Mind the Gap:

Exploring Britain's energy crunch

PUBLIC FIRST

February 2024

Mind the Gap:
Exploring Britain's energy crunch

Acknowledgments
We thank Drax for supporting this project. This report and research are the sole work of Public First, who maintained editorial control throughout the project. We also thank the expert interviewees who engaged with the research project and shared their views with us.

PUBLIC FIRST

Public First is a global strategic consultancy that works to help organisations better understand public opinion, analyse economic trends, and craft new policy proposals.

Public First Ltd, 20 Victoria Street, London, SW1H 0NB
www.publicfirst.co.uk

Mind the Gap:
Exploring Britain's energy crunch

Contents

Executive summary

Two years on from Russia's invasion of Ukraine, the UK's energy security continues to be a critical concern. In 2022, energy prices spiked and public concern grew. While these initial shockwaves have diminished, energy security remains a key challenge for policymakers. Decisions made this year will impact our energy security for the rest of the decade.

This report from Public First combines new modelling of Britain's energy generation, public polling, expert interviews, and policy analysis to present policymakers with a practical route forward for keeping the UK's energy system secure.

The UK is heading for a significant energy crunch point in the next parliament.

Recent setbacks in bringing new electricity supply online have left a shortfall in secure *dispatchable and baseload* capacity with only one nuclear plant (Sizewell B) online in 2028. By 2028, we estimate demand to be 7.5GW higher than secure dispatchable and baseload capacity during peak times (like a winter evening) – this is almost double the size of the difference in 2022 (4GW) and 2.5 times the estimated average difference for 2024-2027 (2.8GW). Our research follows recent announcements that Hinkley Point C faces delays, likely pushing its commissioning date from 2027 to 2029 at the earliest. Secure capacity refers to capacity that has been de-rated to take account of factors like plant availability. De-rated capacity is used to understand the amount of supply that is readily available at peak times.

Dispatchable and baseload capacity are critical for maintaining energy security and balancing wind, solar, and interconnectors in the current system. Dispatchable capacity refers to power sources that can be turned up or on at peak times such as storage options like batteries. Baseload sources, such as nuclear, run all the time. By comparison, wind, solar and interconnectors are more affected by weather patterns. In the current system, dispatchable power is key to balancing the system for intermittency, i.e. in times of low wind and/or low sun. Over time, greater flexibility in a decarbonised power system can aid this balancing.

Policy uncertainty for existing generators risks increasing the gap in secure dispatchable capacity by as much as 40%. Biomass generators contribute 3GW of secure dispatchable power but require clarity on government plans for support post-2027.

Over the next five years, the headroom between secure *total* supply and peak demand is tightest in 2028. Secure total supply includes dispatchable and baseload power as well as power from wind, solar, and interconnectors from Europe. Our research estimates that by 2028, total de-rated capacity is expected to be just 5GW higher than demand at peak times - this represents a significant reduction (c. -40%) from the average expected headroom across 2024-2027 (8.5GW). The 5GW headroom is reliant on a range of planned capacity coming online as modelled in the National Grid ESO's Future Energy Scenarios (FES). This includes an increase in de-rated wind capacity of around a third (37%) from 2.5GW today to 3.5GW in 2028. It also includes a quadrupling of de-rated battery storage capacity from 1GW today to 4GW in 2028.

Very few forms of new capacity and supply are likely to have a major impact by 2028. Bringing new capacity online takes time – we have already seen how supply chain constraints and uncertainty in the policy environment have impacted the construction of new developments, particularly in offshore wind. It is unlikely that new build plants (beyond those already in the pipeline and under construction) will be online to mitigate the crunch by 2028. Policymakers should still aim to accelerate the renewables and storage pipeline and signal certainty to secure new capacity over the medium term, including through future CfD allocation rounds and Capacity Market auctions.

Policy options include making use of existing assets and managing demand.

Extending the life of existing assets could affect material change in energy security by 2028. While helpful for system reliability, gas assets create challenges due to the need for high volumes of gas imports and the adverse impact this poses to energy security and price stability. Increased gas consumption is also counter to the UK's commitments to reduce carbon emissions until carbon capture and storage (CCS) is deployed at scale, which is not expected before 2030. This leaves a role for other options such as extending the life of some nuclear assets or transitional support for biomass.

The UK will also have to strengthen efforts to limit increases to peak and total demand. Managing demand could be significant in influencing day-to-day crunch points. Efforts include encouraging behavioural changes to use electricity outside of peak times (ie winter evenings) either manually or through smart technology, as well as more permanent measures like insulation. Examples in both the EU and the USA show that the government can play a clear role in steering the public to use less energy. There have also been successful demand flexibility initiatives from National Grid ESO to encourage consumers to shift their energy use. Going further will rely on overcoming key barriers and providing financial incentives, which pose difficult political decisions.

Meeting the government's or Labour's political targets will depend on significant delivery of capacity in the late 2020s and early 2030s. For both parties, new capacity is required in offshore wind, solar, nuclear, CCS and BECCS, and storage.

Policymakers should prepare to address any disconnect between policy decisions and public opinion

The public is already concerned that energy insecurity will increase over the next few years. Additionally, two in five (41%) expect shortages to become more frequent. They see energy security as an issue facing the nation, even if not necessarily their own area. A considerable majority (81%) believe the UK should be self-sufficient in terms of energy production, and only 4% disagree.

Voters prefer wind and solar as solutions to increase energy security. Around one in three voters (37% and 31% respectively) think more wind and solar farms will be the most effective way for the UK to make its energy supply more secure. While this should continue to be a policy aim for a secure energy system, new capacity (not already in the pipeline) from these technologies is unlikely to be online in time to bridge the crunch point in 2028 or provide dispatchable or baseload support at peak times. This could create a disconnect between policy and the public. Policymakers will need to take any disconnect into account when communicating potential policy decisions for existing assets, such as extending the life of nuclear power plants or clarity on the transitional arrangements for biomass. Our polling shows that a return to policies that rely upon fossil fuel production is unlikely to be popular.

While the initial options are limited, they should come alongside a suite of actions that prevent the UK from ending up in a similar bind in the future. These should include reducing our total and peak energy demand; accelerating market reform and flexibility; and providing viable business models for a broader range of energy technologies, through near-term political decisions. The UK is facing an energy crunch ahead, but with the right actions early on in the next parliament, it can have a more secure, diverse, and sustainable energy system in the future.

Introduction

The Russian invasion of Ukraine reignited a public conversation on energy security, shining a light on the UK's exposure to international energy markets. Two years on from the invasion, energy security remains a primary focus of both public policy and public opinion.

However, recent announcements have set back the UK's ambition to produce more 'home-grown' energy. The latest Contracts for Difference Allocation Round - the government's scheme to support new low-carbon generation - failed to attract any offshore wind bids. Meanwhile, EDF has confirmed further delays to the UK's first new nuclear plant in over 30 years, Hinkley Point C. Its commissioning date is delayed from 2027 to at least 2029.

We are heading towards a significant crunch point. Alongside problems with bringing new generation capacity online, several existing power plants will be decommissioned in the coming years due to both age and carbon intensity. Action needs to be taken on the UK's energy security.

Given the strong public interest in this debate, this report aims to identify solutions that are both practical and acceptable for the public both in the near-term and the long-term. To do this we ran new research on the near-term future of the UK's energy security and the role of particular energy supplies within that. We then assessed possible solutions both for the immediate crunch points and to prevent further ones in the future. Finally, we looked at public opinion and how this might affect the feasibility of the government's possible solutions.

Methodology:

- **Security analysis.** Assessing GB supply and demand between 2024 and 2028.
- **Expert interviews.** Interviewed 11 experts in the energy sector on how to mitigate energy crunch points to achieve energy security both in the near term and in the longer term.
- **Public opinion polling.** Survey of a nationally representative sample of 2,011 UK adults from 12-16 January 2024.

A glossary of the key features of a secure power system

Keeping the lights on at any given time is ultimately about balancing supply and demand. Meeting **peak demand** is the most challenging. Peak demand is when, at certain times of the day or year, businesses and homes use power at the same time.

We use different types of generation to meet demand at peak times. These types of generation can largely be categorised by the level of control we have over their availability during peak times. We have **baseload** generation that is almost always on and runs at a relatively steady level. Nuclear power is a good example. Many gas-fired power stations were built to run this way, although most now run more flexibly, turning on and off at different times. We also have **dispatchable** power which can be turned on/up at peak times. Gas power has long provided this, as does coal or biomass. As long as the plant is staffed and running at a minimum load it can increase its output. Storage options such as pumped hydro and batteries can be dispatched and are increasingly important in a more flexible system. Demand-side response measures, while not a type of generation, can also be used to get people to use power at different times. We also have generators like wind and solar which are very low cost to run but we have less control over their availability. These sources are **intermittent**, meaning they do not run all the time. Wind and solar sources produce power when there is a breeze and in the daytime respectively.

Different sources of generation have varying levels of reliability. For example, an offshore wind farm with a total capacity of 1GW of power will only be available to provide that some of the time. Even a nuclear plant will need to turn off at times for maintenance. To balance the system during peak times, National Grid ESO applies **de-rating factors** to reflect these variances. These are applied in the **Capacity Market**, the government's insurance scheme to call on additional supply at certain times. De-rating factors create a level playing field for understanding how **secure** each source is at a given time. For example, the de-rating factor for nuclear power is estimated to be 78.3% compared to 11.3% for offshore wind.[1] If each generation site had the same level of installed capacity (ie 1GW), you would need seven offshore wind farms for every one nuclear plant to produce the same amount of secure power at peak times.

Over time, as we move towards an increasingly decarbonised energy system with renewables, greater flexibility can aid reliable balancing of supply and demand. This includes using **two-way resources** like electric vehicles, which have batteries that can store energy (when charging up) and supply it back to the grid at peak times (when plugged in and not being driven).

[1] National Grid ESO, Capacity Market Auction Guidelines, July 2022

Chapter One - A closer look at energy security in the 2020s

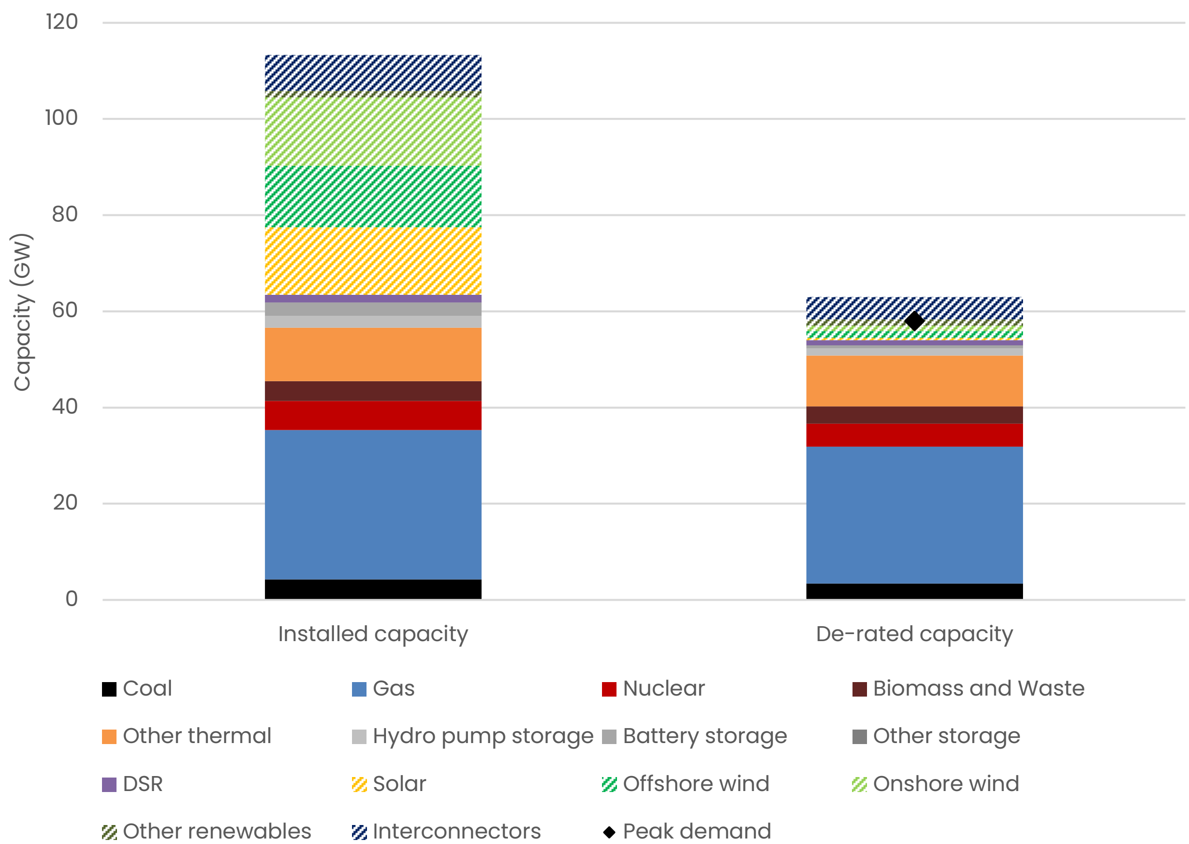
This chapter seeks to understand how secure the UK energy system is and the contribution of different energy sources to that security.

Britain is largely reliant on gas for secure power at peak times

In terms of installed capacity, the GB generation fleet is made up of a range of sources including coal, gas, nuclear, biomass, storage, solar, wind and interconnectors. Currently, just over half of the total installed capacity is made up of baseload and dispatchable power, and just under half is considered intermittent - as seen in Figure 1 below. At any given time, the composition of the energy mix supplied to households and businesses fluctuates depending on weather and plant availability.

When it comes to meeting peak demand, our research shows that secure (de-rated) power is predominantly reliant on dispatchable and baseload power (86% or 54GW). Gas contributes the most to secure power at peak times with a total of 28.5GW, followed by other thermal sources, nuclear, coal, and biomass and waste.

Figure 1: Generation fleet of Great Britain, 2022



Source: National Grid ESO FES and de-rating factors, DESNZ DUKES. Solid colours indicate baseload and dispatchable power. Hashed indicates intermittent power.

GB's generation fleet is set to change over the 2020s

Meeting our legislated net zero target means a seismic transition for our energy system. The government's target is to decarbonise the power system by 2035. As we decarbonise and increase the share of renewables, balancing intermittent supply with sufficient low-carbon dispatchable and baseload power will be critical to keeping the lights on. This is particularly the case with balancing wind and solar, which have high de-rating factors, with other diverse forms of generation that have lower de-rating factors. As we move towards an energy system with increasing intermittent renewables, maintaining energy security will depend on balancing intermittent supply on low-wind and low-solar days.

Changes to dispatchable and baseload supply	Changes to intermittent supply
Coming offline: Several power plants are coming offline resulting in no more coal from 2025; the decommissioning of older, less efficient gas assets, and four nuclear plants. Much of this is not set to be replaced given the carbon-intensive nature of coal and gas. Biomass generators also face financial uncertainty between the end of current renewable schemes in 2027 and BECCS being deployed at scale from 2030. **Coming online:** While the nuclear plant Hinkley Point C was meant to come online by 2027 to replace decommissioned capacity, a recent announcement from EDF indicates delays could push its commissioning date to 2029 or beyond. The government's ambition is for small modular reactors to come online around 2035.[2] CCS and hydrogen are set to play a key role from as early as 2028 under the most optimistic scenarios in National Grid ESO's Future Energy Scenarios. However, the DESNZ Track 1 CCUS cluster sequencing only has one gas CCUS project for deployment so far. The pipeline of battery storage projects also grew significantly from 2022-2023 (+70%) to enable more flexibility - most of which is shorter in duration (c. 2 hours).	**Coming online:** The government has set ambitious targets to increase offshore wind power to 50GW by 2030 (including 5GW of floating offshore wind) up from 14GW currently online. Targets are also set to increase solar power deployment five-fold from 5GW now to 70GW by 2035. Both are considered off track, according to the CCC's Progress Report to Parliament 2023. Since then, there have been further delays to offshore wind. The CfD auction round five attracted no offshore wind bids (3.2GW expected[3]). Additionally, supply chain constraints are causing delays to construction, even cancelling Vattenfall's Norfolk Boreas offshore wind site.

[2] Environment Audit Committee, *EAC raises concerns that the Government's direction on nuclear SMRs needs clarity*, 2024

[3] EnergyUK, *Energy UK Analysis: Allocation Round*, 2023

The energy system has seen significant change before such as the transition from coal to gas heating from the 1960s to the 1980s in Britain. While there are lessons to be learnt here, notably on the speed of infrastructure build in the shift from town gas to natural gas, the transition to a low-carbon energy system is distinct. First, to balance intermittent renewable power, the energy system requires a more diverse generation base than it did for shifting between similar fuel sources like from coal to gas. Additionally, intermittent power impacts grid services like inertia.

Explaining inertia

Our grid functions in part because of **inertia** to maintain frequency. Inertia is created from big, heavy turbines spinning at precisely the same rate all across the country. Gas, coal, and hydroelectric plants provide this. Wind and solar do not. Therefore, a decarbonised power system must rely on alternative means to keep the grid ticking.[4]

National Grid ESO has already set a target to be able to operate a zero-carbon system by 2025. This includes using alternative methods:

- **Dynamic frequency services** can stabilise frequency without the need for mechanical interia. For example, using fast-response storage and batteries, demand response mechanisms, or renewables with smart inverters.
- **Advanced, Localised Management of Capacity and Pricing (ALoMCP)** uses data analytics and localised grid management strategies to more efficiently match supply and demand in real-time, potentially removing the need for large centralised power plants (such as gas generators that traditionally produce inertia) to provide backup and stability.
- **Stability pathfinder projects** to identify new ways to maintain system stability despite lower levels of traditional inertia.

Energy security up to 2028: Security analysis findings

This section details the findings from our GB security analysis reflecting recent developments in the offshore wind and nuclear sectors. Our analysis assesses the risk to energy security between 2024 and 2028. We used ESO's five-year forecast as an independent baseline with modifications for the scenarios set out below. Given high levels of uncertainty in the generation pipeline and de-rating factors beyond 2028, we have not modelled later years.

We began with two scenarios: one where Hinkley Point C was commissioned in line with its most recent date at the time of the project's kick-off and one where the plant was delayed by 15 months to September 2028 (in line with trade press speculation at the time of the initial

[4] Sky News, *'Special report: Redesigning the UK's energy grid for a greener climate'*, 2023

research).[5] Whilst conducting the research project, announcements from EDF made clear that the plant faced further delays. EDF's published re-evaluation of the schedule and costs explores three scenarios with commissioning dates from 2029 to 2031.[6] Therefore, it was evident that the only viable scenario was the delayed nuclear, where Hinkley Point C does not come online before 2028.

See below for methodology details.

"On-time nuclear" scenario	"Delayed nuclear" scenario
National Grid ESO's forecast 2024-2028 published July 2023, which takes account of legal reserve and response requirements.[7]	
Nuclear assumptions •Hartlepool and Heysham I decommission in March 2026 •Hinkley Point C commissioned in June 2027 •Heysham II and Torness come offline in March 2028	**Nuclear assumptions** •Hartlepool and Heysham I decommission in March 2026 •Hinkley Point C not commissioned before 2028 •Heysham II and Torness come offline in March 2028
Offshore wind assumptions •Vattenfall pauses Norfolk Boreas, not expected online before 2028 •Rest of AR4 delivered by end of 2028 as expected (12GW, ESO). No change from ESO FES. •No *new* offshore wind capacity expected online from AR5. No change from ESO FES as any AR5 awarded projects would have been unlikely to be online by 2028.	
National Grid ESO de-rating factors were applied to installed capacity estimates from current Capacity Market Auction Guidelines, July 2022.[8]	

[5] EDF, *Hinkley Point C Update | EDF FR*, 2024

[6] EDF, *Hinkley Point C Update*, 2023

[7] This relates to legal requirements for the ESO to keep a margin of a certain percentage ahead of peak demand.

[8] Given the similarity across most technologies we assume T1 2023/24 factors were applied for 2024 and 2025, and T4 2026/27 factors were applied for 2026, 2027 and 2028. We recognise the limitations around the application of de-rating factors to battery storage figures. We assume that from 2024, all new batteries coming online have a duration of 2 hours given that is the upper end of duration in the pipeline at the moment. Longer duration storage has higher de-rating factors however policy does not currently support the business model for it.

The greatest risk to energy security over the next five years will take place in 2028

Delay to Hinkley Point C's commissioning means that **energy security is most at risk in 2028** (Figure 2). This raises concerns about possible crunch points for supply to meet demand. All capacity figures below reflect de-rated secure capacity unless stated as installed.

National Grid ESO has a legal requirement to keep an Operating Reserve ahead of peak demand to maintain energy security. This margin is complex and can depend on supply, demand, infrastructure, and weather conditions. Fundamentally, this margin relates to the government's Reliability Standard meaning that there should not be more than three hours, over a whole year, where supply would not match demand and exceptional balancing measures are required. This section explores the relationship between peak demand and available capacity over the 2020s.

Our research finds that by 2028, peak demand is estimated to reach 63GW while ***total* de-rated capacity** at peak times is estimated to be 68GW. That includes using 6.5GW of de-rated interconnection and 2GW of demand side response. This gives a total headroom of 5GW at peak times - a significant reduction (c. -40%) from the average expected headroom across 2024-2027 (8.5GW). This difference is in part due to the year-on-year increase at peak demand between 2024 to 2028 from 58GW to 63GW.

While 5GW might seem a reasonable level of headroom (enough to power 4.4 million homes) - maintaining it will be dependent on no unforeseen delays to new batteries and renewables coming online. The 5GW headroom is reliant on a range of planned capacity coming online as modelled in the National Grid ESO's Future Energy Scenarios (FES), such as 4GW of de-rated battery storage and over 3.5GW of de-rated wind capacity up from 1GW and over 2.5GW available de-rated capacity today.

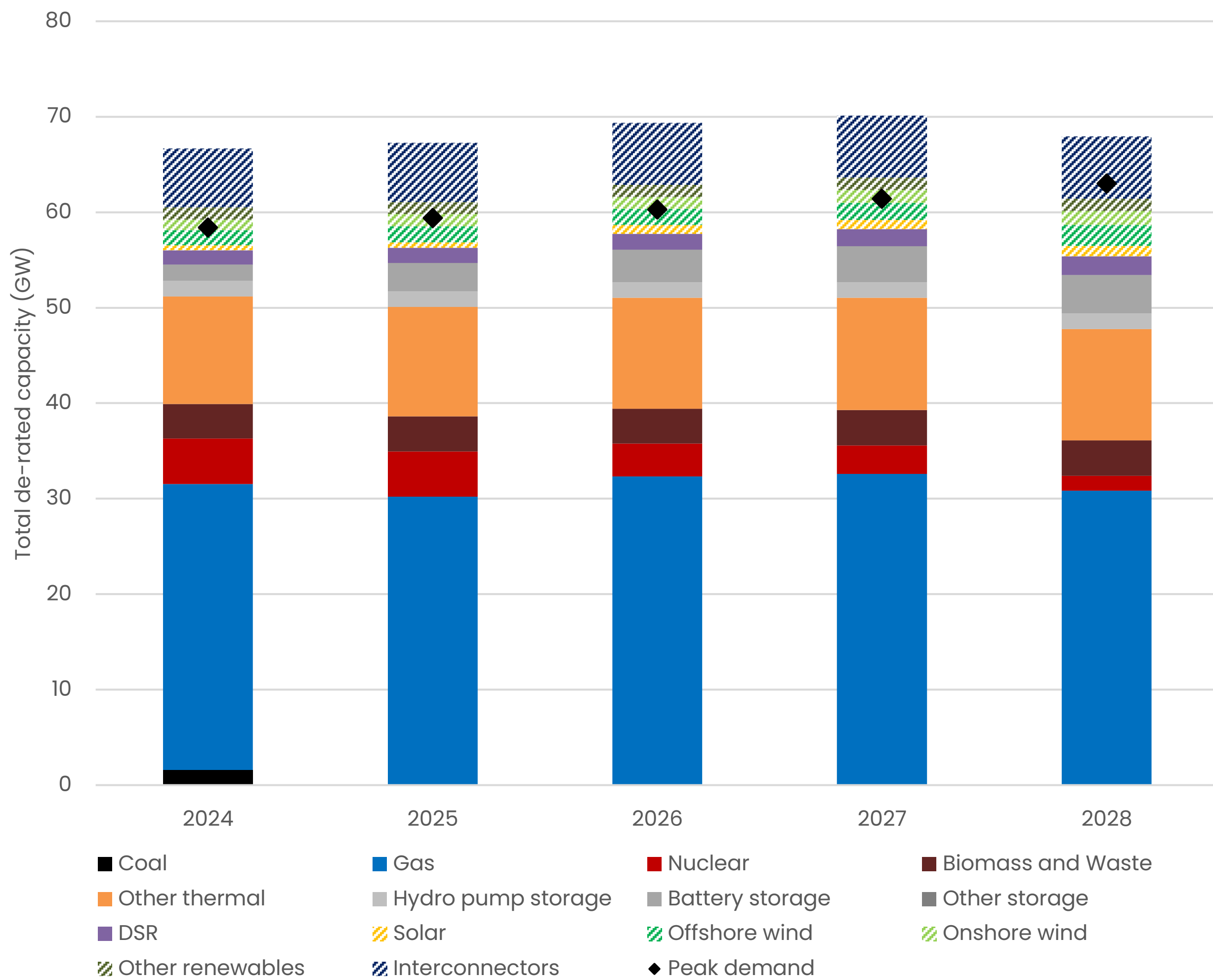
By 2028, we estimate a shortfall of 7.5GW between **secure *dispatchable and baseload* capacity** (i.e. de-rated capacity that does not include wind, solar and interconnectors) and peak demand - almost double what was present in 2022 (4GW). Interconnectors rely on excess generation from Europe meaning that there is no guarantee that the power will always be available, particularly when weather conditions (such as low wind) impacting the UK are also impacting Europe too. It also takes account of demand side response which encourages households or businesses to use power at different times, like running the washing machine or charging an electric vehicle when it's windy or sunny outside instead of during evening peaks.

Biomass generators contribute 3GW of secure dispatchable and baseload power to the headroom but require clarity on government plans for support post-2027. The government is currently consulting on what a transitional support mechanism looks like to enable large-scale biomass electricity generators. The mechanism in consultation is intended to ensure that these generators remain viable between existing support schemes finishing in 2027 and 2030 when Bioenergy with Carbon Capture and Storage (BECCS) is likely to take effect.

With two nuclear plants coming offline in March 2028, this leaves just one nuclear plant - Sizewell B (installed capacity of 1.25GW, which is 1GW de-rated) due to be online for the rest of the year. Sizewell B recently underwent maintenance to enable a 20-year extension of its lifetime, indicating that its available capacity is likely to be reliable despite being the only nuclear plant online.[9]

Had Hinkley Point C come online in June 2027 as previously announced, an additional 2.5GW of secure nuclear capacity would have been available, leaving a headroom of 7.5GW in 2028.

Figure 2: Forecast of GB generation fleet with no Hinkley Point C, de-rated capacity (GW), 2024-2028



Source: Public First analysis of National Grid ESO FES (2023) and de-rating factors (2023). Solid colours indicate baseload and dispatchable power. Hashed indicates intermittent power.

[9]EDF, *Sizewell B starts review to extend operation by 20 years*, 2022

Meeting the government's or Labour's political targets will depend on significant delivery of offshore wind, nuclear, and BECCS in the late 2020s and early 2030s

Our estimated outlook for 2028 poses challenges for decarbonising the power system by 2035 (current government's plans) and 2030 (HM Opposition's plans). The following section is based on installed capacity figures rather than de-rated capacity as above. This is due to limitations in applying existing de-rating factors that far in the future given that different technologies may change in efficiency or availability. Figure 3 below compares our forecast for 2028 with independent analyses of reaching a decarbonised power system by 2030 (Ember analysis in line with Labour's target) and 2035 (CCC's analysis in line with the government's target). Our analysis shows that meeting either target would require a significant acceleration of new generation coming online.

To achieve government targets of reaching a reliable, decarbonised power system by 2035, the CCC estimates that:

- Unabated gas reaches 17GW in 2030 and 12GW in 2035 for security of supply, down from our analysis of 34GW in 2028. Gas is also estimated to have a lower load factor, meaning less of its installed capacity is expected to be used in practice.[10]
- The level of gas maintained on the system will ultimately be informed by the availability of other forms of reliable generation to keep the lights on. Based on the CCC estimates, this would require:
    - 10GW of nuclear power in 2035 up from 1.25GW in 2028. While Hinkley Point C (3.2GW) could come online by 2029, it is unknown whether further nuclear plants such as Sizewell C, Bradwell B or small modular reactors will come online in 2035 when Sizewell B is due to come offline. The government's recent Civil Nuclear Roadmap highlights a possible extension of Sizewell B, citing that it should be technically feasible to extend the asset by 20+ years.
    - 17GW of gas CCS or hydrogen and 2GW of BECCS by 2035, entirely delivered after 2028.
    - The role of biomass is difficult to isolate in the CCC analysis, given capacity figures are grouped with waste and other thermal power such as reciprocating engines. However, overall biomass, waste, and other thermal power appear to play a slightly reduced role from 2028 (at 16GW) to 2030 (15GW) and 2035 (13GW).
    - Upcoming CfD auction rounds (AR6 and AR7) will need to deliver 23GW of offshore wind by 2030 to hit the 50GW government target. Regen approximates that there are 15 GW of offshore wind projects that could be ready to bid into AR6.[11]
    - Keeping on track for current government targets by 2035 therefore requires significant delivery of new capacity for currently available technologies such as

[10] CCC, *Net Zero Power and Hydrogen: Capacity Requirements for Flexibility* (AFRY), 2023

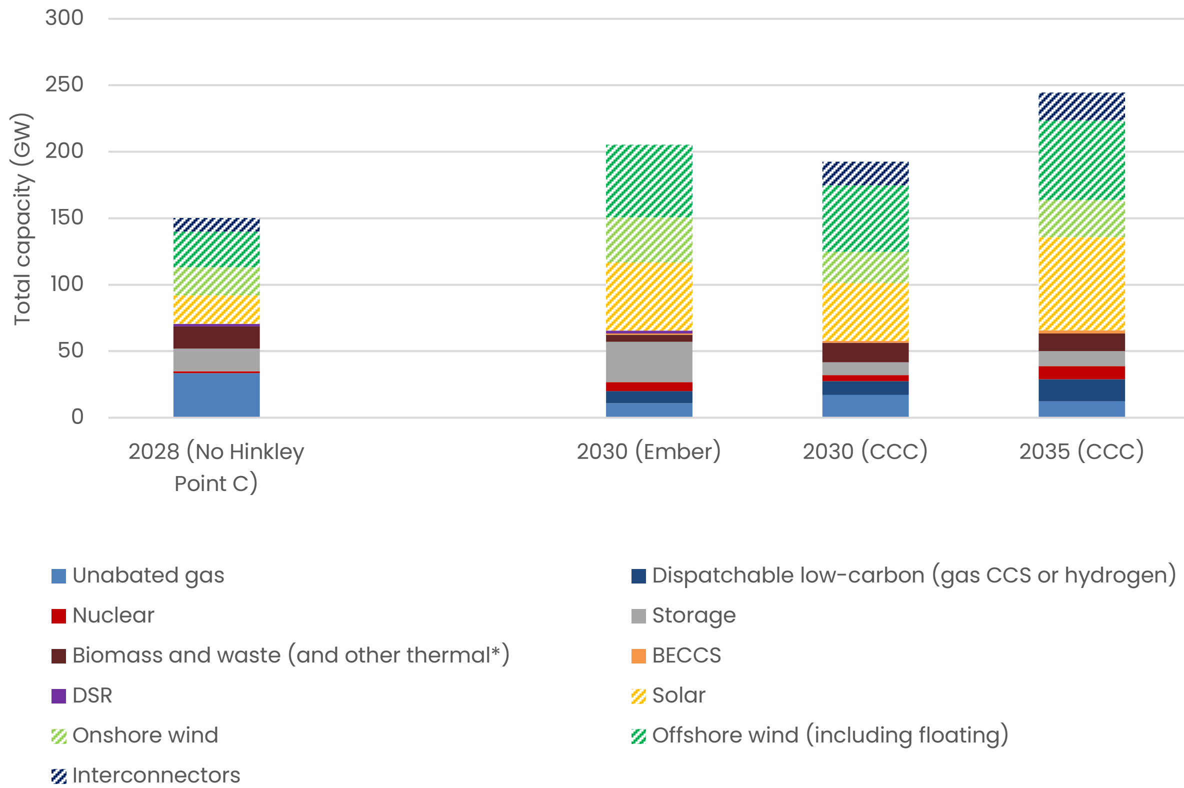
[11] Regen, *Relief as government confirms increased administrative strike prices for offshore wind*, 2023

offshore wind and nuclear, as well as for new technologies such as CCS and hydrogen.

Labour's target is even more ambitious. Ember's analysis demonstrates the type of supply mix required to achieve a decarbonised power system by 2030. Ember's modelling reflects several of Labour's installed capacity targets for specific technologies, such as 50GW of solar by 2030. Within just two years from 2028, our analysis finds the following technologies will need to ramp up their deployment:

- Ember models a total of 30GW of installed storage capacity up from 17GW as forecasted in 2028.
- Additionally, the model estimates 30GW more solar and 28GW more of offshore wind up from 21GW and 27GW respectively.
- Already, since the analysis was published in 2022, EDF has announced earlier decommissioning dates for Heysham 2 and Torness (brought forward from 2030 to 2028) and delays to Hinkley Point C as far out as 2031. This would leave a gap of over 5GW of nuclear in the model.
- Biomass and waste are expected to contribute 5GW just up from the report's 2028 forecast (c.4GW). Both Ember and the CCC estimate BECCS will provide 1GW by 2030.
- Achieving Labour's target by 2030 would therefore require greater efforts to bring new capacity online than for the current 2035 targets. This includes a doubling of storage and plugging a 5GW gap in nuclear capacity in two years.

Figure 3: Forecast of GB generation fleet compared to political targets for a decarbonised power system by 2030 (Ember for Labour) and 2035 (CCC for the government).



Source: Public First analysis of National Grid ESO FES (2023), CCC AFRY (2023), and Ember (2022). Figures represent installed capacity and are not de-rated. CCC AFRY analysis does not include estimates for DSR. Peak demand figures are not provided in CCC AFRY and are not comparable with Figure 2 given that capacity is not de-rated for peak times. Definitions differ across CCC AFRY, Ember and National Grid ESO for thermal and waste. Under our analysis for 2028 (using ESO FES) and CCC AFRY, biomass and waste also includes other thermal reciprocating engines. Ember analysis appears to only refer to biomass and waste, explaining the difference between capacity under those scenarios. Solid colours indicate baseload and dispatchable power. Hashed indicates intermittent power.

Conclusions - analysis

The next decade will be transformative for the power system with multiple – mainly baseload – power plants coming offline and a suite of new technology coming online, including both intermittent renewables and dispatchable storage options like batteries. Maintaining energy security at all times means ensuring a fine balance across different power sources with suitable reliability. Our analysis highlights that delays in bringing new projects online in nuclear and offshore wind, as well as uncertainty around government support for biomass generators post-2027, could have a tangible impact on our ability to keep the lights on. This has implications for the achievability of political targets for both major parties. This trajectory is not set. Policymakers can mitigate crunch points for a secure power system - but any decision must be politically and technically feasible.

Chapter Two - Key considerations for policymakers

This chapter looks at considerations for how the government will need to mitigate energy crunches both in the near-term (out to 2028) as well as in the longer term. Our findings are based on interviews with 11 experts across the energy sector as well as existing literature.

Key findings from experts

Expert interviews drew out several consistent messages.

- Energy security is not just about supply, and current projections of required supply are just that, projections. Policymakers have a central role in promoting policies that incentivise energy efficiency to bring total energy demand down, therefore reducing the total required supply.

- Overall, our power system needs to enable greater flexibility to achieve energy security. This goes beyond a focus on just supply or demand side response but increasingly two-way resources (like using electric vehicles as batteries), and the right market signals to enable them. Interconnectors are likely to play a critical role in balancing and ensuring energy security. The capacity market and balancing mechanism should better incentivise low-carbon technologies.

- Many of the proposed solutions needed to increase supply or decrease demand and stay on track for key climate targets are likely to be both time and cost-intensive. Political decisions in the near term will need to allocate financial and time resources to make progress in the medium term.

- Investors require policy to reduce the uncertainty of markets and to ensure the economic viability of key technologies - such as offshore wind, long-duration energy storage (LDES), nuclear, and biomass for BECCS. Feedback from the sector suggests that the government sticking to decisions will help reduce this uncertainty. However, should changes need to be made, a greater level of public-private interaction can help discuss or explain forthcoming changes. For example, through sectoral or challenge-led boards to allow the private sector to manage this interaction.[12]

[12] The Offshore Wind Sector Deal oversight board is one such example. HM Government, *Offshore Wind Sector Deal*, 2020

Experts highlighted the following three key options for policymakers. Many of these options have benefits and introduce further challenges for policymakers. In the section below we unpack these, and what might be feasible to meet the UK's energy capacity crunch by 2028.

Accelerating new capacity (supply)	Limiting increases to peak demand	Increase use of existing assets (supply)
• Accelerate the renewables and battery pipeline within the ESO connections queue to come online earlier	• Enable greater demand flexibility through information campaigns and smart meter rollout	• Extend the life of existing assets, including potential support to maintain dispatchable and baseload capacity
• Reform the capacity market and balancing mechanism to better incentivise a wide variety of low-carbon technologies	• Insulate homes to improve energy efficiency	• Rely more heavily on interconnectors to import energy
• Enable the business model for investing in long-duration energy storage (LDES)	• Market reform e.g., locational marginal pricing to incentivise matching of demand and supply	
• Ensure policy certainty on the economic viability of critical technology ie CfD auction rounds for offshore wind.		
• Develop market signals to allow new forms of demand to be used as supply, for example, home batteries or electric vehicles. • In the long-term, build dispatchable DSR solutions like Virtual Power Plants.		

Discussion of policy options

Here we run through the potential options facing policymakers, and their potential to reduce the energy crunch over the next four years. These fall into three broad categories, **accelerating new supply, reducing peak demand,** and **increasing the use of existing assets.** This section closes with some short conclusions on the most viable routes forward.

1. Accelerating new capacity (supply)

Accelerating new capacity refers to the bringing online of additional energy generation, and the ability to take that new generation and get it to the right place at the right time.

Policy option	Discussion	Likelihood of plugging the gap
Accelerate the renewables and battery pipeline to come online earlier	The current process for connection to the electricity grid means that critical supply could be ready but may be stuck behind zombie projects. National Grid ESO has already begun work to address these issues, particularly for batteries. Much of this is reflected in the government's connections action plan released in the Autumn Statement.[13] In the summer, Ofgem-approved amnesty agreements have freed up 8GW of capacity, representing around 3% of the queue.[14] Efforts are also being made to increase the speed of transmission build-out. The government has already accepted many of the recommendations from Nick Winser's review, but these now need a clear timetable to be implemented. Transmission build-out needs to increase seven-fold over the next few years.	At an aggregate level, there is around 420GW of low-carbon generation capacity and storage in the ESO's queue.[15] However, there is a question of whether it is the right type of generation, in the right place, and if the projects themselves are even viable. ESO estimates that 70% of all projects in the queue may never be built.[16] Interviews pointed in particular to the queue for energy storage. Whilst this appears on track and healthy, it is unlikely this is an accurate reflection of the future reality.

[13] HM Government, *Connections Action Plan*, 2023

[14] Ofgem, *Letter of support to facilitate the processing of the TEC Amnesty*, 15 August 2023

[15] National Grid ESO, *TEC Register* [Accessed 12 January 2024]

[16] National Grid ESO, *Connections Reform*, June 2023

Policy option	Discussion	Likelihood of plugging the gap
Reform the Capacity Market (CM) and Balancing Mechanism (BM) to better incentivise a wide variety of low-carbon technologies	Currently the Capacity Market and balancing market favour gas and battery storage. This has created disincentives for other forms of low-carbon power to compete. However, incentivising other forms of storage, say pumped hydro or hydrogen, is likely to be a longer-term goal in line with decarbonisation. In the near term, given clear crunch points, it is unlikely and unwise to embark on significant reforms that could squeeze unabated gas out of the capacity market. The Capacity Market for the past few years has also operated with more available (pre-qualified) capacity than is eventually procured. This helps keep prices low. The CM auction register for this year indicates that, compared to the auction parameters on pre-qualified capacity, this year's might be tighter than in previous years.[17] A tighter market with less qualified capacity could impact affordability.	The CM and BM are more a part of wider enablers for expanding the low-carbon pipeline, but research and interviews suggest they are not a central driver to bringing new supply online.
Enable the business model for investing in long-duration energy storage (LDES)	Current battery storage enables 1-2 hours of storage, LDES is considered as 6 hours or more. The current market arrangements have hindered LDES from deploying at scale. LDES developers face high upfront costs and potentially high system costs. This is due to uncertainty on whether revenues will rely only on being able to capture the difference between price at storage and release, or whether they would be able to stack multiple revenue streams. This might be being paid to absorb excess power from generators when we produce more electricity than we need. Successful models of this exist for example in California. The government is consulting on a cap and floor proposal similar to electricity interconnectors.	This is a worthy policy ambition for the medium to longer term but is unlikely to bring on significant capacity by 2028. Recent deployment analysis from the government identifies the potential to add from 1.5GW-12GW in 2035.[18] We estimate that by 2028, peak demand will be over 8.5GW higher than 'secure' dispatchable and baseload capacity.

[17] National Grid ESO, *EMR Portal - Capacity Market Registers*, [Accessed 19/02/2024]

[18] HM Government, *Scenario Deployment Analysis for Long-Duration Electricity Storage*, 2023

Policy option	Discussion	Likelihood of plugging the gap
Ensure policy certainty on the economic viability of critical technology i.e. CfD auction rounds for offshore wind.	The strike price cap for offshore wind in AR6 will be increased to £73/MWh, following auction round (AR5) that failed to attract offshore wind bids. This is a positive step, but policymakers need to maintain this stability and certainty of economic viability for investor confidence.	While increased strike prices are a positive sign, subsequent auction rounds will need to deliver 23GW of offshore wind to hit the current Government's target of 50GW by 2030.

2. Limiting increases to peak demand

Limiting increases to peak demand can reduce the level of supply required at any one time. This could mean rearranging existing demand either manually or automatically (with smart technology). For example, for many households, it could mean putting your dishwasher on overnight rather than during dinner. For households with electric vehicles (EVs) and enabled smart charging, the car will automatically charge up overnight rather than during peak evening times. Over time, as more drivers switch to EVs, this form of demand management will become more common. There are also ways to reduce total demand, rather than just rearrange it, reducing the overall level of supply required. For example, using a more efficient device or insulating your loft.

Policy option	Discussion	Likelihood of plugging the gap
Enable greater demand flexibility through government-led information campaigns and smart meter rollout	The government's information campaign during the energy crisis encouraged households to turn down boiler flow temperatures. This was a useful starting point. However, experts highlighted the lack of messaging around continued demand reduction. Other countries have used public messaging to impact demand, for example, both Texas and Tennessee recently warned consumers of particular capacity crunches at specific times[19]. This contributed to a significant undershoot of forecast capacity. The European Union through their energy efficiency targets has also encouraged similar in member states, for example, Ireland.[20] In the UK, Octopus' demand flexibility initiative with National Grid ESO enabled savings of 108MW from over 200,000 households.[21]	If replicated by all UK energy suppliers, the Octopus/NGESO initiative could save over 1GW during a peak winter hour, however this will depend on rolling out smart meters to all households. Currently, 60% of households have a smart meter installed, but there are concerns about how well they work. Public information campaigns have two potential roles. They can help reduce peak demand at times of particular capacity crunches. However, as part of wider reforms, they may also have a role in reducing total demand.

[19] Heatmap, Asking People to Use Less Electricity Works, 2024

[20] Irish Government, 'Reduce Your Use': *Government launches nationwide campaign to encourage energy efficiency and highlight supports available for households and businesses*, 2022

[21]Octopus Energy, *Believe it or watt: Octopus Energy customers provide 108MW of grid flexibility in first 'Saving Session' - equivalent of a gas power station*, 2023

Policy option	Discussion	Likelihood of plugging the gap
Insulate homes to improve energy efficiency	Energy savings will depend on the treatment given. Existing research indicates insulating all 13 million homes in England up to EPC C would reduce national and peak electricity demand by 8%.[22]	Under current plans, the government is set to insulate 2 million homes in England by 2028. Labour's plans are set to go further, insulating 5 million homes under EPC C by 2030. However, coordination and delivery challenges in the supply chain are barriers to scaling quickly. Measures can be costly and depend on demand uptake. Politically the role of retrofit is also becoming more challenging, with several hostile briefings from the government, for example, aimed at Labour's plans. Both parties have recently watered down home retrofit plans and targets.
Market reform e.g., introduce locational marginal pricing (LMP) to incentivise a greater matching of demand and supply	LMP could give clearer price signals about the best time to use energy, according to supply and demand.	As market reforms like LMP are likely medium/long-term policy solutions, they may not have a material impact by 2028.
Develop market signals to allow new forms of demand to also be used as supply, for example, heat pumps, home batteries and electric vehicles.	Currently, consumer technology has limited uptake that can be used for both storage and flexibility. The key barriers emerging from our research include upfront costs as well as awareness and information. Improving uptake will depend on an adequate range of finance models for example a blend of government grants, loans and private finance, as well as cost reductions from innovation.	For example, under Leading the Way ESO FES scenarios, smart charging from EVs could reduce unmanaged peak demand by 50-60% in the late 2020s.[23]

[22]Citizens Advice, *Home advantage: Unlocking the benefits of energy efficiency*, 2023

[23] National Grid ESO, *Future Energy Scenarios*, 2023 p.87, Chart EC 12

Policy option	Discussion	Likelihood of plugging the gap
In the long-term demand-side response solutions such as Virtual Power Plants could help with peak capacity.	Virtual power plants are the integration of various energy sources, spread across different places, to be able to supply a given level of energy at any one time. For example, an energy company might run a wind farm in Scotland, solar in the South East and electric vehicles in several locations. This allows them to balance their supply in a single contract when, for example, the wind is low or during nighttime.	Currently, VPPs are a minor part of the UK's balancing mechanism. Though other plans are in place it is unlikely they will reach more than 100MW over the next few years, let alone the potential 8GW capacity crunch.[24]

[24] Action Renewables, Virtual Power Plants: *What are they and what are their advantages for renewable technology?, 2020*

3. Increase the use of existing assets (supply)

Many existing assets are due to be retired, either due to age or their carbon footprint. Navigating a security crunch may need to extend the life of these assets beyond expectations. Other options include asking generators to produce either more total energy or to draw on their energy more often.

Policy option	Discussion	Likelihood of plugging the gap
Extend the life of existing assets, including potential support to maintain dispatchable capacity	The government may need to look at extending the life of assets planned for decommissioning, such as gas or nuclear plants. For example, EDF brought the decommissioning dates of Heysham 2 and Torness forward from 2030 to 2028. Meanwhile, Heysham 1 and Hartlepool are set to decommission from 2026, which was already extended from 2024. EDF is said to decide by the end of this year whether to extend the life of those four plants, which would require regulatory approval. Another option includes supporting the viability of existing dispatchable generation such as biomass. The government is currently consulting on what a transitional support mechanism looks like to enable large-scale biomass electricity generators. The mechanism in consultation is intended to ensure that these generators remain viable between existing support schemes finishing in 2027 and 2030, when Bioenergy with Carbon Capture and Storage (BECCS) is likely to take effect.[25]	There are multiple trade-offs here: **Low-carbon.** Assets due for decommissioning include some carbon-intensive coal and gas stations. Using them more would put climate targets at risk. Additionally, when considering extending the life of existing assets, policymakers need to consider the end goal of what will be beneficial over the long-term. For example, it would not be beneficial to extend the life of coal. By comparison, experts agree with the ongoing need for gas, and the ability to pair it with carbon capture and storage (CCS) over time to limit emissions. Notably, CCS is unlikely to be deployed fast enough to reduce the environmental impacts of gas over the next four years. **Reliability.** The older the assets get the less likely they are to be reliable. This could be more planned outages, due to maintenance or unexpected shutdowns due to breakages. One significant factor in the energy price crisis in 2022 was the higher-than-expected maintenance required on the French Nuclear fleet.[26] **Affordability.** There will likely be cost implications related to maintaining assets near end-of-life, or to keeping them only for discrete periods of peak demand.

[25] HM Government, *Transitional support mechanism for large-scale biomass electricity generators*, 2024

[26] EIA, *Nuclear power plants generated 68% of France's electricity in 2021*, 2023

Policy option	Discussion	Likelihood of plugging the gap
Rely more heavily on interconnectors to import energy	The UK now has over 10GW of interconnector capacity and the current pipeline of projects could see this capacity exceed 20GW by 2035. However, there are several challenges facing interconnectors as a reliable source. 1) the UK's exit from the EU and the Internal Energy Market complicates the trading arrangements for GB interconnectors.[27] 2) 2022 saw poor availability from interconnectors, with various major outages.[28] 3) Interconnectors are currently not allowed to participate in the balancing mechanism. 4) Interconnectors do not provide grid services such as inertia.	Interconnectors will play a critical role. While most interconnectors are two-way and price-responsive, new ones such as Xlinks connecting the UK and Morocco will be able to act as effective base load. A major issue is construction time, work on Xlinks will begin this year but won't finish until 2030, if it stays on track.[29] Further, relying too heavily on them to plug gaps in supply poses potential trade-offs for cost, reliability and independence. For example, during extended periods of low wind in winter ie "dunkelflaute", availability from interconnectors may be reduced as our interconnected neighbours may also be affected by similar weather patterns.

[27] Regen, *The growth of GB's interconnector capacity*, 2024

[28] Current, *How is the energy crisis impacting the Capacity Market, and vice versa?*, 2022

[29] AGBI, *UK-Morocco renewables project 'on track for 2030'*, 2023

Conclusions - policy options

Very few forms of new capacity and supply are likely to have a major impact by 2028. Bringing new capacity online takes time – we have already seen how supply chain constraints and uncertainty in the policy environment have impacted the construction of new developments, particularly in offshore wind. It is unlikely that new build plants (beyond those already in the pipeline and under construction) will be online to mitigate the crunch by 2028. Policymakers should still aim to accelerate the renewables and storage pipeline and signal certainty to secure new capacity over the medium term.

Extending the life of existing assets could affect material change in energy security by 2028. While helpful for system reliability, gas assets create challenges due to the need for high volumes of gas imports and the adverse impact this poses to energy security and price stability. Increased gas consumption is also counter to the UK's commitments to reduce carbon emissions. This leaves a role for other options such as extending the life of some nuclear assets or transitional support for biomass.

The UK will also have to strengthen efforts to limit increases to peak and total demand. Managing demand could be significant in influencing day-to-day crunch points. Efforts include encouraging behavioural changes to use electricity outside of peak times (ie winter evenings) either manually or through smart technology, as well as more permanent measures like insulation. Examples in both the EU and the USA show that the government can play a clear role in steering the public to use less energy. There have also been successful demand flexibility initiatives from National Grid ESO to encourage consumers to shift their energy use. Going further will rely on overcoming key barriers and providing financial incentives, which pose difficult political decisions.

Chapter Three - What do the public think?

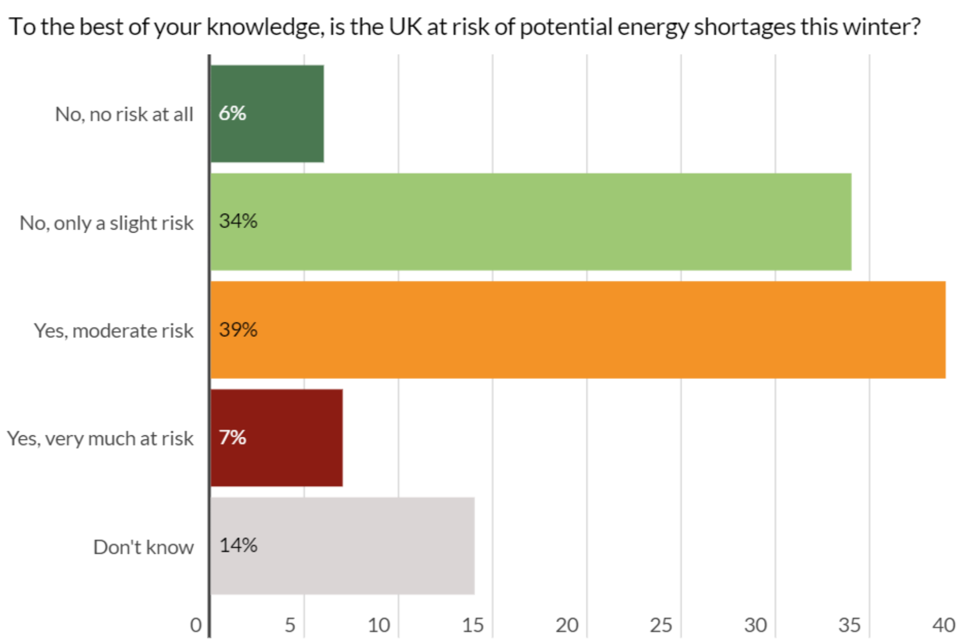
There are viable responses to the energy crunch focused on both extending the life of existing assets and demand management. However, these policies also need to be politically feasible. Politicians need to be able to explain their solutions to the public in a way that resonates with them. Advocating solutions that the public does not feel are credible responses to energy security can restrict the government's ability to act.

To understand what a politically viable route forward on energy security might be, Public First ran a survey of 2,011 UK adults from 12-16 January 2024. We sought to understand how the public thinks about energy security, and what their preferred solutions might be.

There is public concern over the *future* of energy security. 41% expect shortages to become more frequent, and only 12% think shortages will fall. The biggest threats the public identified are extreme weather (32%) and not enough homegrown energy (29%).

Concerns are focused on the national level, rather than the local or individual. **45% of respondents thought that over the last few years, the risk of energy shortages in the UK increased,** with just 12% thinking it was decreasing. Yet only 28% had any knowledge of a disruption to their own supply in the last five years, compared to 63% who hadn't.

Figure 4: Public attitudes on potential energy shortages this winter



Source: Public First

The idea of energy self-sufficiency has strong support from the public. A considerable majority of 81% believe the UK should be self-sufficient in terms of energy production, and only 4% disagreed.

The public is looking for responses to the energy crunch that also make energy more affordable. Politicians should be wary of any responses that increase energy costs. The public maintains very high levels of concern about their energy costs, with 82% of people feeling fairly or very concerned. Only 6% of the public are unconcerned.

Although existing assets are the most immediate response, **the public views renewable energy sources as solutions to make energy more affordable and also more secure**. Wind and solar were seen as more reliable and stable than other sources. However, at the same time, a third of the population believes reducing reliance on oil and gas would increase energy shortages. This creates a potential tightrope of acceptability for policymakers to walk. This view hasn't changed since we polled the same question in 2022.

Policy will need to make clear the reliability of different energy types. Nuclear energy and natural gas were seen as the most reliable energy sources. Geothermal energy and biomass were seen as the least reliable sources, likely driven by the lack of public knowledge with 38% and 40% respectively responding that they didn't know about those energy sources.

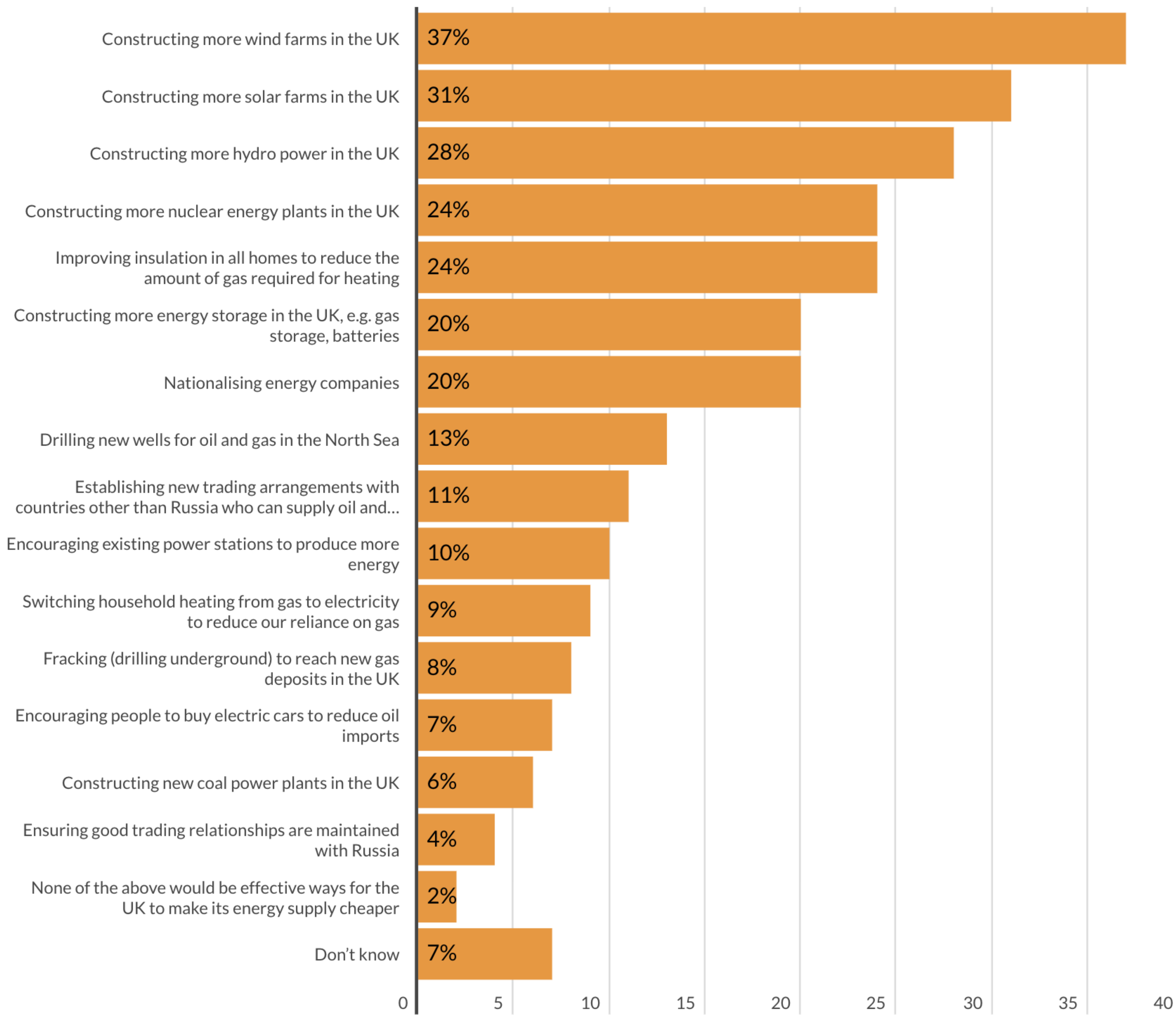
Compared to a previous poll we conducted in October 2023, one significant change in public opinion is worth highlighting. When asked about the causes for increased energy prices, fewer people cited the war in Ukraine, falling from 54% in October to 42% in January. There was also a slight decrease in the number of people who blamed this on global shortages of oil and natural gas. The growing tensions in the Middle East could impact these perceptions in the future. This is worth tracking in the future.

Conclusions - public opinion

Concerns about energy security remain high on the agenda. The public is worried about a potential increase in energy shortages at the national level. This fits with our energy system analysis showing an impending crunch point.

Gaining public acceptability will mean greater clarity on the role of different sources in the energy system. Renewables for example are strongly supported, and the public sees them as playing a strong role in energy security. Yet to address the identified crunch point in 2028, the government will also need to champion solutions that contribute to both secure dispatchable and baseload capacity, which renewables are unlikely to support by 2028.

Figure 5: Public attitudes on how to increase energy security



Source: Public First

Conclusion

There is a significant energy crunch coming in the next four years. Our findings suggest 2028 will be the key year for energy security. The next government will need to take action early to address this shortfall and keep the lights on in 2028. There are limited options available. The two most viable are to extend the life of existing assets, for example, nuclear or biomass, and simultaneously to manage energy demand.

Given that voters prefer wind and solar as solutions to increase energy security, decisions on these near-term policy options could create a disconnect between policy and the public. Policymakers will need to take any disconnect into account when communicating potential policy decisions for existing assets or managing demand. Additionally, there are clear views among the public on the affordability of energy. Cost will remain an overwhelming concern and government action will need to ensure that bills do not rise.

While the initial options are limited there are still actions that prevent the UK from ending up in a similar bind in the future. That should also include accelerating market reform and flexibility and providing viable business models for a broader range of energy technologies. The UK is facing an energy crunch now, but with the right actions during this period, it can have a more secure, diverse, and sustainable energy system.