
NATIONAL INFRASTRUCTURE COMMISSION RESPONSE: E3G

The National Infrastructure Commission (NIC) Baseline Report sets out the current state of the UK's economic infrastructure and identifies key challenges for the coming decades. The Commission will make recommendations to address these challenges in the second National Infrastructure Assessment following consultation with stakeholders. This consultation response has been submitted by E3G, an independent climate change think tank. Please contact Juliet Phillips, Senior Policy Advisor – Juliet.Phillips@e3g.org

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?

E3G broadly agrees with the nine challenges identified as being among the most pressing. In particular, we strongly agree that the heat transition and energy efficiency represent among the thorniest challenges and are where the government's approach to date falls most short. Rather than commenting on sector specific infrastructure challenges, we wish to draw attention to the overarching structural challenges which sit across the nine identified areas regarding the architecture, governance and financing of the transition. We encourage the Commission to consider and develop specific recommendations to overcome these – including considering how this might support cross-sector solutions which contain a combination of the nine sectors identified (e.g., through place-based approaches). Key cross-sector challenges include:

- **Local mandate, capacity and resources:** There is growing consensus that the solutions to many infrastructure challenges will be rooted in locally appropriate solutions, which requires an enhanced role for local and regional actors. At present, these bodies often lack the mandate and capacity to effectively engage with major infrastructure questions. Guided by a national framework which provides scientific, financial and technical advice, there is a need for appropriate powers and resources to spur local leadership, with a race to the top rather than a 'postcode lottery'.
- **Coordination and collaboration:** To avoid local actors and businesses 'reinventing the wheel' in finding solutions to common problems – and enable effective cross-sector, public-private collaboration – there is a need for institutions and architecture to fast-track solutions and bring together the actors who can partner for effective delivery. This might include a national hub for local authorities to share best practice and engage with expert organisations. There could be a convening role for institutions like the UK Infrastructure Bank to link up private sector actors (including financial institutions) with local authorities and others to mobilise capital effectively, with new business opportunities.
- **Ensuring effective delivery:** There are certain key, cross-cutting themes which will be required for effective delivery on the ground. This includes a focus on skills and supply chains, as well as public engagement on net zero, and tailored and targeted advice for households. This is particularly true for the clean heat transition.¹ There are currently under 2,000 qualified heat pump engineers

¹ <https://electrifyheat.uk/wp-content/uploads/2021/12/Electrify-Heat-Briefing-December-2021-Training-Trust-and-Tariffs.pdf>



across the UK, and the skills shortage is a major barrier to heat pump installations. Analysis by the Heat Pump Association suggests that we will need at least 50,200 installers by 2030, based on deployment of 1 million heat pumps. Meanwhile, BEIS research highlights a lack of public awareness regarding clean heat solutions, and there is a dearth of nationally available advice.

- **Developing mission-based innovation capacity:** Identifying the key innovation missions needed for key decarbonisation outcomes (such as net zero power by 2035) and rallying UK innovation capacity behind this is key to deliver at pace. When it comes to infrastructure, innovation is urgently needed on the regulatory side: how to determine a fair distribution of costs in a fast-changing system that sees users migrate between systems at a large scale?
- **Modernising energy infrastructure planning:** as the energy reality changes and systems become more interconnected, infrastructure planning needs to reflect this. Given the range of solutions on demand and supply side, and the need to incorporate them into a coherent and affordable energy network, there is a need to maximise the independence of the advice for planning decisions. In addition, some of the government's goals, such as North Seas wind deployment, need a much more integrated view of the evolving electricity and hydrogen grid landscape to allow for fast and cheap deployment of renewables.

While we largely agree with the nine sectors identified by the NIC, we encourage caution around the focus on 'hydrogen networks'. While E3G believes there is an important role for green hydrogen to support the decarbonisation of certain sectors where there are limited decarbonisation pathways currently technically or economically possible, we are cautious to ensure hydrogen development and deployment is strategic and does not delay action where there are readily available solutions (e.g. heat decarbonisation). We also note that for repurposing of existing gas pipelines for hydrogen use to work we need clarity on when gas networks would be able to end the throughput of gas to shift to 100% hydrogen. For more detail, please see response to question 9.

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.

Answering key questions regarding finance and funding will be essential for unlocking progress for infrastructure decarbonisation. These include, but are not limited to:

- **What is the financial gap?** The total public, private and blended finance needs for net zero and resilience must be mapped as part of the upcoming Green Finance Strategy.
- **Who pays?** Answering this question will go some way to determine what balance of public, private and blended finance will be needed. This should be a blend including some general taxation, as there is a clear public good in tackling climate change. Consumers who will benefit economically must be properly differentiated so that this does not become a burden on the poorer, and wherever possible, those can afford more, pay more.

- **How do we raise and mobilise that money?** This relates to how public funding might be mobilised, as well as how additional private investment can be spurred by incentives, regulation and awareness. It also relates to the accessibility of public funding pots – ensuring that individuals, local actors and businesses have the capacity and knowledge to access funding. As there is a public good to be obtained from the required private capital investment, there is a case for government intervention to lower to cost of capital. Guidance for private finance, such as through Mandatory Transition plans, should ultimately align with the UK’s commitments on Net Zero and Resilience.
- **How do we effectively deploy that money, once mobilised?** This relates to identifying cost-effective solutions and deploying them efficiently.

There are no straightforward answers, and the politics of the day will likely determine how they are answered as much as principles of fairness, speed and cost-effectiveness. However, they must be addressed across the key infrastructure areas.

To date, the government’s approach to financing net zero has fallen far short – especially for addressing major investment gaps for key sectors such as heat and buildings and nature. This has been highlighted in recent analysis by the Climate Change Committee (see table below). The value-for-money calculation in allocating this capital should have a carbon value for money modifier to the economic value for money. Given that there is a critical time dimension to the government’s commitment to decarbonise the power system by 2035 the key analytic outcome, all other things being equal, is what allocation of capital delivers the largest emissions reductions in the shortest time. There are both economic and emissions advantages to arriving at a decarbonised power system earlier than targeted.

Table 2.1 Cumulative additional public and private capital investments required to get on track to net zero

	2025		2030	
	£m	% diff from baseline	£m	% diff from baseline
Surface transport	30,227	11%	81,074	14%
Industry	2,060	2%	7,349	4%
Residential buildings	33,746	17%	110,741	29%
Non-residential buildings	11,969	100%	30,380	100%
Agriculture	928	100%	2,076	100%
Aviation	1,261	11%	2,930	12%
Shipping	-	-	76	3%
Waste	2,986	67%	6,058	177%
F-gases	3	100%	5	100%
Land use, land use change, and forestry (LULUCF)	1,649	72%	5,681	405%
Removals	-	-	1	100%
Power generation	55,746	79%	183,566	540%
Total	140,553	27%	429,937	35%

Research commissioned by E3G by Cambridge Econometrics identified the following public funding gaps, with residential buildings standing out as a key area where additional funding is needed.

Table 2.3 The gap in current public sector investment commitments over 2020-25

Sector ⁽¹⁾	Estimate of public sector investment required over 2020-25 (£bn)	Current Government commitments in this period (£bn)	The gap in public sector investment in the period to 2025 (£bn)
Surface transport	5.0	At least 5.0 ⁽²⁾	0.0
Industry	0.3	At least 0.3 ⁽²⁾	0.0
Residential buildings	16.9	6.1	10.8
Agriculture	0.1	0.0	0.1
Waste	0.6	0.0	0.6
F-gases ⁽³⁾	0.0	0.0	0.0
LULUCF	1.0	At least 1.0 ⁽²⁾	0.0
Power generation	6.1	0.7	5.4
Total	30.0	13.1	16.9

The 2021 Spending Review fell far short of what we estimate is needed to get on track for net zero. Analysis for the Energy Efficiency Infrastructure Group (EEIG) following the Spending Review and Heat & Buildings Strategy identified a major investment gap.² EEIG analysis from 2021 estimated that £11.8bn of public investment would be needed this Parliament (2020/2021 to 2024-2025) for domestic energy efficiency and heat pumps to get on track to meet the Climate Change Committee’s (CCC) ‘balanced pathway’ to net zero. Even with the new funding commitments in the H&BS, there now remains a £9.75bn shortfall. The major missing component is £3.6bn for an energy efficiency subsidy scheme open to all households, helping make progress on decarbonising owner-occupier homes. This omission is particularly concerning considering analysis which finds that of those living in inefficient homes on mid- to low-incomes, 80% have no access to the only nationwide energy efficiency scheme, the Energy Company Obligation (ECO). On top of this, EEIG estimates £4.15bn is still needed for heat pumps. Currently the government’s approach for heat and building relies on private funding to do the heavy lifting. However, it is not clear that this is the right answer to the ‘who pays’ question (given the lack of financial ability of the so-called ‘able to pay’ to finance deep retrofits), and there is a lack of incentives, regulation and awareness to effectively mobilise that money, even if it was. For more analysis of the shortfalls of the Heat & Buildings Strategy, see the EEIG report [here](#).

Moving forward, there are several areas where effective progress can be made:

- **Green Finance Strategy:** tackling investment gaps to meet the UK’s net zero targets will require a whole-of-system approach with clear signals to unlock investment. The Green Finance Strategy should therefore outline a plan for financing the transition which maps investment gaps, identifies key sectors for public investment to support transition, and aligns public policy and regulatory mechanisms with net zero. E3G has published papers outlining a vision for this strategy³⁴.

² https://www.theeig.co.uk/media/1114/eeig_analysis-of-the-heat-and-buildings-strategy_03.pdf

³ <https://www.e3g.org/publications/financing-the-net-zero-transition/>

⁴ <https://www.e3g.org/publications/a-net-zero-uk-financial-centre/>



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- **The UK Infrastructure Bank:** E3G has published papers regarding how the Bank should be set up to maximise additionality to underpin the effective financing of net zero,⁵ and provided sector-specific recommendations for the built environment.⁶
 - **Green gilts:** The UK has successfully issued £16bn of green gilts so far, with high levels of investor interest and demand. E3G is keen to see this mobilised where it is most needed for net zero.
 - **UK Taxonomy:** Definitions of green investment in the new UK taxonomy will be crucial to guiding future investments under the green gilts and potentially also the investments of the UK Infrastructure Bank, as well as a range of other public and private flows. It will be important that the UK maintains a science-based approach which supports the transition to net zero by 2050 as well as our interim carbon budgets⁷. There is a vital need to ensure the integrity of the science basis for taxonomy judgements since politicisation of those judgments would undermine investor confidence. The real-life consequences of this have played out in the EU, with watering down of their taxonomy to include gas as a 'green' activity. This also sets a premium on the importance of transparency and engagement in the development and operation of the taxonomy policy.

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.

Better design will be essential to successfully address key infrastructure challenges. Building upon our response to question 1, key areas for consideration include:

- Clear mandates with requirements for collaboration at a local and national level
- A common set of assumptions about the future and approach to managing resilience to future risks
- Resources to deliver, with sharing of resources (technical, scientific and financial expertise).

Question 4: What interactions exist between addressing the Commission's challenges and the government's target to halt biodiversity loss by 2030 and implement biodiversity net gain?

Please refer to Pollination and E3G's separate joint submission.

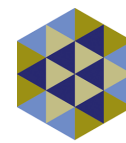
Question 5: What are the main opportunities in terms of governance, policy, regulation and market mechanisms that may help solve any of the Commission's nine challenges for the Next Assessment?

Our answer to this question builds upon responses to question 1 and 2. Regulation and market mechanisms are about the extent to which the transition, and associated infrastructure investment, is driven by consumer choice or centralised strategic decision making. This is relatively clear for shared infrastructures, like networks or the 'digital spine', but much more complicated where consumer behaviour is involved. We can't rely purely on markets and prices, given the rates of diffusion and adverse social impacts. Therefore

⁵ <https://www.e3g.org/publications/uk-infrastructure-bank-investment-principles/>

⁶ <https://www.e3g.org/publications/making-markets-through-the-uk-infrastructure-bank/>

⁷ <https://www.e3g.org/news/letter-to-the-chancellor-on-the-uk-green-taxonomy/>



regulations, such as standards, have an important role to play. Science Based Guidance for private sector companies and financial institutions on transitioning, supporting regulatory requirements such as Net Zero Targets and Mandatory Transition plans, will be key to sending clear market signals to investors on the need to rebalance their portfolios towards sustainable activities. The Government's upcoming Green Finance Strategy should also set out a clear plan for how finance – both public and private – will be deployed to finance the transition of key infrastructure sectors like the Built Environment and Nature.

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

There is a strong case to be made for a focus on the built environment. An ecosystem of enabling digital measures is steadily evolving to support the financing of green homes, including through fintech and PropTech solutions. The UKIB could support the consistent roll-out of tools to collect data to enhance the quality of retrofits, while monitoring the energy cost savings associated with projects. This could be supported through requesting standardised data collection as a condition of support, to allow lessons about outcomes to be learned and provide the data that private investors will need.

Pioneering firms and financial institutions are already offering these tools. For example, Principality Building Society has partnered with energy tech company Sero to develop a green customer proposition with a Building Passport app to provide a better understanding of the home's energy performance and carbon impact, and how it can be improved. The Green Finance Institute's Coalition for the Energy Efficiency of Buildings (CEEB) is helping establish consistent market conditions for the roll-out of Building Renovation Plans through providing a standardised framework. The CEEB is developing an open-source protocol for capturing 'metered' energy savings. The protocol seeks to provide actionable and real-time performance monitoring to catalyse the development of new financial products and business models.

Other digitalisation initiatives can support the effective financing of the decarbonisation of the built environment by the Bank. The UCL London Building Stock Model is providing data-rich insights into the characteristics of local built environments. The scaling up of these approaches is progressing at pace with the Active Building Centre Research Programme, working with the UCL 3DStock Lab to stock model all properties and tenures in Wales, as a pre-cursor to the implementation of Building Retrofit Plans at scale. Digital reconstruction of the built environment enables machine learning technology to better characterise the current condition and potential retrofit pathways of properties whilst capturing dimensional information to support the scale-up of manufacturing processes. Combining this with scalable infrared surveying and machine learning enables better understanding of the diversity of heat loss within typological archetypes. This data could be utilised by UKIB and others to gain deeper insights into the most efficient options for decarbonisation at a household and community level, providing information which could help aggregate demand.

Question 7: What barriers exist that are preventing the widescale adoption and application of these 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).

N/A – covered in response to question 6.

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?

Several financial, political and supply chain challenges exist. For questions 9 and 10, we take energy efficiency and heat decarbonisation together, as a joint-up approach is the most efficient way to decarbonise homes. This represents one of the thorniest challenges for getting on track for net zero, representing a nationwide infrastructure programme involving nearly all households across the UK. Consolidated academic research by UKERC finds energy efficiency, heat pumps and district heating comprise the most effective investment pathway for heat decarbonisation for the next 10 years.⁸ It is deployment of these measures that E3G recommends the government must scale within this Parliament, in order to get on track to meet climate targets and interim carbon budgets.

While hydrogen may have a small role to play in domestic heating, for example around industrial clusters with high hydrogen demand for other purposes, it is very unlikely to play a major role nationwide. The volume of hydrogen which would be needed to supply homes far outstrips predicted production capacity, meaning domestic hydrogen would likely displace more pressing chemical and industrial uses. Hydrogen is also significantly less dense than fossil gas, meaning a greater volume is needed to provide the same level of heat. The consumer price implications of this would likely render hydrogen uncompetitive (a hydrogen-dominated system has also been shown to be at least twice as expensive for consumers than electrified heating).⁹ Even if enough blue hydrogen could be produced to heat the majority of UK homes, fugitive CO₂ and methane emissions and questions over the viability of the CCS required mean blue hydrogen may not be compatible with a zero-carbon approach. While superficially attractive (because, according to some industry claims, in-home changes may be less disruptive than alternative heating technologies), the system costs of hydrogen make it a distinctly poor choice for mass home heating decarbonisation – as a growing independent expert consensus makes clear.¹⁰ For more information on hydrogen, please see question 11.

⁸https://d2e1qxpsswcpgz.cloudfront.net/uploads/2020/09/The_pathway_to_net_zero_heating_UKERC_briefing.pdf

⁹ Hydrogen for heating? Decarbonization options for households in the European Union in 2050 - International Council on Clean Transportation

¹⁰ **See for example:** Potential and risks of hydrogen-based e-fuels in climate change mitigation | Nature Climate Change ; The Clean Hydrogen Ladder ; Hydrogen for heating? Decarbonization options for households in the European Union in 2050 - International Council on Clean Transportation ; Building sector Efficiency: A crucial Component of the Energy Transition (agora-energiawende.de) ; The pathway to net zero heating in the UK | UKERC | The UK Energy Research Centre ; Meeting UK heat demands in zero emission renewable energy systems using storage and interconnectors ; and https://www.beuc.eu/publications/beuc-x-2021-112_goodbye_gas_why_your_next_boiler_should_be_a_heat_pump.pdf

In certain areas, the Heat and Buildings Strategy 2021 (H&BS) went some way to meeting the challenge. Against a politically fraught background, areas of ambition which have been confirmed or increased (such as the 2035 gas boiler phase-out) are to be welcomed. New policy tools like the proposed market-based mechanism to drive down costs of heat pumps and to increase UK manufacturing also have potential. However, in other important areas – particularly with regards to building energy and fabric efficiency among owner occupiers – H&BS looks less like a strategy or investment plan, and more like a statement of intent for future examination. While recognising that decarbonising our homes is a politically challenging area, faster near-term progress among owner-occupiers will be essential. In April 2021, the Energy Efficiency Infrastructure Group (EEIG), which E3G helps coordinate, set out a benchmark for success for the H&BS.¹¹ Following the publication of the Strategy, we published a briefing considering how the H&BS stacks up against these expectations, as well as future steps for Government departments to consider.¹² While the H&BS set a good direction of travel for heat pumps, there is a need to double-down on effective delivery to turn ambition and targets into deployment on the ground. The Electrify Heat coalition, which E3G helps coordinate, has set out three key areas for focus:¹³

1. Training: Creating high-quality green jobs in installation and domestic manufacturing:

- To mainstream and roll-out access to training opportunities, HPA recommends a nationwide technology-neutral course for all NVQ Level 2 trained plumbers, before specialist training on MCS approved low carbon technologies kicks in. In total, this would be 4-5 days of additional training for a qualified gas heating installer. Heat pump technology courses should be delivered through MCS or an equivalent approved body to ensure quality installations. The Government can back this with £1.5 million to cover the majority of training costs for the first 5,000 installers.
- The route to becoming a heat pump installer should be made easier, with a redesign and update of the curriculum to bring the process on to a level of administration and expense closer to that required for boiler installers. This can be backed up with incentives – HPA recommends £300 for the first 5,000 installers. Government can work with companies to support employees to undertake training; as well as engaging with workers and unions to ensure jobs are secure and attractive.
- The Government can take further steps to grow the UK heat pump market and supply chains, considering the complementary role the market-based mechanism for low carbon heat can play in this – with measures to boost skills and promote investment in UK manufacturing.

2. Trust: Driving demand by increasing confidence and building trust

- Nationwide engagement and communications drive, supported by local actors and activities: Comprehensive information is needed at national level – often best to be provided by local bodies or organisations, within a consistent framework for high-quality local engagement. A net zero

¹¹ https://www.theeig.co.uk/media/1106/eeig_heatbuildingsstrategy_thebenchmarksforsuccess_0521.pdf

¹² https://www.theeig.co.uk/media/1114/eeig_analysis-of-the-heat-and-buildings-strategy_03.pdf

¹³ <https://electrifyheat.uk/wp-content/uploads/2021/12/Electrify-Heat-Briefing-December-2021-Training-Trust-and-Tariffs.pdf>

awareness campaign would help build the public's knowledge and understanding of what they can do in their homes to help lower emissions.

- A net zero advice service providing tailored advice and information: An accessible and comprehensive framework is needed to inform, protect and support people throughout and after the clean heat transition. The Simple Energy Advice website can be built on to become a central information resource, providing more information on consumer protection and installation processes. A dedicated, impartial and independent omnichannel net zero advice service would provide advice tailored to people's circumstances to help to make their homes warmer, decarbonise and reduce their bills. The EPC Action Plan can be accelerated to better account for the carbon savings associated with heat pumps, and actions taken to support the roll-out of tools such as Building Renovation Plans to provide tailored, sequenced advice to homeowners.
- Ensure high-quality installations and performance of all green home retrofit measures, aligned with PAS measures, with actions to support and incentivise high-quality, and measures taken to prevent substandard installations. This should be underpinned by an effective monitoring and audit regime to give people confidence that standards will be met.
- A more robust approach to consumer protections, building upon standards including MCS and the Consumer Codes to include clear guidelines and procedures businesses must follow; a complaints process that guarantees a response and outcome; and consumer protection.
- Incentives and drivers to anticipate 'trigger points' to catalyse action. A Green Stamp Duty Land Tax can spur retrofits at the point of sale of the property – a popular time for undertaking retrofit measures. Additional measures could include supporting the market for green mortgages which incentivise additional lending for heat pumps and offering attractive concessional finance (including 0% interest rate loans and blended finance) through the new UK Infrastructure Bank. 0% VAT on heat pumps can also reduce costs for households.

3. Tariffs: Stop penalising people for using clean electricity

- While there is consensus that the way that heating is priced needs to change, there are different ways proposed to achieve this. Many organisations have called for levies to be picked up by general taxation. It is essential that measures are put in place to protect fuel poor and vulnerable households. This might include exemptions from any domestic gas carbon price for vulnerable customers to reduce the distributional impacts of energy bill reform in the short term, and/ or a new mandatory social tariff to ensure that energy costs are applied consistently across the market and targeted at financially vulnerable customers.
- There may be other innovative solutions such as removing eco-levies from new tariffs for heat pumps, to reward first movers.

In terms of converting the existing gas network to hydrogen, the following critical barriers exist:

1. Uncertainty over where demand and supply of hydrogen will come from
2. Uncertainty over when gas customers can be fully taken off the gas grid to switch to hydrogen.
3. Blending hydrogen may drive up consumer costs at low additional climate value.
4. Need for a coordinated approach to switch network and end use appliances simultaneously.
5. Need for minimum number of hydrogen customers to make networks affordable yet consumption will decline as a result of energy efficiency and electrification.



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

These areas are covered in detail in the following reports (in addition to those referenced in question 10):

- Financing energy efficient buildings: the path to retrofit at scale assessing the market for energy efficiency improvements in UK homes across the owner-occupied, private-rented and social-rented tenures, and identified specific initiatives where finance and government can bridge investment gaps to drive systemic change. This report was published by the Green Finance Institute's Coalition for the Energy Efficient of Buildings.
- In December 2020, the Coalition's Zero Carbon Heating Taskforce released Financing zero carbon heat: turning up the dial on investment

Question 11: What barriers exist to the long term growth of the hydrogen sector beyond 2030 and how can they be overcome?

Clean, green hydrogen produced using renewable energy could play a key role in decarbonising certain important sectors of the economy, such as heavy industry and steel. The **UK Hydrogen Strategy** shows some welcome ambition, but must be followed through with clear governance mechanisms if the UK is to be an international leader. The Strategy backs a '**twin track**' of pursuing both clean green hydrogen and fossil-fuel based blue hydrogen. Clarity is now needed regarding how the transition towards zero emissions hydrogen will be managed, ensuring the proposed standard for 'low carbon' hydrogen is aligned with climate science. Clarity to avoid lock-in of high carbon jobs and infrastructure is essential to keep on track for climate targets and avoid stranded assets and jobs, for a just transition. In particular, we are concerned regarding how industry lobbying is influencing the government's approach. Moving forward, there is a need for need for co-ordinated infrastructure planning to make sure we put electrolyzers in the right place and focus on repurposing the right bit of the gas network.

The Government has postponed key decisions, including blending hydrogen into the fossil gas grid, and the role of hydrogen for heating, including a nationwide roll-out of hydrogen ready boilers. Decision-making processes should be inclusive and transparent, taking a precautionary approach on areas where there remain many unknowns. Clarity is required on where hydrogen will and won't make sense when heating our homes to avoid sub-optimal results for climate, consumers and communities.

For E3G's UK vision for hydrogen, please see <https://www.e3g.org/publications/between-hope-and-hype-a-hydrogen-vision-for-the-uk/>

For E3G's analysis of the UK's Hydrogen Strategy, please see: <https://www.e3g.org/publications/lifting-the-lid-uk-hydrogen-strategy-blue-green-heat-buildings/>