Department for
Business, Energy
& Industrial Strategy

Statutory Security of Supply Report 2021

HC 898

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Statutory Security of Supply Report 2021

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Contents

Introduction

1. This report discharges the Government's and Ofgem's respective obligations under section 172 of the Energy Act 2004 as amended by section 80 of the Energy Act 2011, including the Government's obligation to report annually to Parliament on the availability of electricity and gas for meeting the reasonable demands of consumers in Great Britain (GB).

2. The technical data presented here has been produced from analysis conducted by the Department for Business, Energy & Industrial Strategy (BEIS), Ofgem and National Grid. 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.

Electricity

Introduction

3. GB's electricity system has delivered secure supplies to date. The Government has committed to phasing out unabated coal generation by 1 October 2024,[1] and is committed to increasing the share of renewables in electricity generation and to bringing forward low carbon alternatives to fossil fuel generation. The Government is investing in new energy infrastructure and renewables which will provide for GB's domestic electricity demand.

Security of supply

4. 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. It is important to note that 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 it.[2]

5. National Grid Electricity System Operator's (ESO) Winter Outlook Report for 2021/22 forecasts a capacity margin of 3.9 GW in the base case, equivalent to 6.6%, with a LOLE of 0.3 hours/year.[3]

[1] https://www.gov.uk/government/news/end-to-coal-power-brought-forward-to-october-2024

[2] 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.

[3] https://www.nationalgrideso.com/research-publications/winter-outlook

6. This margin is on an underlying demand basis, which aligns with how the ESO calculates the Capacity Market (CM) target capacity recommendations in its annual Electricity Capacity Report.

7. In recent months we have seen higher baseload prices in electricity markets, largely driven by high gas prices. This situation is not unique to GB, as similar price rises have been seen throughout Europe and for other commodities. Higher baseload prices are expected to continue this winter, and BEIS and Ofgem continue to actively monitor market activity and prices. The ESO's 2021/22 Winter Outlook Report forecasts that there will be sufficient electricity capacity to meet peak demand this winter, and the ESO has the necessary tools to manage any operability requirements.

8. In 2021, the Government set out significant new decarbonisation targets to support the statutory target to bring all greenhouse gas emissions to net zero by 2050.[4] In April 2021 the Government legally committed to Carbon Budget Six,[5] adopting the Climate Change Committee's recommendation of a 78% reduction in CO2 emissions relative to 1990 levels.[6] The Net Zero Strategy (published in October 2021) set out the Government's commitment to deliver a decarbonised power sector by 2035, such that all GB's electricity will come from low carbon sources by 2035, subject to security of supply.[7]

9. The Government is, therefore, exploring policy options to address emerging security of supply challenges in the transition to net zero, including those linked to growing electricity demand and the need for more flexible and dispatchable capacity to complement the growth of intermittent renewable generation on the electricity system. This includes issuing a Call for Evidence in July 2021 to seek stakeholder views on how the Capacity Market (the Government's main security of electricity supply mechanism) can be better aligned with net zero, both by ensuring the Capacity Market can support investment in less carbon intensive forms of capacity and by improving assurance that capacity secured through Capacity Market auctions will deliver when required.[8]

Electricity Networks

Current network reliability

10. The historic overall reliability of supply for the electricity networks (both transmission and distribution) has been high, with reliability for the transmission network at 99.999948% for financial year 2020-21.[9]

11. 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

[4] https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law
[5] https://www.gov.uk/government/news/uk-enshrines-new-target-in-law-to-slash-emissions-by-78-by-2035
[6] https://www.theccc.org.uk/publication/sixth-carbon-budget/
[7] https://www.gov.uk/government/publications/net-zero-strategy
[8] https://www.gov.uk/government/consultations/capacity-market-2021-call-for-evidence-on-early-action-to-align-with-net-zero
[9] https://www.nationalgrideso.com/document/211021/download

duration of power cuts experienced by their customers, whilst maintaining focus on minimising network costs and securing optimal value for consumers.

12. 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. They cover a range of activities, including restoring supply during an unplanned interruption and providing notice periods for planned interruptions. All DNOs met their Interruptions Incentive Scheme targets for unplanned interruptions in 2019-20. Customer interruptions have fallen by 19% throughout RIIO-ED1 (the current price control covering the period 2015-2023) so far and the duration of interruptions has reduced by 15%.[10]

13. 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 to 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. For the financial year 2020-21, the annual system availability of offshore networks was 98.81% according to figures provided by ESO.[11]

Future development of electricity networks

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

15. Transmission owners provide quarterly updates on their major projects to BEIS and Ofgem. The latest update shows that 600 MW of network capacity is under construction, with 11.35 GW delivered since February 2012.[12]

16. The 2015 to 2023 price control for the Distribution Network is ongoing. There are 14 regional electricity DNOs that are regulated through RIIO-ED1.Ofgem has approved overall funding of £29.6bn (in 2020 prices) across GB for the period 1 April 2015 to 31 March 2023.[13] This represents a major investment in the distribution network. Draft business plans have been submitted to Ofgem by DNOs for the second price control period, RIIO-ED2, with the final submissions due in December 2021.

[10] https://www.ofgem.gov.uk/system/files/docs/2021/03/ed1_network_performance_summary_2019-20.pdf
[11] https://www.nationalgrideso.com/document/211021/download
[12]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1009598/TO_Major_Projects_Update_September_2021.pdf
[13] https://www.ofgem.gov.uk/publications/riio-1-electricity-distribution-annual-report-2019-20

Interconnection

17. Great Britain currently has 7.4 GW of electricity interconnector capacity with mainland Europe and the Irish electricity market. This consists of:

    - IFA, a 2 GW link to France;[14]
    - East-West Interconnector, a 500 MW link with the Republic of Ireland;
    - BritNed, a 1 GW interconnector with the Netherlands;
    - Moyle, a nominally rated 500 MW link between Great Britain and Northern Ireland;
    - NemoLink, a 1 GW interconnector with Belgium;
    - IFA2, a 1 GW link to France; and
    - North Sea Link, a 1.4 GW link to Norway, commissioned on 1 October 2021.

    There are two projects currently under construction, which will add a further 2.4 GW of capacity:
    - ElecLink, 1 GW to France via the Channel Tunnel, currently undertaking commissioning activities; and
    - VikingLink,1.4 GW to Denmark, scheduled for completion in 2023.

18. There is a significant pipeline of further interconnectors at various stages of development – if all the projects that have applied to Ofgem for regulatory approval come forward, they would bring our total interconnection capacity to nearly 15.9 GW. In the Energy White Paper, published December 2020, we stated our ambition for at least 18 GW by 2030.

19. Many of these projects are being brought forward under Ofgem's cap and floor regulatory regime, which was put in place in 2014 to encourage investment in projects that will benefit consumers by providing a minimum return for project developers (the floor) whilst ensuring that consumers benefit from excess revenues accruing to developers by limiting the maximum return (the cap).

20. In summer 2020, Ofgem announced a review of the Cap and Floor regime and approach to new electricity interconnectors, completing the consultation in summer 2021. The outcome of the consultation is expected to be published in winter 2021.

Capacity Market

21. The purpose of the CM 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 CM 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.

22. The CM works by allowing eligible capacity providers to bid into a competitive auction to provide capacity. Successful capacity providers receive a steady payment to ensure enough capacity is in place to meet demand at times of system stress.

14 A fire at the IFA interconnector site at Sellindge in September 2021 resulted in a period of outage for IFA. Bipole 2 (1000MW) returned in October. Bipole 1 (1000MW) remains on outage but is expected to be available for Winter 2022/23. This outage is accounted for in the margin presented in NGESO's Winter Outlook Report for Winter 2021/22.

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 requested during a System Stress Event.

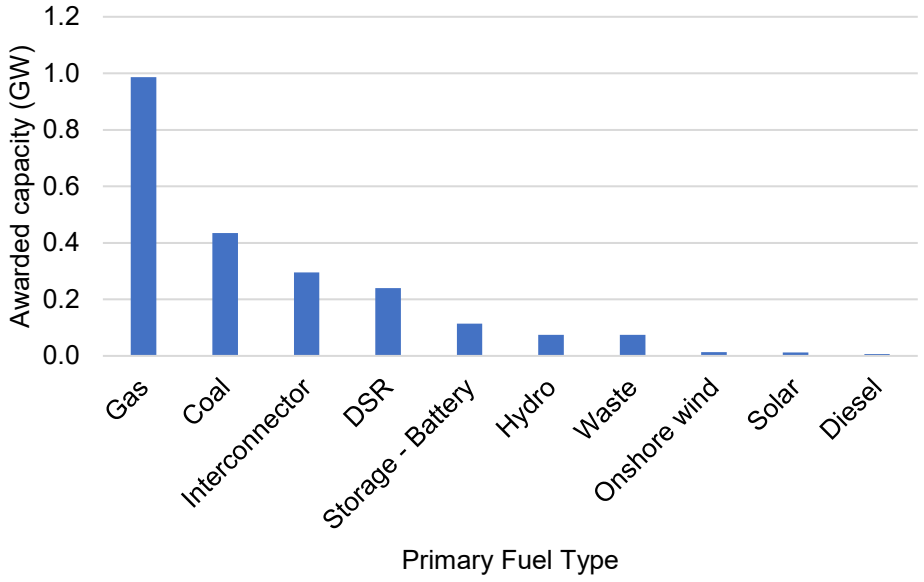
23. The CM is technology neutral – it does not seek to procure allocated volumes of capacity from specific types of technology. All types of technology are able to participate – except for capacity providers in receipt of support from other specific policy measures – provided they can demonstrate sufficient technical performance to contribute to security of supply, and provided they comply with the Capacity Market's emissions limits.[15]

Capacity Auctions

T-1 Auction results for 2021/22

24. The T-1 auction for delivery in 2021/22 concluded on 2 March 2021 and secured 2.3GW of de-rated capacity at a clearing price of £45/kW.[16] Just over 4.2GW of de-rated capacity entered the auction, of which 53% received capacity agreements for delivery. 63% of awarded capacity is from existing generation capacity, and 13% from new build generation capacity. The remaining capacity was awarded to existing interconnectors, proven and unproven DSR.

Figure 1. T-1 Auction results breakdown of Capacity Agreements awarded by fuel type

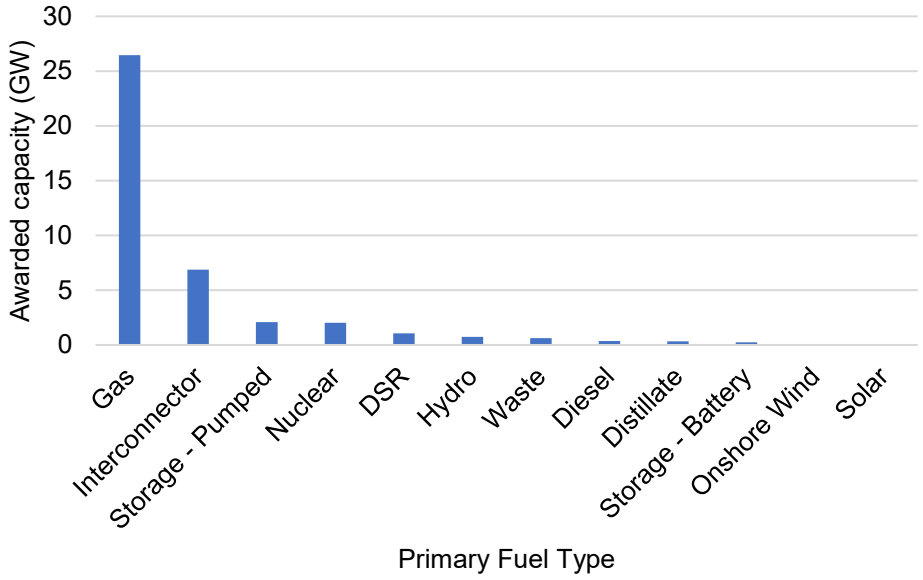


[15] https://www.gov.uk/government/publications/carbon-emissions-limits-in-the-capacity-market
[16] https://www.emrdeliverybody.com/Capacity%20Markets%20Document%20Library/Capacity%20Market%20Auction%20T1%20DY21-22%20Final%20Results.pdf

T-4 Auction results for 2024/25

25. The T-4 auction for delivery in 2024/25 concluded on 10 March 2021 and secured 40.8GW of de-rated capacity at a clearing price of £18/kW.[17] Just under 52.0GW of de-rated capacity entered the auction, of which 79% received capacity agreements for delivery. 75% of awarded capacity is from existing generation capacity, 4.3% from new build generation capacity, 8.2% from existing interconnectors, and 8.6% from new build interconnectors. The remaining capacity was awarded to refurbished generation capacity, proven and unproven DSR.

Figure 2. T-4 Auction results breakdown of Capacity Agreements awarded by fuel type



Capacity Market Payments

26. The Electricity Settlements Company's (ESC) records show that £1,095m was paid out to CM agreement holders for Delivery Year 2020/21. In the Financial Year 2020/21, ESC received £1m in termination charges (compared to £0.8m in FY 2019/20).[18] 2GW of de-rated capacity with agreements beginning in Delivery Year 2020/21 was terminated prior to delivery.[19]

Improvements to the Capacity Market

27. Ofgem ran a consultation between 14 May 2021 and 18 June 2021 seeking views on proposals to improve the efficiency of the Capacity Market and increase transparency of information related to the scheme.[20] This resulted in a decision on 5 July 2021, which

[17] https://www.emrdeliverybody.com/Capacity%20Markets%20Document%20Library/Capacity%20Market%20Auction%20T4%20DY2024-25%20Final%20Report.pdf
[18] https://www.lowcarboncontracts.uk/annual-reports
[19] https://www.emrdeliverybody.com/CM/Registers.aspx
[20] (https://www.ofgem.gov.uk/publications/statutory-consultation-capacity-market-rules-change-proposals

made changes to the Capacity Market Rules, including amendments to the process for updating the list of Relevant Balancing Services.[21]

28. A Government consultation was held in March 2021 on a range of improvements to the CM. Full details can be found in the consultation documents.[22] A summary is provided below. The improvements, which were implemented through legislation in June and July 2021:

- Changed certain formulae and clarifications to the legislation relating to Carbon Emissions Limits in the CM. The amended formulae allow for a better reflection of certain technologies' actual carbon emissions and improved clarity for capacity providers.

- Provided the CM Delivery Body with greater flexibility to consider information which corrects non-material errors in prequalification applications. This reduces the risk of prequalification applications being rejected due to minor, administrative errors.

- Prevented certain secondary trades from being rendered ineffective if the transferor's Capacity Agreement is terminated. This makes it easier to replace capacity which closes prematurely and at short notice, after a T-1 auction.

- Extended the coronavirus easements relating to the extended long-stop date, the extended deadlines for Metering and DSR Tests for DSR CMUs, and Independent Technical Expert certificates in relation to progress reports. The easement around appeals (which applies in specific circumstances and is subject to certain conditions) has not been changed and continues to be in place for CMUs that were awarded an agreement before 1 April 2020. These easements allow management of any delays to operator's fulfilment of CM milestones, caused by the pandemic. We have not extended the easements on Satisfactory Performance Days, DSR baseline data or the Metering Test deadline, as these are expected to be of limited impact and no requests were made for continuation of these easements.[23]

- Extended the deadline for meeting the Extended Years Criteria so that it aligns with the requirement to provide evidence of Total Project Spend, and make the sanction for breaching both (a reduction in capacity agreement length) referable to the Secretary of State. This ensures consistency across CM obligations and deadlines and enable Capacity Providers to refer matters to the Secretary of State if they believe they have sufficient grounds.

- Allowed refurbishing plant to have the same Long-Stop Date as new build plant. This provides refurbishing plant that secure agreements in a T-4 auction with the option of an additional 12 months to deliver their capacity if it suffers delays to works.

- Disabled the net welfare algorithm for T-1 auctions that are held only to meet the 50% set-aside commitment. Under the Electricity Capacity Regulations 2014 we are committed to auctioning at least 50% of the capacity that was set aside for the T-1

[21] https://www.ofgem.gov.uk/publications/decision-amendments-capacity-market-rules
[22] https://www.gov.uk/government/consultations/capacity-market-2021-proposals-for-improvements
[23] For more information, see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994995/capacity-market-2021-consultation-improvements-government-response.pdf

auction. This ensures that when an auction is held for the sole purpose of meeting this commitment, the costs to the consumer of the auction are minimised.

- Maintained the minimum capacity threshold at 1MW. This ensures that the CM continues to be aligned with other electricity markets and that the costs of administration are balanced with broad market access.

Demand

29. Figure 3 shows the historic and forecast trends of underlying peak electricity demand from ESO. This includes demand met by generation which is connected to the transmission network as well as embedded generation (generation that is connected directly to the distribution network) above 1MW.

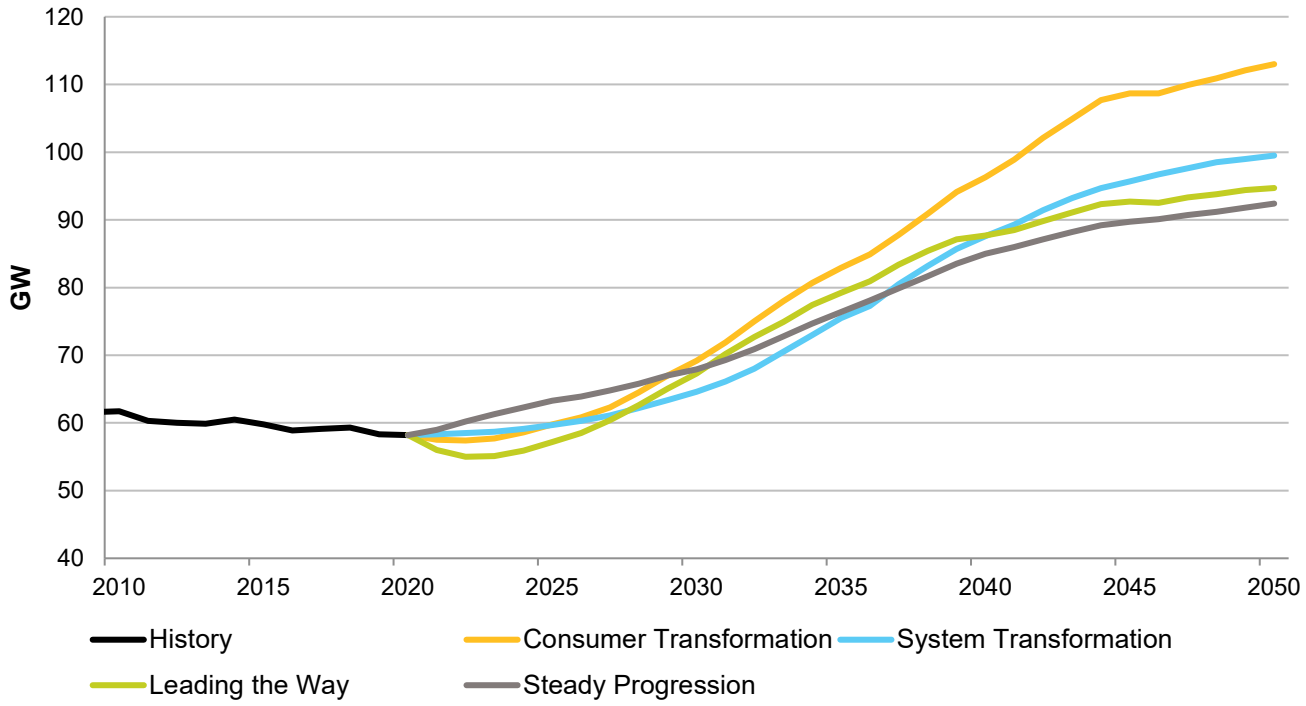
30. ESO has published four scenarios for electricity demand to 2050 as part of its Future Energy scenarios (FES) project:

    a) The Consumer Transformation and System Transformation scenarios represent two different ways to reach net zero by 2050 - either by changing the way energy is used or by changing the way in which it is generated and supplied.

    b) In Leading the Way, 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 103% by 2050 (compared to 1990 levels) - in other words, it is net negative.

    c) Decarbonisation happens slowest and net zero is not reached in Steady Progression, where 2050 emissions are reduced by 73% of 1990 levels.

Figure 3. Peak electricity demand (including losses)[24]



Demand Side Response

31. Demand Side Response (DSR) refers to action taken by consumers, in response to a signal (such as price) 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.

32. DSR can drive decarbonisation, while helping consumers save money, and improving the efficiency of our energy system. 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 decarbonise.[25] 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.[26]

33. Today, industrial and commercial consumers are providing around 1GW of DSR to the system.[27] Participation from domestic and smaller non-domestic consumers remains at an early stage, but we expect electric vehicle charging, energy smart appliances and

[24] https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2021
[25] Smart Systems and Flexibility Plan (2021) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1003778/smart-systems-and-flexibility-plan-2021.pdf
[26] Smart Systems and Flexibility Plan (2021) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1003778/smart-systems-and-flexibility-plan-2021.pdf
[27] Future Energy Scenarios 2020 National Grid ESO (2020), FES 2020 https://www.nationalgrideso.com/future-energy/future-energy-scenarios/

electric heating to provide a significant source of flexibility over the next decade and beyond.

34. Following amendments made to the Capacity Market legislation following the Future Improvements consultation,[28] DSR can now prequalify to bid for agreement lengths of up to fifteen years, if they can demonstrate they meet certain capital expenditure thresholds.

35. The table below shows the amount of DSR winning capacity agreements in T-4 auctions (held four years ahead of delivery).[29]

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

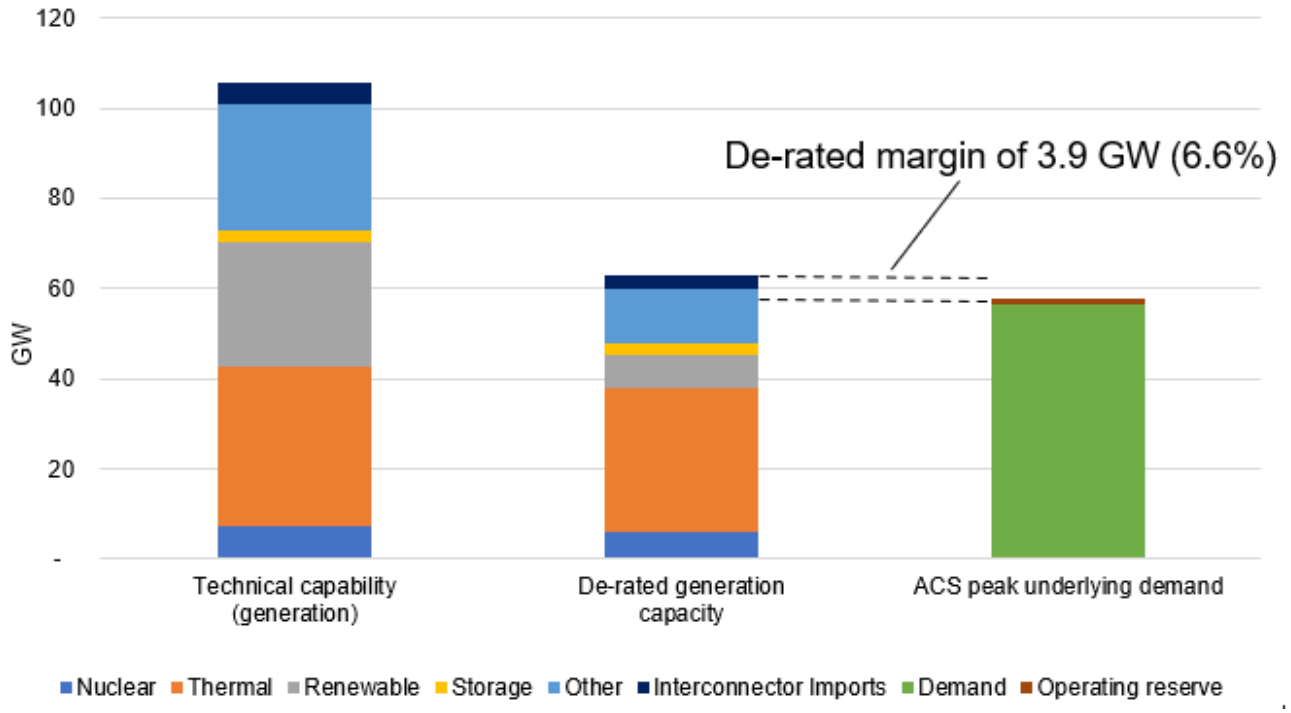
Year	2021-2022	2022-2023	2023-24	2024-2025
Awarded Capacity (MW)	1187	535	1170	1066

Supply

Present Capacity

36. The ESO's 2021 Winter Outlook Report assumes a total maximum capacity of 109.3GW this winter (not taking account of any potential breakdown or outage).[30]

Figure 4. Present Capacity (ESO's 2021 Winter Outlook Report)



[28] https://www.gov.uk/government/consultations/capacity-market-proposals-for-future-improvements
[29] https://www.emrdeliverybody.com/CM/Capacity%20Auction%20Information.aspx
[30] https://www.nationalgrideso.com/research-publications/winter-outlook

Electricity Storage

37. Electricity storage enables us to use electricity more flexibly and decarbonise our electricity system more cost-effectively. It can offer supply or demand to the electricity system within seconds to minutes, and is widely used by National Grid, alongside other technologies and forms of flexibility, to balance and maintain the integrity of the electricity system. It can also support the integration of intermittent renewables and defer or avoid the need for costly network upgrades and new generation capacity. The Government is facilitating the deployment of storage at all scales through actions to remove barriers and reform markets as set out in the 2021 Smart Systems and Flexibility Plan.[31]

38. According to the ESO there is currently around 4GW of electricity storage capacity in GB, with around 3GW from pumped hydro and over 1GW from battery storage.[32] There is a strong and growing electricity storage pipeline representing nearly 13GW of storage: 10GW of battery storage and 3GW of pumped hydro storage.[33]

39. There is further potential for other storage technologies to deploy in future, such as those using novel battery chemistries, compressed air and liquid air energy storage or gravitational storage. The Government will continue to support storage technologies by removing barriers, reforming markets and investing in innovation.

40. The Government is currently supporting the deployment of novel storage technologies through the £68m longer duration energy storage (LODES) demonstration competition, which aims to support the commercialisation of first of a kind long duration energy storage technologies.[34] Alongside this, Government published a Call for Evidence in July 2021,[35] seeking evidence about barriers to the deployment of large-scale and long-duration electricity storage, and on different approaches for addressing these barriers. To further support this, Government have commissioned analysis alongside this Call for Evidence to model and quantify the potential need for large-scale, long-duration storage assets. Collectively, the information gathered will be used to help inform Government's decisions on whether further intervention is needed to support its deployment.

41. Vehicle-to-X (where X could represent the home, a building or the grid) is an emerging technology with trials worldwide involving hundreds of vehicles, but it is not yet at mass deployment. National Grid Future Energy Scenarios (2021) estimates that by 2050 up to 45% of vehicles could be providing V2X services, offering up to 38GW of flexibility for the UK electricity market by 2050.[36]

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[31] 2021 Smart Systems and Flexibility Plan https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021

[32] National Grid ESO (2020), FES 2020, https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2020-documents

[33] Figures taken from Renewable Energy Planning Database and include projects that have planning approval or have submitted an application for planning: https://www.gov.uk/government/publications/renewable-energy-planning-database-monthly-extract

[34] Longer Duration Energy Storage Demonstration (LODES) competition https://www.gov.uk/government/collections/longer-duration-energy-storage-demonstration-lodes-competition

[35] Large-scale, Long-duration Electricity Storage Call for Evidence: Facilitating the deployment of large-scale and long-duration electricity storage: call for evidence (publishing.service.gov.uk)

[36] Future Energy Scenarios 2021 https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2021

42. The UK is a world-leader in V2X energy technologies, with the most innovation projects and the largest domestic demonstration. In 2017, BEIS and the Office of Zero Emission Vehicles (OZEV) provided up to £30m of funding, through an Innovate UK competition, to 20 projects. The projects are wide-ranging, including feasibility studies, collaborative R&D and real-world demonstrators covering commercial and domestic users, and the programme runs to 2022.

43. Alongside the Smart Systems and Flexibility Plan in July 2021, BEIS published a Call for Evidence, seeking views on the potential role of V2X, and the barriers preventing this. The feedback from the Call for Evidence will help inform Government's next steps to facilitate this source of flexibility.[37]

Liquidity in the GB wholesale power market

44. 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: low levels of market liquidity can be indicative of an uncompetitive market.

45. 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.

46. Following concerns by Ofgem and industry about the lack of liquidity in the wholesale electricity market, Ofgem activated the 'Secure and Promote' licence condition on 31 March 2014. Ofgem's monitoring of the market since 2014 showed mixed results with an improvement in peak load liquidity but no step change in churn.

47. On 18 November 2019, Ofgem suspended the Secure and Promote Market Making Obligation (MMO).[38] This followed consideration of the cost-implications of a two party MMO and likely impact on the policy's effectiveness from a further reduction in the number of obligated parties. The Secure and Promote Supplier Market Access Rules and Reporting Requirements remain in effect.

48. In December 2020, Ofgem announced that no further intervention to replace the MMO would be taken forward.[39] This followed an assessment[40] that concluded that, while liquidity in the GB wholesale electricity market is lower compared with other European markets, there is no evident market failure causing this low liquidity. This assessment also concluded that liquidity had not fallen to a level where further intervention would necessarily result in a net consumer benefit. This continues to be our position.

[37] https://www.gov.uk/government/consultations/role-of-vehicle-to-x-technologies-in-a-net-zero-energy-system-call-for-evidence
[38] https://www.ofgem.gov.uk/publications/decision-suspend-secure-and-promote-market-making-obligation-effect-18-november-2019
[39] https://www.ofgem.gov.uk/publications/update-future-liquidity-policy
[40] https://www.ofgem.gov.uk/publications/update-liquidity-policy-review-publication-nera-economic-consulting-options-assessment-report

49. Ofgem has continued to monitor the market since suspension of the MMO. Monitoring shows:

    a) Traded volumes in the wholesale market were stable in the months following the suspension. However, total over-the-counter trading during Q1 to Q3 2020 fell to 59.6TWh, down from 65.2TWh during the same period in 2019. This was due to electricity demand shock and uncertainty owing to coronavirus as opposed to the suspension. Trading volumes remained low relatively low throughout 2021 reflecting the 5 year trend of falling liquidity.

    b) Churn (the number of times electricity which is generated in the market is subsequently traded) has also been relatively stable since the end of last year. It averaged 3.8 from 2014 to Q3 2019, i.e. the period in which the MMO was in place. To date, churn from year to August has remained very similar to the average prior to the suspension. In 2021 churn decreased, reflecting the continued fall of liquidity.

    c) Bid-offer spreads have widened overall since the suspension of the MMO as they are no longer subject to a ceiling. So far this year, baseload spreads have narrowed to lower than 1%, which is above the spreads mandated by the MMO but remains in a medium to high liquidity range. Peak load products have widened more with an average of 1.9% with some large differences between products, driven by lower traded volumes. This is above the historical average (2009 to 2013) of 1.4%.

Gas

Introduction

50. The gas market is crucial to the UK's energy supply because of its significance in heating, industry, and power generation. Over 22m households are connected to the gas grid and in 2020, 37% of the UK's gas demand was used for domestic heating, 29% for electricity generation and 17% for industrial and commercial use.[41]

51. Significant volatility has been seen in wholesale gas markets internationally in 2021, with gas trades reaching record highs at Great Britain's National Balance Point (NBP). Government is continuing to monitor the effect this is having across industries. GB is part of the European gas market and is therefore affected by changes to European gas flows, such as the recent reduction in Russian gas flows. Nonetheless, we remain confident that GB's gas security will be maintained thanks to the diversity of supply sources and established market mechanisms.

[41] Table 4.2 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1017424/DUKES_2021_dataset.xlsx

Supply

52. GB benefits from highly diverse and flexible sources of gas supply, with more than sufficient delivery capacity to meet demand. To date, the GB gas system has reliably delivered a secure supply.

53. GB's supply sources include domestic production from the UK Continental Shelf (UKCS), which remains GB's largest single source of gas and accounting for 48% of the annual average supply mix for 2020. Norway continues to be one of our most important energy partners, supplying around 29% of our gas. Remaining gas is sourced from international markets including via Liquefied Natural Gas (LNG), for which GB has one of the largest infrastructures in Europe, accounting for 22% of supply, and via two interconnectors to the Continent from which we sourced 2% of overall gas.[42]

54. GB's gas infrastructure is designed, taking into account operational measures, to meet the 1-in-20[43] peak aggregate daily demand. 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[44] severe winter. Hence, sufficient entry capability must be available.

55. Similarly, the N-1 calculation[45] has been updated by National Grid for their 2021/2022 Gas Winter Outlook Report. For the coming winter, the supply margin at peak 1-in-20 demand under N-1 conditions has increased from a 9mcm/day surplus last winter to a 32mcm/day surplus.

56. While GB's gas market, trading at the NBP, has experienced unusually high wholesale prices like other international hub markets, the market continues to balance supply with demand by adjusting the price at which trades occur.

57. We remain confident that security of gas supply will be maintained thanks to the diversity of our supply sources – which reduce reliance on any particular source – and the existing market mechanisms.

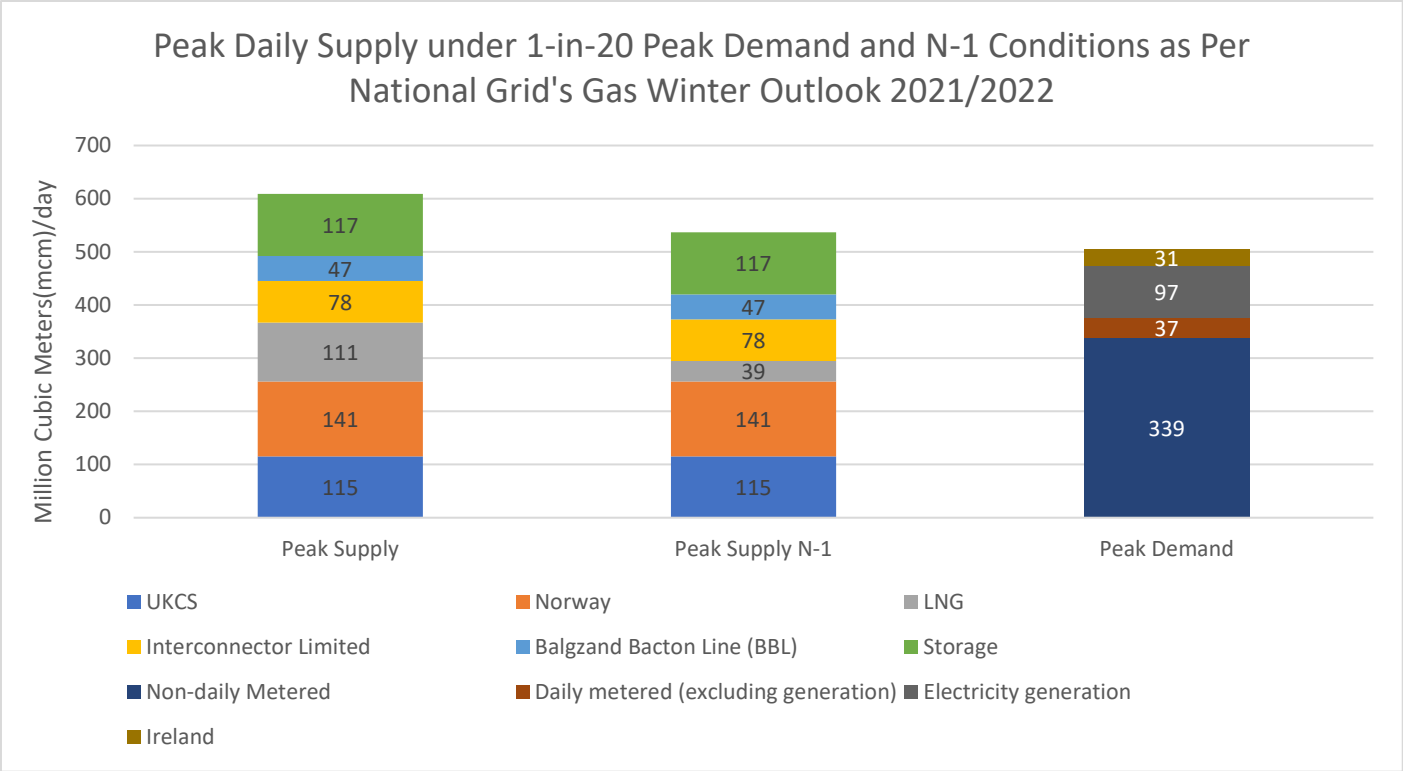
[42] Table 4.5
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1017424/DUKES_2021_dataset.xlsx

43 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.

44 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.

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

Figure 5. Peak gas supply and demand (National Grid Gas Winter Outlook 2021/2022)[46]



Import capacity and outlook

58. As well as domestic production, the UK has a diverse set of import routes, including direct connection to the Norwegian Continental Shelf via 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 GB NBP to the Belgian *Zeebrugge* market, and the Balgzand-Bacton Line (BBL) interconnector links to the Dutch *Title Transfer Facility* (TTF). GB has one of the largest LNG import infrastructures in Europe with facilities at Isle of Grain, Kent, and two in Milford Haven, Southwest Wales: Dragon and South Hook.

59. Currently, the UK has import deliverability of ~55 billion cubic metres per year (bcm/y) from Norway, ~43 bcm/y from capacity connected to the Continent, and ~48 bcm/y from LNG import terminals.[47] Capacity is not itself a measure of utilisation. To date, GB has always secured the gas required; and BEIS, Ofgem and National Grid analysis has all concluded that it will remain well-positioned to do so. A key factor in GB's ability to secure the necessary gas is an appropriately incentivised, flexible and accessible market. This is discussed under Market Functioning below.

[46] https://www.nationalgrid.com/uk/gas-transmission/insight-and-innovation/winter--outlook
[47] https://www.nationalgrid.com/uk/gas-transmission/insight-and-innovation/gas-ten-year-statement-gtys

Production

60. Domestic production continues to be the largest single source of gas for the UK, accounting for 48% of the annual supply mix for 2020.[48] Domestic production declined significantly in the decade after the turn of the century owing primarily to the maturing nature of the UKCS basin, though has been broadly stable since the early 2010s. Despite this decline, in 2020 the UK remained the third largest gas producer in Europe.[49]

61. Flows from the UK Continental Shelf (UKCS) were down through summer 2021, reaching a historically low level in June 2021. This was largely attributable to maintenance shutdowns deferred from 2020 due to the COVID-19 response. There was a significant increase in August 2021, and further increases expected as new gas fields come online, returning domestic production to levels commensurate with the previous decade.

Demand

62. Gas is a critical part of the UK's energy demand and is expected to continue to play a role as we transition to net zero emission by 2050. Nonetheless, the long-term trend of demand is downwards, with gas demand in 2020 around 28% lower than 2000.[50] While 2020 was an unusual year for demand due to Coronavirus lockdowns, this trend was still visible in 2019 which saw a 23% reduction compared to 2000 levels.[51]

63. Total demand in 2020 decreased to around 811TWh, down from 863TWh in 2019. Demand in the first half of 2021 (H1) rebounded with the reopening of the economy post-lockdown, with total H1 demand of around 482TWh representing a 14.2% increase from H1 2020 demand of around 422TWh. Indeed, H1 2021 reached levels of demand last seen in H1 2018 (486TWh). This was also due to particularly cold weather in early 2021, which elevated domestic gas demand (the largest driver of which being gas demand for space heating) in H1 2021 by 15.5% versus H1 2020, and by 17.3% versus H1 2019.[52]

Demand side response

64. This service allows large gas consumers to offer, via a centralised platform, to reduce the amount of gas they use during times of system stress in exchange for a payment. To date, this platform has only been deployed once, in March 2018, after the issuing of a Gas Deficit Warning (now known as a Gas Balancing Notification following approval of Uniform Network Code Modification No. 685 in July 2019). At that time, no DSR offers were placed on the centralised platform and no involuntary demand-side measures

[48] Digest of UK Energy Statistics, table 4.2
[49] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1006628/DUKES_2021_Chapter_4_Natural_gas.pdf
[50] Digest of UK Energy Statistics, table 4.1
[51] Digest of UK Energy Statistics, table 4.1
[52] From Energy Trends: UK Gas, table 4.1, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1024067/ET_4.1_SEP_21.xlsx

were taken by National Grid. Whilst demand side response has been very limited from large users, power generation provides a large response source for demand side response. Indeed, during the Gas Balancing Notification in March 2018, a large response came from power generation. The fact that power generation uses significant amounts of gas means that this can have a considerable impact during times of system stress.

Gas Storage

65. Storage is not a source of supply as such but does play an important role in providing system flexibility in responding to short-run changes in supply and demand. GB does not operate a 'strategic reserve' storage model as the diversity of GB's sources of gas supply precludes a reliance on storage meeting demand during cold weather.

66. GB has around 1.5bcm of natural gas storage which is made available to the market.[53] This has a maximum deliverability of 117mcm/day.[54] Since the closure of Rough as a natural gas storage facility by Centrica Storage Limited in 2018, GB has had no long-range storage facilities, with the remaining being mid-range storage. The closure of Rough prevented the costly necessary repairs being passed on to consumers, and storage deliverability has proved sufficient since despite a cold 2020/2021 winter. Similarly, GB's relatively lower level of storage capacity compared to some European countries has had minimal effect on the price spikes we have experienced in the wholesale gas market, with prices being determined primarily by global trends in supply and demand rather than GB's domestic storage capacity.

67. 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. Seasonal price spreads (i.e., the difference between wholesale prices in summer versus winter) have minimised over time due to increased import infrastructure and access to global markets, which impacts the economic model of long-range storage. Short-term changes in wholesale prices continue to incentivise mid-range storage which can flexibly respond to market conditions. Since Rough's closure, the value GB derives from gas storage has been via its ability to respond to short-run changes in supply and demand, rather than as a strategic reserve. We will continue to monitor the efficacy of GB's storage model as the dynamics of the gas market continue to evolve.

Market Functioning

68. The GB gas market remains highly liquid. The market's churn ratio – which measures how many times a unit of gas is traded before it reaches the final consumer - is a metric for assessing market liquidity. The churn ratio ranged between 9 and 18 in 2020, averaging 14 over the year.[55] A churn ratio of 8 and above is considered the benchmark

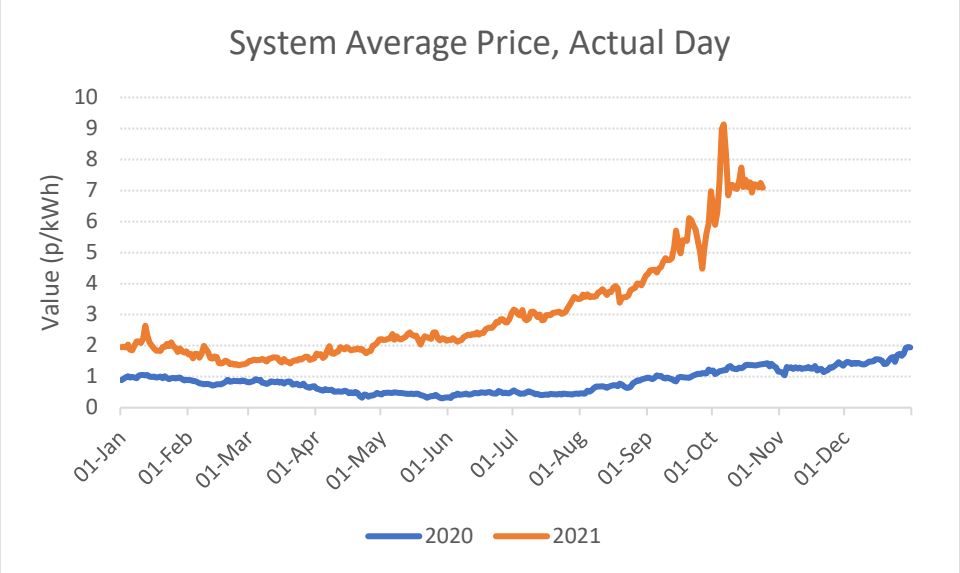
[53] https://www.ofgem.gov.uk/publications/gb-gas-storage-facilities-2021
[54] National Grid, *Gas Winter Outlook 2021/22*, October 2021
[55] Gas trading volumes and monthly churn ratio by platform (GB), https://www.ofgem.gov.uk/energy-data-and-research/data-portal/wholesale-market-indicators

for a functioning wholesale market.[56] The average gas churn rate between January 2021 and September 2021 was 9,[57] meaning we are likely to see a year-on-year reduction in one of the market's measures of liquidity, but remain above the international benchmark of 8.

69. 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.

70. As with many international hub markets in 2021, GB's market (trading at the NBP) has seen elevated prices. According to ONS System Average Prices,[58] prices traded in the day-ahead market for Q3 2021 averaged more than 5 times the level of Q3 2020. The NBP has also seen significant volatility in prices, with the day-ahead market experiencing over 10% swings in closing prices during September and October. The reasons behind the sustained increase in prices relative to previous years are due to global trends in supply and demand, in addition to some upstream supply disruption to the UK as necessary maintenance projects were completed.

Figure 6. National Grid, System Average Price Data[59]



[56] The European Union Agency for the Cooperation of Energy Regulators (ACER) set, in its Gas Target Model, a threshold criterion of 8 for Member States' wholesale markets. While the UK is no longer a Member State of the European Union, this figure can be used an indicative benchmark in assessing liquidity. Microsoft Word - APPGEC Wholesale Gas Market Report final.docx (ecappg.org.uk), P.8

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

[58] The System Average Price (SAP) of gas is the average price of all gas traded through the balancing market. These data can be used to understand the general trend of gas prices within the UK, however, should be treated with caution as these can be subject to extreme within-day trading prices and may skew actual traded prices. It must also be noted that while these prices reflect spot prices on the day, traders can opt for futures contracts where the buyer and the seller agree the market-determined price for gas for a future date. The daily SAP is used to determine the futures price and is therefore a useful indicator of supply constraints and demand pressures. Available at https://www.ons.gov.uk/economy/economicoutputandproductivity/output/datasets/systemaveragepricesapofgas

[59] https://mip-prd-web.azurewebsites.net/DataItemExplorer/Index

71. The UK has an established reputation in promoting transparent market-based approaches and fully supports the evolution towards a 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. While elevated wholesale prices have been seen internationally in 2021, the existing market mechanism in the UK continues to balance supply with demand and we have no reason to anticipate this will not continue.

Network Reliability

72. The UK gas transmission network achieved 100% reliability in 2020/21. The distribution network that carries gas directly to consumers is equally robust, with a reliability rating of 99.998% for 2018/19 across gas distribution network operators, the most recent year for which data are available.

COVID-19 Impacts on the Gas Market

73. There was some COVID-19-related supply disruption in the summer of 2021, caused by upstream maintenance in the UK and Norwegian Continental Shelves deferred from 2020 as well as some staffing capability issues due to either illness or isolation. Nonetheless, the gas system continued to operate reliably, and supply margins remained more than sufficient. Maintenance projects in both the UKCS and Norwegian Continental Shelf were confirmed to be completed as we enter the 2021/22 gas winter.

74. Based on experience of operating the network under a variety of COVID-19 lockdown scenarios, National Grid does not expect any significant operational challenges due to the ongoing effects of the COVID-19 pandemic.

Oil

Introduction

75. In 2020, oil met one-third of total energy demand compared to almost half in 2019. Oil is the main energy source for transport meeting virtually all the UK's needs. However, lockdown and other restrictions due to Covid-19 reduced demand substantially and demand for petroleum products reached a record low in 2020 down 23 per cent compared to 2019. Other uses of oil include industrial, and construction related products and processes, domestic heating and as feedstock for petrochemical plants.

76. Domestic crude oil (including natural gas liquids) production kept its 24 per cent share of total energy production. However, primary oil production in 2020 was down by nearly two thirds of the UK's peak in 1999 at 49 million tonnes. In addition, much of the type of crude oil produced in the UK is more profitable for the export market, meaning imports remain important but net imports fell to a 17 year low in 2020 and the UK became a net exporter for the first time since 2004. The sector plays a key underpinning role for the

whole of the UK economy as well as offering significant direct benefits socially, economically and in terms of resilience.

77. The UK's oil supply chain continues to deliver security of supply and is expected to continue to function well, with sufficient capacity to meet demand, as well as respond to supply shocks. The UK is well placed in the global oil markets (crude and product), trading extensively in all oil types and with significant import and export infrastructure at coastal locations able to source fuels from around the globe, notably from the Amsterdam-Rotterdam-Antwerp oil hub.

78. Analysis by BEIS has provided valuable insight into the risks of specific point failures in our downstream oil supply infrastructure. The evidence shows that the UK fuel supply is resilient to most shocks where the market can adapt as it has done historically. However, for the case of very short-term disruptions, BEIS has identified some measures that could increase our fuel resilience, most notably through an ability to lease additional truck and trailers to the supply chain, which we have held since late 2016.

Primary Oil Supply and Demand

79. All data are sourced from the Digest of UK Energy Statistics unless otherwise specified.[60]

80. Total demand in 2020 for primary oils decreased by 18 per cent on 2019, this fall is primarily caused by the fall in demand for transport fuels, which typically contributes to more than 70 per cent of total demand, as restrictions on movement were put in place to curb the spread of Covid-19.

81. Production of crude oil and natural gas liquids in 2020 was down just 7 per cent compared to 2019.

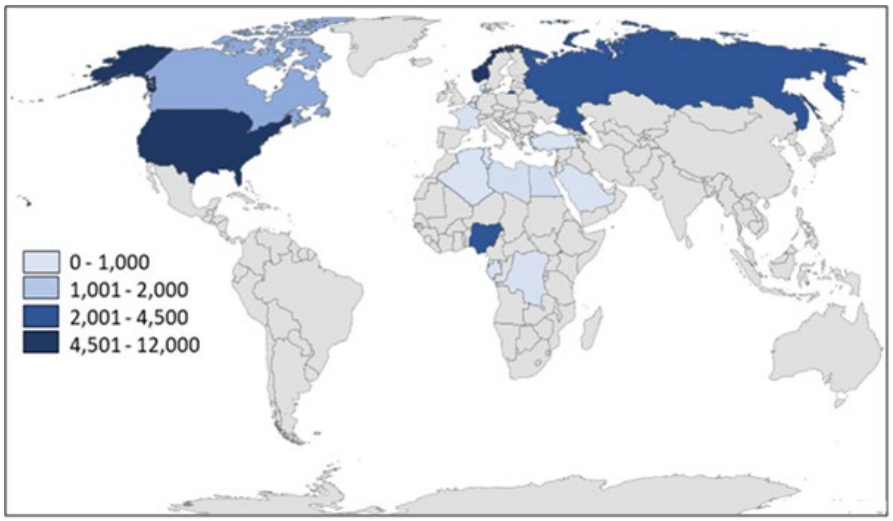
82. Production of crude oil would have been sufficient to meet 100% of UK refinery demand in 2020 and there has been an increase in the diversity of sources coming into the UK. This has reduced the impact of a disruption to any one source of supply on the UK. In 2020 the UK's total production of oil from the North Sea exceeded refinery demand for the first time since 2004.

83. The UK trades extensively in primary oils globally, exporting to meet demand for Brent crude from refineries in the Middle East and importing from Norway and increasingly from the US. In 2020 the UK imported 39.3 million tonnes of primary oils compared to 52 million in 2019.

84. The map shows the diversity of sources of crude imports in 2020. For further information, see the article Diversity of supply for oil and oil products in OECD countries, 2020.[61]

[60] Digest of UK Energy Statistics
[61] Energy Trends September 2021: Diversity of supply for oil and oil products in OECD countries in 2020

Figure 7. Map showing sources of crude oil imports



85. The main source of the UK's imports has historically been Norway given its proximity to the UK and similarity in its crude types. UK imports of crude from Norway fell 30 per cent in 2020 compared to 2019, with Norway providing 34 per cent of total UK crude imports, as opposed to 38 per cent in 2019. Supply from Norway has been in decline since 2016, whilst supply from the US has been steadily increasing.

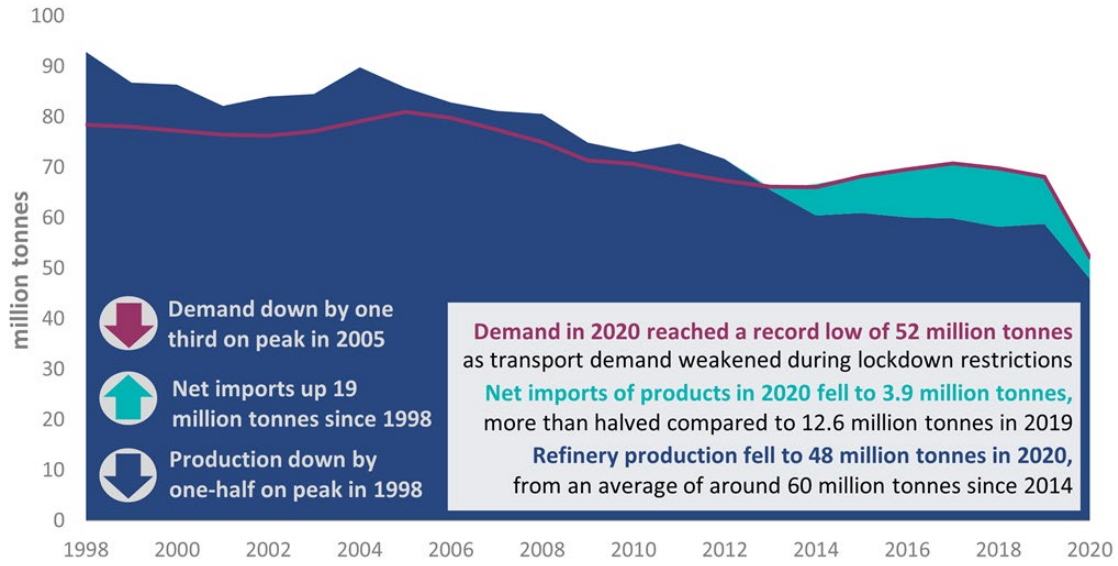
86. Imports from OPEC countries accounted for just 13 per cent of the UK's crude imports in 2020 at 4.6 million tonnes, this is almost half the figure for 2019. Most imports from OPEC countries came from Nigeria, which increased in 2020. Imports from the US remained stable and in 2020 stood at the record set in 2019 of 11.4 million tonnes.

87. The UK is a significant exporter of crude oils as well as an importer. Crude oil exports fell to 36 million tonnes in 2020, compared to 41 and 40 million tonnes in 2019 and 2018 respectively. However, the UK became a net exporter of primary oil products in 2020 following the changes in demand caused by the Covid-19 pandemic.

Refined Product Demand and Supply

88. UK refineries have continued to rationalise and optimise their operations and refinery production remains at just one-half of peak levels in 1998. Production had remained relatively stable between 2016 and 2019. However, in 2020 production fell by 18 per cent compared with 2019 as the UK contended with the Covid-19 pandemic, with UK refineries producing a record low 48 million tonnes of product. This reflected the fall in demand both in the UK and internationally due to the impacts of COVID-19.

Figure 8. Petroleum product demand, production and imports 2020



89. Refinery production is not matched to demand on a product basis meaning that the UK also trades widely in oil products. The UK has been increasingly reliant on imports to meet demand for oil products. However, in 2020 net imports fell to 5.8 million tonnes, less than half of that seen in 2019. The market will continue to drive changes in the supply sector and the Government recognises the benefit of ensuring that a mix of domestic refining and imports remains viable in the UK, so far as market conditions allow.

90. The UK is one of the largest importers of jet fuel and road diesel in the OECD, and one of the largest exporters of petrol. Production of petrol outstripped demand by 44 per cent at 4.0 million tonnes whereas just over 60 per cent of diesel and around 40 per cent of jet fuel demand were met with domestic production.

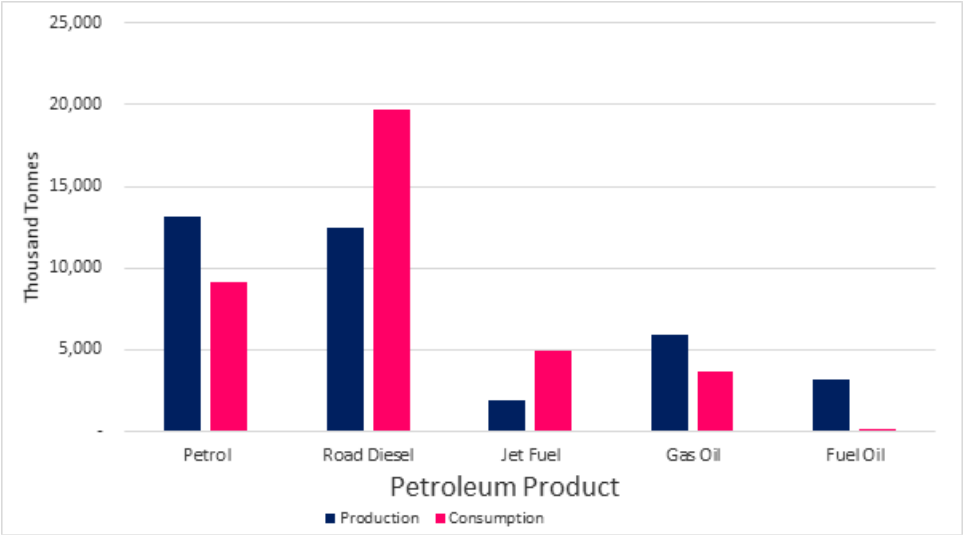


Figure 9. Production and consumption of key petroleum products 2020

91. In 2020 imports of petroleum products decreased by 25 per cent to 24.5 million tonnes, which was predominantly road diesel and jet fuel to meet transport needs. Over 42 per cent of product exports are petrol because of the surplus from UK refineries. Major destinations of petrol exports include the US and the Netherlands, which acts as a trading hub. In 2020 exports fell by 10 per cent on last year to 18.6 million tonnes.

92. Demand for oil products decreased by 24 per cent in 2020. Typically, around 70 per cent of total demand comes from the transport sector, and in 2020 the transport sector made up 73 per cent of final consumption. Demand within the transport sector fell by 29 per cent. Out of the three key transport fuels the largest fall was seen for jet fuel, down 60 per cent on last year. Petrol and diesel also fell, by 22 and 17 per cent respectively. The larger fall in jet fuel is due to restrictions on international travel, with petrol following due to restrictions on domestic travel. Diesel fell the least as commercial fleets remained in operation throughout the pandemic.

Table 2. Demand for oil products 2020

Petroleum Product	Quantity (million tonnes)
Petrol	9.1
Road Diesel	19.7
Jet Fuel	5.0
Burning Oil	3.5
Gas Oil	4.2
Fuel Oil	0.3
Other	6.2

93. Non energy demand, which makes up 7.7 per cent of total demand also decreased by 15 per cent. Demand from the domestic sector increased by 5.7 per cent, primarily due to lower prices early in the year as a result of OPEC+ talks collapsing.

Covid-19 Impacts on the Oil Market

94. In 2020, demand for primary oils by UK refiners was down by 18 per cent compared to 2019 reaching a 17-year low. Production remained relatively robust down just 7 per cent as operations were minimised in response to depressed demand for refined products (mainly for transport fuels) during the Covid-19 pandemic. Energy Trends shows detail on crude and oil product production and demand patterns in 2020.

95. The drop in refinery demand meant that imports also fell to a 17 year low in 2020, making the UK a net exporter of primary oils for the first time since 2004.

96. Production of crude oil from the North Sea exceeded refinery demand for the first time since 2004. However, production of crude from the UK Continental Shelf (UKCS) retained its 43 per cent share of total energy production.

97. Demand for refined products reached the lowest since 1962 at 52 million tonnes as the impact of the lockdown measures taken in response to the Covid-19 pandemic took effect. Demand for all three key transport fuels (petrol, diesel, and jet fuel) were also at record lows due to restrictions on travel but as 2020 progressed demand did continue to recover through the year.

98. During 2020 jet fuel demand fell 60% compared to 2019 at just 5 million tonnes this was the lowest since 1984, this was caused by international travel restrictions which remained in place for most of the year.

99. Road fuel demand fell markedly in 2020 compared to 2019, with a 17% fall in diesel and 22% fall in petrol compared to 2019. Petrol demand reached the lowest recorded since 1962 and diesel the lowest since 2005. The smaller decline in diesel can be partially attributed to some commercial fleets remaining active throughout the pandemic to deliver goods.

100. As 2020 progressed and restrictions were lifted demand continued to recover through the year reaching near normal levels. Road fuel demand has shown remarkable signs of recovery but demand for jet fuel remained flat in 2020 because of continued restrictions on international travel.

Resilience

101. The UK remains well supplied by a combination of domestic refining and imported fuels and there were no significant disruptions to the end supply of oil products and fuels during 2020. On the outbreak of coronavirus in early 2020, BEIS worked with the fuels supply industry to ensure that the major companies had robust contingency plans for maintaining supply and to monitor staff absences in critical roles. BEIS also monitored the impact on demand and stock levels at a large sample of petrol forecourts across GB. The demand destruction caused by Covid-19 placed additional commercial strains

on the downstream oil sector with reduced volumes and profit margins across most of the supply chain.

102. As with many sectors, a shortage of drivers to deliver fuel to petrol forecourts in 2021 led to a loss of resilience in this last part of the supply chain for transport fuels. Reporting of these issues in September 2021 led to increased consumer demand which temporarily overwhelmed the capacity of the supply chain to maintain forecourt stock levels.

103. The Government took action to support the industry by making available additional capacity in the form of the BEIS reserve road tanker fleet and military drivers. Normal forecourt stock levels have been recovered.

Emergency Oil Stocks

104. The UK holds emergency stocks of oil to respond to major disruptions to the global oil market as part of its membership of the European Union and International Energy Agency. In order to meet its international obligations, the UK directs oil companies that are substantial suppliers of oil products to the UK to hold stocks that can be released in an emergency. At the end of 2020, the UK held over 14.9 million tonnes of stocks. Of this total, 12.8 million tonnes were held for emergency purposes, broadly equivalent to around 61 days of consumption. These stocks are held both in the UK and overseas under contractual arrangements that allow stocks to be purchased if necessary.

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