



Department for
Energy Security
& Net Zero

Statutory Security of Supply Report 2023



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Energy Security
& Net Zero

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Presented to Parliament pursuant to Section
172 of the Energy Act 2004 (as amended by
Section 80 of the Energy Act 2011)

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Introduction

This report is prepared jointly by the Secretary of State for Energy Security and Net Zero and the Gas and Electricity Markets Authority (GEMA) as required by section 172 of the Energy Act 2004 (as amended by section 80 of the Energy Act 2011). It deals with the availability of electricity and gas for meeting the reasonable demands of consumers in Great Britain (GB), considering the short and long-term, and includes the electricity supply capacity required to meet demands of consumers for the supply of electricity in GB, covering the subsequent four calendar years.

Although security of supply of oil is not included as part of the statutory requirement, this report includes a section produced by the Department of Energy Security and Net Zero (DESNZ) on oil security of supply for general information.

The technical data presented here has been produced from analysis conducted by DESNZ, Office of Gas and Electricity Markets, (Ofgem), National Gas Transmission (NGT) acting in its capacity as the Gas System Operator (GSO) and the National Grid Electricity System Operator (ESO).

The statistics underpinning this document are for GB only where possible. However, in some cases where it is not possible to split the GB data out from the United Kingdom (UK) data, UK statistics have been used. Where this is the case, they have been referred to as UK in the accompanying text.

Executive summary

The Statutory Security of Supply Report (SSSR) 2023 concludes that GB has successfully delivered sufficient supplies of electricity, gas, and oil amidst a period characterised by high energy prices and increased uncertainties caused by Russia's illegal invasion of Ukraine. Sufficient supplies of electricity and gas continue to be available to meet consumers' demands over the short- and long- term.

Electricity security of supply

GB has demonstrated consistent success in ensuring secure electricity supplies and is expected to continue this trend in the future. The ESO forecasts sufficient electricity capacity to meet this winter's demand, with a margin of 4.4GW (about 7.4%) between supply and demand. This is an increase on the 3.7GW (6.3%) that was expected at this time last year.

The Capacity Market is GB's key mechanism for ensuring sufficient electricity capacity in GB in the coming years. Most of the needed capacity for 2024/25 through 2026/27 has already been procured, and the remainder will be procured through the relevant T-1 auction.

Over the longer term, the ESO anticipates a significant increase in the peak electricity demand, with a 26% to 51% increase estimated in 2035, compared to 2022 peak demand.

The government's Net Zero Strategy, British Energy Security Strategy (BESS), and the Powering Up Britain: Energy Security Plan guide the shift towards a sustainable and decarbonised power system to meet this demand. Central to this plan is the diversification of energy sources, with a significant emphasis on accelerating the transition to renewable energy sources such as wind, solar, and hydroelectric power. This shift not only reduces dependence on fossil fuels but also mitigates the risks associated with volatile global energy markets. The plan also focuses on enhancing the resilience and capacity of the electricity grid, enabling it to handle fluctuations in demand and supply efficiently.

Actions currently being taken include the Review of Electricity Market Arrangements (REMA) – a major review into Britain's electricity market design that will enhance energy security and help deliver our world-leading climate targets whilst ensuring a fair deal for consumers.

Gas security of supply

GB's gas system has reliably delivered secure gas supplies to date and is well-positioned to continue doing so. GB benefits from diverse sources of gas supply which underpinned the security of our energy system over winter 2022/23, ensuring the UK remained well supplied and able to support European supplies. For winter 2023/2024, National Gas Transmission (NGT) forecasts a margin of 159 million cubic meters per day (mcm/d) between forecast peak supply and 1-in-20 peak demand

Over the longer term, even though overall gas demand is expected to decline in the context of decarbonisation, peak demand is anticipated to remain high during the transition. The gas supply picture is also changing, with declining production of gas from the UK Continental Shelf (UKCS) and, though more slowly, gas from the Norwegian Continental Shelf (NCS).

The gas system will need to change to maintain resilience against increasingly dynamic and unpredictable requirements. Steps are in place to strengthen the system's resilience, including maximising the supply of UK gas through consistent annual licensing in the North Sea oil and gas sector and long-term investments to expand LNG import capacity, increasing from ~51 billion cubic metres per year (bcm/y) to 59bcm.

Oil security of supply

GB has continued to maintain good access to oil supplies and is expected to continue this trend in the future. The resilience of the UK oil sector is evident in its ability to adapt, ensuring a steady supply amid fluctuating demand and geopolitical shifts. This is evidenced by the ability of the market to replace the significant volumes of imported Russian oils during 2022.

As the UK navigates the post-pandemic landscape and adjusts to new global energy realities, maintaining a balance between domestic production and refining, import diversity, and

sustainable consumption will remain an essential feature of the market. The government is enhancing its ability to monitor the fuel supply market and intervene if necessary to maintain supplies.

Electricity

Introduction

Electricity security is an absolute priority for government and GB's electricity system has delivered secure electricity supplies to date.

In 2021, government published the Net Zero Strategy which sets out the ambition to deliver a secure, affordable and decarbonised power system. In 2022, government published the BESS which sets out the ambition to accelerate clean, domestic sources of energy to reduce GB's exposure to volatile global energy markets, particularly following Russia's illegal invasion of Ukraine. This includes ambitions to deliver up to double the ambition for low-carbon hydrogen production capacity to 10GW by 2030 and delivering up to 24GW of nuclear power by 2050¹.

In 2023, the Powering Up Britain: Energy Security Plan built on the ambitions set out in the BESS and Net Zero Strategy by setting out further actions government is taking to deliver a more secure, low-cost and cleaner electricity system. Low-cost renewables such as wind and solar will be central to this goal. Government will move towards greater energy independence by aiming for a doubling of Britain's electricity generation capacity by the late 2030s. Low-cost renewables such as wind and solar will be central to government's goal, alongside delivering firm and flexible technologies such as nuclear, power CCUS, storage and interconnection and demand side response. The plan also focuses on enhancing the resilience and capacity of the electricity grid, enabling it to handle fluctuations in demand and supply efficiently.

ESO's 2023/24 Winter Outlook Report forecasts there will be sufficient electricity capacity to meet peak demand this winter, and that the ESO will need to utilise the operational tools available to it².

The government continues to work closely with Ofgem and all relevant stakeholders to monitor the electricity supply horizon, and to ensure the system operator has the right tools so the market can respond to fluctuations in supply and demand.

Demand

Ofgem has consulted on principles to shape the modelling of future supply and demand by the Future System Operator (FSO), as part of its role in developing the Centralised System

¹ <https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy>

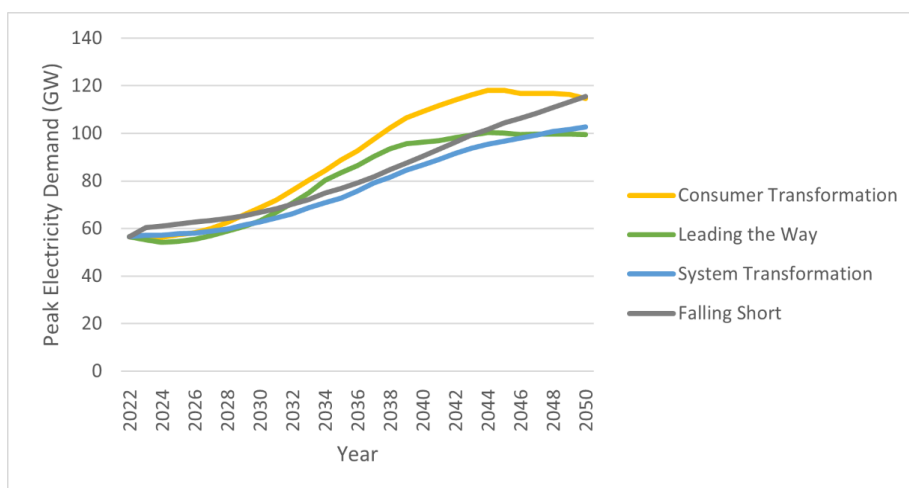
² <https://www.nationalgrideso.com/research-and-publications/winter-outlook>

Network Plan (CSNP)³. Ofgem has proposed that the FSO should set out strategic pathways, including the Strategic Spatial Energy Plan (SSEP) endorsed in the recent government Transmission Acceleration Action Plan, which would enable the CSNP to be directive about the type and scale of investment needed. Ofgem will publish its consultation response on 13 December 2023.

Ahead of the FSO commencing its role, the ESO independently produce:

- Future Energy Scenarios (FES), which are illustrative scenarios for electricity demand to 2050⁴. These scenarios are not forecasts or government policy; rather they are used by the ESO and industry to explore how the energy system might develop under different conditions, reflecting varying degrees of consumer engagement, technological progress and policy choices.
 - Figure 1 shows the underlying peak electricity demand trends from ESO’s scenarios. A significant increase in the peak electricity demand is anticipated with a 26% to 51% increase estimated in 2035, compared to 2022 peak demand.
- A ‘Five Year Forecast’, which forecasts the best estimate of annual peak demand to 2028 and is focused on shorter term operational considerations and planning, as opposed to the strategic wide view taken by the FES scenarios.
 - Figure 2 shows this estimate compared with the illustrative Future Energy Scenarios. In the near term the ESO’s forecast is currently closest to the consumer transformation pathway.

Figure 1. Peak electricity demand (GW) by FES scenario, 2022 – 2050

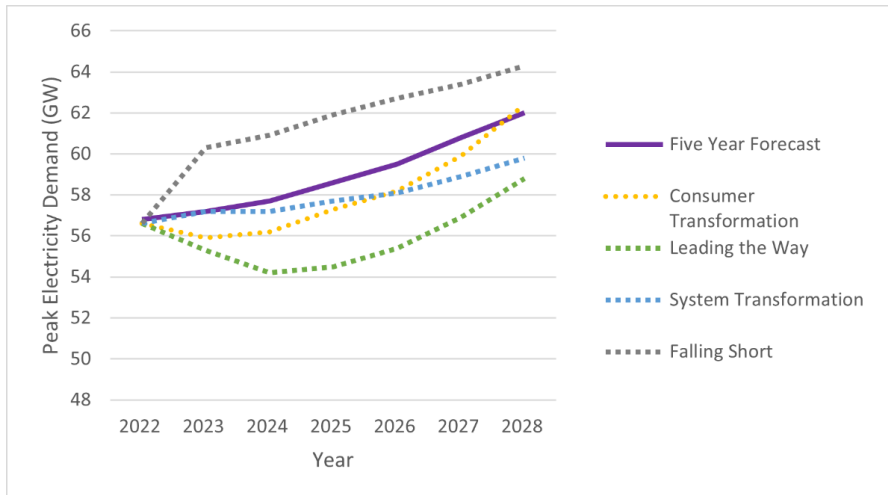


Source: National Grid ESO (2023). Future Energy Scenarios.

³ <https://www.ofgem.gov.uk/publications/consultation-future-system-operator-supply-and-demand-modelling>. The objective of the CSNP is to consider the GB onshore and offshore transmission system as a whole to make recommendations on strategic investment to meet the 2035 and 2050 Net Zero targets.

⁴ <https://www.nationalgrideso.com/future-energy/future-energy-scenarios>

Figure 2. Peak electricity demand short term forecast compared with FES scenarios (dashed) 2022-2028



Source: National Grid ESO (2023). Future Energy Scenarios.

ESO FES

The FES present three illustrative ways in which electricity demand may meet the government’s Net Zero target by 2050, alongside one illustrative way in which this target could be missed, to assist the ESO and industry in building a picture of the ways in which GB can reach Net Zero.

- The ‘**Consumer Transformation**’ scenario represents changes to the way energy is used. This indicates higher use of electrification for heating, transport and industrial processes to reach Net Zero in 2050.
- The ‘**System Transformation**’ scenario represents changes to energy production, where heating and industrial processes are moved to hydrogen. Assumed low gas prices are used for hydrogen production, not unabated burning. This scenario is also designed to meet Net Zero by 2050.
- In the ‘**Leading the Way**’ scenario, a combination of high consumer engagement and world-leading technology and investment help to enable the ESO’s fastest credible decarbonisation journey. In this scenario, GB reaches net zero in 2047 and goes on to reduce emissions by around 104% by 2050 (compared to 1990 levels) - in other words, it is net negative.
- In the ‘**Falling Short**’ scenario decarbonisation happens slowest as neither consumers nor producers rapidly change their processes. Net Zero is not reached in 2050 with emissions reduced by around 78% of 1990 levels.

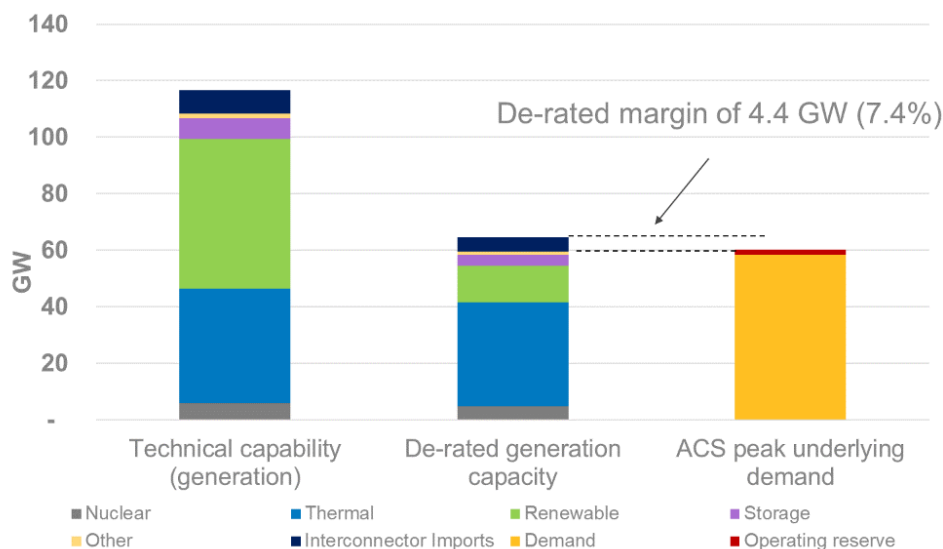
Supply

The government’s reliability standard for security of electricity supply is expressed as a Loss of Load Expectation (LOLE) of three hours per year. LOLE represents the number of hours per year in which supply is expected on average to be lower than demand under normal operation of the system. The LOLE metric is not a measure of the expected number of hours in which customers may be disconnected but represents periods where the system operator may be expected to employ mitigation actions available to it⁵.

The de-rated capacity margin measures the amount of excess supply above peak demand. De-rating means the supply is adjusted to take account of the availability of plant, specific to each type of generation technology. It reflects the proportion of an electricity source which is likely to be technically available to generate at times of peak demand⁶.

ESO’s Winter Outlook Report for 2023/24 forecasts a de-rated capacity margin of 4.4GW in the base case, equivalent to 7.4% (Figure 3), with a LOLE of 0.1 hours/year⁷. This margin is on an underlying demand basis, which aligns with how the ESO calculates the Capacity Market target capacity recommendations in its annual Electricity Capacity Report.

Figure 3. Supply margin in relation to generation capacity and demand



Source: National Grid ESO (2023). Winter Outlook.

The government, the ESO and Ofgem have also taken a range of actions to mitigate risk and strengthen the security of GB’s electric supply for winter 2023/24. This includes reintroducing the Demand Flexibility Service (DFS) and extending the Regulatory Policy Statement. The statement allows generators to operate above their hourly emissions limits if an Electricity

⁵ Use of LOLE is a probabilistic approach – the actual amount will vary depending on the circumstances in a particular year, e.g., how cold the winter is; the number of plants experiencing unplanned outages; the power output from wind generation at peak demand; and all the other factors which affect the balance of electricity supply and demand.

⁶ https://assets.publishing.service.gov.uk/media/5a7c4a16ed915d338141dd0a/Annex_C_-_reliability_standard_methodology.pdf

⁷ <https://www.nationalgrideso.com/research-and-publications/winter-outlook>

Margin Notice has been in place during the 24 hours before the notified periods of tight electricity margins⁸.

In 2022, the government launched REMA following a commitment in the BESS. REMA is a major review into GB's electricity market design that will enhance energy security and help deliver our world-leading climate targets whilst ensuring a fair deal for consumers. The first REMA consultation ran between July and October 2022, followed by a summary of responses published in March 2023. Following the publication of the summary of responses, work is underway to develop, refine and narrow down options for reform, working closely with industry and stakeholders⁹.

Electricity storage

Electricity storage enables us to use electricity more flexibly, decarbonise cost-effectively and maintain operability of the system. This supports the integration of intermittent renewables and defers or avoids the need for costly network upgrades and new generation capacity. The government is facilitating the deployment of storage at all scales through the 2021 Smart Systems and Flexibility Plan¹⁰.

There is currently around 6GW of electricity storage capacity in GB, with 2.8GW from pumped hydro and over 3GW from battery storage¹¹¹². There is a strong and growing electricity storage pipeline representing nearly 38GW of storage: 35GW of battery storage and 3GW of pumped hydro storage¹³.

There is further potential for other storage technologies to deploy in the future, such as those using novel battery technologies, compressed air and liquid air energy storage or gravitational storage. The government is supporting the deployment of novel storage technologies through the longer duration energy storage (LODES) competition, which aims to support the commercialisation of first of a kind longer duration energy storage technologies¹⁴. In total, over £69m of funding has been awarded to projects across the two competition streams in three technology categories: electrical, thermal and power-to-x¹⁵.

As outlined in the BESS, the government will put in place an appropriate policy framework by 2024 to enable investment in large-scale long-duration electricity storage with the goal of

8 <https://www.gov.uk/government/publications/operating-peaking-combustion-power-plant-in-an-emergency-in-winter-2023-rps-268>

9 <https://www.gov.uk/government/consultations/review-of-electricity-market-arrangements>

10 <https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021>

11 DUKES 2023 Chapter 5: statistics on electricity from generation through to sales:

<https://www.gov.uk/government/statistics/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes>

12 Modo Energy, Benchmarking dashboard - <https://modoenergy.com/>

13 Figures taken from Renewable Energy Planning Database and include projects that have planning approval, submitted an application for planning or are currently under construction:

<https://www.gov.uk/government/publications/renewable-energy-planning-database-monthly-extract>

14 Longer Duration Energy Storage Demonstration (LODES) competition:

<https://www.gov.uk/government/publications/longer-duration-energy-storage-demonstration-programme-successful-projects>

15 LODES competition successful projects: <https://www.gov.uk/government/publications/longer-duration-energy-storage-demonstration-programme-successful-projects>

deploying sufficient large-scale long-duration electricity storage to balance the overall system. The government intends to consult with stakeholders on this shortly.

Vehicle-to-X (V2X, where X could represent the home, a building or the grid) is an emerging technology enabling the export of energy from an electric vehicle (EV) battery for EVs to act as storage.

This technology is still at a nascent stage, but in the longer-term has potential to provide additional storage capacity. In July 2021, the government published a Call for Evidence, seeking views on the potential role of V2X, and the barriers preventing this. The government published a summary of responses in January 2023¹⁶.

The feedback from the Call for Evidence informed the design of the V2X Innovation Programme and the Electric Vehicle Smart Charging Action Plan¹⁷, jointly authored with Ofgem. The current V2X Innovation Programme, part of the Net Zero Innovation Portfolio's Flexibility Innovation Programme is providing up to £12.6m funding through to March 2025.

Interconnection

Point-to-point interconnectors are subsea electricity cables which transport electricity between two countries. Offshore Hybrid Assets (OHAs) are a new type of infrastructure asset, which combine interconnectors with offshore wind farms. There are two types of OHAs: multi-purpose interconnectors (MPIs), i.e., interconnectors with offshore wind generation in GB waters, and non-standard interconnectors (NSIs), i.e., interconnectors with offshore wind generation in the connecting country but not in GB.

GB returned to being a net importer of electricity in 2023, with net imports of 7.4TWh in Q2 2023. Compared to Q2 2022, gross exports decreased 69% while gross imports increased to 9.3TWh. Historically GB has been a net importer of electricity but nuclear outages in France and European gas price differentials caused GB to be a net exporter in 2022¹⁸.

- GB currently has 8.4GW of electricity interconnector capacity across eight interconnectors:
- 4GW to France: IFA 2GW, IFA2 1GW, and ElecLink 1GW, operational since 1986, 2020 and 2022 respectively
- 0.5GW to Northern Ireland: Moyle, operational since 2002
- 1GW to Netherlands: BritNed, operational since 31 March 2011
- 0.5GW to Ireland: East-West, operational since 20 September 2012
- 1GW to Belgium: Nemo Link, operational since 31 January 2019

¹⁶ <https://www.gov.uk/government/consultations/role-of-vehicle-to-x-technologies-in-a-net-zero-energy-system-call-for-evidence>

¹⁷ <https://www.gov.uk/government/publications/v2x-innovation-programme>

¹⁸ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1187552/Energy_Trends_September_2023.pdf

- 1.4GW to Norway: NSL, operational since 1 October 2021

This winter, the ESO expects close cooperation between European System Operators to play an important role in helping maintain secure supplies for customers in GB and Europe. It expects imports into GB at times of tight margins or stress on the GB system, provided by the market or ESO trading, an operational tool used by the ESO to manage the market. The ESO does not expect the interconnector market positions to provide exports to Europe if this would mean we were unable to meet GB demand. There will also be periods when exports flow from GB to Europe, including over some peak periods, when GB has sufficient operational surplus. The ESO expects net imports from Norway across the NSL interconnector during the winter period, particularly during peaks. The ESO also expects net exports from GB to Northern Ireland and Ireland during peak times across the winter. When operational surplus is particularly tight, exports to Northern Ireland and Ireland are expected to reduce and may even provide some imports to GB¹⁹.

There are three projects under construction, which will add a further 3.3GW of capacity bringing the total to 11.7GW:

- 1.4GW to Denmark: Viking Link scheduled for completion in early 2024
- 0.5GW to Ireland: Greenlink scheduled for completion in June 2024
- 1.4GW to Germany: NeuConnect scheduled for completion in 2028

Ofgem's Cap and Floor (C&F) regime, launched in 2014, has proven successful in encouraging investment in interconnection. Ofgem introduced investment rounds, estimating that the net total quantifiable impact on GB consumer welfare from Window 1 projects assessed at the Initial Project Assessment (IPA) stage was £13.6bn, and the equivalent impact for Window 2 projects was £8.9 bn²⁰.

There is a further 2.5GW of interconnection, approved by Ofgem, that is awaiting regulatory approval in the connecting country.

In the Energy White Paper, published December 2020, we stated our ambition for at least 18GW of interconnection by 2030.

In December 2021, Ofgem concluded their Interconnector Policy Review (IPR) and announced a third investment application window (1 September to 10 January 2023) for new interconnector projects to come forward to deliver against this ambition²¹. In parallel, Ofgem also launched an Offshore Hybrid Asset pilot scheme combining connections to offshore wind with connections to other markets. Ofgem are currently considering seven projects as part of the Window 3 application, and 2 projects as part of the Offshore Hybrid Asset pilot scheme.

¹⁹ <https://www.nationalgrideso.com/document/289136/download>

²⁰ <https://www.ofgem.gov.uk/publications/interconnector-policy-review-working-paper-workstream-1-review-cap-and-floor-regime>

²¹ <https://www.ofgem.gov.uk/publications/interconnector-policy-review-decision>

Demand Side Response

Demand Side Response (DSR) refers to action taken by consumers to reduce or increase the amount of electricity they take off the grid at a particular time. DSR can help consumers save money and improve system efficiency, by using electricity at times that are beneficial to the system and being rewarded for doing so. It supports the integration of intermittent renewables and helps defer or avoid the need for costly network upgrades and new generation capacity.

Today, industrial and commercial consumers are providing around 1.2GW of DSR to the system²². Participation from domestic and smaller non-domestic consumers remains at an early stage, but we expect electric vehicle charging, energy smart appliances and electric heating to provide a significant source of flexibility over the next decade and beyond, when combined with tariffs that reward flexible electricity use.

Table 1 shows the amount of DSR winning capacity agreements in T-4 auctions (held four years ahead of delivery)²³. This is awarded capacity, so has been de-rated in line with the Capacity Market’s de-rating factor for DSR.

Table 1. Outcomes for DSR in Capacity Market T-4 auctions

Delivery Year	2022-2023	2023-2024	2024-2025	2025-2026`	2026-2027
Awarded Capacity (MW)	535	1170	1066	1004	925

Source: National Grid ESO (2023). Capacity Market Registers.

In response to increased volatility and uncertainty in energy markets following Russia’s illegal invasion of Ukraine, in Autumn 2022 the ESO introduced the new Demand Flexibility Service (DFS), as an additional tool for them to manage the electricity system over winter 2022/23. It gave the ESO the option to pay consumers – via their energy supplier or an approved third-party intermediary – to turn down their demand in time periods where there might be a shortage of electricity. DFS incentivised 1.6 million households and businesses to lower their electricity demand when required, saving over 3,300MWh of electricity during the winter period. The ESO has reintroduced DFS for winter 2023/24²⁴.

²² <https://www.nationalgrideso.com/future-energy/future-energy-scenarios>

²³ <https://www.emrdeliverybody.com/CM/Registers.aspx>

²⁴ <https://www.ofgem.gov.uk/publications/decision-demand-flexibility-service-relation-update-terms-and-conditions-related-balancing-202324>

Future of DSR

The government is removing barriers to the increased participation of consumers in DSR through actions set out in the 2021 Smart Systems and Flexibility Plan. Flexibility from technologies such as energy storage, smart charging of electric vehicles, flexible heating systems and interconnection could save up to £10 billion (2012 prices) per year by 2050 by reducing the amount of generation and network needed to decarbonise²⁵.

Government is consulting on a series of proposals aimed at addressing participation barriers for DSR in the Capacity Market²⁶. These include proposals to address administrative barriers for domestic DSR, proposals to introduce 3-year agreements for low carbon, low capex assets (such as DSR), and a call for evidence on the Generating Technology Classes (GTCs) for DSR.

Capacity Market

The purpose of the Capacity Market is to ensure security of GB's electricity supply at least cost to consumers, by providing all forms of capacity with the right incentives to be on the system and to deliver electricity when needed. The Capacity Market ensures there is sufficient reliable capacity available during periods of electricity system stress, for example during cold, still periods with high demand and low wind generation.

The Capacity Market works by allowing eligible capacity providers to bid into a competitive auction to provide capacity. Successful capacity providers receive payments to provide their capacity at times of system stress such that the GB system operates within a Reliability Standard of 3 hours LOLE. These capacity payments incentivise the necessary investment to maintain and refurbish existing capacity, and to finance new capacity where necessary. Capacity providers face penalties if they fail to deliver against their capacity obligation – to provide electricity, or reduce demand, when required during a System Stress Event.

The Capacity Market is technology neutral and does not seek to procure allocated volumes of capacity from specific types of technology. All types of technology are able to participate except for capacity providers in receipt of support from other specific policy measures, provided they can demonstrate sufficient technical performance to contribute to security of supply, and provided they comply with the Capacity Market's emissions limits²⁷.

The Electricity Settlements Company's (ESC) records show that £680.5m was paid out to Capacity Market agreement holders for Delivery Year 2022/23 and ²⁸ 1,648MW of de-rated capacity with agreements beginning in Delivery Year 2022/23 was terminated prior to

²⁵ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1003778/smart-systems-and-flexibility-plan-2021.pdf

²⁶ <https://www.gov.uk/government/consultations/capacity-market-2023-phase-2-proposals-and-10-year-review>

²⁷ <https://www.gov.uk/government/publications/carbon-emissions-limits-in-the-capacity-market>

²⁸ <https://www.lowcarboncontracts.uk/resources/guidance-and-publications/electricity-settlements-company-esc-annual-report-20222023/>

delivery²⁹. In the Financial Year 2022/23, ESC received £4m in termination charges (compared to £2m in 2021/22).

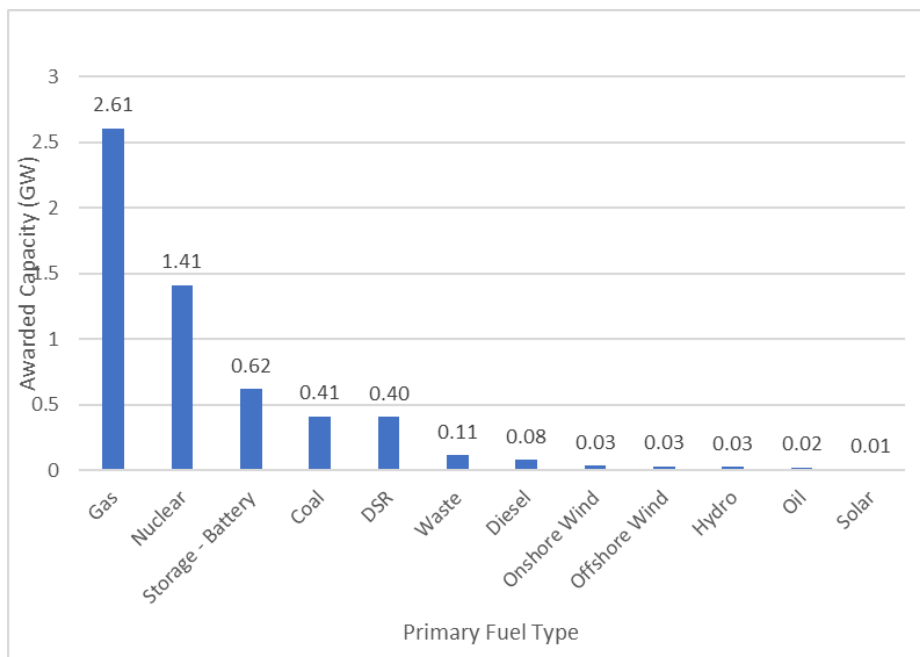
Capacity auctions

There are two capacity auctions per year: the T-4 auction which secures capacity for the delivery year four years ahead, and the T-1 auction which secures capacity for the delivery year one year ahead.

T-1 Auction results for the delivery year 2023/24

The T-1 auction for the delivery year 2023/24 concluded on 14 February 2023 and secured 5.8GW of de-rated capacity at a clearing price of £60/kW per year³⁰. A total of 6.1GW of de-rated capacity entered the auction, of which 94.4% received Capacity Market agreements (Figure 4). 80.1% of awarded capacity is from existing generation capacity, and 12.9% is from new build generation capacity. The remaining capacity was awarded to unproven DSR (5.2%) and proven DSR (1.8%).

Figure 4. T-1 Auction results breakdown of Capacity Agreements awarded by fuel type (de-rated capacity)



Source: National Grid ESO (2023). Capacity Market Registers.

T-4 Auction results for the delivery year 2026/27

The T-4 auction for delivery in 2026/27 concluded on 21 February 2023 and secured 43.0GW of de-rated capacity at a clearing price of £63/kW per year³¹. A total of 46.0GW of de-rated capacity entered the auction, of which 93.4% received capacity agreements for delivery (Figure

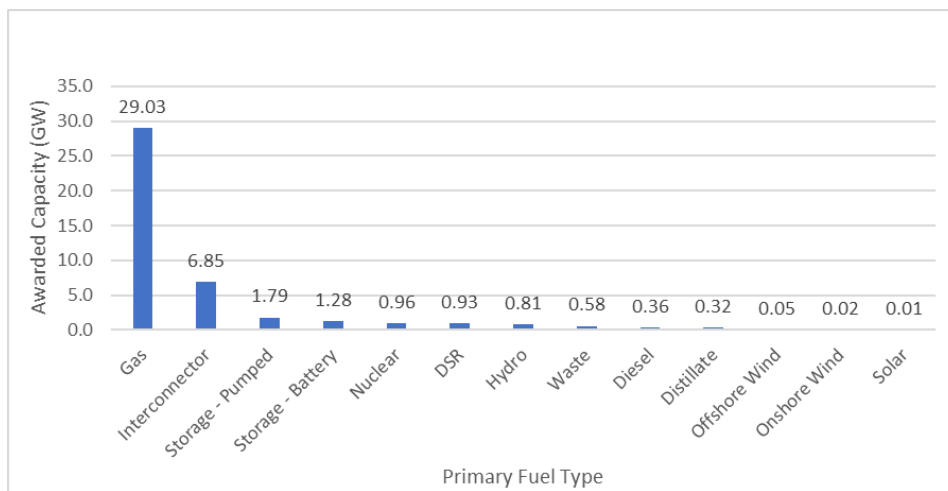
²⁹ <https://www.emrdeliverybody.com/CM/Registers.aspx>

³⁰ [https://www.emrdeliverybody.com/CM/T1\(DY23-24\).aspx](https://www.emrdeliverybody.com/CM/T1(DY23-24).aspx)

³¹ [https://www.emrdeliverybody.com/CM/T4\(DY26-27\).aspx](https://www.emrdeliverybody.com/CM/T4(DY26-27).aspx)

5). 73.9% of awarded capacity is from existing generation capacity, 8% from new build generation capacity, 13.5% from existing interconnectors, and 2.4% from new build interconnectors. The remaining capacity agreements were awarded to unproven DSR (1.8%) and proven DSR (0.3%).

Figure 5. T-4 Auction results breakdown of Capacity Agreements awarded by fuel type (de-rated capacity)

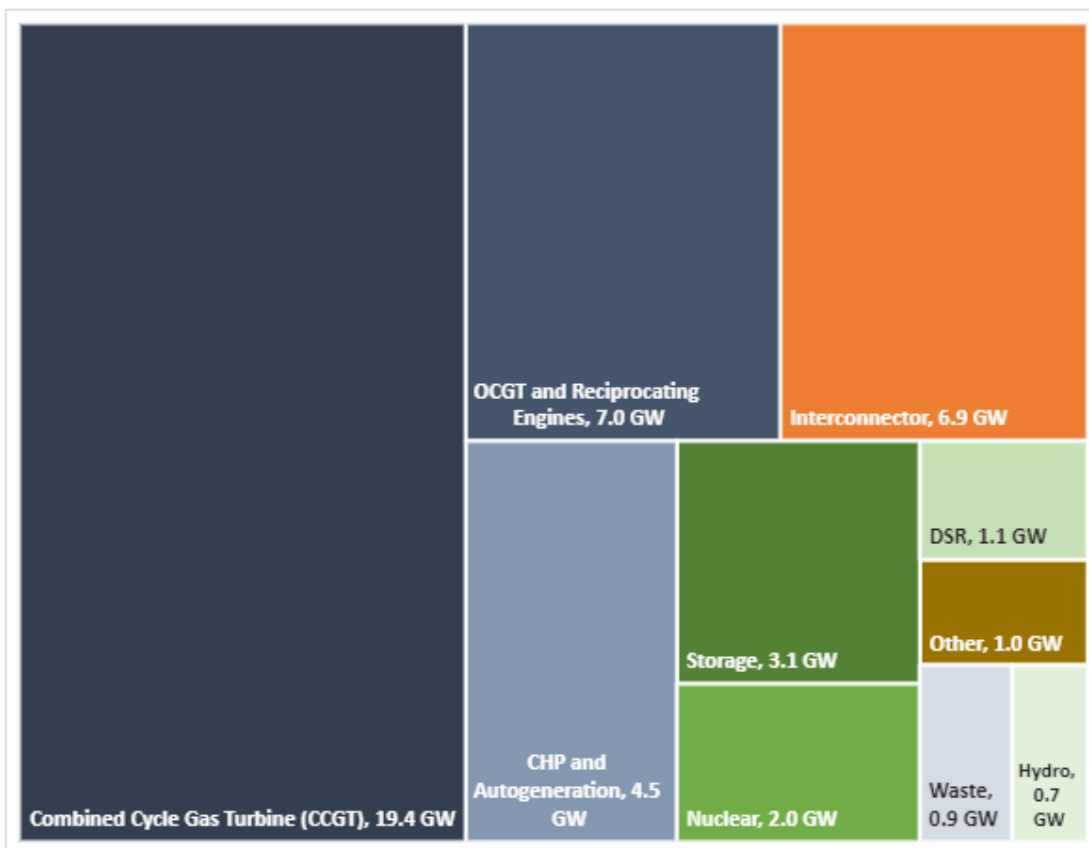


Source: National Grid ESO (2023). Capacity Market Registers.

Capacity procured in historical auctions for future delivery years

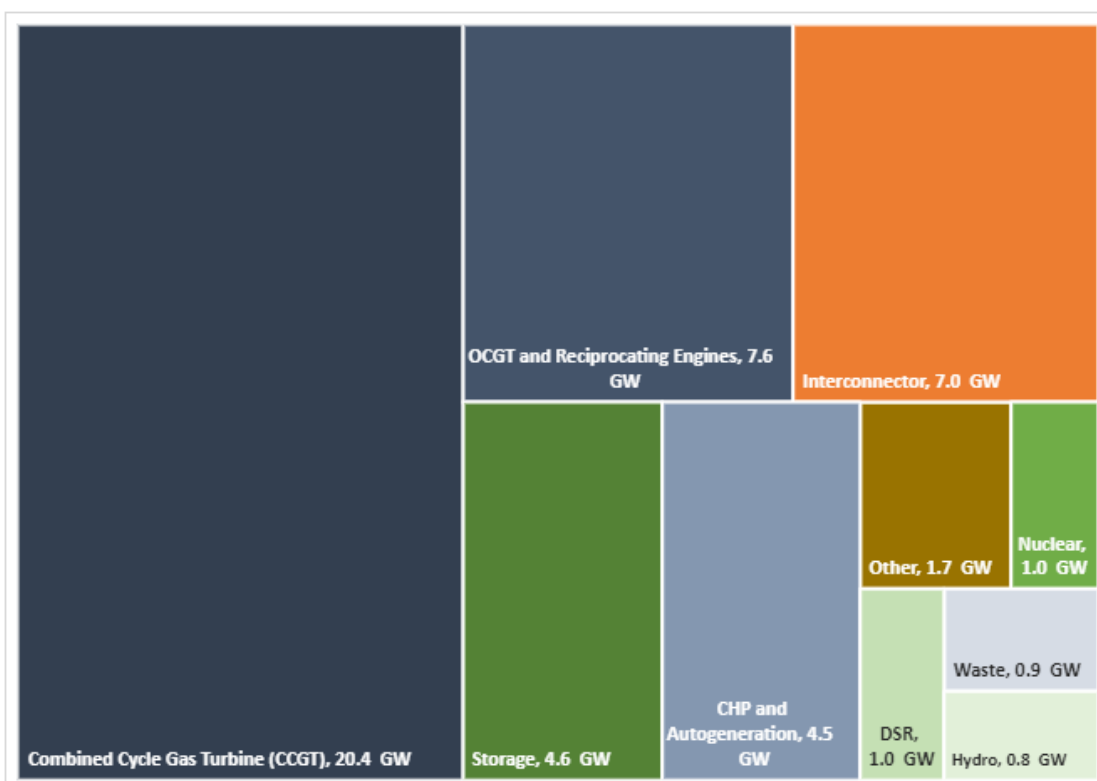
The majority of the capacity required to meet forecasted peak demand for the 2024/25 (40.8GW, Figure 6), 2025/26 (42.4GW, Figure 7), and 2026/27 (43.0GW, Figure 8) delivery years has already been procured in historical T-4 Capacity Market auctions. The capacity for each delivery year will be topped up in the corresponding T-1 auctions.

Figure 6. Capacity secured for 2024/25 delivery year by technology, in GW



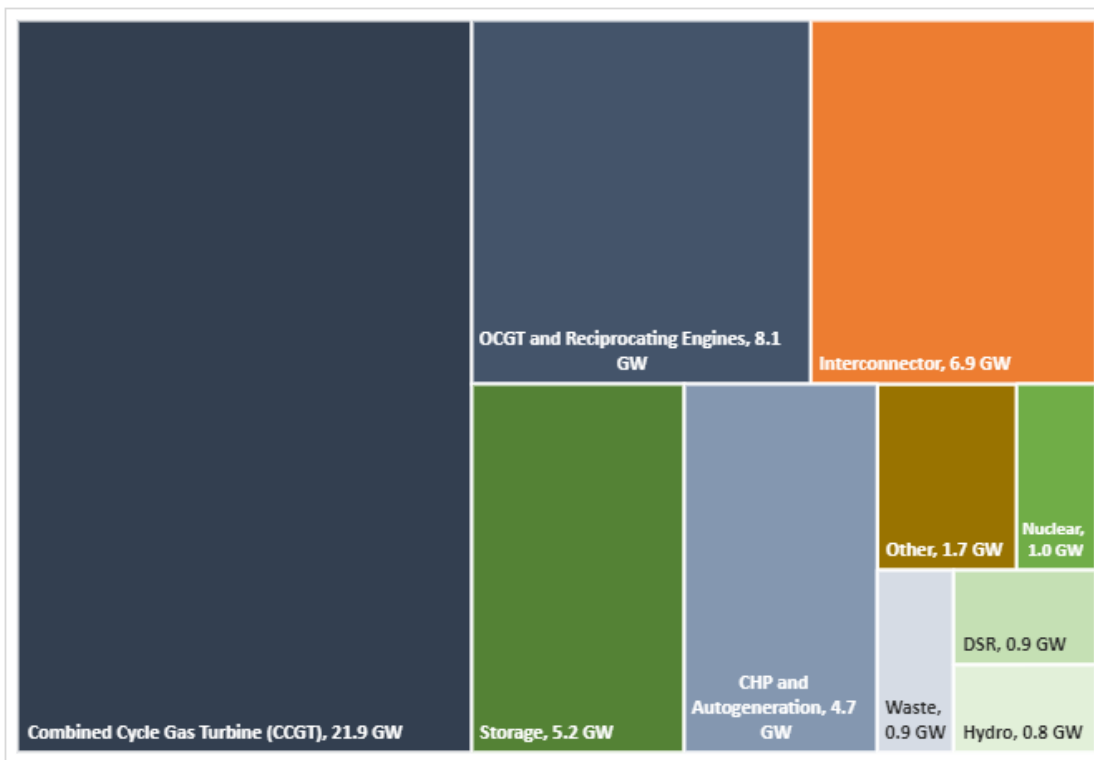
Source: National Grid ESO (2023). Capacity Market Registers.

Figure 7. Capacity secured for 2025/26 delivery year by technology, in GW



Source: National Grid ESO (2023). Capacity Market Registers.

Figure 8. Capacity secured for 2026/27 delivery year by technology, in GW



Source: National Grid ESO (2023). Capacity Market Registers

The next Capacity Market auctions

The government has published its intent to hold Capacity Market auctions in February 2024 – a T-1 auction to top-up capacity for the 2024/25 Delivery Year and a T-4 auction to secure the bulk of the capacity for the 2027/28 delivery year.

The ESO published the target capacity recommendations for the February 2024 Capacity Market auctions in its 2023 Electricity Capacity Report. For the T-1 Auction for 2024/25 this was 7.4GW, to top up the 40.8GW already procured in the earlier T-4 auction for the 2024/25 Delivery Year. For the 2027/28 Delivery Year, ESO recommended a total target of 44.5GW³².

The Secretary of State wrote to ESO on 14 July 2023 to set the Capacity Market auction targets in agreement with ESO’s recommendations³³. For the T-1 Auction, the target was set as 7.4GW. For the 2027/28 Delivery Year, the T-4 target was set as 43.0GW, with 1.5GW set aside for the future corresponding T-1 auction. The Secretary of State may adjust the auction

³² <https://www.emrdeliverybody.com/Capacity%20Markets%20Document%20Library/Electricity%20Capacity%20Report%202023.pdf>

³³ <https://www.gov.uk/government/publications/capacity-market-auction-parameters-letter-from-desnz-to-national-grid-eso-july-2023>

targets ahead of the auctions taking into account updated advice from ESO – final targets will be confirmed before the auctions are scheduled to be held.

Improvements to the Capacity Market

In January 2023, the government consulted on proposals to better align the Capacity Market with the government's net zero targets and to improve delivery assurance across the scheme³⁴. A summary is provided below, and full details can be found in the consultation document.

The following changes were implemented through time-limited amendments to the Rules in June 2023 which:

- reform the way in which Connection Capacity is determined, to ensure it better reflects export capability
- extend the temporary arrangements introduced in 2022 to remove barriers to mothballed plants entering the Capacity Market
- amend the timelines for calculating non-delivery penalties
- clarify auction clearing mechanics
- amend the definition of the Contracts for Difference (CfD) Transfer Notice
- end the requirement for Independent Technical Expert reports for capacity providers under certain circumstances
- delay the requirement for Fossil Fuel Emissions Declaration verification from prequalification until 2024

In October 2023, the government opened a consultation on the second phase of proposals to help drive forward our net zero goals and improve security of supply by enabling more low carbon technologies to access the Capacity Market³⁵. The proposed changes focus on enabling battery operators to address issues around degradation, greater flexibility to allow low carbon projects with longer-build times to access the scheme, new longer term agreement options for low-carbon technology and measures to support the growth of the domestic DSR sector. To complement these proposals, we propose publishing emissions data on the Capacity Market register to ensure transparency.

Alongside this consultation on the second phase of proposals, the government launched a call for evidence and published new research to help inform the statutory five-yearly review of the Capacity Market – referred to as the Ten-Year review.³⁵ The review is taking place within the context of the REMA programme, which will help create the market structures to deliver a net zero power system by 2035, subject to security of supply.

³⁴ <https://www.gov.uk/government/consultations/capacity-market-consultation-strengthening-security-of-supply-and-alignment-with-net-zero>

³⁵ <https://www.gov.uk/government/consultations/capacity-market-2023-phase-2-proposals-and-10-year-review>

Liquidity in the GB wholesale power market

Energy market firms buy and sell their electricity in the wholesale market. The wholesale market allows participants to trade a range of products that enable them to meet their obligation to supply energy whilst also enabling them to mitigate risk. The degree of access to these products relates to the liquidity of the market and low levels of market liquidity can be indicative of an uncompetitive market.

Poor liquidity in the wholesale market can prevent consumers from fully realising the benefits that competition can deliver in terms of downward pressure on bills, better service and greater choice. It can also obscure or weaken price signals, inhibiting long term investment decisions in new generating plants with negative consequences for security of electricity supply.

Ofgem's monitoring shows:

- Total traded volumes (comprising exchange and OTC) fell from highs of over 1400TWh during 2016 to just over 600 TWh in 2022³⁶. This has been a gradual decline. There is no definitive reason to explain this trend, however, a reduced incentive to forward trade electricity has been associated with the rise of CfD increased intermittent generation and price volatility. As prices calmed, the first half of 2023 saw the greatest volume traded since the same period in 2021.
- Churn (a proxy measure for the number of times electricity which is generated is subsequently traded prior to final consumption) has also been on a steady downward trend, falling to an average of 2.2 during 2022. However, churn increased to an average of over 2.6 during the first half of 2023 as market conditions eased and traded volumes increased.
- Bid-offer spreads are another metric used to measure wholesale market liquidity and gauge the number of active buyers and sellers. Baseload spreads are higher than pre-2021. However, average front quarter contract spreads during the first half of 2023 fell to their lowest level since the first half of 2021, indicating improved liquidity.

In light of the above trends, Ofgem and DESNZ continue to monitor and assess whether further intervention is required.

Network reliability

Current network reliability

The historic overall reliability of supply for the electricity networks (both transmission and distribution) has been high, 99.99981% in 2022-23 compared with 99.999612% in 2021-22 and 99.999948% in 2020-21³⁷.

³⁶ <https://www.ofgem.gov.uk/energy-data-and-research/data-portal/wholesale-market-indicators>

³⁷ <https://www.nationalgrideso.com/document/289196/download>

As part of the price control process, Ofgem sets target and incentive rates for the number of customer interruptions and customer minutes lost for each Distribution Network Operator (DNO). The Interruptions Incentive Scheme incentivises DNOs to invest in and operate their networks to manage and reduce the frequency and duration of power cuts experienced by their customers, whilst maintaining focus on minimising network costs and securing optimal value for consumers. The standards encourage DNOs to meet certain expected levels of service and to provide payments to end customers in the event of individual standards not being met. The standards cover a range of activities, including restoring supply during an unplanned interruption and providing notice periods for planned interruptions.

All individual DNOs met their Interruptions Incentive Scheme (IIS) targets for unplanned and planned interruptions in 2021-2022³⁸.

Offshore Transmission Systems connect offshore generation (such as wind) to the wider National Electricity Transmission System. The regulatory system for Offshore Transmission Owners is distinct from that of Onshore Transmission Owners because regulatory performance incentives are based on system availability, rather than loss of supply. This ensures offshore generators are able to export energy with minimal disruption. The Annual System Availability of Offshore Networks for 2022-23 was 99.42% according to figures provided by the ESO³⁹.

Future development of networks

As set out in the 2023 Autumn Statement, we brought forward a comprehensive package of reforms to energy infrastructure, including setting out an action plan to free up over 100GW of capacity in the electricity network connections queue⁴⁰.

In GB, around four times as much new transmission network will be needed in the next seven years as was built since 1990⁴¹. The UK's first Electricity Networks Commissioner was appointed in July 2022 to advise on how this can be delivered, and in August he delivered his first report⁴², outlining 43 recommendations in 8 themes around the process, compensation and operational planning. In the 2023 Autumn Statement, government also set out how it would deliver these recommendations, and halve the time required to build new transmission infrastructure.

To continue providing a reliable electricity system and to facilitate the transition to net zero, networks require ongoing investment. Ofgem's price control settlements through its RIIO (Revenue = Incentives + Innovation + Outputs) model are ensuring this investment takes place, while driving further efficiency savings. The 2021 to 2026 transmission price control (RIIO-T2) started on 1 April 2021. The Final Determinations show a lower annual rate of approved funding than in RIIO-T1 but include the potential for significant additional investment through flexibility mechanisms. Ofgem has approved funding of up to £9.9bn for expanding,

38 https://www.ofgem.gov.uk/sites/default/files/2023-03/RIIO-ED1_Network_Performance_Summary_2021-22.pdf

39 <https://www.nationalgrideso.com/document/289196/download>

40 <https://www.gov.uk/government/publications/electricity-networks-connections-action-plan>

41 Calculated based on transmission network project data provided by the Transmission Owners

42 <https://www.gov.uk/government/publications/accelerating-electricity-transmission-network-deployment-electricity-network-commissioners-recommendations>

replacing, and maintaining the Transmission network for RIIO-T2, with a further £8bn available through flexibility mechanisms.

The 2023-28 price control for the Distribution Network is ongoing. There are 14 regional electricity DNOs that are regulated through RIIO-ED2. Ofgem has approved overall funding of £22.2bn across GB for the period 1 April 2023 to 31 March 2028⁴³; represents a major investment in the distribution network.

Gas

Introduction

As set out in the Powering Up Britain: Energy Security Plan published in March 2023, the UK's energy security remains highly dependent on a reliable, resilient and affordable supply of gas, with natural gas making up 38% of total UK energy demand in 2022⁴⁴.

The gas market is crucial to the UK's energy security because of its significance in heating, industry, and electricity generation. Around 25m households are connected to the gas grid in GB⁴⁵. In 2022, 33% of UK gas demand was from electricity generation, 32% from domestic consumers, and 18% from industrial and commercial users⁴⁶.

GB benefits from diverse sources of gas supply and routes to market, which underpinned the security of our energy system over winter 2022/2023, ensuring the UK remained well supplied and able to support European supplies. Government continue to work closely with Ofgem, the gas and electricity system operators, and all relevant stakeholders to ensure government has the tools available to secure our gas supply.

While overall gas demand is expected to decline as GB decarbonise, demand on particularly high demand days (peak demand) is expected to remain high during the transition⁴⁷. As detailed below, the government has made several announcements to enhance resilience against increasingly dynamic and unpredictable requirements.

43 <https://www.ofgem.gov.uk/publications/riio-ed2-final-determinations>

44 DUKES 2023 Chapter 4: Natural gas:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1182228/DUKES_2023_Chapter_4_Gas.pdf

45 <https://www.gov.uk/government/statistics/sub-national-estimates-of-households-not-connected-to-the-gas-network>

46 DUKES 2023 Chapter 4: Natural gas:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1182228/DUKES_2023_Chapter_4_Gas.pdf

47 <https://www.gov.uk/government/publications/net-zero-strategy>
<https://www.gov.uk/government/publications/net-zero-strategy>

Demand

Gas demand has been relatively stable in the last decade however the Covid-19 pandemic and more recently the cost-of-living crisis have led to shifts in demand patterns. In general gas used for electricity generation, domestic consumption, and other sectors (including industrial consumption) each make up around a third of demand.

In 2022, UK gas demand decreased by 7.9% compared to 2021. This was due to the warmest year on record and higher prices impacting on consumer behaviour⁴⁸. Wholesale gas prices reached record highs in 2022 as Russia's illegal invasion of Ukraine intensified strained market conditions.

Domestic demand was down by 18% in 2022 compared with 2021, reaching levels last seen in the early 1970s when coal was the main household fuel. Industrial demand also dropped to levels last seen during the Covid-19 pandemic and before that the early 1970s⁴⁹. Gas used for electricity generation remained stable compared to 2021, up 1.5%⁵⁰.

Demand levels for Winter 2023/2024 are expected to be comparable to last winter, with an increase in residential (Non-Daily Metered (NDM)) demand being offset by reduced demand for power generation. Demand levels are inherently uncertain, due to the significant influence changing factors such as the weather, cost of energy and geopolitical developments can have on energy requirements.

As set out in the Energy Security Plan, future demand for gas will decline as the UK decarbonises. However, during this transition, peak gas demand is expected to remain high. This means that the gas system will need to change to maintain resilience against increasingly dynamic and unpredictable requirements. The government recognises that the implications of the transition to clean energy could create uncertainty in the gas market, including for consumers. As long as natural gas remains an important part of our energy mix, government will continue to ensure that consumers can rely on secure gas supplies at affordable prices via an appropriately resilient and flexible network that is also efficiently regulated.

Figure 9 illustrates the projected changes in gas demand leading up to 2050. It shows an overall decreasing trend, but it is important to note the potential for higher-than-expected annual demand, posing additional challenges to managing supply and demand effectively. Details of the modelling can be found in the Technical Annex of the Net Zero strategy⁵¹.

48 Digest of UK Energy Statistics 2023, table 4.1

49 Digest of UK Energy Statistics 2023, table 4.1

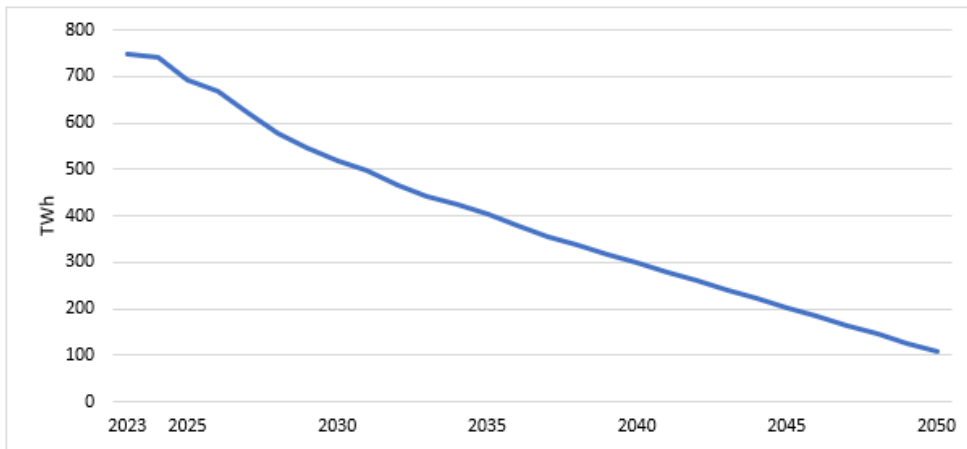
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1182228/DUKES_2023_Chapter_4_Gas.pdf

50 Digest of UK Energy Statistics 2023, table 4.1

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1182228/DUKES_2023_Chapter_4_Gas.pdf

51 <https://www.gov.uk/government/publications/net-zero-strategy/technical-annex>

Figure 9. Projected annual UK gas demand



Source: DESNZ analysis using data from the 2021 Net Zero Strategy (2022)

Supply

GB benefits from having diverse and flexible supplies, with steady reliable supplies from UKCS and Norway coupled with flexible supplies from LNG, GB Storage and the Interconnectors.

Total gross UK gas supply in 2022 was 94.3bcm, compared to total UK gas demand of 71.6 bcm⁵².

Gas from the UK Continental Shelf (UKCS) and from the Norwegian Continental Shelf (NCS) continues to form the majority of Britain’s gas supply. However, as set out in the Energy Security Plan, the gas supply picture is changing, with declining production of gas from the UKCS and, though more slowly, of gas from the NCS.

The UKCS remains the largest single source of gas and met 41% of UK gross gas supply in 2022⁵³. Norway continues to be one of our most important energy partners, meeting 33% of gross UK gas supply in 2022⁵⁴. Technical maximum supply capacity of the UKCS and NCS is 117mcm/d and 141mcm/d respectively (see Figure 10)⁵⁵.

52 Analysis of ‘Natural gas supply and consumption (ET 4.1 – quarterly)’ September 2023:

<https://www.gov.uk/government/statistics/gas-section-4-energy-trends>

53 Analysis of DUKES statistics for chapters 4.3 and 4.5(2023): <https://www.gov.uk/government/statistics/natural-gas-chapter-4-digest-of-united-kingdom-energy-statistics-dukes> (note that estimates of the share of UK gross gas supply across UKCS, NCS, and LNG imports sum to greater than 100% in 2022 due to rounding)

54 Analysis of DUKES statistics for chapters 4.3 and 4.5(2023): <https://www.gov.uk/government/statistics/natural-gas-chapter-4-digest-of-united-kingdom-energy-statistics-dukes>

55 <https://www.nationalgrid.com/uk/gas-transmission/insight-and-innovation/winter--outlook>

LNG is playing an increasingly important role in security of supply, with imports reaching a record high in 2022, and the government is working with industry to increase import capacity and make the best use of existing facilities⁵⁶.

The UK imports gas via interconnector pipelines from Belgium and the Netherlands. In 2022, the UK imported only a small quantity of gas through the interconnectors, at the start of 2022 and in December 2022. Through much of 2022, the UK was exporting gas through the interconnectors at high levels. Exports to Belgium were almost nine times higher than levels seen in 2021⁵⁷.

These changing trade patterns are a result of the illegal Russian invasion of Ukraine, subsequent sanctions on Russian commodities and Russian curtailment of gas supplies to Europe⁵⁸. The UK supported European efforts to move away from Russian gas, utilising shared infrastructure with mainline Europe and our substantial regasification infrastructure to act as a land-bridge for increased natural gas exports to Europe⁵⁹.

NGT's Winter Outlook for 2023/24 states that NGT believe there is sufficient supply capability to meet demand in an average winter, and that during a cold snap with low storage or a cold winter, imports from Europe are required⁶⁰.

As announced in the Energy Security Plan, the government will also be giving the FSO a role to carry out an annual assessment of our medium-term gas security (5 and 10 years into the future). This assessment will inform actions that are needed by NGT, FSO, government, and wider industry to maintain security of energy supply across the GB system, including investment where needed.

Production

The North Sea Transition Authority (NSTA) publishes production and expenditure projections for the UKCS, which incorporate a 10% year-on-year rate of decline for gross natural gas production⁶¹.

However, indigenous production increased by 16% in 2022 compared to 2021 which saw record low production due to maintenance⁶² Production was 3% below pre-pandemic levels

56 Analysis of DUKES statistics for chapters 4.3 and 4.5 (2023): <https://www.gov.uk/government/statistics/natural-gas-chapter-4-digest-of-united-kingdom-energy-statistics-dukes>

57 DUKES Chapter 4 Natural gas (2023):

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1182228/DUKES_2023_Chapter_4_Gas.pdf

58 <https://www.gov.uk/government/publications/energy-trends-march-2023-special-feature-article-supply-of-liquefied-natural-gas-in-the-uk-2022>

59 <https://www.gov.uk/government/publications/energy-trends-march-2023-special-feature-article-supply-of-liquefied-natural-gas-in-the-uk-2022>

60 <https://www.nationalgas.com/insight-and-innovation/winter--outlook>

61 NSTA, Production and expenditure projections (2023): <https://www.nstauthority.co.uk/data-and-insights/insights-and-analysis/production-and-expenditure-projections/>

62 Analysis of DUKES statistics for chapters 4.2 and 4.5 (2023): <https://www.gov.uk/government/statistics/natural-gas-chapter-4-digest-of-united-kingdom-energy-statistics-dukes>

(2019)⁶³. 2021 saw an extensive planned maintenance schedule on North Sea infrastructure including a shutdown of the Forties Pipeline System (FPS).

The government is prioritising making Britain more energy independent, and therefore continues to back the North Sea oil and gas industry. As part of this, the government and the NSTA announced in July 2023 a joint commitment to undertake future offshore oil and gas licencing rounds – the Offshore Petroleum Licensing Bill will place a duty on the NSTA to offer licences annually subject to certain tests being met. New licences will reduce the fall in UK production levels rather than increase them.

The Gas Safety (Management) Regulations 1996 were amended in April 2023 to implement the policy decision to reduce the lower limit of the Wobbe Number for normal supply in British gas networks from April 2025. The Wobbe Index is an expression of the amount of energy within a gas and its density relative to air. Expanding the Wobbe Index range means that, from April 2025, a greater volume of gas from the UKCS can be injected into the National Transmission System (NTS) without the need for blending. DESNZ anticipate this could increase the volume of UKCS gas on the NTS by over 1% per year in the second half of the 2020s⁶⁴.

Import Capacity and Outlook

GB has a diverse set of import routes, including direct connection to the Norwegian Continental Shelf via several pipelines, including the Langeled, Vesterled, Tampen, and Gjoa pipelines. GB is connected to international markets via two interconnectors to mainland Europe and three LNG import facilities. The Interconnector Ltd interconnector to Belgium links the National Balancing Point (NBP) to the Belgian Zeebrugge gas trading hub, and the Balgzand-Bacton Line (BBL) interconnector links to the Dutch Title Transfer Facility (TTF). The UK has the second largest LNG import infrastructure capacity in Europe, with facilities at Isle of Grain, Kent, and two in Milford Haven, Southwest Wales (Dragon and South Hook).

Currently, the UK has import capacity of ~51 billion cubic metres per year (bcm/y) from Norway, ~42 bcm/y from capacity connected to Belgium and the Netherlands, and ~51 bcm/y from LNG import terminals (with plans to expand this further)⁶⁵. While capacity does not guarantee utilisation, with current infrastructure it has always secured the gas required.

LNG imports to the UK reached a record high of 25.6bcm in 2022, rising 74% on 2021, and met 27% of UK gross gas supply (compared to 17% in 2021)⁶⁶. There was also an increased diversification of LNG import sources: the UK imported from 13 countries in 2022, the highest

63 Analysis of DUKES statistics for chapters 4.2 and 4.5(2023): <https://www.gov.uk/government/statistics/natural-gas-chapter-4-digest-of-united-kingdom-energy-statistics-dukes>

64 <https://consultations.hse.gov.uk/hse/cd291-revision-gas-safety-management-regulations/results/impactassessmentforqsmr2023.pdf>

65 [https://www.nationalgrid.com/uk/gas-transmission/insight-and-innovation/gas-ten-year-statement-gtys-\(to-be-published-December-2023\)](https://www.nationalgrid.com/uk/gas-transmission/insight-and-innovation/gas-ten-year-statement-gtys-(to-be-published-December-2023))

66 Analysis of DUKES statistics for chapters 4.3 and 4.5 (2023): <https://www.gov.uk/government/statistics/natural-gas-chapter-4-digest-of-united-kingdom-energy-statistics-dukes>

on record. Imports from the USA more than tripled, accounting for 50% of total LNG imports, making the USA the largest source of LNG to the UK for the first time⁶⁷.

The operators of the Grain and South Hook LNG terminals are investing in upgrades to their facilities to increase capacity. The upgrade at Grain LNG is already underway and will deliver an increase to the terminal's annual import capacity in 2025. South Hook LNG announced a final investment decision in November 2022 to proceed with plans to increase terminal capacity. Once completed, the two projects will together increase the UK's LNG import capacity to around 59bcm⁶⁸.

As of 1 January 2023, the UK has banned the import of LNG originating in, or arriving from, Russia, as well as the acquisition of LNG in, or originating in, Russia with the intention of the LNG entering the UK⁶⁹. The impact of this on UK security of supply is limited as the last shipment from Russia to the UK arrived on 2nd March 2022 (the only delivery received after the invasion of Ukraine). Russian imports made up 0.9% of total UK LNG imports in 2022; this compares to 6.2% in 2021⁷⁰.

A wave of new supply is likely to rebalance the currently tight gas market. Whilst external outlooks differ across organisations, the International Energy Agency (IEA) expect global LNG export capacity to rise ~25% (or just over 130bcm) between 2022 and 2026⁷¹, driven mostly by new capacity installations in the US and Qatar. Whilst European LNG imports are likely to be robust as the continent grapples with the loss of Russian pipeline growth, in the longer-term LNG demand growth is expected to be underpinned by China and developing Asia.

As production from the UK continental shelf declines, gas imports will become an increasingly important part of our energy mix as GB transitions to net zero. The government issued an update in winter on the role and future of gas storage and other sources of flexibility in the gas system⁷².

Gas storage

As with imports, GB storage plays an important role in providing system flexibility in responding to short-run changes in supply and demand. Our highly diverse sources of gas supply means that the UK is less reliant on gas storage, which distinguishes us from some European countries who have larger storage capacities to mitigate for their lack of indigenous supply, thus operating a 'strategic reserve' model.

67 DUKES Chapter 4 Natural gas (2023):

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1182228/DUKES_2023_Chapter_4_Gas.pdf

68 <https://www.gov.uk/government/publications/powering-up-britain>

<https://www.gov.uk/government/publications/powering-up-britain>

69 The Russia (Sanctions) (EU Exit) (Amendment) (No. 15) Regulations 2022 -

<https://www.legislation.gov.uk/ukxi/2022/1110/contents/made>

70 Analysis of DUKES statistics for chapters 4.2 and 4.5 (2023): <https://www.gov.uk/government/statistics/natural-gas-chapter-4-digest-of-united-kingdom-energy-statistics-dukes>

71 <https://www.iea.org/reports/medium-term-gas-report-2023>

72 <https://www.gov.uk/government/publications/role-of-gas-storage-and-other-forms-of-flexibility-in-security-of-supply>

GB currently has eight gas storage facilities, with a maximum capacity of ~3.1 billion cubic metres, and a maximum deliverability of ~124mcm/day, which declines as stocks deplete^{73,74}. Seven are medium-range storage which means they can cycle gas regularly – some sites can empty and refill within days, others within weeks (this is dependent on pressure and the age of the facilities). The one offshore site, Rough, provides long-range storage cycling on a seasonal basis, injecting in the summer and withdrawing in the winter, and now has a capacity of ~1.5 bcm, which is approximately half of GB’s storage capacity. Rough was re-opened as a storage facility in 2022⁷⁵.

The economics of storage relies on gas price variations over time: injections are incentivised when prices are low so that gas can be withdrawn when prices are higher. The value GB derives from gas storage is its ability to offer flexibility to the market when other sources of supply such as the UKCS, NCS or LNG are more expensive or not available. The government will continue to monitor GB’s storage model as the dynamics of the gas market continue to evolve through engagement with the market.

Demand Side Response (DSR)

NGT, as the gas system operator, offers a DSR scheme aimed at reducing demand for gas at times when expected available supplies are forecast to be insufficient to meet forecast demand by the end of a gas day⁷⁶. This covers the gas winter, 1 November to 30 April. Industrial and commercial gas consumers that are daily metered and able to deliver demand reduction of at least 100,000kWh/day are eligible for the scheme. Class 1 sites (whose use is greater than 2m therms or 58,600MWh a year) can directly contract with NGT or can contract through their shipper. Class 2 (smaller) sites can contract through their shipper.

Under the scheme, eligible gas consumers are able to commit in advance of winter to reduce their gas consumption, if NGT requires it, in a way that best suits the needs of their business and would be paid for reducing their demand at these times. NGT ran a tender (August – September 2023), to which potential participants and shippers could offer DSR in advance for the current/forthcoming winter and the next two winter periods and receive an availability/option payment as compensation. For winter 2023/24, NGT accepted offers totalling 6,400 MWh pre-contracted DSR, with an option cost of £6.6m⁷⁷. NGT accepted at least one DSR Option Offer in respect of each available DSR product, corresponding to the notice provided to exercise the option: within day, day-ahead (D-1), and five days ahead (D-5).

NGT is also scoping an NDM trial scheme for domestic and small industrial and commercial consumers which they hope to run during Winter 2023/24. The trial aims to gather data and evidence on the opportunities and challenges of a potential future larger scheme for this group.

73 <https://www.nationalgas.com/insight-and-innovation/winter--outlook>

74 <https://www.ofgem.gov.uk/publications/gb-gas-storage-facilities-2023>

75 <https://www.centrica.com/media-centre/news/2022/centrica-re-opens-rough-storage-facility/>

76 <https://www.nationalgas.com/documents/144051-gas-dsr-methodology-v70>

77 <https://www.nationalgas.com/document/144551/download>

Peak supply and demand capability

There is a licence condition for NGT⁷⁸, to plan the system to meet the 1-in-20 peak aggregate daily demand including, but not limited to, within-day gas flow variations on that day⁷⁹. The 1-in-20 security standard obligation does not apply directly to entry supplies although it is implicit that sufficient transportation capability must be made available such that the security standard can be met both in terms of the 1-in-20 peak demand level and a 1-in-50 severe winter⁸⁰. Hence, sufficient entry capability must be available.

NGT have updated their 1-in-20 calculations for the 2023/24 Gas Winter Outlook. The supply margin between forecast peak theoretical technical supply capability and 1-in-20 peak demand for winter 2023/24 is 159 mcm/d, compared to 122 mcm/d last in Winter 2022/23⁸¹. This difference is due to a reassessment of supply capability, anticipated NDM demand suppression and reduced expected power demand at peak.

However, the 1-in-20 peak demand calculation is an infrastructure test, it does not assess whether the physical quantities of gas required to meet demand are available. To complement these existing measures, a new medium range gas supply security assessment will be delivered by the Future Systems Operator (FSO). As set out in the Powering Up Britain: Energy Security Plan in March 2023, the FSO will deliver, annually, a new medium range gas supply assessment which considers gas supplies against a baseline seasonal normal and peak demand scenario both 5- and 10 years' ahead. The government has published a proposed methodology which the FSO will be able to amend as it considers appropriate⁸².

78 NGT's license is granted by Ofgem to cover their role as the gas transporter that owns and maintains the National Transmission System (NTS)

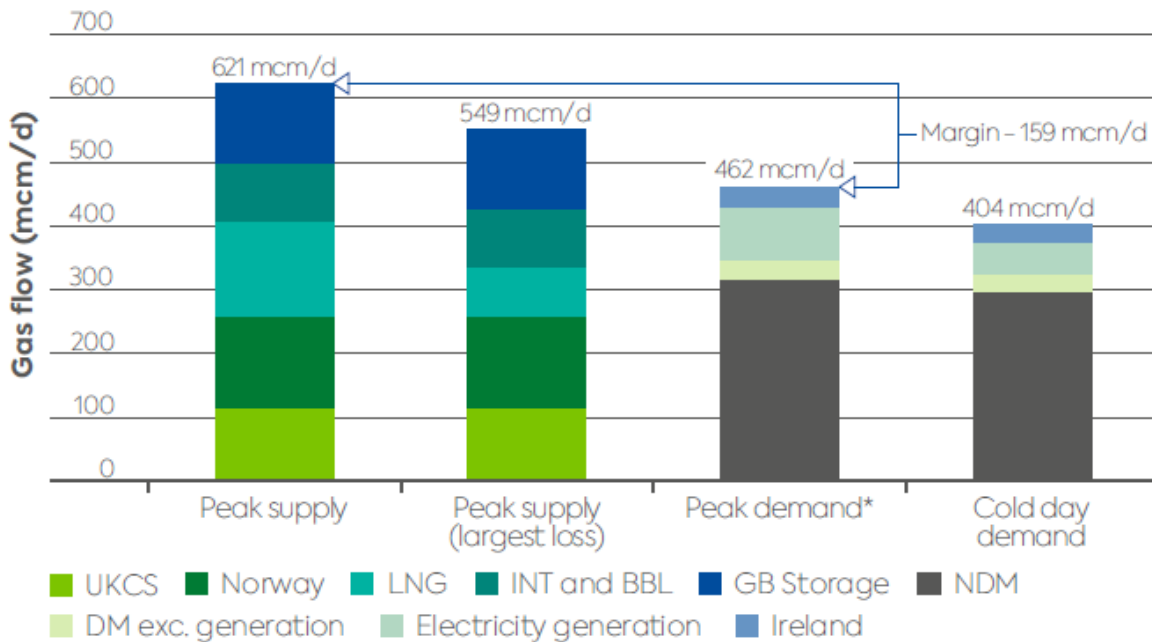
79 Where the 1-in-20 peak aggregate daily demand is the level of daily demand that, in a long series of winters, with connected load held at the levels appropriate to the winter in question, would be exceeded in one out of 20 winters, with each winter counted only once.

80 The 1-in-50 standard is a function of the requirement for transportation arrangements to be consistent with the suppliers' "domestic customer supply security standards" regarding available annual supplies.

81 <https://www.nationalgrid.com/uk/gas-transmission/insight-and-innovation/winter-outlook>

82 <https://www.gov.uk/government/publications/medium-range-gas-supply-security-assessment-methodology>

Figure 10. Peak gas supply and demand (National Gas Transmission Winter Outlook 2023/2024)



Source: NGT (2023). Winter Outlook 2023-24.

Market functioning

The underlying market arrangements in GB are established on the basis that the market will provide the gas itself, and the market will balance supply and demand. Should the market not balance supply and demand, GSO will step in as the residual balancer, effectively entering the market and undertaking trading activity to seek to resolve any imbalance on the system. Access to international markets allows GB to meet annual gas demand by supplementing indigenous production from the UKCS, bolstering security of supply by reducing reliance on any one source. The GB gas market has delivered effectively to date, and we expect that delivery to continue.

The gas wholesale market's churn ratio in Q2 2023 averaged 8.8, an increase from just over 6 seen in the previous quarter. Year-on-year the churn has increased by 1.9, which was likely caused by the decrease in price volatility across the gas forward curve⁸³. Gas volumes traded on the Inter-Continental Exchange (ICE) have increased during Q2 2023, whilst Over-The-Counter (OTC) trading is still falling⁸⁴. The longer-term trend of falling liquidity in the National Balancing Point (NBP) market may be stalling, with high prices and volatility seen since summer 2021 reducing (though remaining significantly above historic norms). However, further

83 Gas trading volumes and monthly churn ratio by platform (GB), <https://www.ofgem.gov.uk/energy-data-and-research/data-portal/wholesale-market-indicators>

84 Gas trading volumes and monthly churn ratio by platform (GB), <https://www.ofgem.gov.uk/energy-data-and-research/data-portal/wholesale-market-indicators>

monitoring will be required to evaluate this more fully, especially given the continued rise of EU trading hubs (the Dutch TTF and the German THE, being prime examples).

As with many international hub markets, GB's market (trading at the NBP) has seen elevated prices since 2021. 2023 has seen a reduction in these elevated prices, however, with a gas day-ahead contract price for the year to date averaging approximately 100p per therm⁸⁵. This is down from the 2022 average of 211p per therm. Increases in wholesale prices since 2021 relative to previous norms are due to global trends in supply and demand, in addition to upstream supply disruption to the UK as necessary maintenance projects were completed, such as maintenance on pipelines between Norway and GB.

GB has an established reputation in promoting transparent market-based approaches and fully supports the liquid, transparent and flexible global gas market. Market flexibility is essential to promoting global security of supply, ensuring that gas is delivered where it is most needed.

Elevated wholesale prices were seen internationally in 2021 and 2022. Prices have since decreased, though they are still higher than historic norms. The existing market mechanisms in the UK continues to balance supply with demand.

Network reliability

The UK gas transmission network facilitated the delivery of 100% of gas requirements for customers in Financial Year 2022/2023⁸⁶.

The UK's gas infrastructure is designed (taking into account operational measures) to meet the 1-in-20 peak aggregate daily demand, even with the failure of the single biggest piece of infrastructure (the 'N-1' calculation⁸⁷). For winter 2023/2024 the supply margin at peak 1-in-20 demand under N-1 conditions has increased from a 50mcm/day surplus last winter to an 87mcm/day surplus⁸⁸.

Ofgem set price controls for the gas and electricity network companies of GB to balance the relationship between investment in the network, company returns and the amount that they charge for operating their respective networks. Ofgem are currently developing their future price control framework for electricity and gas transmission and for gas distribution network companies which will identify network investment from 2026. DESNZ is working with Ofgem to understand how this framework can best facilitate ongoing investment in existing infrastructure, whilst preparing the gas network for future innovations.

85 <https://www.ofgem.gov.uk/energy-data-and-research/data-portal/wholesale-market-indicators>

86 <https://www.nationalgrid.com/gas-transmission/about-us/rrio-2-2021-2026/how-we-are-performing>

87 The N-1 calculation tests that the National Transmission System (NTS) has been designed to meet the 1-in-20 peak day demand even with the failure of the single biggest piece of infrastructure.

88 <https://www.nationalgas.com/insight-and-innovation/winter--outlook>

Oil

Introduction

Oil formed 38% of total UK primary demand in 2022, up from a reduced share of around a third in 2020 and 2021. Travel restrictions in those years to curb the spread of COVID-19 meant much reduced demand for transport fuels, which comprise the bulk of oil demand⁸⁹. In 2020 we saw record low oil product demand, which has since been recovering steadily as travel restrictions eased. UK production of primary oils fell to a record low of 38.0 million tonnes in 2022, down by 7.6% compared to 2021. The UK was a net importer of total oil by 23.6 million tonnes in 2022, up from 14.1 million tonnes in 2021.

The UK remains well supplied by a combination of domestic refining and imported fuels. As a condition of membership of the IEA, the UK is required to hold stocks of oil, equivalent to at least 90 days of net imports. In September 2023 total stocks were equivalent to around 130 days of net imports. Following the illegal invasion of Ukraine by Russia, the UK participated in co-ordinated action led by the IEA to release stocks to help protect global oil market prices. The IEA announced the end of the release in June 2023 and the UK is re-building stocks to pre-release levels. See section Emergency Oil Stocks for information.

All data are sourced from Section 3 of the Digest of UK Energy Statistics unless otherwise specified⁹⁰.

Primary Oil Supply and Demand

UK oil production peaked at 137 million tonnes in 1999 and had contracted to 38 million tonnes by 2022. The NSTA estimates that offshore oil production from the mature North Sea basin will drop by another 29 per cent by 2028, reaching 25 million tonnes⁹¹.

In 2022, refineries took receipt of 7.1 million tonnes of crude produced from the UKCS, meeting 13% of refinery demand.

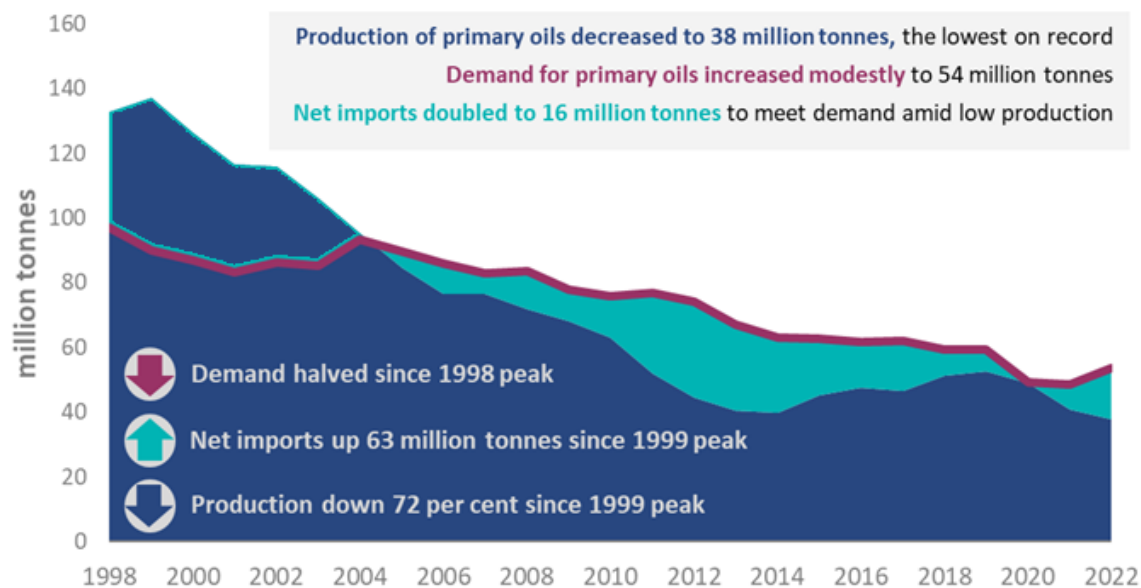
Oil from the UKCS is a high-quality product which is in high demand internationally, but which is not commercially attractive for most of the refineries in the UK for historic reasons. Most crude oil produced in the UK must therefore be processed by refineries abroad into the products the UK needs before it is returned to the UK.

89 Digest of UK Energy Statistics, Section 1: <https://www.gov.uk/government/statistics/energy-chapter-1-digest-of-united-kingdom-energy-statistics-dukes>

90 Digest of UK Energy Statistics, Section 3: <https://www.gov.uk/government/statistics/petroleum-chapter-3-digest-of-united-kingdom-energy-statistics-dukes>

91 NSTA production and expenditure projections: <https://www.nstauthority.co.uk/data-and-insights/insights-and-analysis/production-and-expenditure-projections/>

Figure 11. UK supply and demand for primary oils, 1998 – 2022



Source: DUKES (2023) Chapter 3: Petroleum,

The UK therefore trades extensively in primary oils globally, exporting to meet demand for Brent crude (with nearly 90% of crude oil exports going to EU partners) and importing to meet UK crude type demand. Norway has historically been the largest import source for the UK because of the extensive shared infrastructure but the UK has been increasingly importing from the US since the lifting of the US export ban in 2015. US crude is more favourably priced, and in 2022 the US overtook Norway as the UK’s largest import supplier for the first time, with 15.1 million tonnes (36%) from the US and 13.8 million tonnes (33%) from Norway.

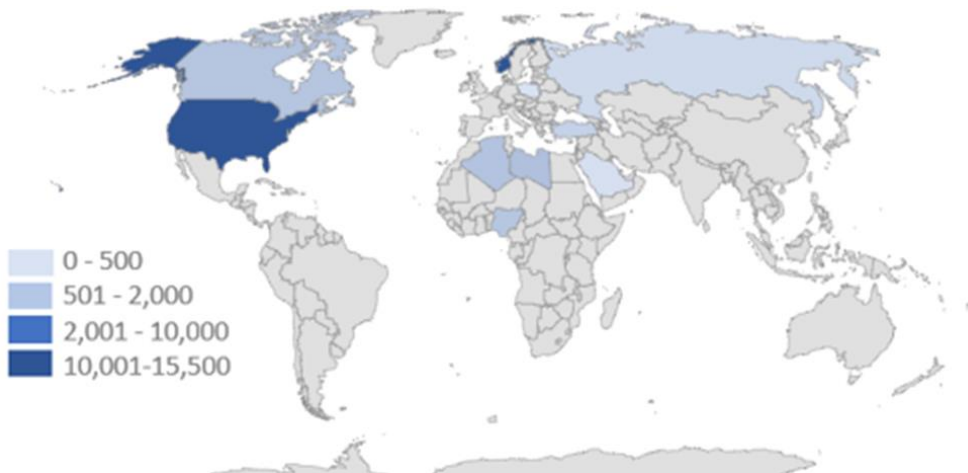
Sanctions were placed on Russia following the illegal invasion of Ukraine in February 2022 with an import ban on oil taking effect from the 5th December 2022. The last cargo of crude from Russia arrived in the UK in April 2022, and of feedstocks in October 2022. Imports of crude oil from Russia made up 1.2% of crude imports in 2022 compared to 7.4% in 2021⁹².

Figure 12 shows the diversity of sources of crude imports in 2022. For further information, see the article on diversity of supply for oil and oil products in OECD countries, 2021⁹³.

92 Energy Trends Table 3.14: <https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends>

93 Energy Trends September 2022: Diversity of supply for oil and oil products in OECD countries in 2021: <https://www.gov.uk/government/publications/energy-trends-september-2023-special-feature-article-diversity-of-supply-for-oil-and-oil-products-in-oecd-countries-in-2022>

Figure 12. Worldwide crude oil imports to the UK in 2022 (thousand tonnes)

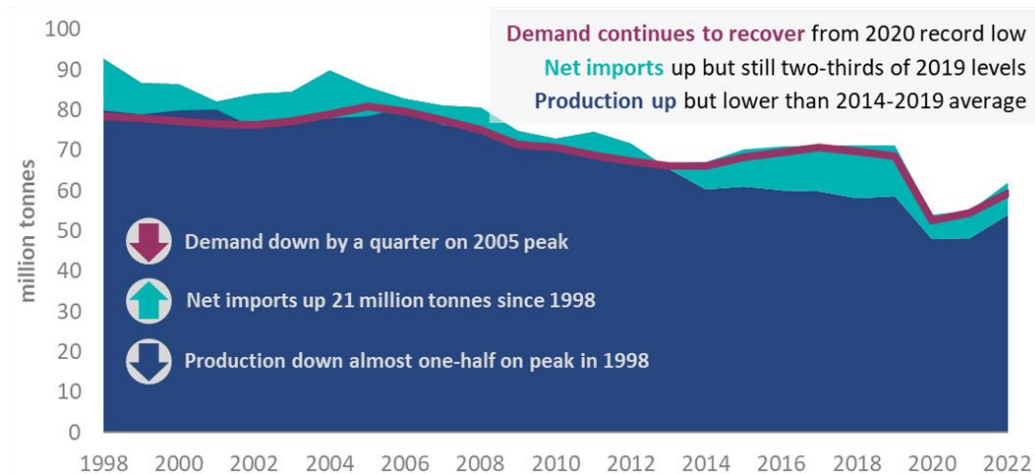


Source: DUKES (2023) Chapter 3: Petroleum.

The UK is a significant exporter of crude oils as well as an importer. Crude oil exports fell by 10% in 2022 to 27.3 million tonnes, the lowest on record in line with reduced offshore production.

Refined Product Demand and Supply

Figure 13. UK supply and demand for petroleum products, 1998 – 2022



Source: DUKES (2023) Chapter 3: Petroleum.

Production of key petroleum products

Oil must be refined into oil products before it can be used for all forms of transport, manufacturing, roads, medicines, textiles, etc. Refinery production increased by 12% compared to 2021 following two years of record and near record lows in 2020 and 2021 as travel restrictions dampened demand for transport fuels. Nearly 60 per cent of diesel and just over a third of jet fuel demand in 2022 could have been met with indigenous production, with remaining demand met through imports.

Refinery production was up by 12% compared to much reduced production in 2020 and a record low in 2021 which saw a ramping down of production in line with demand trends to avoid overbuilding stock levels.

The UK has been a net importer of petroleum products since 2013 and continued to be in 2022 at 7.9 million tonnes compared to 6.8 million tonnes in 2021. The UK benefits from ready access to international maritime trade in oil products, including the Antwerp, Rotterdam, Amsterdam trading hub, with the Netherlands and Belgium combining to provide most of the UK's oil product imports.

Sanctions were placed on Russia following the illegal invasion of Ukraine in February 2022 with an import ban on oil taking effect from the 5th December 2022. The last cargo of oil products from Russia arrived in the UK in November 2022. Prior to the ban the UK had been reliant on Russian imports to meet demand for road diesel, but Russian imports fell from nearly 40% of imports in 2021 to just 13% in 2022 and dropped to zero from July 2022.⁹⁴

UK suppliers have sought different trading partners and 2022 saw sharp increases in diesel imports from the US and Belgium. Most jet fuel imports come from refineries in Middle East countries (Kuwait, UAE, Saudi Arabia).

Conversely, the UK produces more than enough petrol to meet demand and exports the excess, mostly to the US. Most of the total oil that the UK exports goes to EU partners, including Ireland, Belgium, Germany, France, and Sweden.

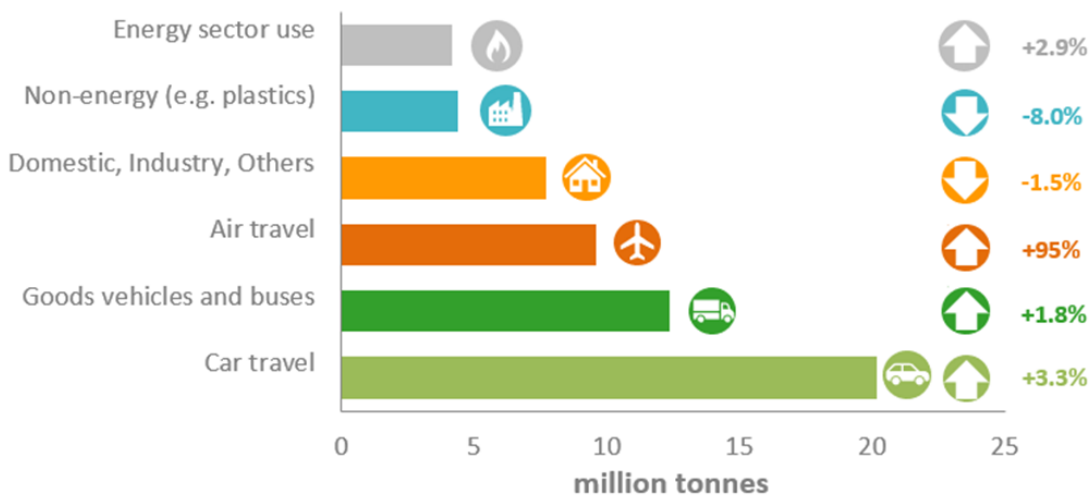
Consumption of key petroleum products

Final consumption of oil was up by 9.7 per cent in 2022 compared to 2021, driven by a 14 per cent increase in demand for transport fuels as road and air travel picked up in a year without travel restrictions.

Overall demand for petroleum products in 2022 remained lower than pre-pandemic levels, down by 13% compared with 2019 at 59.5 million tonnes.

94 Energy Trends Table 3.14: <https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends>

Figure 14. UK demand for petroleum products (arrows show change in 2022 compared to 2021)



Source: DUKES (2023) Chapter 3: Petroleum.

The transport sector is the primary use for petroleum products in the UK. In 2022, demand for road fuels increased by 1.3% in the first year without travel restrictions since the COVID-19 pandemic started. Demand for jet fuel was most severely impacted by COVID-19-related restrictions and continued to fall to reach a record low of 4.9 million tonnes in 2021. Since then, the aviation industry has been recovering and jet fuel demand in 2022 nearly doubled to in 9.6 million tonnes in 2022.

Table 2. UK demand for oil products 2022

Petroleum Product	Quantity (million tonnes)
Petrol	10.9
Road Diesel	23.6
Jet Fuel	9.6
Burning Oil	2.9
Gas Oil	3.0
Fuel Oil	0.5
Other	9.0

Source: DUKES (2023) Chapter 3: Petroleum.

In 2022, non-energy use of oil products was down by 8.0%, following the sharp decrease also seen last year. While non-energy demand for propane and butane remains relatively stable, demand for naphtha remains suppressed, and in 2022 ethane fell by 38% to 375 thousand tonnes. Reduced demand for these petrochemical feedstocks is the result of a 2-year closure of a major plant at Teesside, which has now attracted investment for it to run on hydrogen in line with national and international Net Zero policies.

Technology changes, including adoption of electric vehicles and increased renewables heat generation, will reduce demand for oil. Estimates indicate a reduction in final demand for oil of roughly 17 per cent by 2040 compared to 2022⁹⁵. Whereas oil currently meets around 93 per cent of transport needs, as we move towards Net Zero in 2050 the use of oil will likely become increasingly concentrated in aviation.

Resilience

The UK remains well supplied by a combination of domestic refining and imported fuels.

Following the illegal Russian invasion of Ukraine, the government established an Oil Taskforce to ensure that the UK could end the import of Russian oils while maintaining a secure supply of products to UK consumers. The import ban on Russian oil and Russian oil products came into force on 5th December 2022.

Following the Russian invasion of Ukraine, consumer demand for fuel at forecourts increased briefly, which resulted in a decrease in national forecourt stocks. After this initial reduction, forecourts remained well-supplied. Protests by Just Stop Oil in April 2022 led to a temporary reduction in forecourt stocks and there was also a reduction leading up to Christmas 2022, associated with extended wait times for road tanker maintenance. In both these cases the government worked with the industry to mitigate these issues and ensure that there was no national disruption to the availability of fuels, stocks recovered in the following weeks and have remained around typical levels since. For a complete timeseries extending back to 2019 covering average road fuel sales, deliveries, and stock levels, please refer to the link in the footnote⁹⁶.

Emergency oil stocks

As a condition of membership of the International Energy Agency (IEA), the UK is required to hold stocks of oil, equivalent to at least 90 days of net imports, which could be released in the event of severe disruption to global supply. The government meets this obligation by directing companies to hold minimum levels of stocks. Companies may choose to hold stocks within the

⁹⁵ DESNZ Energy and emission projections, Annex F: <https://www.gov.uk/government/publications/energy-and-emissions-projections-2022-to-2040>

⁹⁶ <https://www.gov.uk/government/statistics/average-road-fuel-sales-and-stock-levels>

UK or abroad via legal agreements with other countries. In September 2023 the net total of tickets held here for other countries or held abroad on behalf of the UK was less than 1.5% of total stocks. In the same month total stocks were equivalent to around 130 days of net imports.

Following the illegal invasion of Ukraine by Russia, the UK participated in an IEA-led coordinated release of oil stocks to help protect global oil market prices. The UK released 2.2 million barrels in March 2022 and 4.4 million barrels in April 2022. The IEA announced the end of the release in June 2023 and the UK has begun re-building stocks to pre-release levels.

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