networks with significant private investment being made. However, for some areas where replacement of dated copper networks is not commercially viable, gap funding is needed.

Energy

- Hinkley Point C development
- New energy initiatives including wind, sub-sea, and improvements in grid capacity
- A National Policy Statement for renewable energy generation in the Bristol Channel and Severn Estuary

[4] https://peninsularailtaskforce.files.wordpress.com/2016/11/prtf-closing-the-gap.pdf

The development of the two nuclear reactors at Hinkley Point C will ultimately meet 7% of the UK's energy needs and directly create 5,600 jobs at peak construction. The investment is of national significance and provides an opportunity to establish Somerset and the South West as a leader in this sector in the UK.
We also believe the Heart of the South West has considerable potential and the market opportunity to contribute to the future energy supply of the nation by becoming a leader in low carbon energy and renewables. We have a range of local projects and we are involved in larger collaborations around tidal power. However, we require substantial investment to upgrade the local grid infrastructure, and we need clarity and Government commitment for large scale schemes to capitalise on tidal energy.

Flood Relief

- Flood relief work in Somerset
- Resilience of infrastructure across HoSW

Between 2012 and 2014, the Somerset levels and moors were subject to significant flooding events. Communities became isolated and the whole Peninsula was impacted as some strategic road and rail routes were cut off and other major services were affected. The estimated economic impact was in the region of £100 million. These events demonstrated the vulnerability of our area to the effects of severe weather incidents, and highlighted the urgent need for a strategic approach to protect infrastructure against future events of this scale and impact.

There has been some investment in water management projects to protect infrastructure across the HoSW, however, this still remains a priority and much of our infrastructure lacks resilience to cope with flooding. There has been £22m invested in dredging, drainage and flood improvements in Somerset. There is planned investment for the Taunton Strategic Flood Project (£16.5m) and the Bridgwater Barrage (£32.4m) giving a total investment of £70m in flood mitigation. We see these projects as an opportunity to develop specialist research, development and business opportunities around hydrology and water management.

Question 2: How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

As set out above the HotSW has potential to be a global leader in a range of sectors. The connection to key gateways such as major airports, direct rail services and increased capacity on our highway could enable this area to maintain the UK's competitiveness.

We wish to support the access to our regional airport such as Exeter to provide the connectivity with other major airports and international travellers both for business and tourism.

We also support the protection and further development opportunities for ports and ferry terminals. For example, Brixham and Plymouth are ports of national significance for landing and exporting fish, and the facilities at Millbay Docks, Plymouth used by Brittany Ferries for cross channel ferries and international cruise liners has major potential to be developed further as a gateway. (Identified in the Plymouth/South Hams/West Devon Joint Strategic Plan) However for these assets to be fully exploited, investment is required to connect different modes to the national networks. Whilst Plymouth's railway station (on

the mainline) is due to be completely refurbished, the ports and ferry terminal (and naval base) are 40 miles from the start of the motorway network.

Question 3: How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Our experience from the new communities of Cranbrook and Sherford highlight that front-loading infrastructure funding is fundamental to the success of new communities and the pace of housing development. In order to 'de-risk' sites for developers Government commitment and support for upfront infrastructure funding is vital if it wants to deliver housing on the scale it has set out in recent announcements.

We would seek a similar commitment within the Assessment process to support early infrastructure investment to allow us to successfully deliver the new garden town at Taunton, and garden village at Culm in Mid Devon. The Government has an opportunity in the Garden Town programme to align with its desire to promote Off-Site Modular Construction as a means to accelerate delivery. This opportunity would only be successful if the infrastructure was in place to enable this acceleration to be achieved.

An integrated approach will deliver the broadest range of gains with active attention to opportunities to enhance natural capital as an integral part of infrastructure planning.

To deliver this integrated approach our Prospectus for Productivity sets out a proposal to create our own Infrastructure Commission. Complementing the National Infrastructure Commission the HotSW body would bring together local partners to formulate a HotSW Strategic Infrastructure Plan. As part of this Plan partners could explore more flexible funding models that would enable infrastructure to be designed, planned and targeted at agreed areas of growth. This plan would be linked to linked to Local Plans for housing and business growth.

We believe the HotSW Devolution Partnership would be well placed to test a sub-regional Infrastructure Commission. This would require a modest investment from Government but could be used to test and inform a revised national assessment process.

Question 4. What is the maximum potential for demand management, recognising behaviour constraints and rebound effects?

There is considerable potential for demand management on the highway network. With one or two exceptions outside London there is currently unrestrained access to the network resulting in significant congestion at peak time. Examples may include smart ticketing. Improvements to the way we examine data and links to the 'big data' and 'smart cities' agendas could improve demand management and influence behavioural change.

Question 5: How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

This is a very real issue for our area and represents a major challenge. Whilst improving access to our area through new or upgraded assets is key, the maintenance of our existing assets, given the size of our road network in comparison to the rest of the UK places a disproportionately large burden on local authorities.

We believe the answer to this question should come from greater collaboration and joint working at a local level and the balance can't be nationally prescribed. We would see this as an issue that could be agreed at a local level through the creation of an agreed HotSW Infrastructure Plan.

Question 6: What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

The Government could provide support with strategic procurement processes for major infrastructure projects by making available a national template that local areas could draw on as required. This would drive economies of scale through the procurement process and reduce complexity.

The HotSW partnership provides an ideal platform for future collaboration and is establishing more formalised decision-making with intention of setting up a Joint Committee from September 2017.

Question 7: What changes in funding policy could improve the efficiency with which infrastructure funding services are delivered?

The Government's current approach to infrastructure spending disadvantages regions such as the South West. Decades of underfunding has starved our area of resources and constrained our ability to transform the economy. An example of this disparity can be shown in the Autumn Statement announcements for Growth Deal. The Government will award £1.8 billion to Local Enterprise Partnerships (LEPs) across England through a third round of Growth Deals. £556 million of this will go to the North of England, £392 million to LEPs in the Midlands, £151 million to the East of England, £492 million to London and the South East, and £191 million to the South West. Clearly only a proportion of this will come to the HotSW LEP.

The Industrial Strategy sets out a commitment to drive growth across the whole country and signals Government's intention to use infrastructure investment to address productivity weaknesses across the country and imbalances between areas. Investment in infrastructure should take account of the economic potential of the wider South West.

There is a risk that investment in rail and the Strategic Road Network is only prioritised in areas where it already provides for business productivity. Highways England, through Route Strategies will determine investment priorities for RIS2. The problem will be that those investment decisions will be based on where problems are most severe and where impact is greatest. This approach tends to perpetuate the historic under-investment and disconnection from major centres of growth in areas such as ours. Therefore, a national infrastructure assessment methodology weighted to addressing the regional disparities would be greatly welcomed.

The key thrust of our devolution prospectus to Government is the need to give our Partnership greater powers and funding to focus on local priorities to remove the barriers to productivity. A key barrier at the moment is the inflexibility and fragmentation of the current funding regime. We believe there are significant efficiencies that could be delivered through a localised Single Investment Framework. The Framework would bring together public and private investment into an Infrastructure Fund that would deliver on the priorities identified by our local Commission.

Question 8: Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

No comment

Question 9: How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

One crucial factor relates to the skills shortages and distortions in the market created by the demand for specialised skills in competing areas. Particular examples in the Heart of the South West relate to the requirement for construction skills which are already in high demand and short supply across the area, and with the imminent significant potential for Hinkley C to draw labour from other areas. Similarly, with the need for specialist nuclear skills at Hinkley, and a growing requirement at the naval base in Devonport for refuelling of nuclear submarines. The risks around skills shortages need to be better understood and planned for.

Question 10: What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

The whole viability assessment process is also not currently fit for purpose. Local authorities are ill-equipped to challenge developers' claims that delivery of infrastructure is not viable. In addition, CIL rates and developer contributions are based on excessive assumptions on land values, minimising the adopted CIL rates and section 106 contributions. These issues cause significant difficulty in securing sufficient funding to deliver the infrastructure required, meaning development impact is often not appropriately mitigated. To avoid this, the planning system needs to be better equipped to either control or capture land value uplift.

Another issue associated with the operation of CIL is the lack of control over phasing, at present development can get ahead of the delivery of critical infrastructure. One option to address this could be some form of Grampian type control to ensure infrastructure is in place to support sustainable development. As we have already pointed out, the reason why new communities such as Cranbrook have been a success is because infrastructure funding is front loaded.

Regulation 60 of the Community Infrastructure Levy (CIL) Regulations makes provision for a percentage of CIL receipts to be used to pay borrowing costs. Currently however the percentage of CIL that can be used to pay back loans, as prescribed within the Regulations is set to zero. There is also provision for the Secretary of State to change this and allow repayments, specifying the percentage that could be applied.

Generally, infrastructure needs to be provided up front to enable growth. Not being able to apply the CIL funds in this way is an impediment to growth. Therefore, there should be a change to the Regulations to allow repayments on loans.

In our Devolution Prospectus, we advised Government of our strong track record of delivery in partnership with residents and businesses. We believe that scaling up our governance arrangements will deliver greater efficiency and accelerated delivery. This would come through the sharing of resources and collective leadership on

commonly agreed goals. The effective delivery of new infrastructure investments would be a beneficiary of these new arrangements.

In order to facilitate this Government would need to allow local areas to control investment, for example by lifting pooling restrictions for those areas that wish to enter into new arrangements for the use of CIL, Section 106 and other capital investments.

Question 11: How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Devon and Somerset is renowned for its natural beauty and the Partnership is conscious of its role to protect and enhance this natural asset and in particular of the importance of natural environment to the areas' tourism sector.

HotSW is the ideal location to trail blaze natural capital-led productivity growth. It is rich in natural capital, spectacular coastline, and substantial land area within National Parks/Areas of Outstanding Natural Beauty.

The area is reliant on abundant natural assets – and the ecosystem services that derive from them – to power economic growth. Our coastline, moorlands and countryside attract more domestic tourists than any other UK region. Employment in sectors that depend directly on natural capital, such as agriculture and fisheries, is proportionately higher than any other UK area. However, in contrast, there is also more potential for increasing economic benefits from natural capital than in any other region.

For this reason, we need the National Infrastructure Commission to support areas such as the HotSW to develop local strategies that can deliver sustainable infrastructure projects that protect and enhance the natural environment but help deliver on our productivity objectives. We have many proposals around digital sectors and renewables that can deliver this and have offered to work as test beds to pilot approaches.

Specific examples of infrastructure that needs to protect the natural environment include the careful implementations of flood relief schemes in Somerset, and the protection from harmful development of unique natural assets which have significant national economic potential, such as deep water berths in Plymouth and the quality of Plymouth Sound.

Question 12: What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

It would be helpful to have a greater ability to base decisions on the wider economic growth and productivity benefits of schemes rather than a narrow reliance on the Benefit/ Cost ratio. In transport schemes (e.g. A303 above) the wider economic benefits for outweigh the transport benefits but decisions are often based on the narrower transport benefits. Some standardisation of approach in this respect would also be useful as business cases are currently being prepared using a variety of approaches making it difficult to compare competing investments.

We would also like to see public realm improvements for transport schemes acknowledged as core benefits by the DfT and included in the WebTAG guidance for Business Cost Ratio (BCR) calculations.

TRANSPORT

Question 13: How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Our travel studies already demonstrate our networks have limited capacity and demand continues to grow. The support for the roll out of Broadband and rail improvements could help to influence more sustainable travel and work patterns and reduce problems at peak periods.

The widespread deployment of autonomous vehicles could lead to an increase in the demand for highway capacity, as personal travel may be available to those who are not able currently to drive cars.

It is reasonable to assume that there will be a further erosion of public transport in rural areas, but that this decline may be offset by the availability of autonomous vehicles and widespread use of information systems to facilitate more car-sharing.

Question 14: What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

The transport priorities identified above represent the partnership's investment areas.

Question 15: What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

The research we have undertaken to inform our Productivity Plan highlights the value of transport investments to allow people and freight to get into, out and around major urban areas and across the two counties. The 2006 Eddington Review estimated that a 5% reduction in travel times nationally would be worth around 0.2% of GDP annually (Eddington 2006) and recommended that the key priorities should be growing and congested areas where there is growing demand for transport. As already illustrated in our evidence business the Heart of the South West has significant lack of capacity and resilience in connectivity and this is a key barrier to our growth.

Econometric analysis by M. Boddy, looking at the correlation between productivity and travel time from London suggests that disconnection from major economic areas plays an important role in explaining regional productivity differentials. This work suggests that investment in transport infrastructure to reduce journey times to and from the capital could make a significant difference to regional productivity outcomes.

This report also points out that the lag is unlikely to be solely due to differences or penalties in terms of travel times, but due to clustering effects, suggesting that reducing journey times could potentially spread the positive effects of clustering (the better exchange of people, ideas, supply chains etc.) focused on London.

There are just two main road routes from London into HotSW: the M4/M5 and the A30/ A303, of which much is a single carriageway trunk road. Both routes are prone to disruption due to road accidents, adverse weather and congestion, making travel times unpredictable and unreliable. An obvious solution to the risk of dependency on the M5/M4, would be to make the A30/A303 a dual carriageway from beginning to end, a project that many consider vital. Partners are also working to deliver series of

improvements on the A30/A303 corridor and to address a series of Pinch Point in the LEP area.

Authorities in the Heart of the South West region welcome the opportunity to engage in this consultation and are keen to work with Highways England and Network Rail in developing the evidence base and development of schemes for RIS2 and CP6 respectively.

Unsurprisingly, average vehicle speeds on locally managed 'A' roads during the weekday morning peak – a measure of congestion – are lower in Plymouth (19.7 mph) and Torbay (23.3 mph) than in Somerset (29.7 mph) and Devon (31.4 mph) and in all areas except Torbay where speeds have remained the same, average speeds in 2013/14 were slower than those in 2006/7. For contrast, average speeds in Inner London were 12.3 mph in 2013/4.

Table 1 Estimated road journey times between selected locations: 2016

	Taunton	Exeter	Plymouth	Birmingham	London	Torquay
Taunton	X					
Exeter	45m (34 miles)	x				
Plymouth	1h 20m (74 miles)	53m (45 miles)	x			
Birmingham	2h 21m (138 miles)	2h 49m (173 miles)	3h 26m (211 miles)	x		
London	2h 55m (165 miles)	3h 24m (200 miles)	4h 0m (238 miles)	2h 17m (126 miles)	x	
Torquay	1hr 5min (54 miles)	40 min (24 miles)	58 mins (33 miles)	3h 12 min (190 miles)	3h 47min (217 miles)	x

Table 5 Estimated train journey times between selected locations: 2016

	Taunton	Exeter	Plymouth	Birmingham	London	Torquay
Taunton	X					
Exeter	25m	x				
Plymouth	1h 26m	59m	x			
Birmingham	2h 05m	2h 32m	3h 33m*	x		
London	1h 42m	2h 8m	3h 7m	1h 13m	x	
Torquay	1h 03m	34m	1h 03m	3h 19m*	2h 52m**	x

Source: Trainline.com

Commuting patterns identified by the 2011 Census returns have been used to create 'Travel to Work Areas'15 (TTWA). These are the closest we have to functional

economic geographies. Exeter has the largest TTWA in the HotSW region, accounting for around one quarter of the population aged 16 and over (426,500 people). This is followed by the Plymouth (354,800), Yeovil (181,200) and Torquay & Paignton TTWA (158,000).

Commuting patterns are such that overall 71% of the working population of the Heart of the South West LEP live and work within the area. Overall, more than 47,700 people commute into the area from outside to work while almost 54,600 commute out. This generates an overall net 'loss' of 6,850 though commuting flows. Exeter (+26,200) and Plymouth (+4,700) gain from inward migration of commuters; Torbay (-4,400), Somerset (-8,200) and all other Devon districts with the exception of Exeter (-25,150) have a net outward migration of commuters. Taunton is the only area in Somerset that sees net in-commuting. 81% of people in employment in the area live in the area and 76% of jobs are filled by people that live in the area.

Question 16: What opportunities does 'mobility of service' create for road user charging? How would this affect road usage?

No comment

Question 17: What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends? When would decisions need to be made?

The issue of digital connectivity is pressing in our area and is the reason why it is one of our priorities.

The BIS report Mapping Local Comparative Advantages in Innovation (July 2015) identifies that in 2014:

- 18.8% of internet users in the HotSW LEP area had access to broadband at speeds of over 30mbs, ranking the LEP 36th out of 39 LEP areas
- 55% of had access to broadband at over 10mbs, placing us in the bottom quartile of LEPs on this measure
- Only two LEP areas (Marches and Cumbria) had slower average download speeds than those found in HotSW.

The Centre for Cities ranks Exeter and Plymouth, 46th and 22nd respectively, out of 62 cities for access to Superfast Broadband.

This highlights the need for significant investment and priority to be given in the National Infrastructure Assessment to improving the HotSW performance in these key metrics. As the Government acknowledges in its Industrial Strategy consultation, digital connectivity is vital for rural economies and the HotSW as one of the most rural economies in the country.

A Full Fibre infrastructure network providing symmetrical and ultrafast connectivity across the country is currently acknowledged as the way forward for fixed Broadband infrastructure. Across HotSW programmes, we have achieved significant uplift in the numbers of premises receiving SF broadband (24 mbps) in a relatively short time, largely by utilising and upgrading existing infrastructure; however, a number of these premises will have to be revisited to achieve Next Generation Access (NGA) (30 mbps) speeds. Dated copper networks are being superseded by fibre technology and are unlikely to merit significant or long term maintenance investment.

We have repeatedly called on Government to encourage commercial providers to provide this infrastructure. However, gap funded or public/ private collaborations should be considered for areas which are not yet commercially viable.

Continual technical developments should mean that most areas will become commercially viable as illustrated by our recent experience through our Connecting Devon and Somerset (CDS) programme. In December 2016 CDS awarded 4 contracts for the delivery of NGA Full Fibre services on a gap funded basis. These contracts will deliver symmetrical Full Fibre networks providing speeds of up to 1 GB. The value of the network is £62.25 M including a £43.75 M private sector investment. In addition, the contractor is also undertaking commercial build. A number of providers participated in the procurement providing a competitive environment. This resulted in a good proposal for a joint public/ private collaboration and with a significant private sector funding contribution which greatly exceeded the public-sector subsidy.

NGA broadband infrastructure requires high levels of investment which are secured by very long term returns of around 20 years. This may point to a different investment model using equity investment. CDS recent experience suggested a good appetite in the market for investment in NGA networks with significant private investment being made. The CDS procurement tested the market on a gap funded basis. The continued market dominance of a single commercial provider causes imbalance in the telecommunications market and appears to frustrate competition. A competitive environment accelerates delivery of Full Fibre networks and provides additional resilience for important infrastructure.

The CDS procurement also highlighted that some deeply rural areas will remain outside the current long term economic limit for Full Fibre networks. This means that other technologies and existing technologies will need to be supported for the next 5-10 years on a “stop gap” basis so that more remote areas are not left behind.
Full Fibre Broadband infrastructure should be included in all new build or a suitable alternative for single premises/ remote sites.

Question 18: Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

We see no evidence that the existing digital communications regime can deliver the required level of connectivity. Whilst there is increasing investment in fixed connectivity which can be supplemented by mobile connectivity in more remote/ difficult to reach areas, the timescales for roll out of comprehensive full fibre networks are not within the next 3-5 years. That timescale may be changing as the dominant provider appears to be contemplating further investment in fibre to maintain its position.

Mobile connectivity, whilst better than nothing, is not universally available. It is at comparatively low speeds, and relatively high cost. Whilst interim solutions such as fixed wireless access seem able to provide a useful speed increase, they don’t have the flexibility of a Full Fibre network.

Fixed connectivity

In addition to testing markets and taking a gap funding/ public/private collaboration approach the following should be considered;

- Supporting commercial providers to innovate new techniques resulting in a reduction in costs.
- Promoting effective competition and seeking to achieve a more balanced market rather than continued market dominance by a single provider.
- Pump-priming more remote communities or co-investment models using public funds
- Availability of long term low cost finance whether by loan or equity investment.
- Use of “interim” solutions pending a Full Fibre solution. E.g. CDS has awarded a fixed wireless contract to cover parts of Dartmoor and Exmoor; a particularly challenging location to deliver broadband infrastructure.
- Local Body/ Local community solutions – no “one size fits all” approach. Previous experience of a nationally driven solution has not worked particularly well for more rural areas. Greater flexibility could be achieved by devolving funds in sympathy with the devolution proposals.

Mobile Connectivity

O2 has a licence obligation through the 2013 4G spectrum auction to provide 98% indoor coverage by the end of 2017 however this is only at 2Mbps and is a national target. EE is investing around £1Billion to achieve 98% of the UK population as soon as possible and 95 % of the UK landmass by 2020. However national targets mask under delivery in rural areas. It is anticipated that there will be a shortfall of between 6-10 % indoor 4G mobile coverage in Devon and Somerset and a shortfall of around 1 % outdoor coverage for the area. These are significant shortfalls when compared to the national targets.

On an interim basis, it may be possible to improve indoor mobile signals using Femtocell and VoWiFi. These solutions are reliable and comparatively cost effective ways to improve mobile signals but less well known. Mobile solutions still tend to be comparatively more expensive.

The Mobile Infrastructure Project (MIP) was intended to improve 4G “not-spots” by provision of additional mobile sites. The project was not as successful as hoped with around 8-10 sites becoming operational out of a projected 43 sites which were expected to be needed across Devon and Somerset. Locations had to be set aside due to location, planning or other problems. It may be appropriate to re-launch the MIP whilst incorporating the lessons learned from the last phase including;

- more consultation (not imposing large lattice masts on communities where smaller less obtrusive masts would be appropriate),
- being flexible - inconsistencies in mapping between operators needs to be considered,
- reflecting the costs that the market can sustain when compared to annual revenues. As remote masts have a limited market these will not sustain high annual rental fees in addition to power costs.
- Mobile operators should be encouraged to use the experience gained from 3G small cell deployments in rural areas and apply that to 4G rural not-spots. Costs may require community engagement.

Other ways in which mobile infrastructure might be facilitated include;

- Amendments to planning and permitted development rights for small cell sites
- Business rate relief for small masts

It would be worthwhile having a reliable source for information about “stop-gap” technologies which could be used pending a universal Full Fibre solution. This could be promoted in areas which are unlikely to have early Full Fibre networks.
It may also be appropriate to offer some form of subsidy for more costly connectivity pending a universal Full Fibre network.

Energy

Question 19: What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

No comment

Question 20: What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

No comment

Question 21: What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

In the Industrial Strategy, Green Paper, the Government sets out its highest priorities for energy policy are affordability and securing opportunities for energy innovation. In addition to the development of the Hinkley Nuclear plant, which is estimated to deliver £50bn work of business opportunity within a 75-mile radius, there is a unique opportunity for our area to support, develop and sustain new energy initiatives including wind, sub-sea and grid improvements. We believe this area is a considerable untapped resource with market opportunity to contribute to energy supply of the nation.

We have the potential to become a leader in low carbon energy and renewables, however, current grid infrastructure is limiting deployment. The grid capacity and fault levels are also affecting business growth on the demand side, due to high costs and time delays in connection offers provided to businesses. According to research on behalf of HotSW LEP, there is a pipeline of £1.1bn of renewable generation schemes delayed. This delay is affecting economic growth, including for developers, supply chain opportunities and land diversification opportunities.

Through our Devolution bid we asked the Government to help us develop and sustain new energy initiatives including wind, sub-sea and grid improvements.

This would include the local control of:

- Feed in Tariff (DECC/Ofgem) Budget to allocated to new projects £75-100m to 2018/19
- Renewable Heat Incentive (DECC/Ofgem) Budget allocated to new projects
- Rural Community Energy Fund (RCEF) (£15m pot DECC/DEFRA)
- Urban Community Energy Fund (UCEF) (£10m pot DECC)
- Greater local control and devolution of ECO funding (though national pooling and distribution by population) in order to support the growth of the energy efficiency sector and assist local residents in fuel poverty to become more energy efficient with a focus on the areas/properties most affected.

Whilst 91% of the HotSW LEP area is considered rural, 40% of the population live in cities and urban areas, with particular concentrations in, Plymouth Exeter, Torbay and Taunton Most electric vehicles currently available on the market today have a typical range of around 100 miles. Therefore, in order to make effective use of low carbon vehicles across the whole region, investment will be needed in storage technologies alongside the energy infrastructure (for example tackling grid constraints issues) in order to ensure that a reliable and robust network of supporting facilities such as charge points is available.

Water and wastewater (drainage and sewerage)

Question 22: What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

No comment

Question 23: What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

No comment

Question 24: How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

No comment

Flood risk management

Question 25: What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

At a local level within the HotSW LEP region, the Somerset levels and moors in particular were subject to significant flooding events in both 2012 and 2014. In both cases communities became isolated as strategic road and rail routes into the South West peninsula were cut and infrastructure services such as waste water treatment and telecoms were interrupted. The estimated cost of these impacts was in the region of £100 million[5].

Recognising the importance of effective infrastructure and transport links for communities and for economic prosperity and growth, the Somerset Levels and Moors Flood Action Plan[6] sets outs to ensure the following level of flood resilience:

- A recognised community should have at least one access road, or if that is not possible, easy access to alternative means of transport
- Maintain strategic connectivity into and through the county
- Infrastructure at risk should be able to recover more quickly from flooding
- Where routes are likely to be subject to flooding the resilience of agreed alternative routes should be strengthened

[5] Somerset Economic Impact of 2013-14 Flooding

[6] Somerset Levels and Moors Flood Action Plan

Question 26: What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

No comment

Solid Waste

Question 27: Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

There is still some way to go to provide sufficient incentives to ensure that waste is treated in the correct way and that there is sufficient treatment capacity. The discord between reducing funding and the ability of waste collection/disposal authorities to manage waste effectively needs to be reviewed. The planning process is a key facilitator of this capacity and waste planning authorities need to work closely with operators, and cooperate with other waste planning authorities, to ensure sufficient and coordinated capacity.

Question 28: What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social be)?

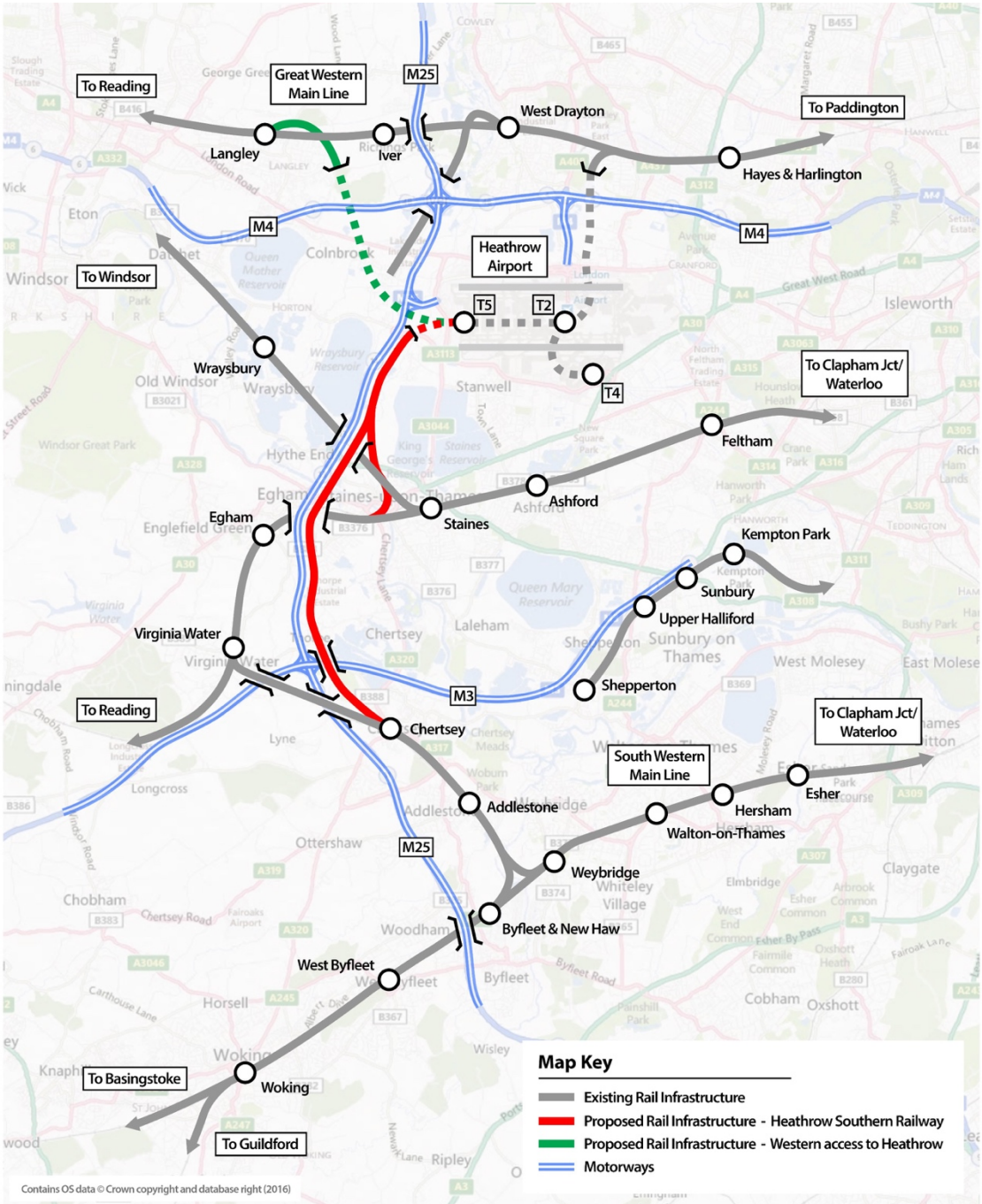
No comment

Heathrow Southern Railway Ltd.

Response to the National Infrastructure Assessment "Call for Evidence"

9th February 2017

1 The project



Heathrow Southern Railway (HSR) is a private sector project to construct new infrastructure from Heathrow, extending west from the existing Terminal 5 station, then running parallel with the M25 motorway to connect with both the Windsor – Staines route north of Staines and the Virginia Water – Weybridge route north of Chertsey. The new infrastructure will enable operation of;

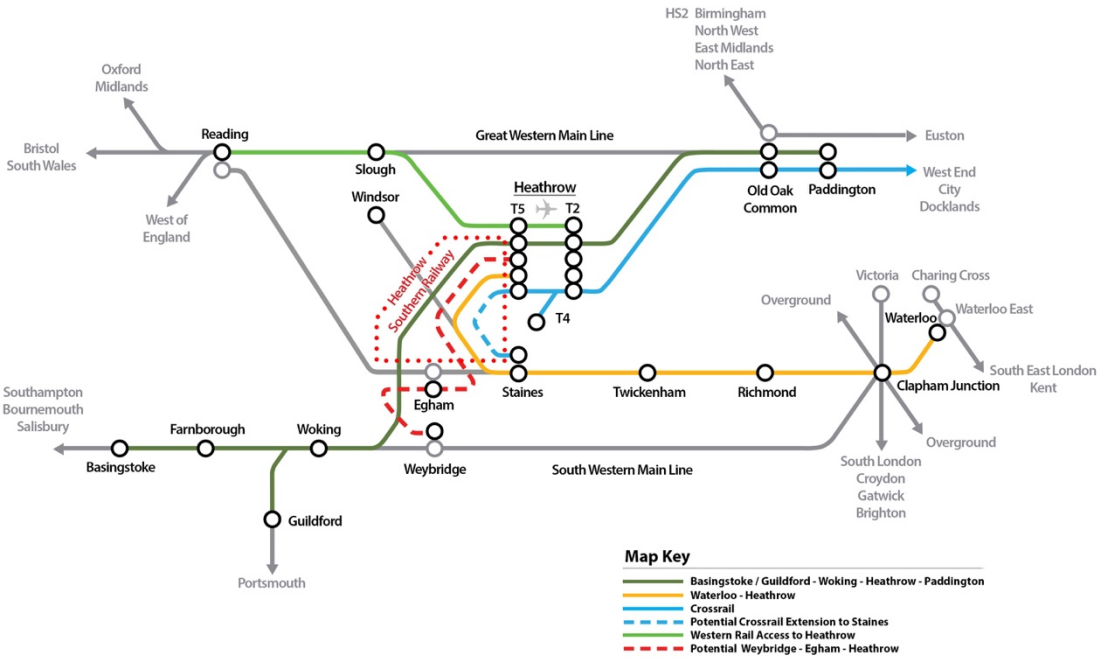
- a new, fast service between Guildford/Basingstoke, Woking and Paddington via Heathrow, using the existing Heathrow Express (HEX) paths between Heathrow and Paddington much more effectively; and
- a Waterloo – Heathrow service via Clapham Junction and Richmond.

Capital costs are estimated at c.£1.2bn including risk and contingency.

In addition to meeting the long-standing aspiration for a rail link between Heathrow and the South, the project provides a link to both HS2 and Crossrail at Old Oak Common, and an alternative route to London from Woking and beyond, with better city centre distribution and relief to the South Western Main Line in advance of Crossrail 2.

2 Strategic case

2.1 The Case for Change



HSR meets the strategic requirement to improve access to Heathrow Airport, giving comprehensive rail access to Heathrow from the South West Quadrant, while at the same time meeting other important objectives:

- Provision of an alternative central London terminal for passengers from Woking and beyond, providing enhanced central London distribution via interchange with Crossrail at Paddington;
- Improved connectivity to HS2, with a fast, one-stop connection at Old Oak Common;

- Significant relief to the existing severe capacity constraints on the South Western Main Line, and the LUL network serving Waterloo;
- Enhanced use from the west of the cross London core section of Crossrail;
- Maintenance of a fast service between Heathrow and Paddington, highly valued by the airport and airlines while making full use of the spare capacity released following the expected transfer from Heathrow Express of many air passengers to direct Crossrail services.

The case for change has already been fully recognised in Network Rail's "Southern Rail Access to Heathrow Feasibility Study", carried out for DfT, although the remit for the study focussed only on Heathrow. This project builds on the Network Rail report to deliver major additional strategic benefits.

Construction of the connections for both routes at the same time will minimise capital costs and disruption, and create a project large enough to be attractive for private sector funding.

2.2 Strategic Fit – benefits for transport users

HSR provides multiple benefits to transport users:

- Significant relief to the capacity constraints at Waterloo and on longer distance services on the South Western Main Line.
- Direct access between Woking, Basingstoke, Farnborough and Guildford and Heathrow, with convenient interchange for passengers from the Portsmouth, Southampton/Bournemouth and Salisbury routes.
- Travel time savings and reduced crowding on underground links for passengers from the stations served by the new link accessing those parts of Central London better served by Paddington and Crossrail than by Waterloo.
- Direct access between key centres in South and South West London (Richmond, Putney, Twickenham and Clapham) and Heathrow, with convenient interchange at Clapham Junction and Waterloo for South and South East London and parts of Sussex and Kent.
- Direct access via Old Oak Common between HS2 and Woking, Basingstoke, Farnborough and Guildford, with convenient interchange for passengers from the Portsmouth, Southampton/Bournemouth and Salisbury routes.
- Improved rail access to Heathrow, resulting in significant mode shift from car, taxi and coach to rail, thus reducing congestion on the M25 and other sections of the busiest parts of the UK highway network and helping to meet the onerous public transport mode share and environmental conditions that are essential to Government's objective of delivery of a third runway at Heathrow.

2.3 Strategic Fit – wider benefits

HSR will help contribute towards the Government's wider economic objectives. It will link the most prosperous part of the South-East outside London with the Midlands and Northern cities that HS2 will serve through substituting a cross-London underground journey with a single interchange. Facilitating such journeys will help to increase HS2's contribution to the economy by increasing accessibility between these regions and reduce the dominance of London in the distribution of these benefits.

By improving the connectivity between Heathrow and parts of Surrey, Hampshire and adjacent counties, some of the benefits of increased foreign direct investment and productivity identified in the analysis undertaken for the Airports Commission can be expected to follow from HSR. Even with its present capacity constraints, total passenger numbers at Heathrow have risen from 65.7 million in 2010 to 76 million in 2016, and DfT forecast a further increase to over 90m without any additional runway or terminal capacity.

2.4 Innovation – the opportunity for a new model of procurement and financing

HSR provides an opportunity to exploit a new model of rail infrastructure procurement and financing, building on the recommendations in the Shaw report. The scheme would be procured and financed privately, funded against a predictable long term revenue stream. HSR Ltd would be at risk for the costs of planning and construction of the new railway, in return for contractual commitments from DfT to purchase a defined quantum of train paths at a predetermined price. HSR will also provide a yardstick for measuring the efficiency of this alternative model of rail infrastructure procurement.

2.5 Preliminary outline economic case – value for money

The scheme is estimated to deliver "very high" value for money, with a Benefit Cost Ratio (BCR) of 15.4. A value for money category can be adduced from the BCR because the scheme has minimal unquantified impacts. The economic case is better than for many capacity enhancement schemes for two principal reasons:

1. By running trains which are forecast to be at or close to of capacity during the peak in place of the current Heathrow Express service which operates at about 30%, much of the capacity is effectively 'free'.
2. The cost to government is reduced because the fare charged to passengers between Heathrow and Paddington is assumed to be set at a premium, although one which is around half of the present Heathrow Express level.

A comparable fare is also assumed in the appraisal for Crossrail services to Heathrow, although it is understood that TfL has not yet taken a decision on the appropriate fare.

The Heathrow – Waterloo service will be fully integrated with other services via Staines, serving both commuter and off-peak markets into London, together with the major destination of Heathrow. The service will therefore achieve major additional revenue for flows to and from the airport at minimal additional operating cost.

Although the benefits have been estimated on the assumption that there is an additional runway at Heathrow, the scheme is not dependent on this. A sensitivity test, undertaken with Heathrow retaining only two runways, shows a BCR of 6.95, well in excess of DfT's "very high value for money" benchmark.

3 Response to specific questions

Q1. Heathrow Southern Railway is a project with exceptionally high economic and strategic value:

- Delivery of a significantly increased public transport mode share for Heathrow Airport, in line with the Government's conditions for the development of the third runway;
- Significant crowding relief to the South Western Main Line (Woking and beyond to Waterloo)
- Enhanced central London distribution for passengers from Woking and beyond, with some relief to the London Underground network at Waterloo;
- Much better connectivity for Heathrow from south west London, and, with a "one stop" connection, improved connectivity for south London, Sussex and Kent (connections at Clapham Junction and Waterloo East)
- A "one stop" connection at Old Oak Common to HS2 for passengers from Woking and beyond, making rail a much more attractive option for journeys from Surrey and Hampshire to the Midlands and the North of England.
- Congestion relief to the M25

Q2. Heathrow Southern railway will dramatically improve access between Heathrow and Surrey, Hampshire and South Western London, directly supporting the UK's international effectiveness, and making these areas significantly more attractive for inward investment.

Q6. Heathrow Southern Railway will provide a clear comparator to Network Rail for major railway infrastructure investment, enabling ORR and the Department for Transport to have a significant external check on Network Rail's costs and delivery for rail enhancement projects.

Q7. The project is potentially an exemplar for private sector rail investment, with only limited interaction with Network Rail's existing infrastructure (two at-grade junctions with relatively lightly used lines).

Q8. We are confident that Heathrow Southern Railway can be privately financed, allowing the delivery of strategically important infrastructure without government capital expenditure. The project can meet government requirements for value and transparency in both its development and construction phases, potentially using a similar framework to the Thames Tideway project.

Q13. Strong growth is forecast for both air travel at Heathrow, both as a result of larger aircraft and the third runway, and for long distance rail travel, particularly HS2. Heathrow Southern Railway directly supports both.

Q14, Q15. Heathrow Southern Railway directly supports the development of Heathrow and contributes to maximising the use of HS2, as well as providing crowding relief to the South Western Main Line, the most capacity constrained major route into central London. This is delivered in a highly efficient way, using the existing underutilised Heathrow Express train paths into central London. The operational effectiveness of the scheme, and the different major markets it serves, is reflected in its exceptionally high Benefit Cost Ratio (15.4)

4. Summary

Heathrow Southern Railway is a project which serves a range of key strategic needs and demonstrates exception value for money.

We would be delighted to provide further information to assist the National Infrastructure Commission in preparation of its assessment, and in particular to provide detailed supporting documentation, including the business case, which has been prepared fully in accordance with the Department for Transport's WebTAG guidance.

In the first instance we attach a brief article from December's Modern Railways magazine and biographies of the HSR Board, chaired by Baroness Jo Valentine.

HEATHROW SOUTHERN RAILWAY
A NEW OPPORTUNITY

CHRIS STOKES of First Class Partnerships examines a new railway proposal with an attractive Benefit Cost Ratio, ranging between 6.82 and a whopping 15.37

After years of debate and delay, the Government has now firmly come out in support of expanding runway capacity at Heathrow – albeit with a further period of consultation, leading to a final vote in Parliament in a year's time. But getting the new runway built will still be vigorously opposed. One of the main potential legal challenges is likely to be about air quality, which is primarily related to road traffic, not flights; Heathrow sits close to three of the busiest motorways in Europe, the M25, M4 and M3, and driving to the airport is unpredictable and stressful. The Government has emphasised both a requirement for a 55% public transport mode share, and the need to ensure that the current level of road traffic to the airport doesn't increase. So modal shift to rail is highly desirable for everyone – Heathrow is probably the largest untapped rail market in the country.

Connections to London are good, with Heathrow Express, the Piccadilly Line and, from 2019, Crossrail. But otherwise, rail passengers depend on coach links from Reading and Woking, so the great majority of people drive or go by direct coach – Heathrow is one of the most important markets for National Express, which charges well above average fares for airport journeys, reflecting rail's poor competitive offer.

WRATH

Network Rail is developing the Reading – Heathrow link (Western Rail Access to Heathrow or WRAtH) that was included in DfT's 2012 High Level Output Specification, although 'subject to a satisfactory business case and the agreement of acceptable terms with the Heathrow aviation industry'. Despite little realistic prospect of financial support from the airport or the airlines, the project appears likely to go ahead, and will provide a 15-minute frequency from Reading, Maidenhead and Slough to the airport, replacing the existing coach service with a faster and more reliable rail route. This will make rail a real alternative to road for the Thames Valley, the South West and South Wales.

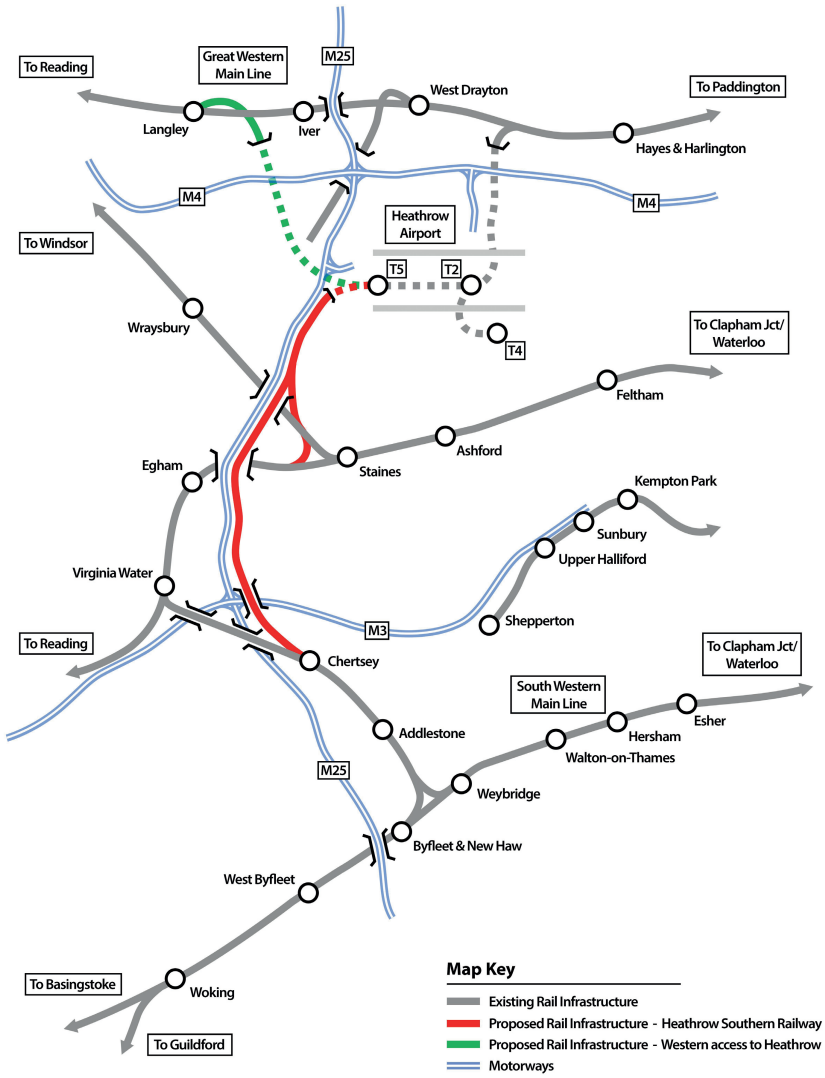
However, the WRAtH business case is not strong, as the airport is the only market it serves, and it also requires longer distance passengers to change at Reading, a significant disincentive for airport journeys. This is in marked contrast to the successful approach of major European airport interchanges which have through operation of services to and via the airport, serving multiple markets at high frequency with direct trains, maximising the use of scarce network capacity, and delivering operating synergies.

Even with WRAtH, there will be no rail access from the south. Network Rail carried out a review of southern rail access last year, but the remit from DfT focused entirely on access to the airport. Network Rail wasn't asked to look at the wider strategic opportunities so successfully grasped at, for example, Schiphol and Zurich.

WOKING TO PADDINGTON

In contrast, the Heathrow Southern Railway (HSR) project serves multiple markets. The proposed scheme is a private sector project to construct new rail infrastructure from the west end of the Terminal 5 station (which was built to allow future westwards extension) to a junction with the Virginia Water – Weybridge line north of Chertsey, together with a connection to the Windsor – Staines line. This infrastructure would provide a direct link between Woking and Heathrow, enabling operation of fast Woking – Heathrow – Paddington services, taking over the existing Heathrow Express paths, and also Heathrow – Richmond – Clapham Junction – Waterloo services.

Extra airport capacity: on 3 April 2008, when Heathrow Terminal 5 had just opened, an afternoon service for Paddington awaits departure from platform 4 formed of Class 332 No 332004. The station here was built with passive provision for extension to the west. Brian Morrison



Plan of the route: the majority of the Heathrow Southern Railway route would run alongside the M25, minimising intrusion in the landscape.

The proposed scheme would serve the following major markets:

- Fast, direct rail access to Heathrow from the important airport catchment areas to the South and South West, currently not served by rail.
- Direct trains to Paddington from the south and south west, providing an alternative London terminal to Waterloo, with Crossrail providing excellent connections to the West End, the City and Docklands.
- Direct trains to Old Oak Common, providing a 'one stop' connection to High Speed 2 and access to the proposed major development site. Our appraisal shows potential passenger numbers for HS2 by this route are comparable to the number of air passengers using Heathrow Southern Railway to reach Heathrow – with a high proportion switching from road to rail for long distance journeys to the Midlands and the North.
- Operation of a frequent service to Waterloo, serving important catchment areas such as Richmond and Putney, and giving major connectional opportunities to South London, Sussex and Kent through Clapham Junction and Waterloo East.
- Continuation of a fast Heathrow – Paddington service. There are major doubts on the viability of Heathrow Express in its current form after the introduction of Crossrail services in 2019, since Crossrail will provide through services to the West End, the City and Docklands and greatly improved connectivity, particularly with Thameslink at Farringdon. Crossrail will have an enormous impact on Heathrow Express revenues, but a fast service remains important for Heathrow's airlines.

As well as serving all these important markets, HSR provides significant crowding relief to the South Western main line (SWML) and the London Underground network at Waterloo for onward journeys. The density of operation on the Up Fast line from Surbiton during the peak is higher than on any other single stretch of main line in the UK and Network Rail's Wessex Route Study forecasts a need for an additional 60% capacity in the high peak hour by 2043. This requirement is potentially met following service changes as a result of the construction of Crossrail 2, but Heathrow Southern Railway will provide critically important interim relief and increases the resilience of the network, providing an alternative route if the SWML is blocked.

We have completed an initial appraisal of the proposal, developed fully in line with DfT's detailed guidance. This shows a Benefit Cost Ratio (BCR) of 6.82, based on Heathrow's existing runway capacity. With a third runway – which is now of course the central case – the BCR increases to 15.37. Both values are much higher than the 4.0 level classified as 'very high value for money' by DfT, and represent unparalleled value for money for a rail scheme.

ROUTE

The proposed route is in a short section of tunnel from the Terminal 5 station box over-run tunnel, then mainly on a surface alignment parallel to the M25 to the junction north of Chertsey, together with the connection to the Windsor – Staines line. This direct route delivers much faster journey times from Woking than the earlier 'Airtrack' proposals put forward by airport operator BAA, and also avoids the level crossings in the Egham area, a major problem for the abortive Airtrack Transport & Works Act Order application.

Services from Heathrow would use the existing grade-separated Byfleet Junction to join the SWML and use the slow lines between there and Woking. These have ample spare capacity west of Surbiton. Network Rail proposes that a new 750-metre loop would be provided north of Addlestone to allow freight trains to be recessed, replacing current provision on the Byfleet Junction curves.

Network Rail's 2015 Wessex Route Study proposes grade separation at Woking and Basingstoke and an extra platform at Woking. These proposals, which Network Rail sees as essential to meet future SWML capacity forecasts, facilitate operation of the proposed services.

Overall, construction of the new infrastructure can be carried out with minimal impact on the existing operating railway. The only impacts would be the new junctions on the Staines – Windsor and Virginia Water – Weybridge routes, both of which are lightly-used lines compared to the SWML.

Capital costs are estimated at £1.2 billion, including substantial allowances for specific risks and an overall 30% contingency.

TRAIN SERVICE PROPOSALS

Basingstoke/Guildford – Woking – Heathrow – Paddington

We have assumed half-hourly services from Basingstoke and Guildford to Heathrow and Paddington, providing a 15-minute frequency from Woking, with stops at Farnborough Main (Basingstoke services), Woking, Terminal 5, Terminal 2 and 3 and Old Oak Common, with the indicative journey times shown in Table 1.

While the Paddington times are 12-15 minutes longer than the current (fastest) services to Waterloo, which would still be quicker for most passengers, Paddington will be an attractive terminus for a significant minority of South Western passengers, particularly given the excellent connectivity provided by Crossrail.

Our appraisal shows that there are major benefits as a result of combining the Woking service with Heathrow Express paths. Similar benefits would not be achieved by through operation of WRAtH trains between Reading and Paddington via Heathrow, as WRAtH would not attract through passengers – direct services on the Great Western main line will always be significantly quicker to both Paddington and Old Oak Common.

Heathrow – Staines – Clapham Junction – Waterloo

This route would be similar to that proposed under BAA's Airtrack scheme, with a new at-grade connection with the Staines – Windsor line between Staines and Wraysbury. Services

would be fully integrated with the South Western commuter services via Staines, with multiple roles, providing capacity for non-airport passengers along the route to/from London, for local journeys and access to Heathrow. In addition, Clapham Junction and Waterloo/Waterloo East are key interchanges with high demand for airport access.

Network Rail's modelling confirms that a four trains per hour service is possible with current planned capacity enhancements, although this will require some adjustments to the service specification for the South Western franchise. These have already been discussed with both DfT and Network Rail.

The addition of a bay platform at Staines, deliverable within the existing railway boundary, would assist service resilience and potentially allow extension of Crossrail services from T5 to Staines, providing a highly attractive alternative route from Staines to central London, together with enhanced interchange with South Western services. Journey times from Staines to Paddington would be as fast as to Waterloo, with excellent central London distribution provided by Crossrail. We would expect the majority of Staines to central London passengers to transfer to Crossrail, with significant interchange to Crossrail from intermediate stations between Staines and Reading, relieving overcrowding between Staines and Waterloo.

With the addition of a chord at Staines, it would also be potentially possible to operate a half-hourly Weybridge – Virginia Water – Egham – Terminal 5 service, providing a further attractive local link to Heathrow.

DELIVERING THE PROJECT

We propose that construction of the Heathrow Southern Railway should be privately financed, with ownership remaining in the private sector after completion. This is consistent with the recommendations of the Shaw Report that 'projects that are separable from the core of national infrastructure… which could be structured to be attractive to the private sector and deliver value for money would also represent an attractive opportunity… in these cases financing by third parties can be structured against the funding of a predictable future long term revenue stream…' (para R6.32). We have set up a new company (Heathrow Southern Railway Ltd) to take this project forward.

Whilst ownership would remain with HSR Ltd, the infrastructure would be regulated by the Office of Rail and Road (ORR), and we would expect that its operation and maintenance would be contracted out, on a similar basis to High Speed 1.

HSR Ltd would be at risk for the costs of planning and construction of the new railway, in return for contractual commitments from the Department for Transport and Transport for London to purchase a defined quantum of train paths at a predetermined price. The price would be negotiated in advance with the parties involved and with the full participation of ORR, and would reflect an appropriate return on capital at the various stages of the project. The initial expenditure in promoting the project is high risk and would therefore justify a high rate of return, with a lower return during the construction phase, while still reflecting the inevitable uncertainties during a major construction programme. After completion, maintenance and renewal costs would be significantly lower risk, and subject to periodic review by ORR.

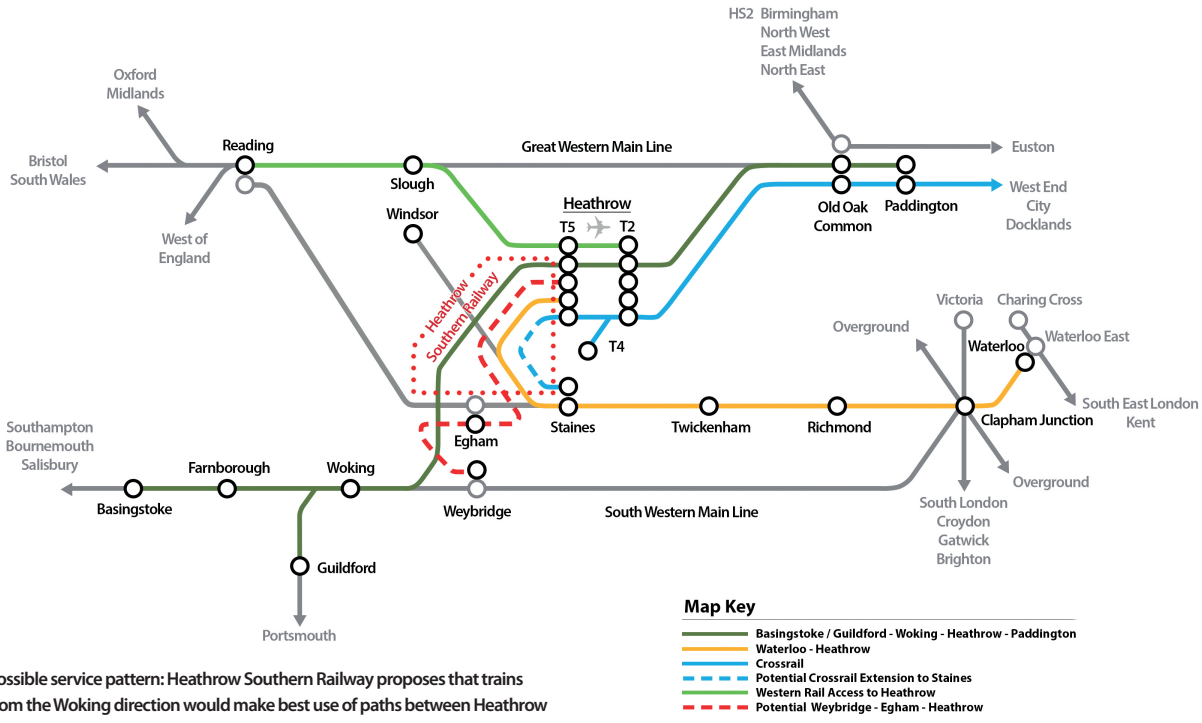
We do not envisage Heathrow Southern Railway taking direct revenue risk for the project. The franchising structure already provides effective transfer of revenue risk to the private sector, and would enable management of the revenue risk as a coherent whole, rather than being based on an allocation of revenue to the new infrastructure, which in turn would be dependent on the overall pattern of train services on the relevant parts of the rail network. To maximise passenger benefit, fares from Woking and beyond to Paddington should be identical with Waterloo fares, and overall benefits would probably be maximised by integrating the new services with the existing South West franchise.

In summary, this is an imaginative, well thought-out project that serves a number of major new rail markets, and can be financed and built by the private sector. The development work to date has been fully supported by professional consultancy, including First Class Partnerships, Aecom, Gardiner & Theobald and Bircham Dyson Bell.

When announcing the Government's decision on Heathrow in Parliament on 25 October, Chris Grayling, the Secretary of State, stressed the importance of accelerating the construction of southern rail links to the airport. But Heathrow Southern Railway does much more than that: it's a smart scheme – with just 12km of new railway, it connects the South Western and Great Western networks to provide new journey opportunities for both airport and non-airport passengers, with significant crowding relief to the South Western network. Heathrow Southern Railway is surely the best possible prospect for developing private sector investment in rail infrastructure in Britain. mr

TABLE 1: JOURNEY TIMES FROM SURREY AND HAMPSHIRE

Minutes	Woking	Guildford	Basingstoke
Heathrow T5	16	26	40
Heathrow T2/3	20	30	44
Old Oak Common	34	44	58
Paddington	39	49	63



Possible service pattern: Heathrow Southern Railway proposes that trains from the Woking direction would make best use of paths between Heathrow and Paddington, with WRAtH operating as a shuttle from Heathrow to Reading for passengers from the airport wanting to travel to the west.

Heathrow Southern Railway

National Infrastructure Commission
The National Infrastructure Assessment Call for Evidence
Herefordshire Council response

Local contact details:

Your name: [name redacted]
Your service area[job title redacted]
Your organisation: Herefordshire Council
Your email address: [email address redacted]
Date completed: 10 February 2017

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

For Herefordshire, the highest value infrastructure investments that would support long-term sustainable growth are the following:

1. As a rural county, the area's contribution to the local, regional and national economy is heavily dependent on the quality of the local road network, and the structures and drainage that ensures continued accessibility and connectivity via that network.
2. Hereford's growth is highly constrained by its single river crossing. The city is at the heart of Herefordshire and an important transportation hub for the region, therefore this constraint impacts on growth over a large area. The construction of another river crossing and the associated infrastructure to link to existing transport networks, will: greatly improve the city's and other surrounding areas connectivity, unlocking housing development and commercial land (including the next phase of the Hereford Enterprise Zone), creating a high potential for growth with the places where people live and provide industry better connectivity with markets to release the County's real potential.
3. Herefordshire must also connect with the World through digital infrastructure if its growth is to be sustained in the modern world.
4. The county is also susceptible to the impacts of severe weather, flooding is frequent and the integrity of the highway network will need to be enhanced if growth is to be sustained in a way that is resilient to individual flood events and the impact of climate change.

Projects that are of particular importance to Herefordshire, in order to unlock housing and employment opportunities, are the Hereford Bypass, the twin tracking of the railway between Malvern and Hereford and A49 improvements.

a) Hereford Bypass

A new bypass and associated infrastructure is required to deliver the planned growth in the Herefordshire core strategy. The bypass will address existing and historically

high levels of delay, journey time unreliability, poor connectivity and poor economic performance. It will also provide an alternative route for the A49 trunk road around Hereford reinforcing the importance of this strategic route through the Marches and, via the A465, the link between South Wales and the Midlands.

The bypass will support the delivery of 6500 houses and 6059 jobs, a new University, expansion of the Hereford Enterprise Zone and the provision of other employment land. Without the bypass there is a risk to existing jobs, as long journey times and delays and impact on business profitability.

The below summary of benefits has been taken from a report entitled Hereford Relief Road – Economic and Business Impacts – A Final Report to Herefordshire Council (SQW) published in 2011 which is contained in our evidence base:

- A western Bypass has the potential to generate £117.8m net additional GVA for Hereford and £131m for the county by 2031.
- The western bypass of the Hereford urban area to remove through traffic from the A49 in the city centre and enable full build out of the Hereford Enterprise Zone.
- Improving business growth prospects and access to existing and new markets
- Improving access to suppliers, expanding production and taking on more staff
- Improvements to the efficiency of local labour markets
- Improving access to high quality labour – by creating jobs and attracting inward investment, which attracts higher skilled workers, by making Hereford a more attractive place to live and reducing commuting times; by stemming out migration of young adults
- Improving the efficiency of business operations, costs and the productivity of existing jobs – with implications for business turnover and profitability
- Encouraging inward investment
- Increasing the scale and speed of development on existing allocated land and bringing other land to the market which will lead to job creation
- Creating temporary construction jobs

b) Rail twin tracking between Malvern and Herefordshire

Rail twin tracking between Malvern and Herefordshire is crucial to Hereford's future growth. The West Midlands Business Council said in April 2009:
" …rail investment needs to improve, and routes from Herefordshire via Worcester to London are currently hampered by the lack of dual tracking via Worcester and Evesham – as well as at Oxford, and this restricts the ability to expand rail services on this route"

Hereford is a junction, connecting Birmingham and London trains with an excellent north-south Cardiff to Manchester service. The single track on the Hereford-Birmingham line between Shelwick Junction at the Hereford end and the Ledbury viaduct at the Ledbury end, is a distance of eleven miles.

The lack of frequent direct rail links to London and the South East has been a major hindrance to business and to the visitor economy. There is untapped potential for moving long distance rail freight both for bulk goods and intermodal. (Investing in Strategic Transport Corridors in The Marches).

c) A49 Improvements

The A49 is part of the strategic trunk road network. It forms the spine of the Marches LEP area running from Ross-on-wye in the South to Whitchurch in the north, a distance of some 89.2 miles. The road caters for both localised traffic movements but it also forms an essential north / south linkage for wider freight movements particularly between north and south wales.

The A49 runs parallel to the M5 and investment would improve journey times, increase safety, and add resilience into the overall strategic road network. Specifically investment would allow the A49 to feature as an alternative route from north to south should there be congestion or closures on the M5 or M6. In terms of specific investment requirements, the significant pinch point on the A49 is Hereford, proposals are emerging for the construction of a Hereford bypass which would address this specific issue. Other requirements include the need for additional safe passing places to allow faster moving traffic to overtake slower moving vehicles, and the straightening of several road sections to facilitate greater road safety.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

- Infrastructure is essential to the UK's international competitiveness, how else can a product (be that an idea, an investment or an object) be taken to market? International gateways are an essential part of a whole system and it is vital that we view infrastructure as a whole system if we are to maximise the contribution made for the sums that the nation is able to invest. The effectiveness of any contribution might be best understood by developing simple, but robust, means of quantifying the realistic social and economic contribution that will be realised by any investment in infrastructure, as part of a whole system/whole life response.
- Herefordshire Council, the Marches LEP and Midlands Connect are working with Network Rail and Highways England in developing the strongest possible case for strategic transport investment in the Midlands. For instance, the Hereford Bypass, the project to twin track the rail from Malvern to Hereford, improvement to the A49 and improved road condition will help connect towns and cities in the West Midlands, to each other, to international gateways e.g. Birmingham International Airport, to key cities e.g. Manchester and London. This work will enable us to realise the West Midlands' and Herefordshire's full economic growth potential.

- Herefordshire Council and the Marches LEP are making a case on the importance of the rural hinterland and the transport needs of the priority economic sectors as well as the interdependency of rural and urban areas.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Infrastructure should be designed, planned and delivered as a whole system and on a whole life basis. Infrastructure and housing are both part of that whole system.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

- We think that technologies e.g. smart meter provide several opportunities for improving how electricity demand and supply could be better forecast and balanced in the future. Technologies such as smart metre provide customers with more accurate domestic energy consumption data which will help ensure supply is better matched to demand in any given area at different times of the day and year.
- There is also the potential for a joined up business case for action on energy efficiency amongst industry, academics, consumers, and the voluntary sector to highlight the benefits of enhancing energy efficiency. This will hopefully educate all consumers in taking massive 'step changes' to permanently reduce total energy demand across the UK.
- Government needs to encourage local authorities and their private sector partners to lead on either city-wide or county-wide retrofit projects as this will help deliver the Government's vision for energy efficiency.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

Whilst we recognise that government funding is urgently needed for the construction of new assets, we think that government should contribute towards the maintenance of existing assets. This include maintenance of and improvements to the rural road network to improve resilience and reduce journey times, such as junction improvements, drainage, winter maintenance, safety schemes and increasing overtaking opportunities.

In Herefordshire the public highway is by far the most extensive of those transport assets and, with the exception of the trunk roads and motorways, is the most significant physical asset (transport or otherwise) that is in the council's management (the council is the highway authority). As is the case across the nation, the public highway in Herefordshire consists of any verge, footway, cycleway, carriageway, bridleway or footpath over which the public has a right of way.

In summary the council is responsible for:

- 2014 miles 1292 yards of carriageways;
- 2160 miles of public rights of way;
- 723 highways bridges with a span over 1.5 metres;
- 11,731 column mounted streetlights and an additional 2047 luminaires that are not column mounted.
- 452 miles 412 yards of footway; and
- 8 miles 1012 yards of off-road cycleway.

In line with best practise our highway assets are valued along the same lines as commercial assets and the disciplines of replacement value and depreciation are applied. The gross replacement cost has been valued at £5.495 billion and the accumulated depreciation in the asset has been assed at £292 million. Consequently the management, maintenance, renewal and replacement of our transport assets must be subject to prioritisation based on sound asset management practices, planning our actions, focusing resources and measuring the impact of what we do.

Asset management facilitates better decision-making by supporting engineering judgement with financial, economic and engineering analysis. It helps us to better understand and manage the relationship between whole life cost and performance and provides the evidence base for our investment decisions.

The County's highways together with other public places such as parks, and other public assets such as ordinary watercourses (the council is the lead local flood authority and the land drainage authority), are the places where the people live and are places that matter to the people of Herefordshire. Through maintaining these places well the council makes a highly valued contribution to our communities and the economy.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Cross sector and in-sector collaboration will, in our view, be key to an effective whole system/whole life response.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

We recommend that funding requirements and processes should be kept to a minimum. Current funding application processes require lengthy proposal requirements and complex application, administration and compliance procedures. They often require institutional cost-sharing and matching. Reviewers tend to favour established applications. Costs to application are much higher. Changing political trends tend to affect security of some programmes. We propose that government addresses these issues.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

A package approach to funding (local, LEP and national sources) to fund infrastructure projects without distorting well-functioning markets may well work. Local sources may include local authorities borrowing, asset disposal, New Homes Bonus contribution, Community Infrastructure Levy and developer contributions. LEP sources may include Growth Deal Funding and its successor funding. National sources may include departmental funding e.g. Department of Transport, and High way Agency Funds.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

To ensure that our infrastructure system is resilient to risks we recommend the following:

- Enhancing cooperation between the public and private sectors in protecting vital infrastructure system e.g. information systems supporting critical infrastructures in key economic sectors.
- Proposing and developing ways to encourage private industry and the public sector to perform periodic risk assessments of key infrastructure systems.
- The government adopts a common definition for resilience and disseminates a high level, top-down strategy for the development and funding of resilience activities.
- Increase the coordination among all levels of government and stakeholders and ensure shared understanding of regulations and standards that promote efficient and timely responses to incidents.
- Establish new or enhance existing public-partnerships to provide a common, agreed upon, set of sector specific goals, with clear input on feasibility and objectives.
- Government to work with stakeholders and local authorities to establish resilience goals, facilitate contingency planning, foster relationships, ease information sharing and garner best practices.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

We recommend that government department and regulators identify and remove unnecessary regulatory barriers to growth and associated cost of infrastructure projects, whilst ensuring necessary protections are maintained.

Likewise, we suggest that government look at the wider issues faced by applicants in the meeting the requirements of the law such as:

- how and where they access information about their legal obligations and the quality, consistency and utility of guidance and related papers;
- what information is needed to support their compliance, and how they prefer to access advice and guidance;
- the cumulative impact of complying with different regimes, the interaction between them, and the impact of compliance activities and requirements carried out by different public authorities;
- experience of how regulatory activity works in the UK, compared with other regimes;
- data, information requests, visits and inspections;
- activity undertaken by the regulators to support business compliance;
- any 'knock-on effects' arising from compliance with legislation – for example, where action to meet one set of regulations leads to conflict with, or additional requirements to meet, another set of regulations; and
- The consistency of compliance and enforcement decisions and ease of appealing against them.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

- Previously developed, derelict, underused, neglected (brownfield) land in and around urban centres can provide real opportunities to deliver social, environmental and economic benefits via conversion to green infrastructure. In particular, by delivering improved environmental health, quality of place and subsequently increased land value and local investment, the conversion of brownfield land to green infrastructure can be very cost-effective.
- Ecological benefits of urban green infrastructure are largely related to the provision of habitat. Species from the very common to the very rare make use of all types of green infrastructure, from large 'brownfield' sites to tiny patches on roundabouts and road islands.
- Digital infrastructure plays a key role in addressing the major challenges related with climate change and sustainable development. Digital infrastructure is fundamental for monitoring climate change, mitigating and adapting to its effects and assisting in the transition towards a green economy.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

The impacts of climate change on the project, referred to as climate change adaptation or resilience to climate change, must also to be addressed during the project design process. The main threats to infrastructure assets include damage or destruction caused by extreme weather events, which climate change may exacerbate; changes in patterns of water availability; and effects of higher temperature on operating costs, including effects in temperate and/or permafrost. The following phenomena need to be screened:

- heat waves (including impact on human health, damage to crops, forest fires, etc.);
- droughts (including decreased water availability and quality and increased water demand);
- extreme rainfall, riverine flooding and flash floods;
- storms and high winds (including damage to infrastructure, buildings, crops and forests);
- landslides;
- rising sea levels, storm surges, coastal erosion and saline intrusion;
- cold spells;
- freeze‑thaw damage.

Costs and benefits resulting from the integration of both mitigation and adaptation measures in the project design should be use in the appraisal of the project's financial and economic performance.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Travel patterns within our county are unlikely to change significantly given the rural nature of Herefordshire and the lack of alternatives to the private car and goods vehicle. Fleet power systems are likely to become increasingly based on electric power systems. As such, in Herefordshire, travel/transportation by whatever mode and for whatever purpose will continue to be dependent on an effective highway network.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Highway maintenance of around £12m per year and some £200m for investment in transport packages for Hereford and the market towns including bypasses for Hereford and Leominster.

Also, see the answer to 1 above.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

The Herefordshire Bypass, twin tracking rail from Malvern to Hereford and the A49 improvement projects are the highest value transport investment in Herefordshire which will deliver growth and jobs.

Also, see the answer to 1 above.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

Road user charging is likely to remain politically undeliverable for many years in Herefordshire. Similarly MAAS schemes are unlikely to be sufficiently attractive to users given the extensive nature of our road network and dispersed population. MAAS would be more deliverable in Hereford.

Digital communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

We support the government's ambition to deliver ultrafast broadband of at least 100Mbps to all premises, and we urge the government to invest in digital technology in rural areas where there is a rising demand for data capacity.

Also, see answer to 1 above.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

The current digital communication regime is only aiming to cover 94 per cent of the county. Hence, the need for more state funding to cover the last 6 per cent hard to reach areas. Having said that, there is also a need for government intervention to break the BT monopoly to ensure value for money.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

- Energy efficiency improvements
- Fabric first approach to retro-fit and new build projects
- District energy schemes, particularly those powered by zero carbon sources,
- Water source
- Biomass (consideration must be given to local air quality issues)
- Deep geothermal

Timeframe: As soon as possible.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?
Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

Decentralised local smart grids supported by main grid exoskeleton for balancing:

- Smart grids with enough capacity for renewable generation combined with storage (both local battery and grid scale reservoirs and damns)

District heat from zero carbon sources:

- Water source
- Biomass
- Deep geothermal

Renewables- Wind, hydro and solar PV all working together for balance

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

- Space requirement may increase. Access to and from potentially centralised location potentially could increase vehicle movements.
- Funding for skills development need to be made available to respond to the skills requirements for these new technologies.
- Resources for feasibility studies for any low carbon vehicle (e.g. feed stock supply, wind speed and capacity and scale of requirements) should be made available.

<u>Water and wastewater (drainage and sewerage):</u>

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

- Electrification – potential for increased demand/consumption, increased role for decentralised renewables and smart grids.
- Smart EV cars- potential for grid balancing (energy stores and off peak charging).
- Need to consider environmental implications on battery creation and disposal.
- Hydrogen fuel cell developments may offer opportunities here.
- Role for Biodiesel?
- Nationalisation approach to EV charging – not regional schemes administered differently and frustrating to customers.

- Home chargers and solar requirements for new build would help here,
- Increased deployment of 30min (or faster) charging facilities across the country.
- Grid capacity must be robust enough to support the above.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

Local authorities are working with water companies in ensuring provision for additional sewer, sewage treatment and sludge treatment capacity where demand is growing, particularly in the areas targeted by the government for growth. Local Authorities and water companies are working with the Environment Agency to encourage more sustainable solutions to surface water drainage, in order to minimise growth in pressures on the sewerage system. According to Severn Trent's 2009 Final Business Plan, the future rate at which new sewer flooding problems arise is uncertain.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

- Herefordshire prepared and is implementing a Nutrient Management Plan (NMP) which is designed to enable the desired economic growth in Herefordshire whilst achieving and maintaining Favourable Condition Status for the River Wye SAC, and as such this document is intended to support and be read in conjunction with the Core Strategy for Herefordshire. The plan describes the actions necessary, outside of the planning regime, to allow development in the catchment. It is designed to support and assist planning and development considerations but is not designed to reiterate or replace the development of planning policy nor does it duplicate the decision making process associated with developments. Necessary planning policies, to further and support the NMP, will be found within the Core Strategy and associated documents rather than within the NMP.

- The development and delivery of the plans' objectives will be managed via the Catchment Based Approach (CABA) with oversight from a Nutrient Management Board that holds overall responsibility for the delivery of the plan. Delivery and Engagement at a local scale will be managed by a Nutrient Management Group that is a subsidiary of the larger catchment management group.

<u>Flood risk management:</u>

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

- The UK faces increasing flood risks because of urbanisation and the effects of climate change. The government has adopted a diversification of strategies for flood risk management (FRM), including flood risk prevention (through proactive spatial planning), flood defence, flood risk mitigation, flood preparation, and flood recovery. The example of England shows that having in place a highly diversified set of flood risk management strategies (FRMSs) is in itself not enough to prevent casualties and losses from happening (cf. floods in autumn 2000, summer 2007, and winters 2013/2014, and 2015/2016). However, there is room for improvement in terms of further risk reduction.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

- Flood alleviation using trees may be restricted to small-scale flood events; however, this is significant as trees store more water during lower intensity rainfall events over longer time periods than intense events over short periods. Green roofs, Sustainable Urban Drainage Systems (SUDS), wetlands and retention/detention basins also offer hydrological benefits through reduced runoff, increased storage and improved water quality.
- The use of natural or green infrastructure for flood storage and enhancement of other natural features in the floodplain provides not only an effective method of mitigating floods, but also a cost-efficient method of reducing the need for major structural projects.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

- Previous and existing incentives, such as recycling targets, landfill diversion targets and landfill tax have encouraged investment in waste infrastructure by local authorities. Future targets are uncertain due to Brexit but even so the UK is unlikely to meet its existing obligation of 50% recycling of municipal waste by 2020 without further investment let alone more ambitious targets.
- Current regulatory incentives do not correctly assign responsibility; they still place the burden of cost on local authorities rather than on producers. Increased producer responsibility for packaging waste, for example, would be a big step forward to address this.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

Note: A “circular economy” is an alternative to a traditional ‘linear economy’ (i.e. make, use, dispose) in which products are designed and packaged to minimise waste, and resources are kept in use for as long as possible, e.g. through re-use, recycling and greater recovery of materials through the waste management process.

As discussed above there are no current or planned incentives to allow local authorities, in particular, to achieve a more circular economy. In respect of proposed recycling targets we should also be careful not to proscribe unsustainable methods of waste management such as food and garden waste collection.

National Infrastructure Assessment

Consultation

Submission by HSR Industry Leaders

February 2017

Overview

HSR Industry Leaders (HSRIL) is pleased to respond to the Commission's call for evidence on the development of its National Infrastructure Assessment and to make a contribution to the Commission's position on long-term infrastructure needs over a 30-year time horizon.

Earlier we provided a view to the Commission on its consultation on the governance, structure and operation of the commission and we stressed the importance of ensuring the integrity and smooth delivery of a long term investment programme.[1]

Our focus is on the delivery of a national high-speed rail network, its significant impacts on the wider UK economy and the strengthening of the UK's rail infrastructure and systems supply chain its development will enable.

Question 2: ***How should infrastructure most effectively contribute to the UK's international competitiveness?***

HS2 – just like HS1 before it, and subsequent high-speed rail developments that should follow it – provides connectivity and capacity that enables the UK economy to grow and become better balanced (across sectors and geographies). High-speed rail brings efficiency gains across the economy and increases productivity, helping in particular the knowledge-based industries in which the nation competes most strongly.[2]

It stimulates investment in the private sector, connects people with jobs and opportunities for education.[3]

And in addition, as HSR Industry Leaders, we believe there is a specific opportunity to rebuild the nation's rail engineering capability. There is a substantial and still growing market for high-speed rail.[4] With a period of sustained growth in the UK's rail sector over 20 years, we have a sound base of highly competitive businesses in the UK from which this outcome can be delivered.

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[1] http://www.rail-leaders.com/our-response-to-the-national-infrastructure-commissions-consultation/

[2] See for example the update to the Department for Transport's Strategic Case for HS2 in 2015 at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/480646/supplement-to-strategic-case.pdf

[3] http://www.rail-leaders.com/great-britain-connected-or-not-2/

[4] UIC; High Speed Lines in the World, updated 1 February 2017: http://www.uic.org/IMG/pdf/20170201_high_speed_lines_in_the_world.pdf

Excellent progress is being achieved in implementing HS2. Members of HSRIL are determined to bring innovation and flair to ensure that the project is delivered to time and within budget. To achieve this, we need to invest so that we can offer the most efficient ways of engineering the project. We are aiming to secure the 'footprint' that the Secretary of State for Transport has said he wants to see from its delivery, in the form of a strengthened, high productivity, high-speed rail capability in the UK, ready to export our expertise.

Like other businesses, we – the private sector – will invest most when we can see certainty in demand over a significant period of time ahead. The current arrangements by which rail sector plans are set risk being brought into disrepute, insufficient care having been taken in the crucial early stages of project specification and risk management in investment in today's rail network, and with an ongoing exposure to changes of heart at a political level. If this was also to infect the HS2 project, with doubts cast over Phase 2B for instance, it would inhibit the longer term investment decisions being taken in the supply chain needed to make UK-based industry competitive on a world stage.

In order to help overcome this problem, HSRIL is calling for a directive to be made to commissioning bodies (including DfT, HS2 Ltd, Transport for the North, Transport Scotland) to have regard to the impact on the supply chain (and hence of national economic output) in their overall management of their forward investment programmes.

We note the National Infrastructure Commission's consultation guidance that we should exclude from consideration projects that are already in the pipeline (HS2 Phase 1 and Phase 2A); that is to say projects that will be implemented over the next ten years. HSRIL welcomes Government's commitment to Phase 2B made in November 2016, but recognises this has not yet secured funding. HSRIL strongly supports the completion of HS2 and envisages a 30-year plan for high-speed rail in Britain that will extend the network across the north of England and to Scotland.

HSRIL is not solely interested in high-speed rail on brand new infrastructure, but also the adoption of techniques that will allow faster running and the creation of more capacity on existing or upgraded infrastructure. We would contend that this area has been relatively neglected, in part because of the lack of strategic direction in this area and partly because this is an area which lies at the boundary of HS2 Ltd's and Network Rail's competencies/jurisdictions and is the priority of neither organisation. As a result, the opportunity to drive out high value investment is being lost. This is an area where the industry (through HSRIL) could lead in project development, as well as implementation.

Question 3: ***How should infrastructure be designed, planned and delivered to create better places to live and work?***

Transport is an enabler of most economic and social activity, so investment in transport, regardless of mode, should consider the positive benefit on other sectors such as housing, jobs and leisure. These benefits are often difficult to understand and quantify in a standard cost-benefit analysis, leading to the question: which should come first – the development or transport infrastructure? A good example was the new transport infrastructure (road and rail) required for London Docklands. High speed rail in general, with significant benefits and cost, suffers from the same difficulty, and we should look carefully at the lessons from UK examples of significant shifts in development patterns to better understand the likely opportunities and impacts of HS2 and its potential successors.

Rail projects have traditionally been treated as discrete schemes, which are often developed in isolation to their surrounding infrastructure - this includes a systems or integrated plan where projects interact (a risk at Old Oak Common, for example). This approach means efficiencies between projects may not be fully realised. It also means rail projects can fail to deliver or enable wider economic benefits that could be realised. The narrow focus means contractors / partners are not incentivised or encouraged to seek more efficient, beneficial ways of delivering projects.

The rail sector is ripe for significant innovation and has considerable opportunities available. Involving designers and builders early in developments would ensure that opportunities to innovate are maximised.

A good example of integrating infrastructure investment with investment in other sectors is the development of the Crossrail Canary Wharf Railway Station. This asset was re-planned, designed and built as a retail/leisure destination involving an investment package from Canary Wharf Group, in addition to being a transport asset. It has been opened and used by thousands of people already as a viable commercial development several years in advance of the transport system becoming operational. This 'transport infrastructure investment' has unlocked jobs in other sectors before becoming operational.

Question 6. ***What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?***

(i) Changing the culture

Partnerships and collaborative models should be used as the model going forward. Moving away from a traditional delivery model with a straight-forward fee-for-service arrangement (no reward shared with contractors for delivering more efficiently/cost effectively, or introducing innovation or improving the performance of the asset) is needed. This can enable greater risk and reward sharing and increase opportunities and appetite for private sector involvement, incentivising delivery partners to innovate and perform over and above specification.

Early engagement of contractors, as adopted for HS2 Phase 1 civils works, has been a major step forward – with Transport for London's Innovative Contractor Engagement procurement of Bank Station Capacity Upgrade an excellent example which has led to a gradually increasing Benefit Cost Ratio. HS2 Ltd is also embracing this approach which is being used in other infrastructure sectors – for example to deliver Hinkley Point C for EDF Energy.

The concept of alliance delivery has been proved to be successful. In the case of Network Rail's Stafford project, it enabled the use of Early Contractor Involvement (ECI), digital modelling, design and off-site manufacturing, with all of the benefits that they provide.

The use of Building information modelling (BIM) gets people and information working together effectively and efficiently to manage information (for construction and asset management as well as for carbon calculations and project controls). The use of BIM requires contractors, operators and maintenance teams to collaborate at much earlier stages to best define their requirements, and optimise safety, all of which are critically important, particularly when working close to live busy infrastructure assets, such as for the Thameslink programme and London Bridge Station redevelopment.

(ii) Broadening the approach to planning and delivery

There should be a willingness to look at opportunities with a wider view – that is, considering commercial uplift through associated developments. At a basic level this could be just designing in commercial (or social *e.g.* health or educational) infrastructure development into the core infrastructure, but it should also be applied in a more strategic sense, looking, for example, at how interchanges might work with and benefit local or regional stakeholders to truly maximise benefits.

Conclusion

HSRIL strongly supports the completion of HS2 and envisages a 30-year plan for high-speed rail in Britain that will extend the network across the north of England and to Scotland. It is needed to support a more competitive and better balanced UK economy.

In addition, as HSR Industry Leaders, we believe there is a specific opportunity to use HSR to spear-head a rebuild of the nation's rail engineering/technology capability. There is a substantial and still growing market for high-speed rail and we have a sound base of highly competitive businesses in the UK from which this outcome can be delivered.

Bringing all elements of the supply chain together in a partnership model encourages innovation, efficiency and commercial benefits to all parties. Within a new era of opportunity, this partnership model offers the real prospect of commissioning projects in a truly collaborative way.

National Infrastructure Commission

National Infrastructure Assessment Call for Evidence (October 2016)

Historic England Response

Historic England is the Government's statutory adviser on all matters relating to the historic environment in England. We are a non-departmental public body established under the National Heritage Act 1983 and sponsored by the Department for Culture, Media and Sport (DCMS). We champion and protect England's historic places, providing expert advice to local planning authorities, developers, owners and communities, to help ensure our historic environment is properly understood, enjoyed and cared for.

The majority of the questions in this consultation lie outside Historic England's remit, and we have therefore limited our response to the following:

Question 3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

We note and very much welcome the recent speeches given by John Hayes, Minister of State for Transport, on the need for 'beauty', especially with regard to new transport infrastructure. He highlights the high standards of design and quality in much of the nation's historic infrastructure which is still celebrated and appreciated today. We should aspire to meet similar standards if the provision of new infrastructure is to stand the test of time, contribute positively to our surroundings, and be more readily embraced by the communities it serves. As the Minister states 'if we learn from this experience, and seek to replicate the best in our new infrastructure, we have great power to satisfy the people's will for structures that ensure our sense of worth by affirming our sense of place'.

From our considerable experience in infrastructure schemes, where we are a statutory consultee on all nationally significant infrastructure projects, early and on-going engagement with the statutory environmental bodies is one of the key ingredients of success in delivering better places to live and work. When undertaken in a meaningful manner, potential risks and solutions can be identified from the outset, which, together with master-plans, can help to ensure effective delivery. We also engage in the design and planning of infrastructure as a member of Highways England's Design Panel and with the High Speed 2 Design Panel through their National Environment Forum.

There are undoubtedly important interactions between infrastructure and housing, but the interdependencies between infrastructure and other forms of development also need to be carefully considered, and an unbalanced approach which delivers only housing

development (and not the other elements of successful communities and local economies) avoided. Care will also need to be exercised to ensure that infrastructure is not being used to determine future housing supply and its location, thereby impacting on, and possibly undermining, the plan-led planning system.

Question 5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

Our role in national infrastructure focuses on responding to the potential impact of new and improved infrastructure on the historic environment, whilst ensuring those elements of England's historic infrastructure are fully considered as part of any future modernisation and enhancement programme.

With regard to existing infrastructure, it should be noted that much of the nation's existing infrastructure is of considerable historic interest, representing key stages in our transport and engineering history. The UK was the world's first industrial nation and a number of the most significant buildings and structures have been recognised as such and are subject to designation at a national, if not international level (listed buildings, scheduled monuments or world heritage sites), whilst many others are recognised as being of local interest and are valued by local communities. The Minister of State for Transport has recently highlighted ' … St Pancras, and Kings Cross, where – dare I say – the original station is enhanced by its extension, its glory revealed ...' and where their improvement has acted as the catalyst in stimulating the surrounding area.

It is also worth noting the embodied energy within these historic buildings and structures which have stood the test of time, surviving changing environments and sometimes changes of use. The older materials they contain are often of a quality that we can no longer match; for example, older softwoods are very insect-resistant, and can last hundreds of years, whereas modern plantation-grown softwoods have much shorter lifespans (re English Heritage 2014 *Practical Building Conservation: Building Environment* especially the final chapter, 'Reducing Energy and Carbon').

With regard to the consideration of new infrastructure delivery, we promote an approach termed Constructive Conservation which seeks to recognise and reinforce the significance of historic buildings and places through the active management of change. The latest volume, *Sustainable Growth for Historic Places* (2013) shows the many ways in which these sites can contribute to job creation, business growth and economic prosperity (https://historicengland.org.uk/advice/constructive-conservation/sustainable-growth-for-historic-places/).

Question 10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

A number of significant changes have already been made to the planning system to improve and speed up the delivery of infrastructure projects, the most important being the introduction in 2008 of the Nationally Significant Infrastructure Planning regime which is underpinned by a series of National Policy Statements. This process appears to be working well and we suggest no further changes are needed at this stage. Continued engagement from us and other statutory consultees as and when appropriate should ensure any issues can be dealt with promptly.

Historic England has also introduced its Enhanced Advisory Services which will be particularly helpful to promoters of large-scale infrastructure projects and aim to speed up projects and reduce risk. These new paid-for services include:

- Fast-tracking listing - to get clarity sooner on whether a building should be listed or not
- Listing enhancement – an enhanced list description will set out more clearly what is of special interest about a particular building
- Extended pre-application advice – reduces the risk of an application for consent being refused by the decision-making body
- Listing Screening Service – reduces uncertainty early in the development process through assessing whether an area of land contains structures that could merit consideration for listing

Further information on our Enhanced Advisory Services can be found here: https://historicengland.org.uk/services-skills/our-planning-services/enhanced-advisory-services/.

Question 11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

In our response to the *National Infrastructure Assessment Process and Methodology Consultation* we identified the need for the National Infrastructure Commission to consider all three strands of sustainable development in preparing the National Infrastructure Assessment, as set out in the Government's *National Planning Policy Framework* (Department for Communities and Local Government 2012). These cover economic, social

and environmental considerations, with the protection and improvement in the quality of the built, natural and historic environment also highlighted.

We welcome the statement by the National Infrastructure Commission in *The National Infrastructure Assessment Process and Methodology Consultation Response* (October 2016) that climate change and the environment are relevant issues in long-term infrastructure planning and will be in included in the National infrastructure Assessment process and methodology. Furthermore, the National Infrastructure Commission recognises the importance of factoring in sustainability and the environment as it undertakes the National Infrastructure Assessment, and will consider these issues where infrastructure impacts on them and where they can impact on or contribute to infrastructure services.

However, Historic England is disappointed this question only relates to the natural environment and it is regrettable that similar issues surrounding infrastructure and the protection and enhancement of the historic environment were not included. Positive synergies can often be identified between the natural and historic environment (through the use of green infrastructure, for example).

Throughout this consultation response we have identified how England's historic infrastructure can be successfully incorporated into modernisation and renewal programmes, whilst emphasising the need to assess the potential impact of new and improved infrastructure on the historic environment, looking for opportunities to reveal and enhance its significance. By undertaking early and meaningful engagement it is often possible to find solutions as illustrated by our approach to Constructive Conservation and echoed in recent speeches by the Minister of State for Transport. Our Enhanced Advisory Services offer another potential tool to promoters of infrastructure projects to better understand the heritage issues relating to a particular scheme and how these can successfully be addressed.

We would be happy to be engaged and involved with discussions and highlight any issues which might impact on the historic environment. In responding to the *National Infrastructure Assessment Process and Methodology Consultation* we also suggested it might be helpful to convene an expert round table to consider all environmental matters. This could involve the relevant government departments (Department for Environment, Food and Rural Affairs and Department for Culture, Media and Sport), the statutory environmental bodies (Historic England, Natural England, Environment Agency, Forestry Commission), together with other key bodies/organisations. Consideration might also be given to setting up a panel of experts covering sustainability issues, to include the environment and climate change.

Question 18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Existing regulatory mechanisms provide a good starting point for the consideration of future communications infrastructure delivery. Much has already been done to ensure efficiency in the handling of planning controls, including the introduction (and extension) of various permitted development rights. National planning policy, and regularly updated Codes of Best Practice further support the delivery of digital communications infrastructure, balancing the economic and social benefits of this technology, with environmental protection (with appropriate reference to the historic environment).

Question 22. What are the most effective interventions to ensure the difference between supply and demand for water addressed, particularly in those parts of the country where the difference will be most acute?

In light of our previous comments it should be noted that a number of sites associated with water storage and supply together with sewage treatment are of considerable historic interest, whereas new pipelines can impact on heritage assets, especially buried archaeological remains. These factors will need to be taken into account when planning future interventions and are illustrated by the good working relationship we have with Tideway in the delivery of the Thames Tideway Tunnel.

Question 25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

Climate change presents the dual challenges of increased intensity and overall rainfall, and increased risk of drought. Each of these present impacts for the historic environment and the primary risk is in people's response to these changes. Understanding how people lived with, and adapted to flooding in the past, is important in being able to take a long term view for the future (re Croft 2013 *Assessment of Heritage at Risk from Environmental Threat* https://historicengland.org.uk/images-books/publications/assessment-heritage-at-risk-from-environmental-threat/). Again we would be happy to be involved in any future work or discussions.

Question 26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

The effects of flood management schemes upon the historic environment can be positive as well as negative, but if the positive impacts are to be enhanced and the negative impacts minimised, it is vital to have a good understanding of the heritage assets being affected (including any below-ground archaeological remains).

Natural flood management: To be most effective, natural flood management should take into account the history of the landscape and land use, ideally at a catchment scale. Ill-thought-out natural flood management can negatively affect the historic character of landscapes and places, but the history of past flooding and flood management may give important clues for designing effective natural management schemes.

Property level resilience: With many property-level resilience measures, there is a real risk that they could prove more harmful to the building and occupants than the occasional flood. This is true for all buildings, not just listed buildings, and the key factor is a good understanding of the building. One very pertinent example is waterproofing coatings, which are often proposed as an option, but tend to trap water and cause moisture problems (re RICS *Building Surveying Journal* Oct/Nov 2016: Pp 18-19 Pender, R. 'A Question of Physics' and p.8 Rushton, T and Danby, M. *'Raincoats and Overcoats'*).

Many traditional building materials work extremely well in flood situations. For example, lime mortars are far more resilient than modern gypsum plaster or gypsum board, so there is considerable scope for the wider use of traditional building materials and techniques alongside innovative new approaches (re English Heritage 2014 *Practical Building Conservation* especially *Building Environment*).

It often proves better to allow the water through a building than to try and keep it out, which is less damaging to the building and allows faster reoccupation. As-well-as structural risks from water pressure when the waters are held back at too high a level, if the defences are overtopped they may trap the water in and around the building, leading to more wetting and material damage (re Historic England 2015 *Flooding and Historic Buildings* https://historicengland.org.uk/advice/technical-advice/flooding-and-historic-buildings/)

Historic England very much looks forward to working with the National Infrastructure Commission in preparing the first National Infrastructure Assessment and would be willing to engage in its expert advisory panels, round tables, workshops, seminars and/or other stakeholder events.

<Name>
<Job title>
10 February 2017

National Infrastructure Commission
5th Floor
11 Philpot Lane
London
EC3M 8UD

8th February 2017

Sear Sir/Madam,

RE**: NIC CALL FOR EVIDENCE: (1) WATER & WASTEWATER SECTOR: (2) FLOOD RISK MANAGEMENT**

Having attended respective 'workshops' HBF welcomes the opportunity to submit additional written evidence to the Commission. We therefore trust that you will find our contribution to be both constructive and helpful. As the national trade association representing the body of UK House Builders, (including a number of SMEs) who are responsible for providing around 80% of all new housing in the UK, we are encouraged by the fact that appropriate quantitative and qualitative weight will be given to our response.

Our submission crystallises the operational and customer level experience(s) accumulated by the HBF and its members over several years. In addition, we can call upon the outcome of our earlier and continuing discussions with Senior Government Officials, in particular when it comes to the tensions and conflicts specific to infrastructure availability and which are now undermining our ability to increase the delivery not just of new homes but homes that are affordable.

In order to keep the content of this letter to the minimum we have included a series of related HBF Papers produced over the last two years or so. Many of these 'papers' have been shared with other partner and stakeholder interests, including Government and in many respects they define the key issues that are confronting the house building industry. Moreover, rather than make two separate submissions we have structured our response under two distinct headings, namely, Water & Wastewater matters and SuDS/Flood Risk Management. In both instances there is a common thread, i.e. the growing demand for developer funded off-site network reinforcement that is not in consequence of new development.

1. WATER & WASTEWATER (WATER & SEWERAGE SECTOR)

1.1 Since 'sector' privatisation in 1989, there has been a perceptible lack of investment by Water & Sewerage Companies (WaSCs/WoCs) in new assets to meet the needs of a plan-led planning system. Moreover, during the past 5 years the number of occasions when house builders have been confronted with WaSC holding objections at the planning application stage, on the grounds of inadequate sewerage network capacity, have increased significantly, especially within Southern-based WaSCs.

1.2 Importantly, at the time of sector 'privatisation' the Developer Community accepted that it was to make a financial contribution towards investment in new water and sewerage infrastructure, namely and infrastructure charge for every new home connected to the public water and sewerage network respectively. The cumulative contribution to date is around £2.60 billion but sadly, there is no audit in terms of where, when and how this significant 'developer' contribution has been invested by each WaSCs/WoCs. Not even the Regulator, Ofwat can advise. The current charge is £715/dwelling and when other infrastructure costs are included, typically, water/sewerage connection, on-site/off-site mains, building water etc., the cost of connecting a new home to the water and sewerage network is over three times the cost of an energy connection. In one case, based on the company's statutory accounts, Southern Water invested a mere £24.8 million in new assets in 2014/15. Where and how this capex was invested, i.e. water or sewerage assets, residential or commercial sector, was not disclosed but the corresponding annual developer contribution, in the guise of infrastructure charges, represented a staggering 44% of the £24.8 million.

1.3 At the 'macro' level' privatised water and sewerage companies are run on a debt financed basis. As a result, many companies incur high interest charge payments but more noticeable are the dividends being paid to overseas shareholders rather than investment in new UK infrastructure. The financial structure of the Water and Sewerage Sector is likely to be 'out of scope' for the Commission but it nonetheless plays a very influential part in our approach to infrastructure delivery. How the Sector is funded and more so how it can increase its investment in new infrastructure to ensure the UK not only remains opens for business but also provides the infrastructure to meet the Government's housing objectives remains crucial. In 2013, the Centre Forum published a key report on the workings of the Water and Sewerage Sector. This report provides useful information for the Commission in terms of contextualising the performance, commercial structure and value for money aspects of the Water and Sewerage Sector. Many of the concerning aspects raised in this report also chime with the comments and concerns highlighted by the HBF over several years. We have therefore provided a link to the report in question. In addition, the Housing White Paper published by the Government yesterday, also highlighted the critical need for adequate and timely infrastructure to be in place.

http://www.centreforum.org/assets/pubs/money-down-the-drain.pdf

1.4 At appendix 1, appendix 2 and appendix 3 we have included three HBF papers each of which provide more in-depth evidence of the difficulties being faced by the UK's house builders, namely:

i. The inappropriate use of the planning system to secure off-site network improvements, funded by the developer and which are not in direct consequence of new development. This is often termed asset betterment that very much favours the commercial interests of WaSCs/WoCs.

ii. How off-site network capacity modelling is undertaken, in particular when dealing with foul sewers – the variability and lack of a more representative approach is clearly evident. Moreover, the reluctance of certain WaSCs to disclose all aspects of any modelling undertaken does not foster trust when dealing with a utility sector that has monopoly privileges.

iii. The costs and delay implications, in particular the potential impact on project viability and ultimately, new housing delivery.

1.5 At the workshop held on the 13th December there was little, if indeed any discussion relating to the extent and impact of potable water leakage. Based on Water Company returns to Ofwat potable water leakage is around 23% to 25% of all water supplied. (To put this into context it is the equivalent of filling Kielder Reservoir five times over each and every year). More importantly, just a 1% reduction in leakage would serve the water needs of around 100,000 new homes each year and yet WaSCs and Water Only Companies (WoCs) are not incentivised by the Regulator to reduce leakage. The current approach is to rely on a loosely defined economic level of leakage before intervention is required. We firmly believe that after being in place for 17 years this is an outdated concept and more should be done by WaSCs/WoCs to reduce leakage. This is particularly relevant in defined water stress areas. The Gas Industry has successfully introduced cost effective and efficient robotic pipeline relining techniques to deal with leakage. Why hasn't the Water Sector introduced similar technology and why does the Regulator remain so ambivalent in this regard?

1.6 In the context of potable water leakage, this also begs the question as to what quantity of water lost through leakage is also entering foul/combined sewer systems and thereby compromising hydraulic capacity? (See the report referred to previously).

2.0 **FLOOD RISK MANAGEMENT**

2.1 Development and flood risk has been a key consideration for the house building industry for many years and long before the coming into force of DoE Planning Circular 30/92(1).

(1) Planning Circular 30/92: Development and Flood Risk 1992

Moreover, the reputational damage that can arise from the provision of a new home that may become susceptible to flooding at some time in the future should not be under-estimated. Furthermore, because of this primary 'customer care' requirement HBF and its members have always had an intrinsic interest in all matters relating to development and flood risk. Needless to say it is an aspect of the development process that remains a principal consideration, especially at the crucial land acquisition stage. In many respects, outside of the Developer Community, there is little understanding of the land acquisition and development process, especially when there are so many inter-dependent and inter-related issues that influence key decisions.

2.2 It is for such underlying reasons that HBF has continued to play an integral part in the development and preparation of planning and technical guidance specific to flood risk, especially when there are opportunities to improve existing guidance so as to reflect the latest and more robust scientific evidence that is available. That said, hydrology is not an exact science - it is very much influenced by natural phenomenon and mitigated, by a design response that relies on predictive 'probability'. For example WaSCs rely on a return period of 1 in 30 years when designing adoptable sewerage infrastructure. This needs to be contrasted with our design approach to surface water run-off in general, namely, a 1 in 100 year return period plus an allowance (30%) for climate change. Indeed, certain SuDS infrastructure also have differing hydraulic design standards.

2.3 In the UK we have to deal with variable rainfall intensities and storm durations – these events can also have differing spatial footprints and therefore significant geographical variations. Extreme rainfall events can always be expected but how do we define 'extreme?

2.4 Predicting the future is not an easy task - there will always be occasions when rainfall intensity and/or storm return periods far exceed current design/mitigation standards. For example, reference to Meteorological Office rainfall records for December 2015/January 2016 show that parts of Cumbria experienced a rainfall intensity/return period of around 1 in 1300 years. This is indeed an extreme event and needs to be compared with current design conventions that are based on a return period of 1 in 100 years plus a 30% allowance for climate change.

2.5 A question often asked is - why can't we design for all eventualities? However, to do so would result in substantial, unacceptable costs from the public purse. Similarly, it would render any number of new sites planned for residential development unviable. In many respects public awareness needs to be raised to widen understanding that it is unaffordable to engineer against extreme rainfall events and there is an inevitable need for repairs in certain situations. The solution is to find the right balance between cost effective mitigation and an acceptable degree of flooding – not an easy task. Similarly, to find the right balance between scientific rigour and engineering pragmatism.

2.6 On 19th February 2016 the EA introduced revised/updated climate change allowances with the intention that these be applied with immediate effect for all new developments, namely, sites that had not already entered the planning/land allocation process. These revised allowances, based on the latest scientific research by the Environment Agency, introduce a further factor safety. Moreover, they build upon on our collective experience of the flooding that took place in 2007 and 2012. The floods experienced in December 2015 and January 2016 show how important it is that we have a continuous iterative approach to understanding rainfall events and what design/construction mitigation measures are needed in response.

2.7 Protecting communities and sensitive infrastructure should be a key component of any Strategic Flood Risk Assessment. Similarly, a Local Authority's Local Plan policies. We expand upon this later in paragraph 2.12 of our submission.

2.8 Physical flood defence structures remain an integral part of the suite of options to mitigate the risk of flooding. However, local communities need to be educated so that they can begin to understand that what has been provided, in particular historic defences designed to meet earlier flood mitigation standards, can still be over-topped and result in flooding. As part of this education there may be merit in explaining that defences will cope with a particular level of rainfall, but anything in excess of what is stated may well result in flooding.

2.9 Investment in flood defences needs to be increased. However, pressure on the public purse and/or developer funding through S106 Agreements can be reduced by allocating sites for development that are situated in Zone 1 flood risk areas and unlikely to cause a flooding issue further downstream within a catchment. Surface water attenuation and limiting discharges to green field run-off, a concept that developers have employed since the 1970's, also remains an important part of the mitigation solution.

2.10 A key aspect of protecting communities and infrastructure is to have in place effective maintenance regimes for all main-rivers and other critical water bodies. Given the thrust of extant EU Directives this may be more difficult than first envisaged. However, the report produced by the Centre for Ecology and Hydrology [2] immediately after the 2007 floods identified the need to reduce eutrophication [3] in main rivers through more effective maintenance. However, a precursor to more effective maintenance is to limit the pollutant loading contained in surface water run-off from the agricultural sector[3].

2.11 For many years the HBF has advocated that the effective management and control of surface water run-off requires a holistic approach and one based on the engineering concept of 'working from the whole to the part'. Moreover, as advocated in the Pitt Report of 2008, it remains our view that a single body should have responsibility for surface water management and control. HBF have always opined that this should be Water and Sewerage Companies, with the Environment Agency providing appropriate research and science-based advice covering hydrology and rainfall trends. Such an approach makes the most productive and responsive use of experienced resources but the need to have sufficient critical mass in place is essential.

2.12 At present, the management and control of surface water run-off is still too fragmented. Whilst the EA has overall responsibility/control for flood risk, at the local level, i.e. non-main rivers/local watercourses, Lead Local Flood Authorities (LLFAs), or Internal Drainage Boards (IDBs) have delegated responsibility. More importantly, since April 2012, LLFAs have been required to work with Local Planning Authorities in the preparation of Strategic Flood Risk Assessments (SFRAs). The overarching requirement is for SFRAs to inform the planning process when considering local plan land allocations for development and/or development planning applications. At present, only 72% of LPAs have an SFRA in place and of these 80% are at level 1 (generic) rather than level 2, i.e. more area/site specific where the risk of flooding is far greater. However, the experience of HBF members is one of insufficient critical mass and experience within many LLFAs thereby enabling them to effectively discharge their statutory responsibilities.

2.13 Since the 1960's average annual rainfall has increased between 6% – 8%. However, surface water sewer design and SuDS design standards have remained largely un-changed. Have we reached the stage when a review of these design standards should be undertaken?

2.14 The provision of above ground SuDS infrastructure has been viewed as a panacea for many flooding problems. However, whilst infiltration into the ground can be a highly effective solution, saturated ground conditions (evidenced in the floods of 2007 and 2015/16) can seriously compromise the operational efficiency and effectiveness of SuDS infiltration drainage infrastructure. In many respects, above ground SuDS solutions would have made little if indeed any difference to the flooding experienced in 2015/16.

2.15 The approach to the effective management and control and surface water should be one that relies on the suite of options that are available, whilst taking note of prevailing site conditions, topography and groundwater levels. The latter can be influenced by seasonal variations with certain soils and rocks having relatively rapid response times following rainfall, e.g. the chalk downs in the South of England.

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(2) Marsh, T. J. and Hannaford, J. (2007) - The summer 2007 Floods in England & Wales – A Hydrological Appraisal (Centre for Ecology & Hydrology

(3) It has been shown that surface water run-off from agricultural land contains elevated levels of nitrates and phosphates. These nutrients are resulting in algal/weed growth in our rivers to the extent that capacity and flow can be reduced significantly, i.e. by as much as 25%

2.16 **SuDS INFRASTRUCTURE** – What constitutes SuDS infrastructure has never been authoritatively defined – this remains a fundamental requirement and one supported by many other partner/stakeholder interests. The HBF has articulated in many forums that our primary and collective objective is "…..*the effective management control of surface water run-off using a suite of options (below and above ground) and which are best matched to the characteristics of the site and the local catchment*". Perhaps this could be a useful starting point? Moreover, whilst we have so many differing interpretations (there are over 340 local planning authorities in England and Wales) we are not going to make effective progress.

2.17 The role of 'planning' in the context of flood risk cannot be over-stated – it is a vital component. Land allocations in local plans are the result of a robust democratic process with little in the way of influence from house builders. That said, it is accepted that there are occasions when developer promoted windfall sites are brought forward but these are relatively few in number. However, what is important is that from the outset, any proposed land allocation be subjected to the following de minimis process:

i. The undertaking of a flood risk assessment before any allocation for development is crystallised. The SFRA should be capable of dealing with this requirement but on a cautionary note, LLFAs only exist in County and Unitary Authorities – there is a potential gap at the District Authority level. In our view the Local Planning Authority working alongside the EA is the most effective way of tackling this issue but for the time being this ignores the potential for WaSCs having more specific involvement.

ii. That there is a robust, supporting strategic flood risk assessment in place and one that is based on the best possible guidance from the EA. Water Cycle Studies, advocated by the EA after the 2007 floods are also a key informative – at present there are over a 100 in place but these should be extended to include to cover all local authorities, including District Authorities.

iii. As a first principle, development should be constrained to Zone 1 Flood Risk Areas as defined by existing EA flood risk maps. If land allocations under consideration are located in a higher flood risk setting, the LLFA/EA should make a point of seeking clarification that there are no better land allocation alternatives available. In other words, application of the sequential test.

iv. Consideration should be given to morphing EA flood risk maps with the land use plans that support the local plan. This would make for smarter planning guidance/advice.

v. As part of the SFRA, only realistic opportunities for SuDS infiltration drainage should be considered. Experienced understanding of hydrogeology is essential and this is one of the underlying strengths of both the EA and Water and Sewerage Companies.

vi. At the planning application stage, all applications should be supported by a well-considered and representative site specific flood risk assessment. Work on refining our current approach to undertaking an FRA, based on a consistently applied framework, would make a worthwhile contribution.

vii. Flood resilient/resistant construction should be considered as a last option for any development proposed in a Zone 2/3 flood risk category. Moreover, selling a property with flood resilient construction could be counter-intuitive as potential buyers may be dissuaded from purchasing a new home simply on the basis that by default, it could be construed as already being at risk of flooding.

2.18 The current approach to Flood Risk Management still remains too fragmented. Moreover, some of the recommendations contained in the recent EFRA Select Committee Report and which also considered our approach to flood risk, chimed with those of the HBF. In particular, that there should a single overarching body with responsibility for defining and delivering the Nation's Flood Risk Strategy. Secondly, that adoption and maintenance of all surface water drainage infrastructure, including what we euphemistically call SuDS should rest with Water & sewerage Companies.

This approach would provide greater conviction and certainty whilst also making the best possible use of knowledge and resources.

2.19 There is a compelling need for a structured and continuously iterative approach to development and flood risk. This starts with River Basin Management Plans informing and cascading through a Local Authority's SFRA, thereafter a site specific FRA, and eventually, a clearly defined, site specific surface water drainage strategy. With regular scientific input from the EA, in terms of changing rainfall patters, climate change implications etc., this should begin to establish a much improved framework for a workable and responsive degree of consistency. If we add to this local plan land use allocations that are better informed, then the contribution to flood risk mitigation should be a notable improvement.

2.20 At the site level, we have enclosed a decision flow chart that takes the Developer through the iterative process to determine the most appropriate surface water drainage strategy for any site. Sadly, many approval bodies involved in land-use planning have yet to fully grasp what is involved but the approach identified, has been at the forefront of the land acquisition due diligence process employed by Developers, and for several decades.

3. **CONCLUDING COMMENTS**

In concluding, we trust that you find our comments both informative and helpful, in particular the content of the appendices we have enclosed. We are more than happy to meet separately with the NIC and to share further evidence that we hold – it is confirmed that we are due to meet with the NIC in London on 2nd March.

Yours sincerely

[name redacted]
On behalf of HBF London

Enclosure 1 – HBF Paper 9: Planning Conditions/Section 106 & Foul Sewerage Infrastructure – March 2016
Enclosure 2 – HBF Paper 11: Planning Objections/Cost of meeting WaSC demands
Enclosure 3 – HBF Position Paper: Foul Sewer Capacity Modelling – February 2017
Enclosure 4 – Surface Water Management & SuDS Flow Chart - 2015

National Infrastructure Commission.
Consultation process.

Housing

Sirs,
A comment /query.
By strict definition the term Infrastructure excludes any particular construction sector, but it might be argued that large scale Housing developments, including new conurbations must be considered within a national framework.

The remit for the new National Infrastructure Commission excludes Housing; the subject on which successive Governments have made meaningless promises, resulting in the state of current provision against growing demand. Immediately before the general election in May 2016 a reported decline in the Construction sector, which so much influences quarterly 'growth' figures, was a timely reminder that the promises of the main Parties were simply without foundation. In a 'bidding war' the Lib Dems had pledged 300,000 new starts a year, Labour 200,000, the Conservatives 200,000 starter homes, and UKIP opted for 1,000,000 new homes by 2025; in fact about 100,000 a year, but sensibly on brown field sites. It was reported that sixty seven percent of house builders disagreed with the projections and suggested that about 180,000 houses a year – or less - was more realistic. Analysts reported a shortage of skills and training in the industry, called for more reform and speeding up of planning processes, and some better access to building on public sector land. Depending on various differing reports, we appear to be faced with the requirement for 340,000 new homes each year until 2020 and beyond. Existing production is barely one third of this number.

In 1945 when a Labour Government declared national housing targets, the post war Housing Act had made Local Authorities responsible for all the housing needs of their residents, and the grant assisted construction of rented accommodation was provided as a public service, while middle and higher income housing, built by private developers, was restricted by building licences. Initially, the Minister of Health and Local Government had set a target of 200,000 new dwellings per annum, but given the shortages of materials and trained craftsmen, Bevan admitted that he had hoped for systems which would turn out mass produced housing. The target was increased in 1951 by the Conservatives to over 300,000 new units per annum. This was achieved for a time. In effect, the Housing crisis was solved by a largely nationalised industry employing methods and standards of construction which are simply unacceptable today. "Green" credentials were unheard of; health and safety was an unknown subject.. Seven hundred thousand 'traditional' homes were built by local Councils between 1945 and 1953 but to meet increased targets, patented, prefabricated Housing Systems were introduced, many using heavy pre-cast concrete panels suitable for multi storey high rise construction, and as progressively greater rates of subsidy from Whitehall were available for dwellings above four storeys in height, many of the urban Housing Authorities planned and built accordingly. Britain is the custodian of such expediency, which while achieving numbers of units, produced a housing legacy unacceptable for today.

In the totally altered political scene, private developers and not local authorities provide Housing. In this market, commercial decisions by developers and builders will always outweigh other needs, apart from the separately part funded provision of 'affordable' or 'social' housing. The unprecedented scale of car ownership dictates planning and wider infrastructure considerations never before contemplated. Previously, eighteen New Towns were designated in England, and five in Scotland. The New Town commissions have been disbanded, and while the emphasis now may become the building of a number of new "eco towns" or garden cities, these will provide only a fraction of the additional housing need. 'Brownfield' land is varyingly expensive to develop, thus pushing up the cost of sites to developers, and while It is one thing to instruct planning authorities to 'free up' land and to accelerate their procedures, it is another for builders to finance, plan, design in detail, market, and realistically build the scale of new housing which we are assured is required. The 'demand side' for housing increases relentlessly while the 'supply side' stalls.

If large scale Housing is not included as a component of the national infrastructure plan its provision will, as now, be driven by market forces, empty pledges from politicians, and lacking new legislation which must accompany the emerging paradigm requiring wider consideration.

Yours etc.,

[Name redacted]
[Town redacted]

[Telephone number redacted]

National Infrastructure Assessment - Call for Evidence

Humber LEP Response

Cross Cutting Issues

Question	Humber LEP Response
1.	The highest value investments which would support long-term growth in the Humber include: • Electrification of the transpennine rail route from Liverpool to Hull as a first stage of improvements being planned with Transport for the North (TfN) to link Hull into the wider Northern Powerhouse Rail (NPR) network to provide faster more regular links to other Northern Cities, Manchester Airport and beyond. • Long term electrification on the Cleethorpes to Doncaster rail route. • Continued government commitment to the low carbon economy and renewable energy production is vital to the long term growth of the area. • Efficient roll out of the next generation of wireless digital communications infrastructure to encompass all areas of England including rural areas. • Improvements to the A15 corridor through Lincolnshire. This could take the form of extension of the M11 to create additional capacity for the east coast North to South corridor, to deliver growth and maximise the eastern ports infrastructure. • Wider highway connectivity projects being considered by TFN including an improved/new route from the M62 to the Port of Hull, improvements to the A1079 route to connect with an improved A59 cross Pennine route and a new route between the M18/M180 junction westwards to the M1 North of Sheffield linking to the proposed new tunnel link to the M60 at Manchester. • Development of Hull Lagoon Project which will provide flood risk management, port growth, regeneration and traffic flow benefits. [We would request that reference to this project is kept confidential at this time] Allied to this, the Humber LEP feel that existing national priority of prioritising infrastructure for enterprise zones is one which will continue to deliver growth, and would advocate the retention of this priority.
2.	The Humber LEP sees the role of international gateways as key to UK's international competitiveness. We see that the development of the northern transport corridor between Liverpool and Hull can have real benefits in the long term, in terms of enhancing east/ west trade

	connections, and provide a vital connections between Europe and America through UK In order to fully plan the infrastructure required to recognise this opportunity, a greater engagement in future planning of port infrastructure with port operators is vital, as is much closer cooperation with Network Rail, Transport for the North and Highways England. We need infrastructure that facilitate social mobility, we need to ensure that local labour is able to commute easily to places of work and able to live in local areas thereby spending the money in the local economy
3.	The Humber LEP clearly recognise the need to support upfront infrastructure costs that can reduce development risks and facilitate delivery of housing. There are structural issues with the housing and commercial development markets in the Humber LEP area. Low margins and high abnormal costs result in many sites being seen as unattractive for private developers. Government sponsored instruments are not always a good fit for areas such as the Humber. This is especially true in the context of the HCAs housing instruments. It is felt in the Humber that a grant element, to pump prime development, is required in specific circumstances. In the Humber there is also need to promote housing development from small and medium sized house builders in order to boost the housing delivery in our area. In discussions with house builders, drainage and flood risk has been highlighted as a key issues in bringing forward housing sites. As well as traditional house building methods the Humber feels it has a strategic opportunity through its sectoral specialisms and regional skill sets to contribute fully to the development of modular building delivery in England. Work is ongoing with local authority partners to progress this agenda.
4.	There is potential for demand management however our experience is that this is best delivered using a bottom-up approach and when well-functioning markets are available. In parts of the Humber it can be argued that there is a range of sub optimal markets (public transport, digital communication, housing market, flood mitigation) which means that demand management techniques will be of only limited benefit.
5.	The Humber LEP recognises the use of resources to maintain/ repair/ improve existing assets versus development of new infrastructure is a delicate balance. We acknowledge that new infrastructure can provide

	am economic transformative affect, however are also cognisant of issues such as resilience of the transport network. A priority of the Humber LEP is to improve the resilience of the road network in the Humber area especially on the A63 in the Hull area.
6.	There is a feeling that greater collaboration between 'gatekeepers' of infrastructure funding, often differing government departments, would lead to far more effective delivery of large scale infrastructure project which could cut across a range of outcomes.
7.	As noted above the arrangement of government infrastructure funding could be streamlined to allow approaches which target more than one outcome, for example flooding and transport. At the current time there is a view that this is often difficult due to ring-fencing of budgets. Longer term commitments for funding would also be welcome, to aid long term planning in the development and delivery of infrastructure schemes.
8.	The Humber LEP do not have a specific comment to make on this question.
9.	The Humber LEP do not have a specific comment to make on this question.
10.	As previously noted streamlining of central government infrastructure governance responsibilities would be useful to aid delivery.
11.	We see the most effective way of infrastructure contributing to the protection and enhancing natural environment is via consideration of these elements within the in the design of all large scale infrastructure schemes e.g. Within public realm, and flood mitigation schemes. The Humber LEP is promoting the development of a holistic Humber Plan for habitat mitigation in the area, which will allocate mitigation land for major investment projects. Investment in this, and other similar approaches would add value.
12.	The Humber LEP do not have a specific comment to make on this question.

Transport

Question	Humber LEP Response
13.	Car ownership and traffic levels are continuing to rise, putting pressure on the road network, particularly at peak times and in built up urban areas. However, the demographic of car drivers is shifting, with a drop in car use amongst younger people who appear more willing to consider alternatives to the car when supported by a high quality public transport and sustainable transport network. Conversely, our aging population is likely to result in fewer commuting trips by car but an increased requirement to access healthcare and leisure facilities with many people choosing to continue to drive well in to old age. There is expected to be improvements in the availability and take up of electric vehicles and driverless technology; however, this will continue to rely on road infrastructure.
14.	The highest value transport investments which could be developed in this area are those which improve international connections to the area, such as connection to Humberside airport and Port infrastructure improvements, as well as interventions which connect the Ports of Hull/ Immingham and Grimsby to the main UK north/south and east/west transport corridors. In the short to medium term these measures should include road improvements to the A63 through Hull, the A1079 corridor and the A160/A180/M180 corridor, and rail projects such as Transpennine electrification, South Humber Gauge Enhancement and Goole Intermodal Terminal. In the long term this may include the Hull Lagoons project which provides an improvement in roads infrastructure alongside port growth opportunities and flood alleviation measures.
15.	The connection of people and places is a large issue in the Humber due to the division of the area by the Humber Estuary and the rural nature of the parts of the region. The ongoing affordable crossing of the Humber Estuary is key and we would not the importance of ongoing investment in this infrastructure. Since the reduction in Humber Bridge tolls there has been a 30% increase in utilisation. The Humber LEP would support a further reduction in these tolls to stimulate further cross estuary economic activity. This point links in with the aspiration to improve the M11/ A15 north/south road corridor to allow pressure to be taken off the M1 &A1 routes. The Humber LEP would support moves to dual either dual the A15 or upgrade this road to motorway standard. East Riding and Hull Councils are members of Transport for the North (TfN) and are working closely with TfN officers in the development of its Strategic Transport Plan. It is anticipated that this will consider a number of potential high value 'transformational' schemes for the north

	of England that, if constructed, will boost the economy of the north with corresponding benefits for local residents.
16.	It is difficult to envisage 'Mobility as a service' as being successful solution for rural or peripheral areas, such as those within the Humber LEP area due to the relatively dispersed settlement netwok, long journey times between settlements and limited public transport availability.

Digital Communications

Question	Humber LEP Response
17.	We envisage the highest value infrastructure investments which could be made to secure digital connectivity will be wireless solutions. We envisage that in Rural areas this will be the only effective way to ensure universal coverage to a level which will boost UK productivity. Therefore infrastructure which facilitates this wireless provision should be prioritised.
18.	There are currently 'blackspots' both in mobile and broadband access in rural areas of the Humber. The cost of addressing these areas of 'no service' are high and need to be met with each iteration of digital communication infrastructure required.

Energy

Question	Humber LEP Response
19.	The Humber LEP sees offshore wind as continuing to have significant role for decarbonising energy production. There are significant areas for planned development wind farm development in the North sea and we see ongoing phases of build providing increased supply of low carbon energy. How to store the energy produced is an ongoing challenge and one which the Humber keen to engage with, including the development of hydrogen technologies. There are other opportunities presenting themselves in the Humber for the generation of low carbon energy, however grid connectivity to allow these potential investments to be realised remains an issue. Grid connectivity is also an issue for bringing forward industrial development.

	The potential still exists for the development of carbon capture utilisation and storage under the north sea.
20.	The offshore wind sector will play a key role in the achievement of an effective zero carbon power sectors. Ongoing commitment to this energy source will be required to unlock further investment in this sector.
21.	The Humber LEP do not have a specific comment to make on this question.

Water and Wastewater (drainage and sewerage)

Question	Humber LEP Response
22.	The Humber LEP do not have a specific comment to make on this question.
23.	The Humber LEP do not have a specific comment to make on this question.
24.	The River Hull Integrated Catchment Strategy has effectively brought together all parties with a responsibility for storm water and flood risk management to work collaboratively across the River Hull Catchment area to deliver an effective management approach. This multi-agency strategy is additionally looking to engage with other infrastructure developments such as the Hull Lagoon Project to explore the potential to realise further benefits through the integrated management of the whole catchment.

Flood Risk Management

Question	Humber LEP Response
25.	A level of flood resilience which protects key infrastructure should be seen as minimum to secure supply of services such as electricity, telecommunications, water, healthcare and transport. Flood risk is a key issue in the Humber. There are currently about 90,000 hectares of land around the Humber at risk of being flooded. Around 400,000 people live within this area, mostly in Hull and Grimsby, or in

	smaller towns or villages. The area is also home to major industries, including power stations, refineries and the country's largest port complex. Most of the remaining land is farmed, vital to England's food security. Tidal surge events have had a significant impact upon national infrastructure and businesses, such as Oil Refineries, as well as the sustainability of major settlements. In the Humber we are keen to ensure that business and employment development sites can be mitigated against floods and see local responses as most effective in developing these.
26.	We see the most effective way of managing flood risk as by mainstreaming resilience into sustainable private sector businesses processes (eg shifting the view that provision of flood mitigation measures is only a public sector concern) but also as being a key consideration in the design of other infrastructure design, e.g. public realm, transport infrastructure schemes for example. With the support of elected members, local MPs and major businesses, the Humber Local Authorities along with the Humber Local Enterprise Partnership submitted an innovative proposal to Central Government in 2015 seeking a commitment for a single settlement of £1.28bn required to improve estuary-wide flood defences along the Humber Estuary. This proposal was unsuccessful in securing funding and following feedback from the government the EA is now leading on further work to develop this proposal in further detail A long term commitment to addressing flood risk in the Humber region is crucial to support the long term economic viability of the area.

Solid Waste

Question	Humber LEP Response
27.	The Humber LEP do not have a specific comment to make on this question.
28.	A key barrier to development of a more circular economy is the knowledge of waste streams/ feedstocks for use by other industrial processes. This is particularly acute in the bio-renewables and waste management areas where far more value could be extracted from waste products before being disposed or used to derive energy. Additional resource for local areas to understand what waste assets are held within their catchments which could be shared openly would add value to the development of a circular economy and drive economic growth.

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8 February 2017

Hutchison Ports response to National Infrastructure Assessment
Call for evidence
Response submitted by [name redacted]

Dear Sirs

NATIONAL INFRASTRUCTURE ASSESSMENT - CALL FOR EVIDENCE

Hutchison Ports (UK) Limited ('HPUK') is the owner and operator of the Port of Felixstowe, Harwich International Port and London Thamesport. It is part of the Hutchison Ports group, the port and related services division of CK Hutchison Holdings Limited.

Hutchison Ports operates the world's leading port network with over 30,000 employees and operations in 48 ports spanning 25 countries throughout Asia, the Middle East, Africa, Europe, the Americas and Australasia.

The Port of Felixstowe is the largest container port in the UK. In 2016 the port handled over 4 million TEU of container traffic, more than 40% of all containers handled in UK ports. The port is also the country's largest intermodal rail freight facility with three rail terminals handling nearly 1 million TEU of intermodal rail freight each year. It sits at the eastern end of the A14 and is directly connected to the strategic road network

Harwich International Port is a leading ferry, passenger and offshore-wind support port. London Thamesport handles short-sea containers, general and project cargoes and is situated on the Isle of Grain in Kent. Harwich and London Thamesport are connected by both road and rail to their respective hinterlands.

HPUK welcomes the opportunity to contribute to the development of the National Infrastructure Assessment (NIA) and to help identify the long-term infrastructure needs over the next 30 years.

It is noted that the NIA will cover transport, digital communications, energy, water and wastewater (drainage and sewerage), flood risk management, and solid waste. As one of the UK's leading port operators and the operator of the country's largest container and intermodal rail port, our response focuses chiefly on transport-related issues.

We have not answered all the questions in the consultation but the nomenclature below refers to the original consultation document:

Cross-cutting issues:

1 *What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?*

The Port of Felixstowe is the UK's largest container port. Over 40% of all the country's container trade passes through the port. The largest container ships in the

Registered in England & Wales No. 03484910
Registered Office: Tomline House, The Dock, Felixstowe, Suffolk, IP11 3SY, United Kingdom.

world are frequent callers at the Port of Felixstowe. Large container vessels only make one port of call in the UK so the port, and the infrastructure connections to it, serve all parts of the country.

In addition to being the country's largest container port, Felixstowe is the largest generator of intermodal rail freight on the UK network. In 2016 nearly 1 million TEU of intermodal freight was carried on the 33 daily rail services that serve the port. 28% of all inland traffic moves by rail with that increasing to 50% for traffic to the West Midlands and North.

The 33 daily services run to 16 different inland terminals at Birch Coppice, Birmingham, Bristol, Burton-on-Trent, Coatbridge, Daventry, Ditton, Doncaster, Hams Hall, Liverpool, Leeds, Manchester/Barton Dock, Manchester/Trafford Park, Rotherham, Teesport, Wakefield.

The port is also served by short-sea coastal feeder vessels serving the East coast and Scotland. Almost two-thirds of traffic to the North East and half of Scottish traffic moves by coastal feeder. The majority of the remainder of Scottish traffic is moved by rail to Coatbridge, near Glasgow.

Road haulage remains the leading mode for transporting goods to the port and the only viable option for journeys of less than 150 miles.

The annual number of container vessel calls has been steadily falling at Felixstowe for a number of years. At the same time, container throughput volumes and the average size of container ships have risen significantly.

Prior to 2006 the largest container ship in the world was of less than 10,000 TEU capacity. In 2016 the Port of Felixstowe had 137 calls by vessels of over 18,000 TEU capacity with the largest able to carry 19,870 TEU. Between 2006 and 2016 the number of container vessel calls fell from 3,109 to 1,656 whilst container throughput increased from 3.0 million TEU to 4.1 million TEU.

The result of this is that the average container exchange per vessel has more than doubled, increasing from 965 TEU to nearly 2,500 per call. The largest exchanges are of the order of 12,000 TEU loaded and discharged from a single ship. The increasing size of the exchanges from individual vessels places greater strain not just on port facilities but also on inland infrastructure as many importers want their goods as soon as possible after the container has arrived.

Investment in efficient and effective road and rail connections to the Port of Felixstowe are therefore of the highest value not just to local regional growth but to growth in all regions of the UK. For example, approximately 1.5 million TEU of container traffic travels between Felixstowe and the North each year, over twice the volume handled by any port in the region itself, making Felixstowe the largest container port serving the Northern Powerhouse.

The container is the dominant mode of carriage for trade in non-bulk goods with countries outside Northern Europe. Approximately 75% of Felixstowe's traffic is with

countries outside the EU which is likely to become progressively more important post-Brexit.

2. *How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?*

The Eddington Transport Study, published in 2006, concluded that that the strategic economic priorities for long term transport policy should be growing and congested urban areas and their catchments; the key inter-urban corridors; and the key international gateways. The report further concluded that "international gateway surface access projects are likely to offer the very highest returns".

These conclusions were predicated upon the high proportion of national income derived from trade and the fact that, even then, routes were "showing signs of increasing congestion and unreliability". The reliance on trade, especially with the routes outside the EU served through Felixstowe, is likely to be even greater in a post-Brexit world than it was at the time the Eddington study was produced. Congestion and reliability have both got worse since then so we believe Eddington's conclusions remain at least as valid today as when they were made originally.

Consolidation in the global shipping market, and the emergence of ultra-large mega vessels, means that international trade is likely to become increasingly focussed on a limited number of ports over the period covered by the NIA.

Felixstowe's pre-eminence in this market is due chiefly to its geographical location. The majority of the capacity on large container ships is assigned to ports on the continent of Europe. Typically, only something of the order of 25% will be for the UK. By calling at Felixstowe shipping lines are able to minimise the cost of deviating from the main route to the Rotterdam/Antwerp area to call in the UK. These costs can be very considerable. The capital and operating costs of a 19,000 TEU container ship have been estimated at US$37,726 and US$14,380 per day respectively[1]. Adding to these the additional bunker (fuel) cost, a call at, for example, Liverpool instead of Felixstowe would add approximately $250,000 to the cost of each call.

In terms of infrastructure, the world's largest mega-ships also require deeper access channels and appropriately sized port infrastructure. The Port of Felixstowe's access channel is currently maintained at 14.5 metres below chart datum and studies have been undertaken into potential further deepening. Maintaining the greatest possible period of time (the 'tidal window') during which the largest ships can access a port is an important consideration for shipping lines when deciding on their ports-of-call.

The significantly greater tidal range on the West coast of the UK makes port development there more challenging in terms of maintaining access at low water. Locks and enclosed docks have traditionally been used on the West coast in particular as a way of maintaining a constant depth to make the loading or discharging of ships more straightforward. However, locks are expensive to develop

[1] The Impact of Mega-Ships, OECD/IFT, 2015

and increase both the time taken for vessels to berth and increase the possibility that the vessel may be damaged. They are not therefore popular with ship operators. The alternative, working ships at riverside berths with a tidal range of up to 10 metres also presents considerable operational issues.

With the exception of a recent dredge at Liverpool, all recent major port development in the UK has been undertaken without recourse to public funds. Government investment in infrastructure would most effectively contribute to the UK's international competitiveness if clear priority was given to improving surface access to key international gateways ensuring direct and efficient connections to the main areas of economic activity across the country.

The main infrastructure axes in the UK have traditionally been developed in a radial pattern out of London. This has resulted in a particular deficiency in East-West links which need to be addressed. Key routes to connect with international gateways and therefore enhance international competitiveness include: the A14, A120 and Felixstowe to the North rail route.

4. *What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?*

Managing demand for freight is challenging without penalising economic activity and undermining competitiveness. The market is very effective at selecting the most economically efficient way to route traffic. Technology is increasingly helpful in this regard and transport optimisation software will be increasingly prevalent in future.

Similarly, improvements in real time traffic information relayed directly to drivers in their vehicles would allow better responses to incidents and improved operational performance of the road network.

Government policy should encourage further research, investment and uptake of technology to improve journey planning and management and minimise empty running of vehicles which would deliver environmental benefits as well reducing congestion.

International shipping operates 24 hours per day, 7 days per week. Other elements of the distribution industry, including parts of the road haulage industry, remain a 5 day a week operation focussed on deliveries during the daytime.

Rail freight distribution makes significant use of the rail network throughout the night although it remains chiefly a 5-6 day/week operation. Large parts of the network are unavailable on Sundays to facilitate engineering works. Better planning is required and more investment in diversionary routes is necessary to expedite the delivery of a 7-day railway. In the road haulage sector more work needs to be done to see how demand for road freight can be spread more evenly throughout the day. This would include, *inter alia*, a review of city centre lorry bans at night and ways to offset the higher cost of a 24-hour operation.

Road user charging could be an effective way of managing and/or spreading demand on the road network. However, any scheme would need to be designed so as to avoid penalising certain regions or cross-subsidising between regions. A national scheme would be required though charges could be varied according to the type of road, levels of congestion and time of day. The highest charges could apply to congested urban motorways with the lowest charge on rural roads.

5. *How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?*

Poorly maintained infrastructure increase delays and reduce the performance of the road and rail networks. The performance of the existing network must be maintained but additional assets will be required to increase capacity and accommodate future economic growth.

This is equally true in the ports sector where operators need to undertake regular maintenance dredging to ensure continued access by large vessels. Failure to do so reduces the ability of the port to serve its customers. Maintenance of channels is therefore important but is not an alternative to capital dredges to accommodate larger vessels as they are developed.

Analogous decisions apply to other modes as well and in all cases a rational investment policy based on best Benefit Cost Ratios with minimal distortion from other political factors will deliver the most effective result.

6. *What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?*

The supply of port infrastructure is almost entirely in the private sector. Competition is keen and has been very effective at delivering capacity ahead of demand. We do not believe there is a need to change the existing balance. The use of public grants in the port sector is unnecessary, a poor use of scarce resources, and undermines the case for otherwise viable investments that would be made by the private sector.

UK deep-sea container ports compete in a national market for domestic container traffic as well as with other ports in Europe for transhipment traffic. Greater devolution of spending to regional authorities increases the risk of distortive subsidies being offered to local ports and is something the Government needs to guard against.

The competitive element of the ports sector is important in driving efficiency, investment and innovation. The ability of operators to maximise their competitive position to deliver economies of scale also helps deliver operational efficiency. Scale also helps ensure the best return on public funds where they are used to improve access to ports or other international gateways.

8. *Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?*

The large majority of port investment relies on private funding. Where funded by public bodies, primarily port trusts, funding is usually provided on commercial terms. We are not aware of any port investment for which there was a sound business case that has failed to secure the necessary funding.

The planning regime does, however, pose a potential risk to port investment. Some ports have been required, through planning conditions, to contribute to inland infrastructure on the erroneous premise that the port is the primary beneficiary of the investment. In reality, efficient connections to ports are a prerequisite for an efficient economy and benefit the whole economy. The high cost of such interventions are difficult for any port development to bear and, rather than be an effective policy to leverage private sector investment in public infrastructure, they risk distorting competition, hindering developers, forcing traffic to use alternative sub-optimal routes and increasing costs for importers and exporters. Some developments have been given significant planning obligations (which delay development initially and then again once it has been accepted that they are unreasonable and need to be renegotiated), others have received no comparable obligations and, in one recent case, the private port was given a substantial government grant towards the cost of its own port infrastructure.

Where external infrastructure investment is required by the planning process, the challenges for port investors are exacerbated by the absence of any way to obtain estimates of the cost of the external infrastructure demanded to a level of accuracy, and within a timescale and cost, that does not render the port investment uneconomical.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

The commercial imperatives described above and the need for shipping lines to serve a range of North European ports in the most efficient way possible has resulted in all the major deep-sea shipping companies calling at ports in the South and East of the UK between Felixstowe and Southampton. The increasing use of ultra-large mega ships in future is likely to reinforce this position.

Whilst there may be some niche operators that buck this trend there will be no major deviation from this pattern in the foreseeable future.

The pattern of distribution for imported goods is very complex. Few goods travel directly from ports to their point of sale. Most go through distribution centres which may be national, regional or local. Some distribution centres are based in ports, port-centric distribution, but the majority are located away from port areas and some goods may go through more than one distribution or fulfilment centre before reaching the buyer.

A number of factors influence the location of distribution centres. Whilst there are distribution centres in every region, the central location, good connections and lower land and labour costs mean there is a higher than would otherwise be expected concentration in the East Midlands and relatively few in the South East.

The patterns of distribution are changing with the growth of online retailing. The need for next day, or even same day, delivery is driving demand for smaller local fulfilment centres. There is the prospect of more innovative final-mile solutions being adopted – drones, use of urban transport networks etc - but the basic pattern of trunk haul with large volumes of goods entering ports in the South and East and being transported to distribution centres nationwide will not change.

In terms of modal choice, 28% of containers transported inland from the Port of Felixstowe move by rail. This has increased from 21% since 2004, a total volume increase of 92% over the period. Rail is more competitive over longer distances and the modal share of rail is 50% to the North and West Midlands.

Scotland and the North East are also served by coastal feeder vessels. Although a relatively small proportion of total throughput, coastal feedering carries approximately two-thirds of traffic to the North East from Felixstowe and half Scottish traffic. The bulk of the remainder of Scottish traffic is carried by rail.

Although the number of containers moving by rail has increased in recent years the share of the total volume has levelled off. There is evidence of additional demand for rail but growth is constrained by a lack of capacity on the network. This will result in greater pressure being placed on the strategic road network until rail capacity is increased.

The shortage of HGV drivers, and the ability of rail to move large volumes of traffic (see comments above about larger vessels and larger exchanges of containers per ship) will also help drive demand for rail. In the longer term it is also likely to push the development of driverless freight vehicles. In the shorter term, and as also referred to previously, increased investment in, and use of, optimisation software could reduce the number of empty truck miles and help mitigate the pressure on the conventional road network.

The UK rail network was developed before containers. One consequence of this is that, unlike in some other countries, the loading gauge in the UK is insufficient to allow double stack trains to be used. As demand for rail capacity increases it may be necessary to investigate the feasibility of increasing the loading gauge on key routes to increase capacity as an alternative to laying more track.

It is unclear what the potential impact of 3-D printing might be on freight transport. Not all goods will be suitable. For example, there will still be large quantities of food and drink that will need to be moved, but there may be an impact in certain categories. It is possible however that the reduction in component parts being transported will be offset to some extent at least by the need to transport the raw material for the 3-D printers.

Similarly, there is much discussion on the potential for delivery of goods by drone but it is not possible to forecast accurately to what extent this will prove to be practical especially given the quantity and bulk of much of the freight carried today by more conventional means.

15. *What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?*

As referred to above, the Eddington Report found after extensive study that "international gateway surface access projects are likely to offer the very highest returns". The same report also concluded that the benefits from improved transport are likely to be greatest when focusing on congestion and bottlenecks. The factors that led Eddington to these conclusions remain valid and, if anything, have only intensified since, adding extra weight to the conclusions.

There are a number of bottlenecks already identified on the Felixstowe to the North (F2N) route, the line connecting the UK's largest container port with the major rail-served markets in the Midlands, North and Scotland. The most immediate constraint is on the Felixstowe Branch Line. A scheme has been developed by Network Rail and, with a contribution from Hutchison Ports, should be substantially complete by April 2009.

Beyond that, there are a number of other bottlenecks including those at Ely, Haughley, Bury St Edmunds and Leicester. Whilst the need for improvement has been identified, none of these are as yet funded or scheduled and should be treated as a priority for the national network.

The Orwell Bridge on the A14 is the most intractable problem on the road network. Congestion and a lack of resilience on the route will constrain growth in East Suffolk and add cost for exports travelling to the country's major port. At the present time there are no plans in any future road programme to address this bottleneck which needs to be prioritised for future action.

Digital Communications:

17. *What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decision need to be made?*

The digitalisation of the railway signalling system has the potential to allow more train services to operate on the existing infrastructure. Digitisation of supply chains has already resulted in greater use of just-in-time logistical strategies and this trend will continue. Changing logistics strategies are also opening the market for port-centric distribution, a trend we also expect to continue.

18. *Is the existing digital communications regime going to deliver what is needed, when it is needed, in the area that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?*

Whilst the digital railway forms part of the infrastructure manager's strategy to tackle capacity issues, progress is slow. In order to benefit end to end freight movements full implementation across operating regions is required.

We hope the above comments are useful in the developing the National Risk Assessment and would be happy to expand on any of them if that would be at all helpful.

Yours sincerely

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10 February 2017

NIA Call for Evidence
National Infrastructure Commission
11 Philpot Lane
London
EC3M 8UD

Dear Sir/Madam,

The IET's response to the National Infrastructure Assessment Call for Evidence.

The IET is Europe's largest professional engineering and technology organisation. The members represent a wide range of expertise, from technical experts to business leaders, encompassing a wealth of professional experience and knowledge.

We have responded to the National Infrastructure Commission queries on Transport, Energy and Digital Communications for the National Infrastructure Assessment, call for evidence. This response has been compiled on behalf of the IET Board of Trustees by the IET's Policy Panels.

If the IET can be of any further assistance please do not hesitate to contact me.

Yours faithfully,

[signature redacted]

[name redacted]
[job title redacted]

The Institution of Engineering and Technology
[emai redacted]
[telephone number redacted]

The IET welcomes the establishment of the new National Infrastructure Commission (NIC) established with the intention to provide an "unbiased analysis of the UK's long-term infrastructure needs." Coupled with a renewed interest in an Industrial Strategy, the establishment of the NIC indicates government willingness to invest in large infrastructure projects.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

Communications

- International competitiveness must be examined through the balance sheet of the nation, where changes over time are measured. Better use of data reporting and reuse of data must be encouraged with a review with ODI, ONS and all the UK regulators on how data can be opened up for innovation and investment.

- Digital development also allows more efficient use of resources. This is widely accepted in the energy field (i.e. the use of smart meters). UK should benchmark itself against other leading countries. Ofcom does this well for Communications but rarely acts on it as there is a lack of commitment from central government; this needs to be addressed. A provision of suitable bandwidth and latency is also necessary for competition in infrastructure.

Transport

- Fifteen percent of the cost of goods is to cover transportation cost. A more efficient transport infrastructure to reduce congestion will reduce prices, increasing the UK's international competitiveness.

- Roads are congested, especially at certain times and locations, including rush hours in towns and cities, and motorways at Bank Holiday weekends. The congestion is estimated to cost £20Bn-£50Bn per year in the UK, and ten times this in Europe as a whole and in the US.

- There is also insufficient funding for road maintenance. As a result the national and local infrastructure is deteriorating. Road pricing technology is proven and is in use world-wide (although not on a national basis). Road building combined with efficient pricing would result in a higher economic return because mobility would be enhanced while congestion is reduced. The extra capacity would reduce the price needed to contain congestion and travel by car would be affordable for more people on lower incomes.[1] Air pollution can also be addressed by road pricing, as in the London Low Emission Zone and the proposed Ultra-Low Emission Zone.

[1] Banks, Bayliss & Glaister (2007, "Motoring towards 2050: Roads and Reality", RAC Foundation).

- Infrastructure needs to be seamless in terms of allowing passengers and freight to travel safely from where they are to where they need to be as efficiently as possible. Efficiency can be determined by:
    - The cost (of travel and to the environment).
    - How quickly the journey can be made (important for perishable goods, some people and some non-perishable goods).
    - The smoothness of transition from one travel mode to another (especially if a person is frail or travelling with heavy baggage).
    - The provision of data from which informed travel choices can be made for people and freight.
    - The actual or perceived risks associated with the travel (i.e. does a parent allow a child to walk/ cycle/ use a bus to travel to school or is the risk too great so they take them themselves. How do they do this keeping time efficient?).
    - International gateways should be better integrated internationally to ensure seamless onward travel.
    - Gateways (international and domestic) are essential in fulfilling smooth transition from one travel mode to another for passengers and freight. Data gateways are essential to make sure informed travel choices can be made for people and freight.
    - Freight gateways (consolidation centres) are in their infancy but at present not much has been done for the passenger.
    - International gateways, especially for road freight, are also good points at which to detect foreign and potentially polluting vehicles entering the UK.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

- Digital connectivity is of critical importance for promoting economic growth whilst planning national infrastructure. Good broadband connections can facilitate economic development in rural areas, lessening the need to commute. The House of Commons Scotland Affairs Committee noted that: "Access to broadband is an important issue far beyond its impact on the creative industries, but we have heard that poor internet access is a particular barrier to creative enterprises in rural Scotland. It is essential the UK and Scottish governments work together to ensure the successful rollout of broadband across Scotland." [2]

- The development of Ultrafast Broadband will drive development opportunities in regions where the uptake is fastest. Mobile phone coverage varies widely within the UK and must be tackled to sustain 5G, which will facilitate innovations in Autonomy and Internet of Things (IoT), making time more efficient and freeing up people's time.

[2] http://www.parliament.uk/business/committees/committees-a-z/commons-select/scottish-affairs-committee/inquiries/parliament-2015/creative-industries-in-scotland/

- Flexibility and modularity are key drivers for developing a successful communications infrastructure. An intelligently designed network will be able to cope with changing requirements. Dynamic re-configuration of the network to support short term requirements plus modular building blocks to support longer term trends, thus avoiding the short term "fixes" that cause longer term bottlenecks.

- Most infrastructure remains cost effective if designed nationally (UK wide) and devolving too much locally is to be discouraged for fear of lost national competitiveness and added costs. For example, spectrum policy is not well handled locally. Deviation from standards is also a bigger pressure on costs, even if there may be pressures to reduce costs these standards are important for safety and compatible services.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

- Future electricity demand will be impacted by so many drivers that it is very difficult to estimate the "maximum potential" for either demand reduction or spreading. Nevertheless, we are confident that the ability to manage electricity demand will be extremely valuable in the future. Also, as it involves little investment in capital equipment it is likely to be economically attractive. This subject is explored in detail in the call for evidence that BEIS and Ofgem published last year[3]. The IET responded to this in detail and would be happy to provide our response to you if requested.

- Whether a rebound effect in electricity is problematic from an infrastructure perspective depends not on the total energy used, but on the timing of the use (does it increase network congestion?), and the carbon content of the energy at the time of use (why is it a problem if surplus wind or solar power is effectively "spilled" as a consumer lifestyle benefit?).

- Most rebound effects in energy are to do with domestic comfort levels (i.e. how warm you choose to keep your house), which also have a saturation characteristic (i.e. you might choose to warm your house to 23 degrees if it was 18 degrees, but you may not warm your house to 28 degrees if it was at 23 degrees).

- The issue is also linked to storage (it might appear in measurements as a rebound effect if additional energy is taken at times of low price, even though it is not), and to all the complexities of issues like the time of day when Electric Vehicles (EV) are charged.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

<u>Energy</u>

[3] https://www.gov.uk/government/consultations/call-for-evidence-a-smart-flexible-energy-system

- In electricity networks there is already a strong emphasis on intelligent asset management and the optimisation of asset life, balancing risks with the consequences of failure. Adding smart capability with additional sensing and data processing will allow this to be developed further, but in so doing we might find new issues and limits with what in some cases are very old assets whose ageing characteristics we do not fully understand at present.

- In many situations, it could be argued that the most valuable assets are the rights of way or physical sites that accommodate the electricity infrastructure, particularly in densely populated urban areas. A longer-term, more integrated approach to these assets should be investigated further. Replacing a life expired electricity cable like-for-like may be an inefficient use of a right of way, albeit one the regulatory environment might currently encourage.

- Future planning in infrastructure development is key. There is value in installing a new cable of higher voltage rating, even if not fully utilised at present, to create optionality for greater capacity in the future. Maybe at the same time we should, as a matter of routine, also be considering the potential use of the right of way for district heating, water or data connections. Adding a communications fibre alongside a new power cable is likely to be an enabler for smarter network operations and new energy services as these invariably require data.

Transport

- Modelling of economic activity (including traffic demand) should be used to develop predictive models involving asset construction and maintenance. In some cases longer life construction costs will be warranted in whole life costing models taking account of construction, use, repair and recycling.

- When making investment decisions it is important to consider the following:

Achieving a reduction in:	Achieving an increase in:
• Total costs of operating the assets. • Capital costs of investing in your asset base. • Potential health impacts of operating the assets. • Safety risks of asset operation. • Environmental impact of asset operating. • Legal risks associated with operating the assets.	• Operating performance of the assets, (reduce failure rates, increase availability, etc.). • Reputation of the organisation (irrespective of whether this is a national organisation such as Highways England or a local Authority or the private sector). • Regulatory performance.

- A balance needs to be struck between financial performance (profit), operational performance (customer satisfaction) and risk (safety). For assets which are deemed to be critical, high operational performance is required and the tolerance to risk is low, which could result in low profit.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

Communications

- Every communications system must, of course, incorporate redundancy to ensure resilience and tolerance of faults. Intelligent flexibility (modularity) is inherent to any properly designed network so, providing the infrastructure has indeed been correctly designed, changes to traffic patterns will not be an issue. This needs suitable bandwidth and latency.

- In addition to this there is scope to appoint a lead person in each national regulator to lead on infrastructure resilience and related interdependencies. Each regulator needs to accept this duty and work with the others in a more joined up way. International benchmarking for resilience should begin.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

Energy

- Transformational change is necessary for which a fragmented infrastructure system is no longer suited. Individual infrastructures must be examined as total end to end systems (including the parts in consumers' hands and the hands of technology companies), and look at infrastructure as a whole as a system of systems.

- This has been explored by the FPSA[4] project that provides evidence of pressing requirements to review and update industry change mechanisms and governance arrangements.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

- Environmental costs and benefits must be factored into infrastructure decision making. Currently, infrastructure providers navigate around codified rules based on systems to provide compliant solutions. Approaches that value environmental costs and benefits should be explored further.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

- A series of scenarios can be envisaged depending on whether disruptive technologies take hold. Important issues to consider in future scenarios are:

[4] http://www.theiet.org/sectors/energy/resources/fpsa-project.cfm?origin=reportdocs

- The impact of automation on travel patterns and use.
- The shared economy (uber/Lyft and others).
- Car ownership.
- Demand management and the importance of e.g. air quality.
- The success of moves to increase the share of public transport trips.

- Future travel patterns in the UK will be driven by population growth and by increasing urbanisation. The impact of the adoption of new technologies, including the further development of mobile phone technology, will be significant in the consumer sector with the increased power and connectivity of smartphones, which facilitate new services such as 'Mobility as a Service'.

- Increased connectivity of vehicles will allow the advent of autonomous vehicles (AVs). However, these developments are in their early stages and predicting their impact is very difficult. For example, AVs have been predicted to both increase and to decrease road congestion.

- "Travel patterns" include both frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight. Taking the different types of travel patterns into consideration:
    - Personal travel: This is likely to grow mainly because families and friends are increasingly living further and further apart but there is still that desire and/or need to be there in person sometimes and to have new experiences. However, commuting travel (e.g. going to the same office everyday) will reduce providing that it is possible to undertake the work remotely.
    - Commercial travel: There is a similar desire to that for personal travel desire for people working in businesses, i.e. there is a need for people who work in different locations to physically meet in order to create better relationships and work collaboratively to determine solutions.
    - Freight travel: This will be influenced by a change in shopping habits to greater use of local shops and online shopping, and the uptake of freight consolidation centres to minimise trips in major urban areas.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

- High quality, higher speed transport is required to link to domestic 'gateways', acting as transition points for inter-urban travel and travel to rural areas. This could be best implemented through use of road pricing, as outlined in Q2, which would be most effective in cost-benefit terms. Investment in digital infrastructure in also important to support the self-organisation of disparate transport needs.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

- As a general point better value will come from developments that separate modes from each other except at designed transport hubs, and separate

slow-moving traffic from faster so cycling is kept apart from motorised driving and freight vehicles are kept apart from passenger on roads and rails.

- Specific answers to these questions are almost impossible as the assessed investment value and its cost will vary dramatically depending on location.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

- As indicated in Q13, 'Mobility as a Service' is in the very early stages of development, and predicting its impact is very difficult at present, but the impacts are likely to be significant.

- There are no agreed standard definitions of Mobility as a Service (MaaS). However it would be accepted by most that it means a world in which there is no strong requirement to own personal transport assets such as cars; instead a mix of mobility solutions is purchased and used as a service.

- Individual transport services from public and private providers and across all modes are purchased through unified portals that offer trip planning, priced route choices and single account billing. Users might opt for pay-by-trip or make a monthly subscription. MaaS is usually seen as a passenger service but it applies just as well to the movement of goods.

- There are many approaches to calculating the road user charge depending on what is to be optimised. The main issue in Road User Charging (RUC) is public acceptability. However, RUC could be developed to support an economic and logical prioritisation of road use. If MaaS supports and enhances the "user pays" principle then some form of road pricing becomes the ultimate expression of user pays. MaaS provides an excellent opportunity to facilitate it technically, primarily due to the fact that it could be another add-on service.

- If MaaS is to be successful, especially in an urban context, then driving using personal vehicles must be one of the priced options. Some form of road user charging would seem to be unavoidable especially in countries where roads are free at the point of access. The charge model would not need to be a fairly precise location-based pay-per-Km (perhaps with added variability depending on time of day, engine size and type etc.). An Oregon-style set of payment options would be sufficient.

- However the introduction of RUC would need to be carefully considered as it could limit the take-up of MaaS in the UK. There is however the potential for early incorporation of a facility to pay tolls, etc. that are already in existence. Other early initiatives could include providing information to allow the traveller to compare travel options. For example: to compare the direct cost and time of personal car travel (fuel, wear and tear, insurance, VED), to the use of other forms of transport in order to start making people think when choosing their travel mode(s).

Digital Communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

- Designing the network in a flexible and modular way will allow changes and upgrades be achieved.

- Good (high bandwidth, low latency) communications are vitally important to the future success of the UK that any delay in decision making must be avoided.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

- No, definitely not. We are playing “catch-up” with our current UK infrastructure. In the same way as piece-meal implementation of the transport network quickly creates traffic blackspots and delays, short termism and a poorly arranged competitive framework for the digital communications system will not allow for the connectivity the UK needs. Low latency, high bandwidth networks are absolutely fundamental to our success.

- An Internet Exchange in every major city should also be a consideration, for example the initiative in Liverpool - IX Liverpool who are currently battling with the local council to use unused fibre in the ground to expand bandwidth and services to local citizens and businesses while contributing towards UK infrastructure resilience.

- If digital connectivity is simply viewed as a utility then the price pressure may deter investments. Pricing needs to reflect demand, and in some areas the coverage may not have the demand or the fibre backhaul.

- Competition shape will change over time , but is not based on network coverage alone – billing and customer care remain important ; data security and devices too . Regulation tilts the field today in favour of international Internet players at scale versus network investors. Mobile and fixed networks (including Cable TV) have for too long been seen as separate for regulatory purposes.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

- In 2015 heat represented 84% of domestic energy consumption and 61% of services (commercial) consumption. Consistent with the IET’s Energy

Principles[5], the first priorities should be to reduce demand through conservation (i.e. behaviour change) and efficiency (i.e. improving the thermal performance of our buildings).

- The primary source of heat (2015) came from natural gas (75% domestic and 69% services). Decarbonising heat will mean that the UK will need to stop using natural gas for heating. The alternatives to natural gas which are suitable for large scale deployment include electricity and district heating.

- In both cases there are very significant infrastructure repercussions such as the construction of new power stations, as well as upgrades to buildings. However, there are also very significant network repercussions. District heating will require pipe network to be installed involving substantial street works. As the low voltage electricity network will need to be reinforced to cope with the additional heating load this will also require substantial street works.

- Assessing these network costs is difficult because the UK has relatively little experience of constructing district heating networks and reinforcing low voltage networks. However, the main challenge is likely to be implementing a major nationwide programme involving street works and limiting the associated disruption to the public and businesses. For example, at present the UK is halfway through a programme to replace the iron gas mains with polyethylene pipework to 13 million homes and businesses. The Iron Mains Replacement Programme (IMRP) has been scheduled over 30 years in order to limit the annual rate of replacement to 3,580 km as this was judged to "represent an achievable level of replacement that would not cause excessive disruption to the public". Both district heating network construction and electricity network reinforcement are likely to have a similar effect and so the timescale to transition from gas will probably also be measured in decades.

- A possible alternative to district heating and electrification of heat is hydrogen. This has recently been given serious attention[6] and involves the repurposing of the low pressure gas network from natural gas to hydrogen. The IMRP has effectively meant that most of this will be "hydrogen ready" when it is completed as polyethylene pipe can be used for hydrogen. As a consequence there will be much less need for street works activity. However, there are many other issues that need to be examined before large scale deployment can be considered. For example, a step change in hydrogen production will be required and the primary feedstock is likely to be natural gas. The chemical process used produces CO2 as a by-product. This then needs to be captured and sequestered and hence a nationwide CCS infrastructure would be required.

- In terms of which has the highest value, despite numerous investigations, it is very difficult to conclude that one solution has a higher value than another. This is because the UK has no experience of deploying these technologies at scale and the many unexpected problems that might arise and need to be

[5] http://www.theiet.org/factfiles/energy/energy-prin-page.cfm

[6] "H21 Leeds City Gate." Accessed from www.northerngasnetworks.co.uk in January 2017.

addressed. They include unexpected costs, engineering difficulties, deployment challenges and resources with the requisite skills and expertise. Crucially it is not known how consumers are likely to respond to being transitioned from natural gas to an alternative and whether this can be on the basis of choice or if the transition will need to be mandated.

- Consequently, and assuming that the timescale for decarbonising heat will take 20 to 30 years to implement, consideration should be given to identifying a region in the UK to trial each of the technologies as soon as possible. The Smart Systems and Heat" programme[7] is is taking an important step in this direction. The knowledge and experience gained is likely to lead to much better choices, particularly as there are other factors that need to be considered, e.g. type of buildings, geographic locations, etc.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

- We would first clarify the note to the question. The work undertaken for DECC (now BEIS) by the IET and the Energy Systems Catapult through the Future Power Systems Architecture Project has demonstrated very clearly that the part of the electricity system on the consumer's side of the meter is as important as the conventional generation, transmission and distribution infrastructure in delivering a decarbonised, resilient system.

- Activities 'beyond the meter' can already be seen to be changing and include new parties, new technologies and new commercial models. These are beyond the governance mechanisms of today's sector, which results in frustration for the new parties who seek changes to long-established industry arrangements and present a growing threat to the security and integrity of local and national networks.

- This threat arises, for example, where high volumes of distributed resources (generation, demand, storage) may respond to automated signals such as Time of Use prices, resulting in loss of diversity that creates unacceptable step changes of demand or generation. This aggregated effect can overload networks or destabilise the national demand/generation balance.

- There are a range of pathway choices to decarbonise electricity. The optimum choice to decarbonise electricity is far from clear currently and must enable options to develop and for either the market or government to make choices in due course. Key issues include:
    - The extent to which technology companies and service providers enter the space, and bring new value propositions to consumers.
    - The role of electricity in the transportation sector, and whether electric personal transportation evolves as owned vehicles or shared autonomous vehicles (the two pathways would likely result in very different temporal and spatial patterns of charging). This could impact

[7] http://www.eti.co.uk/programmes/smart-systems-heat

absolute and peak demands, where investment in electricity distribution should be directed.

- The role of electricity in space heating (which if extensive would create large increases in absolute demand and potentially even larger increases in peak demand).
- The role of hydrogen in space heating (extensive use make the need for large scale hydrogen production, which would drive a need for electricity infrastructure that would co-produce hydrogen and extensive hydrogen storage).
- The extent to which cities and communities start to drive the agenda for electricity (which if extensive would drive a more integrated system locally with less need for large central facilities).
- The effectiveness of energy efficiency improvement in existing building stock.
- Technological and cost improvements in storage, end-use and generation.
- The different timescales of technological and consumer product development (a few years) versus heavy infrastructure development (a decade or two).
- Effective and agile governance of the end to end system, with clarity of accountabilities for key issues such as system integrity and cyber security.
- End to end system co-ordination is an imperative not an option; to simply leave this to ad hoc and goodwill arrangements between today's incumbents at their respective boundaries, is unacceptable and would be a serious failure of today's policy makers and regulators.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

There are a range of means by which low carbon vehicles may be delivered, each of which has different implications, as set out below:

<u>Biofuel</u>

- A substantial shift to biofuel as a transport fuel would require minimal change to existing infrastructure. However, the feasibility of producing biofuel on this scale is unclear. It is currently difficult to see how this could replace more than 10-20% of current road fuel usage.

<u>Electricity</u>

- A major shift to electrify the vehicle fleet would have a profound effect on the electricity system, and this effect would be very different for shared AVs versus owned vehicles, or different again if the market were to evolve with shared vehicles that were not autonomous.

- It is far from clear which technology might win out and over what timescales, however it seems unlikely that AVs will deploy at scale over the next decade or so.

- There would be a case to deploy public charging infrastructure, acknowledging the risk that it might become redundant in the future.

Owned Vehicles:

There are a number of different classes of impact, which are interrelated:

- On the generation capacity needed for these vehicles to be charged when owners want to charge them. Wholesale transfer of personal transport to electricity might roughly double total energy requirements from the electricity system and also creates significant increases in peak capacity requirements. However, a fuller integration with storage, especially at local level, could mitigate the capacity increase requirements significantly. EV charging, if co-ordinated through smart charging mechanisms, could provide a powerful and flexible source of demand management. Similarly, these vehicles could become a source of mobile storage and power infeed though 'vehicle to grid' services.

- On the distribution network, down to and including feeders at street level, mitigated to the extent possible by smart charging arrangements to stagger charging temporally. EVs are electrically quite unlike other electrical device currently in the hands of consumers, because their charging consumes significant amounts of power for long periods of time. Other high demand items in consumers' homes like electric showers consume high power but only for short times. The distribution network was not designed for loads of this nature, and it might take only a relatively small number of EVs charging to create overloads.

- On the need to provide public charging infrastructure, potentially including major electricity network reinforcement to locations where large numbers of people gather for relatively short time periods (football matches, shopping centres), and where consumers cannot provide their own charging (for example in cities where off-street parking is very limited).

Shared Autonomous Vehicles

- Charging would likely take place at times of low demand for vehicles and as far as possible at times of low electricity cost, so would be much better correlated to times of lower demand on the electricity system.

- Charging would likely take place in more centralised locations in urban areas (we foresee locations such as supermarket car parks or industrial estates becoming used for this purpose). These would typically be connected to distribution systems at higher voltages, obviating the need for mass distribution feeder reinforcement at local distribution voltage.
- Vehicle fleet owners would see commercial opportunity in their fleets acting as virtual or real power stations and providers of system services, this potential of electric vehicles might be easier to realise in this scenario.

- There would be much less need for public charging infrastructure.

Hydrogen

- Hydrogen as a transport fuel is technically viable and has been demonstrated in automotive and public transport applications. The challenges are around the production and distribution of hydrogen and whether it might more beneficially be used in heating rather than transport.

- A substantial shift to hydrogen transport would have significant implications for energy infrastructure and for the electricity system.

- Firstly, a hydrogen distribution infrastructure would be needed by either making use of, or in parallel with, existing hydrocarbon infrastructures and recognising that a transition would not be instantaneous. Consumers would presumably continue to operate hydrocarbon vehicles for many years after hydrogen vehicles were brought to market and hydrogen vehicles would need a supporting infrastructure in place if they were to sell in numbers. The most likely applications seem to be in low emissions zones in larger cities.

- Secondly, a means of producing hydrogen at scale would need to be constructed which could in turn influence choices in the electricity sector. Carbon capture from fossil-fuelled power stations has stalled in development and application because it is uneconomic at present.

- If hydrogen production at scale became important, the role of carbon capture could be transformed, which could give thermal power a much greater role in electricity (and perhaps heating) than it might otherwise enjoy. Also hydrogen production is a potential (though quite costly) means to use excess wind or solar power, which might then allow rather more wind and solar to be connected than would otherwise be economic.

- If large amounts of hydrogen were to be stored as part of development of a hydrogen infrastructure for transport this could also open new opportunities for energy storage on the electricity system.

National Infrastructure Assessment: Call for Evidence

This is a response to the National Infrastructure Commission's Call for Evidence for its National Infrastructure Assessment.

Value for money

There is only a finite amount of money that the UK can spend on infrastructure, and this is dependent on income from taxpayers and priorities between competing departments and projects. It is essential that the government gains high value for money when procuring goods and services. However this is not always achieved.

For example the cost per mile of building High Speed Two is estimated to be up to nine times higher than the cost of constructing high speed lines in France [1]. Costs of building high speed rail lines in China are believed to be one third lower than those in Europe [2]. Engineering consultants working for the UK government at the initial stages of a major project set price guidelines which are way too high. Companies subsequently bidding for this work use the initial price guidelines when tendering for this work. The UK government needs to make a step change in its approach to costs so that in future it will be buying goods and services at internationally competitive rates.

In addition much tighter controls on cost overruns need to be maintained during the life of projects. The cost of electrifying the Great Western route has more than trebled while its scope has been reduced by cutting out electrification of the Cardiff – Swansea section, the Welsh valleys as well as deferring work on four other sections [3]. The estimated cost of electrifying the Midland Mainline more than doubled before any significant work had started [4]. Some of these cost overruns can be attributed to poor initial planning and loose project control.

It may be argued that the views expressed in the previous two paragraphs are incompatible or that lower priced bids will inevitably lead to greater cost escalation during construction. I would not accept such arguments as I consider the construction companies are ripping off the government and they have been allowed to get away with such practices for far too long. If other European countries can achieve very significantly lower construction costs then the UK should be able to as well.

If the above procedures are adopted, then this country will be able to either build much more infrastructure for the same cost or the same amount of infrastructure for far less cost.

Infrastructure spending needs to be prudent. UK public sector debt has more than doubled since 2009 and now stands at £1.7 trillion. Network Rail no longer has the flexible funding arrangements that it had up until two years ago.

Regional Development
The government has to decide how much it wants to encourage growth in areas away from London as that will affect where its infrastructure spending is going to take place. Trains are relatively little used in North East England to travel to work [5]. Would improvements to this part of the rail network encourage more businesses to locate to this area and encourage a modal shift from cars to trains? The Northern Powerhouse no longer appears to have the same level of support behind it that it first had two years ago.

Improving rail links from the Midlands and the North to London is more likely to benefit London rather than the regions. This was one of the points made by Professor John Tomaney when he appeared before the Transport Select Committee [6]. On this occasion he also expressed other useful views on regional development such as the desirability of investing in skills, knowledge and technology. I find the views of Professor Tomaney on the effects of high speed rail on regional development far more credible than those of government as they are based on the evidence gathered from several countries. Both his written submission and oral responses are very worthy of detailed study. I highly recommend them.

The government has quite often talked up the benefits of agglomeration. Perhaps it is seeing its claims come true with regards to the growth of businesses in London. Some would view the growth of businesses in London at the expense of the rest of the country as undesirable.

Future travel needs
There are going to be major changes in our travel needs over the next thirty years. There is likely to be more working from home. Ideally people need to live closer to their places of work. Both concepts reduce the need for travel.

Car usage is likely to change with increased car sharing, fully autonomous control and possible car "convoys" on motorways. Congestion charging is likely to be introduced on our most congested roads and I consider such a move to be necessary. The use of public transport needs to be encouraged; however suitable capacity needs to be provided to support such concepts.

The UK needs a national transport strategy which encompasses road, rail, air and sea. It should include both passengers and freight. While it is an improvement that the UK now has a National Infrastructure Plan, this appears to be an assembly of projects. We should be developing a national transport strategy, and then reviewing our National Infrastructure Plan projects to assess how well they fit with our national transport strategy.

Where to invest in rail
70% of all passenger rail journeys in the UK are made in the London and South East area [7]. 90% of passengers that have to stand on trains during the morning three-hour peak do so on trains into London [8]; this equates to 155,000

passengers. The 90% figure may be slightly overstated as only 10 other cities are listed in this DfT data besides London. However any difference is not likely to be significant.

While Crossrail, the revised Thameslink programme and the South West Trains capacity improvements will all add much needed additional capacity on commuter routes into London, they will not address all the overcrowded peak time train issues. As most major train projects take many years from decision to completion, some radical thinking is needed now to address London's rail capacity issues. I am aware of the plans for Crossrail2. The overload of London's public transport also raises the question of how many companies can be successfully encouraged to relocate out of London to the Midlands and the North. Please see previous comments on regional development.

There is a need to continue to invest in addressing the worst bottlenecks and pinch points on the rail network. Credible cost benefit analysis is needed to compare enhancement projects. Such analysis should not be based on flawed thinking such as passengers do not work on trains [9]. The DfT's own secret report from 2009 indicated that up to 82% of business travellers worked on their train journeys. In the past the Department for Transport and its associate organisations appear to have been ready to justify certain projects using very questionable data and assumptions [10]. Such practices waste taxpayers' money, undermine government credibility and must be stopped.

Improvements for freight traffic by rail do not always appear to be given the priority they deserve. For example, there are at least four improvements needed on the Felixstowe to Nuneaton route to increase its freight carrying capacity. It is noted that Felixstowe is our busiest container port handling as much tonnage as our next two busiest container ports combined [11]. Yet at least two of the improvements were delayed from Control Period 5 to Control Period 6 [12] during the review carried out by Sir Peter Hendy at the beginning of 2016. Was there a concern that implementation of these enhancements would undermine the case for HS2? If that were the case, it would have been an extremely poor reason for delaying these enhancements.

It is preferable to move as much freight off the West Coast Mainline and North London Line as possible as they are both very heavily used routes for passenger as well as freight traffic. Improvements to the Felixstowe to Nuneaton route would allow more rail freight on this route so relieving some of the pressure on the West Coast Mainline and North London Line by allowing additional freight trains to travel from the port of Felixstowe to the Midlands more directly, without travelling via London.

Rail electrification

Electric powered trains are preferable to diesel powered as they are usually less polluting (depending on how their electricity is generated), quieter and cheaper to run. Only 30% of our rail network is electrified which is low compared to many other leading countries [13]. China, France, Italy, Japan, Spain and others

have electrified more than 50% of their rail networks, Switzerland's is 100% electrified and even Ukraine has electrified 44% of its network. We need to learn how to electrify (some further parts of) our rail network at much more affordable rates.

I do not consider bi-mode (hybrid) trains are a suitable alternative. They are more expensive than a diesel or electric train and also heavier as they have twice as many power sources. They are noisier than a pure electric train when their diesel engines are in use. Their performance is poorer due to their greater weight and the likelihood of the diesel engine being lower powered than the electric engine. This can result in longer journey times as has been forecast for the IEP trains due to be deployed on the Great Western route later in 2017 [14].

Strategic Rail Freight Interchanges

This country currently has legislation that requires developers of strategic rail freight interchanges (SRFIs) to submit their applications to the Planning Inspectorate rather than the local planning authority. While strategic rail freight interchanges are needed and it is desirable to transfer freight from road to rail, their locations are not being strategically planned at all. Proposals are put forward where a developer owns some land. Applications for SRFIs can be approved without a commitment from Network Rail to provide the minimum required train paths. Several SRFIs can be established in a relatively small area which potentially undermines the viability of each of them.

Using information from the Railfreight Interchange Investment Group [15] and literature distributed by the proposed Rail Central and Northampton Gateway SRFIs, there appear to be 17 SRFIs in operation or approved and a further 15 SRFIs currently proposed in England and Scotland. That is in addition to smaller sized rail freight interchanges (non-SRFI) and rail-linked ports. Is there and will there be sufficient demand to justify 32 *Strategic* Rail Freight Interchanges?

If such applications are going to continue to be processed at a national level then there needs to be much clearer scrutiny that there is a *strategic* need for an SRFI in those locations. As things currently stand, the existing SRFI system allows a developer to build a series of warehouses near a rail line and bypass the local authority planning system.

Climate Change Act 2008

The Climate Change Act was a big mistake in several ways. Firstly it was based on the false premise that the world is getting warmer and that this is the result of humanity's actions. Several people have demonstrated these views to lack a credible foundation, one example being the book written by Andrew Montford called the "The Hockey Stick Illusion".

Secondly its target to reduce carbon emissions in 2050 by 80% compared to 1990 is almost certainly unachievable. This objective is more stringent than in any other country in the world as far as I am aware. However the government is

still working to achieve this aim and it will soon make electricity unaffordable for industry and individuals [16]. The Climate Change Act 2008 needs to be revoked so that we can build power stations that are less expensive to construct and which produce electricity that does not require subsidy.

One industry that uses a great deal of electricity is steel manufacture. Already we are losing steel manufacturing businesses as they can no longer afford to pay the UK's high electricity costs. [17].

We have rushed to close coal-fired power stations or tax the carbon emissions of those that remain. Yet the energy "capacity market" is providing expensive subsidies to power stations that can provide a reliable supply in one year's time. So we have the paradox of heavily taxing and subsidising coal-fired power stations at the same time [18]. What logical strategy produces such a solution?

Electricity power generation

Solar and wind powered electricity is generated on an irregular basis dependent on the weather. We need gas powered electricity plants to provide power as these can be brought into action more quickly when there is a lack of wind or solar powered electricity being generated. More precisely they should be "Combined cycle gas turbines". As our "Capacity Market" energy system is not encouraging companies to build such plants we need to find other ways to ensure that they are built.

Our current plans for nuclear power are disastrous. Hinkley Point C will be one of the most expensive nuclear plants in the world. The sale price of its electricity will be approximately double the existing rate and will be index linked. Its technology is unproven, as there are no other plants in use which have adopted the same technology, and the ones under construction have been beset by delays and cost overruns [19]. Instead we should be using smaller modular nuclear power plants of a proven design.

We have been closing down coal powered and time-expired nuclear electricity power plants faster than we are replacing them. We can expect black outs in the next several winters as a consequence. We must quickly develop a plan for building new electricity power plants, both combined cycle gas turbines and small modular nuclear units. The government needs to be conscious of the increasing demand for electricity in the longer term through the greater use of electricity by trains (including HS2) and cars. HS2 trains could necessitate the building of a complete small to medium power station. I am not in favour of some forms of renewable energy as I consider that the ongoing subsidies we provide to the owners of solar and wind powered electricity generators are grotesque.

Communications

The government has not treated high speed broadband as a particularly pressing priority. Consequently BT has not made sufficient investment meaning that users in some rural areas suffer poor or extremely poor broadband line speeds. Not

only that, but BT has not committed to a fibre optic network in the way that suppliers in other countries have done [20]. Such a network is needed to support 5G mobile technology. Currently the UK is at the bottom of the OECD league for fibre optic rollout. A widely available fibre optic network is a vital requirement for any globally competitive economy. We also need to address the too frequent "not spots" where mobile phone signals are not available.

Road improvements

Several countries in Europe charge car users from other countries for the use of their roads or motorways. This may be by buying a monthly or annual vignette on entry to the country. This should be implemented in the UK for vehicles (including trucks) from other countries. It will provide a valid means of raising money to fund more road repairs and improvements. We currently have a 14 year backlog of pothole repairs [21].

The DfT has attempted to identify which will be the most congested parts of the strategic road network in 2040 [22]. I would question whether its solutions will be adequate.

[Name redacted]

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2. http://www.worldbank.org/en/news/press-release/2014/07/10/cost-of-high-speed-rail-in-china-one-third-lower-than-in-other-countries

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6. http://www.publications.parliament.uk/pa/cm201012/cmselect/cmtran/writev/rail/m14.htm

http://www.publications.parliament.uk/pa/cm201012/cmselect/cmtran/1185/11071201.htm

Answers to questions 281, 286 and 310. Worth reading his answers from question 269 onwards.

7. http://dataportal.orr.gov.uk/displayreport/report/html/a10e3c7b-7766-40ae-a87a-14c56cf85a63 Table 12.6

8. https://www.gov.uk/government/statistical-data-sets/rai02-capacity-and-overcrowding Table RAI0212

9. http://www.telegraph.co.uk/news/uknews/road-and-rail-transport/9321412/Benefits-of-HS2-were-exaggerated-secret-report-reveals.html

10. https://beleben.wordpress.com This website regularly challenges the justifications used by the Department for Transport using evidence based analysis

11. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/465439/port-freight-statistics-2014.pdf See section 2.5

12. http://www.railwaysarchive.co.uk/docsummary.php?docID=4895

13. https://en.wikipedia.org/wiki/List_of_countries_by_rail_transport_network_size

14. Modern Railways February 2017 pages 32 to 34

15. http://www.riig.org/Assets/RIIG%20interchange%20map%202020.pdf

16. http://www.telegraph.co.uk/news/2017/01/28/collective-act-make-believe-devastating-environment-budgets/

17. http://www.bbc.co.uk/news/business-34581945

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22. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/383145/dft-ris-strategic-vision.pdf See page 35

Dear Sir/Madam,

I am a member of the English Regional Transport Association (ERTA), which is a voluntary membership-based, pro-public transport improvement association with several projects having a nation-wide positive benefit and impact, and I am responding to your consultation in relation to the above-mentioned paper.

Any new housing developments must be close to suitable transport corridors, which should include rail, bus, pedestrian and cycling facilities. Too many housing developments have ignored provision for these transport means and this is particularly true in areas which have showed the greatest population increase in recent years, such as South-East England and the East of England. Indeed many small/medium-sized towns have in fact lost their railway services during the Beeching axe in the 1960s and early 1970s, whilst in several cases the old track-beds remain. Therefore it will be necessary to protect such track-beds should any housing development be proposed in their vicinity. In some circumstances Lightweight Rail lines could be built on these disused track-beds and such services (with the appropriate technology) could also be extended following natural contours or on-street. Tram-trains (which now occur frequently on the Continent) are also another possibility. Furthermore, should a housing development take place close to an existing railway line there should also be a new station if one does not conveniently exist in the immediate vicinity.

There are several examples of disused railway lines which could be re-opened in areas showing recent population increase:

- Bedford - Cambridge
- Bedford - Northampton(which used to serve Olney now without a rail connection)
- Great Central(which used to run Aylesbury - Leicester and the trackbed passes through another area with increased population)
- Lewes - Uckfield
- Chessington - Leatherhead
- Okehampton - Bere Alston
- Cambridge - Haverhill - Sudbury
- March - Wisbech

ERTA web-site: https://ertarail.com/

Further information on re-opening disused railways can be found with Railfuture (http://www.railfuture.org.uk) and also Campaign for Better Transport (www.bettertransport.org.uk).

Yours faithfully,

[Name redacted]

Email address: [email address redacted]

Individual Response (1) response to National Infrastructure Assessment Call for Evidence. Response sent by [Name redacted] [Address redacted].

Sir John Armitt. (Infrastructure Tzar)
c/o Institute of Civil Engineering.
1Great George St,
Westminster,
London,
SW1P 3AA.

Ref:- Northern Powerho.use .

23rd Sept 2016

Dear Sir,

I hadn't realised we had an Infrastructure Tzar until I listened to a debate on Radio 4 on the Accountability for National Infrastructure Projects in which you took part. An exciting project centred on the Liverpool- Manchester- Leeds- East Coast corridor exists, a project which however, never gets the light of publicity shone upon it. I therefore wish to alert you to a "Northern" initiative which will do more for the creation and sustainability of the North than any project that I am aware of.

This Northern initiative is as follows:-

You may be aware the Panama Canal (as we speak) is being widened to accommodate even larger container carrying vessels than we have hitherto witnessed, vessels which I believe are being commonly referred to as Panama-max vessels. So large are these ocean going vessels that their operators are losing money whilst their ships are shunting around the inshore waters of Europe from port to port and therefore seek ports which can deliver a "One Stop Docking shop", ie, all containers delivered and reloaded in one berthing. The Peel Group have identified this need and are "endeavouring" to facilitate a "one stop docking shop" at Liverpool and can cleverly achieve this by not only unloading/ loading containers from Panama-max vessels straight onto the quayside (including rail waggons) but simultaneously unloading onto inshore barges, (berthed alongside) These inshore barges (which have a very low carbon footprint and the capacity for hundreds of containers at a time) can/will onwards deliver said containers across the Irish sea to Belfast, Glasgow, Barrow, Milford Haven, Southern Ireland and also to Manchester via the Manchester Ship Canal.

The Peel Group have also identified the need for an East- West (Transpennine) rail corridor to facilitate the transit of train loads of containers (American style) from Liverpool to Goole/Humberside from where ditto barges can ferry these containers across the North sea to Rotterdam/Hamburg- Europe, again to maximise the low carbon footprint and are campaigning for enhanced rail connections to Liverpool Docks.

Of all the initiatives coupled with the anticipated creation of the Northern Powerhouse this "Liverpool Gateway" project has surely most merit, and, being a transport initiative crossing county borders has to attract national attention and Westminster support. (Westminster dismissed it as a "regional initiative") Colleagues of mine who ditto share my sentiments have even produced and published detailed route proposals. See also HSUK via a google web page.

Lamentably, if Britain fails to step up to the provision of "one stop docking shops" to attract the operators of these "Next Generation Vessels" to our shores then Europe will step up, the result will be Panama-max vessels avoiding Britain, docking at Rotterdam or Hamburg instead, those same inshore barges operated by the EU will be then delivering to us. Britain will have missed out again.

Please refer to the included map, illustrating in simplest form this exciting National Project. I thought you ought to know about this important initiative, in case you don't already, this is surely something of great interest to your good offices.

Yours faithfully,

AA risk rating of Britain's motorways and major roads.

Research led by the AA Foundation for Road Safety Research as part of the European Road Assessment Programme (EuroRAP) shows that the risk of death or serious injury on a single-carriageway road is typically far higher than on a motorway.

This map shows the statistical risk of death or serious injury occurring on Britain's motorways and major roads for 1999-2001. The risk is calculated by comparing the frequency of death and serious injury on every stretch of road with how much traffic each road is carrying. For example, if there are 20 accidents involving death or serious injury on a stretch of road 5 miles long that carries 10,000 vehicles a day, then the risk is 10 times higher than if the road section has the same number of accidents but carries 100,000 vehicles.

Some of the roads shown have had improvements made to them recently, but during the survey period the risk of a fatal or serious injury accident on the black road sections was more than 10 times higher than on the safest (dark green) roads.

For more information on the statistical background to this research, visit the EuroRAP website at **www.eurorap.org**. For navigation purposes please refer to the road maps in the main section of this atlas.

PANAMA-MAX SHIPPING.

INSHORE BARGES FOR ONWARDS DISTRIBUTION.

TRANSPENNINE RAIL INCLUDING IMPROVED CONNECTION WITH BOTH EAST AND WEST COAST ROUTES.

AA RISK RATING

- Low risk (safest) roads
- Low-medium risk
- Medium risk
- Medium-high risk
- High risk

- Motorway and dual carriageway sections
- Single carriageway and mixed single and dual sections
- Motorway spurs and linking roads

0 10 20 30 40 50 miles
0 20 40 60 80 km

EuroRAP
EUROPEAN ROAD ASSESSMENT PROGRAMME

[name redacted]

From: [name redacted] [e-mail address redacted]
Sent: 14 December 2016 09:13
To: NIA Evidence
Subject: National Infrastructure Assessment – idea submission

To The National Infrastructure Assessment
I write to you regarding a specific national infrastructure issue which I believe is of significant economic importance.
No doubt you have heard of Bacs payments. Bacs payments are synonymous with electronic payments in the UK. Your salary is probably paid by Bacs. 90% of the UK workforce is paid by Bacs. All government payments are made by Bacs. Pick up any supplier invoice in the UK and it will undoubtedly include instructions for how to pay by Bacs. Bacs is the only option for wages and salary payments in the UK, the only option for direct debits, and the entrenched option for all other types of payments. In fact, four in every five electronic payments made in the UK today are Bacs payments.
But why do all of these electronic payments – 6 billion of them in 2015 alone – take three whole days to process? It doesn't make any sense. For an electronic transaction to take three days to process, in 2016, is frankly absurd. A cheque which clears on the fourth day is barely any slower. Back in 1968, in the days of magnetic tapes delivered by courier, Bacs payments took three days to process. Nearly half a century later Bacs payments *still* take three days to process. There is simply no reason in this day and age why an electronic payment – let alone billions of them – should not be processed by the end of the next business day at the latest, by default.
You may be tempted to point out that Faster Payments can be used instead of Bacs. However, putting aside the many other uncertainties and shortcomings about Faster Payments (concerning sort codes, scheme limits, security, cost, hash codes, delivery times, etc.), Faster Payments cannot be used for direct debits (despite direct debits being explicitly included under the "D+1" rule in the European Union's 2007 Payment Services Directive). Faster Payments also cannot (or should not) be used for the payment of wages and salaries due to the unique and essential importance of the Bacs RTI hash code. To argue otherwise is to discount the whole purpose of the Bacs RTI hash code. In effect, UK employers are unable to pay their staff the next day.
Why have UK employers been left behind when it comes to D+1 payments? In 2016, many organisations employ staff working complex 24-hour rotas and shift patterns. This is how modern businesses work. Employers do not always pay their staff the same amount on the same day each month. (If only payroll was this simple). Furthermore, payroll processing in 2016 requires negotiating a vast array of complicated and ever-changing payroll rules and regulations. And yet, when it comes to processing payroll at the end of each pay period and when there is a limited amount of time between when the pay period ends and when the pay is due in the bank accounts of employees – i.e. just when employers need all the time they can get to capture hours worked and run their payroll – employers lose a day or more of their time – *every time* – just because of Bacs. Where employers should be able to submit their payment orders the day before payment is due, instead they are forced into submitting their payment orders the-day-before-the-day-before, just because it takes Bacs three days to process an electronic transaction.
More generally, consider the 6 billion 3-day Bacs payments in 2015. Imagine how much better off the economy would be if all these billions of 3-day Bacs payments (which include impromptu payments sent by Bacs just because Bacs remains the established "way of doing things") were instead processed overnight. The economic benefit would be exponential, astronomical. Three-day payments should be redundant in 2016. There is simply no benefit in processing a payment over a rigid three-day cycle. And yet, nine years after the EU's "D+1" rule (which specifically includes direct debits), 80% of payments in the UK are still paid over three days.

We are all payment service users in the UK, in one way or another, and we are all adversely affected when payments which could and should be next-day payments are instead processed over an anachronistic and drawn-out 3-day cycle time. Payments channel the very life blood of business and industry and if the blood pumps faster it's better not just for individuals and business but for the whole economy. If rapid payments are essential for a modern and properly functioning economy, as declared by the EU nine years ago, then the reverse is also true: non-rapid payments are a constraint upon a modern and properly functioning economy. 6 billion three-day payments in 2015 is 6 billion too many. It's about time Bacs got with the times and stopped slowing the wheels of commerce in the UK. It is nothing more than what should have happened a very long time ago.

I therefore urge you to consider the importance of **compelling Bacs to process all payments by the end of the next business day, at the latest, by default**. I believe such an improvement – which is long overdue – would (a) support sustainable economic growth across all regions of the UK, (b) improve competitiveness, and (c) improve quality of life.

Please sign and share my petition regarding Bacs payments:

[link deleted]

Please do not hesitate to contact me if you require any further detail or information.

Yours faithfully

[name redacted]

[name redacted]

From: [name redacted] [e-mail address redacted]
Sent: 11 January 2017 14:29
To: NIA Evidence
Subject: Response to National Infrastructure Assessment Call for Evidence

Dear NIA Call for Evidence,

Please see below my responses **(in Red)** to some of the questions set out in the National Infrastructure Assessment Call for Evidence Document, October 2016.

Please don't hesitate to contact me should you have any queries with my submission.

Regards

[name redacted]

4. QUESTIONS

The questions that the Commission has identified to assist respondents in focusing their submissions to this call for evidence are set out below:

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?
Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.
The value of infrastructure investments will only me maximized if opportunities to plan and design individual infrastructure to be integrated with one another are fully explored and taken. Two or more infrastructure projects can be designed so that they can be delivered in a co-ordinated manner that enhances their combined benefits and with possible economies of construction. The UK needs to learn how to overcome the adverse effects of having much of its infrastructure delivered through separate agencies in "silos".

The Victoria Embankment construction project in London delivered through the Metropolitan Board of Works included the integration of a River Wall, Underground Railway, Interceptor Sewer, In-ground Utilities, Public Highway and Public Realm. The way current UK infrastructure structure is organized and regulated agencies would make doing something akin to this today virtually impossible. The NIC should tackle this important issue.

In terms of long term planning, it is vital than any major new infrastructure project can be adapted for future enhancement or network expansion. The cost of providing passive future-proofing for later growth is generally small whilst to cost of not doing so can often mean that later expansion becomes prohibitively expensive for future generations. A current example where lack of passive provision for future expansion could make expansion too expensive is the HS2 project. Here no provision is being built in for future network connection to HS1 or to the UK's southern rail network.

2. How should infrastructure most effectively contribute to the UK's international

competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

See response to question 1 above.

New housing and infrastructure should be planned and designed together. One creates a demand for the other to supply. Thus the planning of any major new housing areas should include proper consideration of the centres of employment that the populations of the new housing are likely to work within. Current Government proposal for major new housing seems to place housing at locations that are most convenient in terms of land availability rather than where people want to live. New housing proposals should not be accepted without a proper assessment of associated employment, public transport connectivity (especially railways) and social infrastructure.

The NIC should establish a Nation Infrastructure Plan that shows geographically where new infrastructure networks are planned alongside new towns/ cities.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

The advantages of having separate "competing" infrastructure agencies to deliver services can only be realized if true competition and or collaboration is allowed. Currently, regulated infrastructure agencies are not allowed to effectively compete against one another as there are too many restrictions or what each agency is allowed to do with its assets and there is little incentive for separate agencies to collaborate of projects. Publicly owned infrastructure agencies should be allowed to compete against private companies. Shared publicly owned infrastructure corridors coud be created that allow multiple private companies to have long-term lease interests.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

The government (national and regional) should set up dedicated infrastructure banks to finance infrastructure projects. The public should be allowed and encouraged to invest in these.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the

issuance of gilts) is out of scope.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?
Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.
See answers to questions 1 and 3 above.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?
The Government should revise the way in which the benefits of new infrastructure projects are assessed over the long term. Current methods of evacuation are not fit for purpose in assessing complex projects where benefits can be spread over a wide economic area and over a long time frame.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?
Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.
The Government should encourage and incentivise the public to adopt travel patterns that are both economically most advantageous over the long term. This is likely to mean that private individual forms of transport should subsidise public transport.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?
Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.
The highest value transport investments will be those that benefit the widest number of people for a given cost. Generally speaking the most benefits will come from investment made as part of a strategic network. Proper consideration should be given to finding dual uses of passenger networks so that they can be used for freight as well as people (e.g. night time use of networks used primarily for passengers during daytime.)

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?
Note: this includes travel in and between rural areas, as well as between urban areas and international travel.
Expandable and adaptable transport corridors that can also incorporate other infrastructure such as energy and communication links.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

.....

[name redacted]
[job title redacted]
[phone number
redacted]

[phone number redacted]

[address redacted]

Comments to National Infrastructure Commission.

I did not read the NIC Consultation Document until after the closing date for the submission of responses on 5 August 2016. Subsequently I have also read the Consultation Responses publication at end of October/early November 2016.

I have worked in the civil engineering construction industry for 50 years. Mainly in civil engineering contracting, but also in consulting engineering and as a client stakeholder. I am now retired from a 'proper' job but still do a bit of freelance consulting.

The NIC publications and responses pretty well cover most aspects and hence I do not propose to add my 'tuppence worth' but to make two general observations.

1. General: The motive behind the formation of the NIC is most commendable and long overdue. It is in general based on an 'aim for the sky' strategy and is well worth pursuing even if it generally just 'reaches the roof-tops'.
2. Specific Item. Cost Benefit Analysis (CBA): The Consultation Document does mention CBA *(*Pg21, Item 61*),* and it is of-course generally considered in any planning and cost appraisal of a particular project (usually as a benefit factor on completion). However it tends to be overlooked as a contributing debit factor during the actual construction phase. That is, for just one example, whether during the construction a particular section of a road will need to closed or limited to traffic for say 6months and how much will that cost. This is generally not considered (is ignored) in the project cost assessment because this is not a cost bourn directly by the client but mainly by the local general public using the facility who are delayed, (detours, traffic congestion and the like).

[name redacted] (December 2016)

From: [Name redacted] <[Email redacted]>
Sent: 06 January 2017 17:11
To: NIA Evidence
Subject: Paper on Wateringpipe and the CDP concept
Attachments: CopyofWatering_Pipe_report_scholz_041213.pdf

Hello
I am sending the paper in to be considered for the assessment by the members. I would like to add the extra details which are not covered in the paper. They are designed to the same ends as the CDP.
I hope this can resolve the flood resilience and waste water issues the UK and world is faced with. I look forward to cooperating with this initiative.

--

Regards

[Name redacted]

Contact: (call [Telephone redacted] or email.[email redacted])

Web sites: www.Wateringpipe.co.uk &

@wateringpipeltd.

- https://uk.linkedin.com/in/wateringpipe

NIC Call for Evidence October 2016

Response (in italics)

from [name redacted]

1.3 The objectives of the National Infrastructure Commission are to: (i) support sustainable economic growth across all regions of the UK, (ii) improve competitiveness and (iii) improve quality of life.

The term 'sustainable economic growth' begs the question that growth in 'economic' terms as they are currently understood can be 'sustainable' in environmental and social terms as they are currently understood. This should be made clear in the NIC terms of reference. The operation of the NIC should be made consistent with the land use planning system that has the overriding purpose of achieving sustainable development – that is development that would not disadvantage future generations.

There is the potential for a bias in favour of 'provision' as against maintenance and sweating of assets. It is encouraging that the consultation recognises this potential in a number of questions referring to demand management and rebound effects. However, the NIC must continue to factor in the possibility that repair and maintenance represents better value than new provision.

Questions

1. What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

This question immediately exposes the problem with the term 'sustainable growth'. All investments in infrastructure have to consider whether they would also be sustainable in environmental (eg carbon neutral) and socially inclusive/equitable respects.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

There is no direct or useful correlation between international competitiveness and connectivity. The UK could be extremely competitive (in respect of

international comparisons) in the way it provides services (eg the NHS) but being unconnected to any import/export potential (other than the substantial dependence of both the NHS and the social care system(s) on migrant labour). Increase in transport costs (ie internalising some of the environmental and social costs) could make home made/grown products more competitive. This question implies that there is something intrinsically good about international trade when it is only justified when there is some identifiable comparative advantage. The Government's attempts to control and limit migration suggests that the coupling of trade and movement of labour to welfare is being officially challenged.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

The overriding priority is to make an assessment of existing infrastructure with a view to its future maintenance before looking to add new provision that will imply increasing future maintenance costs. The recent record of permitting housing in locations that are car dependent will be adding to the serious levels of congestion making the respective areas even less sustainable for both new and existing residents and businesses. In most if not all cases the new housing should have enabled demand management measures (eg parking restrictions, workplace parking levies, developer funded EV car clubs). There are few if any examples where this has been the case and the 'presumption in favour of sustainable development' has been seriously if not irrevocably discredited. Such new provision(ie car clubs) could and should be made available to the existing residents so that there would be a net gain in terms of sustainability and resilience.

The planning system has not yet recognised the important part that could be played by local food systems. Green infrastructure has been seen as planting trees (and some allotments) when it should always include community gardens, orchards, forest gardens and (genuinely affordable) smallholdings/market gardens (see Garden City principles and para 50 of the NPPF) together with facilities for processing and storage and affordable housing for land workers.

This should be carried out in accordance with bio-regional plans which could be recommended by if not carried out by the NIC, to cover the whole country (eg covering flooding, water courses, catchments, woodland, agroecology etc).

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects.

The lack of 'systems analysis' has led to ineffective Government (and local) policies in respect of housing and transport. These failures have led to further tinkering which causes more confusion and incoherence etc etc. A holistic view of the housing and planning system would show that there has never been more 'housing' per capita and the shortage due to unequal distribution of the housing stock must be addressed before being able to understand where there is under-supply. The rebound effect of continuing to build larger houses is to increase demand for smaller ones. Government could continue to feed the demand for housing as investments for individuals, or it could start to provide housing targeted at meeting housing needs (The Refern Report 2016). It is unlikely to be able to do both in a sustainable way. The social care (and health care) problem is intrinsically linked to housing provision and will require everyone of the 200,000 units that resources might enable to be built to address these needs(ie meeting the HAPPI 3 agenda).

A succession of Government reports on transport since the Environmental Audit Committee report of 2005/6 'Reducing emissions from transport' have mostly identified and accepted that reducing the national speed limit to 50mph or 60mph will be necessary if carbon emission targets are to be met. This was before the need was accepted to aim for 1.5 degrees of warming. The NIC should be very cautious about supporting any road schemes given the systemic effect which a reduced national speed limit would have on the transport system as a whole ie modal shift to coaches and trains, walking and cycling, reduced congestion, power shift to EVs (with relatively limited speed and range). The NIC must also take into account the scope for autonomous vehicles (cars and freight) to increase the capacity of existing roads by reducing separation distances and lane widths, in much the same way that is achieved by lower speed limits (see M42 and M25).

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

This is the most important question and the most difficult to answer. It is crucial that the future maintenance costs of new infrastructure are factored in together with the costs of delay in repair and maintenance of the existing. As an example, 80% of the existing housing stock is at an equivalent of EPC D at the same time as new housing is being specified to comply with Part L of the Building Regulations (ie about 30% less energy efficient than would qualify as carbon neutral ie consuming its own smoke so that it is not left for future generations to do so).

The impression gained form daily use of pavements and roads is that there is a large and growing maintenance deficit.

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

It might not be what is intended by the question (ie competition between private providers of the same item of infrastructure?) but the NIC could and should see it as their job to avoid competition between low carbon and sustainable systems and car dependent unsustainable ones. There is a clear conflict (ask Chiltern Railways) between supporting an improved road link between Oxford and Cambridge (an "Expressway") and the provision of the much anticipated restoration of the rail link. There could be a similar conflict between the trans-Pennine road and rail links. Building or even improving roads is locking us both deeper and longer into unsustainable travel systems while forestalling the provision of sustainable systems.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered? Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

Given the underplayed crisis facing the use of diesel ICEs the NIC should add the provision of EV rapid charging points to its priority list. There will have to be a very fast power-shift from diesel to EVs if legal air quality standards are to be

met. The costs of this transition will have to be shared between Government and the private motorist.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets? The National Infrastructure Assessment | Call for Evidence Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

The Oxford to Cambridge rail link. But having used public funding this investment needs to be protected from any directly competing road link. It is not just a funding issue. A systems approach to this link has already suggested that the Expressway is very likely to increase traffic on the feeder roads. The A34 and A40 are already heavily congested. Were the NIC to assist with the Expressway it will soon find that massive investment will be required to upgrade the A40 and A34. There are actually no easy options for these works so the costs of congestion (including C02, NOX and particulate emissions) will have to be borne by the local and regional economy, residents and businesses.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors? Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

There is an irony (if not a glaring contradiction) in the Chancellor backing the NIC at the same time as he backed both road and rail investments along the same transport corridor. The evidence from this consultation (eg see this particular question) is clear, that the NIC is aware of the need for a systems approach and that the competition between road and rail creates a substantial risk that in the short term the rail will be slow to become financially viable and in the longer term the roads will become stranded assets. All infrastructure plans must comply with the overarching objective of the National Policy Statements to contribute to reduction in carbon emissions. This will only be

possible by privileging and investing in rail, tram and express coach over the car and road building.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

First and foremost reducing political interference. *The all party Environmental Audit Committee made its recommendation on the need to reduce the national speed limit on the basis of its close examination of expert evidence. The recommendation was framed by saying that the (Labour) Government cannot forever run scared of tabloid headlines (and that such a necessary move would demonstrate to the public that the Government was concerned about climate change). Government's failure on political grounds to do so actually shows that it is not serious about reducing carbon emissions. An almost exact parallel can be seen in the Coalition Government rejecting The Highways Agency/Highways England) recommendation in respect of the M1 to impose a 60mph limit as part of the Smart Motorways programme. Political overriding of expert advice might resonate with the uninformed opinions held by much of the electorate (and popular press) but will endanger most if not all the changes which will be necessary in the transition to a low/zero carbon economy in the next 30 years.*

The dangerous and insidious corollary of this attack on expert and scientific opinion is that technical advisers will second guess their political masters and temper their advice. In this climate the NIC must make extra efforts to ensure that its advice is clearly related to the evidence – including that collected through this consultation.

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Many species of flora and fauna (ie ecosystems) are put at risk by climate change. The most effective contribution that can be made by infrastructure provision will be to ensure that each and every investment is consistent with a low/zero carbon economy and does nothing to slow down or prevent the transition. It is also important to include green infrastructure as part of every scheme, not as a bolt-on but as a principal element.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent? Note: “credible” improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. “Tractable” improvements are those that can generate usable quantitative outputs. “Transparent” improvements are those that do not rely on ‘black box’ modelling and assumptions.

The NIC should have in mind the statement in the Stern Review that climate change is the greatest ever market failure. Lord Stern was referring to the failure to include the costs of climate change mitigation and adaptation in the balance sheets of significant investment proposals. Over ten years later, during which the only measurable progress which has been made in the UK has been in power generation (ie coal to gas) and in exporting industrial emissions to abroad, while transport emissions have increased absolutely and as a proportion of the whole, Lord Stern has said that he had underestimated the problem and the targets have been made more challenging. The mitigation costs he estimated at about 1% of GDP are considerably higher. Realistic costs of the zero carbon transition by 2050 must be included in every CBA analysis.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies? Note: “travel patterns” include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

Much of this has been covered above. Unless carbon reduction targets are abandoned the only way that the transport system will be zero carbon by 2050 will be through a massive electrification programme with a parallel increase in zero carbon generation. This is very unlikely to happen unless the national speed limit is reduced to 50mph that will act as stimulus to the use of EVs, where efficiency and range are paramount, by removing the comparative/competitive advantage of the ICE. This change would also be helpful to the introduction of autonomous vehicles not having to deal with vehicles approaching each other at 160mph. Low carbon is likely to mean more

use of trains, coaches, buses, trams, cycling and walking (all compatible with and triggered by lower national speed limits).

The discussion about autonomous vehicles has already implied that these would encourage the use of car clubs which have been seen to cause a very significant reduction in individual car ownership and use. These trends are indications that the UK has reached 'peak car' or will very soon do so. This should logically translate to 'peak road'.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas? Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

Unfortunately, despite the expert evidence, it is inconceivable that the NIC will be subjecting High Speed rail to a proper systems analysis (Lord Adonis needs to step aside from this issue given his historic interest) . Expert opinion has shown that the business case does not justify the £50billion investment. The only current justification is one of increasing capacity on the West Coast Main Line. Capacity can be increased in many other more modest and less disruptive adjustments to the rail system (eg track, signalling, trains, seating).

The reduction in the enforced speed limit for cars of 85mhp to 50mph would be 40%. The increase of the limit for coaches to 70mph would be about 15%. The current advantage of the car over the coach is about 40% but with the recommended changes to the speed limits it would be the coach passenger that would have a 40% advantage over the car driver. The NIC needs to model these shifts to see what scale the modal shift might be from car to coach. A substantial increase in custom for express coaches would enable a very diverse route map that would enable commuters to get close to their destinations and avoid the problems that arise around London terminuses - several already having to close for safety reasons at peak times!) Unless passengers from the north have good reasons to alight at Old Oak Common, massive problems will be caused by by 15000 new commuters an hour being dumped at Euston (with a similar number trying to get out?). All at a time when London's population continues to grow by 2 million and generate about 6 million more trip.s

No public investment is required to make the express coach the highest value means of inter-urban transport. Better use would be made of the existing road network and there would be even less justification for investing in more rail track (eg HS2 and 3).

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area? ….areas and international travel.

Highest value is again likely to be represented by guided buses and express coaches (powered by batteries or green gas). International travel to Europe is likely to be limited to water/tunnel/rail, as aviation cannot be decarbonised and will have to be limited to long haul. A systemic analysis could show that more investment might be needed in international rail and port connections but none in airport capacity.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

The only expert support for road user charging has been made in the absence of any comparison with the impacts on mobility of lower national speed limits (70mph to 50mph, and 30mph to 20mph). Such a comparison would probably be a necessary component of any SEA into road use charging. In these circumstances the NIC can probably rely on a systemic analysis of alternative forms of demand management rather than its sheer unpopularity for road user charging to be resisted.

Although the constant time budget suggests that there would be a limited rebound effect in terms of increased driving/mobility from the costs savings derived from lower driving speeds, it is possible that some residual congestion or just unacceptable use of ICEs for air quality grounds might need to be addressed through environmental road charging schemes.

Road user charging without a (very) significant environmental element would result in 'roads for the rich'; larger and less efficient vehicles being driven further and faster on roads vacated by drivers of smaller cars driving at cheaper times or longer and more circuitous routes (or leaving their car depreciating at home).

Work place parking levy (paid for by employers might be more effective and acceptable.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

All the evidence shows that the highest value 'solution' for decarbonising heat is to upgrade the 80% of the existing housing stock from the equivalent of EPC D to B or A. That programme of green refurbishments must start now (a tonne of carbon saved in 2017 will be saved for all the years to 2050 and beyond). In all areas of inflated house prices (ie sale prices above the cost of agricultural land plus build costs plus 20%) the necessary upgrade could be a requirement at point of sale or as a 'consequential improvement' when an existing property is being altered (see Coalition Government proposal dumped by Mr Pickles). All new building must be zero carbon (or carbon negative) if the problem is not made worse. There might be a case for public funding for green refitting at scale in low price areas.

Although the role of 'green gas' needs to be explored, a substantial number of green refurbs are likely to imply electric heating systems powered by a combination of PV and batteries. For hot water, solar thermal is likely to be superseded by more reliable diverters to immersion heaters from PV.

All lighting must be by LEDs as soon as possible.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved? Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

It is not possible to say what the optimal mix of wind, solar thermal, hydro and tidal lagoon should be planned for. Given the decreasing costs of all these renewables and the independent need to reduce demand, there is no justification for either nuclear (on cost if not safety grounds- see Ft article on Hinkley Pointless) or fracking (as gas has to be phased out now and not brought in as a bridging fuel). The supply of electricity from this range of

renewables and storage can be made to fit very well with the day/night and seasonal demand for power.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

There would be an increase in demand for electricity if cars, buses (and trains) were all electric. However, EV vehicles are compatible autonomous vehicles and both are compatible with car sharing/clubs. Overall levels of accessibility could be maintained through a power-shift and modal-shift to EVs (triggered by lower national speed limits).

Flood risk management:

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk? Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

Green infrastructure including forest gardens, agroecology, permaculture can make a substantial contribution to reducing flood risks. For food growing systems to make a significant contribution to flood mitigation there needs to be a substantial shift away from industrial agricultural practices which denude soils and increase runoff.

Through Section 10 of the National Planning Policy Framework the Government has confirmed that flooding is a consequence of climate change. In these circumstances it seems likely that the Government will have to rely on the potential for soils to sequester carbon (a zero carbon global economy by 2050 will not be adequate to reduce concentrations from 400ppm to 350ppm). To privilege agricultural regimes which support carbon sequestration (and biodiversity) is probably beyond the scope of the NIC. However, bio-regional plans and planning will soon become necessary.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be? Note: A “circular economy” is an alternative to a traditional ‘linear economy’ (i.e. make, use, dispose) in which products are designed and packaged to minimise waste, and resources are kept in use for as long as possible, e.g. through re-use, recycling and greater recovery of materials through the waste management process.

Preparations should be made to increase the scale of human waste which is returned to the soil for growing of crops and grass (forest gardens are ideally placed). The driver for this change is likely to be a shortage of phosphorous if not the need for nitrogen and the costs of disposal compared to recycling.

NIAEvidence@nic.gsi.gov.uk.

[name redacted]

From: [name redacted] [e-mail address redacted]
Sent: 28 January 2017 09:57
To: NIA Evidence
Subject: NIC - National Infrastructure Assessment

In response to your call for input to the national infrastructure assessment my comments are as follows:
The first and main priority should be to ensure that our existing infrastructure is adequately maintained and that it is done so in a timely manner. Also that this infrastructure is fit for purpose and is resilient in terms of the global challenges that we face; climate change, peak oil, resource depletion, environmental degradation, etc.
Our governments like adding to the existing infrastructure, however there is not enough focus on adequately maintaining what we already have. The poor state of our local roads, which have not received adequate maintenance (funding), is a good example of how not to look after your assets. There needs to be strategic asset management applied to our existing infrastructure. A stitch in time saves nine is as true as it always was!
Also any new infrastructure should take account of these global issues as well. For example to me Heathrow runway 3 and HS2 are two infrastructure projects that are opposite to taking account of these global issues.
In deciding about infrastructure investments, it needs to be remembered that from an economic point of view our economic growth system is unsustainable on a finite resourced planet. To integrate environmental, social and economic components in a sustainable way changes are required to this economic system. This system is geared towards maximum economic growth generated by maximised corporate profit fuelled by mass production and mass consumption.
In the longer term the only economic system that is going to work for us is one that values the natural world and accepts that we are merely part of it and there is no benefit to be had from its continual erosion and ultimate destruction.
Business as usual is not an appropriate response to the serious issues that we face. To me there is a lack of joined up thinking and not asking better questions, we need to address issues, not symptoms, such as by the application of permaculture ethics and principles.
A final thought: ‘Only when the last tree has died and the last river has been poisoned and the last fish has been caught will we realise that we cannot eat money’ – Native American Cree saying.
Yours sincerely,
[name redacted]
[company name redacted]
Email: [e-mail address redacted]

Water

Probably the greatest requirement is to solve the present water shortage problem in South East England AND make provision for the changes that are predicted to occur as a result of global warming. The Government has recognised this and evangelised that we should make best use of every drop. They have set in motion a review of the potential to pump water from north to south.

Your table predicts the use of desalination. The water companies propose building more reservoirs and pumping water around.

ALL of these solutions fail on two major points. They remain at risk of climate change and both involve using vastly more electricity.

I have patented an innovative way of solving all of the above problems AND to reduce electricity consumption. This idea contains no new technology, just a better use of what exists.

For example. In my view minor adjustment to the operation of the Richmond Half Tide Weir on the River Thames could produce up to 300 Megalitres per day, with only the possibility of constructing a short tunnel. This is approximately what Thames Water are seeking by building a new reservoir at Abingdon at an estimated cost of £1billion.

Another example. Installing a small adjustable weir in the top of the estuary of the River Medway could produce up to 200Megalitres per day, make pumping water uphill unnecessary and climate proof supply. It would reduce other pumping arrangements and make the enlargement of Bewl Water.

The Environment Agency requires a hands off flow in rivers and this results in perfectly useable water going into the estuary whilst reservoirs run dry (19January 2017 - Bewl Water only half full!)

The concept is good but the implementation is not. To achieve the requirement of continuous water supply and hands off flow is creating considerable anxiety.

My idea is highly innovative, novel and completely different to any current process. It is fast, flexible and financially acceptable. It also seems unacceptable.

This water shortage problem should be sorted out before Brexit trade talks get under way. Our negotiators are going to have a tough time encouraging investment into the UK. The South East is

one of the Powerhouses and it will fail to attract investors if they perceive an uncertainty, and water shortage is a huge uncertainty.

Current proposals will not be completed for many years, probably not before the end of the next decade. The infrastructure for my solution is either there (River Thames) or cheap and easy to install. Given the right characteristics it can be installed on any river and because it is cheap it can make available rivers which have insufficient flow to support the construction of a reservoir.

Section 4 identifies the need to reduce the construction of new infrastructure. My patented proposal does just that. Not only that it can do it in a fast flexible and financially attractive way.

I would be pleased if you would take my ideas into consideration for the future of water in the UK.

[Name redacted]

[address redacted]
31/1/17

NIA Call for Evidence

National Infrastructure Commission

(By E-mail)

Dear Sir,

Consultation response

Thank you for the opportunity to provide input to the NIA. I regard the NIC as an important tool for the development of the nation and it is long overdue. Being overdue means that there is quite a backlog of things to tackle and it should be recognised that the overall task of creating an infrastructure fit for the mid to late 21st century should not really have to start from here. Had the NIC been around years ago we'd be starting this conversation from a better place.

So although we are where we are, we should not automatically assume that what we have has ever been optimal. Everything needs to be re-considered. The nation's infrastructure has been allowed to become fractured and in many places 'time expired', so there will need to be some clearing out done as part of the process.

I therefore offer the following comments for your consideration. I have limited myself to areas where I believe input is necessary and I have something to offer and have skipped some of the questions. The original questions posed are shown in bold.

1. What are the highest value infrastructure investments that would support longterm sustainable growth in your city or region? Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

There are two:

a.) Reinforcement of the national grid to transmit the bounty of renewably generated electricity from the Northern Isles and other peripheral areas to the rest of the UK. At present British innovation is being stifled due the inadequacies of the grid to handle demands to be placed upon it by de-carbonisation. Companies are leaving the UK and a world lead in marine energy is being frittered away due to persistent inadequacies in the grid.

b.) Improvement of digital connectivity (both fibre and wireless) throughout the country. Personal experience of attempting to use digital communications are often thwarted by inadequacies within cities, not just in remote areas. Fibre will need to become ubiquitous in the way water and electricity are today.

2. How should infrastructure most effectively contribute to the UK's international competitiveness?

Infrastructure will underpin our competitiveness, or its absence will condemn us to a continuing slide on world position with the consequent loss of attractiveness. The UK has already seen its

position slip in the Ernst and Young Attractiveness Index[1] (page 9) ranking due to a combination of inept policy implementation and inadequate grid investment. (We have now dropped to 14… behind such industrial giants as South Africa and Morocco!). As a result there is less innovation in specific sectors and our innovation ranking[2] has also slipped back from 2nd to third.

~~What is the role of international gateways for passengers, freight and data in ensuring this?~~

3. How should infrastructure be designed, planned and delivered to create better places to live and work?

There is little recognition that there is expertise in remote areas. As a result there is a patronising and inefficient view that ideas are brought from the centre to the peripheries and presented as gospel. There is a need for a more balanced, measured and respectful dialogue that will be driven by the needs of all. Such a dialogue will take time to establish, possibly decades because we do not have a 'pro-infrastructure' culture in the UK at present. Having had the privilege to travel widely; I am impressed by what I have seen achieved elsewhere and depressed at the level of debate in the UK. Getting this debate properly framed is going to be difficult, time consuming and infuriating. It is, however, essential. NIC needs to own the quality of this debate.

Assuming that a more positive debate is framed; then inclusion of all parts of the nation by the extensive use of remote communication tools will be crucial. At present we pay lip service to such consultation processes and one really has to be 'in the room' to have an impact. We have to find a way to break that. Speaking as someone living in Orkney and attempting to engage; it is hard to get good phone conference/VC engagement; not by our end, but by those in London and Glasgow. This needs to change if input is to be valued and information flow improved.

Finally; there needs to be a plan and we then need to stick to it. What was achieved for the London Olympics was little short of revolutionary. A clear deadline and a commitment to it early enough led to a remarkable outcome; a games that everybody was proud of. That is the model we need to hold up as what we are seeking to achieve.

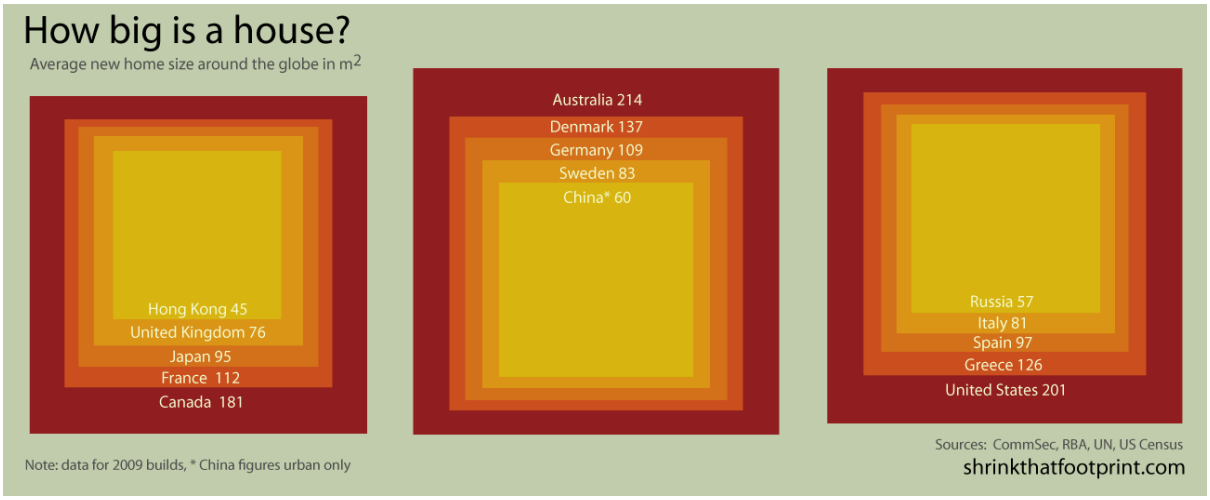
How should the interaction between infrastructure and housing be incorporated into this?

Housing densities need to be allowed to increase in the UK and in different forms. Generously proportioned apartments built to high standards of sound insulation can provide desirable residences if built near services and in town and cities. Given the high cost of land this will require vertical expansion to medium rise blocks. At present we seem to believe that flats need to be small and it is acceptable that they feel crammed as they are only temporary. In addition modern housing is suffering the same problem and UK housing is actually shrinking. Comparing areas around the world[3] sees the UK with fairly mean space:

[1] http://www.ey.com/Publication/vwLUAssets/EY-RECAI-48-October-2016/$FILE/EY-RECAI-48-October-2016.pdf

[2] https://www.globalinnovationindex.org/analysis-indicator

[3] http://shrinkthatfootprint.com/how-big-is-a-house



This needs cycle needs to be broken making housing desirable for long term occupation.

The provision of apartments that have flexibility will enable them to be re-shaped over time, so up and down-sizing will be possible within the same building envelope or area leading to mixed occupation and stable communities. However this requires a move away from some of the modern building techniques involving lightening structures and will require increased mass and careful detailing for sound and thermal insulation.

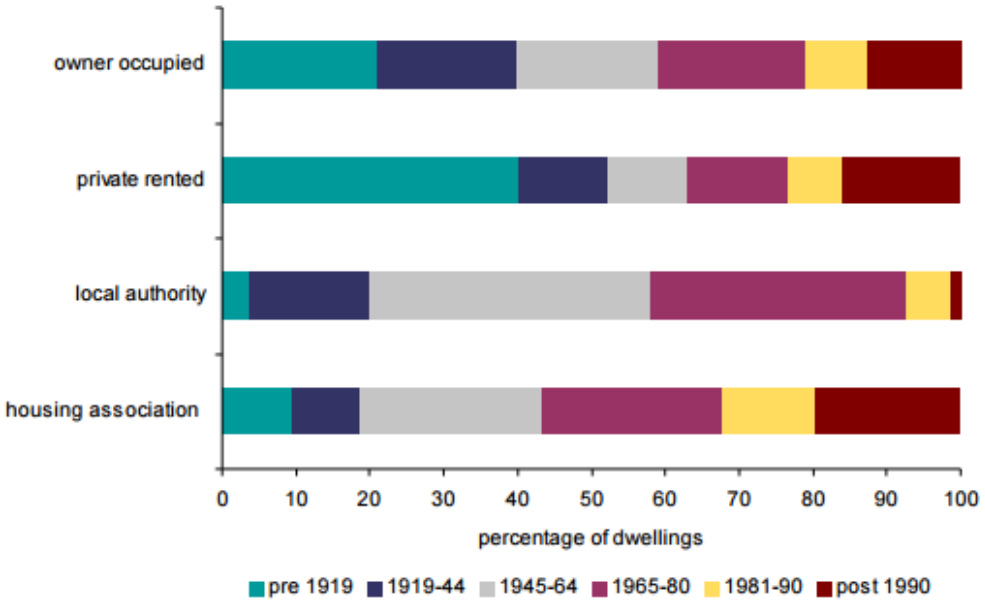
With the stabilising the location of accommodation can come the provision of mixed services in a permanent location leading to a more efficient provision of infrastructure over time.

4. ~~What is the maximum potential for demand management, recognising behavioural constraints and rebound effects? Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.~~

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

It is important to recognise that we are going to need to replace swathes of our present housing, so maintenance may not be an issue. We have allowed cheap, shoddy, profitable, inefficient housing estates to sprawl from our towns for generations and in doing so have generated needs for travel and servicing that are difficult to accommodate. Replacement of some of the housing stock is inevitable.

Figure 8: Age of housing stock by tenure, 2010

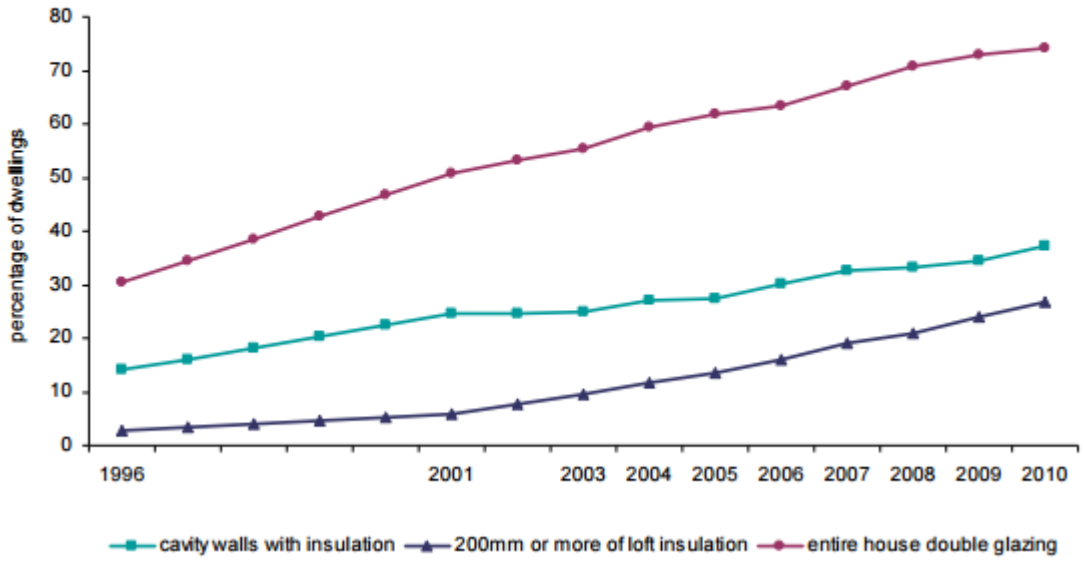


Base: all dwellings
Source: English Housing Survey, dwelling sample

[4]

Any maintenance carried out will need to consider the imperative to reduce carbon emissions and criteria need to be set and clearly adhered to so as to carbon reduction targets. Disappointing progress is being made in insulating old property and it may well be time to realise that some property will never be able to got up to scratch. In which case it shod be demolished and re-built. [5]

Figure 12: Insulation measures, 1996-2010



[4] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6735/2084179.pdf
[5] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6735/2084179.pdf

So some maintenance may not be permitted if it does not meet specific energy reduction objectives and replacement may become necessary. Care will need to be taken that this does not then enshrine dereliction and imaginative measures will need to be developed to prevent this, particularly in the rented sector.

~~6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?~~

~~7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered? Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.~~

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets? Note: projects that "can be funded" but "will not be financed" refers to projects that can be paid for, but where the upfront costs of construction cannot be raised at an efficient price and/or with an appropriate risk sharing balance between the different parties. General government financing policy (i.e. the issuance of gilts) is out of scope.

The reconfiguration of the electricity grid to maximise the use of renewables presently lacks a coherent plan. It is known that the resource is predominantly in the north of the county and the load in the south, however only piecemeal attempts have been made to make the necessary changes. A coherent design needs to be set out and plans enacted.

At present renewables schemes are cramming onto the network in odd corners and crannies where grid is available. Where new grid is provided it tends to be 'just big enough' for the new project coming along and lacks the space for further activities.

Evidence of this is provided in answers 19-22 in the Energy section.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors? Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

At present there seems to be absolutely no public recognition of the risks being posed by climate change. We will have higher sea-levels and probably more intense winters as circulation patterns in the North Atlantic switch off. Agriculture will need to be re-formatted and our landscape will change.

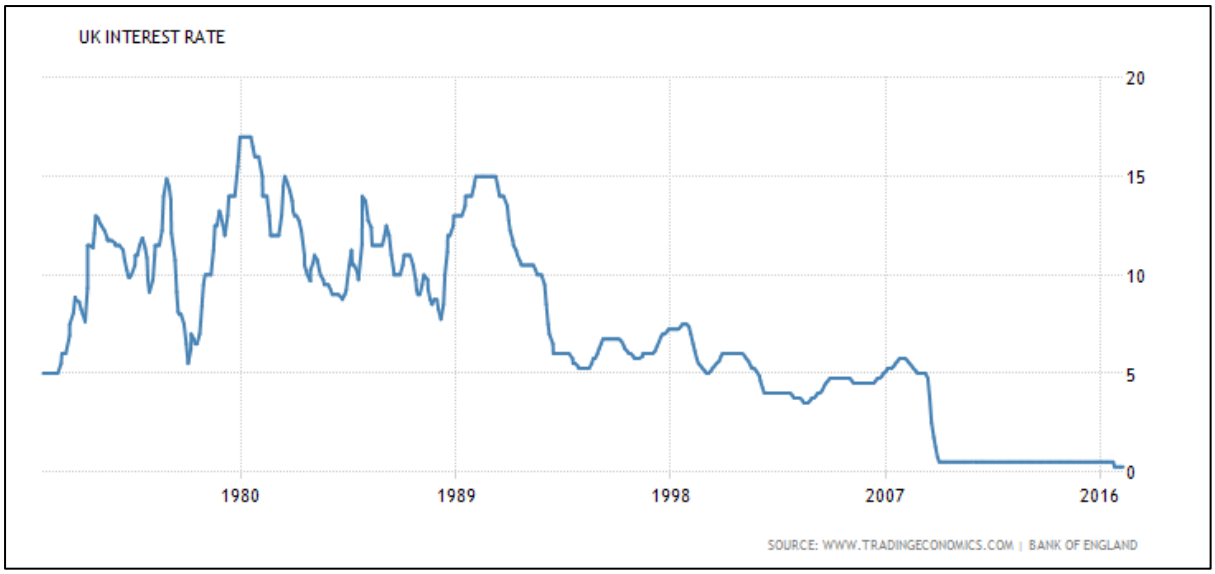
Assuming we still intend to travel, communicate, feed and heat ourselves then there will need to be wholesale campaigns to identify assets at risk, future proof them and replace those that are un-defendable. This will give rise to replacement systems needing to be installed and this provides a unique opportunity to build modern systems and facilities.

Or we can sit and wait whilst the tide comes in and retreat in disarray to the increasingly crowded areas of high ground….

The costs of making infrastructure more resilient will need to be borne by consumers or tax-payers who are actually the same people, so there is little point in wasting time on debating who eventually will have to pay. The only matters will have to be when we start (as Lord Stern pointed out in 2006 that the sooner we start, the cheaper it will be) and how long before we want to pay for it. This

latter aspect simply increases the cost due to the interest payable between doing the work and paying for it.

So the actual conclusion is that since money is historically cheap at present and it will be cheaper to do the work early; there seems to be no compelling arguments as to why we don't get on with it now.



10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

The 80% reduction in carbon emission intensity needs to be imposed NOW. This will be painful, but will force us to work out how to live on 20% of the carbon emissions we presently have. However, the act of dealing with it now will bring benefits of new products and services. Two examples come to mind from Germany:

a. They imposed draconian levels of gas detection. As a result they became the experts in the instrumentation which then led to their market domination and exports.
b. They also decided to incentivise pv installation. This led to several German products to service the industry and whilst the Chinese have taken the lead on pv cell production German companies such as SMA lead in the production of inverters to tie the panels to the grid. Not only that, but the inverters are now also widely used in other renewable technologies such as micro wind. So encouraging one market led to a lead and then diversification.

So the imposition of decent building standards will lead to a thinning out of some of the rubbish building and a professionalization of the remaining sector. It will also lead to an immediate reduction in the growth of energy demand for housing. The systematic imposition of insulation standards on existing housing stock will lead to a burgeoning retrofit market for suitable property and a replacement for those that cannot be upgraded.

It is also worth noting that the wholesale replacement of the generally 20th century housing will also enable towns to be revitalised and reduce the hollowing out of our centres.

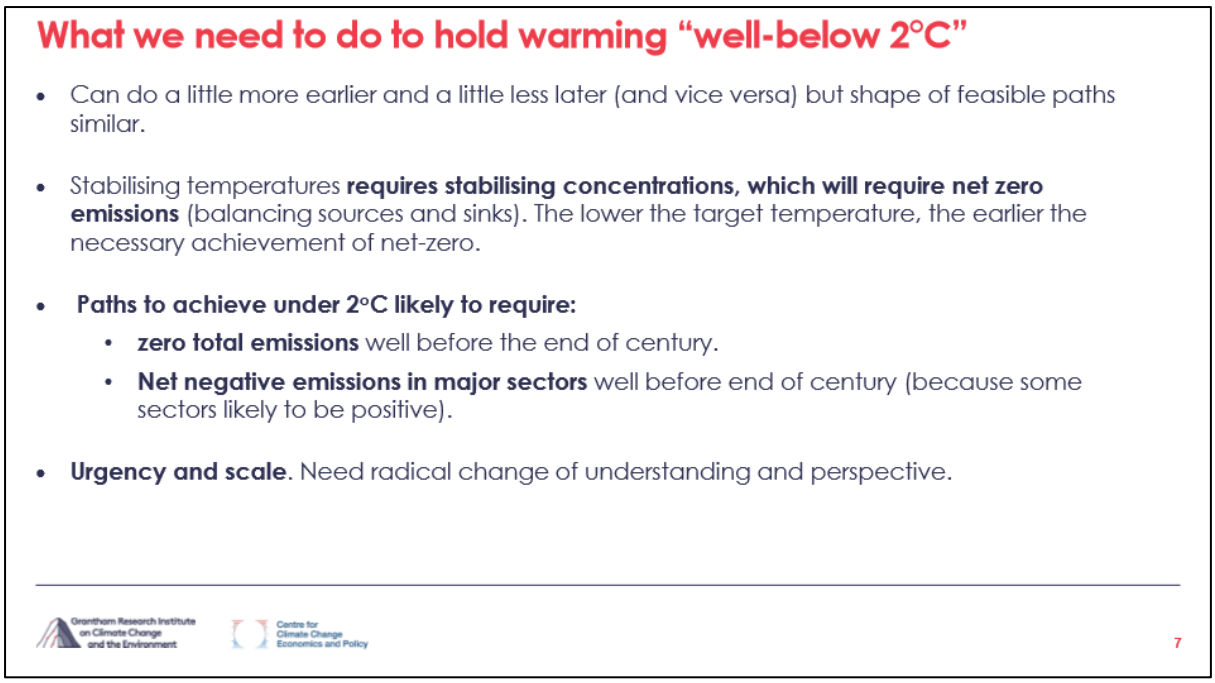
Note too that there are other countries with more developed solutions to retrofitting infrastructure. So; the UK should anticipate this is not an empty market. An example of retrofit of otherwise un-pre-possessing structures is underway and sets the benchmark that the UK should seek to achieve.

In some examples, whole houses are being re-skinned in a day with factory made kits providing insulation, better living conditions and renewable energy.[6] The point being that this is not just about someone in a white van squirting some foam in some gaps and leaving an energy monitor in the kitchen. This is about complete re-modelling and wholescale improvement of housing stock systematically.

[6] http://www.energiesprong.eu/index.php/our-projects/nieuw-buinen/

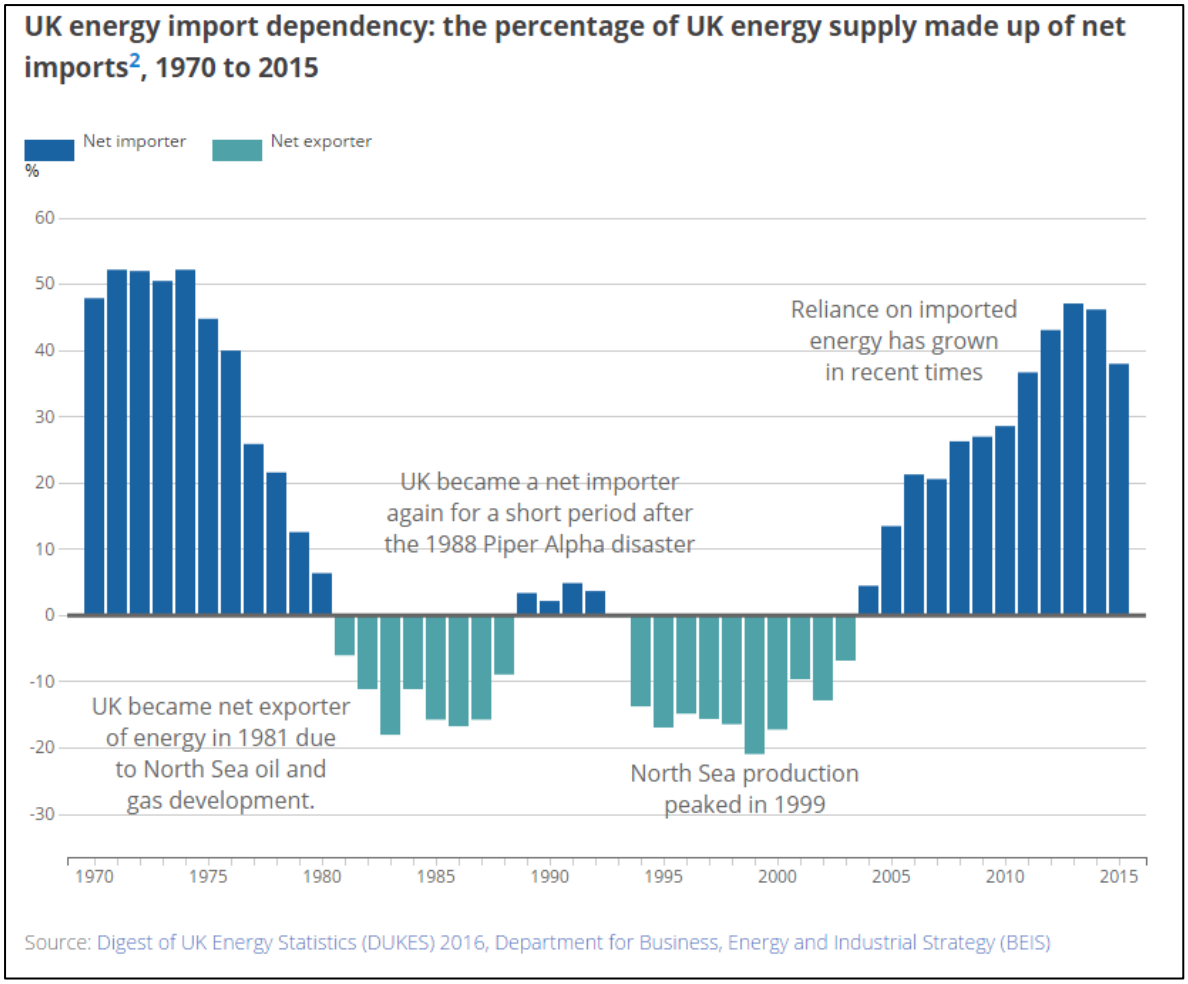
11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Although it should go without saying: we must reduce our nett CO2 emissions to as close to zero as is reasonably practical if we are to have any chance of saving our natural environment. (Lord Stern's CT lecture – Dec 2016 – slide 7)



At present it is not clear that we can save it, however we have moral and financial obligations to try.

Increased energy efficiency will reduce our environmental impact, but it will also improve our balance of payments now that we are a nett energy importer.



Changes to traffic patterns brought about by changes in travel need will further save money. Added to the health benefits of less pollution, improved air quality and lower noise levels it remains unclear why we have not already embarked upon radical measures to electrify transport and improve telecommunications.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent? Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions.

A true cost of carbon remains the missing piece of the jigsaw. At present we do not cost in the effect of increased storminess/damage, fluvial flooding/sea-level rise, habitat loss, economic migration etc. into the calculations made over emissions. To fail to account for these impacts is leading to flawed decisions.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies? Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

Travel will be largely automated, electrified and charged for per km covered with tariffs based on time of use. Commuting distances may be reduced for many through better IT communications, but will remain a chore for those that have to do it. 'Always on' communications available aboard mass transport will continue to allow flexible working times, but core attendance for at least some of the week will remain necessary.

Freight will continue to be moved mainly by road although some products will be locally 3D printed rather than shipped across the world. Courier and postal transport will grow, but probably plateau as saturation occurs and local printing becomes the norm.

Air travel will continue to grow if 'fossil carbon-free fuels' become available (ammonia, hydrogen derivatives etc)

Shipping routes will alter with more freight arriving through the ice-free North-West Passage and into the north of the country. Freight hubs in the northern ports should be anticipated.

~~**14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas? Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.**~~

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area? Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

Fibre for all properties will connect people and both reduce the need for travel and also enable essential transport due to better data connectivity/billing/resource use.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

It is essential that cause and effect are linked. i.e. charging occurs to allow a journey. Receiving a bill at the end of the month will cause a disconnect from the impact of the travel and the choices that led to the journey; the cause and the effect will be too far apart. Service providers will inevitably

seek to create a gap in order to maximise the travel undertaken, but socially we need to guard against this and put in the cause/effect links from day 1. Note: this should also include the benefits given of discounts for travelling off peak etc.

It should be possible to reduce road use through punitive costs; it should certainly be possible to halt growth.

The costs charged will also enable more rational investment decisions to be taken. i.e. does one need to own a car, just renting it for the journey will become more normal. The low utilisation figures of present vehicles (approx. 5% of time the vehicle is in use, 95% it stands idle) should convince people that an alternative is economically rational, but they do not presently arrive at this decision because the costs (purchase/repair/fuel) and often far away from the actual journey taken. Charging at the time of use will re-connect people with their transport decisions.

Digital communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

Fibre to every home and business (not just near, but into every property) is a pressing need now. The country is falling behind other nations and it will prove difficult to recover if we slide further. Fibre should now be regarded as a standard utility in the same ways as electricity, water and gas (in many places). None of these were in the ground from the start and each has been introduced into the townscape. This needs to be repeated for fibre (however on this occasion we also need to put heat mains in at the same time so giving a saving. See 19).

Education of those to code and make the most of the communications provided.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this? Note: the existing "regime" refers to the current market, competition and planning frameworks. "Digital communications" includes both fixed and mobile connectivity.

From the media it appears that a decision may have been taken to get Broadband to every home, but this needs to be upgraded to fibre and not left to 1950s copper for the last mile. If it is not ubiquitous (or provided wirelessly to a metropolitan standard) then isolation and digital division will result.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

District heating running from heat-pumps and insulation of property are the most effective means of de-carbonising this sector.

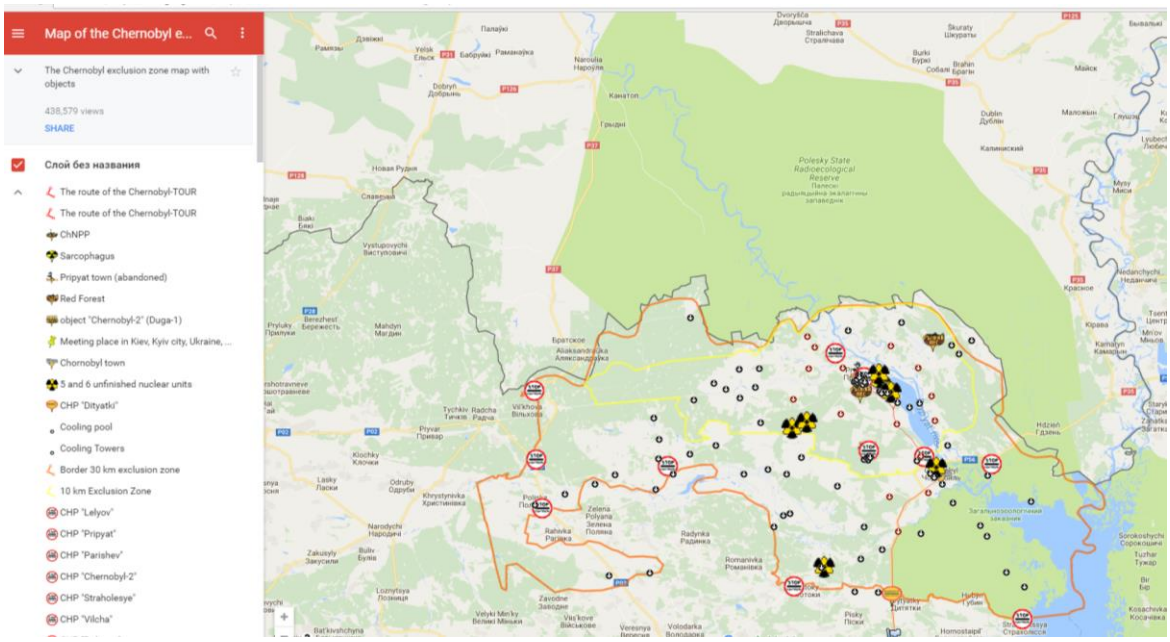
When to decide? NOW!

We used to have district heating in London (Battersea Power-station) and elsewhere, but failed to continue to develop it. Other locations have been better e.g. Copenhagen with 97% of the city heated this way.[7]

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved? Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

More efficient use of energy through insulation, integration of vehicles into the storage side of the grid to remove peak electrical loads, heat-stores in properties and feeding the heat mains to reduce peak daily heat loads, dispersed storage across the grid looking a lot like the storage of water is at present. i.e. dispersed as reservoirs, local stores, roof tanks, cisterns.

The electricity supply will be entirely renewable after we realise that we cannot accept the risk of a nuclear incident in these crowded islands.



Gas will be bio-gas or electrolytic hydrogen derived. Some may be used for instantaneous generation, but with waste heat recovery into district heating.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Vehicles will be part of the storage system. Monitoring done in Orkney has mirrored other locations and found that EVs drive around 1 hour/day. They take 1 to 3 hours to charge, so they are unused for over 20 hours per day. Each vehicle has a 25kWh battery (expected to increase as range is boosted). So for every 40 cars there is already a 1MWh hour battery sitting unused for 20 hours per day. Also most electrical loads in houses and businesses occur when people get into them (often having just exited a vehicle), so the process that gives rise to demand is not coincident with the need

[7] http://www.c40.org/case_studies/98-of-copenhagen-city-heating-supplied-by-waste-heat

to charge vehicles. Indeed the journey has generally brought the energy needed to start the static period of a day to the point of need in the vehicle parked outside.

It is possible that the number of vehicles will reduce as transport is shared/socialised, however the range of the individual vehicles (and therefore battery size) will increase possibly cancelling each-other.

To make the most of the unused batteries it will be necessary to plug in cars whenever they are not in use and make them available to the grid. This will require a wholesale cabling of practically every car-parking spot in the UK! However the chargers will be able to be less sophisticated than at present as economies of scale will prevail.

There seems to be concern that charging will overload the grid. This is false. Provided charging is staggered and synchronised it is entirely possible to charge with little impact on peak demand.

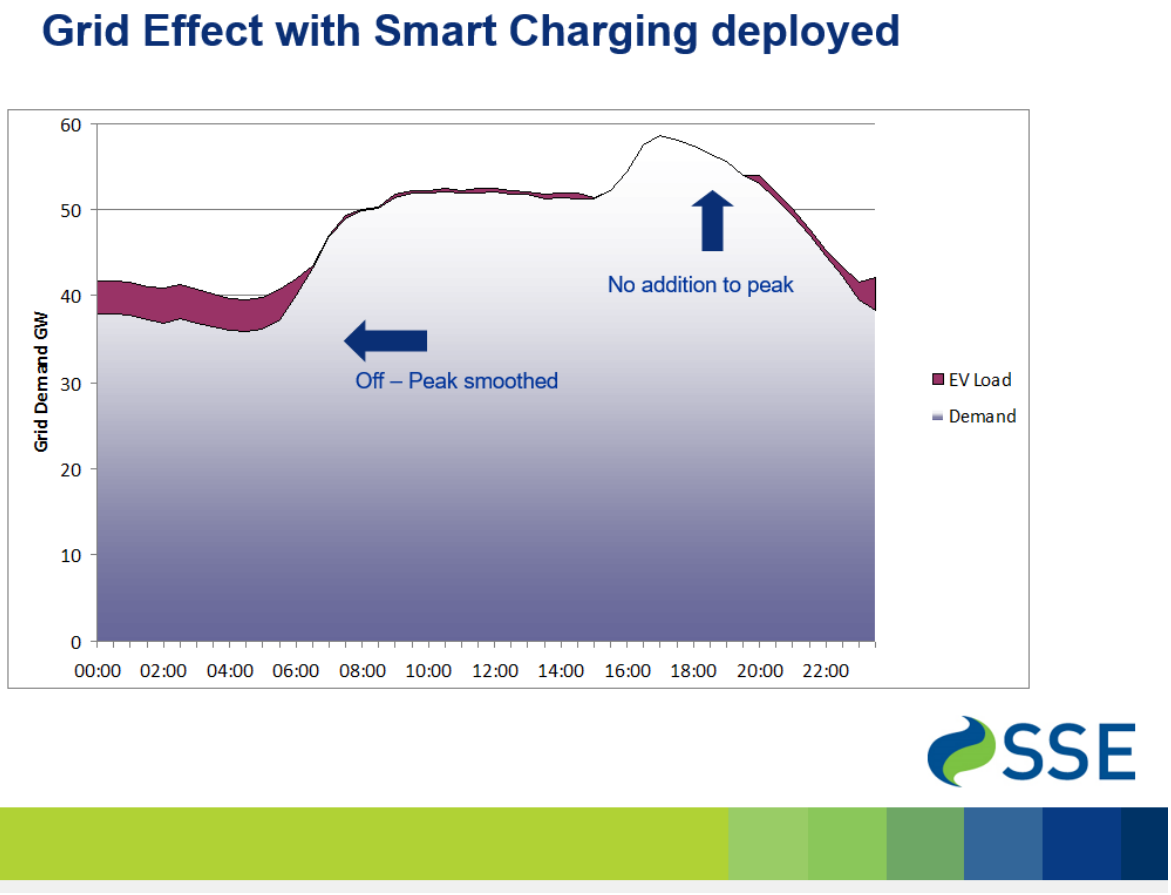


Fig: Presentation by David Densley of SSE reporting on vehicle trials in 2013

Water and wastewater (drainage and sewerage):

~~**22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute? Note: "demand" includes domestic, commercial, power generation and other major sources of demand.**~~

~~**23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand? Note: this can include, but is not necessarily limited to, governance frameworks across the country.**~~

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

Get people to value water, the service it provides and therefore those that supply it. i.e. catchment farmers. This in turn will lead to more value being placed upon the quality and treatment of the topsoil, so reducing run-off and smearing the hydrographs to reduce peak flow.

Flood risk management:

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

The return period is going to be difficult to set because of the increasingly aggressive climate we will be encountering. So even existing defences will not provide the planned 1:100 year protection if the statistical chance of such heavy rainfall in any given year has doubled. So picking a numerically convenient notional return period will be arbitrary and subject to challenge in court in due course when flooding occurs more frequently than the statistics say is likely. The vocabulary around levels of protection is going to need to change because the introduction of the erosion of protection by climate change now needs to be factored in.

Similarly the level of acceptable damage will also be a function of preparedness and the durability of the assets at risk. So if the flooding requires a major re-build after a flood then this needs to be a rare event. If it just requires a hose down and a new carpet then it can happen more frequently and still be acceptable. So the consequence of the flood rather than the blanket expectation of avoidance needs to be factored in. This in part will be driven by the reaction of insurers and the insured to the costs; however the opportunity to ensure that the new energy efficient housing is built cognisant of flood risk (and storm damage) will be critical.

Example: Houses presently built in flood prone areas normally use the same construction techniques as those up hills. i.e. wooden framing, gypsum plaster, cabling under cavity floors, wall penetrations etc. In flood risk areas the EA were promoting the ideas of tanked/cement render on block walls, services dropped from 1st floor ceiling level down walls to ground floor sockets; Solid concrete slab floors. All these features enable a building to be re-occupied much faster after a flood as repair is limited to a wash out and re-furnish rather than a rip out/dry/clean and repair all below flood level.

There are examples of old fishermen's houses at Chesil on Portland that were built to tolerate flooding. Stone flag floors and solid walls could be rapidly swept clear after inundation and the few sticks of furniture re-installed. A modern version of this approach needs to be developed now.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk? Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

We need to adopt SUDS on an industrial scale with immediate effect. To date this has been stalled (for 20 years in my personal experience) by an unwillingness to tackle long term maintenance responsibilities. This is madness and needs to be sorted out by immediate government intervention in the same way that shared drains were sorted out and made a municipal responsibility in the Public Health Act of 1924.

It is also likely that the housebuilders will resist this approach due to the land-take required for these features. SUDS will reduce the stacking densities achievable for their developments and so affect

profitability of property to be built on land already owned by builders. Such opposition will not be seen on land the builder has yet to buy, since the value of the land is partly set by the level of unprofitable space within it. Making sure the house developers know the costs of the measures they will be called upon to incorporate allows them to knock those costs off the value of the land they are buying. So in effect the house builders will not lose out and will not resist. Their opposition will come from land where they have agreed prices and then have additional costs of SUDS imposed. A short term 'buy out' of SUDs costs may well be appropriate.

It may also be necessary to introduce by-laws to prevent the hardening of permeable spaces and also for there to be proper enforcement of existing prohibitions on discharging surface water onto the highway. Most hardened driveways do so discharge and cumulatively are overloading the surface water system. As a first step there must be no further areas added into existing drainage systems by stealth. Proper enforcement of the Highways Act will be sufficient.

Public Awareness needs to be raised so that people react appropriately to flood risk by continued development of the EA's Floodline campaigns. This was effective in the late 90's and beyond, but appears to have stalled. It raised flooding as an issue, but has not managed to galvanise the public into taking better actions when flooding is threatened. It seems to have mainly resulted in the public demanding better flood prevention. i.e. 'they need to do something', as opposed to 'we need to flood proof our house'.

Solid waste:

~~27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?~~

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be? Note: A "circular economy" is an alternative to a traditional 'linear economy' (i.e. make, use, dispose) in which products are designed and packaged to minimise waste, and resources are kept in use for as long as possible, e.g. through re-use, recycling and greater recovery of materials through the waste management process.

Waste needs to be designed for its final use. In some cases this will be 'energy recovery' by incineration. At present products are designed to the point of use. i.e. to get the cereal onto the plate efficiently. They are not designed for what happens next. If this is to be recycling then the product needs to be designed to facilitate this. However there are likely to be occasions when recycling is impractical due to contamination (e.g. food wrappings) in which case 'tokenistic' recycling should not be required and incineration should be deemed appropriate.

Example: Orkney presently collects paper for recycling. It is shipped far south by diesel powered lorries. It is hard to see how this is the most effective process. It would be perfectly possible to use it as a fuel, particularly if the product has been designed for incineration and its chemical content has been appropriately designed.

Beyond final incineration it is hard to see a way to minimise waste other than to break consumerist behaviours and to reward 'non-consumption'…… good luck with that!

I hope the above points are of use in your deliberations. If I can be of further assistance then I would be glad to contribute.

Yours faithfully,

[name redacted]

FICE

[name redacted]

From: [name redacted] [e-mail address redacted]
Sent: 06 February 2017 12:41
To: NIA Evidence
Subject: call for evidence

4. QUESTIONS
The questions that the Commission has identified to assist respondents in focusing their submissions to this call for evidence are set out below:
Cross-cutting issues:
3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?
The role of architecture is of primary importance.
4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?
Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.
Energy storage, including 'behind the meter' devices (tesla power wall, even the PEHV vehicles themselves)
Low grade heat storage as a means of decarbonising heat and refrigeration [website link redacted]

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?
Design and build was supposed to provide this, but has shown many instances of providing poor quality buildings.
8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?
More establishment of financial forecasting methods such as NPV to equip investors to make better decisions.
9
9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?
Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.
Electricity: Distributed generation. Digital management.
11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?
We need to underpin the value of Environmental Impact Assessment and Ecology.
With all their shortcomings, certification schemes such as CEEQUAL, BREEAM and DREEAM still have a significant role to play.
12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?
More open data.
Transport:
13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?
Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and

commercial travel, including freight.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

I think the UK has more potential for cars that can periodically operate in self-drive mode than the US. Having visited the US recently, the line markings on freeways are often very poor in comparison to the UK. There may also be a lack of standardisation between states.

The UK has very well marked highways. There is great potential for self drive vehicles on motorways running in 'road-trains' (bumper to bumper) with vastly reduced aerodynamic forces.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

Self-drive cars, 'road-trains'

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

Energy storage

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

A highly distributed, digitally controlled network with multiple CHP units (fuel cells?) in the 10 – 50 MVA range.

Diverse grid mix.

Electricity storage.

Heat / coolth storage.

Real time tariffs

Interventions may always seem to be necessary to balance value, security and emissions.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

There are basically a form of behind the meter storage that could interact with the power grid. They may even be able to buy and sell to help balance the grid.

For example, I drive to the charging point. I tell it that I will be back in 6 hours time and expect a full charge on return, but give the charging point 'permission' to charge / discharge during this period in order to balance the grid and reduce my tariff.

The impact of population change and demography on future infrastructure demand.
NIC Consultation
Date: 28/2/17

My main comments are on the Housing side. The population projection side is well considered but you may be aware that ONS are consulting on alternative variant Sub-national population projections (these may replace or be in addition to the experimental variants recently released) which may help provide a better variant projection set, at sub-national level, for say, lower migration. There is a day meeting on this topic at Leeds University on 27th March, 2017 should you wish to attend - BSPS Link.

1) Page 21 of your report states: "Household size will have an impact on demand for infrastructure services, but for modelling purposes the Commission will assume that household size will evolve as per DCLG's projections across all scenarios." i.e. a continuing fall in Average Household Size (AHS). I would suggest that variants around Household Formation and increasing Average Household Size should also be considered.

   As you note in your report (Page 19)- DCLG projections for Average Household Size (AHS) are still falling in spite of no change between 2001 and 2011 censuses. It is not unreasonable to suggest that the AHS will be higher in the 2021 census for the following reasons:
   a. Increasing numbers of graduates leaving university with high debt with minimal prospects of forming a new household on their own, in many areas. Indeed, by 2035, the whole cohort of 25-44s who undertook higher education in England will have experienced higher university fees for the duration of their course(s). In 2013, roughly 40% of school/college leavers (496,000) went onto higher education http://www.bbc.co.uk/news/education-25432377).
   b. Increased sharing as the only means to afford housing in high cost areas.
   c. A broken housing market forcing families out of London.
   d. Low build rates coupled with high net in-migration of international migrants.

   To this end, variations in Household formation rates, and therefore Average Household Size (AHS) should be planned for. Fewer Households relative to higher population does have efficiencies for supply of utilities, as noted several times in your report.

2) Page 25 "A projection based on the aggregate population in the ONS central projection, but with sub-national populations less skewed towards London, with the shift in population distribution motivated by trends in house building."

   Whilst this is probably the only practical way to test this kind of scenario, (as Local Plan data is available - though this becomes less accurate as time goes on as some sites are not developed and new sites, not previously considered, appear), trends in house-building need to be linked to employment opportunities which are much harder to predict at a sub-national level. It may apply around Greater London where people are moving to take advantage of high house prices and seek a less polluted area outside London to live or raise a family, while retaining employment within London but further north where population is stable or falling, then the assumption is less strong; new houses don't necessarily attract new residents from outside the Local Authority. In the Tees Valley for example, between 70% and 80% of moves (year before 2011 Census) were within the same Local Authority and with a declining population, it is merely spreading more people across the same area. Building more houses doesn't necessarily increase the population. So some areas will continue to see falling AHS while in areas of unaffordable house prices, AHS will probably increase.

3) Brexit. The changing mix of International Migrants following Brexit could have an impact on AHS. It is likely that there will be fewer EU migrants who tend to be younger and coming to work. If that changes to an older age profile, where Household formation is higher, then that may increase the demand for housing and together may reduce AHS.

4) ONS have recently announced that they have taken over the production of Household Projections from DCLG and are consulting on possible changes to methodology in the first place (See here). It may be that Sub-national Variant Household Projections will be produced which may help with testing changes to Average Household Size.

5) You talk of shocks - perhaps one such shock could be to consider lower uptake of Higher Education places. Currently 40% of the post-school age group go onto Higher Education - if that fell significantly, then there would be a large amount of city centre accommodation available and a change in the profile of city centre residents. The release of communal establishment flats/rooms would add to housing availability without the need for new build.

[name redacted]
[job title redacted]

From: [Name redacted] <[email redacted]>
Sent: 07 March 2017 18:53
To: NIA Evidence
Subject: The social dimensions of urban resilience to climate change. Policy report.

HI there,

Please look at pages 87-95 of this report, plus the preface, exec summary and introduction.

Ever thought that the social and well-being dimensions were often absent from policy dialogues about sustainable, resilient cities vulnerable to the impacts of climate change?

What about the people? The socially sustainable, resilient community and urban development

By [Name redacted] (University of Oxford and Oxford Brookes University)
and [Name redacted] (World Resources Institute and Georgetown University)

Available for download from:

http://be.brookes.ac.uk/research/iag/resources/what-about-the-people.pdf

Hosted here under Working Papers:

http://be.brookes.ac.uk/research/iag/

What about the people? is a research and policy report about planning and designing public urban built environments to influence community behaviours and psychological states of mind that promote strong networks and cohesion in communities, thus improving their collective ability to adapt to and cope with the effects of climate change and natural disasters.

It includes:

1) Practical and policy case studies from real urban development projects for housing, public spaces and transport stops, and / or environmental disasters situations from the following cities:

London (England, UK)

Delhi and Surat (India)
Belfast (Northern Ireland, UK)

Cape Town (South Africa)
Buenos Aires (Argentina)

Christchurch (New Zealand)
Portland Oregon (USA)
Vancouver (Canada)

Adelaide (Australia)

Jakarta (Indonesia)

The Gulf states of the USA
Manchester (England)
Yala (Thailand)

2) Policy recommendations for urban development stakeholders wanting to implement socially-aware planning for socially sustainable, resilient cities.

3) A theoretical framework drawing on the social and psychological sciences.

Best wishes,

[Name redacted]

Dr [Name redacted], [Email redacted]
Research Associate, Institute of Social and Cultural Anthropology, University of Oxford
https://anthro.web.ox.ac.uk/people/dr-[Name redacted]
Visiting Research Academic, Faculty of Technology, Design and Environment, Oxford Brookes University

Dear Sir

In operation infrastructure must reduce the damage to the environment due to CO_2 emissions, and the use of finite resources such as chemicals materials and land, but should only be built if reductions exceed the disbenefits embodied in the infrastructure and arising from construction.

It is usually environmentally better to repair existing structures rather than building new infrastructure.

The environmental benefits and the operating costs of all the possible schemes for improving our infrastructure must be accrued over the likely operating life, which (with proper maintenance) should be millennia, for a proper comparison of the alternatives.

Storm drainage schemes must as a priority reduce the flooding, particularly with sewage, of homes and businesses, and then local streams, the lowest priority being sewage in tidal estuaries (sea water) such as the Thames in London, and should separate rain from foul water to reduce costly, high carbon footprint, environmentally damaging pumping and treatment, so the Thames Tideway Tunnel, for example, is a poor wasteful scheme for which there are environmentally better alternatives.

Rail (or even road) travel on existing routes is better environmentally than traveling by air, particularly short haul, but new (high embodied energy) rail/road infrastructure is only justified if there is a large transfer from less to more sustainable modes of travel, perhaps encouraged by targeted taxation .

Hydrogen appears to be the best option for energy since it can be generated at hydroelectric/ solar/ wave/ tidal/ wind energy sites and shipped in existing tankers, or moved in balloons, and countries already have gas grids (albeit perhaps requiring lining as a defence against hydrogen embrittlement), which can refill cars at times when house heating is subdued, and new intrusive, high embodied energy and materials electricity transmission systems are not needed.

Used products should be collected, stored, transported and restored for reuse, or else broken up and their constituent materials recycled, unless the environmental costs exceed the benefits, and it is more sustainable to burn them for energy and/or send them to landfill.

Regards
[name redacted]

_____

NIA Call for Evidence
National Infrastructure Commission
11 Philpot Lane
London
EC3M 8UD

9th February 2017

The Institute of Directors welcomes the opportunity to respond to the NIC's call for evidence on the National Infrastructure Assessment. With a growing national debt and a persistent budget deficit, combined with a fast growing population, The IoD is mindful of the need to prioritise carefully selected infrastructure investment with limited resources. Infrastructure investments are not all equal and necessarily a net public good. All too often, the infrastructure policy environment is dominated by a wish list of large construction, engineering and blue chip consultancy industries. The mantra is that spending on infrastructure is always good, but how do we know that?

We call our approach Frugal Infrastructure. We advocate it as a methodology to shape the National Infrastructure Assessment based around an Infrastructure Best Value Index to size up projects against one another and where necessary, say no. Below we have outlined in some more detail how this could work and have answered a number of the questions.

About the IoD:

The IoD was founded in 1903 and obtained a Royal Charter in 1906. It is an independent, non-party political organisation of approximately 35,000 individual members. Its aim is to serve, support, represent and set standards for directors to enable them to fulfil their leadership responsibilities in creating wealth for the benefit of business and society as a whole. The membership is drawn from right across the business spectrum. 71% of FTSE 100 companies and 51% of FTSE 350 companies have IoD members on their boards, but the majority of members, some 70%, comprise directors of small and medium-sized enterprises (SMEs), ranging from long-established businesses to start-up companies. IoD members' organisations are entrepreneurial and growth-orientated, and more than half (57%) export goods and services internationally.

Frugal Infrastructure – the IoD approach

Spending money is easy but generating returns is hard. We believe there is a new opportunity to match austerity with infrastructure to deliver better outcomes for the least financial input. The middling performance of UK infrastructure according to the World Economic Forum is well known as is the fast growing population, the core driver of infrastructure demand, of 70 million people by 2030.

We would suggest more attention needs to be paid however to three other infrastructure challenges;

i) **Time delay from government stimuli on infrastructure** – we note that the time lag between government committing to spending on infrastructure to it actually happening can be anywhere between 6 and 24 months, once tendering, procurement, planning and Environmental Impact Assessments are taken into account. Therefore, spending on infrastructure during a recession to boost growth should not be held up as a useful intervention because by the time it comes through, the downturn may be over.

ii) **Tracking opportunity costs** – when government commits to invest public funds taken from the taxpayer, we would like to see more attention paid to the silent and invisible opportunity costs of that capital, were it deployed elsewhere. The opportunity cost needs to be measured and put alongside the cost of a given infrastructure project.

iii) **Being realistic about the multiplier effect** – we believe that the multiplier effect can be easily overplayed because the buying, hiring and producing can be greatly influenced by the time-lapsed distribution of capital expenditure which could be smooth – spread out evenly over time – or lumpy – where unsustainable jobs for example are mainly created in the construction phase.

We see great opportunity in asking more demanding questions of potential infrastructure projects like;

Is the Capital expenditure smooth or lumpy?

Does the proposed asset create additional consumer choice?

Does the proposed project crowd out existing infrastructure?

Does the project promote capital deepening?

Does the project constitute an additional asset?

What are the on-costs over the lifetime of the asset?

All this being so, we propose eight key metrics for the NIC to score projects against each other within the National Infrastructure Assessment – an Infrastructure Best Value Index.

Metric 1: Capital. How much capital is required, what price can the capital be obtained for and how much will be spent on physical objects?

Metric 2: Labour. How much is being spent on labour as a percentage of the total project cost and where is the labour coming from?

Metric 3: Uncertainty and Complexity. Is the project a First-of-a-kind, how many subsystems are there and what are the risks of execution?

Metric 4: Supply Chain Gains. What are the potential gains in technical capabilities, skills and growth in UK suppliers' turnover from the project?

Metric 5: Soft landing handover. Is there an end to end extended handover with full training, documentation and ongoing support or is it a turnkey project?

Metric 6: Whole life costs. What are the total lifetime costs of the asset and are they sustainable with resources and parties to meet them?

Metric 7: Networked value extension. What are the claimed benefits outside of the project?

Metric 8: Endogenous Revenue Potential. When will the project achieve operating profit and reach breakeven?

QUESTIONS – select responses

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

We believe that the highest value and quickest returning infrastructure investment is the laying down of symmetrical gigabit plus speed fibre optic cable to all UK premises. Broadband is now a critical fourth utility but when surveyed, our members have said not only is it the most important infrastructure to them, but with faster broadband, they would be employ more people, be more profitable, productive and more likely to allow flexible working. It is quite clear that the demand for data is insatiable, far beyond what the copper network can cope with and left untouched, we will progressively start to lose out on the new markets that are coming in the next few years. 5G, virtual and enhanced reality, self-driving vehicles, drones and Artificial Intelligence are not far away, but there is a very real risk that we will simply not have the network capacity to join the future.

2. How should infrastructure most effectively contribute to the UK's international competitiveness?

From a user point of view, infrastructure can be seen to be working at its best when it is frictionless and requires no second thought. That shapes the perception of competitiveness from an international point of view when comparisons are made. From a UK government or investor point of view, competitiveness is increased by infrastructure that promotes capital deepening, has low O&M costs over a long lifetime that are greatly exceeded by the benefits and has high networked value benefits that reach beyond its immediate vicinity.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

In the case of smart meters for domestic premises, we see the maximum potential as very small – in electricity terms, perhaps a maximum of a few hundred megawatts at stupendous cost – at least £11 billion. Households really have very little control over when they go to work or school, when they can realistically cook dinner, sleep or watch tv. Worse, with the rise in homeworking, time of day pricing that spikes at peak times, like Uber taxis, may actually stop people working. Nor do we see how it is possible to easily disaggregate smart meter induced behavioural change from falling energy demand from more energy efficient products, wifi controlled LED lighting and insulation.

For the large industrial sector, demand side response (DSR) clearly is an established and growing market, perhaps equal to two gigawatts of power. Many new firms are now offering DSR solutions which seems to fit well with the shift towards a predict and provide grid with the growing penetration of intermittent renewables and quick response gas turbines.

The rebound effect from energy efficiency is real but only if the money that is saved is in excess of the cost of the energy efficiency. At that point the size of the rebound depends on what is done with the new additional resource. If it is placed in a bank account, then the rebound effect is high because banks lend out a multiple of what is on deposit leading to additional demand for energy. Equally, the rebound effect has to be understood in a global context. Energy consumption has been falling in the UK, but not if you count the cost of the energy consumption from goods and services purchased from abroad and of bringing them here, especially if they obtained from less energy efficient nations. That is why global energy consumption continues to rise and cannot yet decouple from economic growth.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Please see our proposed Infrastructure Best Value Index above.

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)?

We believe Symmetrical 1 gigabit plus Fibre optic cable to all premises across the UK is the highest value infrastructure investment with a long life of 50 years and very low running costs, a fraction of copper networks and with greater reslience to flooding.

Institution of Civil Engineers
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United Kingdom
[telephone number redacted]
[telephone number redacted]
[email address redacted]
www.ice.org.uk

Submitted electronically

10th February 2017

ICE written submission to the National Infrastructure Assessment Call for Evidence

Dear Lord Adonis,

Please find below the Institution of Civil Engineers' submission to the National Infrastructure Commission's call for evidence on the National Infrastructure Assessment.

This submission draws on the ICE's *National Needs Assessment*, which we shared with the NIC back in October 2016. The report was the product of collaboration and consultation with a wide range of parties – including experts from industry, finance and environmental research - over an 18 month period. It also includes emerging findings from our next *State of the Nation* Policy Report, launching next month. *State of the Nation: Digital Transformation* will look out how best to harness technological advances to produce smarter infrastructure, which in turn, supports more prosperous communities.

As you will know, the ICE is a UK-based international organisation with over 91,000 members ranging from professional civil engineers to students. It is an educational and qualifying body and has charitable status under UK law. Founded in 1818, the ICE has become recognised worldwide for its excellence as a centre of learning, as a qualifying body and as a public voice for the profession.

ICE would like to thank the National Infrastructure Commission for the chance to take part in this consultation. We would welcome any opportunity to provide further insight at subsequent stages.

Yours sincerely,

[signature redacted]

[name redacted]
[job title redacted]

ICE Submission to the NIC's Call for Evidence on the National Infrastructure Assessment

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region? Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both. "Long-term" refers to the horizon to 2050 and should exclude projects that are already in the pipeline.

Modern societies depend on infrastructure to sustain their quality of life and business competitiveness. Our advanced economy increasingly relies on connectivity – bringing people together physically and virtually to innovate and trade. Infrastructure is not a series of stand-alone assets. It delivers benefits through complex networks. We explore the opportunities derived by managing the network interdependently later in this submission.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Some of the greatest opportunities for innovation are in people's homes and workplaces – working and socialising with ultra-fast digital connectivity that removes a need to travel, smarter use of energy and storage which can be balanced with intermittent renewable energy supplies, energy generation with cheap photovoltaic cells, drastic reductions in demand for heating and cooling through intelligent design and retrofit, re-use of rainwater and sewage, resource recovery from solid waste – these are all opportunities that should be harnessed in new and retrofitted buildings.

Opportunities to reduce demand for water through recycling and reuse are currently not cost effective at a household scale but are being realised at community level.

We must reduce the cost of building and operating infrastructure. Innovation and training will be key. Use of offsite manufacturing and building information modelling (BIM) can reduce construction costs and provide data packages that are shared across multiple projects. Sensor technology will streamline new construction (with significant cost savings) and improve the whole life approach to maintenance and asset management. This technology can cut the cost of maintenance by identifying leaks in water mains and gaps in the thermal insulation of houses, for example. There are many other examples of advances in sensor technology leading to significant cost savings of new construction and of management and maintenance of infrastructure.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects? Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

Demand management for the UK's economic infrastructure needs can be achieved through strategic decisions concerning the location of new housing delivery and technical measures in building design. Concentrating new housing development in locations offering easy access to public modes of transport serves as a form of demand management in the transportation sector. Increased use of

urban and suburban public transportation contributes to an overall reduction in transport congestion and help to decarbonise the national transportation system and reduce environmental impacts such as air pollution.

The design and construction of housing offers potential to contribute to energy, mitigating energy demand and production of waste. Construction methods can be designed to maximise re-use and recycling of materials and minimise waste, contributing to the circular economy agenda. Use of alternative fuels to natural such as biogas and hydrogen, combined with district heating and to the decarbonisation of the energy sector, whilst thermal efficiency measures (e.g. insulation) reduce overall demand for energy.

The need for density in new developments should be balanced with provision of green infrastructure, which acts to reduce the urban heat-island effect and store carbon. 'Whole house solutions' or 'smart homes' – could include power-to-heat systems and stationary battery storage technologies - that enable the consumer to export electricity when it is economically advantageous to do so. The housing sector's potential contribution to energy demand is likely to increase in the future as working patterns shift away from offices to (potentially less efficient) individual homes.

In the long term, new housing development could contribute to mitigating the regional imbalance in UK transport congestion and water demand, if new developments are utilised to create new opportunities in the water rich, less populated north and west. Spatially rebalancing the UK's economy is a multifaceted task requiring significant and varied investment and political commitment - including transport infrastructure - to promote a more even distribution of employment opportunities. Nevertheless, the provision of high quality housing facilitating development of places and communities is integral to the rebalancing agenda.

Housing delivery also presents the opportunity for providers of digital infrastructure to exploit economies of scale, facilitating the deployment of new to market and often very expensive technologies where dense population allows access by a large quantity of early adopters. In order to fully realise cross-sectoral benefits offered by the housing sector, measures must be implemented in the existing housing stock which will form the majority of the UK's housing to 2050. Existing stock can be retrofitted to enhance demand management in energy (insulation, electric heat, smart systems) and flood risk, water and wastewater (sustainable urban drainage systems, dual sewer networks, rain water harvesting, etc.), albeit frequently requiring large-scale investment.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

We should adopt a 'whole life' approach to infrastructure. The performance of assets and networks often determines what new capacity we require. We cannot afford to spend our way out of infrastructure challenges simply by building new capacity. Nor would that be the smart choice. As set out in the response to the previous question, technology, enabled by the right policies, provides the opportunity to use new and existing infrastructure capabilities much more efficiently. This will enable high quality affordable services. Infrastructure policy should involve a combination of increased capacity (where necessary), optimised by technology.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered? Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.

Technological innovation means that people are paying for infrastructure services in different ways – from Uber taxi car rides to bundled telecoms packages. Car tax and duty on fuel will become

obsolete as vehicles become powered by electricity (a low tax fuel) and car ownership diminishes. This will have an impact on revenue generation and so Government needs to quickly look into new ways for raising revenue from roads. Charging per trip with smart metering provides a more flexible way of paying for roads while enabling smarter management of demand.

Some innovative schemes are being put in place. For example, Greater Manchester Combined Authority has negotiated a model, which allows it to 'earn back' tax from the growth it creates. Such schemes are welcomed as ways of increasing areas' control over investment streams. However, they are complicated, resource intensive to set up and, therefore, unlikely to be suitable for all combined authorities.

Allowing such flexibility will enable investment to widen the currently narrow focus on economic development and support truly transformative change. Furthermore, facilitating greater financial autonomy should establish the necessary conditions for further devolution of power.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors? Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

Many interdependencies occur because of the demands that one infrastructure network places on others. Interdependence also occurs because increasing demand from households and businesses, due to economic and population growth tends to be correlated across all sectors. There are technological changes that mean that these interdependencies are becoming more significant. The response to this question sets out cross sector opportunities.

Water and wastewater solutions
Demand in the water sector has a direct impact on the wastewater sector as most of the national per capita daily consumption of water (150p/c/d) is returned as wastewater. Accordingly, demand management in the water sector translates directly into demand management for the wastewater sector, reducing the need for investment in new capacity of wastewater treatment and reducing this infrastructure sector's contribution to carbon emissions.

The Infrastructure Transitions Research Consortium (ITRC) has modelled the future demand for wastewater services based on the projected future population and the national per capita daily consumption of water and tested two demand reduction strategies (medium and high) with lower per capita water use, respectively 127 and 117 p/c/d, based on the demand management interventions in the water sector. Total volume of wastewater in 2050 is over 1m ML lower in a high demand reduction strategy, saving £18bn compared with a scenario in which demand is unconstrained. It also results in a reduction in cumulative emissions of almost 3 Mt by 2050.

Flood risk management and wastewater solutions
Measures to mitigate flood risk frequently also act as a form of demand management for wastewater. 'Green infrastructure' solutions involve naturally removing pollutants from watercourses and adding additional buffering capacity to reduce the impacts of flood events, whilst sustainable urban drainage systems (SuDS) reduce the amount of storm water discharged into sewers and hence directed to treatment plants for processing. It is not possible to quantify savings from SuDS at this stage since the relevant data are unavailable.

Housing and multi-sectoral solutions
The interdependencies of housing delivery and demand for economic infrastructure, while adding complexity to decision making also present opportunities for demand management and cross-sectoral enhancement. To seize the opportunities presented by housing delivery, integration of the

decision making framework for infrastructure with planning (such as coupling land use planning with the identification associated off-site infrastructure requirements), regulation and demand management, and that a spatial approach be taken.

Digital communications and multi-sectoral solutions
The increasing pervasiveness of digital and 'smart' technology, enabling collection and analysis of big data, is to have a profound impact on infrastructure needs, demands and delivery across all sectors – only likely to increase with future innovation. Projected contributions of digital communications to infrastructure sectors include:

- Energy: smart grids, meters and 'smart house' solutions for demand management;
- Transport: telecommunications and teleworking reduce the need to travel and aids demand management for transport, smart highway and journey planner systems and autonomous vehicles to manage congestion and peak demand;
- improved transport network availability and increased capacity through condition and usage monitoring and condition based maintenance; and
- Water, wastewater and solid waste: smart metering to manage demand.

Big data requires significant electricity to power it. The US National Resource Defense Council reports that in 2013 US data centres consumed energy equivalent to 34, 500MW coal fired power stations. Managing the storage and sharing of the huge quantities of data requires policy action if data demand and ultimately energy to support are not to grow beyond sustainable levels.

Housing delivery to increase economic infrastructure capacity
Effective housing delivery is dependent upon supporting infrastructure. As such, delivery of housing in locations lacking in sufficient infrastructural capacity can act as a stimulus to investment in capacity increase. Moreover, housing delivery can contribute towards the funding of investment in infrastructure via section 106 obligations or Community Infrastructure Levy (CIL). For example, the Northern Line extension has secured over £200m from the developers of Battersea Power Station housing development in this way.

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

The scope of the National Needs Assessment (NNA) did not cover planning; however, ICE received anecdotal evidence regarding public engagement for infrastructure projects. The general view is that local communities are not engaged effectively in the proposal and planning process. This can lead to NIMBYISM and add to time and cost delays for infrastructure delivery.

ICE believes that the NIC has a role in addressing this public engagement challenge. Through the NIA, the NIC could set out a series of desired outcomes for the economy and society. In order to achieve these outcomes, the NIC could propose a series of demand and supply infrastructure interventions that could be debated by local communities. This would involve early engagement in multiple options, rather than consultation over a single option.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies? Note: "travel patterns" include both the frequency and distance of trips taken, as well as the mode of transport used. This covers both personal and commercial travel, including freight.

The UK's population has grown from just over 50 million in the early 1960s to just over 65 million at the present time[1]. During this period, the demand for transport across all key modes (with the exception of bus patronage) has also risen[2]. Factored against the ONS central scenario for the UK's population to reach 75 million by 2050[3], it is almost inevitable that the demand for transport infrastructure and services will continue to grow in the coming decades.

Growth will occur in both intercity and urban transport operations. Emerging centres of economic growth in the Midlands and North of England will create new opportunities for the movement of people and goods to access new markets. In London and other high-wage urban centres, economic and population growth will increase the mobility of people and goods.

Greater demand placed on urban transport systems – overcrowded inner city roads, metro systems and orbital routes – may lead to policy interventions to encourage modal shift. This means new bus rapid transit, light rail and tram systems, alongside higher rates of active travel such as walking and cycling. Road user charging to alleviate congestion on key urban and intercity routes may also emerge as a more viable option for managing traffic flows.

Demand drivers impact use of infrastructure in different ways. Technological advancements in communications and IT are already creating new opportunities for many office based employees to work from remote locations. At scale, remote working could reduce peak travel demand and therefore cut congestion across transport networks during the busiest times. Conversely, demographic changes such as ageing population are likely to increase travel demand in peripatetic sectors such as health and social care, pushing up travel demand rather than reducing it.

Mobility as a service (MaaS) and the introduction of connected and autonomous vehicles (CAVs) have the greatest potential to disrupt travel patterns between now and 2050.

MaaS providers are already common place in the UK's transport system. On demand services like Uber and vehicle sharing schemes like Lift Share are challenging traditional network planning and delivery models. MaaS solutions mean transport services are increasingly based around an index of consumer preferences; journey planning and management, personalised service and flexible payment[4]. As our comprehension of mobile technologies and applications grow, MaaS will challenge conventional attitudes towards travel and create wider opportunities for the personalisation of services. This will present both challenges and opportunities for transport planning.

CAVs will result in a host of efficiency, safety, environmental and public benefits. On efficiency, this includes extracting greater capacity out of existing road networks through closer lane running. With regards to safety, sophisticated sensory and communication technology could result in less road traffic incidents. Potential environmental and public benefits include the reduced need for car parks and on street parking, therefore creating cleaner spaces for walking and cycling.

The 'connected' aspect of CAVs could revolutionise the management of road networks. Connectivity and information sharing between vehicles – and the wider network infrastructure – would enable smoother traffic flows, through the detection of traffic hotspots and real time rerouting capability. CAVs may even be sophisticated enough to carry out routine network maintenance operations, feeding back diagnostic information to asset operators.

[1] ONS (2016) Overview of the UK population
[2] ITRC (2016) in ICE (2016) National Needs Assessment
[3] ITRC (2016) in ICE (2016) National Needs Assessment
[4] Transport Systems Catapult (2016) Mobility as a Service: Exploring the opportunity for mobility as a service in the UK

As a cheaper form of mobility, CAVS are likely to lead to a significant decline in private vehicle ownership. This in turn paves the way for the wider adoption of MaaS, as service users seek to travel in the most efficient and cost effective way.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas? Note: "high value transport investments" in this context include those that enable 'agglomeration economies' – the increase in productivity in firms locating close to one another.

There are a variety of high value transport investments that can be made to reduce congestion for people and freight in major urban areas.

Road user charging can be an effective tool for reducing congestion in urban traffic hotspots, improving local environments and freeing up space for more active forms of transport, such as cycling and walking. However, as such charges become accepted as a cost of business, the impact of such interventions as a deterrent for avoiding heavily congested areas can become less significant[5]. Shifting to a usage charge based on the time spent within a congestion charging zone or on distance covered could be a more effective way of reducing traffic levels.

Greater infrastructure provision for active forms of transport will lead to higher levels of modal shift, which in turn will help to alleviate congestion in major urban areas. Active modes of transport, like cycling and walking, also reduce greenhouse gas emissions, improve air quality and reduce noise levels. There is also an economic case to be made – payback on £1millon of investment in cycling infrastructure requires only 109 people a year to become regular cyclists when considering the benefits to health, congestion and pollution[6].

Reducing the number of heavy goods vehicles by consolidating freight operations in urban areas can help to reduce congestion. This will require investment in new consolidation centres close to the UK's major urban areas. Consolidation can be incentivised by providing congestion charging discounts for freight vehicles registered to consolidation centres. There are also opportunities to take advantage of cycling as an effective means of transporting goods around large urban areas.

Technology also has a key role to play in helping to smooth traffic flows into and out of major urban areas. Live traffic and travel information, made available via mobile applications, provides both passengers and freight operators with the necessary information to make intelligent decisions on travel in real time. This requires investment in the digital infrastructure underpinning the UK's largest cities in order to improve mobile internet connectivity and data sharing[7].

As outlined above, CAVs could improve traffic flows within major urban areas in a number of ways. This includes creating additional capacity in existing road networks by allowing vehicles to travel closer together and via the sharing of traffic information between CAVs to enable in travel route management. Investment in MaaS and interventions to promote the potential of shared ownership models for CAVs could also have a significant impact on reducing congestion by reducing the number of privately owned vehicles in operation[8].

Improvements in technology can also help improve the attractiveness and capacity of rail-borne freight. One of the current problems is the mix of freight and passenger traffic on key rail lines such as the East Coast Main Line, which has the impact of limiting the capacity of the route and the

[5] ICE London (2016) Response to the London Assembly consultation on traffic congestion in London
[6] SQW (2008) Planning for Cycling – Report to Cycling England
[7] NIC (2016) Connected Future
[8] WSP I Parsons Brinckerhoff (2016) Making Better Places: Autonomous vehicles and future opportunities

availability of rail freight paths. The introduction of the Digital Railway programme[9], much like CAVs, can help achieve a better balance between freight and passenger traffic by optimising the pathing distances, thereby making better use of existing infrastructure and opening up additional freight paths.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area? Note: this includes travel in and between rural areas, as well as between urban areas and international travel.

The demand placed on the UK's transport network continues to grow. Road travel reached 317bn miles in 2015[10], while trips across the rail network in England and Wales reached approximately 65bn passenger km[11]. The UK's largest airports are fast approaching runway limits, with Heathrow at 95% and Gatwick at 80% operational capacity[12].

There are a number of high value investments that will improve the connectivity of people and freight between single urban areas in the UK. Schemes earmarked for the Government's second Road Investment Strategy, include the Oxford to Cambridge expressway and better Trans-Pennine connections across the A66.

Improving connectivity between high-performing economic areas can significantly reduce business costs and enable economies of scale and agglomeration[13]. Other potential schemes included in the strategy development, like Trans-Pennine Tunnel, will enhance connectivity between northern cities like Manchester and Sheffield.

In rail, the successful delivery of HS2 will mean eight of the UK's ten largest cities will be directly linked[14]. Journey times between key cities in the North and the Midlands will be significantly reduced, providing access to new jobs markets, with HS2 expected to create 400,000 new jobs[15]. Taking forward the emerging preferences for the Northern Powerhouse Rail scheme, as well as enhanced connectivity at HS2 stations and touch points will only widen the benefits from HS2 and increase its agglomeration benefits.

The Davies Commission has been clear that building a third runway at Heathrow will deliver the greatest benefits to UK trade globally via better connections to emerging markets in Asia and South America. Expansion will also mean an extra 16 million passenger seats by 2040, while 6 new regional routes – providing 14 in total – will improve accessibility throughout the UK for both business and leisure purposes[16].

But improving connectivity between single urban areas isn't simply achieved through building new capacity into existing networks. The introduction of smart motorways – the management of traffic flows in real time – to certain parts of the strategic road network has already resulted in a number of improvements to journey reliability and a reduction in accidents[17]. There is a clear case for the wider rollout of this technology, including: effective use of gantry signs for communicating roads hazards, variable speed limit management and all lane running.

[9] Digital Railway (2016) A Digital Railway for a Modern Britain
[10] DfT (2016) Transport Statistics Great Britain 2016
[11] Ibid
[12] ITRC (2016) in ICE (2016) National Needs Assessment
[13] DfT (2016) Oxford to Cambridge Expressway Strategic Study
[14] DfT (2013) High Speed Two: an engine for growth
[15] Ibid
[16] DfT (2016) Government decides on new runway at Heathrow
[17] Highways England (2016) Smart motorways programme

Similarly, there is a need for greater investment in mobile data sharing networks to enable road users to more effectively share information about traffic conditions in travel. Greater access to reliable information on road works or incidents enables road users to take avoiding action, which in turn reduces the build-up of unnecessary congestion[18].

Some progress has already been made in integrating new technologies into the rail network to improve reliability. It is estimated that 12,000 rail infrastructure assets are now connected to an intelligent infrastructure system of points, track circuits and signal power supplies which has meant 153,000 minutes saved in delays[19].

Progressing with the Digital Railway programme is fundamental to transforming the passenger network and delivering a modern railway that can accommodate more trains, enable more and faster connections, and greater reliability. The successful delivery of the programme will also mean more efficient rail freight operations through timetable flexibility, the greater availability of paths and optimised running. ICE welcomes plans set out in the Government's Industrial Strategy for priority investment in digital signalling[20].

Delivering these benefits will require investment in traffic management software and driver advisory systems, alongside the rollout of reliable mobile network technology across the network that will enable industry to better communicate real time journey information to passengers and freight operators alike.

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

Road user charging already exists in London through the Congestion Charge. Individuals entering the zone have a choice between paying the daily charge to enter in their own vehicle or to use an alternative mode of transport. Such alternatives include public and active transport or private hire. There is a legal requirement for monies raised from the charge to be spent on improving transport provision across London[21].

On demand MaaS providers like Uber– which fall within the private hire category – are therefore exempt from the Congestion Charge. However, there is little available evidence that demonstrates that as a consequence less private vehicles are entering the zone during its operational hours. Only 5.9% of all Uber journeys in London occur in the charging zone during operational hours[22] and this is against the backdrop of an increase in overall congestions levels within the zone[23].

The ability of businesses in London to absorb the cost of the Congestion Charge is evident. Trialling road user charging with exemptions for MaaS providers in other towns and cities will provide an alternative context for measuring its impact on road usage more widely. Including schemes that provide shared mobility solutions like car and cycle clubs could also provide useful data for the rollout of more sophisticated MaaS platforms in the future.

Digital Communications:

[18] NIC (2016) Connected Future
[19] ICE (2016) National Needs Assessment
[20] BEIS (2016) Building our Industrial Strategy: green paper
[21] TfL (2016) Congestion Charge
[22] Inrix (2016) London Congestion Trends
[23] Ibid

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

The UK currently has a very advanced digital communication infrastructure system comprising communication (fixed and mobile telephony, broadband, television and navigation systems) and computation (data and processing hubs). Due to rapid innovation, increasing demand and a changing economic landscape, it is challenging to forecast the future of the digital communications infrastructure system to meet our future connectivity needs. There will almost certainly be a mix of fixed, mobile, wireless and satellite connectivity.

It is anticipated that 5G technology will mean seamless connectivity, ultra-fast and ultra-reliable, transmitting massive amounts of data at super low latency[24]. By 2050, the main access points to data services will be through mobile devices and the internet of things grounded on widespread coverage of 5G (or other) mobile broadband[25]. Delivery will require significant infrastructure densification. To date there has been strong political ambition for the UK to be a world leader in 5G technology deployment, reflected in Ofcom Strategic Review of Digital Communications 2016. ICE welcomes the Government R&D funding commitments in the 2016 Autumn Statement.

However, the desire for expediency in delivery must be balanced with the need to ensure implementation of a system that can meet long-term economic, social and environmental needs.

In determining when decisions would need to be made, it is important to consider the interdependencies with other infrastructure systems, as highlighted in ICE's *National Needs Assessment – A Vision for UK Infrastructure.* 5G technology – or other future wireless broadband services - has the potential to enable a number of high-value use-cases, including autonomous vehicles, Internet of Things, smart cities, and real-time infrastructure operational data. As with existing digital connectivity, efforts must be made to ensure comprehensive coverage in order to maximise opportunities from these technologies. However, consideration should be given to the impacts on other infrastructure, like transport and particularly electricity generation.

The increasing pervasiveness of digital and 'smart' technology, enabling collection and analysis of big data, is to have a profound impact on infrastructure needs, demands and delivery across all sectors – and is only likely to increase with future innovation. This will be enabled by increasing 'always on' connectivity – both fixed and wireless. Big data requires significant electricity to power it. The National Resource Defense Council reports that in 2013 US data centres consumed energy equivalent to 34 500MW coal fired power stations, managing the storage and sharing of the huge quantities of data requires policy action if data demand and ultimately energy to support are not to grow beyond sustainable levels. More recently it was estimated that the 416.2 terawatt hours of electricity the world's data centres used last year was significantly higher than the UK's total consumption of about 300 terawatt hours[26].

However, it is also worth noting that increased connectivity can also help to balance energy consumption and generation through use of smart grid and smart meter technologies, benefiting both consumers and generators. Swift decisions on how best to meet the resultant increased energy demand in a sustainable way are required.

[24] NIC (2016) Connected Future
[25] ICE (2016) National Needs Assessment
[26] The Independent (23 January 2017) Global warming: Data centres to consume three times as much energy in next decade, experts warn

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Due to rapid innovation, increasing demand and a changing economic landscape, it is challenging to forecast the future of the digital communications infrastructure system to meet our future connectivity needs. There will almost certainly be a mix of fixed, mobile, wireless and satellite connectivity.

A key current challenge for the digital sector is a persistent digital divide between those who have access to the latest technologies and those who do not, with resulting social and economic exclusion, particularly as dependence on e-services and digital communications increases. 8% of all UK premises cannot access a broadband speed of 10Mbit/s[27], while around 3% of premises in the UK fall below the government's current minimum target download speed of 2 Mbit/s[28]. While all four mobile network operators (O2, Three, Vodafone and EE) enable you to make a call in 99% of urban areas, this proportion falls to 72% in rural areas, 41% on UK roads, and 31% inside buildings in rural areas[29]. Universal digital connectivity would serve as an equaliser of economic opportunity in that it enables participation in a modern digital economy. The recommendations from the National Infrastructure Commission's Connected Future report should be supported and will help to address the digital divide.

The UK currently performs well in digital communications. Internet penetration is at around 90%, and in 2014, on average 76% of adults in the UK accessed the internet every day. OfCom has obligated 98% population 4G coverage by 2017[30], and provide superfast broadband coverage to 95% of UK premises by the end of 2017.[31]

Estimates of projected bandwidth demand for 2023 show that peak technical demand for a single person household with standard definition television could be satisfied with 10Mbit/s[32] whereas a household with four intensive users and a 4k television would require 25Mbit/s. The top 1% of households would demand in excess of 35Mbit/s. Demand is likely to increase further with the introduction of novel technologies.

By 2050, the main access points to data services will likely be through mobile devices and the internet of things grounded on widespread coverage of 5G (or other) mobile broadband. To date there has been strong political ambition for the UK to be a world leader in 5G technology deployment, reflected in Ofcom Strategic Review of Digital Communications 2016 and the NIC Connected Future report. However, the desire for expediency in delivery must be balanced with the need to ensure implementation of a system that can meet long-term economic, social and environmental needs. As with existing digital connectivity, efforts must be made to ensure comprehensive coverage. This will require increased densification of supporting infrastructure, and changes to planning frameworks should be made with this in mind. The UK Government's commitment at the 2016 Autumn Statement of £1bn for improved connectivity, including 5G, is a welcome step.

Government has a role in establishing standards, opening up networks and ensuring that high quality access is available even where it is less financially viable for commercial providers. In the Autumn Statement in 2016, the Government pledged to support the broadband delivery programme to

[27] OfCom (2016) Connected Nations
[28] ITRC (2016) in ICE (2016) National Needs Assessment
[29] OfCom (2016) Connected Nations
[30] House of Commons Library (2016) Briefing Paper, Number CBP-07069: Mobile Coverage in the UK: Government plans to tackle 'mobile not-spots'
[31] House of Commons Library (2016) Briefing Paper, Number CBP06643: Superfast Broadband Coverage in the UK
[32] Broadband Stakeholder Group (2013) Domestic demands for bandwidth: An approach to forecasting requirements for the period 2013-2023

provide fibre broadband to reach 95% of the UK by the end of 2017, and 97 – 98% by 2020. Government should provide the private sector with incentives to roll out 'ultrafast' broadband coverage. Where the market fails to respond to those incentives, the Government should intervene to require that coverage is provided. The outcomes of the Government's recent consultation on the extension of full-fibre networks will reflect a range of potential approaches.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

Shifting to alternative types of gas holds the potential to decarbonise heat without the need to disrupt millions of people's homes and businesses or overhaul our (electricity and gas) distribution and transmission networks.

Around 50% of UK energy use is for heating and around 84% of domestic and commercial heat (space and water) is from fossil fuels – mostly natural gas[33]. Due to its diffuse nature (around 27 million homes and 2 million commercial premises), comparatively little has been done to decarbonise heat: overall, there has been an 8% *increase* in emissions from heat between 1990 and 2015[34].

The electrification of heat through adoption of heat pumps alongside district heating, as set out in DECC's Future of Heating strategy (2013)[35] remains the current policy. It suggests heat pumps/district heating could supply 80% of domestic properties by 2050. The forthcoming Emissions Reduction Plan -expected to be published in end of February 2017[36] - is anticipated to include detail on the decarbonisation of heat. At present, there has been little further published Government work in the area.

Much of the difficulty in the electrification of heat is that it depends on individual property owners and landlords making decisions to change their heating systems, which typically involves installation of radiators and insulation as well as the pumps themselves. This not only costs considerably more than replacing gas boilers (around £8,000 compared to around £2,000 for gas), but it also results in far greater disruption during installation and requires different heating practices and supply chains that currently have very limited capacity.

As a result, despite funding being available through the Renewable Heat Incentive[37], there has been little progress: gas heating remains far more popular with 1.6 million gas condensing boilers sold in 2014 compared to only 50,000 heat pump installations[38].

From an infrastructure point of view, switching to heat pumps would involve serious challenges (and associated costs). For example, it would require significant additional electricity generation[39] and reinforcement of the grid. At present, there is no storage in the electricity system able to manage

[33] UKERC (2014) The Future Role of Thermal Energy Storage in the UK Energy System: An Assessment of the Technical Feasibility and Factors Influencing Adoption
[34] Policy Exchange (2016) Too Hot to Handle? How to decarbonise domestic heating
[35] DECC (2013) The Future of Heating
[36] Royal Geographical Society (2016) Looking Ahead to 2017: The Emissions Reduction Plan

[38] Policy Exchange (2016) Too Hot to Handle? How to decarbonise domestic heating
[39] Ibid. A recent estimate of switching 80% of homes to heat pumps would require an additional 105 GW of electricity generation capacity - an increase of 175% above current peak power demand

the equivalent seasonal variations in heating demand[40]. Such capacity will likely be under-utilised during summer seasons but still carry significant economic cost[41].

Moreover, if electrification and district heating progress at the rate needed to reach around 80% penetration it is likely to outstrip at least in the short-term the decarbonisation of the electricity grid, leading to an increase in emissions. Electrification may also result in stranded gas assets including storage units, distribution and transmission networks, much of which is currently being upgraded through the Iron Mains Replacement Programme due to be completed in the early 2030s.

It is necessary to consider alternative strategies to provide heat services that may be more efficient with respect to cost and non-cost factors. An optimal strategy for energy needs to include a mixture of supply technologies to balance their strengths and weaknesses[42]. The choice of technology will depend partly on the population density and types of properties in the area served.

A more effective approach could be at the macro level: instead of replacing millions of boilers with heat pumps, the type of fuel could be changed. Alternatives including biogas, bio-methane[43] and power to gas fuels such as hydrogen and synthetic natural gas (SNG) have significantly lower emissions than natural gas and can be injected directly into the gas grid. This is not to discount heat pumps completely – they are likely to have a role for the 20% of homes not connected to the gas grid, which in the main currently use either solid fuel or heating oil.

It is unlikely that any one of the alternatives to natural gas could on their own provide a complete replacement. For example, the amount of raw material for the production of biogas from AD facilities would limit it to a maximum of around 10%[44]. For power to gas, the amount of hydrogen that can be used without needing to modify gas boilers and cookers is around 7-10% of total delivered gas[45] but could potentially be used in total conversion of sections of the distribution network[46]. SNG offers more potential. It can be conditioned to meet the quality requirements of the GB gas network and the amount that can be produced is (theoretically) unlimited and but with a lower conversion factor than hydrogen, requires more electricity for its production.

Whether power to gas technologies can provide low carbon heat depends on the source of electricity generation they use. An ideal situation would be for the electrolysers to be powered by dedicated renewables facilities, therefore providing 100% renewable heat. Due to renewables intermittent nature, this is unlikely but it is estimated that up to 58 TWh (approximately 15% of annual electricity demand) of wind power will be curtailed each year once wind penetration has reached 55%[47]. Therefore, introducing power to gas reduces the amount of wind curtailment, providing both cost and balancing benefits.

Power to gas could utilise the existing storage capacity of the gas network to store large amounts of renewable electrical energy. For SNG in particular, as it combines hydrogen with carbon dioxide to produce methane there is potential for it to be utilised in CCS facilities. It could, therefore, create a bi-directional link between the electricity and gas sectors, which could offer an efficient management of energy resources at each point in time.

[40] Winter gas peak demand for heat can be 12 times higher than in the summer, and is five times the current electricity peak demand (Maclean et al. 2016). See ICE (2016) National Needs Assessment

[41] Eyre and Baruah (2015) have estimated the cost of additional generation capacity at £3,000 per household not including the price of the heat pump, which is currently £8,000 per household (to decrease to £5,000 by 2030). See ICE (2016) National Needs Assessment

[42] Eyre and Baruah (2015), Maclean et al. (2016): see ICE (2016) National Needs Assessment

[43] The recently announced increase in support under the non-domestic RHI is welcome (BEIS (2017) The Renewable Heat Incentive: A Revised Scheme, and we would encourage Government to look at similar systems for power to gas technologies

[44] ENA / Labour Party Energy and Climate Change Committee (2016) The Green Gas Book

[45] Dodds and McDowall (2013) The Future of the UK gas network' and ENA / Labour Party Energy and Climate Change Committee (2016) The Green Gas Book

[46] Northern Gas Networks (2016) H21 Leeds Citygate

[47] Imperial College (2012) Understanding the Balancing Challenge

Furthermore, the by-products heat and oxygen can be recycled in industrial processes and directly as an energy source for domestic and industrial customers. It can also be used as a fuel in the transportation sector, especially in mobility applications that are difficult to electrify (e.g. heavy goods and public service vehicles).

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved? Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

As all renewables involve the production of carbon and/or other greenhouse gases at some point in their life-cycle[48], this question is taken specifically to refer to zero carbon from power generation.

A zero carbon power network is not an end in itself - it is part of the infrastructure that allows customers to use their appliances while limiting environmental impacts. However, it has key features that contribute to the security of supplies of energy and is likely to be hugely important for decades to come.

There is significant historic investment in network assets and they are long lived. A substantial portion of the electricity networks that exist now will still be in service in 2050 and beyond. This means that zero carbon power sector will be similar to our current networks.

To achieve a zero carbon network, it is not just systems being zero carbon in their own right. It is also about being able to enable / accommodate low carbon and widely dispersed sources of generation on the system. This will require smart systems for consumption, generation and network management.

The transition to a secure, affordable and zero carbon power sector is feasible but requires a clear vision from Government and policy makers, with cross-party support to maintain the necessary policy stability.

The question rightly identifies that a zero carbon power sector includes generation, transmission and distribution. However, added to this should be consumption: reducing demand through energy efficiency and behavioural changes could significantly reduce demand from domestic and commercial consumers, reversing or at least mitigating expected increase in demand for example from population increase and electrification on transport (see question 21, below).

Efficiency improvements across buildings, appliances and lighting can produce the following outcomes:

- 5% reduction in leakage rate in buildings (increasing thermal efficiency);
- 10% efficiency improvements in residential and service sector lighting;
- 10% efficiency improvements in residential and service sector appliances;
- 20% in industrial sector appliances; and
- 20% in industrial sector lighting [49].

In addition, behavioural change can be promoted through education encouraging conservation of energy or technological measures such as pricing, which acts as a deterrent, as well as monitoring technology that enables users to track and moderate their own consumption.

[48] For example, a recent study of onshore wind generation found a range of 5 CO2eq/kWh to 106 CO2eq/kWh, depending on a range of factors including capacity, design lifespan and turbine location. See Climate Exchange (2015) Life Cycle Costs and Carbon Emissions of Onshore Wind Power
[49] ITRC (2012) in ICE (2016) National Needs Assessment

For electricity infrastructure itself, such as generation, distribution and transmission, a key limitation is that it is set up to transmit power from a small number of large generators to demand centers. While the infrastructure generally works well at present, to get more renewables on the system means accommodating more distributed generation at the same time as managing increasing demand. Balancing and maintaining the system will become increasingly complex. These limitations are likely to manifest at the distribution level.

There are several potential ways to address these limitations:

- Deployment of electricity storage across networks;
- Greater use of demand side management;
- Further installation of interconnectors; and
- Line upgrades.

The key point is not to look at individual technologies or responses in isolation but rather consider the electricity system as a whole. As such, there is a need for systems-of-systems engineering and a 'system architect' to ensure integration of design, implementation and operation of energy networks to address the energy trilemma[50]. Analysing the national infrastructure as a system-of-systems allows these important interdependencies to be captured and quantified and measures to maximise efficiency to be identified[51].

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Managing the connection of an ever-increasing share of distributed generation combined with the electrification of transport, plus increasing numbers of customers actively taking part in the market will be a challenge, particularly for Distribution Network Operators (DNOs). With multiple, intermittent sources with the potential to alternate between demand and supply, networks will no longer be just from transmission to customers, but rather multifaceted networks with two-way flows.

DNOs will feel pressure to operate new services, such as storage and ancillary services, to actively manage their networks. However, at present DNOs' (and the Transmission System Operator's) licences prevent them from operating generation in the market and, therefore, they cannot control storage facilities, nor participate in demand side management or smart metering.

There is a strong case to examine the licensing of regulated activities with a view to freeing up this red tape to reflect the changing nature of maintaining balance in the system.

While the future of low carbon vehicles is likely to be dominated by battery electric vehicles, other fuel types, such as hydrogen and SNG should not be discounted. As outlined above in the response to Question 19, power to gas offers the possibility of low carbon fuel for both heat and transport via the existing gas grid. Advantages of utilising gas are the relatively straightforward conversion of existing petrol/diesel vehicles, are suitable for use with HGVs and greater range.

Water and wastewater (drainage and sewerage):

[50] See IET (2013) Handling a Shock to the System for more detail.
[51] ICE (2016) National Needs Assessment

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute? Note: "demand" includes domestic, commercial, power generation and other major sources of demand.

Although the UK climate is generally wet and mild compared to much of the world, less rainfall and high population density in the South and East means that water availability per person in these regions is low. Regional rainfall differs significantly. The Southeast is the driest part of the country (London is drier than Istanbul) and already water stressed. By contrast, the North and West and much of Wales and Scotland receive the majority of UK rainfall but are more sparsely populated.

The challenge for future water supply in the UK is to meet the demands of socio-economic growth and climate change –without compromising the environment and other users of water, or placing an excessive financial burden on consumers. Recent work by water companies and particularly by Water UK (2016) has assessed the resilience of supplies to key drivers (drought, environment, growth and climate change) over the next 50 years. This shows that significant and growing risk of severe drought arises from climate change, population growth and environmental drivers. Some risks (drought and environmental demand) are immediate and will require a prompt response. The most cost-effective approach to increasing resilience is likely to drive action in the current round of water resource management plans (WRMPs).

The investment needed to increase resilience to drought is relatively modest. Building on the existing water resources planning framework, Water UK concludes that a 'twin track' approach that includes supply enhancement, with associated transfers, as well as demand management, remains the most appropriate strategic mix to meet supply demand pressures now and into the future.

There is a case for considering more extensive measures to manage demand than are in place today to provide a greater level of resilience to more extreme future shocks. However, such levels of demand management are ambitious and will require significant behavioural change, innovation and potential regulatory change.

Inter-regional transfers, new storage capacity and re-use of water may represent key components of a more resilient system, through a combination of localised and strategic schemes. For example, using the River Severn and River Trent to transfer water to the South and East. However, connecting major supply systems has implications for river regulation, water quality, and environmental risk (both the natural environment and carbon costs of moving water over large distances). In some cases, the nature of drought risk within the supplying water resources systems may also increase as a result. The transfer and trading of water, as well as innovation across all other aspects of supply and demand of water are a key focus of ongoing regulatory reform.

There is a case for a national level 'adaptive plan' that supports on-going WRMPs and balances risks against opportunities to defer costs. Such a plan would identify the key 'trigger points' that will determine which set of investments and policy interventions would be needed for the 2040 and 2065 horizons, depending on how risks materialise in the future.

Demand management is expected to play an important role in future water security for the UK. Water companies plan to increase metering coverage from 48% in 2011 to 61% in 2020. A key advantage of metering is the ability to provide complete coverage within a short time frame and its increasing sophistication, with digital transformation and smart technologies, enables more effective monitoring to determine pricing and can provide the basis for block tariffs to manage variation in demand.

Furthermore, technology that enables users to track their own consumption of infrastructure can induce behavioural change. A potential blocker to the success of consumer behaviour change is price inelasticity of demand for services. Other demand reduction measures include technologies such as grey water re-use and policy measures such as tariffs, water efficiency audits, pay- as –you- save schemes and educational programmes. A less hi-tech method involves designing for reduced point of use consumption - one-cup kettles and half-flush toilets.

Education has a particularly important role for technological roll-outs as it can ensure that the benefits of technologies are fully exploited. Demand management in the delivery of water services is incentivised by mechanisms such as outcome delivery incentives within the 2015-20 period, with additional mechanisms for upstream water trading and sludge management being considered as part of the price control methodology by Ofwat.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand? Note: this can include, but is not necessarily limited to, governance frameworks across the country.

The UK enjoys high levels of sewage connectivity compared to the rest of Europe. However, meeting increasing environmental standards together with improved understanding of the fate of contaminants and better detection have driven more challenging wastewater treatment standards and significant investment in new infrastructure, often requiring increased energy and chemical consumption, resulting in higher tariffs for customers.

The energy intensity of wastewater treatment infrastructure also makes it a target for policies to reduce greenhouse gas emissions, such as the 2008 Climate Change Act. The wastewater industry consumes approximately 0.4% of the national energy budget (Ofwat, 2011).

Wastewater management will also be improved by approaches to flood risk management which increase systemic resilience, including sustainable urban drainage schemes (SuDS) and other ‘green infrastructure’ solutions which provide buffering capacity.

However, total volume of wastewater is still likely to increase, requiring new treatment capacity and acting to increase emissions. In delivery of new wastewater capacity, adoption of new technologies could decrease or retain net energy consumption for wastewater treatment. More energy could be recovered from waste in future. Targeted ‘green infrastructure’ solutions can be implemented to naturally remove pollutants from watercourses.

Increased centralisation of services could alleviate increasing costs through economies of scale. Wastewater plays an important role in maintaining river flows – smaller sewage works, which might benefit most from centralisation, can be the sole contributor to river flow during dry periods – so there is an environmental cost. This would require planning reforms and an estimated cumulative capital investment of £17.5bn (ITRC 2016). For the time being, decentralised technologies do not achieve the same economic advantages, levels of reliability or purity of effluent.

Further regulatory reform could ensure the implementation of building-level efficiency measures (including demand management). Many new housing developments are being connected through dual wastewater and storm water networks which could contribute to lower per capita costs and lower susceptibility to water quality problems during extreme rainfall events. There is potential – albeit requiring major new investment – to retrofit dual sewer systems. Depending on demographic trends, projected cumulative expenditure on new sewers to 2050 ranges between £20 - 120bn (ITRC 2016).

Flood risk management:

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

Flood resilience is divided into three aspects: resistance, preparation and response, and recovery.

Resistance to flooding may be provided by flood defences at a regional or local level, or by local resistance measures at the level of the individual development plot or property. Flood protection and resistance measures should be implemented where the risk of flooding is high – either because the likely frequency of flooding is high or because the consequence of flooding is high (e.g. critical infrastructure). The level of protection or resistance to flooding should be based on the cost of implementation balanced against the consequential impact of flooding. However, as a general rule, high consequence flooding should be exceptional, that is it should not occur more frequently than once in 200 years on average.

The Environment Agency's long term investment scenarios highlight the cost-beneficial nature of flood risk management solutions. It recommends a programme of investment over the next century to reduce risks where benefits are greater than costs. Modelling shows that a cost-beneficial investment programme will require between £750m and £920m per year on average to maintain a climate-adjusted current level of risk for expected annual damage reduction of 4%-24% in the next 50 years[52].

There has been good progress through the combined efforts of the Met Office and the Environment Agency on flood forecasting. This now needs to be matched by effective preparation and response to limit the consequences of flooding. Although Fire and Rescue are usually a primary responder to floods they have no statutory duty to do so. This anomaly should be rectified, but only if Fire and Rescue are adequately resourced to undertake a more effective and proactive role in helping communities to prepare for floods.

Evidence from recent floods shows that flood recovery is poor. Recovery is often hampered by the breakdown of other infrastructure whose availability has been unduly affected by flooding. The inter-dependency of infrastructure is still not well understood. In particular redundancy has been stripped out of infrastructure in the pursuit of efficiency without a full understanding of its impact on resilience. Resilience is not simply about prevention – it is about recovery as well.

In the longer term, flood risk will be affected by two key pressures – development of the built environment and climate change. It is unlikely that England can meet its development needs without new construction in flood risk areas. Such development must meet two conditions. It should not make flood risk worse in other areas, and secondly it should not expose future occupiers of the development to high levels of flood risk. As stated in the recent Environment, Food and Rural Affairs Select Committee report[53], these conditions are not met by the current planning process and we believe they should be adopted as standard practice.

The second pressure arises from climate change which is likely to result in more intense summer storms and more prolonged winter storms. There is sufficient information available from climate models to predict at least the scale of the change if not the precise timescale. A more holistic approach to managing flood risk is needed to counteract this threat, treating flood risk management on a catchment scale and engaging the multiple stakeholders that have a part to play. It would be

[52] Environment Agency (2014) Flood and coastal erosion risk management – long-term investment scenarios
[53] Efra Select Committee (2016) Future Flood Prevention

wrong to look at climate change in the context of flood risk only, since it is likely to have an even greater impact on water resource availability, especially in the South East of England. It would be a mistake to address long term flood risk management in the absence of the management of drought, since potential solutions may well prove to be complementary.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk? Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.

Natural flood management measures are being promoted as a fresh approach to managing flood risk. Such measures would make use of farm land and other areas to temporarily store water during flood events. They have been shown to be effective on a small scale but so far there appears to be no conclusive evidence to show that they work cost-effectively on a large scale.

The principle of managing flood risk through the provision of additional storage within a catchment is however well established. There a numerous examples of on-line and off-line flood storage schemes along our major rivers and smaller watercourses. The difference with the natural measures proposal is that it distributes such storage over a wide number of sites. If it is to be effective, these sites would need to provide the necessary flood storage volume if they are to be effective.

There is however significant scope for innovation. Moving to a whole catchment approach to flood risk management involving all the necessary stakeholders would be a good first step. As mentioned above, combining the needs of drought management with flood risk management is recommended.

Buildings should be both flood resilient and resistant. Currently many of our buildings suffer unnecessary flood damage due the materials used and the way housing are designed. For example, timber and gypsum take longer to dry out than other materials and plug sockets positioned too close to the floor are unusable post flooding due to damage. Through the Government's property flood resilience action plan[54], ICE believes all new buildings should be resilient and resistant to flooding and previously flooded buildings should be restored to flood resilient and resistant standards.

In a similar vein, key energy and transport infrastructure assets are inappropriately located in areas prone to flooding without any sensible measures to protect them from the consequence. This is not helped by our approach to mapping the extreme flood outline. It is not simply the area that is flooded but the velocity and depth of flood water that matters.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

The main financial incentive in the solid waste sector in the UK is the Landfill Tax. Since January 1998, the Treasury has received £14bn in tax receipts – with just under £1bn in 2015 alone. The tax had its annual escalator of £8/tonne suspended in 2014 to allow for a consultation on the level that should apply to waste processed at mechanical treatment plants. This concluded in 2015 but the escalator remains suspended with the landfill tax rate only increasing at RPi.

[54] Defra (2016) The property flood resilience action plan

The Landfill Tax has been successful in the primary driver of increasing diverting waste from landfill and consequently increasing recycling rates[55]. Therefore, ICE agrees with organisations such as the Resource Association[56] and CIWM[57] that the escalator should be reinstated.

There also remains a need to intervene directly in recycling itself to offset effects of market fluctuations. This is because collection and recovery processes and maintenance of recyclate quality, is at least partly market driven and as such it is often more economic to instead of recycling send materials to energy from waste plants either in the UK or increasingly, abroad.

Municipal Solid Waste (MSW) recycling rates in England had been increasing steadily from 11% in 2000 to over 40% by 2010 but the rates have plateaued over the past five years and actually fell back from 45% in 2014 to 44% in 2015[58]. In the same time period, Scotland saw an increase in recycling of only 1% to 43%[59]. In comparison, Wales increased from 57% to 61% for the 12 months to the end of June 2016[60].

Unlike the rest of the UK, Wales not only has a comprehensive long-term waste strategy, it has also set statutory waste and recycling targets. To avoid financial penalty, every local authority in Wales must meet recycling and landfill targets that rise gradually to 70% by 2025[61]. With Wales leading the way in recycling in the UK, it suggested that Government in England examines and learns from its experience and focus on creating a policy, regulatory and commercial environment that encourages maximisation of waste prevention and recycling through specific, legislative action.

Material recovery could be enhanced by a re-use and recycling strategy to make better use of existing capacity to recovery – with a potential increase from 18 Mt in 2015 to 21.4 Mt by 2050[62]. The UK recycling system should be realigned to include manufacturers, re-processers and recyclers[63]. A step in this direction would be to increase packaging recycling and reuse targets in line with the Circular Economy Package recycling targets for 2025[64].

In addition to the MSW sector, there is a high potential for recycling and reuse of both Commercial and Industrial (C&I) construction and demolition (C&D) waste, not least because the amount produced in these sectors far outstrips that managed by local authorities[65].

The construction sector is currently outperforming many other sectors for recovery of materials. The UK generated an estimated 46 Mt of construction waste in 2012. Some 45 Mt of this was non-hazardous, 39 Mt of which was recovered – a rate of 87%.

The UK has made significant progress in this over the past decade: concepts such as design for manufacture and assembly, building information modelling, and the circular economy are all having a positive impact, but there should be more focus on the whole lifespan of a development.

As outlined in Defra's Waste Management Plan for England[66], in managing waste to support the economy and protect the environment, much has been done but much remains to be done:

[55] HMRC (2016) Landfill Tax: Increase in Rates
[56] Resource Association (2014) Response to Budget 2014
[57] CIWM (2014) Survey Finds Respondents In Favour Of Landfill Tax Rise
[58] DEFRA (2016) Statistics on waste managed by local authorities in England in 2015/16
[59] SEPA (2016) Household waste – Summary data 2015
[60] Welsh Government (2016: 1) Local authority municipal waste management, April – June 2016 (provisional)
[61] WLGA-CILC (unknown date) Waste
[62] ITRC (2016) in ICE (2016) National Needs Assessment: A Vision for UK Infrastructure
[63] ICE (2016) National Needs Assessment: A Vision for UK Infrastructure
[64] Option 2 in DEFRA (2016) Consultation on changes to packaging recycling business targets for paper, steel, aluminium, wood and overall recovery and recycling for 2018-20
[65] Data for C&I waste arisings in England are not regularly collected. The most recent data is from the 2009 'Commercial and Industrial Waste Generation and Management Survey'. In the 2009 survey, arisings were 48Mt compared to 24 Mt of MSW. See DEFRA (2013) Forecasting 2020 Waste Arisings and Treatment Capacity

population increase, rising consumption, climate change and raw material supply risks are combining to increase pressure on resources resulting in rising - but volatile - prices and supply risks.

Waste minimisation is the most straightforward strategy to reduce the cost and environmental impact of waste management. It should be deployed alongside strategies for re-use and recovery. An ambitious strategy could reduce total waste produced to 22 Mt in 2050[67] and significantly decrease carbon dioxide emissions and costs associated with waste collection and treatment. Measures including designing in recyclability, designing out waste, light-weighting and eco-packaging will result in a reduction in overall volume of waste.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be? Note: A "circular economy" is an alternative to a traditional 'linear economy' (i.e. make, use, dispose) in which products are designed and packaged to minimise waste, and resources are kept in use for as long as possible, e.g. through re-use, recycling and greater recovery of materials through the waste management process

A circular economy where opportunities for recycling are maximised and all residual waste may be sent for energy recovery rather than landfill is estimated by the Environmental Services Association to require a further £5bn investment[68]. An aggregated services model, such as that proposed by Viridor[69], can contribute to the development of progressive policies in recycling and resources and realising economic benefits (productivity, employment and business growth) of a circular economy.

The establishment of a circular economy will require leadership from policymakers, embedding the idea across government, for example through broadening the ban on sending materials to either landfill and developing minimum reuse/recycling targets as set out as 'Option 2' in DEFRA's recent packaging recycling consultation.[70]

At present, the market process fails to emphasise the total first lifetime costs of a product and structure such as purchase, running costs and repairs, or identify the value remaining at the end of a product's first life. For example, capital and running costs may not be borne by the same party, thereby driving lower initial costs at the expense of full life costs.

As such, there is little incentive for designers and constructers to design and build in minimised total first lifetime costs, or to maximise the value and reusability of the product/structure at the end of that lifetime use, for example through design for disassembly in the construction sector[71]. Broadening the use of leasing or pay-per-use would address this but has failed to find traction, especially in the domestic market

While data for MSW is reasonably well recorded, in the C&I sector – estimated to produce around double the annual tonnage of MSW[72] – the available figures are outdated and often inaccurate. Without rigorous data, resource management (and, it follows, a circular economy) becomes difficult to implement. This not only affects investment in the waste sector but also has negative effects on other sectors, for example by creating uncertainty for EfW and associated combined heat and power operators.

[66] Defra (2013)'Waste Management Plan for England
[67] ICE (2016) National Needs Assessment: A Vision for UK Infrastructure
[68] Ibid.
[69] Ibid.
[70] DEFRA (2016) Consultation on changes to packaging recycling business targets for paper, steel, aluminium, wood and overall recovery and recycling for 2018-20
[71] Rios et al (2015) Design for Disassembly and Deconstruction - Challenges and Opportunities
[72] DEFRA (2013) Forecasting 2020 Waste Arisings and Treatment Capacity

The availability of accurate information is crucial for effective public policy and the operation of markets. Material flows are largely unmonitored compared to the financial flows they accompany. This results in sub-optimal decisions about materials management at every economic stage. Without good data it is impossible to determine the right facilities to invest in and their optimum location – or indeed, if in one type of technology is seeing over-investment.

The lack of C&I waste data is mirrored in the dearth of strategic direction in the sector. While MSW operators have benefitted from government leadership, C&I management has been left largely to the private sector; ministers have provided no clear direction, targets or support. In England, this is due to a lack of government co-ordination with responsibility dispersed across at least nine government departments including Defra, DCLG, BEIS and the Treasury.

Only Government can set policy frameworks, act as a facilitator for action and provide support for innovation where market conditions - both on the supply and the on demand side - are difficult.

Government's role in shaping the 'information infrastructure' needs explicit attention. Until we have high quality data and statistical information, it will be very difficult for policymakers to understand the UK's resource needs and vulnerabilities, let alone how materials contribute to the economy or remain in productive service for longer.

For more information on this submission contact:

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National Infrastructure Commission
Call for Evidence for the National Infrastructure Assessment (NIA)

IOAF Paper for NIA Call for Evidence

About the IOAF (Infrastructure Operators' Adaptation Forum)

The IOAF was set up in 2012 to bring together infrastructure operators, regulators, government, trade associations, professional bodies and academics so that they can learn from each other and work together to reduce vulnerability, and realise opportunities, from a changing climate, including as a result of dependencies among infrastructure systems. There are over sixty member organisations comprising IOAF.

Our vision is *'for our assets and services to be resilient to today's natural hazards and prepared for the future climate'.* The Environment Agency provides secretariat support.

IOAF meets three times a year to discuss and share information while ad hoc working groups work in more depth – and meet more frequently - on specific issues.

Why do we wish to contribute to the NIA at this time?

In 2018 the NIC will produce a National Infrastructure Assessment setting out long-term infrastructure needs on a 30 year time horizon with recommendations to the government. We in IOAF see this as an excellent opportunity to bring our collective thoughts and priorities to help shape the future of infrastructure provision and the services provided in the UK.

As well as contributing to the NIA, we also volunteer our services to assist the NIC in any way deemed fit as the work develops.

How should infrastructure be designed, planned and delivered to create better places to live and work? (Q3)

The design, planning and delivery of infrastructure should take account of the impacts of climate change and the associated vulnerabilities and risks so that the services provided are resilient now and in the future, in an environment of increasing population and demographic change. In order to achieve this, attention should be given to:

- <u>Dealing with uncertainty and the long-term future:</u> Consideration should be made of the thresholds associated with different design and delivery solutions. Testing these against climate projections (including plausible worst case scenarios) in both the short and long-term will enable us to move beyond incremental business-as-usual resilience improvements to the kind of transformative adaptation that may be required in some cases. Some infrastructure operators have begun developing and using approaches of this type, including through the use of tools such as 'robust decision making', 'portfolio analysis', 'real options analysis' or 'adaptation pathways'.

- Governance: Economically regulated sectors face multiple pressures to reduce bills, improve resilience and ensure security of services provided. They also tend to work in discrete review cycles (5 or 8 years for example) and many reorganise internally on 1 – 3 year cycles. Governance systems need to be developed that enable:
    - Appropriate investment that takes account of, and yet transcends, organisational lifecycles and delivers resilience and adaptation in the long as well as the short term;
    - Knowledge transfer between sectors to address dependencies and interdependencies; and
    - The embedding of that knowledge in the corporate psyche, for example with processes in place for incorporating it within systems and standards, such that learning related to resilience and adaptation is retained.

- Capacity: Our working group on 'Embedding adaptation in infrastructure organisations' piloted the Climate Capacity Diagnosis and Development (CaDD) tool. Although all participating organisations were found to have high levels of adaptive capacity, they all had opportunities to improve in the themes of leadership, learning and managing operations.

- Economics: It is not necessarily true that affordability is better for future generations and in many cases it is more economically efficient to invest in adaptation now. However, evidence to support this claim is mostly anecdotal and piecemeal. The development of approaches for valuing resilience would therefore help make sure beneficial resilience measures don't get value-engineered out.

- Urban Development: As more people move to cities, there is an opportunity, and an increasing urgency, to build the resilience of interconnected infrastructure supporting the urban form and function. This in turn will benefit the health and well-being of people in urban communities, especially solutions that are based on innovative designs to deliver multiple benefits.

How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

The IOAF has found that all sectors are highly dependent on transport, water, energy, and ICT. In order to ensure our interconnected infrastructure systems are resilient the group believes that we should:

- Focus on service provision rather than assets and think of interconnected infrastructure as a 'system of systems'. This is particularly relevant when we think about how we measure performance, which in many organisations is related to asset performance rather than service provision.

- Seek to understand dependencies and interdependencies and address how they interact and are affected by the risks from climate change and other pressures, including in the context of identifying and assessing the required responses. This

should build on that which was started for the CCRA Evidence Report's chapter on 'cross-cutting issues'.

- Encourage joint working and appropriate information sharing between interfacing and interdependent organisations, including suppliers and customers. Currently the lack of sharing data and information make it difficult to assess and manage risks, and address adaptation and resilience concerns to whole systems. However, the prospect of sharing data raises legitimate commercial sensitivity and security concerns, particularly in sectors where business models are more dependent on competition, such as energy generation, ICT, ports and airports. These need to be resolved with appropriate governance, funding and legal measures. The IOAF is an example of national-level knowledge exchange with good attendance and a reputation for successfully driving cross sector understanding. Along with sector bodies, it could form part of an approach to facilitate *appropriate* information and data sharing between organisations.

- Develop the role of standards, for example by agreeing standards for different categories of resilience of dependent and interdependent 'services'; these could be related to the infrastructure organisations' individual purpose but also (ideally) to a higher, societal purpose. As a first step, investigations into supply chain specifications could be useful. A greater understanding of the tension between standardisation and flexibility in the context of resilience and climate change adaptation is required in order to move forwards in this area.

National Infrastructure Assessment: Call for Evidence

Response from the Infrastructure Transitions Research Consortium

[name redacted]: University of Oxford
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This response to the National Infrastructure Commission's call for evidence for the National Infrastructure Assessment (NIA) has been produced by the UK Infrastructure Transitions Research Consortium (ITRC). The UK Infrastructure Transitions Research Consortium (ITRC) is a consortium of seven UK universities (Oxford, Cambridge, Cardiff , Leeds, Newcastle, Southampton, Sussex) funded by the Engineering and Physical Sciences Research Council (EPSRC) to "develop and demonstrate a new generation of simulation models and tools to inform the analysis, planning and design of national infrastructure". Since beginning in 2011 the ITRC has developed the NISMOD national infrastructure system model, along with a series of other innovations in interdisciplinary systems research. In this response to the call for evidence on the NIA we draw the Commission's attention to the most relevant aspects of that research. We offer our continued support as the NIA proceeds.

In our research we have emphasised the importance of taking a 'system-of-systems' perspective that integrates across infrastructure sectors based on general frameworks and principles. The consultation on the National Infrastructure Assessment that was published in 2016 proposed a framework for the NIA that was closely aligned with the approach that we have developed, whilst advancing upon it in some important ways. The consultation questions in this Call for Evidence are wide-ranging and align less rigorously with a logical framework. We trust that the NIC will adopt a coherent logical structure for the analysis and recommendations in the NIA.

All of the cited references can be made available on request. For further information contact [name and email redacted] or [name and email redacted].

1: What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

In ITRC we have adopted a multi-attribute perspective on value, based around the dimensions of the 'trilemma':

1. Security of supply, accessibility and quality of service
2. Affordability and economic efficiency
3. Environmental impact and sustainability

Value for money should be considered in these broad terms, to help navigate inevitable trade-offs between alternative investments/policies and in space and time (Hall et al., 2017b). We have sought to apply a consistent set of metrics across infrastructure sectors (Hall et al., 2016) based upon the dimensions of the trilemma.

We welcome the focus upon the long term and upon sustainability. Most infrastructure planning and investment decisions have long term implications. They are difficult decisions because of the uncertainties in factors that will influence the long term performance of infrastructure (like climate change and population growth) (Otto et al., 2014, Hall et al., 2012b). In the face of these uncertainties, attention to flexibility in infrastructure assets can provide opportunities to increase economic, environmental and social returns (Young and Hall, 2015). Careful consideration should be given to incorporating designs and practices (even in the event of higher installation costs) that enable system adaptation to changing policy, economic and social conditions (Hino and Hall, 2017). What is considered the highest value investment now might not be so in 5 or 10 years' time due to changes in demand, technology or policy goals. Examples include modularity in design and openings for experimentation (this could be in policy, operation, design, usage, governance, regulation… etc.). Using the example of low-carbon infrastructure Hiteva et al. (2017) identify a key opportunity for successfully matching infrastructure investments to societal needs. This advocates addressing the often described *investment gap* in infrastructure simultaneously with an *institutional gap* in infrastructure development and decision-making. Where possible, decision making should avoid technological lock-in and prevent path dependence, building in system flexibility. An example of missed opportunities for creating value from infrastructure investment is the construction of unilateral transmission connections with limited capacity between offshore wind farms and the onshore grids under the OFTO regime, thus precluding their usage as connectors and part of a Supergrid (Hiteva, 2013).

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

In the first phase of the ITRC programme we focussed upon national infrastructure networks with rather simplified treatment of the interface between the UK's infrastructure networks and the rest of the world. Exceptions related to our analysis of the role of trans-national energy interconnectors (Baruah et al., 2014, Baruah et al., 2016), airports (Blainey and Preston, 2016) and export of solid waste (Watson et al., 2016). Within the ITRC's MISTRAL programme, which began in 2016, we are looking more explicitly at the interconnectivity between the UK, its geographical neighbours and the rest of the world, including connectivity for energy, transport (passenger and freight), digital (cable and satellite) and solid waste systems. The results from that analysis are not yet available but we will be generating scenarios for international connectivity and the role of gateways in enabling that connectivity.

3: How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

ITRC has adopted a service-based view of infrastructure, focussing upon the services that infrastructure systems deliver (Otto et al., 2014). Reliable, affordable and environmentally sustainable infrastructure services are one aspect of "better places to live and work".

Demand for all sorts of infrastructure service comes from houses, so it is important to take an integrated view of infrastructure and housing. The ITRC's research has therefore focussed upon characterising the nature of demand, for example for energy (Baruah et al., 2016), digital (Oughton

et al., 2016, Oughton et al., 2015, Oughton and Frias, 2016), water (Simpson et al., 2016), waste water (Manning et al., 2016) and solid waste services (Watson et al., 2016) at a household or community scale. That analysis has illustrated the significant range of possible demands for infrastructure services at a household scale and the potential for innovation to reduce demand.

Our intra-zonal traffic model (Blainey and Preston, 2016) provides some insights into urban congestion, but at a highly aggregate level. The new transport model being developed in the MISTRAL programme will provide more detailed insights into this aspect of urban liveability. The more geographically refined research in MISTRAL will also explore the role of urban green spaces in urban drainage

In the MISTRAL programme we will be using individual buildings as the lowest level of resolution in our modelling. We are developing a methodology to characterise all of Britain's building stock and household occupants. We have developed a microsimulation model that simulates the evolution of household composition over the coming decades. That simulation has been conducted for Newcastle and we are ready to extend nationally. We offer this evidence base to the NIC.

Our research on building characterisation combines GIS data with evidence from remote sensing to characterise buildings in terms of their age and type (Barr and Barnsley, 2004). This approach has been applied in London and is being rolled out nationally. Further research will develop spatial optimisation methodologies so that we can allocate future infrastructure (like CHP plants or photovoltaic panels) according to a set of objectives and constraints. A version of this was developed for allocating new housing in London (Walsh et al., 2011) according to objectives (e.g. prioritising brownfield sites) and constraints (e.g. avoiding floodplains). This methodology may be of interest to the NIC in developing spatial scenarios of demand for infrastructure services.

A further strand within the MISTRAL programme is the development of an agent-based model of the housing market, which is being extended to make it spatially explicit. This is still work in progress and we do not expect robust results on the timescale require for the NIA, but we hope it will provide worthwhile evidence for future rounds of the NIA.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

The ITRC has developed modules for projecting demand for different infrastructure services, including household and industrial energy demand (Baruah et al., 2016), water demand (Simpson et al., 2016, Water UK, 2016), transport trip generation (Blainey and Preston, 2016) and generation of solid waste (Watson et al., 2016). We are now in the process of generating a new geographically resolved model of demand for digital connectivity. Each of these models can be used to explore the potential for demand management strategies.

The potential for improved energy efficiency is very large. It has been estimated that the global thermodynamic potential is a reduction of approximately 85% (Cullen et al., 2011). The economic and practical potential is clearly smaller. Most reliable estimates (Lucon et al., 2014, NAS, 2010) are 20%-50%, which is the range that we modelled in the ITRC analysis as achievable by 2050. The lower end of the range would probably be achieved by market forces alone; the upper end requires significant policy intervention. The difference is clearly hugely important for energy infrastructure policy.

Meta-analysis of energy efficiency evaluation studies shows that energy efficiency programmes tend to deliver significant benefits and to be highly cost effective, but to achieve less than simple engineering estimates (Wade and Eyre, 2015). The reasons are diverse. Rebound effects are relatively well understood. They can be significant where there is large unmet demand for energy services, but in an advanced economy like the UK, direct rebound effects are small, typically ~10%. Under-performance of more complex technical solutions is also a factor, implying that skills and training in supply chains and installation need to be an important parts of energy efficiency policy (Killip, 2013). Behavioural, cultural and institutional factors are also important in understanding the reason for under-investment in energy efficiency and in policy design.

For road and rail transport we have modelled the response of demand to economic and population change, as well as the negative feedback from congestion (Blainey and Preston, 2016). In fact, in our simulations self-limiting congestion is only avoided by decoupling demand from the economic and population drivers, which might be achieved by demand management. However, there is a risk that such demand management will lead to sub-optimal outcomes for the economy and the environment – we have not yet modelled these effects. It should also be noted that in many circumstances capacity investment and pricing are joint decisions, and the optimal balance between these will vary between contexts. The potential for demand management by limiting supply is noteworthy for modes where absolute limits on capacity apply (in other words where additional users can not attempt to use infrastructure which is effectively full), such as airports.

5: How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

In our analysis in ITRC using NISMOD we have incorporated operation as well as capital costs of infrastructure. However, we have not yet quantified the role of maintenance. Some worthwhile examples of this do exist, for example in the Environment Agency's Long Term Investment Scenarios (LTIS) which we are now incorporating within NISMOD (Hall et al., 2017b). LTIS models the deterioration of flood defences and triggers investment decisions when decisions when assets have deteriorated badly (Environment Agency, 2014).

6: What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

The ITRC's analysis of governance has explored the role of competition in infrastructure provision. In the right circumstances, competition has been shown to yield more efficient production, control costs and/or motivate innovation. However there are many instances within the infrastructure sectors where competition may not lead to the most efficient/cost effective/high performance solutions (for example where capital intensive assets and technologies exhibiting strong network effects lead to characteristics of a natural monopoly). Examples of the limitations of commercial competition in parts of infrastructure provision include the roll out of smart meters in electricity and the application of a franchising model to passenger rail services (e.g. mismatch between vehicle asset lives and franchise lengths led to additional organisations and misaligned incentives in vehicle provision). If competition is useful in an infrastructure setting, care should be taken to select appropriate mechanisms for competition for the sector, technology and processes being delivered. Mechanisms to co-ordinate and motivate the work of organisations without using competition can be more efficient in some circumstances.

Given the importance and long-life of infrastructure systems, it is often not an efficient use of resources to have more than one organisation developing knowledge or expertise that is either duplicated elsewhere or isolated from other complimentary knowledge bases (as might be the case if knowledge is being built for commercial exploitation in a competitive setting). There are opportunities for investment in the development and maintenance of common and cross-sector knowledge bases/sets of expertise that can be applied across sectors, supporting learning between sectors and offering the basis for tackling inter-sector interdependencies. The building up of knowledge/expertise can be located in several places, for example in universities, businesses operating across sectors (such as construction firms or management/engineering consultancy firms) and policy and regulation arenas (such as through the National Infrastructure Commission and UKRN) (Hiteva et al., 2016).

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

It is generally acknowledged that the introduction of a road user charging system where the cost of driving on a road varies by time, place, and vehicle type would improve the operational efficiency of the road network (Walker, 2011, Eddington, 2006). If the income from such a system was then allocated to offset the various externalities on which charges were based (such as congestion, air pollution, and infrastructure damage) it would also improve the financial efficiency of the network, providing that the implementation costs of the scheme were not excessive. Forms of user-based congestion charging already exist for air, rail and sea, meaning that the lack of such charges on the road system leads to serious market distortions.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

9: How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

The ITRC has worked extensively on analyzing risks and resilience of national infrastructure systems. Our approach incorporates:

1. spatial representation of climate hazards, for example flooding (Pant et al., 2017) and cooling water shortages for power plants (Byers et al., 2016, Byers et al., 2015),
2. analysis of infrastructure network performance during extreme events,
3. network disruption (Pant et al., 2016a),
4. interdependencies with other infrastructure networks (Thacker et al., 2017c) and
5. the indirect economic consequences of infrastructure failure (Pant et al., 2016b).

The methodology has been used to identify geographical ‘hotspots’ of infrastructure vulnerability, where a hotspot is defined as a concentration of infrastructure assets with a large number of users directly or indirectly dependent on those assets (Thacker et al., 2017a).

Analyzing potential failure scenarios and the direct and indirect economic consequences provides the starting point for making the business case to invest in resilience. It also helps to target

investments where they will most efficiently reduce the consequences of infrastructure network failure (Thacker et al., 2017b).

Our analysis of governance indicates that economic regulators may need to move beyond recent initiatives like the U.K. Regulators Network and towards more comprehensive and proactive collaborative arrangements. These could not only bring together economic regulators and relevant national government departments, but could also include other actors, such as environmental regulators (e.g. the Environment Agency), and different levels of government including Local Authorities. Working across levels of governance in this way will require rebalancing between the better co-ordination by central government and more context specific processes, resources and actions at a local level. Multi-agency organisations such as Resilience Forums (for example the Lincolnshire's Critical Infrastructure and Essential Services Group) at local and regional level, facilitate the development of closer relationships and cooperation between infrastructure providers (such as Anglian Water, CE Electric and British Telecom) and Local Authority bodies (such as local drainage boards) through regular meetings on the resilience of critical infrastructure along the coast. These meetings are thought to significantly improve the knowledge of infrastructure assets held by national government agencies. They could also help to build trust and facilitate the flow of information between local industry, infrastructure owners and local authorities, through activities such as the development of Information Sharing Protocols (Hiteva and Watson, 2016).

10: What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

The ITRC has developed an approach to infrastructure planning that examines the performance of existing infrastructure networks, the drivers of future need for infrastructure services and the alternative investments and policies that might be implemented to address those needs. That is closely aligned with the approach to the NIA that has been proposed by the NIC. Nonetheless, it represents a significant departure from conventional infrastructure planning practice:

1. Our focus is upon the assessment of the performance of national infrastructure systems as a whole, not the appraisal of individual projects.
2. We consider a wide range of possible scenarios of changing drivers of demand for infrastructure services. A straightforward but significant contribution has been the adoption of a set of consistent scenarios that are used across infrastructure sectors.
3. We have tested sets of alternative strategies for infrastructure provision, including investments and policy instruments.

This process is not intended to provide a deterministic masterplan for infrastructure delivery, but it provides a sense of direction, whilst being flexible enough to adapt to uncertainties. In our analysis of adapting cities to climate change, we have demonstrated how an 'adaptive pathways' approach can provide robustness to a range of future uncertainties (Kingsborough et al., 2017).

In our analysis for the National Needs Assessment study (ICE, 2016), we emphasised the importance of accompanying investments in new capacity with more vigorous action to manage demand. Approaches that emphasise efficiency, innovation and using existing assets more effectively are likely to have lower costs.

Our analysis of infrastructure governance has exposed how a range of potential economic, social and environmental gains could be made by strategic and positive infrastructure coordination between infrastructure sectors. Potential benefits include more coordination, greater information about interdependencies; and fostering greater trust between different stakeholders (public and private actors, and national, regional and local authorities). To realise these benefits, further co-ordination may be required between the individual sectors at multiple levels (international, national and local); the removal of regulatory and investment barriers to cross-sectoral infrastructure investment. For example, this could include further regulatory actions to ensure that innovation in smarter electricity networks and learning is sustained beyond the life of current regulatory incentives provided by Ofgem (which have included the Low Carbon Network Fund). Another example is the weakening of incentives for water companies to invest in on-site renewable energy projects because the costs of such projects cannot be recovered from water consumers, and they do not count towards some of those companies' emissions reduction obligations (Watson and Rai, 2013).

The evidence suggests that increasing the amount of engagement and consultation, and taking account of the views of stakeholders within infrastructure plans, can lead to more legitimate outcomes. Examples include research on low carbon infrastructure (Hiteva et al., 2017) and research on energy system change (Parkhill et al., 2013).

11: How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

The ITRC's analysis has analysed environmental impacts from two perspectives:

1. Taking environmental metrics as an output variable (the third pillar of the trilemma), by which alternative infrastructure strategies can be compared, alongside metrics of security of supply and cost.
2. Taking the environment as a constraint on the set of possible options. We understand that this is the approach that the NIC will take with the UK's legal carbon targets. We have taken this approach with respect to water abstraction licencing, though there is some ambiguity in how licences may change in future (Water UK, 2016).

We welcome the NIC's development of indicators of infrastructure performance, which we believe should be constructed around the dimensions of the 'trilemma': (1) security of supply, reliability, accessibility and quality of service (2) affordability and economic efficiency and (3) environmental impact and sustainability of resource use. We suggest in particular that environmental protection, including meeting statutory climate change targets (see Q11) should be central to any future national infrastructure assessments and plans.

Hiteva et al. (2017) argue that environment protection for low carbon infrastructure should adopt a holistic approach, taking into consideration trade-offs, network effects and integrated thinking in infrastructure. Since infrastructure underpins the choices and behaviours of decision-makers and users, they also argue that a more progressive approach could include a focus on outcomes (e.g. low carbon living) rather than being confined to the means to deliver such outcomes.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

Current CBA techniques contain plenty of flexibility to include multiple versions of valuation (including wide economic, social and environmental benefits) and to analyse programmes as well as projects and network effects. In practice, relatively few CBA studies make use of this flexibility. In part this may be because estimates of wide economic and environmental benefits are quite uncertain, and because of the complexity of appraising adaptive sequences of investments and policies (Young and Hall, 2015, Borgomeo et al., 2016). Our aim in the MISTRAL programme is to provide a platform and datasets that will make system-scale appraisal process more straightforward, whilst recognising inevitable uncertainties.

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

It is clearly impossible to predict with any certainty how travel patterns will change between now and 2050, as this depends on how a range of other factors change and play out over this time period, ranging from growth in population, through developments in technology, to the impacts of political events such as 'Brexit'. However, while definite predictions may be impossible, flexible modelling systems can be used to examine how travel patterns might change in future in response to a range of different future strategies and scenarios. This is exemplified by the ongoing research work being carried out by the ITRC using its NISMOD system, which has so far examined future travel patterns under 3 external scenarios (covering demographic economic change and fuel prices) and 7 transport strategies (covering technological development, infrastructure investment, and policy-related decisions) (Blainey et al., 2013, Hickford et al., 2015, Blainey and Preston, 2016). Further work is currently ongoing to develop a typology of transport strategy components, to permit more flexible investigation of transport futures using the updated NISMOD system.

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

With respect to urban and inter-urban transport there are no magic formulae. Each infrastructure investment is context specific (as WebTAG stresses), and each urban area will have specific transport needs. Furthermore, the quality and effectiveness of existing transport systems varies significantly from place to place, meaning that a bespoke approach will be needed in each case. It should also be noted that a focus on enabling accessibility might in some circumstances deliver a greater increase in productivity at lower cost than a more 'traditional' focus on enabling mobility through the construction of additional transport infrastructure. Investments in ICT infrastructure enabling virtual mobility to substitute for physical mobility may also prove to be of high value, particularly if combined with economic and fiscal policies which encourage flexible/home working. Agglomeration diseconomies should also be considered, including excessive specialisation (and a mono-cultural economy), adverse knowledge spill-over effects, congestion (London as a barrier for links within the UK and between the UK and Europe) and pollution.

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

See response to Q14

16. What opportunities does 'mobility as a service' create for road user charging? How would this affect road usage?

The answer to this question depends on what exactly is meant here by 'mobility as a service' (MaaS). As the recent Transport System Catapult (Transport Systems Catapult, 2016) report makes clear MaaS might be either based around private transport (and tantamount to car leasing with added value services) or multi-modal (and based around national and local public transport networks). There are also important distinctions depending on the balance between public and private sector involvement. Road charging would have most relevance for a MaaS system based around car sharing, whereas a public transport focused MaaS might deliver greater efficiency and environmental benefits. However, it is difficult to see how even a MaaS system based on car-sharing would create direct opportunities for road user charging unless the charging system that was applied meant that travel using MaaS vehicles was cheaper for the users than travel by private car and hence MaaS was used to overcome equity issues. For travel in congested areas (where the greatest benefits from road user charging might be expected) this would only be the case if the road user charging system applied to private cars as well as to MaaS vehicles, or if MaaS vehicles were charged a fee which was far below the full economic cost they imposed on society. This is because under the current system of road taxation the only charge perceived at point of use is the cost of fuel, meaning that drivers do not face any penalty for driving in highly congested areas compared to driving on uncongested roads, whereas with an efficient road user charging system vehicles would pay significantly more for driving in congested areas than in uncongested areas. This would mean that if the road user charging system applied only to MaaS vehicles it would be significantly cheaper to drive into a congested area using a conventional vehicle than to use MaaS. This means that MaaS is only likely to have a significant impact on reducing traffic congestion if time and place-variant road user charging is introduced for all vehicles using the road network. However, it is not obvious how the existence of MaaS would help overcome the political barriers which have previously prevented the introduction of comprehensive road charging. Even if such a scheme was introduced, then there is still a risk that a road-based MaaS system could in some circumstances make congestion worse by diverting passengers away from more space-efficient public transport systems. There is therefore a need for a multi-modal MaaS that encourages use of the most efficient modes at different times of the day.

17. What are the highest value infrastructure investments to secure digital connectivity across the country? When would decisions need to be made?

With constrained annual capital investment, there is a capacity-coverage trade-off in the delivery of digital infrastructure.

Gruber et al. (2014) make an assessment of the economic benefits of broadband investment across the EU and find that the overall future benefits outweigh the investment costs, but that the private sector is reluctant to invest because investors only partially appropriate the benefits. They suggest the public sector has a role therefore in subsidising the build-out of high speed broadband infrastructure. We believe this role should be focused at the bottom end of the market where the costs of delivery are unviable through normal market methods.

Near-ubiquitous coverage is important because past evidence of telecoms technologies has shown that the largest network externalities only accrue once a critical mass of infrastructure is present.

This critical mass has been found to be near universal service (Roller and Waverman, 2001). Hence, the true economic and social benefits of online content, applications and services only take place when practically all of the population can make use of them.

We believe large headline speeds are not necessarily required currently (e.g. 1 Gbps), based on existing bandwidth demand forecasting (Kenny and Broughton, 2013, Kenny and Kenny, 2011). However, deployment of high-capacity infrastructure (e.g. Fibre/FTTP) does provide a future proof solution, and if we do end up requiring this solution in decades to come, it would be cheaper in the long-run to install now.

The decision therefore needs to be made as to whether we (i) use a 'big bang' investment approach to digital infrastructure investment (with heavy state support), or (ii) use an incremental rollout of digital infrastructure, that sweats assets, uses minimal public funding, but may cost more over the long run as it will be a less efficient way to use available capital allocations.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

The question of 'need' is central. Economic theory implies that if there is a 'need' for specific goods or services, consumers will be prepared to pay for them. However, broadband services are widely regarded as having a 'broken value chain'.

Briglauer (2014) finds that the Digital Agenda for Europe targets can be best achieved by focusing on supply-side rather than demand-side policies. This includes deregulation, and encouraging favourable competitive market conditions.

However, Nardotto et al. (2015) finds no evidence that unbundling increased broadband adoption, except for in early years before the market reached maturity. The data instead found that inter-platform competition from cable always leads to market expansion.

This is comparable with the work of Oughton et al. (2015) who also found that inter-platform competition had the largest effect on network investment in the UK. Hence, encouraging greater inter-platform competition via expansion of the Virgin Media cable network (e.g. via Project eLightning) will deliver better quality digital infrastructure.

With regards to mobile, under current baseline scenario conditions, Oughton and Frias (2016) find that it will take significant time and resources to rollout ultrafast mobile broadband to rural areas if one wishes to deliver superfast broadband speeds (50 Mbps). While this may be a viable option using small cells in urban and suburban areas (if planning rules can be relaxed for deployment), wide area coverage in rural areas will be challenging to deliver data rates above 10 Mbit/s. In areas where there is spare capacity in infrastructure assets, infrastructure sharing is a viable option worth exploring (Ibid.).

Fund et al. (2016) undertook an economic analysis of spectrum and infrastructure sharing in millimetre wave cellular networks, concluding that 'open' deployments of neutral small cells serving subscribers of any service provider encourage market entry by making it easier for networks to get

closer to critical mass. Infrastructure sharing is one way in which the costs of deploying network upgrades can be reduced.

However, analysis by Ovando et al. (2015) of LTE rollout in rural areas shows that passive infrastructure sharing does not necessarily constitute a single-cost solution for meeting required coverage obligations in low population density areas, but sharing a single network does begin to make deployment more feasible for operators. A package of measures should be explored including market-based, regulatory and policy strategies to increase coverage and capacity.

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

For the ITRC's analysis we assumed decarbonisation of heat for one of our key strategies (Baruah et al., 2016). We exclusively looked at electrification of heat demand. On the supply side we looked at the options for supplying the increased electrical demand through Nuclear/ renewables/CCS. Supplying this demand was cheapest through building big nuclear plants and reinforcing a number of transmission lines (modelling output). With regards to when decisions need to be made, this was exogenous to the ITRC modelling.

Our broad conclusion from the ITRC analysis and subsequent work is that decarbonisation of heat using electrification as the only mechanism is very unlikely to be a cost effective or acceptable strategy (Eyre and Baruah, 2015). Not all buildings are suitable for electric heating systems. And even using efficient heat pumps, such a strategy would require at least an additional 40GW of power generation, all of which would operate at a load factor of less than 25%, much of it very much lower as it would only be used on the coldest days. This analysis concludes that strategies using more diverse fuel mixes will be more resilient and lower cost. Medium term options that are robust against uncertainty include greater use of biogas (although the resource is limited to a fraction of heat demand) and more concerted efforts to improve building efficiency and reduce demand (see our response to question 4 above).

However, there is currently no consensus on the optimum strategy for heat decarbonisation. We endorse the broad conclusions of the recent report of the Committee on Climate Change (Committee on Climate Change, 2016) to which we provided expert advice. We interpret the key conclusions as being:

1. There is a need to integrate heat decarbonisation and energy efficiency policies with increased urgency for energy efficiency in the short term.
2. There are some no regrets options for decarbonising heat, including the deployment of ground source heat pumps off the gas grid and the development of heat networks in urban centres.
3. That choices between hydrogen and electricity for decarbonisation of existing on gas grid homes need to be made in the early 2020s, with evidence collected to support the decision during this Parliament, including through trials.

It seems likely that hydrogen will form part of the optimum solution, but with uncertainty about the relative roles of natural gas (with CCS) and electrolysis in that process.

Within the MISTRAL programme we are extending NISMOD to explicitly represent local electrification and the potential role of heat and hydrogen networks. This will is being achieved through the development of a local Energy Hub model, which is embedded in our national CGEN+ electricity and gas model.

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

The ITRC analysis did not examine this question specifically, though the Committee on Climate Change has done extensive analysis of this question (Committee on Climate Change, 2015). The question is however cast rather narrowly in that it exclusively talks about the 'power system'…..if we assume that heat is not electrified, we then have a system that has similar demands (possibly lower – through demand side management/efficiency) than today. This would be an ideal situation when attempting to get to a near 'zero carbon power system', but would not be sufficient to achieve a near zero/low carbon 'Energy' system.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

From a supply perspective this 'might' lead to a large increase in electrical demand on the system. In some of our scenarios electric vehicles were projected to represent 10-12% of electricity demand by 2050 (Hall et al., 2017b, Baruah et al., 2014). This increase in demand was included in our analysis of production and transmission infrastructure requirements, but not distribution.

The implications of charging electric vehicles depend on when they are charged. In the ITRC project we did not explicitly explore the possibility of optimising charging times during the day/night. This will be addressed in the MISTRAL project, alongside explicit consideration of intermittency in renewable supplies (wind, solar, tidal) and hence the probability of insufficient supply.

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

The interventions that can be used to improve security of water supply are all well-known:

- technologies and behavioural options for demand reduction;
- reduction of leakage, the cost of which will be assisted by technological innovation;
- abstraction reform to allocate water more efficiently and safeguard the aquatic environment
- new and enhanced supplies from surface and groundwater, including groundwater recharge, surface storage and inter-basin transfers; wastewater reuse; desalination

In our analysis for ITRC (Simpson et al., 2016) and in other research studies (Borgomeo et al., 2016), we have explored the full range of options, as have Water UK (Water UK, 2016). The more challenging issue is how to:

1. sequence interventions so that they cost-effectively and adaptably provide security of supply; and
2. ensure that the interaction between a growing number of actors in water supply and use does not lead to systemic risks at times of stress across the whole system.

We are proposing the reform of Water Resource Management Planning so that it more explicitly deals with the trade-off between affordability and security of supply (Hall et al., 2017a). We are also beginning to develop national synthetic drought event sets that can be used to stress test the nation's water resource systems, including interdependencies and interactions.

In related research we have analysed the demand for cooling water by the power sector in order to analyse the risks of cooling water shortage (Byers et al., 2014, Byers et al., 2016, Byers et al., 2015). Ongoing research funded by EDF is exploring the possibilities for optimising the interplay between intermittent energy supplies and energy use in the water sector, including possible energy storage and load-shedding.

Over the coming year we will include agricultural abstractions (Rey et al., 2016) alongside public water supply and industrial/energy abstractors, to understand better the interplay between different abstractors during times of drought.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

Demand for sewage transfer and disposal is a simple function of population and per capita water use. However, most sewers are also used for storm water drainage so are sensitive to intense rain storms. Because of the complexity of rainfall patterns and runoff in urban areas, analysing sewer capacity and the conditions under which that capacity will be exceeded requires high resolution modelling. In the MISTRAL programme we are combining synthetic rainfall generation with high resolution modelling of sewer and surface flows (Glenis et al., 2013). We have developed broad scale methods based on the Drain London datasets to simulate the changing risk of surface water flooding for all of London (Jenkins et al., 2017). This analysis also explored the potential for reducing flood risk through retrofitting of Sustainable Drainage Systems (SuDS). In our assessment of waste water systems (Manning et al., 2016) we estimated the costs of different rates of sewer replacement.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

In a previous submission (ITRC, 2016) we have argued for a more integrated approach to the natural environment. Many of the services that infrastructure networks deliver rely upon the natural environment: rivers and groundwater for water supplies; uplands and floodplains for the regulation of flooding; water bodies for the assimilation of treated sewage effluent; the land for the provision of biofuels and spreading of sewage sludge etc. The natural environment cuts across infrastructure sectors, notably water and flood risk management, but also energy and solid waste. 'Blue-green infrastructure' can potentially substitute for 'grey infrastructure' in several respects: recharging groundwater avoids the need for storage reservoirs or desalination; natural flood management can reduce some of the risk of flooding; sustainable drainage systems (SuDS) can reduce the need for piped drainage infrastructure; restoring uplands can reduce discolouration of water supplies and avoiding diffuse pollution from agricultural land can improve the quality of rivers, both of which avoid costly water treatment costs for public water supplies.

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

The concept and terminology of "resilience" is helpful in that it emphasises the importance of a system's capacity to cope with and recover from extreme events like floods. However, the term "level of flood resilience" is not generally understood. The concepts and quantification of risk is much more prevalent in decision making regarding flooding. If properly conducted, risk analysis evaluates not only a systems capacity to resist flooding, but also the effectiveness of coping strategies and the full costs of recover (see for example (Beven and Hall, 2014, Hall, 2011, Crawford-Brown et al., 2013). The amount invested (in the broadest sense) in flood risk reduction should be determined by the cost-effectiveness of risk reduction (Hall et al., 2012a), taking into account projected future changes and associated uncertainties. A given design standard (e.g. 1:200 years for urban areas) provides a very rough guideline but it would be unwise to rigidly adopt any such target because (i) the costs and benefits of flood risk reduction can vary significantly, so a prescribed design standard will not result in efficient allocation of resources and (ii) focussing upon the standard of protection neglects alternative cost-effective steps that might be taken to reduce flood risk, for example though land use planning, property level protection or flood forecasting and warning (Hall et al., 2003).

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

The merits and limitations are reviewed in the following, soon to be published paper: Dadson et al. (2017)

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

Long term treatment capacity: It is not clear whether or not the UK has sufficient long term treatment capacity. Eunomia predict that there is sufficient capacity (Goulding, 2016b), though this view is not universally held in the industry. In 2016, 3 million tonnes of RDF were exported to incinerators in Northern European (primarily, Netherlands, Germany, Sweden and Denmark) where there is overcapacity (Goulding, 2017). It is likely that this overcapacity will reduce over time as old plant comes off line. It is not clear when this will happen or if new capacity will be built or if the post-Brexit UK will have access to this market hence leading, potentially, to a major shortfall in thermal treatment capacity. However this may be offset by continuing reductions in waste arisings (Watson and Powrie, 2014).

Regulatory incentives: Removal of ROCs for AD under 5MW in 2013 may well have acted as a brake on further investment in small AD and the planned cap on FiTs for AD > 500kW may make large AD less attractive (Moore, 2017). Holder (2015) was told that the government incentives - RHI, ROCS (for gasifier) and FiTs (for AD) - are the third most important revenue stream (for a plant taking black bag waste and treating by sorting to remove recyclates, digesting the organics using AD and gasifying the remainder), behind gate fees and power sales, but ahead of recyclate sales. This position may be changed if the planned reduction in FiTs for large AD is introduced.

Financing innovation: There has been a great deal of investment in gasification despite the contrary recommendations in the Defra New Technologies Demonstrator Projects (NTDP) (Powrie, 2011, Pugh et al., 2011). Despite this, there have been multiple failures of companies and difficulties with

the technology (e.g. (Goulding, 2016c, Goulding, 2016a, Date, 2016). Eunomia (2016) suggest that despite these difficulties, the take up of gasification is likely to increase.

Landfill objectives: The objectives for landfill come primarily from the Landfill Directive, and are to reduce the amount of biodegradable waste going to landfill in order to reduce methane emissions. The main mechanism for achieving this in the UK has been the landfill tax and the landfill tax escalator. The objective has been achieved with amounts of waste being landfilled having fallen faster than required by the Directive (e.g. (Date, 2016)). The unintended consequence of this has been to reduce the revenue obtained from landfill (due to reduction in both amount of waste being received and gas generation per tonne of waste decreasing) and hence the landfill business is becoming unsustainable. This has led to some of the major players leaving the industry and to a funding shortfall for the long term management of landfill (Beaven et al., 2014). It seems likely that there is a long-term requirement for landfill in the UK and that an alternative funding mechanism will need to be developed (Watson et al., 2016, Watson and Powrie, 2014). Other issues arising from landfills include the redevelopment of land (e.g. housing & HS2) and pollution risks.

Recycling objectives: The increase in UK recycling has slowed and in some areas, stopped. Wales is the only nation on target to meet the 50% 2020 recycling target. It seems likely that this is due to a variety of reasons (e.g. (Morton and Read, 2017) some of which e.g. LA price cutting leading to reduced communication budget contributing to confusion/disinterest amongst consumers). It is possible this will need to be incentivised more effectively, possibly by increasing producer responsibility.

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

Principal barriers:

1. Design which fails to incorporate the principles of the waste hierarchy (Curran and Williams, 2012) for:
    i) Reduction,
    ii) Reuse,
    iii) Repair,
    iv) Refurbishment,
    v) Remanufacturing,
    vi) Recycling,
2. Accessibility and availability of facilities to undertake and perform the 6 “R’s”.
3. Recoverability and separation of materials (recovery rate and quality of recycled materials).
4. A market and demand for products and materials recovered using the 6 “R’s”.

Foreign markets for recyclates are becoming increasingly selective so quality needs to increase (Morton and Read, 2017). Better design and improved education/communication would help. Domestic industries could create more sustainable markets for recyclates.

The benefits would be:

1. Less reliance on imported raw materials
2. Less waste (with associated disposal costs)

3. Significant economic savings (e.g. (Ellen MacArthur Foundation, 2017))

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Response from Joint Radio Company (JRC)

4. QUESTIONS

The questions that the Commission has identified to assist respondents in focusing their submissions to this call for evidence are set out below:

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long-term sustainable growth in your city or region?

Note: this can apply to national, regional or local infrastructure, where you consider it would best support sustainable growth in your city or region in practice. Considerations of "highest value" should include benefits and costs, as far as possible taking a comprehensive view of both.

JRC highlights that almost every product and service offered to the UK's 68 million citizens, consumers, and businesses rely directly or indirectly on the stable provision of electricity and / or gas[1] by the UK's Critical National Infrastructure[add CNI footnote here] Utility Operations.

Highest value: JRC therefore suggests that the value of the electricity Smart Grid will be at least equal to the sum of values that are created by its use (+VAT).

Benefits: the increasing number of distributed generation sources, e.g. wind turbines, being connected to the current electricity grid is placing an increasing strain on maintaining the stability of the network. The benefit of investing in the rolling out of the electricity smart grid will be that the likelihood of significant power outages will be reduced, and the time to restore the network when faults arise or it suffers damage is greatly reduced.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.

JRC suggests that smart electricity metering as implemented in Great Britain may not be as useful for the control of the electricity smart grid as may be assumed. This is because the architecture of smart metering in GB may not be able to deliver adequate data on a timescale appropriate for real-time control of the electricity network. The electricity smart grid is already expected to monitor local area low voltage, 240 / 400 volts, sub-stations and alert the associated control centre immediately if the power to or from it were to be lost. There is therefore little value

[1] Gas is used to generate typically 50% of the UK's electricity (Source: Grid Carbon)

seen in receiving subsequent last-gasp power loss alerts from wide scale outages when the fault is already known and being managed. (Ideally, the smart grid will recognise a power fault in an area and automatically re-route power from an adjacent area in a few seconds, but definitely within the target timeframe of 3 minutes) The main benefit from smart meters in the GB scenario is to identify interruptions to small numbers of consumers which is not picked up by substation level alarms, and to confirm re-connection of all consumers following a fault where sometimes a second fault on a network is masked by the first.

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?
Note: this includes resilience against external risks and/or problems that arise in one or more parts of the system.

Resilience requirements necessitate that existing electricity and gas grids are controlled by private resilient SCADA (supervision, control, and data acquisition) networks. These SCADA networks are increasingly being referred to as private resilient machine to machine (RM2M) networks (and occasionally as private resilient Wireless Multi-Point / WiMP networks). There is a risk that these private RM2M networks could be confused with the generic / sales term of machine to machine (M2M). This could lead to the incorrect belief that public mobile M2M networks will be suitable for RM2M systems.

It should be noted that public mobile systems have been operating, and incrementally upgrading, since the mid 1980's. Despite these on-going improvements (primarily focussed on improving the public's requirement for broadband data), for various technical and operational reasons, the use of public mobile networks remains ruled out for controlling electricity grids. (Other nations including Germany, The Netherlands, and China have already come to the same conclusion and are now deploying dedicated 'Utility Grade' wireless systems to support smart grid functionality).

JRC further highlights that the term IoT refers to the Internet of Things (a different technology to M2M). Whilst this technology could be used for private RM2M networks, the roll-out of IoT systems for public use will not be suitable for electricity smart grids.

Digital communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)?
When would decisions need to be made?

JRC suggests that the highest value infrastructure investment will be the eventual roll-out of the electricity Smart Grid. This is because electricity will be required at every point of the digital communications fixed infrastructure.

JRC further suggests that the **highest value infrastructure investment** will be the allocation of suitable resources to enable the roll-out of the electricity Smart Grid. The scarce resource that is most eagerly sought is access to the private radio spectrum held by Ofcom.

It should be noted that, whilst the UK's public mobile phone companies will soon have been allocated ~840 MHz of spectrum by Ofcom, the UK's critical national infrastructure utility operations have only been allocated 2 MHz of radio spectrum (actually, 2 x 1 MHz. Used for separate transmit and receive channels). This very small allocation needs to be increased to 2 x 3 MHz of spectrum in the 400 MHz band (this band continues to be preferred because the radio transmission infrastructure is either in place already or can be added with relatively low cost). There is also a requirement for 10 MHz of spectrum in the 1350/1400 MHz band, and 2 MHz of spectrum in the VHF band. (These allocations of spectrum will enable, inter alia, the most appropriate resilient private SCADA / RM2M control systems to be rolled out. As now, these systems will be long-term technology solutions rather than the perceived ever-changing public mobile technologies.)

As a priority, a speedy UK decision to allocate 2 x 3 MHz (6 MHz) of useable spectrum within the 400 MHz Band (380 to 470 MHz) needs to be made so that the Smart Grid(s) may be planned with a certainty of gaining the necessary access to suitable spectrum.

For information, perhaps surprisingly, the existing resilient SCADA / RM2M systems typically use 12.5 kHz narrow band channels rather than the MHz-wide broadband channels necessary for public mobile systems. This is possible because the typical SCADA data rates are only 9.6 kbit/s to the remote electricity sub-stations, etc. It is, however, expected that Smart Grids will require an increase in data rates, and channel widths, from 9.6 kbit/s in 12.5 kHz to 64 kbit/s in 25 kHz narrow band channels. Unfortunately, there is currently no available spectrum in which to roll-out these systems. An independent study by the European Utilities Telecom Council (EUTC) identifies that 2 x 3 MHz of 400 MHz Band (380 to 470 MHz) spectrum will be required.

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?
Note: the existing "regime" refers to the current market, competition and planning frameworks. "Digital communications" includes both fixed and mobile connectivity.

JRC highlights that the proposed digital communications system may not be suitable for all types of communications. For example, the electricity smart grid will need to remain isolated from any public mobile or public Internet connections. This method is seen as the most effective resilience method of preventing attacks to the grid control networks and service denial thorough malicious system overloading.

Energy:

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?
Note: the "zero carbon power sector" includes the generation, transmission and distribution processes.

A 'zero-carbon' power sector would need more dynamic monitoring and control of a greatly increased number of geographically-dispersed points on the networks. This monitoring and control would be of a critical nature requiring specialised functionality such as mains electricity power resilience, low latency and guaranteed asymmetry. These functions are provided most cost effectively, quickly and flexibly by radio networks, but these networks require access to small suitable quantities of radio spectrum. Thus, an effective zero carbon power sector in 2050 will look like the banking sector in terms of its critical reliance on ICT in order to function.

Joint Radio Company

JRC Ltd is a wholly owned joint venture between the UK electricity and gas industries specifically created to manage the radio spectrum allocations for these industries used to support operational, safety and emergency communications. JRC also represents gas and electricity interests to government on radio issues.

JRC works with the Energy Networks Association's Future Energy Networks Groups assessing the ICT implications of Smart Grids, Smart Meters, and Smart Networks.

JRC and the utilities manage a significant number of fixed, mobile, and satellite links to UK-wide critical national infrastructure and is keen for their protection and the on-going access to the frequency bands in which they operate.

Indeed, access to appropriate private radio spectrum in the coming years will be critical for the intended roll-out of Smart Grids.

The VHF and UHF frequency allocations managed by JRC support telecommunications networks to keep the electricity and gas industries in touch with their network assets and field engineers throughout the country. The networks provide comprehensive geographical coverage to support the operation, installation, maintenance, and repair of plant in all weather conditions on a 24 hour/365 days per year basis.

JRC's Scanning Telemetry Service is used by radio-based System Control and Data Acquisition (SCADA) networks, which control and monitor safety critical electricity and gas industry plant and equipment throughout the country. These networks provide resilient and reliable communications at all times to unmanned sites and plant in remote locations to maintain the integrity of the UK's energy generation, transmission and distribution.

JRC also manages blocks of VHF and UHF spectrum for Private Business Radio applications, telemetry & tele-control services and network operations. JRC created and manages a national cellular plan for co-ordinating frequency assignments for a number of large radio networks in the UK.

A 2050 vision for Kent

Technological advance has, and is likely to continue to grow at a rate that, if utilized and developed as an integral part of a multi-functional, system approach to infrastructure, could transform the way we live, work and travel by 2050.

Enabling this smart infrastructure requires an equally ***smart approach*** to infrastructure:

1) The infrastructure needed for the future

Smart, networked transport for the future - By 2050, the capacity that we are planning for now will have already been exceeded – by 2050, demand will be such that we will need not one, but two, Thames Crossings in the East. Smart and multi-functional infrastructure that incorporates latest technology for capacity management will be in place along main corridor in Kent; a smart highway/motorway bifurcated corridor through Kent with a networked series of lorry parks with the technology to efficiently stack and manage flows of traffic will be managing fright flows. Enhanced rail capacity for freight and passenger will be developed and we have already made the case for Crossrail extension to Ebbsfleet, by 2050 a thriving community and business destination, but if we are looking to the future, we should be considering Crossrail to our other Garden Town in Otterpool.

Digital connectivity for tomorrow, not yesterday - Digital infrastructure will form the bedrock for driving Kent's and the UK's prosperity and supporting innovation and smart infrastructure. Digital connectivity for 2050 needs to be prepared in its capacity and capability to anticipate change, to ensure that we remain competitive. There is need now to implement stronger incentives and regulations to ensure that new development is taking this new connectivity into account and driving innovation in the provision of digital connectivity.

A robust national energy infrastructure supported by local solutions - An integrated circular energy 'system' that is balanced and provides energy that is affordable, environmentally sustainable and secure will be in place, where energy is generated as well as used, connecting the whole community - homes, businesses and cars. Smart and flexible, it will provide and use energy only when it is needed and as close to the customer as possible to minimise transmission waste and maximise use of waste heat. It will harness its surroundings and renewable energy potential, utilising storage to make the most of this generation.

2) A smart approach to how we fund/deliver infrastructure

Smart cities, towns and infrastructure – Given network constraints and the funding challenges set out above, delivering today's infrastructure for 2050 is simply not sustainable. The infrastructure of 2050 will, by necessity, be "smart" and maximise our ability to manage demand and use through technological advances, creating growth that is highly response and networked. To achieve this smart infrastructure of the future, partnership working across public and private sector with local communities, and with Government, needs to be incentivised to enable the use of cutting-edge information technology to manage assets and infrastructure technologies– allowing the future-proofing of the digital technology of tomorrow.

From silos to multi-functional infrastructure – With the pressures of growth and the urgent need for multiple infrastructure to support the growth of sustainable communities, government and infrastructure providers at all levels will need to maximise the value of infrastructure and make as efficient as possible its installation. From the use of green infrastructure in flood management to the use of solar highways to power electrical needs, an integrated, cross-sector policy approach will be fundamental in maximising the efficiency of infrastructure of the future.

Foreword

Dear Lord Adonis,

Kent County Council (KCC) welcomes the opportunity to respond to the National Infrastructure Commission (NIC)'s call for evidence to inform the National Infrastructure Assessment (NIA). KCC considers the NIA a critical opportunity to help unlock the barriers to the delivery of such infrastructure and in the process, shape the fundamental prospects for sustainable growth across the UK.

In the current climate and in the medium term, the UK faces a fundamental infrastructure challenge; in the NIC's time horizon to 2050, this challenge becomes an outright crisis. From the drastic shortfall in funding to the fragmented and consequently overly bureaucratic approach to delivering infrastructure, the UK's approach to delivering infrastructure to support growth is fundamentally broken.

The County Council has long understood that unlocking the right infrastructure is fundamental in the delivery of sustainable growth. In 2015, KCC published the Kent & Medway Growth and Infrastructure Framework (GIF), a first of its kind assessment of the predicted levels of housing and economic growth for the county and the full complement of infrastructure needed to support this growth – a holistic look at roads, rail, health and social care, education, green infrastructure, utilities and flood defences. **We have an ambitious growth agenda –** for 158,500 new homes, 293,300 new people and 135,800 new jobs within the county between now and 2031. Whilst providing a useful tool for local partners to effectively identify infrastructure priorities and secure investment, the GIF analysis unveiled stark realities, including a significant gap between the funding required and that anticipated/secured from central government, developer contribution and other investment. Of the £6.74 billion investment needed, a third (£2.01 billion or £118 million pa) was still required to support the growth ambitions. This represents a **current infrastructure funding gap of 68%** - a gap which will not be that dissimilar across the UK.

Left unaddressed, this infrastructure challenge will fundamentally stifle the potential of Kent and other parts of the UK to deliver the kind of sustainable and productive growth that the Government is so keen to drive forward.

In the face of such unprecedented levels of growth, we share the NIC's ambition of catering for that growth in a sustainable way, supported by the right infrastructure at the right time. The need for a robust response to this pace of growth is currently at crisis point, and the way in which we as a country have delivered infrastructure up to now has effectively failed. We have the opportunity now with the NIC to consider how we approach infrastructure challenges and growth opportunities in a an efficient and agile way, which will be crucial in ensuring that we can anticipate and cater for the population rise and housing growth forecast ahead, to 2050.

A future vision of how Kent and the UK could accommodate growth, in a way that provides well designed, highly functioning environments and communities, can only be achieved if a new approach is taken to overcome the problems and to optimise the opportunities that we highlight in the attached submission. The problems are significant; nonetheless, the solution could be relatively simple, if a bold approach is taken to ensuring that funding and delivery, that are streamlined and flexible and long term, are progressed.

Efficient and effective funding and finance – The challenge of funding infrastructure in the long term is one that requires a fresh and far simpler approach to the current model. Across all of the key infrastructure classes identified by the NIC, there is a role for Government in pump-priming and forward funding strategic infrastructure to unlock growth effectively, which once delivered, will effectively repay the Government's investment. At the same time, there is a need to empower local highways and education authorities, as well as local planning authorities, to play a more effective part in supporting nationally strategic infrastructure – whether that is in more flexible deployment of developer contributions or in the delivery of local energy generation and storage.

3) Effective strategic planning to drive innovation and robust infrastructure

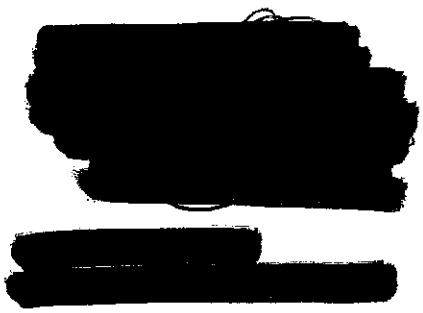
Strategic planning mechanisms – Fundamental to delivering the infrastructure of 2050 is the need to enable infrastructure providers and planning authorities to flexibly respond to the market and more effectively link infrastructure provision to new growth. Strategic planning at the right geographical level is a necessity for integrated and sustainable delivery of growth, linking planning for housing and infrastructure provision. Planning reform could provide an integrated policy approach for funding, and powers and flexibilities for councils to have confidence in borrowing, to enable the financing and delivery of strategic development.

Embracing and extending the New Town model - Planning freedoms will enable sustainable growth via the creation of more new town and village developments in Kent, following on from the successful community established at Otterpool Park. Strong strategic planning will lead to better spatial planning linked to infrastructure opportunities, rather than being aligned to district boundaries.

Kent County Council looks forward to the opportunity to work with the Commissioners as work on the National Infrastructure Assessment develops. We are keen to have further detailed follow up discussions with you, to share and discuss the research, evidence and suggested approaches all the key themes that you are currently targeting.

I look forward to working with you as the work of the NIC progresses.

Yours sincerely,



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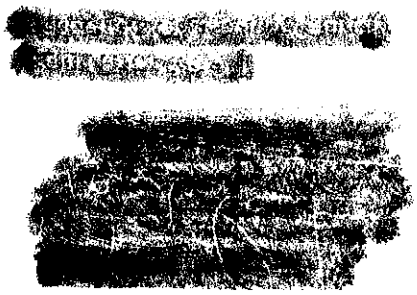

1) Welcoming the national focus for growth in Kent (Q's 1-12)

Kent plays a critical role in the wider UK economy and geography, as **a strategic international gateway** but also as an **important economy in its own right** in relation to London, with strong links both in business trade and labour markets. In this way, it occupies a particularly strategic position vis a vis the UK's ambitions to drive up productivity and the competitiveness of the national economy. Kent has the potential to facilitate an average of 10,800 HGV movements a day through the channel (4 million per annum) and 23 million passengers a year). £220 billion of trade per annum passed through the Channel Ports in 2016[1].

The **strategic importance of Kent has been recognised by successive Governments** over the years with a succession of initiatives designed to facilitate growth in the county, including the designation of North Kent as part of the Thames Gateway, the creation of Ebbsfleet Garden City led by a new Development Corporation and the selection of Otterpool Park as Garden Town. The recent establishment of the Thames Estuary 2050 Growth Commission, looking at the transformational growth potential of North Kent and extending to Canterbury and Thanet districts, offers further recognition that Kent and Medway has an important part to play in shaping the economic future of London and the South East. Kent boasts a number of strategic locations that benefit from the excellent rail connectivity provided through High Speed One and Eurostar, and with future investment into enhancing the strategic transport corridors, there is huge potential for much more development to be brought forward to meet the growth forecast in current and emerging district Local Plans, the Kent and Medway Growth and Infrastructure Framework (GIF), and beyond to 2050. Ebbsfleet is to provide an anchor for business growth, and Chatham Maritime university campus, Rochester Airport Technology Park, the Kent Science Park (south of Sittingbourne), the University of Kent and Canterbury Christ Church University campuses in Canterbury and Discovery Park at Sandwich are a selection of sites that are all attracting higher value employment and businesses, with scope for innovation and housing into Kent.

Technology, combined with better connectivity, is disrupting the traditional economic geography of the UK, and creating new opportunities for growth. There are particular opportunities for Kent to benefit from the growth of London's digital economy, which represents one of the world's largest and fastest growing digital clusters. The reach and influence of this cluster already extends beyond the traditional London/urban economic geographies and businesses located in Kent are already participating, virtually, in this digital economy. Growing this participation is dependent on having access to good digital infrastructure. The County Council views **digital infrastructure as the bedrock for driving Kent's and the UK's future prosperity and supporting wider innovation** (including smart infrastructure). Due to the speed of digital innovation, it would be impossible to predict the digital infrastructure requirements in ten years' time, let alone by 2050; however, it is possible to introduce greater flexibility and capacity into our current infrastructure to allow future modernisation, and specifically 'design principles' in the delivery of digital communications infrastructure that anticipates and allows for future needs so it is not a constraint on future innovation, technological adoption or productivity. For example, the rollout of superfast broadband has lagged behind the need for this infrastructure in too many areas. Also, there is recognition of the need, for the ubiquitous and fast rollout of these new emerging technologies beyond cities and large metropolitan areas where much of the Government's focus for investment has been in recent years. Kent's important agricultural/horticultural sector is increasingly dependent upon having digital connectivity.

Vital to this ambition for growth is the role of infrastructure, and as such, Kent County Council (KCC) welcomes the opportunity to comment in this current call for evidence. This submission sets out some areas for the National Infrastructure Commission to address in ensuring that the main infrastructure challenges facing the country are understood. In its response, KCC is setting out several key messages which it feels are fundamental to the infrastructure challenge currently facing the UK:

- **Sufficient, well planned and well timed infrastructure is vital to the Government's ambitions for housing & commercial growth** – the GIF goes some way to articulate this
- The solution to effective nationally strategic infrastructure is in part about **empowering local infrastructure to support such national infrastructure;**
- The current model used by Government to support the delivery of nationally important infrastructure are **not fit for purpose:**
    - The risk of developing the business case for investment in major infrastructure is **disproportionately with local authorities and developers;**
    - The **approach to funding infrastructure is fragmented and siloed**, such that the partner driving growth – often the local planning authority and the developer – spend

The remainder of this submission addresses key points raised by the questions posed by the NIC in its call for evidence. It combines questions into key points and references questions in the section headings.

2) Addressing the infrastructure challenges (Q's 5-12)

2.1 The scale and pressures of anticipated growth in Kent

Kent is growing rapidly. In 2015, KCC published the GIF, a first of its kind in assessing the predicted levels of housing and economic growth for the county and the infrastructure needed to support this[2]. A 2017 Update is currently being compiled and the County Council will be providing the Commission with the evidence that underpins this new document as it emerges through the year.

Table showing growth to 2030 *(using 2015 and 2017 GIF figures)*

Calculation	2015	2017
New homes	158,500	**172,600**
New people	293,300	**381,800**
New jobs	135,800	135,800 *(2016 interim figures)*
Total infrastructure funding gap	£2,007,520,000	£2,247,650,000 *(2016 interim figures)*
% of infrastructure funded	70%	68% *(2016 interim figures)*

The County Council has long understood that unlocking the right infrastructure is fundamental in the delivery of sustainable growth. The GIF was a first of its kind assessment of the predicted levels of housing and economic growth for the county and the infrastructure needed to support this. This work has enabled KCC to understand to a new degree the scale and geography of the required infrastructure and a way forward in addressing this problem. The GIF analysis has shown a significant gap between the funding required and that anticipated/secured from central government, development contributions and other investment. In fact, of the £6.74 billion investment needed, a third (£2.01 billion or £118 million pa) is still required to support the predicted number of homes, people and jobs forecast for 2031. With new 2017 figures so far showing a rise in population and housing numbers, the funding gap is likely only to widen. The table demonstrates an increase in housing growth figures from 2015 to 2017, and it is anticipated that figures concerning new jobs and the **total infrastructure funding gap will also increase.** CLG's national household projections show that Kent and Medway should be meeting **an annual target for housing delivery of 9,064 per annum - almost**

[2] KCC's GIF (September 2015) can be accessed via this link.

twice the average rate of completions for Kent and Medway when looking at the period 2011-2015[3]. The population figure extrapolated for Kent for 2051 is 2,573,900, with housing presented at 1,063,000.

Migration is the main driver of population growth for Kent. Between 2003 and 2015, population in Kent increased by 175,700, of which 74% was a result of net inward migration. The majority of people who move into Kent come from London - in the last year, this was 23,200 people (equivalent to 28.4% of internal in-migrants). There will be continued pressure from internal migration on Kent's population figures, with particular focus of pressure from London.

We need well-designed, safe, healthy and confident communities – **a 'one size fits' all approach will not work.** We need to recognise the diverse range of communities in planning for growth. There is a critical role for infrastructure in boosting the productivity of areas of deprivation, by connecting communities in areas of deprivation to areas with greater affluence and economic opportunities, whilst equally encouraging business investment in the former. Kent has some of the most deprived and most affluent communities living adjacent to each other. A ward located in the Thanet District is ranked 4th most deprived out of 32,844 in England; whilst one in Tunbridge Wells Borough is ranked 32,728th[4].

The GIF takes a bold approach in identifying the infrastructure challenges in Kent; through using the evidence base to shape the infrastructure agenda and in identifying actions to tackle barriers to infrastructure delivery. There are cross-cutting challenges around the funding and delivery of infrastructure to enable sustainable growth in Kent, with **a real need to draw out and address what essentially is a broken system of delivering infrastructure in the UK.** We need solutions to the viability gap that is impeding timely and sustainable delivery – in many cases this is down to site-specific issues of infrastructure deliverability, in the context of the market more generally still being unable to deliver. The lack of supply of skills in the construction industry, for instance, is a real challenge for housebuilders[5] and needs to be boosted The scale of unimplemented planning permissions in Kent[6] – not unlike authorities across the country – demonstrates that whilst there is significant growth permitted already, there remain fundamental barriers in the systematic and robust delivery of infrastructure to support the build out of these permissions. The **GIF identifies key areas for change, which are developed and evidenced in this consultation response.**

2.2 The role of collaboration and competition *(Q6)*

Collaborative, cross-sector forward-planning is vital to aligning infrastructure with growth: This is true across sectors and has been a key outcome of the County's experience with the GIF. For instance, from KCC's experience around water utilities, a collaborative approach in the alignment of local authorities' development plans and the development of the water companies' statutory 5-year capital plans is essential in ensuring the identification and provision of necessary capital investment required to accommodate forecasted growth. Alignment is required between long-term planning models for all sectors, including transport, digital, water and waste.

Equally, the recent introduction of a Medway Flood Partnership to enable a collaborative approach across the Environment Agency, local authorities and other key partners to supporting flood risk and watercourse management to the Medway River catchment has been borne out of the need to ensure that multiple capital investment programmes are aligned with local planning polices and timeframes, as well as highways authority investments.

In freight management, KCC has engaged very positively in the cross-sector Strategic Freight Group. It will bring together the relevant partners and agencies to work collaboratively to consider the medium to longer term issues and potential solutions to managing and/or preventing freight congestion around the Port of Dover and Eurotunnel. The key outcome will be a shared narrative for priorities, opportunities and threats for the management of freight in Kent. The group includes MPS, DfT, Ports, District Councils, Police, Trade Association, Lorry park operators

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[3] KCC's 'Housing Information Audit Kent Local Authorities – Residential Land Supply 2015/16' (Oct 2016)

[4] KCC's 'The English Index of Multiple Deprivation (IMD 2015): Headline findings for Kent' (Sept 2015) can be accessed via this link.

[5] David Thomas, Chief Executive of Barratt Developments, (The Guardian, 13/1/2016)

[6] As at March 2016, there were **31,877 units** not started in the County (not including Canterbury, Gravesham and Shepway) – this includes all permissions for sites, including for single units and outline permissions.

Examples of collaboration: KCC fully promotes collaborative working with relevant stakeholders to provide infrastructure in Kent. A good example of this collaboration was the County Council's work with Ashford Borough Council to support critical signalling improvements at Ashford International Station to enable the new fleet of Class e320 Eurostar trains to stop at the station. This required joint, collaborative working across stakeholders including KCC, Ashford Borough Council, Network Rail, Eurostar and HS1, to be awarded £4.8m in additional funding from the South East Local Enterprise Partnership to provide the critical gap funding to progress this project.

As another example, KCC is also working with the private sector to look into the feasibility of delivering a number of lorry parks across Kent to accommodate demand for such parking. With such high volumes of HGV traffic to and from the Ports, there is a high demand for both short and long term overnight parking which outstrips the supply of suitable lorry parking. As a result, the County Council conducted parking surveys into inappropriately parked HGVs across Kent and found between 500 and 800 vehicles parked inappropriately overnight in Kent[7]. This evidence is underpinning a feasibility study into the potential for developing additional lorry parks to enhance the existing supply. In exploring the opportunities for such additional parking, KCC is seeking to identify market failures and consequent solutions, and in the process, engaging with existing private sector providers as well as Highways England. The latter relationship is critical in informing a complementary work-stream to improve enforcement capacity of local partners to enforce against inappropriate lorry parking.

2.3 The need for change in funding policy *(Q7)*

Fundamental to overcoming the problem of delivering infrastructure to support growth is the need to correct what is ultimately a flawed system of infrastructure funding. The current approach is fragmented and inefficient, with the spread of risk being held overwhelmingly by local authorities and developers in delivering much of the critical infrastructure that although sometimes local or regional in importance, is critical in supporting national infrastructure. Even in cases of nationally strategic infrastructure, such as Junction 10a off the M20 in Ashford, the burden of proof and risk has been disproportionately on the local borough council, KCC as the highways authority and the developers in and around the Junction.

The risk of project development is overwhelmingly on local partners: Much of the strategic infrastructure that supports growth is dependent on local partners identifying and driving forward the business case and bid for funding for such projects.

The **mechanisms in place to secure investment in major infrastructure are lengthy and difficult to navigate in the time-frames required** and fragmentation of funding across difference infrastructure types and within sectors accentuates the problem. As a key example, the funding of major transport projects require a large up-front cost to develop a business case, which is usually at risk to the local authority, as a result of the fact that most capital funding pots are competitively provided and the Government looks for projects that are ready to go. Guaranteed long-term funding streams need to be guaranteed, with simplification of the pots available to bid for local authorities.

The **requirement to follow rigorous appraisal guidance puts further financial strain on local government, at a time of continuing revenue budget reductions**, when bidding for infrastructure capital funding and smaller scale funding (e.g. Local Growth Fund), which comes with no guarantee of success. KCC submitted a bid to the Large Local Major Schemes fund for funding to develop an Outline Business Case (OBC) for substantial improvements to M2 Junction 7 (Brenley Corner). The estimated cost to complete a WebTAG compliant OBC was over £880,000, and most schemes of this "large local" type require OBCs that cost on average £750,000 to £1m. In the case of the Brenley Corner example, the bid was unsuccessful and so the option for KCC to fund this development work at its own risk is the only alternative. This is a considerable chunk of very limited revenue, when the possibility of being awarded capital funding, from which to claim it back, is extremely uncertain under a competitive funding system.

Local Authorities bear the cost of millions of pounds without Government backing and no assurance of capital funding. With local authorities facing significant financial pressures, this is untenable and could lead

[7] KCC conducted 2 surveys over 3 week nights in 6/16&9/16. Figures appear in the draft Freight Action Plan for Kent (page 12) via this link

to a drying up in the pipeline of infrastructure that taken cumulatively is nationally significant. Assessment for indicative funding allocations, i.e. to develop an Outline Business Case, that may or may not result in the actual delivery of the scheme, is not proportional to the size of the proposed scheme and the stage of its development. The Government's New Stations Fund is an example of the more typical situation in which a local authority bears the entire risk of developing the business case and getting a project to planning application stage and Network Rail's GRIP 3 before the Government will put its own funding into the project. As KCC has borne the risk of developing the project to this stage, it is a project that is "shovel ready" and could be delivered within the Fund's very restrictive time period for spending the capital allocation if successful[8].

In general, **competitive bidding has significant resource and cost implications for local authorities at a time when revenue budgets continue to be reduced.** If bids are successful, these costs can be justified, but as Government appraisal guidance makes preparing successful bids even more resource-intensive and costly, the chances of local authorities being able to prepare robust bids and business cases, and by extension a sufficient pipeline of infrastructure to support growth becomes even more unlikely. The bidding culture also tends to favour projects that are less complex to bring forward in the short term, but which are not necessarily of the highest longer-term strategic importance. A possible solution would be to introduce a Government revenue and funds for business case development and a preliminary to the appraisal system. This might lead, by a lighter touch pre-development approach, to more cost-effective decision-making about the status of each scheme at an early stage in its development before substantial revenue funding has to be committed to a full appraisal and business case.

There is need for funding policies for different sectors in transport and flood risk management to be better aligned. Using a flood risk example, Lead Local Flood Authorities rely on flood defence grant in aid to support flood defence projects – this has a minimum threshold of 1 in 20 standard of protection. However, the sewerage companies generally do not consider schemes that provide more than 1 in 20 standard of protection. This means that it is hard to work together to deliver collaborative projects.

Lead-in times for the identification and funding of key infrastructure are also excessive and can lead to inefficient outcomes. The Lower Thames Crossing is an example in point – originally mooted in a White Paper in 1989, the Government originally consulted on options for the Crossing in 2009. Eight years on from the original consultation and almost 30 years on from the original concept being developed, there has still been no announcement on a preferred route, even though the private sector is able and ready to deliver. The prospect of a new Crossing opening by 2025 is fast slipping away and this infrastructure is required now. Such excessive lead-in times are also experienced in smaller scale transport improvements designed to support growth, such that often, development precedes the network improvements required to support such development – leading not only to issues with financing such infrastructure, but also genuine frustration for new and existing residents who have to cope with the resulting congestion in the meantime. Smaller scale examples are Bean/Ebbsfleet junctions, (which are now funded) and Brenley Corner (which is still not funded).

A similar issue with lead in times exists with utilities to support new developments. The work of the KCC Utilities Engagement Sub-Committee has identified significant issues with the regulatory regimes and constraints in which water companies and power networks are delivered. Whilst these utilities generally work with local planning authorities to accommodate new allocations in their medium-term investment plans, they are unable to deliver that infrastructure ahead of a new development starting on site – meaning that often, the development is held up whilst utilities infrastructure is put in place[9].

Even when appropriate funding can be identified from developer contributions or development, the risk of delivering infrastructure is often front-loaded to either the local authority and/or the developers delivering growth: The lack of forward funding for strategic infrastructure means that there is generally an expectation that a project will attract funding, often by delivering growth in housing numbers, but often the growth required to provide that funding needs the infrastructure to deliver the growth – a conundrum and a mismatch in expectations that can put unnecessary burden on local players who are trying to deliver

[8] view via this link

9 See Minutes of Utilities Workshop Meeting 5.4.16 setting out the evidence

ambitious growth agendas. This lack of forward funding capacity is a huge constraint on transport, digital and utilities infrastructure. In addition, the funding formula rarely delivers full funding and therefore additional partnership funding is required to fully fund such schemes. Using another flood defence scheme illustration; to date, the majority of extra funding has come from local government. Also, Natural Flood Management, although recognised as multi-functional infrastructure, suffers from a lack of sufficient capital funding to demonstrate this and in turn deliver what is required to support growth. For one site, KCC, through the Kent Countryside Partnerships, is providing match-funding to deliver natural catchment management works, to the tune of £62,000 a year for the last two years. Without a multiple partnership approach, with many contributions, there would be no way of delivering such schemes. However, this approach is time-consuming and is limited in its scope, due to a lack of sufficient local authority funds.

In waste, there is even greater reliance on and risk with the local authorities in fronting the capital investment. Waste collection and disposal is the third largest local government services in terms of spend and is essential for local communities. The current absence of an effective funding policy associated with waste infrastructure is a key concern for authorities with a statutory responsibility to manage existing waste and it generates uncertainty in relation to accommodating future demand. To date, investment in Kent's waste infrastructure has been secured only via annual capital bids. The lack of funding opportunities, diminishing economic and regulatory incentives (for instance, Climate Change Levy exemption certificates and OFGEM's reduction in imbedded benefits for local energy producers) and limitations associated with the s106 developer contribution process, will increasingly prohibit the County Council's ability to secure required funding to deliver the necessary waste infrastructure to support growth. This in turn will increase the risk borne by local waste authorities in providing necessary infrastructure.

2.4 Delivery and the need for government interventions to improve financing *(Q8)*

The GIF identifies the need to explore radical changes in funding policy for infrastructure, from the introduction of greater forward funding capacity to more effective methods of value capture.

The Government needs to develop forward-funding capacity for strategic infrastructure: As identified in section 3.3, the risk of delivering strategic infrastructure is one that rests overwhelmingly on local partners – particularly local authorities. It is proposed that central Government is better placed to bear this risk, and that a forward funding capacity is required to enable the growth that so much of our new infrastructure will depend on to fund. This forward funding capacity would allow the infrastructure to be delivered and be paid back over time from the proceeds of growth.

There is a need for simpler funding from Government: There is also a need for streamlining the large number of different pots available and the different timescales, thresholds and make access to funding for major strategic development hard to navigate.

This is particularly evident in the field of transport infrastructure, where funds to highway authorities are broken into formulaic grants (e.g. the Maintenance Grant), ongoing competitive funding streams (e.g. Maintenance Challenge Fund), funding delivered through other bodies (e.g. the Local Enterprise Partnership's Local Growth Fund or Highways England's Growth and Housing Fund) and one-off funding streams (e.g. Pinch Point Fund). The different timelines result in the need to bid for the same scheme multiple times to maximise the chances of being successful, which is not an efficient use of time. The system is not transparent or clear to us and to developers, who often partner us in bids.

There is a need to de-risk local authority borrowing in supporting capital projects: Where local authorities are investing in infrastructure, there is also a need to enable councils to have more certainty over revenue, which would help allow for greater confidence on long-term borrowing for infrastructure and less reliance on Government grants. Councils need the flexibilities and powers to help fill the funding gap – this could involve having more local control over setting council tax or perhaps retention of some proportion of stamp duty on new homes. Such measures need to provide greater certainty over local authority future revenue streams, to enable councils to borrow with confidence, where needed to fund infrastructure projects.

There is a need for more effective value capture: The GIF[10] highlights how successful Kent County Council working with district councils and local partners has been in securing development contributions towards

[10] See p. 122.

necessary social and community infrastructure via Section 106. Between 2006/07 and 2014/15, the Authority received in excess of £150 million in development contributions, 75% of the amount sought. However, this amount has been insufficient in providing the comprehensive infrastructure that communities would and should expect from sustainable new developments. Further, it is expected that recent changes to the developer contributions legislation will further stunt the ability of local planning authorities and upper tier authorities in securing this much needed investment.

Emerging evidence from the introduction of the CIL regime shows that **developments liable for the Community Infrastructure Levy contribute significantly less to infrastructure than a contribution made by the same proposal under the Section 106** regime which would actually worsen the infrastructure funding gap. From local evidence, it is estimated that the Community Infrastructure Levy could deliver up to 50% less than what would have been secured via s106.[11]. The GIF also recognises[12] that the pooling restrictions[13] implemented in April 2015 are likely to exacerbate the demonstrable infrastructure funding gap in the county of Kent. The complexities of ensuring that pooling restrictions are not compromised are impractical.

Along with a more effective approach to developer contributions, there is a **need to look at other ways of extracting value from the users of infrastructure**: For instance, the HGV Road User Levy was introduced in 2014 to create a level playing field for both UK and non-UK registered vehicles over 12 tonnes to pay taxation depending on the amount of time the vehicle spends in the UK. It would be beneficial if this revenue could be ring-fenced and spent on mitigating the effects of HGV movements across the UK including highway maintenance (a 40 tonne HGV causes around 160,000 times more wear to the road surface than a small 1 tonne car), road improvements on approach to international gateways, for example as a contribution towards a new Lower Thames Crossing and the enhancements needed along the A2/M2 corridor, as well as lorry parking provision for Kent and the UK. The HGV Levy net revenue from non-UK registered HGVs in 2014/15 (the first year of operation) was £46.5 million. The proportion of foreign registered HGVs entering the UK via the Channel ports is 87%[14] which equates to £40.5 million per annum (of the 14/15 net revenue). It is estimated that 27%[15] of the distance that foreign HGVs drive in the UK is on parts of the strategic road network within Kent as they travel to and from the Channel ports, which would equate to £10.9 million per annum of the net revenue from the HGV Levy that could pay for improvements to the road network directly affected by the user.

The Government needs to explore the potential for private financing: There is significant untapped potential to use private sector financing to fund major infrastructure. For instance, to raise the estimated £6 billion for a new Lower Thames Crossing, private financing could be explored by Government. This could allow the scheme to be delivered more cheaply and quickly. In a similar way to the M6 Toll road system (first privately funded motorway in the UK), the future crossing receipts could be used to finance the scheme. KCC research has shown significant interest from the private sector in financing a new Lower Thames Crossing and that there are infrastructure investors in Europe, North America and elsewhere that are ready to be involved in such a project today[16]. Use of tolls would allow the project to be self-funding and therefore delivered without the need for public funds. Toll setting is not an issue if there is a controllable trade-off between toll level and concession term length, allowing Government to control the parameters of the tolling rate. Traffic risk and Government willingness to see tolls increased are key to revenue forecasting and must form part of an acceptable model for Government and investors. A Design, Build, Finance and Maintain (DBFM) model is desirable with a 35+ year concession arrangement that includes toll revenue from the existing Dartford Crossing. The tolling model should incorporate the existing (Dartford) and new Crossing, and tolling regulations should be transparent and certain over the life of the concession. Government should consider holding confidential market meetings with identified funders and investors to discuss how to bring forward the project.

2.5 A planning system and infrastructure governance arrangements that deliver *(Q10)*

[11] KCC can provide further evidence, should Commissioners wish to discuss this area further.
[12] See p. 124.
[13] Regulation 123 of The Community Infrastructure Levy 2010 (as amended).
[14] DfT Statistics 2011 Q4
[15] DfT (2012) Charging HGVs –estimated average trip by foreign-registered HGVs to be 406 miles. A round trip in Kent is c 112 miles.
[16] Confidential report, contact KCC for further information.

There is a **need to plan for housing and infrastructure provision at the right strategic level for integrated and sustainable delivery of growth**. Planning freedoms from Government will enable significant sustainable growth across the County, with local authorities having a significant role to play. As well as exploring opportunities for the flexibility for local authorities to help fill the funding gap (as discussed above), the concept and importance of strategic planning linking more effectively to infrastructure provision at local authority level needs to be promoted by Government. More emphasis should be placed on using Local Plans as the evidence base for long-term planning and growth.

An effective planning system needs to enable councils to tap into the necessary funding and policy mechanisms necessary to support growth with the appropriate infrastructure. This needs to coincide with income that can be ring-fenced for planning departments and incentives to provide an adequate resource of skilled planners.

2.6 Cost-benefit analysis techniques *(Q12)*

Existing cost-benefit analysis techniques, whilst improved from previous regimes, remain a concern for local authorities at the forefront of developing business cases for infrastructure investment.

Proportionality is an important factor for Kent as an international gateway. Kent has large volumes of cross-Channel traffic (10,800 HGVs cross Dover each day with additional tourist traffic) and consequently a small change to transport infrastructure in Kent with, comparatively, low costs, may have impacts across the country. For this reason, **improved clarity is needed on what criteria triggers a change from single scheme appraisal to programme appraisal.** For example, a programme of small schemes in the Thames Gateway could be appraised individually or holistically as a programme. KCC put this point forward to the DfT's recent consultation on changes to WebTAG wider impacts transport appraisal[17]. Another problem experienced with transport appraisal is that **emphasis on new growth does not reflect the requirements of existing communities owing to background growth in traffic.** This puts future sustainability and quality of life at risk.

2.7 Balancing maintenance and repair of existing assets with construction of new assets (Q5)

Maintenance of infrastructure is often overlooked in current infrastructure funding regimes – whether central Government funding or the current mechanisms for value capture.

Due to existing and forecasted demand as a key strategic corridor and a growing economy, significant pressure is placed on Kent's infrastructure and in turn results in rapid asset deterioration. The County's highest value asset is its highway network (with an estimated value of £11.5 billion) and is deteriorating at a rate that exceeds the current level of investment. If the current levels of investment are maintained, the cost to maintain KCC's highways assets is expected to increase to approximately £370 million to 2025/26. Assessments of the Capital investment required in 2016/17 to address current demand identified a shortfall in Capital funding of £11.5 million[18]. In addition, Kent's Public Rights of Way network is valued at £107 million with an annual maintenance requirement of £2.6 million. There is a shortfall in funding for required maintenance measures, as well as a backlog of surfacing work and safety critical bridgework of 12 and 3/4 years respectively.

Given the substantial and increasing costs associated with asset maintenance, it is **essential that opportunities for sourcing funding for maintenance purposes are maximised and the costs are considered in the planning and provision of new infrastructure.** A proactive approach would assist in obtaining the essential funding required to meet future demand, as well as help to avoid the unnecessary decline in necessary infrastructure.

[17] View via this link

[18] Annual Local Authority Road Maintenance' (ALARM, 2014)

An equitable and adequate funding regime is needed, which reflects the needs of the expanding road network. The current disparity in funding between regions, which experience vastly differing traffic levels, and between the Highways England and local highway network, is inequitable and unsustainable. For example, Highways England's network received an allocation of £15 billion in the first Road Investment Strategy (2015 – 20). This equates to approximately £200,000 per mile per year[19]. KCC's network receives £25 million per year for maintenance (set to reduce) and £6.8 million from the integrated transport block (small schemes, safety critical, etc.), which equates to only £6,000 per mile per year[20].

A combination of a lack of forward funding, and increased limitations and complexities to funding policy, will continue to increase the burden placed on delivering infrastructure.

Recommendations:

- **Central Government to bear more risk of delivering key strategic infrastructure through the introduction of more forward-funding for strategic infrastructure and funds for a business case preliminary appraisal system;**
- **Streamlined infrastructure funding mechanisms, as opposed to the current fragmented approach across different Government departments and priorities;**
- **More effective mechanisms for value capture;**
- **Robust consideration of options for private sector funding;**
- **More robust strategic spatial planning with a direct link to infrastructure funding;**
- **Maximise opportunities for sourcing funding towards asset maintenance.**

3) A smart transport network - the strategic priorities *(Q's 2, 13&14)*

A smart and resilient road network is required alongside enhanced rail capacity, to accommodate rising international freight and housing and commercial and housing growth across Kent. Reliable, sustainable mass mobility and reduction in journey times between major centres of population is fundamental to the country's future competitiveness and productivity and the UK's strategic gateways plan a fundamental part in this wider ambition.

3.1 Kent's role as an International Gateway for international competitiveness *(q2)*

As the UK's 'Gateway to Europe', it is estimated that around **one-sixth of the UK's total economic output derives from movements facilitated by the Port of Dover**; the value of trade passing through the Port is £119bn (17% of UK trade in goods). This makes Dover the busiest roll-on, roll-off ferry port in the EU and the busiest passenger port in the UK, and the vast majority of land-based journeys to and from Europe pass through Kent in one way or another. The Port of Dover reports that 2.5 million freight vehicles and 2.4 million tourist vehicles pass through the Port each year, and they have seen 30% growth in freight vehicles in the last 3 years alone. Freight and vehicle fluidity is absolutely essential for the business models of both the Port of Dover and Eurotunnel.

Kent is the **only county outside Greater London with direct rail links to the continent**, with Eurostar services operating to Lille, Brussels, Paris and Marseille – and as a result of overseas tourists using the Tunnel, it supports 45,000 UK jobs. The port of Calais Boulogne forecasts that **cross-Channel traffic will grow by 40% by 2030**. The Department for Transport (DfT) forecasts that **HGV volumes will grow by 43% and Light Goods Vehicles (LGVs) by 88% by 2035**. This would equate to 3.8 million HGVs using Dover, with around 1.3 million of these using a new Lower Thames crossing[21].

As the UK's front line to the continent, the Port provides a vital role in facilitating UK trade and tourism with Europe and the wider global economy, and its infrastructure in regulating this traffic is critical to the competitiveness of the UK economy. The capacity within the Port of Dover to hold vehicles for customs

[19] Highways England's network is 4,300 miles - equates to £3.5 million per mile over 5 years or £697,674 per mile per year (as a national average). Dividing mileage by 3 lanes in each direction on motorways and trunk roads, HE is funded with c £200,000 per mile of road.
[20] KCC's total of £31,867,000 (2016/17) – assumes 1 lane in each direction - equates to £6,000 per mile pa for 5,400 miles of local roads.
[21] Department for Transport, Dartford-Thurrock River Crossing: Traffic Flow 2015: view via this link

clearances (potentially required post-Brexit) or in times of delay to the Channel crossing is limited). Currently, both Dover and Eurotunnel have a policy of "first come first served" (therefore creating the need for Operation Stack) and are very reluctant to introduce such a system that removes flexibility for operators. The amount of HGV traffic that Dover handles is equivalent to a queue to Stansted Airport and an increase in checking in time to just 5 minutes will severely impact on the road network. For example, two ferries arriving simultaneously would generate four miles of traffic. Lorries could be directed to the new Operation Stack lorry area on the M20 during times of disruption to cross Channel services and to a network of smaller lorry parks that meets the needs of the growing freight industry and reduces inappropriate parking along the strategic and local road networks. The use of virtual queues in lorry parks across the country to time arrivals to the Port is one possible utilisation of smart infrastructure that would have a real benefit to connectivity and the free movement of traffic. Smart technology is required to maintain fluidity of traffic flows to key locations (e.g. ports) on a timed basis (e.g. arrival slots).

Beyond the Port's own infrastructure, there are **wider network infrastructure needed to facilitate traffic to and from the Channel Ports**, including the New Lower Thames Crossing and enhancements of the M2/A2 corridor to enable the bifurcation (splitting) of traffic between the M2/A2 and M20/A20 corridors to provide resilience on this international corridor and create a new strategic route from the Port of Dover to the Midlands and the North.

3.2 Accelerating the delivery of the Lower Thames Crossing *(q 1 &14)*

The constrained capacity of the existing Dartford Crossing is stifling growth and increasingly restricting trade between the South East and the Midlands and North, as well as more locally between Kent and Essex. The Dartford Crossing is heavily used by freight vehicles with more than 70,000 using the crossing each day, and 70% of all Heavy Goods Vehicle (HGV) traffic from Dover and Eurotunnel using the crossing. A new Lower Thames Crossing will support regeneration and further economic opportunity in the Thames Gateway area. A new Lower Thames Crossing will enable regeneration in the Thames Gateway area allowing up to 160,000 houses and 225,000 jobs across Kent and Essex. To enable this growth the area urgently needs additional crossing capacity[22].

It is **vital that the Government makes a swift decision on the delivery of this critical infrastructure** – on the basis that not only is growth compromised, but the resilience of the national and international network is too. KCC has found substantial interest from the private sector and there are infrastructure investors in Europe, North America and elsewhere who are ready to be involved in such a project[23]. For such large infrastructure projects, alternative financing models should be considered by Government where they provide savings to the public purse and a faster pace delivery of homes and jobs.

There is currently no alternative to the Dartford Crossing for vehicles travelling north-south between Kent and Essex. The next closest crossing is the Blackwall Tunnel in London. When incidents occur or the tunnel or bridge has to be closed, it causes severe congestion and brings the town of Dartford and surrounding area, including key business locations, to a standstill. Besides offering much-needed strategic capacity, a new Lower Thames Crossing would mitigate the impact of disruption at the Dartford Crossing by providing an alternative route and resilience across the network leading to and from the Channel ports, the key international gateway for freight to and from UK.

3.3 Strategic bifurcation of the a vital international passenger and freight corridor *(q 1 & 14)*

It is vital that the Lower Thames Crossing is accompanied by **bifurcation of the strategic road network to improve connectivity and resilience along the A2/M2 and the M20.**

Freight transport volumes through Kent are disproportionately higher than other parts of the Strategic Road Network, due to Kent's strategic location as an international gateway. In 2015, 13 million passengers and 2.5 million freight vehicles travelled through the Port. In addition, the passenger vehicle and freight shuttle operator, Eurotunnel, operates out of Cheriton in Folkestone and in 2014, 21 million passengers used the Tunnel and in the first quarter of 2016, it set a record for traffic volumes with 410,729 trucks carried. High

[22] KCC commissioned studies from KPMG (2010) &URS (2012) on economic benefits & job creation from the LTC, available on request.
[23] Commercially sensitive report, contact KCC for further information.

Speed One (HS1) travels through Kent from Dartford to the Channel Tunnel entrance at Folkestone, with international stations at Ebbsfleet and Ashford. Significant growth is also planned at Dover and Calais (Calais sets to implement an impressive €675 two-phase expansion project).

The road freight industry is worth £74bn to the UK economy per annum and the Channel Ports play a vital role in this prosperity. Last year, over 2 million HGVs entered Kent through both the Port of Dover and Eurotunnel and the Department for Transport Road Traffic Forecasts (2015) predict a 22% increase in HGV movements between 2010 and 2040. The Port of Dover is the busiest Ro-Ro and passenger port in the UK and has plans for expansion at its Western Docks to accommodate future freight demand volumes.

The cost of congestion to the freight industry will be £14 billion in 2040, from a sector that provides 9% GDP, and 24% of businesses cite the quality of connections to international gateways as a barrier to exporting (HE Figures)[24]. This is particularly relevant in heavily congested areas such as around the Dartford Crossing. Any congestion and delay at the Kent border risks putting British businesses and 'UK plc' at a disadvantage compared to our European competitors (particularly in the export and import of perishables or time-sensitive goods). As Kent forms a vital link on the trans-European transport network and the UK's strategic freight network, future planning at international gateways must take account of the interplay between the demands that local and international transport place on the same infrastructure – be it for freight or passengers.

KCC's **policy of 'bifurcation' - the splitting of traffic to and from Dover between the M20/A20 and M2/A2 corridors - is a strategic priority.** A new Lower Thames Crossing on the preferred route to the east of Gravesend needs to be accompanied by enhancements to the M2/A2 including adding capacity to the existing 2 lane section of the M2 between junctions 4 and 7, upgrading junctions 5 and 7, the latter to provide free-flow connection to the A2, and completion of the dualling of the A2 to Dover around Lydden and Whitfield. Enhanced connections between the M2 and the M20 along the A229 (M2 junction 3 to M20 junction 5) and A249 (M2 junction 5 to M20 junction 7) will increase resilience in the strategic network between London and the channel ports. As well as completing the strategic network to a consistent minimum standard, these enhancements are also essential to enable housing and employment growth along the Thames Estuary corridor from Dartford to Dover.

3.4 Enhancing rail connectivity *(q1, 14 &15)*

Rail connectivity is a vital component in the management of road capacity. **Long-term significant investment is required in rail passenger and freight capacity, with rail freight interchanges and a policy shift to encourage freight onto rail.** Long-term significant investment in local bus services delivered through a publicly owned regulatory body is required.

Enhancing rail capacity to support sustainable growth across Kent – Rail capacity is vital to unlocking the growth potential of locations across Kent, including **particularly our Garden Town of Otterpool and Ebbsfleet Garden City.** In the case of the former, proposed improvements to the station at Westenhanger will be fundamental in supporting the bold vision for the future of Otterpool; in the case of Ebbsfleet, the Crossrail extension (below) is vital to maximising the value of public investment in the Garden City. To this end, the Network Rail Kent Route Study will set out proposals for investment in the rail network in Kent during the period 2019 – 2024. Our priorities must include interventions at Ashford and on the Ashford-Hastings route to enable High Speed services to reach Hastings. The study should also include proposals for station re-builds at Swanley and Strood, and also Westenhanger to serve the Otterpool. A need has also been identified for an additional platform at Canterbury West. Also planned during this period is the completion of the Journey Time Improvement scheme between Ashford and Ramsgate and the delivery of the new Thanet Parkway station by 2020.

Extending Crossrail towards Gravesend - Extending Crossrail from Abbey Wood towards Gravesend offers the potential to enhance connectivity between Thames Gateway and London and be an enabler of longer-term ambitions, particularly for Ebbsfleet Garden City and the wider Thames Estuary. This rail extension will unlock c. 55,000 jobs and 50,000 homes along the corridor in both North Bexley and North Kent and support the proposed leisure park development on the Swanscombe peninsula, but the key station on its line of

[24] Highways England 2016 "Roads to Growth" Discussion Paper – view via this link

route must be Ebbsfleet International to deliver wider connectivity with High Speed and international rail services. Work on the strategic outline business case for such an extension is being developed by a consortium of partners including KCC, GLA, TfL, TGKP, Ebbsfleet Development Corporation, LB Bexley and Dartford and Gravesham Borough Councils. The consortium would welcome engagement with the Commission on this ongoing project.

The rail network in Kent needs enhancements to the service levels and network infrastructure in several locations. Among those raised by stakeholders are:

- 2 trains per hour to Dover with one of them being under the hour;
- All services which pass to serve Thanet Parkway, with no diminishing of services to Sandwich or Deal;
- Network Rail's Kent Route Study to include repowering of all East Kent lines sufficient to permit operation of 12-car HS trains;
- Additional train sets required as commitment in specification for new South Eastern franchise.
- Tonbridge to Hastings line to receive additional power supply to permit regular operation of 12-car trains

All of these service and network enhancements would however be dependent on funding commitments by the DfT, for the new franchise specification in respect of the service levels and for Network Rail's next control period in respect of the network investment.

3.5 Freight (*q 1, 2, 14 & 15)*

The critical need for a package of measures to more sustainably and sensibly manage road freight through the Kent strategic corridor - The cost of Operation Stack to the Kent and Medway economy is estimated at £1.45 million per day and the Freight Transport Association estimate a cost of £250 million per day to the UK economy as a whole. The uncertainty and ongoing delays with the current proposal is frustrating businesses and residents alike and we would urge DFT/HE to deliver at pace. The Operation Stack Lorry Area is one step forward, but there remains a growing need for a smart solution to the growing demand for freight traffic through the UK and particularly Kent as a strategic corridor. KCC has been proactively working with the private sector to explore the potential for a network of lorry parks, supported by the necessary enforcement powers and ideally smart technology to allow more efficient stacking of freight in times of cross-Channel and other disruptions to the network.

The main limitation to lorry parks being built, according to existing operators, is planning and the local objection from the public and Planning Authorities. They say there needs to be a change in Planning Policy to encourage their use. In Kent there are difficulties of the council building and/or operating lorry parks around public/private competition and state aid implications. It can however be argued that there has been a market failure in the lack of facilities available to take HGVs for overnight parking in the county from the private sector.

The need for a suitable investment and support for rail freight to support this wider freight solution – Improved freight transport to mainland Europe is a national issue, which is gaining importance as freight at Dover and Eurotunnel are forecasting significant growth. In the context of UK connection to Europe, the unknown quantity of Brexit could see patterns of import/export change fundamentally. There is a current emphasis for modal shift from road to rail freight. In Kent, there is a proposed rail freight interchange at Howbury on the Kent/Bexley border. Howbury will be able to handle up to 7 trains per day which equates to 300 – 540 HGV movements. There is also a regular flow of through rail freight trains between Dollands Moor at the Channel Tunnel portal and points north and west of London. These trains have 35 paths provided by three different routes through Kent, for which there is statutory provision in the Channel Tunnel Act 1987. The High Speed 1 route does offer some night-time capacity for freight trains, but at present there is very little use made of this provision. The limitations to rail freight in Kent include both the lack of rail paths through London for freight trains and on the French rail system.

Kent's role as the UK's international gateway is vital for the UK economy and therefore the timely provision of necessary infrastructure is critical to increasing the County's international competitiveness.

Strategic priorities required to deliver a 'smart' strategic network and enhance Kent's role in the UK economy:

- **Accelerating the delivery of the Lower Thames Crossing;**
- **Enhancing Kent's existing rail network (to include the Crossrail extension);**
- **The strategic bifurcation of Kent's passenger and freight corridors; and**
- **A 'smart' approach to addressing the impact of increased freight demand**

4) Investing in digital communications (Q's17-18)

4.1 The infrastructure investments required to secure digital connectivity

Critical investment in digital infrastructure by the Government appears to be coming too little, too late – and we are effectively delivering the infrastructure of yesterday, today.

Mobile broadband and phone coverage to support the economy of the future, not yesterday: There are many areas of Kent where mobile broadband and phone customers get no, or an unreliable (outside) 2G signal. KCC has found serious discrepancies between mobile coverage claims and mobile users' experiences. For example, the Ofcom website claimed that Canterbury city centre benefited from 4G coverage from all operators; yet many users struggle to make calls or receive texts in this area. Ubiquitous 4G coverage, subject to robust verification, is needed across Kent[25]. Further investment by Mobile Network Operators is required to ensure that the capacity of mobile networks meets ongoing data demands. In addition, the rollout of 5G technologies must not be limited to large urban, or cities. There should be universal coverage of 5G networks – especially important in areas that cannot access fibre-based broadband services, particularly rural areas which depend on the agricultural and horticultural economies, which in turn are increasingly dependent upon digital connectivity.

Continued investment to anticipate future user needs: There is a need for continued investment, so that network capability and capacity anticipates and meets future user needs. The UK's future socio- economic prosperity, competitiveness and productivity is dependent on ensuring that broadband networks are an enabler, rather than a constraint on future economic growth. How this interacts with technical advances in transport connectivity and the transport system will also be crucial. It will be important to ensure that technological advances are digitally connected and well integrated into transport services. The Kent and Medway BDUK programme has brought better broadband connectivity to over 125,000 homes and businesses with no or slow broadband connectivity. Business and resident feedback, throughout the rollout of Phase 1, stated that there was need for this connectivity 3-4 years ahead of services being available. It will be important that a similar lag does not emerge as new technologies emerge creating a new digital divide, especially with the rollout of full-fibre networks.

A regulatory regime that maximises market-led investment: The Government should consider developing a regulatory regime that maximises market-led investment in digital communications infrastructure. The UK's regulatory framework for digital communications infrastructure will need to be appropriately geared to maximise the opportunities for market-led investment. The recent growth in the number and size of 'alt-net' providers specialising in fibre-based broadband deployments has helped drive competition and investment in the UK's digital communications infrastructure sector.

4.2 A digital communications regime that delivers

All new development to include full fibre networks: Whilst the BDUK programme has directed the Government's investment and focus on retrofitting as a priority, there is a danger that it starts losing traction in achieving its 95% target for broadband coverage, as new homes are developed without the same focus on ensuring connectivity. Too many housing schemes are being completed without any broadband access being available to the occupants and a lack of transparency is resulting in prospective occupants purchasing without realizing their homes are not connected. KCC has been championing the need for fibre-to-the-premise networks being installed at the point of build in new planning schemes. However, the current

[25] https://www.ofcom.org.uk/

national voluntary regime between developers and infrastructure providers is not delivering the required connectivity; resulting in the need for costly and less effective (and future proofed) retro-fit solutions.

There is an opportunity to strengthen the customers' position in the market; one option could be to enable them to have conveyancing searches carried out before purchase and challenge the infrastructure providers/developers over lack of broadband provision. At present, lack of transparency around connectivity data and regulation are unlikely to allow for searches to take place. Further, simplifying the offer for developers to provide broadband access during the construction and the relationship between the developers and infrastructure providers needs to be strengthened - developers need the assurance that connectivity will not delay construction and increase build-out costs.

Meeting the demands of both population and economic growth is largely dependent on the UK's ability to adapt to technological advances. KCC advocates the following design principles:

- **Ensure the capability and capacity of the available digital communications infrastructure anticipates future needs;**
- **Enable ubiquitous and fast rollout of new emerging technologies beyond cities;**
- **4G and 5G coverage across Kent;**
- **A national strategy for full fibre broad networks to meet future data consumption needs**
- **New developments have full fibre broadband connections.**

5) Energy – decarbonising the system (Q's19-21)

5.1 Decarbonising heat solutions

A need for a national approach: A **strategic national infrastructure policy framework is required,** which is evidence-driven, incorporating local needs **that provides mechanisms to access national infrastructure where appropriate (such as energy from waste) but supports and allows for development of local infrastructure solutions where needed.**

Currently, there is a lack of understanding of our energy system, especially at the local level - what we use (sector/area/individual), what we need, what we generate locally and what we waste – which makes it difficult to establish the business case for action and focus scarce resources on developing intelligent energy systems[26]. Kent's recent Energy Select Committee identified that there is a need to better understand the following:

- Present energy use patterns and future use needs;
- The role of energy efficiency and demand side response to manage energy better and flexibility with supply and demand to reduce primary demand (overall and at peak times);
- How our national network takes from and supplies to other networks at an international level (interconnectors) and local level now and the potential for the future[27];
- Decentralisation and storage to maximise local generation and more intermittent energy supplies;
- The potential for new renewables - The Kent Renewable Energy study (April 2012) and the subsequent Renewable Energy Action Plan identified significant renewable resources and is now being updated[28]; and
- New energy sources such as hydrogen and ultimately how we move towards developing a 'future energy system' that is intelligent and uses new technologies to create a smarter grid that is more integrated geographically and between sectors. This is now a generally excepted principle[29].

Tackling the faults of the current system Tackling current patterns of energy use to maximise efficiency, especially high users and minimising use of high carbon heat energy sources such as oil through supporting local energy generation systems (e.g. district heat, solar) is key[30]. In addition, there is a need to address the

[26] Kent Energy Security Select Committee Report 2016
[27] (KCC are about to embark on a study to look at Demand Side Response in the KCC estate);
[28] View via this link
[29] National Grid, NIC – Smart Power
[30] KCC Energy Security Select Committee 2016

locational element of energy transmission and distribution costs. As it stands, there are disparities between regional network charges as costs are typically determined by distance from sources of energy supply. For example, regions located further from the source of supply (e.g. Scotland and South West England) pay higher charges than those in London and the south east of England[31].

Lack of grid capacity **prohibits development of alternative decentralised energy sources because of the cost of connecting to the grid**. For example, a recent proposal to develop a heat network in Maidstone faces was derailed due to potential connection costs of £11m[32]. The Kent Grid is almost at capacity with regards to returning energy to it. Future energy policy (local and national) and support will need to encourage more decentralised supply, energy storage capacity for intermittent generation and demand-side management initiatives for higher energy users expand/argue/back up

Preventing repetition of the mistakes of the past by managing future demand Given the previously referenced growth pressures in Kent, there is a need for any future energy infrastructure to be resilient to pressures and risks (environmental, economic and political), affordable and efficient; focusing on low carbon electricity and heating, maximising alternative energy sources and models, and incorporating energy storage and demand side management agreements where possible/appropriate.

Fragmented energy policy and standards, particularly in relation to new developments, often result in insufficient finance to properly consider and implement alternative energy provision options at the local level. The lack of consideration of energy issues in the early stages of the development process increases expenses, as well as the risk of being value engineered out. **Energy Planning should be undertaken at a strategic level**, to provide an evidence base for local district authority planners and strategic authorities for delivery of low carbon energy across sectors. This should focus not just on housing but economic (DSM strategies to increase competitiveness for businesses) and transport strategies (e.g. EV infrastructure). Several authorities such as the GLA have already begun to do this, and KCC in partnership with Kent's districts are doing this as part of the second iteration of the Growth and Infrastructure Framework.

To support this strategic planning for energy, **Energy Statements should be required for new developments over 100 houses** and especially larger developments such as Ebbsfleet and Otterpool. Statements should be driven by a clear set of principles and policies set by the planning authority and statutory consultees, such as identifying opportunities for decentralised low carbon local energy generation incorporating energy storage capacity and encouraging demand side response agreements. New homes/buildings and developments should be designed to minimise the use of heat, using smaller boilers and/or renewable heat solutions like heat pumps. Better design will also reduce energy bills into the future[33]. In addition, similar energy statements/policies should be required and implemented for new large commercial developments, business estates and larger businesses for the same reason as large domestic developments and encouraging links between energy users to use waste heat for example e.g. Anaerobic Digestion plant being developed at Gatwick which utilises energy from its own waste[34]. KCC advocates support/incentives for the retrofit of commercial/industrial buildings and specification of new industrial buildings to maximise the potential for renewable energy (e.g. solar panel roofing).

Maximise New Technical Solutions: Hydrogen trials need to be undertaken to see if this can be a reliable, safe and cost effective way of decarbonising the grid. This needs to be trialled over the next few years. Such trials will also need to include consideration of carbon capture and storage. Where possible and where there is a local heat demand, District Heating schemes can provide a solution to reducing heat demand and providing renewable heat solutions from heat pumps and alternative fuels. Evidence suggests that the use of District Heating schemes has resulted in 30% heat cost savings nationally[35]. Thermal storage options also need to be implemented and the necessary research and development needs to be adequately funded and innovation promoted. There will also be a role for renewable heat solutions such as heat pumps, biomass boilers, and possible bio-methane injection into the gas grid from anaerobic digestion plants where possible (although this will be limited).

[31] Ofgem (October 2015), 'Regional differences in network charges' can be viewed via this link.
[32] See letter from UK Power Networks to AECOM infrastructure & Environmental UK Ltd dated 27 April 2016.
[33] View via this link
[34] View via this link
[35] DECC (2015) 'Assessment of the Costs, Performance, and Characteristics of UK Heat Networks' can be accessed via this link.

KCC has invested just over £3m in energy efficiency and small renewables in its own estate and schools since 2008 resulting in long term savings of £10m and continues to invest in energy efficiency and renewable energy as a way to meet the energy trilemma[36]. In terms of innovation, KCC may look to become its own energy company providing a range of energy services) and could consider owning energy infrastructure, from generation to distribution and setting energy prices. Such a solution would be quite radical but not impossible[37].

5.2 Achieving a zero carbon power sector

The most effective zero-carbon environment will achieve smart, flexible and low carbon electricity supply. The predominance of a centralised energy grid is reduced and local generation is increased. Networks where efficiency is central, integrated across all sectors (domestic, business, transport), waste heat is utilised and energy users (homes, cars, businesses and schools) are linked. The **National Grid will need reforming, to allow for sufficient capacity and access, for alternative, intermittent forms of generation.** The vision is for larger 'smart grids' to be positioned across Europe, which the UK will be able to access through interconnectors and the power sector will integrate transport and heat sectors. There is some significant emerging research in this area including that undertaken by the NIC in the Smart Energy Report[38] . NIC has identified a possible £8bn of savings from better use of interconnectors, energy storage and demand side response initiatives. Also National Grid maps set out a range of scenarios requiring various levels of investment.

The UK must devise cost-effective, responsive and sustainable intelligent energy systems to safeguard supply for future generations. Resilient future energy infrastructure is essential.

- **Strategy planning for energy is needed;**
- **Existing disparities associated with the locational element of energy transmission and distribution costs is required;**
- **Future energy policy needs to encourage a more decentralised supply, energy storage capacity and demand-side management initiatives.**

6) Water and wastewater (drainage and sewerage) (Q's 22-24)

6.1 How to ensure the difference between supply and demand for water is addressed

The balance of supply and demand for water mainly occurs through the natural recharge of Kent's groundwater aquifers and is dependent on water that is stored during short period of availability. Since 1990, some water companies that supply Kent have consistently reduced the amount of water available in the supply network whilst accommodating housing growth. This efficiency has been achieved through the use of demand side measures; including leakage reduction, water metering and the promotion of water efficiency. Further emphasis on demand reduction measures across all water uses would be effective in helping to balance demand and supply, whilst minimising additional energy use and carbon emissions and reducing costs to customers, as evidenced by Southern Water's current Water Resources Management Plan, in which water efficiency measures were judged to be more cost-effective than major supply side infrastructure solutions[39].

Effective demand management interventions are evidenced in the following initiatives concerning domestic water efficiency measures and water use and irrigation efficiency in horticultural production systems: *Saving on Tap: Water Savings for Existing Homes; Assessment of Water Use in Homes Built to CSH Level 3 and 4* [40] and *European Regional Development Funded WATER project* reports. However, there is anecdotal evidence[41]

[36] The Energy Trilemma: balancing environmental targets, security of supply and making energy affordable/equitable
[37] As other councils like Nottingham, Bristol and Peterborough have shown, and is commonplace in Europe.
[38] View via this link
[39] https://www.southernwater.co.uk/water-resources-plan
[40] KCC's 'Assessment of Water Use in Homes Built to Codes for Sustainable Homes Level 3 and 4' (2012) can be accessed via this link.
[41] Conversations with Southern Water and South East Water indicate that agricultural pesticides and other pollutants in the River Medway and its tributaries commonly prevent the abstraction of water to fill Kent's largest reservoir, Bewl Water.

that suggests that environmental water quality problems are a major constraint to water availability (e.g. pollutants in the River Medway preventing abstraction of water to fill Bewl Water). Given that environmental water quality improvements have numerous other benefits and are in any case required for compliance with the Water Framework Directive, it is recommended that an integrated approach is applied to catchment management to tackle this issue. Such an approach could include flood risk management, building performance, behaviour change, farm productivity and urban diffuse pollution and would require enhanced policy alignment across central government departments.

6.2 How to ensure that drainage and sewerage capacity is sufficient to meet future demand

In order to ensure drainage and sewerage capacity is sufficient to meet future demand, it is **essential that a collaborative, strategic and evidence base approach is applied in understanding the water-related environmental constraints and risks across local environments**, identifying whether planned growth can be accommodated and what infrastructure is required to facilitate this and identifying potential ways to reduce water infrastructure costs for future development and to increase environmental, social and economic benefits.

KCC is currently collaborating with local planning authorities and water utilities providers in the preparation of the Kent Water for Sustainable Growth Study[42]. The aim of this document is to assess strategic, long-term sewerage capacity across Kent in relation to the environmental constraints on effluent discharges, as well as the most recent projections of the quantum and locations of future growth. It will also consider a number of alternative interventions that may be effective in ensuring that capacity. The study is dependent on data from the local wastewater undertakers and, subject to possible issues of commercial confidentiality; the final report will be available to National Infrastructure Commission in March 2017.

In many areas, the drainage system relies on combined sewers, sewers that carry foul and surface water drainage. These require capacity for storm water flows and if this capacity is exceeded foul flooding or pollution occurs. In these areas, the capacity for the combined sewer may be a limitation on growth and have an adverse effect on the performance of the sewer network. Increasing the capacity of combined sewers or providing new separate sewers is expensive and can only be justified in some locations. Retrofitting sustainable drainage systems is an alternative option for reducing the capacity needed in combined sewers and that should be used as an intervention to help ensure that drainage and sewerage capacity is sufficient to meet future demand. Increased infrastructure governance would help to prevent current time delays with planning review and provide greater certainty.

6.3 Using a whole catchment-based approach

A catchment-based approach is essential in determining the best approach for flood risk management; for the standard of protection, and which economic activities to protect. This approach is more integrated and predominantly concerns engagement and collaborative working, as well as promoting a better understanding of the water environment at a local level. This will balance the water and environmental needs in the catchment and ensure that funding is directed towards such needs rather than to specific policy objectives to the detriment of other benefits in the catchment[43]. Without such an approach, different sectors in the water cycle will continue to work independently, without coordination and at times in competition, and will in turn lead to the best funded sectors gaining the most, not the most important. KCC is actively pursuing partnership opportunities to develop integrated approaches to catchment management that would include water supply, wastewater, natural flood management, water quality, agricultural land management and biodiversity. KCC is currently developing the evidence and partnership working mechanisms on the Medway catchment through the newly launched Medway Flood Partnership.

7) Flood risk management (Q's25-26)

7.1 Achieving the right level of flood resilience -balancing costs, development pressure and the long-term risks posed by climate change

[42] This document is being drafted and outcomes will be available to the NIC by March 2017 following publication.

[43] Case studies of adopting a collaborative-based approach can be accessed via this link.

The Government needs to address a fundamental lack of policy alignment: Lead Local Flood Authorities rely on flood defence grant in aid to support flood defence projects. This has a minimum threshold of 1 in 20 standard of protection, whereas sewerage companies generally do not consider schemes that provide more than 1 in 20 standard of protection. There is a **real need for funding for different sectors in flood risk management to be better aligned, to enable access to funding for the delivery of collaborative projects.** Moreover, the funding formula rarely delivers full funding for flood defence schemes, nor is it designed to – the majority of this extra funding has come from local government.

There is a need to revise methodology for funding allocations: The **appropriate standard of protection from flood risk should be based on a wider range of the economic drivers rather than focused solely on housing;** however, present funding allocation is based predominantly on the number of houses that are moved from certain flood risk categories into a lower category. This is disadvantageous as measures that reduce risk (i.e. from 1 in 5 to 1 in 15) do not attract funding, despite the significant benefits they bring in reducing high frequency flooding. Additionally, the high focus on protecting residential housing means that other economic activities are not included in the funding calculation to their full economic value. This means that city and town centres, where there may be a high concentration of businesses and services, may not be allocated funding for required flood protection measures, despite the economic activity of the area. For example, KCC and Tonbridge and Malling Borough Council submitted a bid for Local Growth Fund towards the Leigh Flood Storage Area scheme in East Peckham as traditional funding sources for flood defences were not designed to accommodate such economic benefit[44]. Further, the current funding formula only considers houses constructed since 2012, which prevents development in flood plains from continuing to increase the flood risk burden and in turn prohibits the construction of flood defences to facilitate growth. However, the funding formula rarely delivers full funding for flood defence schemes and therefore additional partnership funding is required to fully fund such schemes.

The Government needs to address contradictions in the system for funding: There is **currently real conflict in the funding mechanism, as the policy for allocating funds is to not promote defences that lead to growth in the flood plain.** Some of the partnership funding is provided by Local Enterprise Partnerships (an additional tax-payer source) and developers due to the potential to unlock land for development. The policy for the quantum of capital underfunds defences to attract funding from other sources and growth is often the only commercial opportunity with sufficient resources to make a meaningful contribution. It is considered that flood funding policy for town and city centres should align with the goals associated with urban development and complement other forms of investment. In addition, specific flood policy in areas other than towns and cities may need to target alternative economic activities.

Ultimately, **flood defence infrastructure needs to be better funded.** As of March 2014, the Environment Agency was achieving an average benefit –cost ratio of 9.5:1 on schemes delivered in that spending review period (2011-2015) and expected to achieve an average of over 8:1 by the end of the spending review period. This means that flood defence investment is good value for money. An increase in flood defence investment would increase flood resilience in the UK and would still represent high value for money.

7.2 Merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk

Natural Flood Management techniques are best suited to preventing small impact, high frequency storms. Whilst such techniques are appropriate for reversing the localised impacts of man-made changes to catchments and associated flood responses, there is no evidence of their widespread application to largescale floods. Largescale catchment-wide flooding is likely to require significant land use changes, which is likely to require national and local policies to promote such changes. However, such Natural Flood Management techniques should continue to be used for small scale impacts.

Sustainable Drainage Systems (SuDS) offer opportunities to mimic natural drainage that can reduce flood risk and offer other benefits, such as amenity space and habitats. Retro-fitting SuDS into urban areas offers opportunities similar to natural flood management techniques. However, the constraints, especially costs, are prohibitive in urban areas, despite urban flooding and sewer capacity affecting the potential of many

[44] http://www.southeastlep.com/growth-deal

areas to grow. The cost: benefit ratio needs to be broadened when looking at the economically viability of such schemes - OFWAT needs to place more value on the opportunities that retro-fitting can provide – in extending the period of time before investment for additional capacity is required.

The **effective integration of sustainable drainage systems (SuDS) for surface water drainage into development at the master-planning stages early in the design process would ensure that it was properly incorporated and the benefits could be maximised.** *"Water. People. Places"* (KCC, 2013)[45] focuses on the inclusion of sustainable drainage to enhance the surrounding environment. The lack of a formal adoption mechanism by a recognised authority with a funding stream is a barrier to the delivery of effective SuDS. As an example, a sewerage undertaker will not adopt a drainage system that incorporates a permeable pavement to a sewerage system, so the developer will then change it to asphalt surfacing. If a developer is open to incorporating SuDS, the maintenance is then reliant on private management companies, which can fail.

For water, wastewater and flood issues, taking a catchment approach is required. Water policy for flooding, resources and quality, needs to be imbedded into infrastructure delivery, where developments incorporate water efficiency measures, ensure water discharges are clean and do not increase flood risk, as a fundamental principle. There needs to be better follow-through of policy into the policy drivers, including funding, and more compatibility between the various funding drivers in different sectors.

8) Solid waste

(Q27-28)

8.1 Aligning financial and regulatory incentives to provide sufficient long-term treatment capacity, finance innovation, meet landfill and recycling objectives and assign responsibility of waste

The capacity for final disposal of waste and recycling processing wi[redacted] organisations, which are strategically located close to the strategic transport corridors in order to serve wider commercial markets. **A lack of investment in existing infrastructure in Kent has resulted in high haulage costs and other impacts associated with highway network congestion**. Kent County Council is facing a significant gap in capacity for waste infrastructure when accounting for future growth. This has been hindered by imposed legislative changes and as such, existing facilities are unable to accommodate increased waste streams (e.g. storage for large domestic appliances, WEEE and food processing waste).

Investment in infrastructure facilitating the generation of renewable energy for use within Kent through energy and value recovery technologies, (e.g. Energy from Waste facilities) is essential. The typical capital cost of an Energy from Waste plant (250k tonnes p.a.) is £150 million. Whilst Kent has one Energy from Waste Facility in operation and another due to become fully operational in 2019, the provision of materials recycling, food processing and composting facilities is required. Investment will enable the County Council to meet increasing demand and ensure self-sufficiency, as well as the use of waste as a resource; meeting the objectives of the recently adopted Kent Minerals and Waste Local Plan 2013-2030 and its commitment in driving the management of waste up the 'Waste Hierarchy'.

At present, **there is very little in the way of financial or regulatory incentives regarding the provision of long-term treatment capacity and in turn serving domestic Waste Disposal activities.** Within Kent, the treatment capacity of household waste is currently stable. Reliance on landfill is low however - this is being achieved through the County Council setting specifications supported by market providers. In addition, the cessation of the Climate Change Levies has been cited by the waste management industry as a principal reason to no longer invest in anaerobic digestion facilities. In light of this and changes in the European market for materials, it is considered that a **national strategic plan is required to enable the UK to become self-sufficient in processing all waste**. This must offer resilience to Brexit implications (such as EU legislation around recycling percentages and using European markets for waste) and other international trading arrangements, whilst also considering waste as a valuable resource and a source for economic growth and

[45] KCC's 'Water. *People. Places: A guide for master planning sustainable drainage into development'* via this link.

employment. Furthermore, there is a current lack of regard for waste as national infrastructure and ever diminishing economic incentives. For example, a combination of the recent loss of Climate Change Levy exemption certificates regarding Energy from Waste facilities (resulting in a loss excess of £500,000 per annum), as well as OFGEM's reduction in embedded benefits for local energy producers of approximately £1 million per annum, significantly threatens the economic case for waste infrastructure provision in Kent.

8.2 Barriers, costs and benefits to achieving a more circular economy

Within Kent, **there is a significant need for investment in recycling processing facilities**. Recycling rates from local Waste Collection Authorities have plateaued in recent years and the impact of a Circular Economy Package and whether this is transposed into UK law from European legislation post-Brexit could pose as a significant financial risk. For example, if high recycling targets are set, authorities that utilise Energy from Waste facilities (classed as recovery, not recycling facilities) will be required to source alternative outlets to meet such requirements, as well as retain commercial and contractual risk with suppliers. With regard to a lack of Material Recycling Facility infrastructure, the cost of added haulage will limit commercial benefit and therefore increase pressures on local authorities. Unless national infrastructure is developed to meet new demand, this waste stream will not be processed.

The loss of incentives securing financial investment in waste management and lack of aligned Government funding policy will place significant pressure on the County Council as Local Waste Disposal Authority to deliver sustainable waste infrastructure. A national strategic plan is essential to enable the UK to become self-sufficient in processing all waste.

Contact details

KCC would welcome the opportunity to engage with the NIC on the above points further. Please contact [redacted] for further information or to arrange further engagement.

[name redacted] [e-mail address redacted]

National Infrastructure Assessment Call for Evidence

Response submitted by: [name redacted] [title redacted], Kingspan Insulation Britain & Ireland ([email address redacted])

About Kingspan Insulation

Kingspan Insulation Ltd is a large-scale manufacturer and exporter of insulation products for the UK market and beyond. It is part of the Kingspan family of companies who have experience across diverse product and technical ranges in the renewable energy and energy efficiency sector. The company has facilities throughout the United Kingdom and its products are in particular demand from those with specialist architectural needs in this country and across Europe and further afield. Kingspan's range of products include high and premium performance insulation products.

Kingspan's customers benefit from reduced energy waste and more floor space for economic activity compared with use of traditional insulation materials thanks to the particularly thin Kingspan solutions. These qualities are valuable, contributing toward the long term prosperity of the United Kingdom and the business community.

Answers to questions

We have answered questions 1, 3, 5, 7, 12, 19, 20, 25 and 26.

Cross Cutting Issues	
1.	What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

We would support more investment on the energy efficiency of the UK's buildings as one of the highest value infrastructure investments. Energy efficiency measures such as insulation can have a high value impact on improving the UK's building infrastructure. Improved building efficiency can lower bills for both domestic consumers and commercial consumers. This provides more expenditure for consumers to invest elsewhere in the UK economy or to grow their businesses. There are various other benefits to improved efficiency of the building stock such as improved health due to living in a warmer home, which results in reduced strain on the NHS. Health benefits can have a domino effect of positive impacts such as improved performance at schools, more people in work and more productivity in the workplace.

Carbon emissions can also be dramatically reduced through improved energy efficiency of buildings; supporting delivery of UK carbon targets. Some renewable or low-carbon heating technologies perform best in well insulated buildings. Therefore support for energy efficiency measures such as insulation can also increase the deployment of low-carbon or renewable heating systems. Achieving even greater gains towards lowering carbon.

Reducing energy demand has a positive knock on effect by reducing overall energy demand therefore reducing the transport and supply infrastructure requirements of energy

generation. It can also support to flatten peak load times, in the morning and evening, if buildings are more able to stay warmer with heating lower or turned off. This can be further facilitated through use of time of use tariffs and smart meters.

3.	How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

The national building stock, including new and existing buildings, should be considered as a part of our Infrastructure. New buildings and those retrofitted should be planned, designed and delivered in such a way as to reduce energy demand and minimise carbon emissions, whilst producing benefits to health and welfare for the people that live and work in them.

Reducing energy demand has other positive knock on effects such as by reducing overall energy demand therefore reducing the transport and supply infrastructure requirements of energy generation.

4.	What is the maximum potential for demand management, recognising behavioural constraints and rebound effects? *Note: "demand management" includes smart pricing, energy efficiency, water efficiency and leakage reduction. "Rebound effects" refer to the tendency for demand to increase when measures aimed at reducing or spreading demand also lead to lower prices or reduced congestion, undoing at least some of any demand reduction. For example, if smart meters reduce the cost of electricity in off-peak periods, this could lead to greater energy consumption overall, where a large number of individuals or firms take advantage of these lower prices by increasing their total usage.*

As outlined in answer to question 1 energy efficiency and in particular building insulation can have a hugely beneficial impact on demand management of energy in buildings. For example, in its 2016 report the Committee on Climate Change (CCC) recommended that to reduce emissions in line with UK 2050 carbon targets, in the 2020s at least 2 million cavity wall and 1.5 million solid wall installations will need to be deployed. However, CCC also suggests that funding the required energy efficiency measures to achieve a fall in fuel poverty would be around £1.4 billion per year.

At Kingspan we have recently produced two papers (attached) considering various behavioural and other constraints to the delivery of these much needed measures. In the papers, we outlined support for changes in the Energy Company Obligation to target funding towards more fuel poor households. We agree this approach is required particularly for higher cost measures or lower income households. In another paper Kingspan also proposed how to support deployment to those household considered 'able-to-pay' for the energy improvement measures. Behavioural constraints exist in this demographic associated with; a failure to recognise energy savings[1] alongside issues related to a general lack of awareness of available measures. Proposal were included in the paper such as developing an ISA fund similar to the 'Lifetime ISA' with funds that can be accessed in order to deliver home energy efficiency improvements. Alongside this

[1] https://academic.oup.com/reep/article/8/1/18/1588147/Bridging-the-Energy-Efficiency-Gap-Policy-Insights

'nudge' approaches such as including a benchmark on energy bills for those with similar household types could help stimulate action. Rebound effects could be avoided by gradually tightening the benchmark. Finally, we would support strengthening of building regulations in the new build sector. Kingspan were disappointed by the scrapping of the zero carbon homes targets and nearly zero energy buildings. This target should be restored. Demand management must be improved in new buildings today to avoid the necessity to retrofit these buildings at a later date. It is more complex and costly to retrofit than to build energy efficient houses at time of construction.	
5.	How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?
As mentioned in answer to question 4 Kingspan think it is important to build new buildings to a high energy efficiency standard today. This is more cost-effective than retrofitting these buildings at a later date. A point which was recognised in the recent Government *Housing White Paper* stating that *"there is more to do, particularly if we want to avoid consumers having to carry out expensive, inconvenient retrofit at a later date"*.[2] Energy efficiency should be recognised as part of a buildings value and improvements should be made in this sector through adequate regulation. Incentives and support should be targeted at existing buildings to improve all of the UK's building stock to an high level of energy efficiency.	
7.	What changes in funding policy could improve the efficiency with which infrastructure services are delivered? *Note: by "funding", the Commission means who pays for infrastructure services and how, e.g. user charges, general taxation etc.*
As a provider of insulation materials Kingspan has closely followed policy schemes relevant to the sector including the Energy Company Obligation (ECO) and the Green Deal. For funding of policy to be successful industry must be given the confidence to invest in a scheme and to continue to do so as the scheme evolves. Rapid changes, lack of transparency and scrapping of schemes are detrimental to industry and investor confidence. It is of high importance to the success of such schemes that a clear direction is set at the outset of the scheme. If changes must be made this should be done so with transparent consultation, minimal delay and with clear guidelines on what and when changes will come into effect. For example, under ECO, companies have been planning their contracting of ECO deliveries and procurement based on the previous framework. The recent consultation on transitional changes and the anticipated consultation on the next phase of the scheme should be structured in such a way which is minimally disruptive to the supply. Approaches such as those described will ensure industry and investors have the confidence in a policy approach.	
12.	What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

[2] https://www.gov.uk/government/publications/fixing-our-broken-housing-market

	Note: "credible" improvements are those that generate results that are in line with robust evaluation findings for comparable schemes. "Tractable" improvements are those that can generate usable quantitative outputs. "Transparent" improvements are those that do not rely on 'black box' modelling and assumptions

There are various benefits to be gained from the improved energy efficiency of the UK building stock however, not all benefits are always considered when carrying out cost-benefit analysis on building improvements.

As outlined in answer to question 1 improvements to building efficiency can lower bills for both for domestic consumers and commercial consumers. This provides more expenditure for consumers to invest elsewhere in the UK economy or to grow their businesses. Other benefits from improved efficiency of the building stock include improved health due to living in a warmer home, which results in reduced strain on the NHS. Health benefits can have a domino effect of positive impacts such as improved performance at schools, more people in work and more productivity in the workplace.

Carbon emissions can also be dramatically reduced through improved energy efficiency of buildings; supporting delivery of UK carbon targets. Some renewable or low-carbon heating technologies perform best in well insulated buildings. Therefore support for energy efficiency measures such as insulation can also increase the deployment of low-carbon or renewable heating systems. Achieving even greater gains towards lowering carbon.

An economic analysis by Cambridge Econometrics and Verco in 2014[3] demonstrated that for every £1 invested in energy efficiency, £3.20 is returned to economy. The report concluded that the economic case for making the energy efficiency of the UK housing stock a national infrastructure priority is strong.

In the new build sector, the zero carbon homes policy was scrapped to reduce regulation on housebuilders. However, this took little consideration of the long-term benefits as outlined above of building to the zero carbon standards. Or the negative legacy being created through continuing to build to a lower standard of energy efficiency. With the long-term benefits considered the zero carbon homes and buildings policy should be restored.

Energy

19.	What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

As outlined in answer to question 1 improving the energy efficiency of homes to reduce heat demand, such as through improved insulation is one of the most effective ways to decarbonise heat in both the domestic and commercial sectors. As well as lowering carbon emissions, additional benefits include lower fuel bills for consumers and improved quality of life from living in warmer homes. Improved insulation can also increase deployment of low-carbon and renewable heating systems because these technologies perform best in well insulated buildings. This achieves even greater gains towards

[3] http://www.energybillrevolution.org/wp-content/uploads/2014/10/Building-the-Future-The-Economic-and-Fiscal-impacts-of-making-homes-energy-efficient.pdf

lowering carbon.

In order to achieve this, as outlined in answers to other questions, building regulations should be strengthened again towards the zero carbon standard. Incentives and support should be targeted at existing buildings to improve all of the UK's building stock to an high level of energy efficiency. This would ensure all UK buildings are operating at a high level of energy efficiency.

Decisions on a targeted approach towards achieving this should be made at the earliest opportunity and a pathway outlined. Industry and investors must be given the confidence to engage in the approach, developing supply chains towards delivery and towards a self-sustaining low carbon heat and buildings industry. As outlined in answer to question 7 frequent changes or scrapping of regulations can be discouraging.

20.	What does the most effective zero carbon power sector look like in 2050? How would this be achieved? *Note: the "zero carbon power sector" includes the generation, transmission and distribution processes*

We do not have any specific comment to make on the generation, transmission and distribution processes for power except to say that; where the power is also providing heat and as outlined in answer to other questions, a highly energy efficient building can ensure the benefits of low carbon and renewable technologies are maximised. In addition, reducing building energy demand can have a positive knock on effects on the power sector by reducing overall energy demand and therefore reducing the transport and supply infrastructure requirements of energy generation.

Flood Risk Management

25.	What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

Kingspan do not have a comment to make on the level of flood resilience the UK should aim to achieve. However, when considering flood resilience measures for properties, insulation measures can play an important part in the mix of measures. For example, PIR board insulation is water resistant and can therefore improve the flood resilience of a building. As outlined there are a number of benefits to be gained from insulation used to improve the energy efficiency of a home. This can also be extended to support with mitigating against risk posed by climate change.

26.	What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk? *Note: "innovative technologies and practices" can include, but is not necessarily limited to, property level resistance and resilience, temporary defences, advances in predictive asset maintenance and innovative construction materials.*

As outlined in answer to question 25 certain insulation materials have water resistant properties that can improve the flood resilience of a building. One of the key merits of this is the technology can be installed at individual property level, tailored to the needs of a building, unlike larger engineering projects, to reduce flood risk. This can be beneficial because it may be lower cost or may be practical for buildings where other projects are not suitable. In addition, the building occupier will also benefit from improved energy efficiency of a property.

For more information on this consultation response please contact:

[name redacted], [title redacted], Kingspan Insulation Britain & Ireland ([email address redacted])

KMEP Kent & Medway Economic Partnership

A partnership between the business community and local government
& a federated arm of the South East Local Enterprise Partnership

NIA Call for Evidence
National Infrastructure Commission
11 Philpot Lane
London
EC3M 8UD

10 February 2017

Dear National Infrastructure Commission

Infrastructure investments that would support long-term sustainable growth

The Kent and Medway Economic Partnership (KMEP) is a federated board of the South East Local Enterprise Partnership, which aims to drive forward economic growth and prosperity. A fundamental component of our work is making the case for infrastructure that will deliver a significant economic uplift to the local economy.

We welcome this call for evidence from the National Infrastructure Commission, and wish to form a close-working relationship with you in the identification of infrastructure investments required.

Our Board Members represent the business sector, education providers, and all local government leaders in our region.

Collectively we believe that immediate and significant investment is required now in the South East international trading corridor to enable long-term transformation of both the region and UK PLC.

On roads, this means taking an urgent decision that empowers the private sector to construct a new Lower Thames Crossing, with sufficient capacity to handle future traffic growth. The M2/A2 must become fit-for-purpose through junction redesign and dualling of the single carriageway sections. National co-ordination is needed to create a network of Lorry Park with smart technology advising drivers when cross-channel disruption occurs. Our global competitiveness is reliant on keeping the traffic, services and goods flowing freely across our international borders on the Kent coast.

On rail, investment should be focussed on increasing capacity, reducing journey times, redeveloping station facilities and supporting the locations earmarked for growth (such as Ebbsfleet Garden City and Otterpool Park).

More broadly on infrastructure, we require a step-change in the co-ordination of funding and activities to allow all partners to work more effectively together. For example we require regulatory changes that place a requirement on digital providers and developers to lay fibre cables before the housing development is built.

We believe the issues listed above are the "**highest-value infrastructure investments that would support long-term sustainable growth in our region**". Recognising the NIC wishes to see the evidence why the infrastructure is required, we have included further detail in the appendix. We have also provided a perspective of the South East to show why the investment is needed in our region.

We do not intend to respond to the other questions within the NIC's call for evidence, but would urge you to refer to Kent County Council's submission that has been written in collaboration with KMEP.

Thank you for taking these points into consideration.

Yours sincerely

[Signature redacted]

[Name redacted]

[Job title redacted]

Appendix

Before looking in detail at the highest-value infrastructure investments listed, we would like to place the South East in perspective.

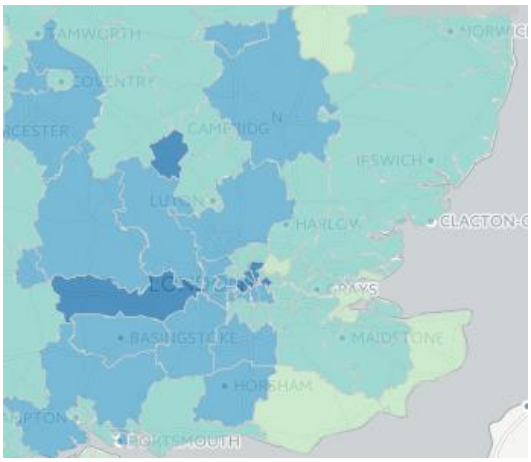
The South East in perspective

First, let us define the South East. The Government often defines the South East as running from Hampshire to the Kent coast, and from the Isle of Wight to Milton Keynes (based on NUTS 1 statistical regions). Using this broad regional approach masks significant local variance in outputs and performance.

For example, the GVA in Milton Keynes in 2015 was £39,709, and in Berkshire was £38,961. This contrasts strongly with the Kent and Medway figures:

- Medway: £17,038
- East Kent: £17,152
- Kent Thames Gateway: £20,172
- Mid-Kent: £22,392
- West Kent: £24,793

The diagram below from the ONS shows this GVA variance[1]:



Why does this matter? One of the ten pillars in the recently published Industrial Strategy Green Paper seeks to rebalance the economy, and address the fact that the "South East, and particularly London, have pulled ahead of much of the rest of the country."

To be clear, the need for high-value infrastructure in Kent and Medway is as strong as the need in the industrial cities of the North. This is evidenced by the Northern Powerhouse having higher GVA values (Manchester's GVA was £30,963 and Leeds was £26,341 in 2015).

Kent and Medway have significant potential. We have under-utilised assets (such as our population and housing capacity) in a landscape where achieving economic excellence is within grasp, were the investment to be directed towards creating resilient transport links. Action to address regional imbalance is rightly a national priority, however we would urge a more localised view to be taken.

[1] http://www.neighbourhood.statistics.gov.uk/HTMLDocs/dvc220/index.html

Highest Value Road Infrastructure Investments

Lower Thames Crossing

By far, **the highest single priority for KMEP** is a new **Lower Thames Crossing east of Gravesend**, future-proofed to cope with increasing traffic flow and delivered in the shortest possible timeframe**.**

KMEP urges the government to authorise the construction of a 3-lane bored-tunnel at location 'C'. We believe that private finance options should be considered to accelerate construction of the project. There is considerable appetite to be involved in this project from infrastructure investors, international banks, construction parties, fund managers, and pension investors across the globe - were the Government to approve this approach[2].

Reasons why a new crossing is required were included in Highways England's 2016 consultation[3]. These include:

- Partial or full closure of the existing crossing occurs over 300 times a year, and it typically takes 3 to 5 hours for the roads to clear.
- During the last 25 years, daily average traffic has increased substantially – from 80,000 vehicles in 1991 to 141,000 vehicles in 2014. This is significantly above the design capacity of 135,000 vehicles per day.
- 25% of journeys are made by heavy and light goods vehicles, and this is predicted to increase by 34% by 2041.
- 73% of respondents to a Highways England survey say traffic congestion at Dartford affects their business. 60% thought their business would grow and almost 50% said that they could employ more people if the problem of congestion were addressed.

In addition to these points, KMEP would like to emphasise:

- There is a significant cluster of key employment sites with over 1,000 sq.m of commercial floorspace located in the Thames Gateway region[4]. The decision of businesses to invest in these sites is inextricably linked to their ability to transport goods, services and employees to these locations.
- Ebbsfleet is designated to become the first Garden City in 100 years, delivering 15,000 new homes. To access the Garden City, we need highway investment and the Lower Thames Crossing.
- 47,000 businesses and residents feel so strongly that they responded to the Highways England consultation – the highest number of respondees ever to a road consultation.
- The noise and air pollution is damaging the health and wellbeing of local communities in the vicinity of the crossing. Nitrogen dioxide concentrations fail to comply with the EU Air Quality Directive and related national regulations. The ruling by Mr Justice Garnham in his judgement of 2/11/2016 underlines the necessity to achieve compliance with the Directive within the shortest possible time.

[2] Research has been undertaken by KCC to identify possible investors.

[3] https://highwaysengland.citizenspace.com/cip/lower-thames-crossing-consultation/

[4] http://www.kent.gov.uk/__data/assets/pdf_file/0012/50124/Growth-and-Infrastructure-Framework-GIF.pdf

M2/A2 Corridor

KMEP believes the **M2/A2 corridor is not fit-for-purpose**. It is an international trading corridor and, for the UK to retain its global competiveness, the corridor must allow the fast and free-flow of traffic.

In particular, KMEP believes the following junction and highway improvements are needed on the M2/A2 corridor route:

- Redesign of **M2 Junction 7** (Brenley Corner)
- **Dual the A2** from Lydden to Dover
- Improve the **M2-M20 connectivity** (by upgrading the A229 and A249)
- Improve the **A2 Bean & Ebbsfleet** Junction
- Introduce **temporary A2 Dover TAP** - to hold port-bound freight outside Dover on the A20/A2 to prevent queuing in central Dover during cross-channel disruption
- **Widen the M2** to three-lanes where possible – It is a dual carriageway for much of its length.

The M2/A2 must be upgraded to support a greater volume of traffic and to ensure that goods, services and people can be easy be transported to and from the continent without delay. Points supporting this argument include:

- The M2 links international border points (such as the Port of Dover and Eurotunnel) with London, the Midlands, the North, and beyond.
- £119bn of trade[5] per annum enters the UK through the Port of Dover alone (Eurotunnel's freight is additional to this). If Port of Dover were a separate country, it would be the world's 55th largest economy.
- This trade is transported on up to 10,000 HGVs per day, 365 days a year.
- In addition, 5 million tourist vehicles pass through the Port of Dover per annum.
- The Port of Dover saw a 30% freight growth in just three years from 2013 to 2015. This trend continues to grow…
- All lorries use Kent's M2/A2 or M20 for part of their journey.
- 50% of all freight traffic from the Port of Dover and Eurotunnel use the Dartford Crossing to travel to the Midlands and Northern England, so may prefer the more northerly M2/A2 route.
- If the Port is blocked for one day, lining up the HGVs back-to-back in single file would stretch up the M2, around the M25, up the M11 and reach Stansted Airport. The A2 is **single-carriageway** for part of its length. Hence if there is an accident on the A2 in this stretch, this scenario becomes more probable.

[5] Information provided by Tim Waggott, CEO of the Port of Dover.

For those unfamiliar with Kent, the difficulty with **Brenley Corner** is that people and freight drivers on the M2, who wish to continue onto Canterbury and Dover via the A2, are currently compelled to leave the M2, use the slip road, navigate the Brenley Corner roundabout, before turning right to join the A2. This current configuration of the junction creates peak hour congestion on a regular occurrence, as traffic on the strategic Highways England road network mixes with traffic on the local road network. Significant housing developments planned in the nearby city and towns of Canterbury, Faversham, and Margate/Ramsgate will all increase the pressures on this junction beyond what is manageable by traffic signal control.

Lorry Park Network

KMEP has collectively agreed that there is a need for a **national lorry park network**, connected to smart technology, so that HGVs are directed to sites where they can park appropriately overnight, and in the event of cross-channel disruption.

KMEP welcomes the investment by the Government in the Stanford West lorry park for Operation Stack. However, we feel that it would be appropriate to explore delivering **a number of lorry parks across Kent and Medway** as well to accommodate demand for overnight HGV parking.

Due to being located on the international road network, there is significant numbers of HGV drivers that park illegally and/or inappropriately in Kent.

Kent County Council conducted parking surveys and determined that **500 to 800 HGVs are parked inappropriately** overnight every day.[6]

[6] http://consultations.kent.gov.uk/gf2.ti/-/740130/24321093.1/PDF//Freight_Action_Plan_Consultation_Draft.pdf

Highest Value Rail Infrastructure Investments

Crossrail Extension

KMEP urges the NIC to support the **extension of Crossrail** to **Ebbsfleet** as a minimum, and preferably to Gravesend.

There is a consortium of partners, which includes Kent County Council, the Greater London Authority, Transport for London, Thames Gateway Kent Partnership, Ebbsfleet Development Corporation, Bexley Council, Dartford Borough Council and Gravesham Borough Council. This consortium is working to produce a strategic outline business case for the extension, and KMEP would ask the NIC to engage with the consortium in this regard. We are led to believe the strategic narrative for the case for the extension is due to be submitted to HM Treasury within the next month or two.

The reasons why the Crossrail extension is so pivotal in Kent and Medway include:

- Ebbsfleet is designated to become the first Garden City in 100 years, delivering 15,000 new homes.

- The wider Thames Estuary is scheduled to deliver 100,000 new homes between 2011 and 2031.

- Travel to work patterns indicate a significant proportion of residents living in the Thames Estuary commute to London for work purposes. In the 2011 census, it showed that 19% of Dartford's and 12% of Gravesham's residents that commuted used rail or light rail/metro to reach their work place[7].

- Anecdotal evidence and personal experience indicates that the existing High Speed services that run from Ebbsfleet International to Stratford International and London St Pancreas are full during the peak times.

- There is thus a need to increase capacity. However, the extension of Crossrail to Ebbsfleet International will also to deliver wider connectivity with High Speed and international rail services. It would provide the first direct connection for Kent residents to an international airport (at Heathrow).

[7] http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/ons/publications/re-reference-tables.html?edition=tcm%3A77-295663

High value rail infrastructure sought through new South Eastern Franchise Tender

KMEP's view is that the new **South Eastern Franchise Tender** should include these requirements:

- **Elongate High Speed trains in the peak** to add capacity (trains should have 12-cars, not 6)*.
- Provide **new Ebbsfleet shuttle service to London** with 2 trains per hour (tph) all day (otherwise Garden City less achievable).
- Provide 2 tph all day to **Canterbury West, Dover and Shepway**
- Provide 1 tph High Speed service to **Rye and Hastings**
- **Tonbridge to Hastings line** to receive additional power supply to permit regular operation of 12-car trains
- All services that pass through should stop at **Thanet Parkway,** with no diminishing of services to Sandwich or Deal
- **Rebuild Westenhanger** station
- Have **Tonbridge to Gatwick through-services**
- Ensure sufficient **capacity at London termini**
- Agree sufficient station **car parking**
- Roll-out smart and mobile **ticketing**
- Establish a best **fare price promise** across all ticket media

*The specific trains which KMEP wishes to extend from being 6 cars in length to 12 cars in length are shown in the table below:

High Speed Route	**New 6-car sets**
St Pancras - Ashford – Canterbury West / Dover Priory	12
St Pancras - Ashford – Hastings	3
St Pancras - Ebbsfleet shuttles	5
Total new 6-car sets	**20**
Total estimated cost:	**£150.0m**

KMEP has already secured some funding towards the delivery of a new railway Station in Thanet called **Thanet Parkway**. It is seeking to secure further capital from the New Station Fund to cover the funding shortfall. The reason this station is required includes:

- East Kent contains some of Britain's most iconic natural and built landmarks (such as the Turner Contemporary), has a vibrant tourism economy, and has significant capacity for growth.

- This capacity is proven by the success of the Discovery Park Enterprise Zone at Sandwich, launched in 2011, which has quickly established itself as one of Europe's leading science and technology parks. Now more than 150 companies and over 2,400 people from established organisations to emerging start-ups in the fields of life science, pharmaceuticals, biotechnology, science and technology are based at this Enterprise Zone.

- In conversations with the businesses and entrepreneurs based at the Discovery Park, it is clear that a significant barrier to their further economic growth is the long journey times to travel by rail to London.

- At present, these businessmen and women can choose to travel from Ramsgate or Deal stations to London, but will face a journey time of 1.5 to 2 hours to cover the 100 miles distance. In contrast, it takes businessmen and women only 1 hour to travel from Swindon to London, which is located a similar distance away at approximately 100 miles.

- To reduce this journey time, a joint project between Kent County Council, Network Rail, London and Southeastern Railway, and the Department for Business, Innovation & Skills is underway, which will deliver up to 7 minutes journey time saving.

- If this were to be coupled with a new station at Thanet Parkway, a journey time of 60 minutes from London Stratford International to Thanet Parkway would be achievable.

- Being within an hour from London will help improve investors' perception that East Kent is easily accessible and an attractive place to invest in and do business.

- Thanet Parkway will also support new and existing commercial and residential developments in the region. Significant housing growth is planned with 15,660 new homes anticipated in Thanet, and another 10,000 in the Dover district. It will also support a new mixed-use development called 'Stone Hill Park' on the former Manston Airport site.

Another crucial objective for KMEP is to secure the rebuild of **Westenhanger station**.

Shepway District Council with Cozumel Estates is leading on a proposal to **build a new garden town**, which is known as **Otterpool Park**[8]. The new garden town will be a 12,000 home development, that is situated seven miles from Folkestone and accessible from Junction 11 of the M20 and Westenhanger train station. The brand-new town could house potentially 29,000 people.

The Westenhanger station, which opened in 1844, is an unmanned small station, originally designed to serve the nearby village. It will not be able to accommodate the passenger numbers without being redesigned and rebuilt.

Westenhanger stations also lies next to the High Speed 1 line, and Shepway District Council proposes that the station becomes part of the HS1 network. This is needed to provide clear and positive signals to the market, to stimulate and meet the demand and accelerate the supply of housing.

The Network Rail's Kent Route Study

In addition to the changes we seek to influence through the South Eastern Franchise Tender, we will also be making the case for the following interventions to be included within the Network Rail Kent Route Study (which will set out proposals for investment in the rail network in Kent during the period 2019 – 2024).

KMEP believes that the Network Rail's Kent Route Study should include:

- A new Thanet Parkway station (see above)
- Rebuild of Westenhanger station
- Rebuild of Maidstone East station
- Rebuild of Strood station
- Rebuild of Swanley station
- An extra platform at Canterbury West station

[8] http://www.otterpoolpark.org/

- Track works at Ashford International to link Rye and Hastings with High Speed 1
- Removal of all road level crossings over 20 years and improved safety at foot crossings
- Improved accessibility at stations for disabled
- Introduce new journey time improvement schemes
- A review of the route bottlenecks
- Network Rail to repower the East Kent Network to accommodate 12 car trains.

Other highest value infrastructure investments

Digital infrastructure

KMEP urges the Government to change regulation to ensure all new developments include full fibre networks.

As Kent County Council's response to the NIC makes clear, whilst the BDUK programme has directed the Government's investment and focus on retrofitting as a priority, there is a danger that it starts losing traction in achieving its 95% target for broadband coverage, as new homes are developed without the same focus on ensuring connectivity.

Too many housing schemes are being completed without any broadband access being available to the occupants and a lack of transparency is resulting in prospective occupants purchasing without realizing their homes are not connected.

KMEP partners, including Kent County Council, have been championing the need for fibre-to-the-premises networks being installed at the point of build in new planning schemes. However, the current national voluntary regime between developers and infrastructure providers is not delivering the required connectivity; resulting in the need for costly and less effective (and future proofed) retro-fit solutions.

Simplifying the offer for developers to provide broadband access during the construction and the relationship between the developers and infrastructure providers needs to be strengthened - developers need the assurance that connectivity will not delay construction and increase build-out cost.

The National Infrastructure Assessment
Response of the Landscape Institute
10 February 2017

Introduction
The Landscape Institute (LI) is the royal chartered body for the landscape profession. As a professional organisation and educational charity, we work to protect, conserve and enhance the built and natural environment for the public benefit. We represent over 5000 landscape architects, planners, designers, managers and scientists. We champion multifunctional and sustainable landscapes in both town and country. We believe that through careful and appropriate planning, design and management, it is possible to deliver a wide range of economic, social and environment benefits.

Response
The LI shares the view of the Commission that 'the NIA will only be a success if it is undertaken in an open and transparent way, engaging a wide range of stakeholders.' Many of the LI's members are willing to contribute their expertise across a broad range of landscape issues to the Commission, as it continues to engage with stakeholders and to collate its evidence base for the NIA.

The landscape architects, designers, landscape planners, managers and scientists who are Chartered members of the LI will be in a position to assist the Commission where it identifies systemic gaps in the evidence base. In particular we can offer relevant case-studies, research papers and technical guidance relating to sustainable drainage systems (SuDS), water sensitive urban design (WSUD), integrated catchment management, health and wellbeing, biodiversity, biosecurity and ecological resilience, and have published the definitive technical guidance for landscape and visual impacts assessments. We are currently intending to publish planning guidance around the potential landscape impacts of shale gas fracking exploration, and developing an assessment method for 'dark skies' and lighting impacts.

The LI accepts that the inclusion of natural capital and green infrastructure as infrastructure sectors in their own right is beyond the Commission's remit. However, we welcome the commitment to take them into account where, for example, grey infrastructure impacts on natural capital and where natural capital can impact on or contribute to grey or blue infrastructure. The Institute has published guidance for the creation and enhancement of landscape infrastructure, green and blue, and is now developing this further to incorporate a 'natural capital' and 'eco-system services' approach. We encourage the Commission to consider the role of natural capital and green infrastructure as potential solutions to flood risk management and can offer evidence, case studies, research findings and technical guidance on this topic.

The LI has a wealth of relevant information to offer to the Commission. Sue Illman, Past President and Construction Industry Council Champion for Flood Mitigation and Resilience, has submitted to the NIC the Institute's published position statements on a number of policy themes including public health and green infrastructure.

The Institute would welcome the opportunity to contribute to the proposed panel and roundtable discussions as appropriate, and will also be willing to submit detailed evidence in response to the following questions, as outlined in the Call for Evidence.

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Please refer to our work on housing here:
https://www.landscapeinstitute.org/policy/housing/

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

Please refer to our work on green infrastructure here:
https://www.landscapeinstitute.org/policy/green-infrastructure/
https://www.landscapeinstitute.org/wp-content/uploads/2016/03/Ecosystem-Services-TIN-2_16.pdf
https://www.landscapeinstitute.org/wp-content/uploads/2016/03/Connectivity-And-Ecological-Networks-TIN-1_16-20160425.pdf

Please refer to our work on landscape and visual impact assessment:
https://www.landscapeinstitute.org/technical-resource/landscape-visual-impact-assessment/

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

Please refer to our work on natural flood management here:
https://www.landscapeinstitute.org/policy/water/
https://www.landscapeinstitute.org/technical-resource/catchment-approach/
http://www.landscapeinstitute.org/wp-content/uploads/2015/12/TGN1_14SUDSmanagementMar2014.pdf

For further information, contact should be made in the first instance with Stephen Russell, Head of Policy at the Landscape Institute, email: Stephen.Russell@landscapeinstitute.org

Light Rail Transit Association

Submission to the National Infrastructure Commission
call for evidence for the National Infrastructure Assessment

1. Light Rail Transit Association

The Light Rail Transit Association (LRTA) was established in 1937 by a group of people concerned about the proposed closures of tramways in London. The Association has grown over the intervening years into an international body with almost 3,000 members around the world, half outside the United Kingdom. Although the LRTA's members come from all walks of life, they share a common concern with the development of good quality public transport through the use of light rail and tramways. Many are professionals working in the transport industries. The Association's monthly magazine, "Tramways & Urban Transit" is widely regarded as essential reading around the world by those concerned with the development, building, operation and use of light rail and tramway systems.

The Association's objectives are to educate people about light rail and modern tramways and to advocate the adoption of such systems as core components of modern integrated transport systems. The Association carries out its campaigning under the banner *TramForward*.

2. The problem facing our cities

The LRTA is concerned that too much emphasis in current major infrastructure planning is being placed on better connections between cities whilst there is a significant problem with transport within cities and other urban areas.

A major factor in improving the economic performance of our major cities is by improving the access by businesses to a high-skilled workforce. This can be achieved by a better local transport infrastructure giving better connectivity between the city, its suburbs and the surrounding areas. A recent Centre for Cities report has highlighted this:

"The UK's biggest cities are currently punching well below their weight. To change this policy needs to improve their two key advantages – their ability to create new ideas and spread information, and the access they give businesses to many highly-skilled workers. This requires … investment in transport within cities and their wider areas to better link jobs in city centres in particular to residential areas in suburbs and hinterlands." [1]

Another report, in comparing the North of England with the Rhine-Ruhr (Germany) and Randstad (Netherlands) conurbations came to a similar

conclusion that intra-city connectivity is more important than inter-city in stimulating economic development:
"An argument often put forward about both the Randstad and Rhine-Ruhr areas is that their transport links allow people to live in one city but work in another, suggesting that there would be benefits for the North of England in strengthening transport links between cities. But the data suggests that people don't use the transport links in this way."

"Highly skilled workers do tend to commute further. But they tend to commute from the rural hinterlands of the cities they work in, rather than from other cities." [2]

The problem with many of our larger cities is that while they may have had efficient public transport systems in their industrial heyday much of this has been lost by closure of local railways and of tramway systems. Subsequent reliance on the private car has led to congestion and gridlock, while the bus-based public transport systems have not been able to maintain their efficiency on the congested roads. There have been more recent improvements resulting from the electrification of local rail lines (such as the cross-city line in Birmingham) and the development of light rail systems (most notably Metrolink in Manchester). By and large, however, our cities still lack comprehensive, efficient and properly-integrated public transport.

Some of our smaller cities and towns have prospered, notably Cambridge, Milton Keynes, Norwich, Oxford, Reading and Swindon. They are now, however, becoming victims of their own success and are suffering from high property prices (which force workers to live further from the city centre) and from congestion as these same workers struggle to reach their places of work. These places, too, are sorely in need of improved and efficient public transport.

3. An answer

The LRTA believes that the problems of urban connectivity are best solved by the provision of a high quality public transport network. While heavy rail and bus must play their part at opposite ends of the passenger loading spectrum, the backbone of such networks should be light rail and trams. The essential requirement in any network is the full integration of modes, in terms of interchange and through ticketing, allowing seamless journeys into and within the city.

4. Benefits of trams

Trams are a highly-efficient way of moving large numbers of people in urban

areas, typically 2,000 to 18,000 passengers per hour per direction. They have a proven record in attracting people out of cars; the rate of modal transfer from car to tram at peak times is typically around 20% - often more. This compares with estimates of between 4% and 6.5% for quality bus investment. Levels of traffic reduction from trams are typically around six times greater than with bus schemes. Reductions of road traffic of up to 14% after introduction of tram schemes have been recorded.

A tramway improves the city's image and assists urban regeneration. Shiny rails instil confidence. All UK schemes have had positive effects on the image of the city in which they have been built, which has brought benefits in terms of attracting inward investment as well as business visitors and tourism. This is supported by the examples from overseas, where tangible improvements to a city's image are made obvious through numerous travel documentaries.

There are also beneficial effects on property values, both commercial and residential, from the introduction of trams. Tram schemes can encourage regeneration of run-down urban areas. Trams increase labour force mobility between job opportunities and residential areas, including deprived areas, and give better access to community and shopping centres.

Being electrically powered, trams are pollution-free at point of use, avoiding both the tail pipe emissions of the internal combustion engine as well as the particulate pollution generated by wear of tyres and road surfaces. The carbon footprint is also lower than other modes, particularly if they are powered by electricity generated from renewable sources.

5. Response to specific questions

It is the firm view of the LRTA that lessons need to be learned from other European countries and the United States about infrastructure investments and local revenue-raising mechanisms to fund them. The example of the *Versement Transport* in French cities; the *Gemeinde Verkehrs Finanzieurungs Gesetz* and regional fuel taxation in Germany and the variety of local sales taxes in American cities all help significantly with funding of public transport systems. In addition, as practised in Nottingham, a Workplace Parking Levy can similarly raise local funds.

We also believe that land value capture should be properly investigated so that the increases in property and development land prices that public transport infrastructure investments generate are used to part-fund the capital costs

incurred. This was done to good effect in the development of the Toronto (Canada) metro system.

Though businesses inevitably complain about higher taxes or other levies it is ultimately to their benefit that better public transport is delivered.

The emergence of "city deals" between HM Treasury and Combined Authorities is a step in the right direction but much more needs to be done to give large urban communities the freedom to act without every investment being referred to Westminster for approval.

In terms of future travel patterns we do not believe that much will change as a result of the drive to develop autonomous vehicles, as these have the potential simply to worsen congestion and thereby reduce still further the quality of life in urban areas. The time has come for city governments to take back the streets for people from low-occupancy modes, and to restrict (better still reverse or eliminate) the huge growth in the number of private hire cars (eg: Uber) and delivery vehicles (eg: handling orders from on-line retailers to urban pick-up points or customers' places of work).

Digital communications enhance the output of integrated transport systems and enable sensible development of "mobility as a service" provision alongside conventional public transport.

To reduce energy consumption and tackle the problem of PM10 and other harmful particulate emissions, public transport systems urgently need to be electrified and the proven benefits of modern tramways (and trolleybuses in a feeder role or in small cities) hold out the best totally proven means of achieving both outcomes.

References:

[1] Competing with the continent: How UK cities compare with their European counterparts
Hugo Bessis, Centre for Cities, September 2016
http://www.centreforcities.org/wp-content/uploads/2016/09/16-09-21-Competing-with-the-continent.pdf

[2] Building the Northern Powerhouse: Lessons from the Rhine-Ruhr and Randstad
Paul Swinney, Centre for Cities, June 2016
http://www.centreforcities.org/wp-content/uploads/2016/06/16-05-31-Building-the-Northern-Powerhouse-Lessons-from-the-Rhine-Ruhr-and-Randstad.pdf

On behalf of the Light Rail Transit Association

[name redacted]
[position redacted]
[address redacted]
[telephone number redacted], [telephone number redacted], [email address redacted]

National Infrastructure Commission

National Infrastructure Assessment: Call for Evidence

Response on behalf of the Greater Lincolnshire Local Enterprise Partnership & Lincolnshire County Council

Cross-cutting issues:

1. What are the highest value infrastructure investments that would support long term sustainable growth in your city or region?

Sustainable growth is all about business and housing growth.

One third of Lincolnshire businesses tell us that their business growth is constrained by poor transport infrastructure, one third of Lincolnshire businesses tell us that they are concerned about the risk of flooding, and a quarter of businesses tell us that their growth is constrained by a lack of access to finance.

Our dialogue with housing developers tells us that they will invest where the market gives them the opportunity for a reasonable return. In areas like Lincolnshire where the market is fragile, then the additional cost of flood defence and transport improvements can make developments inviable.

Unviable developments, whether commercial or domestic, are a missed opportunity for UKplc.

- Economic growth is important because it leads to higher average incomes, lower unemployment, increased investment, and lower government borrowing which in turn leads to improved public services.
- Housing growth is important because it increases the availability and affordability of homes, increases people's ability to move to jobs, makes local services like schools and doctors' surgeries more viable, and gives people more money to spend on other things

That is where we believe that the NIC's efforts would be best focused; on the investments that will address these higher value benefits. These are:

- Improving transport networks both by improving infrastructure and reducing journeys through better use of digital infrastructure
- Defining the balance between public and private benefit of flood risk management schemes, and recommending shared financial approaches

Lincolnshire County Council is keen to work with the NIC on enquiries that address these issues. In particular we would highlight two areas where infrastructure investment offers opportunities to make a difference to the national economy.

- Flood risk management is important at local, regional;, and national level. SUDS management in a new housing development is patently a local issue.

Making better use of waterway corridors, like the River Trent which passes through the West and East Midlands on its way to the sea at the River Humber, to transport goods and trigger investment is a regional issue.

- However, flood management along the East Coast, as a way of protecting the countryside and communities but especially as a way of securing the nation's food supply, is an important national issue. A nation with an unprotected food supply is a vulnerable nation, and we know that international investment will not take place in a vulnerable nation.

- The NIC has already identified the benefit of investment in important road corridors. The Oxford/Cambridge corridor has clearly been identified a way of promoting investment in the nation's technology sector; one of the country's best exporting opportunities. Strategic infrastructure to support the growth of food sector –not only food production but also the knowledge based businesses that support the sector- will enable the UK to enhance its role as one of the most advanced centres of food production in the world.

- The A47/A17/A52(A50) corridor is as important to the food sector as the Cambridge/Oxford corridor is to technology. And food is as important to the country's security and export as technology. Increased pressure on global food producing areas from climate change and population growth will place a growing emphasis on the need to secure the UK's food security, and the combination of effective water management (both supply and risk management) with distribution infrastructure represent a key opportunity for the UK economy as a whole. At present the UK imports about 40% of its food: the Greater Lincolnshire LEP's ambitions to treble the areas exports of food and drink provide a significant opportunity to address emerging issues of future food security.

Current priorities and future planning

At present Greater Lincoln is the main economic driver of a large sparsely populated rural county. Like many small sized city areas (pop. 80 K – 130 K) it requires balancing investment to promote growth (e.g. Lincoln Eastern Bypass) and to mitigate environmental impact. LEB is funded and consented but benefits need to be locked in via:

- Traffic calming (air quality)
- Improved public realm (visitor attraction)
- Public transport (modal shift)

In addition, a Lincoln Southern Bypass is needed to complete an orbital route around Lincoln (see GLSIDP):

- Capital cost = £ 74 m
- Funding gap = £ 62 m
- Housing impact = + 2,200
- Net GVA impact = £ 36 m

- Jobs (net FTE) = c. 600

Central Lincolnshire is waiting for the Inspector's Report for its Local Plan, details of which can be found at: www.n-kesteven.gov.uk/central-lincolnshire/local-plan/

Agri-food production and processing is a major part of the economy, contributing £187m to the national economy every year, including up to 25% of the UK's vegetable production, 70% of its fish production and processing, and 10% of all English agriculture. Further details can be found in the LEP's Agri-food Sector Plan (2014) at: https://www.greaterlincolnshirelep.co.uk/documents/agri-food-sector-plan/

In both cases the bulk of these activities are necessarily located in the extensive coastal plain, which is maintained as productive land and protected from coastal inundation by an extensive system of water management and coastal defence infrastructure. The Shoreline Management Plans for the East Coast (Flamborough Head to Gibraltar Point) https://www.nelincs.gov.uk/planning-and-development/planning-policy/the-local-plan/the-new-local-plan/pre-submission-draft-local-plan/humber-estuary-coastal-authorities-group-flamborough-head-gibraltar-shoreline-management-plan-2010/ and for the Wash http://eacg.org.uk/smp4.asp detail these systems from a flood risk management perspectives, but include outlines cases for continued investment in coastal management on the basis of economic and social benefits. These were completed in 2010.

In Lincolnshire a more detailed study of the coastal areas with greater focus on economic and social aspects was undertaken in 2008-2010 for the purposes of spatial planning, and now forms part of the evidence base for LPA Local Plans. https://www.lincolnshire.gov.uk/residents/environment-and-planning/environment/lincolnshire-coastal-study/ (see esp. Task 1 – evidence base).

The Environment Agency and local partners are currently reviewing the long-term future of coastal management, which currently costs in the region of £10m per year, with a view to reaching a sustainable methodology which protects key economic, social and environmental assets in the coastal plain, while providing the longer term security required to maintain and grow investment and business opportunity in key sectors such as the visitor economy, agri-food and associated services.

The Humber Estuary Strategy is being developed concurrently to perform the same function for the ports, transport and industrial infrastructure in the north of Greater Lincolnshire.

Together, these initiatives form part of a broader strategic approach on the part of the Greater Lincolnshire LEP and the Lincolnshire Flood Risk Management Partnership (details provided below) where water management is considered as an element of effective resource management in the interests of securing and driving economic growth.

2. How should infrastructure most effectively contribute to the UK's international competitiveness? What is the role of international gateways for passengers, freight and data in ensuring this?

Securing continued operation of east coast port facilities
Enabling movement of water to where it is needed on a strategic level to sustain and grow food production and processing (details of Water Resources East provided below)
Securing the UK land base for domestic food production and processing

3. How should infrastructure be designed, planned and delivered to create better places to live and work? How should the interaction between infrastructure and housing be incorporated into this?

Infrastructure should be designed, planned and delivered in partnership with local people and their representatives, with reference to statutory adopted Local Plans and Infrastructure Delivery Plans (IDP) at district and LEP level. Master planning of large housing development (e.g. sustainable urban extensions) requires incorporation of low impact technologies such as SUDs and solar tiles in addition to communal facilities such as car-pooling. Connecting these communities with sustainable choices – for example around travel: car clubs/ public transport/walking and cycling opportunities can enable behaviour change. Central Lincolnshire is promoting 8 SUEs via its Local Plan.
Furthermore, it is critical that infrastructure should recognise the need and plan effectively for a low carbon future and a future that recognises climate risks and plans and designs accordingly. Government should seek to institute long term, settled policy framework recognising carbon budgets agreed under Climate Change Act.

4. What is the maximum potential for demand management, recognising behavioural constraints and rebound effects?

Demand management should be underpinned by fiscal incentives/disincentives to promote behavioural change. The educational approach to achieving better outcomes is too uncertain and long term. Targeting activities which generate negative externalities (pollution, congestion etc) will require more robust policy intervention backed by available empirical evidence e.g. Local Transport Plans.

5. How should the maintenance and repair of existing assets be most effectively balanced with the construction of new assets?

6. What opportunities are there to improve the role of competition or collaboration in different areas of the supply of infrastructure services?

Opportunities around collaboration between business and academia in developing and driving new technologies.

7. What changes in funding policy could improve the efficiency with which infrastructure services are delivered?

In terms of flood risk and water management infrastructure, current funding rules tend to operate on a project by project basis, with benefits calculated strictly in relation to the individual project in question. This makes it difficult to consider one piece of infrastructure in the context of the broader system of which it is a part, and

militates against truly strategic solutions providing benefit beyond the immediate area and making a difference to the national economy.

In addition, at present, national flood risk funding is very limited in the extent to which it can be used to protect economic assets, and cannot be used to protect future benefits realised by unlocking potential for growth. While this can, to an extent, be offset by accessing alternative sources of funding, these often still come from the public sector and are subject to considerable limitations. Securing sustainable funding from non-governmental sources that is geared to releasing growth potential remains highly challenging.

8. Are there circumstances where projects that can be funded will not be financed? What government interventions might improve financing without distorting well-functioning markets?

9. How can we most effectively ensure that our infrastructure system is resilient to the risks arising from increasing interdependence across sectors?

10. What changes could be made to the planning system and infrastructure governance arrangements to ensure infrastructure is delivered as efficiently as possible and on time?

Inefficient delivery of infrastructure is a systemic failure as well as a symptom of "fiscal consolidation". Most infrastructure is needed at the local level and should be funded and delivered locally. This will require structural change allowing:

- LEP areas to prioritise needs and delivery through statutory IDPs, aligned with adopted Local Plans
- Local authorities to raise finance using prudential borrowing, bonds or pension funds as appropriate
- More local involvement in the agreement of private utility capital investment programmes

11. How should infrastructure most effectively contribute to protecting and enhancing the natural environment?

For most cost effective (in the broadest sense) investment an eco-systems services approach needs to be a principle adopted and integrated. In doing so we will have infrastructure that contributes to a wide range of policy objectives.

12. What improvements could be made to current cost-benefit analysis techniques that are credible, tractable and transparent?

CBA is not a panacea for guiding resource allocation. The value of a cost–benefit analysis depends on the accuracy of the individual cost and benefit estimates. Comparative studies indicate that such estimates are often flawed. Causes of these inaccuracies include:

- Overreliance on data from past projects (often differing markedly in function or size and the skill levels of the team members)
- Use of subjective impressions in assessment
- Inappropriate use of case studies to derive money cost of the intangible elements
- Confirmation bias among project supporters (looking for reasons to proceed).

For some environmental effects cost-benefit analysis can be substituted with cost-effectiveness analysis. This is especially true when there is only one type of physical outcome that is sought, such as the reduction of energy use by increasing energy efficiency. Using cost-effectiveness analysis is less laborious and time-consuming as it does not involve the monetization of outcomes, which can be difficult in some cases.

Transport:

13. How will travel patterns change between now and 2050? What will be the impact of the adoption of new technologies?

Transport is set to see substantial change over the coming decades driven by new and innovative emerging technologies. Already the growth of the home delivery market has seen increases in the number of 'white vans' on the roads and the emergence of Uber and its associated ride-hailing app is challenging the traditional taxi industry. As for vehicle development, the number of electric vehicles being sold continues to rise (albeit still a very low proportion of the overall fleet) and already there are self-parking cars and autonomous emergency braking systems. On the freight side, there are trials of automated HGV 'platoons' and deliveries by drone. The transition towards CAVs (Connect and Autonomous Vehicles) continues to grow in importance as evidenced by the interest and involvement of private companies such as Google, Tesla and the majority of the major car manufacturers who are all investing heavily in developing this technology.

The speed at which this change to travel behaviour becomes mainstream will also be as much about society's readiness to accept such change as it is about technological advancement. For the last hundred years or more, car ownership has been seen as a status symbol, bringing with it personal and flexible mobility. It has almost come to be seen as a necessity of modern life, particularly for those living outside of the larger cities where public transport is not a viable option. Moving society away from this view will be a considerable challenge. Whilst CAVs may bring many advantages such as reduced accident numbers, improvements to air quality and health benefits, there will be a natural reluctance to anything which involves a loss of personal freedom. It also represents a threat to those who drive for a living in the logistics and bus/taxi industries. However, there may be signs that this is changing particularly among the younger generation who are growing up in a more technologically advanced world and who are perhaps more open to new mobility solutions.

Consequently, all of the above makes trying to forecast future changes in travel patterns (and the pace at which they will happen) a considerable challenge. New types of demand will emerge whilst old types of traditional demand may lessen or disappear.

In a policy neutral world, one can reasonably expect the following to occur up until 2050:

- Increased commuting journeys (number and distance) as unaffordable housing forces relocation of staff further away from place of work (cf East Coast Main Line effect and concept of "Greater South East")
- HS2 if implemented will encourage long distance commuting
- Reduced bus patronage in rural areas
- Increased car useage (requires predict and provide road policy)
- Levelling off of rail patronage as price and congestion ration availability and attractiveness
- Increased use of internet shopping will result in more delivery traffic (driverless or manned)

14. What are the highest value transport investments to allow people and freight to get into, out of and around major urban areas?

15. What are the highest value transport investments that can be used to connect people and places, as well as transport goods, outside of a single urban area?

16. What opportunities does ‘mobility as a service’ create for road user charging? How would this affect road usage?

The emergence of 'Mobility as a Service' (MaaS) as a way in which the movement of people and goods is managed through the greater use of technology linked to the provision of transport related services is fundamental to any future forecasts. However, this is very much an emerging area and the subject of much research and investigation by a range of bodies and academics. One of the findings of the Transport Systems Catapult report 'Exploring the Opportunity for Mobility as a Service in UK' (July 2016) was:

- *The impact of MaaS is unknown. MaaS could result in more journeys and distances travelled by car or potentially less; it could support national and local transport policy or challenge it but further research is needed.*

On the more positive side, MaaS also has the potential to provide transport authorities/organisations with substantial data with which to manage transport systems and plan future enhancements. The uncertainty around the future demand for movement is again highlighted by the establishment by Research Councils UK of the 'Commission for Travel Demand'. The Commission is comprised of a mixture of academics and practitioners. Over the coming year, it will explore the changing demand for travel and look at how this demand can be shaped in the future in a way consistent with environmental obligations.

If predicting the demand for travel is unclear at national level, it becomes even more uncertain in a rural area such as Lincolnshire. The predominantly sparsely distributed population, coupled with limit public transport alternatives, leads to a heavy reliance on the private car for travel. Quite how ready the population of Lincolnshire are to move towards a MaaS type approach (i.e. no longer own their

own vehicle) is difficult to assess. In a similar way, industries such as the economically important agri-food industry in the south of the county will remain reliant on the movement by road of large volumes of raw materials and finished products.

Hence, there will still remain a need for transport infrastructure investment across Lincolnshire to remove longer distance cars (whether private or autonomous) and HGVs (whether single or platooned) from strategic routes passing through the towns and villages across the county. This will offer an improved environment locally and opportunities for place-making enhancements to support health and social aspirations, whilst enabling growth.

In addition, going forward rail will continue to have an important role to play. The rail network in Lincolnshire is in need of improvement to enable enhanced services to be provided. Initiatives such as line speed improvements, electrification (with its accompanying carbon reduction benefits) and the roll out of the 'Digital Railway', together with schemes to address specific problem locations such as the flat crossing of the East Coast Main Line outside Newark by the Nottingham-Lincoln line, will all contribute to providing the necessary capacity as the demand for rail travel continues to grow.

Digital communications:

17. What are the highest value infrastructure investments to secure digital connectivity across the country (taking into consideration the inherent uncertainty in predicting long-term technology trends)? When would decisions need to be made?

See response below

18. Is the existing digital communications regime going to deliver what is needed, when it is needed, in the areas that require it, if digital connectivity is becoming a utility? If not, how can we facilitate this?

Available and reliable superfast broadband is critical in a modern economy.

Our experience is that there are three interconnected but distinct concerns that would benefit from further analysis by the NIC.

1. Provision of superfast broadband across the country. Our experience as one of the first rural counties to complete the roll-out of our BDUK superfast broadband programme is that there is a need to improve the relationship between installing the broadband network and improving communities' ability to connect up to the network. We have witnessed communities with a lack of knowledge about the availability of superfast broadband, and more worringly we have witnessed businesses signing up to superfast broadband but experiencing a significant delay in the period between signing up for a broadband service and it being activated. Is there a role for the regulator in this?

2. Tackling "the final 5%". As superfast broadband becomes an increasing part of modern business transactions, the need for universal superfast broadband services becomes more acute. However, our human tendencies are such that if there is a small number of businesses or communities that are not connected, then we believe that most people cannot access the service ! A concerted push from service providers and the media is required in addition to innovative solutions to infrastructure problems. Whilst it is less of an apparent concern for the NIC, the use of public perception as a tool for promoting (rather than hindering) growth may merit exploration. The government's behavioural Insight Team may be able to offer some useful advice.

3. Finally, terms like "superfast" broadband are often used generically. However, work that we have done with four digital business clusters in Lincolnshire show that there is a difference between (i) superfast broadband for domestic use/use with non-digital businesses, and (ii) superfast broadband for the benefit of digital businesses. The capability of superfast broadband for digital businesses will be substantially higher than that for domestic customers, and without an understanding of the need for a higher grade of superfast broadband for digital businesses then policy makers run the risk of focusing digital businesses within highly urbanised areas, thus reducing the opportunity for the vitality of market towns and villages and the industrial linkage that accompanies the relationship between rural digital businesses and broader rural business.

Energy:

19. What is the highest value solution for decarbonising heat, for both commercial and domestic consumers? When would decisions need to be made?

20. What does the most effective zero carbon power sector look like in 2050? How would this be achieved?

As the current BEIS/Ofgem call for evidence on 'A smart, flexible energy system' recognises we are at a critical stage in designing and planning generation, distribution and consumption of energy. That consultation asks all the right questions. An effective 2050 zero carbon power sector will have a settled, long term policy framework that enables distributed generation; utilises the opportunities from energy storage at all scales (from domestic to grid); enables a competitive, innovative market place.

21. What are the implications of low carbon vehicles for energy production, transmission, distribution, storage and new infrastructure requirements?

Water and wastewater (drainage and sewerage):

22. What are most effective interventions to ensure the difference between supply and demand for water is addressed, particularly in those parts of the country where the difference will become most acute?

Provision of strategic infrastructure to achieve storage and management of water in times of excess, with release in times of scarcity. This requires further development of existing multi-stakeholder approaches to ensure multiple benefits to flood risk management, water resource management and environmental enhancement, leading to efficiencies across sectors.

The East of England is the driest part of the UK and the fastest growing. Agriculture, technology, manufacturing, the environment and tourism are all key elements of the regional economy. Future success depends on providing enough water for people and business while simultaneously protecting the environment. Water resource systems in the region are under pressure from climate change, pollution and growth. Action to restore abstraction to more sustainable levels is further reducing supplies while severe or extreme drought threatens to exacerbate the effect of any shortage. In South Lincolnshire, the South Lincolnshire Water Partnership (SLWP) and the Water Resources East (WRE) project are working together to find affordable, reliable and sustainable solutions for meeting these challenges. This means:

a. Securing resources for agriculture and the food processing industries, fenland habitat restoration, public water supply and for improved navigation across fenland waterways, and
b. Enhancing levels of flood protection, both within the South Lincolnshire Fens and in the adjacent upland areas

See:

http://waterresourceseast.com/

A vision to see water as a resource and deliver economic benefits across sectors whilst addressing these issues has been taken on by the GLLEP's Water Management Plan (2016). This focuses on opportunities for managing water that directly support economic growth, and seeks to drive links with organisations responsible for water supply and management. A fundamental principle of the LEP's approach is to integrate activities in flood risk management and water resource management. By placing this in a coherent plan, it is intended that this will incentivise investment in the LEP's priority sectors. This will enable effective water management to be a positive contributor to economic growth.

https://www.greaterlincolnshirelep.co.uk/documents/water-management-plan/

Consideration should be given to minerals planning, particularly restoration which can form part of broader water supply and storage requirements whiclst potentially delivering multiple benefits to the local economy through the agri-food sector, nature conservation, flood risk management and tourism.

23. What are the most effective interventions to ensure that drainage and sewerage capacity is sufficient to meet future demand?

There remains a need for a clear, properly resourced responsibility for drainage systems (eg SuDS) in the long term. With regard to sewerage capacity, it is essential that engagement with the water industry is integrated into the local

planning process as a key consideration in planning for supply and demand, and in design. Account should also be taken of recent legislative changes in relation to SuDS, as well as forthcoming industry changes concerning water supply.

In governance terms, effective engagement can be promoted as a normal way of working through effective partnership arrangements, or, for specific programmes of work, by establishing local and / or regional stakeholder groups to encourage cross boundary working on wider issues, making investment savings and efficiencies such as that being championed by WRE above.

24. How can we most effectively manage our water supply, wastewater and flood risk management systems using a whole catchment approach?

Water resource management, flood risk management and environmental management must be seen as integral parts of a single water management regime informing local and national planning policy, and closely linked into present and future plans for growth.

Since 2010 Lincolnshire has developed a strong partnership approach to flood risk management, set out in a joint Flood Risk and Drainage Management Strategy with a common works programme that brings together the operational and strategic forward plans of all risk management authorities within the area. This is expressed in a joint Flood Risk and Drainage Management Strategy (2012) which can be accessed below:

https://www.lincolnshire.gov.uk/residents/environment-and-planning/flood-risk-management/implementing-a-strategy-to-manage-flood-risk-countywide-and-locally/103045.article

Continuously enhanced, this joint strategy has been widened in scope since 2012, leading to the Water Management Plan developed jointly with the Greater Lincolnshire LEP (described above). In turn, this has opened up opportunities to engage across boundaries with multi-agency strategic initiatives, such as Water Resources East, of which the Black Sluice Catchment pilot is an integral part. The purpose of this pilot is to explore in detail the potential opportunities of whole-catchment water management across large areas, and directly delivers a number of the core objectives of Greater Lincolnshire's Strategic Economic Plan

It has been identified there is still a need to address water management systems which currently attract little funding through existing asset funding regimes. One opportunity to explore is through the potential offered by a whole-catchment approach in the area, linking asset management, flood risk, water and environmental management principles.

A framework of assessment is to be established for risk management authorities and other local delivery partners to use in order to deliver a partnership approach to water management on a catchment scale, and how to apply this in practice. The work focuses on all issues relevant to the movement and management of water in a defined catchment or area. This work offers a unique opportunity to assess the most

appropriate authority to lead on asset management, delivering efficiencies and enhancing opportunities for reinvestment locally. It will provide a foundation for all organisations which have an interest in the catchment. This can range from RMAs to volunteer groups and the general public to understand and agree how a catchment is too be managed, by:

- Developing an approach to understand and align flood risk and water level management within a system to achieve multiple benefits.
- Take a local level review of all benefits and costs of asset systems.
- Look at partnership management options for unfunded or part-funded systems, including asset transfer, Internal Drainage Board (IDB) boundary changes and the impact of limited resources, promoting efficiencies and ensuring options are fit for purpose.
- Draw this together in an operations-focused document to assess the best management options for a system that is aligned with strategic plans already in place.

Flood risk management:

25. What level of flood resilience should the UK aim to achieve, balancing costs, development pressure and the long-term risks posed by climate change?

A broad scale approach needs to be taken to deliver maximum resilience delivering the best possible social, economic and environmental benefits, in particular to facilitate growth opportunities where these are currently held back, and where appropriate, informed mitigation and preparation for risk management can also be taken. We would draw attention particularly to comments made above on coastal management, which in Lincolnshire forms a significant component of overall flood risk. This is a consequence of 40% of the county's land area lying at or below sea level, corresponding with those areas that are most productive for the agri-food industry and offer much of the potential for the visitor economy.

To maximise national funding opportunities and seek local funding options there is a clear need to ensure consideration of water supply and flood risk is fully integrated into the planning process and where possible seek multi stakeholder involvement to deliver broad benefits rather than individual approach to issues.

Full account should be taken of the change in roles and statutory responsibilities for flood risk management in England and Wales are set out in the Flood and Water Management Act 2010 and Flood Risk Regulations 2009 for LLFAs and the Environment Agency in its strategic overview of all sources of flooding in England. and is the lead Risk Management Authority for flooding from main rivers and sea. In doing so it is important to establish the relative risk to communities of flooding from 'all sources' in combination to enable proactive decision making something that is being piloted in Lincolnshire with the Communities @ Risk Project.

26. What are the merits and limitations of natural flood management schemes and innovative technologies and practices in reducing flood risk?

This can mean less hard engineering (though in many cases extensive re-engineering necessary to achieve a more 'natural' aspect to the water system; natural flood management, properly implemented, means significantly less maintenance work required and can deliver broad scale risk reduction over a wide geographical area.

Natural Flood Risk Management has its merits in the right areas and 'slowing the flow' initiatives are proving effective. To be really innovative and forward thinking natural flood risk management schemes should not necessarily be looked at in isolation and all opportunities should be explored to establish multiple benefits for a variety of stakeholders and support economic objectives of an area. As detailed above the WRE initiative can be used as a good exemplar, as can re-naturalisation schemes applied to certain upland chalk stream habitats in the Lincolnshire Wolds.

http://www.lincswolds.org.uk/chalk-streams/the-lincolnshire-chalk-streams-project

It is important to prevent new housing developments from connecting to old and already over-capacity sewer systems. It is a call that has been made repeatedly since it was formally recommended in the 2007 Pitt Review. The Flood and Water Management Act, which followed the review, contained a requirement for SuDS to be prioritised but this not been implemented nationally due to tensions with growth / housing need.

Solid waste:

27. Are financial and regulatory incentives correctly aligned to provide sufficient long-term treatment capacity, to finance innovation, to meet landfill and recycling objectives and to assign responsibility for waste?

28. What are the barriers to achieving a more circular economy? What would the costs and benefits (private and social) be?

There is a need for clear policy signals recognising that circular economy is the desired direction of travel. That should be linked to strong regulatory framework with appropriate targets and enforced product design standards that ensure products can be disassembled and re-used.

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