

An aerial photograph of a landscape featuring a wind turbine in the foreground on a grassy hill. In the background, there is a reservoir or dammed lake, surrounded by rolling green hills and a distant town or industrial area under a clear sky.

# The Second National Infrastructure Assessment

NATIONAL  
INFRASTRUCTURE  
COMMISSION

Better infrastructure for all

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## Energy and net zero

To tackle climate change and ensure energy security, the UK should move away from its reliance on fossil fuels. Currently around 80 per cent of the energy demand is met by fossil fuels, primarily from fossil fuel based electricity generation, natural gas boilers for heating homes and businesses, petrol and diesel cars and vans, and fossil fuels powering industry.

The solution is to replace these fossil fuels with low cost, reliable, low carbon electricity. This will require a fundamental change in the country's energy infrastructure. Over the next 30 years the country will need:

- a larger electricity system running mostly from renewable power sources like wind and solar
- heat pumps and networks to replace gas boilers in homes and businesses
- cars and vans fuelled by clean electricity and charging infrastructure to replace petrol stations
- industry running on electricity where possible, but, where it is not, new infrastructure to supply clean hydrogen, or capture and transport the carbon emitted from burning fossil fuels to underground stores.

Moving to an electrified energy system should create cheaper, less price volatile energy in the long term. An energy system running on electricity, rather than fossil fuels, is more capital intensive and so insulated from fuel price changes. This should lower costs for households and businesses and provide more certainty over future prices. However, there will be significant upfront costs from creating the new capital assets needed and government should provide support during the transition, especially to households on lower incomes.

There have already been major steps forward. In 2022, electricity generation produced 75 per cent less emissions than it did in 1990 as renewables replaced fossil fuel powered generation. The share of new car sales that are battery electric has increased from less than one per cent in 2015 to around 16 per cent in 2022.

While there is still a long way to go in creating a secure net zero energy system, it is achievable with the right policies and a relentless focus on delivery. The UK has transformed its energy system many times before. In the 1960s and 70s, all properties connected to the gas network were converted from town gas to natural gas in just ten years. In the 1990s 'dash for gas', the UK built almost 40 gas power stations, and more recently since 2010 the UK has deployed over 13 GW of offshore wind and now has the second largest offshore wind fleet in the world.

## Building a secure, low carbon electricity system

By 2035, the UK needs a reliable electricity system running mostly on renewable power. Government should accelerate the deployment of offshore wind, onshore wind and solar power. These technologies should be complemented by more flexible technologies that can generate if the sun isn't shining or the wind isn't blowing. Government should support the market to deploy electricity storage and demand side response (tools and incentives to

reduce or reschedule energy usage at times of peak demand). At the same time, it's critical that government establishes effective business models that incentivise investment in large scale hydrogen and gas with carbon capture and storage power stations that can provide electricity even during extended calm or cloudy periods. More demand for electricity means more transmission and distribution cables are required. Investment in electricity networks has not kept up with demand and therefore connections to the network are being delayed. The scale and speed of infrastructure deployment requires transformational change to planning, regulation and governance of both the transmission and distribution networks.

The electricity system will become even more important as the rest of the economy electrifies and so needs to be underpinned by a new strategic energy reserve. The energy system has proven to be vulnerable to price shocks such as that caused by Russia's illegal invasion of Ukraine. Part of the reason it was so exposed was because it did not have adequate gas reserves that could be used to mitigate the impact of the shock. Government should establish a reserve of energy that can be released into the market to generate electricity in order to mitigate the effect of price shocks in the future.

## Switching to electrified heat

Gas boilers, which currently heat around 88 per cent of English buildings, need to be phased out and replaced by heat pumps. Around eight million additional buildings will need to switch to low carbon heating by 2035, and all buildings by 2050. Heat pumps and heat networks are the solution. They are highly efficient, available now and being deployed rapidly in other countries. The Commission's analysis demonstrates that there is no public policy case for hydrogen to be used to heat individual buildings. It should be ruled out as an option to enable an exclusive focus on switching to electrified heat.

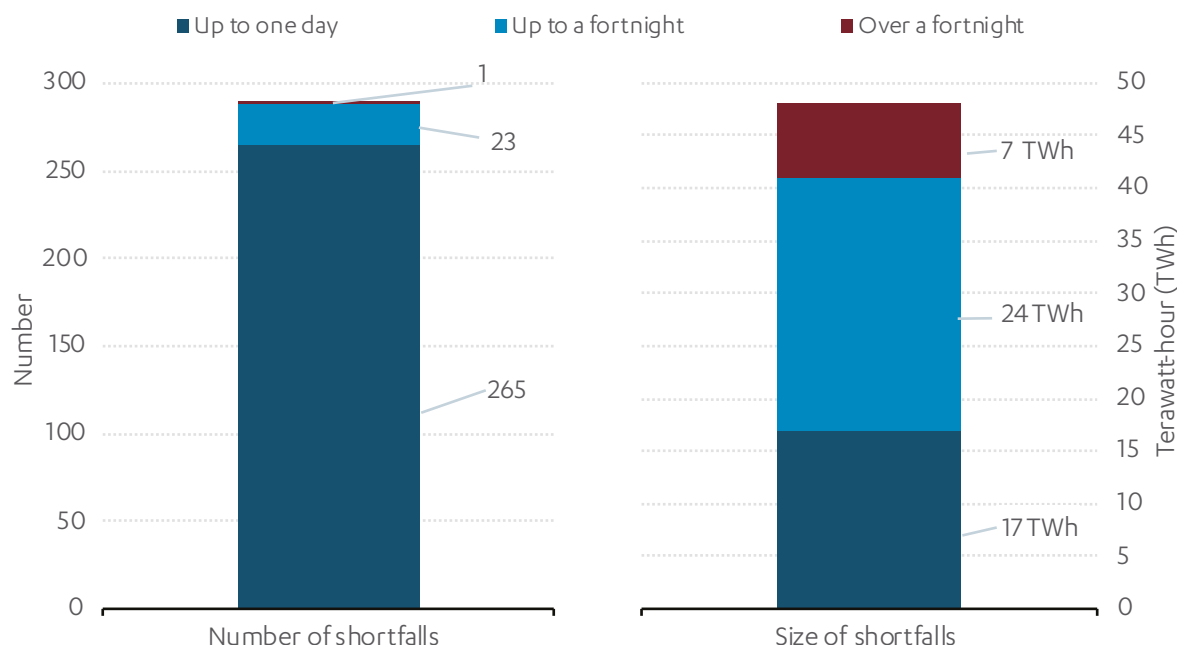
Kick starting the market for heat pumps and heat networks will require urgent action and implementation from government, including a number of one off investments:

- committing £1.5 to £4.5 billion per year to improve energy efficiency and install heat pumps across the public sector estate and social housing that will help boost supply chains
- closing the gap with the lifetime cost of gas boilers by providing an initial upfront subsidy of £7,000 to households installing heat pumps or connecting to heat networks, alongside access to zero per cent financing, backed by government, for the additional cost
- committing £1 to £4 billion per year to cover the full cost of heat pump installations and support energy efficiency improvements for households on lower incomes that will be unlikely to be able to fund the costs themselves
- taking policy costs off electricity bills and ensuring the cost of running a heat pump is lower than the cost of running a gas boiler.

Effective delivery will be supported by setting devolved long term budgets for local authorities for decarbonising the homes and buildings they are responsible for. Collaboration between energy suppliers and local authorities will also ensure energy efficiency improvements are targeted at those most in need.

**Figure 2.1: Longer shortfalls occur less frequently but require much more energy**

*Number and size of shortfalls in an illustrative 2035 scenario*



Source: Commission analysis of Aurora Energy Research (2023), The role of system flexibility in achieving net zero (A)

By 2035, modelling for the Commission suggests that 60GW of short term flexible capacity will be needed to provide a low cost electricity system.<sup>87</sup> There is currently around 15GW of low carbon supply side flexibility on the system.<sup>88</sup> The technologies that provide short term flexibility have different characteristics, so a portfolio of technologies will offer benefits to the system while minimising deployment risks. To support an efficient highly renewable system, two thirds of this target may be needed by 2030.<sup>89</sup>

Government can support this level of capacity by ensuring that all technologies have routes to market by:

- Using the planned Review of Electricity Market Arrangements to develop policies that support deployment and making this a priority.<sup>90</sup>
- Encouraging the Independent System Operator to apply market arrangements that allow the full range of technologies to participate in markets for balancing and ancillary services.<sup>91</sup>
- Bringing forward the promised policy framework to enable investment in electricity storage technologies.<sup>92</sup>
- Incentivising households to participate in demand side response.<sup>93</sup> Demand side response means consumers changing when they use energy. Sending price signals to consumers and automation will be important to increasing the scale of response. Tariffs that incentivise shifting electricity use to times of lower demand and the rollout of smart enabled electric vehicle chargers and heating technologies will support this.<sup>94</sup>
- Continuing to promote innovation funding to develop newer technologies that could provide flexibility at lower cost.

**be sufficiently scaled to provide 30TWh of persistent flexible generation to manage the potential for prolonged shortfalls during winter.**

**Recommendation 3: Government should target establishing a minimum of eight TWh of large scale hydrogen storage to be in operation by 2035.**

## **An end to unabated gas fired generation**

To fully decarbonise electricity generation, unabated gas fired generation must end. By 2035, actions to meet renewable generation targets and scale up flexible low carbon technologies should allow the contribution of unabated gas fired generation to fall to no more than two per cent of generation.<sup>105</sup> The UK has successfully taken action to reduce coal generation from 39 per cent of electricity generated in 2012 to two per cent by 2021.<sup>106</sup> Similar policies can drive the same reduction in unabated gas fired generation.

Government has proposed strengthening the requirements for new gas power stations to have clear decarbonisation pathways through conversion to hydrogen, or the use of carbon capture and storage.<sup>107</sup> These measures are welcome, but policy should be stronger. Future capacity market contracts should not provide unabated gas fired generation with contracts that extend beyond 2040. Unabated gas fired generation should be less economic to deploy than low carbon gas generation to accelerate the deployment of these technologies.

Preventing unabated gas fired generation operating in the wholesale, capacity and balancing markets from 2040 would provide a clear signal of government's intent. This would give greater clarity to the private sector on the trajectory for bringing gas off the system, allowing it to invest accordingly.

From 2040, security of supply can be safeguarded by allowing the Independent System Operator to turn on backup unabated gas fired generation, similar to the measures used to allow for coal generation over the winter starting in 2022. Deployment would only occur once all other mechanisms have been exhausted.

**Recommendation 4: Government should phase out unabated gas fired generation so that it generates less than two per cent of electricity by 2035, and prevent unabated gas power stations from operating in the wholesale, balancing and capacity markets by 2040 at the latest. Actions to deliver this should include:**

- **ensuring that carbon capture and storage enabled and hydrogen fired electricity generation stations deploy ahead of unabated gas power stations, through a combination of carbon pricing and emissions limits on new and existing unabated gas power stations**
- **shortening the length of future capacity market contracts for unabated gas power stations from the 2025 auction round, ensuring that these contracts do not extend beyond 2040**
- **allowing the Independent System Operator to turn on unabated gas power stations 'in extremis' to ensure security of supply.**