

# ICE submission to the Economic Affairs Committee's inquiry on UK energy supply and investment

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## Introduction

Established in 1818 and with over 96,000 members worldwide, the Institution of Civil Engineers exists to deliver insights on infrastructure for societal benefit, using the professional engineering knowledge of our global membership.

This response focuses on questions 2 and 6 of the call for evidence.

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## 2. What are the main challenges as regards energy supply and storage which public policy must address over the next decade?

### A blended approach to decarbonised energy generation

As the UK transitions to a net-zero economy, the greatest risk to security of energy supply is overinvestment in one single source of low carbon energy generation. There needs to be a blended approach to decarbonised generation.

To decarbonise the UK's power generation within the timescales required means building 9–12GW of new or replacement capacity every year between now and 2050.<sup>1</sup> There is no realistic scenario for decarbonising energy demand in the UK without a significant contribution from nuclear and offshore wind, as well as smaller contributions from other sources. Within this model, managing the intermittency of offshore wind requires either more nuclear capacity or CCGT (combined cycle gas turbines) with CCUS (carbon capture utilisation and storage), or both.

Trying to establish what the exact electricity generation mix will look like in the future is unlikely to be a productive exercise given the vastness of the challenge and the unknown potential of some technologies. Alongside reducing energy demand, it is likely that we must build as much energy generation infrastructure as we can and build faster than ever before.

### The role of hydrogen

From a practical standpoint, the UK's pathway to decarbonisation is becoming de facto electric. Hydrogen will likely have a place, but will need to fight for it as the infrastructure for it does not currently exist. For instance, having any kind of hydrogen as a replacement for natural gas in our homes or to power large vehicles would mean inventing and investing in CCUS at scale from a starting point of zero.

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<sup>1</sup> Atkins (2019) [Engineering Net Zero](#)

The longer it takes to make an intervention around hydrogen, the more established electricity will become. Nevertheless, there is an important case for hydrogen to prove what it can do in the areas where it may have a natural advantage, such as within energy-intensive industries and harder to abate sectors.

### Decarbonising heating

Heating and hot water for buildings make up around 40% of the UK's total energy demand, and 20% of its total greenhouse gas emissions. Given this contribution, the success of a decarbonised heating system is likely to depend on the success of decarbonising the national energy system.

A pathway based on hydrogen combustion in home boilers would entail vast quantities of hydrogen production, initially via natural gas and later by the scaling of water electrolysis. There are, however, many technology questions around electrolyzers that use electricity to break water into hydrogen, as this has not been done at scale. In any event, this pathway assumes that, where geography makes access to hydrogen impractical, heat pumps would be required.

Electrical heating would require the majority of homes in the UK to be fitted with heat pumps (generally air source or where homes have gardens, ground source). Several million homes will also need to be connected to centralised district heat networks.<sup>2</sup> Solar panels could be considered as an addition since they are becoming more efficient and cost-effective. Air source heat pumps are becoming more efficient with the addition of technology like 'solar iboost' and homes can now connect solar panels to the air source hot water tank, negating the requirement for solar thermal.

It is important to state that one heating solution will not be the answer in all cases or in all parts of the country - the right answer in one location will depend on the resources and needs of that region. For example, localised wind turbines can be added to the hybrid basket of solutions at rural properties that have available land.

### Infrastructure adaptation and resilience

Most infrastructure that supports the UK's national resilience over the next 30 years already exists and will do so for many years after. Much of it dates back to the post-war or even Victorian eras, while a lot of the UK's energy infrastructure is located in coastal areas. This poses a growing risk as they face additional pressure due to climate change, such as rising sea levels and storms.

Maintenance of infrastructure assets and systems must be further up the agenda. The Climate Change Committee (CCC) has warned that the UK faces an adaptation and resilience deficit as policy and implementation is not keeping pace with the rising risks and impacts of climate change.<sup>3</sup>

There is a need to better understand the current condition of assets and their structural integrity, the maintenance measures needed to improve their operation and resilience, as well as the impacts of new infrastructure on existing systems.

Infrastructure operates as a system of systems. Infrastructure owners and operators must better understand their interdependencies with other networks to mitigate the risk of cascading failures across multiple sectors.

## 6. What should the Government do to incentivise and enable investment in, and financing of, reliable and affordable energy that is in line with its climate objectives, including net zero by 2050?

The UK Infrastructure Bank, announced by government in 2021, is an important development in enabling infrastructure investment. The Bank has a clear mandate to support net-zero and a mission to help address market failures and crowd-in

<sup>2</sup> Mott MacDonald (2020) [The Path to Zero Carbon Heat](#)

<sup>3</sup> Climate Change Committee (2021) [Independent Assessment of UK Climate Risk](#)

private investment. The £650 billion National Infrastructure and Construction Pipeline announced in 2021 also sets out a clear framework for the next decade of infrastructure investment and should give confidence and direction to investors.

However, in the context of energy there is a concern that the UK is too reliant on the privatised market to build and pay for the infrastructure required for the net-zero transition. In reality, there is an extremely limited supply of organisations with access to the available finance that would be willing to fund such projects.

A flexible strategy that is owned and executed by central government, albeit supported by numerous stakeholders, is required rather than a completely market-led approach. This will require constant review to stay relevant and achievable in meeting the original goal.

Beyond this overarching concern, there are several areas the government will need to address to enable the investment required to meet the UK's climate objectives.

### Strengthening net-zero governance

The infrastructure required to meet net-zero by 2050 is unlikely to materialise without sound governance. Reaching net-zero is an objective unlike previous political and policy challenges. It requires transformation across several vital and interconnected systems of infrastructure, regulation, finance and human behaviour. The UK's system of legislative governance on carbon reduction targets, built around the CCC, is world leading. However, while there are many processes which govern net-zero, there is no formal system of governance or guidance for translating high-level targets into net-zero governance at a policy or local level.

There will be examples where particular policies fall between government departments and would benefit from better cross-departmental working. Rapid decarbonisation of electricity supply will provide a platform for the decarbonisation of other sectors such as heating and transport, but for optimum outcomes the sector strategies must be aligned. For example, policy on electric vehicles is separated between those responsible for roll-out of charging infrastructure, those encouraging switch-over, and those dealing with the impacts of increased demand on the energy system.

With infrastructure needing to be considered on a systems basis, forward-looking analyses and frameworks, such as the second National Infrastructure Assessment due in 2023, should consider the governance required to deliver net-zero infrastructure. Below strategy-setting, which will remain the government's domain, there are myriad complex interconnected delivery challenges that need to be navigated to enable a coherent, fair, cost-effective net-zero transition. It may be the case that an additional body is required to provide the guidance needed.

### Evolving existing funding and financing mechanisms

For the most part, the funding and financing mechanisms required to support infrastructure's transition to net-zero already exist. The key will be adapting and iterating existing mechanisms so they can be deployed where appropriate to unlock the market and are tailored to net-zero outcomes.

In many instances, this work is already underway within government. The Nuclear Energy (Financing) Bill currently before Parliament will embed the RAB model for nuclear in legislation, while the Contracts for Difference auctions are now held annually.

### Support for nascent markets and technologies

ICE has previously recommended that energy storage and other emerging technologies receive enhanced government support, drawing on the successful impact of Contracts for Difference on the renewable energy market.<sup>4</sup>

In the case of hydrogen, building a national transmission system is considered a high-risk venture, though the extent of the engineering and logistical effort that will be required is as yet unknown. Underlying this is an economic situation where

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<sup>4</sup> ICE (2020) [State of the Nation 2020: Infrastructure and the 2050 Net-Zero target](#)

large-scale hydrogen production does not yet work commercially, and to seriously entertain a hydrogen pathway to net-zero means quickly learning how to increase its commercial viability.

It is possible the government will need to back multiple production technologies to discover the best way forward, rolling out solutions in different parts of the country – some of which may turn out to be ‘dead-ends’. This may be a necessary, albeit politically unpalatable path.

### Regulation and net-zero

Almost half of the UK’s infrastructure, chiefly water and energy, is financed and delivered by the private sector, and paid for by consumers, under the Regulated Asset Base (RAB) model.<sup>5</sup>

The model of regulation has generated significant investment and improved performance over the past decades. However, it was not designed to meet the challenge of delivering the 2050 net-zero target. Regulators’ duties vary considerably, with inconsistency on aspects such as resilience and security of supply. Crucially, none of the regulators have a direct duty to consider the government’s long-term policy commitment of achieving net-zero.

Given the increasingly complex long-term solutions that are required, the regulation of economic infrastructure needs to be more flexible.<sup>6</sup> To this end, the Government’s planned consultation on economic regulation in 2022 is a welcome step.

### Building a compelling public narrative and supporting consumers

The biggest barriers to any initiative are likely to be lack of public support and the high cost of installing the infrastructure. Globally, governments are under pressure to pass more of the cost of infrastructure to users – either as taxpayers or bill payers – but there are concerns about public acceptability.

Greater alignment between users and payers will need to be found if the government is to deliver net-zero. There will be a need to bring the public along on the journey and develop a compelling narrative that highlights the wider benefits of net-zero infrastructure investment.

In the energy sector, this issue is likely to become more difficult because of recent high energy costs and the raising of the energy price cap. Most consumers will be concerned about having sufficient means to maintain their current energy needs without being asked to consider new initiatives.

The consumer also needs to understand the return period on the investment for heat pumps or other technologies. There is therefore an implied obligation on the government to be transparent on this and to provide financial support, grants, or feed in tariffs, above and beyond what is currently offered.

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<sup>5</sup> ICE (2018) [State of the Nation 2018: Infrastructure Investment](#)

<sup>6</sup> ICE (2020) [Aligning long-term government policy and the regulation of utility companies](#)