

Energy Networks Association Response to Second National Infrastructure Assessment

Introduction

Energy Networks Association (ENA) represents the companies that operate and maintain the gas and electricity networks in the UK and Ireland. Serving over 30 million customers, they are responsible for the transmission and distribution network of “wires and pipes” that keep our lights on, our homes warm and our businesses running.

If you have any questions on the points raised in this response, please contact Joshua Atkins, Head of Communications at Energy Networks Association by email:

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Background

ENA members believe that if our power, heat, transport, waste and industrial sectors are all interdependent, then so must the solutions for their decarbonisation. Solutions must be driven locally as well as nationally. There are a number of areas in which industry and government can focus on with the right regulatory support to accelerate economic recovery and a carbon neutral future and we are working with Ofgem and the government to support this.

The scale of the challenge ahead is vast. The networks are looking to the future and the ‘difficult to reach’ sectors – including heating, heavy transport and industry - which we need to decarbonise to fulfil our Net Zero obligations. As we detail in this submission, energy network companies have a foundational role in decarbonising these industries; whether ensuring the safety of a decarbonised gas system, or the resilience and reliability of a power system which by 2050 will be serving 60% of all the UK’s energy needs, compared with 15% now¹.

Network companies have been quick to respond to these changing demands and have led on innovation to remove barriers and facilitate investment in and take-up of low-carbon solutions; and within the existing price control system, RIIO, have been key to delivering this.

However, in the face of the seismic shifts taking place in the decarbonisation of heat and transport, along with the continued deployment of often geographically disparate renewable assets, network investment has never been more important. Network investment which we believe is best delivered through sustained, strategic investment which can socialise the cost of building long-term, essential infrastructure over a longer period of time. In doing so, it mitigates the cost to the consumer.

Networks are at the forefront of many of the innovations now essential for Net Zero. One such example is the research from Imperial College has shown that the UK could save up to £40bn across the system by 2050 by deploying markets for flexibility services. ENA’s

¹ <https://www.theccc.org.uk/publication/sixth-carbon-budget/>

Open Networks programme is playing a pivotal role in helping to deliver these benefits with the foundations of a smarter, flexible energy system in GB. The project is building on existing successes to drive forward change that will improve transparency, boost new flexibility markets, and secure the supply of clean, low-carbon energy.

Another is the homes built in the northeast which are running entirely on hydrogen, developing and testing the infrastructure and appliances needed to give customers diversity of choice, security of supply and, crucially, confidence in the Net Zero solutions of the future.

ENA would welcome the opportunity to hold further conversations with the Commission or support the Commission in sourcing expertise from our membership.

Response to questions

Question 1: Do the nine challenges identified by the Commission cover the most pressing issues that economic infrastructure will face over the next 30 years? If not, what other challenges should the Commission consider?

1. With power being rapidly decarbonised, the foremost challenges to hitting Net Zero are the decarbonisation of heat and of transport. The proliferation of the electric vehicle (EV) market will mean great change for the energy sector – specifically the electricity networks. The high-power consumption of EVs combined with increased uptake of heat pumps and existing demand will place unprecedented demands on the grid at a high level of market penetration. Without domestic-level flexibility and wider network investment, the demand these technologies place on the network is likely to occur during and exacerbate existing peak power demand.
2. This challenge is, however, an opportunity for UK network companies. Our world-leading flexibility markets are moving from strength to strength with other countries already exploring how to develop their own. Independent research carried out by Pöyry for Ofgem has shown that innovation projects by electricity Distribution Network Operators (DNOs) could deliver up to £1.7bn of benefits by 2031.
3. ENA would be happy to support the Commission in any further considerations into EV infrastructure, both physical and digital.

Question 2: What changes to funding policy help address the Commission's nine challenges and what evidence is there to support this? Your response can cover any number of the Commission's challenges.

4. Please see our answer to Question 5 where we detail recommended changes to Ofgem's remit with regards to the RIIO regulatory regime.

Question 3: How can better design, in line with the design principles for national infrastructure, help solve any of the Commission's nine challenges for the next Assessment and what evidence is there to support this? Your response can cover any number of the Commission's challenges.

5. Please refer to our members' submissions

Question 4: What interactions exist between addressing the Commission's nine challenges for the next Assessment and the government's target to halt biodiversity loss by 2030 and implement biodiversity net gain? Your response can cover any number of the Commission's challenges.

6. Please refer to our members' submissions

Question 5: What are the main opportunities in terms of governance, policy, regulation and market mechanisms that may help solve any of the Commission's nine challenges for the Next Assessment? What are the main barriers? Your response can cover any number of the Commission's challenges.

7. We support the National Infrastructure Commission's recommendation that Ofgem's statutory duty to explicitly support delivery of the government's greenhouse gas emissions targets be strengthened. This would enable Ofgem to better align their duties with the government's ambition on Net Zero
8. Ofgem faces significant constraints to delivering an affordable transition to Net Zero for customers. The RIIO framework should support well justified strategic investment ahead of need with detailed processes consistent with the urgency and need to deliver government's strategic objectives that are directly reliant on networks.
9. Timely strategic investment can unlock growth in low carbon technology and investment delivering greater overall efficiencies and intergenerational fairness. Network investment is, alongside energy efficiency, the least risk investment that can be made in delivering Net Zero.
10. Timely and efficient investment in our energy infrastructure needed to deliver Net Zero will be dependent on the statutory and regulatory framework that governs the land rights and consents processes being 'fit for purpose'.
11. The electricity networks will face significantly higher demand than at present and can already identify areas where reinforcement or flexibility measures can be implemented. Equally, the gas networks have essential testing and trialling of systems which, if done earlier, minimises costs later and allows for us to decarbonise sooner.
12. On specific example of where this strategic investment would add value is 'looped services' on the LV network which runs from local substations to customers' properties. Based on our members' assessments, interventions are needed at tens of thousands of HV/LV substations within RIIO-ED2 to maintain a safe and secure electricity supply to our customers, this will be c. ten times the RIIO-ED1 intervention rates for LV cable.
13. DNOs would welcome more visibility of renewable assets, particularly smaller assets. BEIS is undertaking work to deliver a single asset registration strategy (as recommended by the Energy Data Task Force) that will help to setup a national process. The BEIS work on asset registration will help to ensure that all assets get registered, and the data is available to networks, which can significantly improve planning and operation of networks, and hence reduce costs.

Question 6: In which of the Commission's sectors (outside of digital) can digital services and technologies enabled by fixed and wireless communications networks deliver the biggest benefits and how much would this cost?

14. As detailed in our response to Question 8, ENA is leading a significant workstream in conjunction with BEIS and Ofgem to deliver a smart, flexible power system through our Open Networks programme.
15. Beyond the Open Networks programme ENA works closely with the Government on their Energy Data Taskforce and is delivering a number of the recommendations that group has put forward.

16. One of which is the proof-of-concept National Energy System Map (ESM) of the full energy system which ENA is developing. This digital map will include details of network assets, generators, and energy intensive users. The map creates a new way for gas and electricity networks to serve their customers even better by helping them develop quicker, more efficient, and cheaper ways to deliver Net Zero solutions.
17. Gas network operators are also unlocking the potential of data. Robots are being deployed throughout the gas networks and in their pipes, gathering data to improve the accuracy of their records and monitoring the condition of the pipes themselves.
18. Big data is also being used to improve the accuracy of demand forecasting and to develop simulation tools that reduce costs in network design. If networks can better forecast future demand, they can invest even more efficiently to solve the challenges they are facing.
19. Networks are digitalising the energy system so that it is increasingly managed in real time and can enable new services like these flexibility markets. By deploying this more sophisticated technology networks can balance the increasing amounts of local renewable generation and customer demand flexibly.
20. By offering installers of low carbon technologies a digitalised connections process - including using AI technology that is field equipment ready - we are harnessing fixed and wireless communications networks to make the connections process faster for customers, easier for installers, while also providing accurate timely data to networks.

Question 7: What barriers exist that are preventing the widescale adoption and application of new digital services and technologies to deliver better infrastructure services? And how might they be addressed? Your response can cover any number of the Commission's sectors outside digital (energy, water, flood resilience, waste, transport).

21. Please refer to our members' submissions

Question 8: What are the greatest risks to security of supply in a decarbonised power system that meets government ambition for 2035 and what solutions exist to mitigate these risks?

22. Whilst there are many components to ensuring security of supply i.e. ensuring sufficient generation plant is operating, the area most relevant to the energy networks is the flexibility of the system itself. If flexibility cannot be holistically built into the UK power system, it will pose a significant challenge to deploying new energy resources and ensuring the security and stability of a high renewables system.
23. As mentioned above, ENA runs the world-leading Open Networks programme, which is making great strides towards the smart, flexible system needed to deliver Net Zero.
24. Local flexibility services are a relatively new market but one that has seen an incredible growth over the past three years alone in Britain. This record has been achieved through DNOs adopting a "flexibility first" approach where the network operators have looked to the market to seek alternative solutions to all significant traditional investment that would otherwise be required to solve congestion on the grid.
25. Figures from 2021 revealed that record levels of local flexibility were put out to the market and contracted by Britain's electricity distribution networks. In 2021, around 3GW of flexibility was put out to the market and 1.6GW of it was already contracted halfway through 2021. This is an increase of 45% since 2020 when 1.1GW was contracted for the whole year, showing an increase in market liquidity – great news for

customers and great news for Net Zero. It is worth noting that this is significantly more than any other market internationally and is set to increase this year as more flexibility is tendered out.

26. Flexibility services have so far tended to focus on the industrial and commercial sectors, the next big step for both Open Networks and industry is harnessing the power of residential flexibility through EVs, heat pumps and other domestic smart technologies – delivering direct benefits to customers across the country.
27. Benefits would be gained if CfD generators were incentivised to provide flexibility to distribution and transmission networks for the purposes of grid congestion management and national balancing services, significantly reducing the cost of networks for customers.
28. The CfD should support renewable projects using multiple low carbon generation technologies or being co-located with low-carbon flexible assets. Having CfD sites that are flexible will significantly increase liquidity in these local and national markets, creating more competition in 3rd party services, helping to bring down costs to networks and in turn their customers.

Question 9: What evidence do you have on the barriers to converting the existing gas grid to hydrogen, installing heat pumps in different types of properties, or rolling out low carbon heat networks? What are the potential solutions to these barriers?

29. ENA does not advocate for a specific technology. The future of heat will be much more diverse than it is now, with heat networks, hydrogen and heat-pumps as well as hybrid solutions working alongside one-another.
30. Energy efficiency is essential to the decarbonisation of heat. Tightening the building standards for energy efficiency to meet the standards of zero carbon buildings or above is a vital action for driving the decarbonisation of heat.

Barriers to Hydrogen

31. Through live trials the gas networks have demonstrated that it is safe to distribute hydrogen blends of up to 20% volume through the HyDeploy projects and from evidence gathered from a range of other network innovation projects. To proceed with blending ENA has identified critical work required to:
 - Review relevant technical and safety standards which sit outside IGEM's remit to ensure they are aligned to enable blending
 - Understand system wide changes that may be required to support management of blending
 - Prepare wholesale trading rules and systems
32. Working alongside government the networks are also undertaking a series of occupied trials of 100% hydrogen following testing. A neighbourhood scale trial will commence in 2023 followed by a village scale trial in 2025. A 100% hydrogen town pilot could follow, to be operational by 2030. These trials will stimulate the growth of a hydrogen production market, support the development of industrial clusters, and provide distribution infrastructure to support fuel switching to hydrogen.
33. ENA recently published Britain's Hydrogen Networks Plan to set out how the gas networks will deliver their vision. Along with detailing the trials, this plan builds on the existing hydrogen research developed through the [H21](#) and [H100](#) projects which will test and ensure the safe delivery of hydrogen to homes and communities, ensure security of energy supply, work with customers to ensure choice, and deliver jobs and investment.

34. A green gas grid, using hydrogen will also support the decarbonisation of industry, the mass roll-out of EVs (with the target coming forward to 2030), gas vehicles, and – alongside hydrogen boilers in the domestic setting – the electrification of heat through heat pumps. Funding networks to invest ahead of time will ensure that we are able to create customer-led networks that deliver all the benefits for the public quicker and at lower cost.
35. This whole-systems approach will also help the UK realise the potential of pairing hydrogen production with excess renewable energy generation, providing inter-seasonal storage.
36. Safety must be at the core of this shift. The networks are ready to bring forward the changes necessary to gas standards and safety regulations in an evidence-based manner to ensure the safety of our customers is maintained as we transition to a zero-carbon gas grid.

Barriers to Heat Pumps

37. Heat pumps provide a viable option for decarbonising heat provided that the underlying electricity that is powering the heat pump is decarbonised.
38. Heat pumps, although very efficient, could place significant load on the network when clustered within communities that have a poor quality or leaky housing stock, or a lack of local storage, as in these scenarios flexibility cannot play as significant a role as it does for EV charge-point connections. This is due to average time of use within the household – something which cannot be as easily shifted away from peak load within a house that is not well sealed or does not include storage, like it can for EV charging.
39. Certain types of heat pumps also have a heavy reliance on inflexible direct heating (boost) elements on low temperature days, which again has the potential to significantly increase the network and generation requirements during peak periods. The specification of heat pumps or efficiency measurement methodologies should take this into account, and reward the correct specification, installation, and sizing of good quality heat pumps, with a sensible set of assumptions around the lowest temperature conditions in a given area.
40. If paired with thermal or electrical storage, including hot water tanks, heat pumps can provide a significant amount of flexibility, which in turn could be used by local DNOs or National Grid ESO. In turn this could help reduce the socialised costs of electricity networks and facilitate alignment of heating usage requirements with the availability of zero carbon electricity generation. This local storage could also help reduce the need for system-wide electrical storage or the over-provision of generation capacity.
41. ENA's Low Carbon Technologies working group has recently launched a new connections process and associated database for heat pumps, to enable quicker and easier connection of heat pumps for customers. Guidance is also being produced to help installers with sizing and minimising connections costs for customers.

Systems Testing

42. In order to deliver the low carbon economy of the future we will need to ensure that the technologies being developed and delivered can work cohesively. 'Full systems' end-to-end testing of the green economy in a region or island of the UK would achieve this.
43. Possibly centring around one of the low carbon industrial clusters being supported by Government, this would provide an opportunity to test the integration of flexible generation, hydrogen, EVs and high-volumes of renewables as well as other technologies, all connected by a smart, data-driven grid.

44. Whilst trials of this nature take a long-time to coalesce, the early stage, high-skill developmental work could begin now, creating opportunities for the engineers, system designers, planners and multitude of other people a project of this scale needs.
45. Government support through match-funding would enable the investment of significant volumes of private capital. Central coordination from the Energy Systems Catapult could similar enable the cohesive, cross-industry collaboration needed from the multitude of parties involved to take this big step towards a net zero economy.

Local Planning

46. There is scope to increase the level of planning coordination between the various actors including local authorities, utilities and community groups in order to help identify the priority decarbonisation needs, enabling the co-designing of plans for network investment. We believe this should go beyond the long-term targets outlined in the government's current Road to Zero strategy.
47. These changes will also require a ramping-up of customer service support as, along with the decarbonisation of transport, customers' contact points with network companies exponentially increase.

Question 10: What evidence do you have of the barriers and potential solutions to deploying energy efficiency in the English building stock?

48. No comments – this area is beyond ENA and our members' remit.

Question 11: What barriers exist to the long term growth of the hydrogen sector beyond 2030 and how can they be overcome? Are any parts of the value chain (production, storage, transportation) more challenging than others and if so why?

49. The hydrogen economy similarly presents a huge opportunity for the UK to take a global lead on a key zero carbon technology that has the potential to create over 220,000 jobs and £18bn of GVA across the UK as well as a net benefit to customers of £89bn by 2050.
50. As detailed in our response to Question 9 there are a number of barriers to the development of a domestic hydrogen economy, however ENA has published Britain's Hydrogen Network Plan² which maps out the role that Britain's gas network infrastructure will play in meeting the UK's net zero carbon emissions target through the delivery of hydrogen, including the Government's plans as recently set out in the *Ten Point Plan for a Green Industrial Revolution*. Through this Plan, Britain's gas networks will:
 - Be ready by 2023 to blend hydrogen into the gas distribution grid up to 20% volume.
 - Commence a 'neighbourhood trial' of 100% hydrogen by 2023, a large village trial by 2025 and be ready to convert a large town by 2030.
 - Accelerate the shift to low carbon vehicles through a network of refuelling facilities for zero emissions HGVs.
 - Connect the renewables production, carbon capture and storage and hydrogen use of industrial SuperPlaces, delivering two clusters by the mid-2020s and two more by 2030.

² <https://www.energynetworks.org/newsroom/what-you-need-to-know-about-britains-hydrogen-network-plan>

- Support producers to meet the target of 5GW of hydrogen production capacity by 2030, and 1GW by 2025.
51. The Plan notes that there must be sufficient hydrogen production for a widespread gas network conversion to take place from 2030, to build on this progress. A hydrogen CfD is one policy mechanism that could support the production both in the short and long term.
52. We believe a hydrogen CfD for the production of zero-carbon hydrogen should play a similar role. The instrument would strike the same balance between investor returns and cost to the energy billpayer, whilst providing the Government with control over production volumes. Investors' familiarity with the CFD as a 'bankable' instrument would also increase its attractiveness.

Question 12: What are the main barriers to delivering the carbon capture and storage networks required to support the transition to a net zero economy? What are the solutions to overcoming these barriers?

53. No comments – this area is beyond ENA and our members' remit.

Question 13: In what ways will current asset management practice need to improve to support better infrastructure resilience? Your response can cover any number of the Commission's sectors.

54. In line with their regulatory obligations, energy networks constantly assess and test the resilience of their systems and infrastructure against national and international standards and in conjunction with government and arms-length bodies.
55. The main impacts on gas and electricity networks from the latest independent Met Office UKCP18 climate change projections remain:
- Temperature—predicted increase.
 - Precipitation—predicted increase in winter rainfall and summer droughts.
 - Sea level rise—predicted increase.
 - Storm surge—predicted increase.
 - Increasing wet– dry cycles.
 - Increasing windstorm frequency (particularly when following high intensity precipitation).
 - Significant cold spells – predicted decrease but more severe.
 - Wildfire.
56. While the likelihood of global temperature rise is accepted, the impacts on UK distribution and transmission network operators have not yet begun to be realised. Because of this, networks do not currently see any drivers to invest ahead of need to offset risks. Network and asset performance will continue to be monitored and developed and will be modified once climate change impacts begin to have a direct and longer-term effect.
57. Where low ground to conductor clearance has been identified, and air temperature sagging of powerlines is considered to be a contributing or additional factor, some DNO companies have installed taller poles during pole replacement programmes in order to counteract the loss of clearance through thermal sagging.
58. It should be noted that all DNOs use cables and overhead conductors designed and manufactured to international standards, and consequently these assets are designed to operate safely in much greater maximum and minimum temperature ranges than those found in the UK.

59. Above ground assets, such as gas Pressure Reducing Stations (PRS) and substations, may be at risk from flooding where they are located within river or coastal flood plains or low-lying areas. Company risk assessment processes and the use of available tools, such as Environment Agency Flood Maps, assist in the development of asset registers and determine vulnerabilities. Assets can be protected by the use of physical flood barriers and there may be opportunities to install more resilient equipment on replacement. Companies also work with environmental regulators and agencies to establish catchment area flood mitigation practices.
60. Asset replacement programmes include consideration of current and future expected climate change and incorporate flood modelling prior to design and installation. There may be limited opportunity to relocate assets and so robust emergency response plans and equipment are in place, such as the use of breathers on pipes and procedures for shutting off the network in extreme circumstances.
61. In response to the 2008 Pitt Review³, Electricity transmission and distribution companies have been delivering programmes to protect assets and supplies from the impact of flooding over the last 2 regulatory periods.

Question 14: What are the barriers to and solutions for expanding recycling capacity, both now and in the future to deliver environmental and net zero targets?

62. No comments – this area is beyond ENA and our members' remit.

Question 15: What is the likely environmental impact of waste streams from construction across economic infrastructure sectors, over the next 30 years, and what are the appropriate measures for addressing it?

63. No comments – this area is beyond ENA and our members' remit.

Question 16: What evidence is there of the effectiveness in reducing congestion of different approaches to demand management used in cities around the world, including, but not limited to, congestion charging, and what are the different approaches used to build public consensus for such measures?

64. No comments – this area is beyond ENA and our members' remit.

Challenge 9: Interurban transport across modes – the Commission will consider relative priorities and long term investment needs, including the role of new technologies, as part of a strategic multimodal transport plan.

65. As detailed under Question 1 energy networks have a critical role in delivering the transport system of future, namely the charging and hydrogen refuelling facilities which will be required across the country.

³[https://www.jesip.org.uk/uploads/media/incident_reports_and_inquiries/Pitt%20Review%20\(UK%20Floods\).pdf](https://www.jesip.org.uk/uploads/media/incident_reports_and_inquiries/Pitt%20Review%20(UK%20Floods).pdf)

66. As detailed under Question 5, regulatory changes are required to allow for the strategic investments to be made into the networks so as to ensure that when the seismic shift to decarbonised transport comes, the foundational infrastructure is ready.

Question 17: What are the barriers to a decision making framework on interurban transport that reflects a balanced approach across different transport modes?

67. No comments – this area is beyond ENA and our members' remit.