Department for
Business, Energy
& Industrial Strategy

Statutory Security of Supply Report 2018

Presented to Parliament pursuant to pursuant to section 172 of the Energy Act 2004 as amended by section 80 of the Energy Act 2011

Ordered by the House of Commons to be printed 5 November 2018

HC 1644

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Introduction

1. This report discharges the Government 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 (NG). The statistics relied on in 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.

EU Exit

3. The Government recognises the importance to businesses and households of access to an affordable, secure and sustainable supply of energy. GB has a resilient electricity and gas system with sufficient capacity to meet demand in all but the most unlikely circumstances, as a result EU Exit is not likely to have an impact on security of supply in GB. Retaining a well-functioning, competitive and resilient energy system after leaving the EU is a priority.

4. The UK is seeking a deep and special future partnership with the EU on energy. A well-functioning energy market is of vital importance for the European economy and the well-being of citizens. The UK will work to ensure that our future partnership is successful at ensuring efficiency of trade.

Electricity

1. GB's electricity system has delivered secure supplies to date. While the system continues to face the challenges of decarbonisation and replacing ageing and polluting plant, the experience of past years shows that we have a plan to manage the system and provide for our domestic energy demand.

2. The Government reliability standard for security of electricity supply is expressed as a Loss of Load Expectation (LOLE) of 3 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[1].

3. National Grid's Winter Outlook Report for 2018/19[2] forecasts a margin of 7.1GW, equivalent to 11.7% with a LOLE of 0.001 hours/year. This margin is on an underlying demand (UD) basis, which aligns with NG's calculations used in the Capacity Market target capacity recommendations in its annual Electricity Capacity Report.

4. This margin takes account of the 49.3GW of capacity which was successful in the T-4 Capacity Market auction four years ago, and the 5.8GW of plant which was successful in the T-1 auction, as well as plant which have indicated they will stay open without a Capacity Market agreement, and is expected to deliver a high level of security.

5. With the start of the Capacity Market, NG introduced a new tool, the Capacity Market Notice (CMN), to ensure that capacity is available when needed. The CMN was first available in 2016/17 as there was a small amount of capacity available from the first Transitional Arrangement's auction but it assumed a more significant role last year during the first full Capacity Market delivery year (2017/18). Last winter (2017/18) it was not necessary for NG to issue any CMNs.

6. The CMN is a signal to the market that the risk of a system stress event in the electricity network is higher than under normal circumstances. It is not a call to bring forward more capacity, but a notice that providers – especially those with Capacity Market agreements – should be alert to the possibility of system notices being issued and be ready to respond as required. CMNs are issued automatically - four hours ahead of a potential system stress event - when forecast margins reach a pre-determined level.

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[1] 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.

[2] National Grid Winter Outlook Report 2018/19

Capacity Market

Deliverable	Achieved	When
Capacity Market 2015 T-4 auction opened	✔	8 Dec 2015
Capacity Market 2015 T-4 auction results published	✔	22 Dec 2015
Capacity Market 2016 Transitional Arrangements auction opened	✔	26 Jan 2016
Capacity Market 2016 Transitional Arrangements auction results published	✔	8 Feb 2016
Capacity Market 2016 T-4 auction opens	✔	06 Dec 2016
Capacity Market 2016 T-4 auction results published	✔	16 Dec 2016
Capacity Market Early Auction opens	✔	31 Jan 2017
Capacity Market Early Auction results published	✔	24 Feb 2017
Capacity Market 2017 Transitional Arrangement auction opens	✔	22 Mar 2017
Capacity Market 2017 Transitional Arrangement results published	✔	12 Apr 2017
Capacity Market 2018/19 T-1 auction opens	✔	30 Jan 2018
Capacity Market 2021/22 T-4 auction opens	✔	6 Feb 2018
Capacity Market 2018/19 T-1 results published	✔	13 Feb 2018
Capacity Market 2021/22 T-4 results published	✔	23 Feb 2018
Capacity Market 2019/20 T-1 auction opens	On track	29 Jan 2019
Capacity Market 2022/23 T-4 auction opens	On track	5 Feb 2019

7. The Capacity Market is intended to ensure long-term security of supply at least cost to consumers, by enabling adequate investment in the overall level of reliable capacity needed to provide secure electricity supplies, at the lowest cost to consumers. It is designed to ensure sufficient reliable capacity during periods of system stress, for example during cold, still periods where demand is high and wind generation is low. It works by giving eligible capacity

providers, who have bid into a competitive auction declaring that they will be able to provide capacity when needed, a steady payment to ensure enough capacity is in place to meet demand. Capacity providers face penalties if they fail to deliver electricity (or temporary demand reduction) when needed during a stress event.

8. The Capacity Market allows the market to set a price for capacity competitively. Auctions are held one (T-1) and four (T-4) years ahead of the year capacity must be delivered, giving investors certainty over part of the future revenues they will receive.

9. The Capacity Market is required to be technology neutral, provided technologies can demonstrate sufficient technical performance to contribute to security of supply. Existing generating capacity competes against new build, Demand Side Response (DSR) and storage technologies, with the auction procuring whatever mix of capacity provides best value for consumers.

Capacity Market Delivery Year 2017/18

10. 2017/18 was the first full Capacity Market delivery year. The Supplementary Capacity Auction which concluded in February 2017 secured 54.4GW of capacity for delivery in 2017/18.

11. National Grid's margin forecast as set out in the 2017/18 Winter Outlook publication was 10.3% (on an underlying demand basis)[3], which included some plant without Capacity Market contracts remaining in the market. There were no system stress events during the winter period November 2017 – end February 2018. Even with the prolonged period of cold weather in late February / early March, margins remained healthy.

[3] National Grid Winter Outlook 2017

Capacity Market Payments

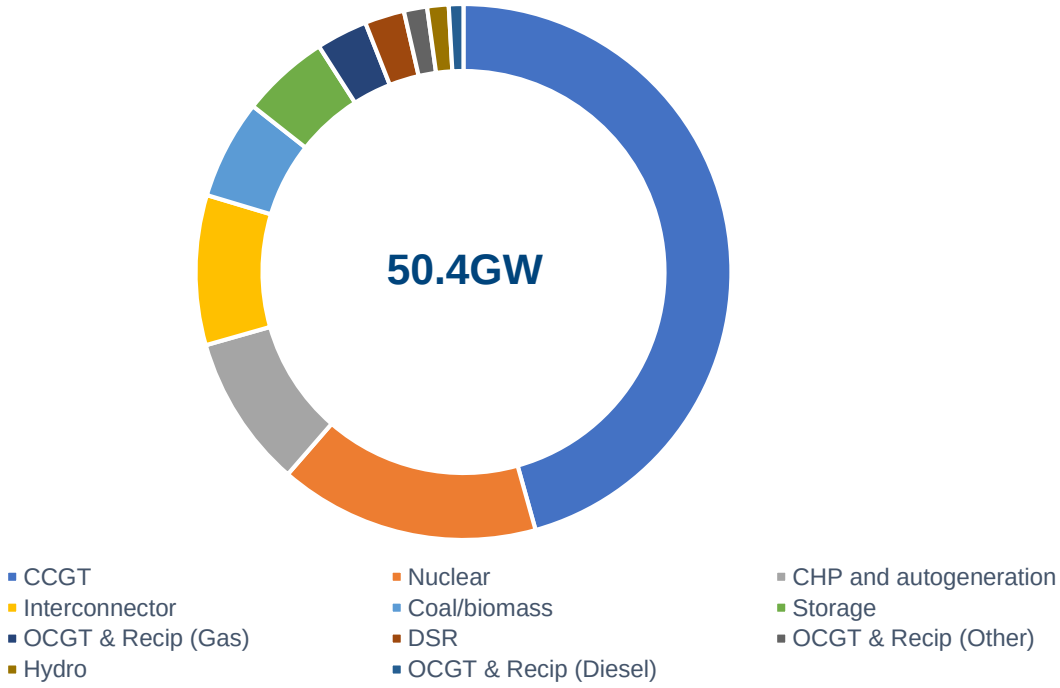
12. Electricity Settlement Company records show that to date £220.7m was paid out to capacity market agreement holders during the 2017/18 financial year[4].

T-4 Auction for 2021/22

13. The fourth T-4 Capacity Market auction concluded in February 2018, securing 50.4GW of capacity at a clearing price of £8.40/kW. Just over 74.2GW of capacity entered the auction, of which 67.9% received capacity agreements for delivery.

14. Figure 1 shows the breakdown of Capacity Agreements awarded by technology type in terms of capacity (MW).

Figure 1 – The breakdown Capacity Agreements awarded by technology type in 2021/22 T-4 Auction



15. The total forecast cost of capacity agreements awarded in this auction is £423.4m (in 2017 prices).

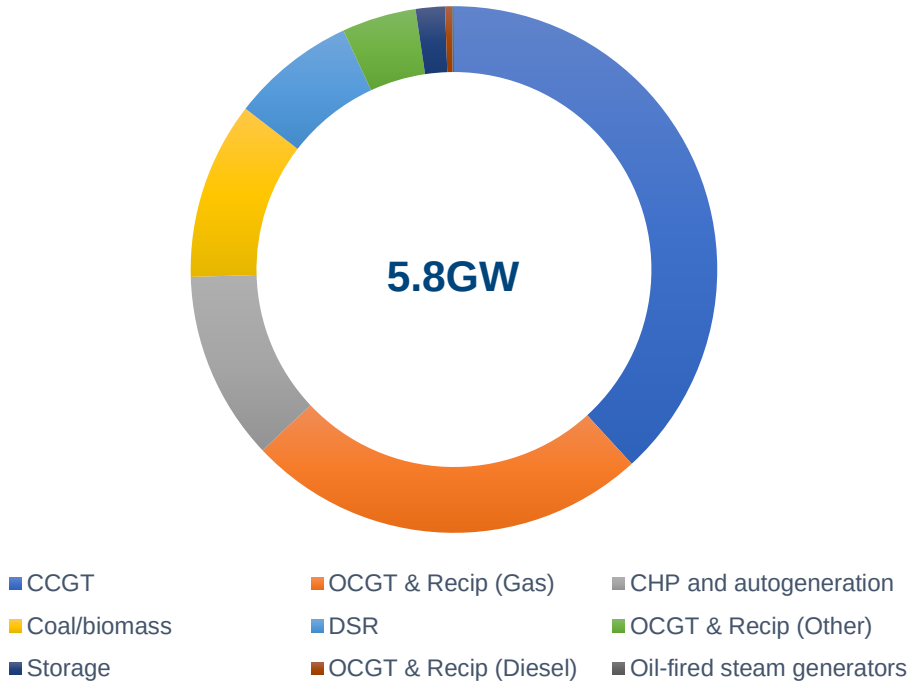
[4] Electricity Settlements Company Annual Report and Accounts 2017/18

T-1 Auction for 2018/19

16. The first T-1 Capacity Market auction for delivery in 2018/19, which tops up the capacity secured through an earlier T-4 auction, was concluded in January 2018, securing 5.8GW of capacity at a clearing price of £6.00/kW. Just over 10.6GW of capacity entered the auction, of which 54.2% received capacity agreements for delivery.

17. Figure 2 shows the breakdown of Capacity Agreements awarded by technology type in terms of capacity (MW).

Figure 2 – The breakdown Capacity Agreements awarded by technology type in 2018/19 T-1 Auction



18. The total forecast cost of capacity agreements awarded in this auction is just short of £34.7m (in 2017 prices).

Appeals Processes for T-4 Auction for 2021/22 and T-1 Auction for 2018/19

19. All unsuccessful applicants for pre-qualification had the opportunity to have the decision reviewed as part of a two-tier dispute resolution process – initially by the Delivery Body, National Grid (Tier 1) and subsequently by Ofgem (Tier 2). During the 2021/22 T4 and 2018/19 T-1 pre-qualifications the majority of Capacity Market Units (CMUs) were successful in overturning the initial prequalification rejections through Tier 1 appeals. Of the 52 Tier 2 disputes received, ten decisions were overturned.

Changes to Capacity Market Rules and Regulations

20. After consultation a series of changes were made to the Capacity Market under the Capacity Market (Amendment) (No. 4) Rules 2017[5] and Ofgem's Capacity Market (Amendment) Rules 2018[6].

State Aid

21. In December 2014 Tempus Energy brought a challenge against the European Commission's decision in 2014 to grant State Aid approval to the Capacity Market. The General Court of the Court of Justice of the European Union heard the case on 11th July 2017. The UK intervened as an interested party. The Government is awaiting the judgment. The operation of the Capacity Market is unaffected unless and until there is an adverse judgment.

Panel of Technical Experts

22. The Panel of Technical Experts is an independent group which is tasked with scrutinising the analysis that National Grid provides to Government on how much capacity to auction. Their remit does not include policy decisions, outcomes or costs to consumers. The Panel's 2018 report[7] commented in particular on National Grid's capacity assessments for the 2022/23 T-4 and 2019/20 T-1 auctions and on de-rating factors for interconnectors[8].

[5] Capacity Market (Amendment) (No. 4) Rules 2017

[6] Capacity Market Amendment Rules 2018

[7] Available at: https://www.gov.uk/government/publications/national-grid-electricity-capacity-report-2018-findings-of-the-panel-of-technical-experts

[8] Derating factors adjust the assumed deliverable capacity to take account of reliability and other factors. Different derating factors are applied to different technologies at different rates.

Electricity Balancing Significant Code Review (EBSCR)

23. The first phase of Ofgem's Electricity Balancing Significant Code Review (EBSCR) reforms to cash-out arrangements came into effect for winter 2015/16. The objective of the reforms is to address issues with balancing arrangements which undermine efficiency in balancing and security of supply. The second phase of the reform will come into effect this winter (2018/19), further sharpening the cash-out price and increasing the Value of Lost Load for imbalance from £3K/MWh to £6K/MWh.

24. In conjunction with the Capacity Market introduction, EBSCR reform has the potential to strengthen the provision of security of supply by the wholesale market – for instance, by incentivising suppliers to strike demand-side reduction contracts rather than risk facing the cash-out price on their imbalances. The introduction of EBSCR and the Capacity Market will also help to ensure security of supply is delivered at least cost.[9]

[9] The incentive will be even stronger once the basis for arriving at the cashout price (Par 50 to Par 1) comes into effect on 1 November 2018 as per the BSC

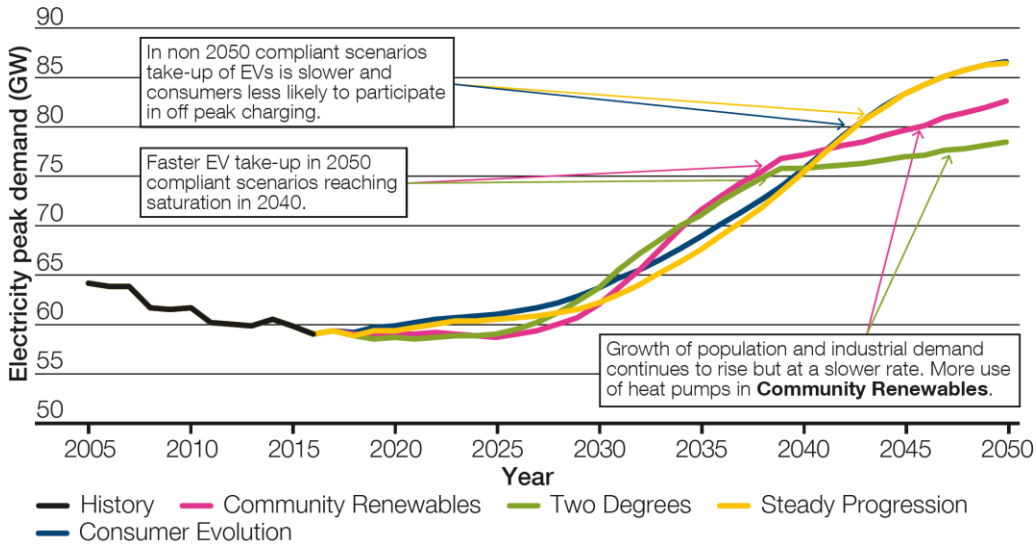
Demand

25. Chart 1.1 shows historic and forecast trends of underlying peak electricity demand from National Grid. This includes demand met by generation which is connected to the transmission network as well as embedded generation above 1MW (generation that is connected directly to the distribution network). Peak electricity demand has been declining in recent years; peak demand levels were around 59GW over winter 2017/18 down from around 64GW in 2005.[10]

26. National Grid has published four scenarios for electricity demand as part of its UK Future Energy Scenarios (FES) project. National Grid changed the framework of its scenarios for this year's report so that they are aligned against two new axes: "speed of decarbonisation" and "level of decentralisation". Under the Two Degrees and Community Renewables scenarios the UK meets its 2050 carbon reduction target the other two scenarios do not.

27. Under all scenarios the electricity peak demand is moderated by improvements in appliance efficiency until 2030. After this all scenarios predict a steep rise in electricity demand, primarily due to electrification of transport. For the Community Renewables and Two Degrees scenarios growth in peak electricity demand after 2040 is not as dramatic as the other two scenarios due to the use of smart charging technologies.

Chart 1.1 Future Development of Underlying Peak Electricity Demand



Source: National Grid Future Energy Scenarios 2018[11]

10 Please note that National Grid has reviewed and recalculated its historical peak demand data to use the most up to date information it has. Further information about these changes can be found in National Grid's Demand Incentive Letter to Ofgem.

11 National Grid Future Energy Scenarios 2018

Demand Side Response (DSR)

28. DSR was aided by the Transitional Auctions (TA), which encouraged providers to offer more capacity in the Capacity Market. DSR has been successful in the CM auctions, with around 1.2GW and 1.4GW of DSR capacity contracted in the 2017 and 2016 T-4 Capacity Market (CM) auctions.

29. The precise volume of DSR currently utilised in GB is unknown because DSR arrangements between businesses can be organised independently of network owners. It is also not always clear what proportion of DSR is achieved by using on-site back up generation versus turning demand down/off, however findings from the evaluation of the first TA estimate that 10-15% of delivered capacity was turn-down DSR.

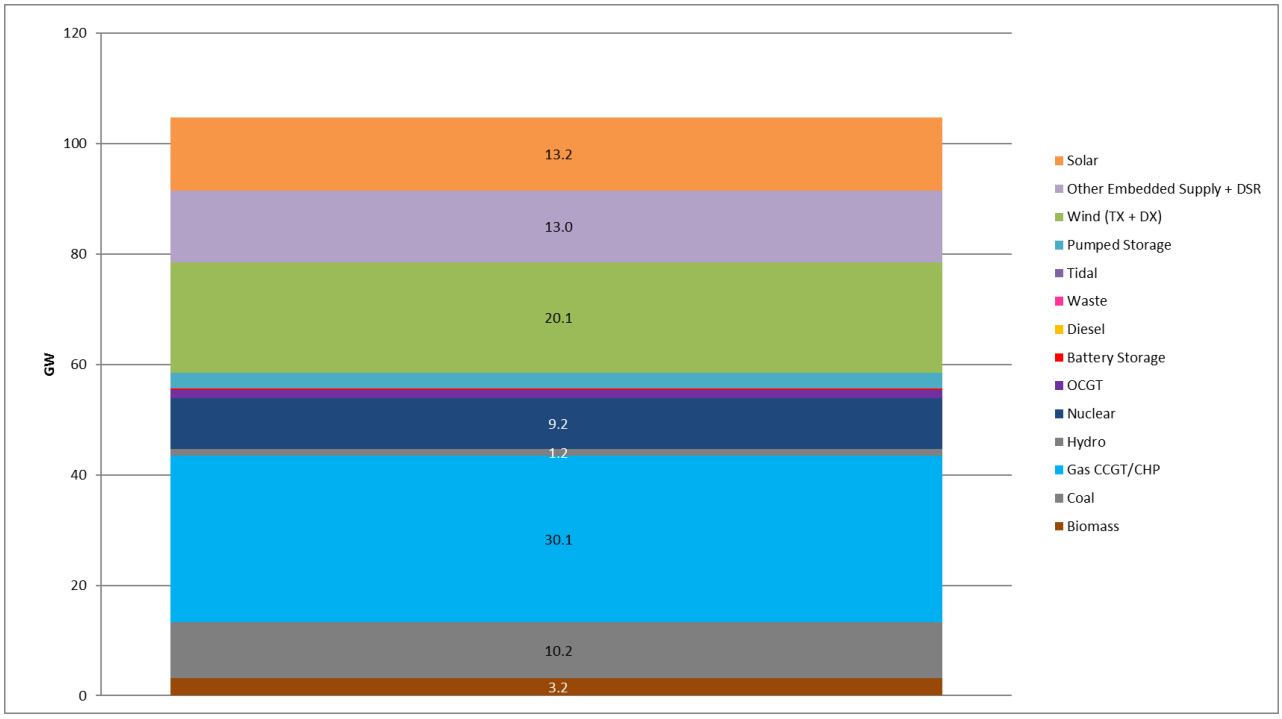
30. Parliament tightened the eligibility for the second Transitional Arrangements auction so that it focused on turn-down DSR rather than DSR enabled by on-site back up generation.

Supply

Present Capacity

31. National Grid's 2018 Winter Outlook Report assumes a total of approximately 104.7 GW of GB generation capacity (including solar) to be available this winter (2018/19) for the base case and Chart 1.2 shows the breakdown[12].

Chart 1.2 Generation Capacity by technology type (winter 2017/18)

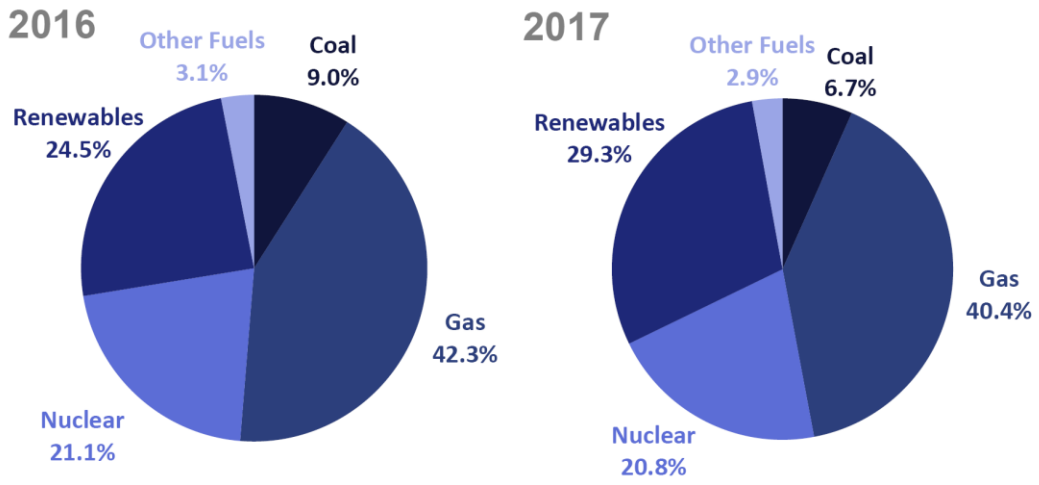


Source: National Grid Winter Outlook Report 2018[13]

12 Solar power is not relevant to security of electricity supply during winter peak.

13 National Grid Winter Outlook Report 2018

Chart 1.3 Shares of Electricity generation, by fuel, in 2016 and 2017



Source: DUKES 2018[14]

Storage

32. In GB there is currently around 3GW of electricity storage capacity, the vast majority of which is from pumped hydro. Storage can be operated flexibly, meaning it can offer supply or demand to the electricity system within seconds to minutes, and is widely used, alongside other technologies, by National Grid to balance and maintain the integrity of the electricity system.

33. Around 1GW of battery capacity is contracted to come online by 2021 through the 2016 and 2017 Capacity Market Auctions, with a subset of these also obtaining Enhanced Frequency Response (EFR) ancillary service contracts with National Grid.

34. While lithium ion battery storage is currently where the highest growth in storage deployment is being seen, there is potential for other storage technologies to deploy in future, such as those using different battery chemistries or new-build pumped hydro. The rise of Electric Vehicles running on lithium ion batteries is also expected to see mobile storage capacity support the energy system, through the use of vehicle-to-grid technologies[15].

[14] Digest of UK Energy Statistics 2018

[15] National Grid Future Energy Scenarios 2018

Electricity Networks

Current network reliability

35. The networks, both transmission and distribution, remain reliable but along with the rest of the electricity system, continue to require investment to ensure they continue to facilitate the transition to a low carbon system. Ofgem's price control settlements through its RIIO (Revenue = Incentives + Innovation + Outputs) model are ensuring this investment takes place and drives further efficiency savings. The historic overall reliability of supply has been high, with overall reliability for the transmission network at 99.999962%[15] for financial year 2016/17.

36. Offshore Transmission Owners face statutory obligations and regulatory incentives to create an operating environment designed to reduce unsupplied electricity. They are incentivised to maintain availability of their offshore transmission systems. This ensures offshore generators are able to export energy with minimal disruption. For the financial year 2016/17, the average availability of offshore transmission systems was 99.36%[16].

37. As part of the price control process, Ofgem set target and incentive rates for the number of customer interruptions and customer minutes lost for each Distribution Network Operator (DNO). The 'Interruptions Incentive Scheme' (IIS) 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.

38. 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.

Future development of electricity networks

39. The 2013 to 2021 transmission price control (RIIO-T1) started on 1 April 2013. Ofgem has approved funding of up to £22.50bn for expanding, replacing and maintaining the GB transmission network for RIIO-T1.

40. In addition, the transmission owners provide quarterly updates on their major projects to BEIS and Ofgem[17]. The latest update shows that 3.85GW of network capacity is under construction for delivery by Q3 2019, with 8.35GW delivered since February 2012.

16 National Electricity Transmission System Performance Report 2016 – 2017

17 Electricity transmission networks: major projects update 2018

41. As part of the first price control for the 14 regional electricity DNOs under the RIIO process Ofgem has approved overall funding of £24.60b across GB for the period 1 April 2015 to 31 March 2023. This represents a major investment in the distribution network.

Interconnection

42. GB currently has 4GW of electricity interconnector capacity with mainland Europe and the Irish electricity market. This consists of a 2GW link to France (IFA), a 500 MW link between Wales and Ireland (East-West), a 1GW interconnector with the Netherlands (BritNed), and a nominally rated 500MW link between Scotland and Northern Ireland (Moyle).[18]

43. There is a significant pipeline of projects 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 18GW. 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).

44. There are four projects under construction, which will add 4.4GW of capacity:

    i. Nemo Link – 1GW to Belgium, expected to be completed in 2019;
    ii. NSL – 1.4GW to Norway, expected to be completed in 2021;
    iii. ElecLink – 1GW to France (via the Channel Tunnel), expected to be completed in 2019; and
    iv. IFA2 – 1GW to France, expected to be completed in 2020.

45. Three more projects were granted initial regulatory approval in GB through Ofgem's first cap and floor application window. These would add a further 3.3GW of interconnected capacity and could be connected by 2023:

    i. FAB Link – 1.4GW to France;
    ii. Greenlink – 0.5GW to Ireland; and
    iii. VikingLink – 1.4GW to Denmark.

46. Ofgem has also granted initial project approval to three projects through the second cap and floor application window. These would add 4.2GW of interconnected capacity and could be connected by the early 2020s:

    i. GridLink – 1.4GW to France;
    ii. NeuConnect – 1.4GW to Germany; and
    iii. NorthConnect - 1.4GW to Norway.

[18] Moyle's transmission entry capacity is currently limited to 90MW in Scotland, but will rise in future to 500MW by 2022/23, with export capacity at 450MW.

47. Another project, Aquind, 2GW to France, is not applying for the cap and floor but instead has applied for exemptions from certain aspects of EU Regulations.

Market Functioning

48. Energy market firms buy and sell their electricity in the wholesale market. The wholesale market allows participants to trade in 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.

49. 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 plant with negative consequences for security of electricity supply.

50. Ofgem and industry had concerns about the lack of liquidity of the wholesale electricity market. Ofgem's liquidity project has examined poor liquidity in the electricity wholesale market and the potential barriers that this poses to competition and entry in the market. After extensive consultation, Ofgem activated the 'Secure and Promote' licence condition on 31 March 2014, with the aim of ensuring that all parties can access the wholesale market effectively and that robust reference prices are available from the wholesale market. Ofgem has monitored the success of the licence condition and published its first report on 9 September 2015[19] and its second annual report on 3 August 2016[20].

51. Ofgem's liquidity monitoring shows mixed results. Some indicators have improved since the introduction of the policy. For example, there has been a slight increase in the volume of contracts traded since the policy began - a total of 1,104 TWh of wholesale electricity was traded in GB during 2017, up 17% from 2013. Of note, the volume of longer dated peakload products has increased, which makes hedging easier for participants. Further, bid offer spreads on mandated products have also decreased, from 0.7% in 2013 to around 0.4% in 2017. This gives market participants confidence that they can buy and sell without significant transaction costs.

52. However, some indicators have been inconsistent, for example although average churn rates in 2017 were 3.7, up from 2.9 in 2013, they fell compared with 4.7 in 2016. Similarly, total over-the-counter trading fell in 2017 from 779TWh, down from 1,083TWh in 2016. This reflects an increase in trading in 2016 that could have been driven by increased price volatility, rather than by structural change. Yet churn is just one measure of liquidity, and we note that

[19] Wholesale Power Market Liquidity Annual Report 2015
[20] Wholesale Power Market Liquidity Annual Report 2016

independent suppliers have told us they are finding it easier to access the products they need.

53. In summer 2017, Ofgem consulted on the impact of the Secure and Promote special licence condition on wholesale electricity liquidity and on the possible need for change[21]. This identified a medium-term need to explore the criteria used to decide which companies should face the market making obligation (MMO) special licence condition. In August 2018, Ofgem published an open letter seeking views on the option of suspending the MMO licence condition pending a review.[22] The letter identified a need to bring forward a review due to changing market conditions and the potential for the subsequent reduction in number of parties subject to the MMO to affect the licence condition in meeting its original objectives and/or result in undue burden being place on the remaining obligated parties. Ofgem intend to review the MMO criteria and other potential mechanisms for delivering market making throughout 2019, with responses to the open letter due by 20th September 2018.

[21] Secure and Promote Review: Consultation 2017
[22] Open letter: Secure and Promote Update

Gas

Introduction

1. GB's gas system has delivered securely to date and is expected to continue to function well, with a diverse range of supply sources and sufficient delivery capacity to more than meet demand. The UK Continental Shelf (UKCS) remains a major source of gas in the GB market, with the remainder imported from a variety of sources, including pipelines from Norway, interconnection with the Continent through the IUK and BBL pipelines and some of the largest liquified natural gas (LNG) import infrastructure in Europe. There are a range of future supply outlooks, but all show sufficient gas available from the combination of domestic, regional and global markets.

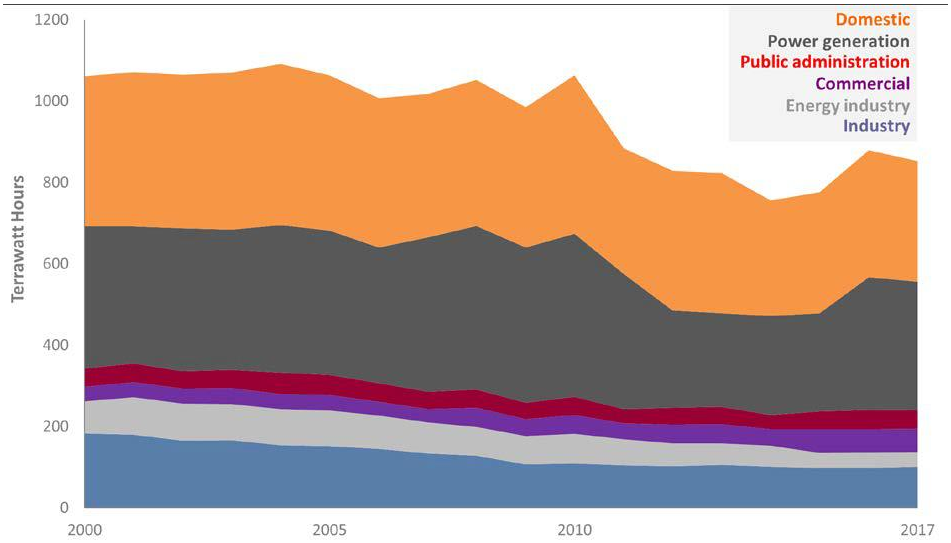
2. Gas is a central part of the GB energy system and gas security is of importance to all parts of society and the economy, both directly (i.e. through its use as a fuel source for domestic heating and cooking, and for various industrial uses) and indirectly (i.e. because of its role in electricity generation). Past analysis by BEIS (including that undertaken for the 2017 Strategic Assessment of Gas Security of Supply[23]) and by Ofgem has provided valuable insight into the nature of the risks to our gas security, building an evidence base that UK gas supply infrastructure is resilient to all but the most extreme and unlikely combinations of severe infrastructure and supply shocks. Nonetheless there is always future uncertainty – for gas this includes wider energy system changes required to deliver lower carbon energy, increasing import dependency and the future mix of sources of gas (both domestic and international).

Demand

3. Chart 2.1 shows annual gas usage by sector since 2000, with overall gas consumption falling through to 2014 until a slight uptick in 2015 and 2016, then it fell again in 2017. Overall, gas demand has fallen by more than a fifth compared with 2000. Over this period, significant reductions in gas used for power generation have been notable, although a reduction in coal-powered generation in 2016 led to the increased use of gas that year. Gas for power generation fell again in 2017, reflecting the longer-term trend. Peaks in gas demand increasingly correspond with weather variations, not only in terms of fuelling space heating in homes and other buildings, but also to provide flexible power generation at times of lower renewables output.

[23] Gas Security of Supply Strategic Assessment and Review

Chart 2.1 Annual gas usage by sector since 2000



Source: DUKES 2018[24]

4. Gas demand in 2017 was 3 per cent lower than in 2016. The principal cause was a reduction in final gas consumption caused by generally warmer temperatures, which resulted in a reduction in demand for gas for space heating. Domestic consumption was down 4.6 per cent compared to 2016.

5. Demand for natural gas from the industrial sector in 2017 increased by 3.2 per cent compared to 2016, with a marked 8.4 per cent increase in gas used in the chemicals sector.

6. Gas demand in Q1 2018 was 7.8 per cent higher compared to the same time last year. Colder temperatures at the end of February and beginning of March 2018 resulted in an increase in demand for gas in the domestic sector. Domestic use was up 16 per cent, as was demand from other final users, driving an increase of 14 per cent in final consumption in Q1 2018 with respect to the first quarter of 2017[25]. Demand for gas used for electricity generation fell on the previous year by 1.9 per cent, as a result of increased low carbon electricity generation[26].

7. In addition to meeting annual demand, the gas market's ability to meet demand on a peak day is an important security of supply consideration. In general, a 1-in-20 peak day demand is over double the average daily gas demand over a year with seasonal normal temperatures. Gas market participants build redundancy into their supply arrangements, above the

[24] Digest of UK Energy Statistics 2018

[25] 'Final consumption' relates to gas sold directly to consumers, such as domestic, industrial, services, public administration etc; 'Demand' includes all of these and additional categories, most notably gas used for electricity generation.

[26] BEIS Energy Trends – Gas – Section 4

minimum amount to meet peaks, to manage the risk that other capacity may not be available.

8. The peak winter day demand for 2017/18 was 418mcm[27] on the 1st March, which was the highest level for 7 years and 47mcm lower than the record winter peak day demand in January 2010. The 1-in-20 peak demand for winter 2018/19 is 472mcm/d with a peak deliverability of 575mcm/d[28].

9. On the 1st March, 2018, due to a combination of high gas demand caused by low temperatures, and constrained gas supply caused by a number of infrastructure outages, National Grid issued a Gas Deficit Warning – a signal to the market, which incentivises shippers to supply more gas to the national transmission system to avoid the system being out of balance. This was the first time a Gas Deficit Warning has been issued.

10. The market responded to the Gas Deficit Warning, with extra supplies delivered into the gas system, and by some energy users voluntarily adjusting their gas usage in response to the price of gas. In particular, the electricity generation sector switched fuels to a significant degree, with a greater proportion of coal being burnt in place of the more expensive gas.

11. In addition to issuing a gas deficit warning, National Grid also took actions on the On the day Commodity Market (OCM). By purchasing gas on the OCM, National Grid sends a financial incentive to gas shippers (traders) to flow more gas onto the GB system as purchases they make affect the imbalance charges. This was the first time that offers were able to be placed; however, no offers were placed on the platform. No involuntary demand-side measures (disconnections) were taken by National Grid, because of the market-based response seen after the Gas Deficit Warning was issued.

12. The events of the “Beast from the East” and the ability of the Gas Deficit Warning to drive sufficient market response illustrate the resilience and effectiveness of the gas system even during a stress event.

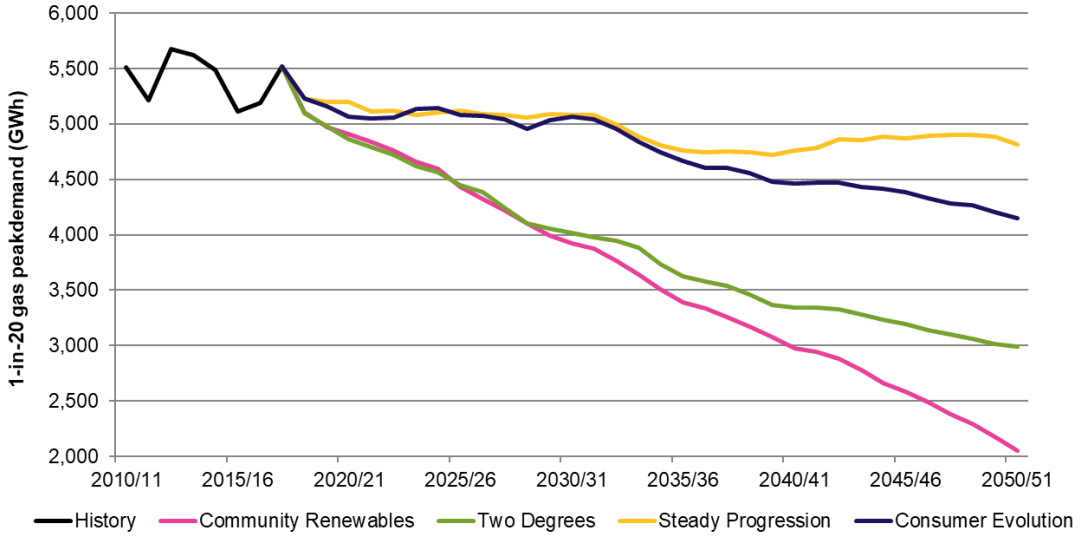
13. Looking further forwards, National Grid’s Future Energy Scenarios (FES) also cover gas peak demand under a range of decarbonisation pathways, as shown in chart 2.2 below. Winter 2018/19 1-in-20 peak demand is estimated at around 5,192 GWh/d (472 mcm/d)[29]. Whilst all four scenarios show a decline in gas peak demand, it varies depending on the pathway: under the pathway with the greatest commitment to the electrification of heat, ‘Community Renewables’, peak gas demand will be supressed to around 2,047 GWh/d (186 mcm/d) by 2050; under the ‘Steady Progression’ pathway with the lowest emphasis on decarbonisation, gas demand will reduce but to a less significant degree, reaching 4,817 GWh/d (438 mcm/d) by 2050. The two remaining pathways sit between these.

[27] National Grid Winter Review and Consultation

[28] National Grid Winter Outlook Report 2018/19

[29] Conversions to mcm assume a representative gas calorific value of 39.6MJ/m^3

Chart 2.2 Gas Demand for a 1-in-20 peak day



Source: National Grid Future Energy Scenarios 2018 charts workbook (chart 4.3)[30]

Demand-Side Response (DSR)

14. The conclusions of Ofgem's Gas Significant Code Review (SCR)[31] placed an obligation on National Grid to develop a centralised demand side response mechanism to encourage greater demand-side participation from industrial and commercial users. National Grid's proposed DSR methodology was approved by Ofgem and went live in October 2016.

15. 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. This platform was deployed for the first time after the issuing of the Gas Deficit Warning in March 2018, however no DSR offers were placed on the centralised platform and no involuntary demand-side measures were taken by National Grid.

Supply

16. To date, the GB gas system has reliably delivered secure supply. Security of supply reports by Ofgem and by BEIS[32] have concluded that the GB market is

[30] National Grid Future Energy Scenarios 2018
[31] Gas Security of Supply Significant Code Review Conclusions
[32] By DECC:

generally secure. Most recently, BEIS's strategic assessment of gas security of supply, published on 12 October 2017[33], noted that GB will have enough import capacity to deliver under high demand and the resilience to cope with severe shocks to the system. The UK's N-1 calculation (whether peak demand could still be met if the single largest piece of infrastructure fails) exceeds the target of 100% with a score of 120%, meaning that UK has 20% more infrastructure than is required to meet demand on the coldest day in 20 winters even if the single largest piece of infrastructure fails. This N-1 score of 120% includes exports to the Republic of Ireland. In the 2017 SSSR, the N-1 calculation excluded exports to the Republic of Ireland, and a direct comparison with the 2017 figure of 127% cannot therefore be made. If exports were excluded in the 2018 calculation, the N-1 score would be 125%.

17. This N-1 forms part of the UK's National Risk Assessment, which is repeated biennially and which was last undertaken in October, 2018.

18. National Grid's FES also examines the adequacy of supply to meet demand, with the greatest system challenge being to meet peak demand. Chart 2.3 shows that in all scenarios, maximum deliverability of gas infrastructure exceeds projected peak demand even under N-1 conditions. Whilst the majority of the FES pathways show gas supply margins increasing due to the overall reduction in gas demand, under the pathway with the highest gas use, 'Steady Progression', the supply margin will reduce to around 62mcm/d by 2050 from around 102.5mcm/d at present due to a continued high demand for gas and significantly reduced UKCS production.

19. Whilst two of the four Future Energy Scenarios include production from shale, for BEIS' purposes of assessing Great Britain's security of supply, no contribution from shale is currently assumed. The increasing role imports are expected to play in the gas supply mix is discussed under *Gas Imports and Outlook* below.

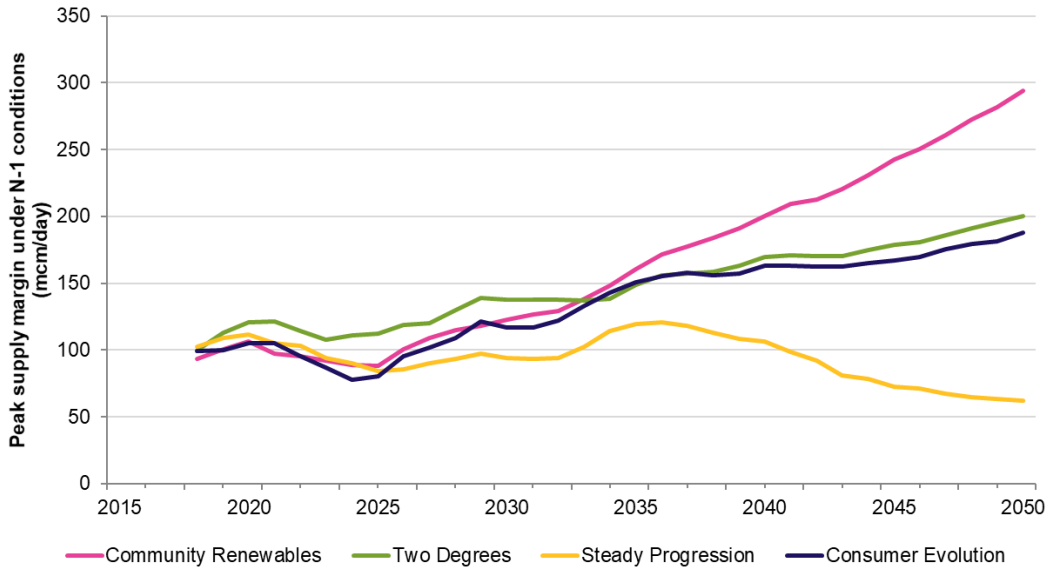
- The Impact of Gas Market Interventions on Energy Security (for DECC by Redpoint, July 2013)
- Gas Security of Supply Report (Ofgem requested by DECC, November 2012)
- GB Gas Security of Supply and Options for Improvement (for DECC by Pöyry, March 2010).

By Ofgem:

- Gas SCR (for Ofgem by Pöyry, January 2014)
- Gas Security of Supply Report: Further Measures Modelling (for Ofgem by Redpoint, November 2012)
- GB Gas Security of Supply and Future Market Arrangements (Report to the Gas Forum by Pöyry, October 2010)

[33] Gas Security of Supply Strategic Assessment and Review

Chart 2.3 Gas margins



Source: National Grid Future Energy Scenarios 2018[34]

Production

20. Domestic UKCS production (also referred to as North Sea gas) is a key source of gas for the UK, accounting for 36% of gas supplies in winter 2017/18[35]. Although production from the United Kingdom Continental Shelf has, since 2014, increased year-on-year due to the development of new fields, increased production at some of the existing fields and production of cushion gas from the Rough storage facility as it is prepared for closure[36], production from the UKCS has generally been falling since the turn of the century, with production declining by around 8% a year between 2000 and 2013[37]. Despite this, the UK remains, along with the Netherlands, one of the two major gas-producing nations within the EU.

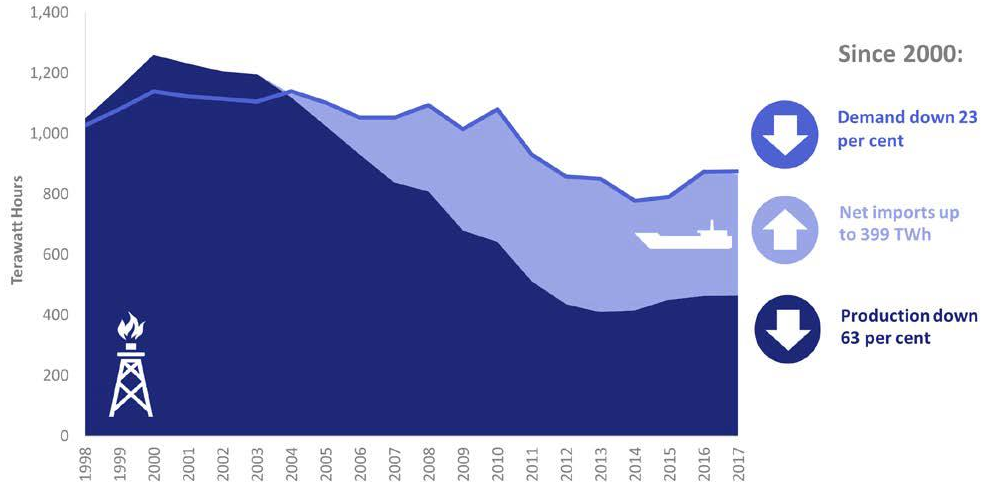
[34] National Grid Future Energy Scenarios 2018

[35] National Grid, 2018 Winter Review, Table 3.2

[36] Without the contribution made by the extraction of cushion gas from the Rough storage facility, overall UKCS production would have fallen by 1.5%.

[37] Digest of UK Energy Statistics 2017, Chapter 4, p.91

Chart 2.4 Changes over time in gas production and demand



Source: DUKES 2018[38]

Import capacity and outlook

21. The UK has a diverse range of sources of gas supply, including domestic production, pipeline imports from Norway and mainland Europe, LNG from global markets, and storage (which is not strictly speaking a 'source' of gas but is an important source of system flexibility). GB's gas supply infrastructure is capable of sustaining a 1-in-20 peak day demand as required under National Grid's Gas Transporters Licence. This is defined as the amount of infrastructure (pipes and compressors etc.) needed to transport the gas that would be required by our customers in the coldest day of winter, in the coldest winter we can expect in a 20-year period.

22. Currently, the UK has an import deliverability[39] of ~56 bcm/y from Norway[40], ~43 bcm/y from capacity connected to the Continent, and ~49 bcm/y from LNG import terminals.[41]As UKCS production declines, imports will play an increasing role in meeting UK gas demand. Domestic production of gas from shale could offset an increasing dependence on imports; however, to what extent it is not clear and, as such, is not factored into BEIS' assessments of security of supply.

[38] Digest of UK Energy Statistics 2018

[39] Nameplate deliverability figures may differ from actual operational deliverability

[40] Norway is a crucial gas supplier to the UK, supplying 39% of total gas in winter 2017/18 and accounting for over 60% of total imports in quarter one of 2018.

[41] Gas Ten Year Statement 2017. Nameplate deliverability figures may differ from actual operational deliverability.

23. 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. National Grid's FES notes that there are a wide range of possible supply patterns but that the gas market provides enough gas from Europe and beyond to make up the difference between GB's indigenous supply and demand. A key factor in GB's ability to secure the necessary gas it is an appropriately incentivised, flexible and accessible market. This is discussed under *Market Functioning* below.

Storage

24. Storage itself does not produce gas but allows gas from other sources (whether domestic or imports) to be held until times of high demand.

25. Storage takes in gas when it is low priced (usually at times of over-supply such as in the summer) and returns it to the system when prices are high (usually during peak demand). Some storage operates over short timescales (days/weeks) while other facilities exploit longer term seasonal differences. GB storage does not operate as a 'strategic reserve' of gas – providing a large volume of gas to be used in case of an emergency but otherwise not utilised. Instead, the value of storage lies in its ability to operate flexibly in response to relatively short-term price signals.

26. In June 2017, Centrica Storage announced the closure of Rough as a storage facility. On 26 September 2017 the Oil and Gas Authority (OGA) granted consent to produce 868.81mcm of cushion gas on safety grounds. Centrica estimated 5.18bcm of recoverable reserves but actual recoverable reserves and production timeline will be dependent on economics. Since this consent was granted, Rough has been classed as a production field rather than a storage site and is now included in the production figures listed above. In 2018, EDF announced the withdrawal of the Hole House Farm storage facility from commercial operation. With a capacity of 0.022bcm, Hole House Farm was the UK's smallest storage facility and no significant security of supply impact is expected to arise from this commercial decision.

27. The economics of storage relies on the variations in gas price over time (the spreads). For long range storage such as the former Rough storage facility, this is summer-winter (seasonal) spreads and for short range storage it is a combination of seasonal and shorter-term spreads. Seasonal volatility in the gas market has declined, which can be explained by the diversity of supply sources and capacity of infrastructure, both in the UK and across Europe. In particular, seasonal spreads have declined significantly, impacting the economics of storage facilities in the UK. The closure of Rough and the withdrawal from operation of Hole House are not considered to undermine security of supply. Nonetheless, we will continue to monitor the value of long-term storage as the dynamics of the gas market continue to evolve.

28. Whilst the CEPA (2017) report was concluded before the announcement in June 2017 of the planned closure of the Rough gas storage site, the scenarios considered within the report examine the impact of Rough closing. As such, the announcement of Rough's planned closure is not considered to have impacted the findings of the CEPA (2017) report, or BEIS' assessment

of security of supply. As the Strategic Assessment outlines, current and forecast levels of GB supply and storage infrastructure are sufficient to meet customer demand in all but the most extreme cases.

Market Functioning

29. The UK gas market is one of the most liquid and developed markets in the world. The National Balancing Point (NBP) is by far one of Europe's largest traded gas markets, with only the Netherlands' comparable in size. In 2017, total traded volumes were approximately 1,853 bcm in the GB market[42]. There is a diverse range of products and platforms available for those looking to trade at the NBP. This includes a wide range of forward and spot contracts with significant trading volumes throughout. Furthermore, market concentration is at healthy levels, indicating competition between participants.

30. This liquidity is evidenced by high "churn rates" at the NBP, i.e. the number of times a unit of gas is traded between extraction and consumption (one indicator of liquidity). GB continues to perform well on this indicator, with annual average churn of 23 in 2017; a number in excess of 10 is taken by industry commentators to indicate gas hub maturity. This churn rate was notably higher than gas hubs on Continental Europe with the exception of the Dutch TTF (Title Transfer Facility). High liquidity benefits security of supply as it provides gas producers with effective markets where they can bring gas, and also the means by which gas consumers can indicate their willingness to buy.

Network Reliability

31. The UK gas transmission network achieved 99.975% reliability in 2016/17[43]. An interruption is classed as a significant event on the NTS that causes a cessation of flow relating to the loss of firm or Off-Peak Capacity at an NTS Exit Point where commercial tools have not been utilised. In the last year there have been three incidents directly impacting the UK gas distribution network, which resulted in precautionary evacuations of properties: two in Central London and the other in the East of England. One incident in London resulted in the precautionary evacuation of approximately 650 people and 550 local businesses on safety grounds. The other London incident resulted in the evacuation of 100 properties. The case in the East of England was caused by a damaged pressure main and resulted in the evacuation of 3 properties.

32. The distribution network that carries gas directly to consumers is equally robust, with a reliability rating of 99.998%[44] for 2016/17 across gas distribution network operators.

[42] Ofgem, Wholesale Market Indicators, Gas Trading Volumes and monthly churn ratio by platform (GB)

[43] Ofgem, Energy Networks Indicators, Network reliability: Gas transmission (RIIO-T1)

[44] Ofgem, Energy Networks Indicators, Network availability: Gas distribution (RIIO-GD1)

Oil

Introduction and Summary

33. This chapter sets out a summary of key facts and figures on UK oil demand and supply, production and imports. Oil currently meets around a third of primary energy demand and is the main energy source for transport, meeting virtually all the UK's needs, other uses include electricity generation, industrial processes, domestic heating and as feedstock for petrochemical, industrial and construction products and processes. 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.

34. 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 / export infrastructure on coastal locations able to source fuels from around the globe, notably from the Amsterdam-Rotterdam-Antwerp (ARA) oil hub.

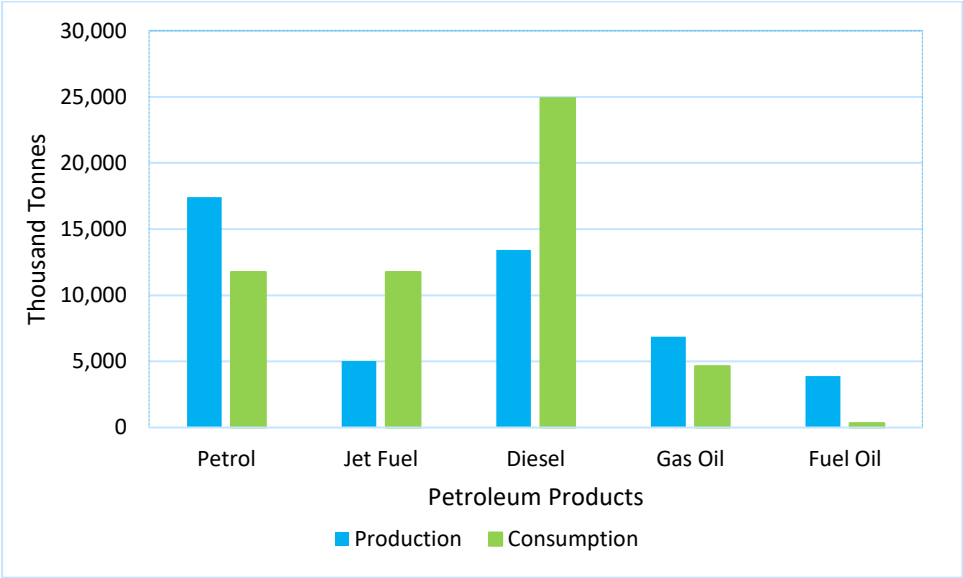
35. Analysis by BEIS has provided valuable insight into the risks of specific point failures in our downstream oil supply infrastructure. The evidence shows that the UK fuel supply is resilient to most shocks where the market is able to adapt as it has done historically. However, for the case of very short-term disruptions BEIS has identified some measures that are able to increase our fuel resilience, most notably through leasing additional truck and trailers to add to the supply chain, which we have done since late-2016. BEIS consulted on further measures that may improve the sectors' resilience in late-2017 and published its response to the consultation in April 2018.[45] BEIS is committed to maintain an ongoing relationship with industry in finalising the proposed measures and to ensure that the best solutions are found and implemented efficiently.

Demand

36. Primary demand for oil was stable in 2017, up just 0.5 per cent on the year before. Demand has been increasing or stable for 3 consecutive years now and has been largely driven by demand for transport fuels. However, demand for oil products for use at petrochemical plants also increased. Demand for oil in the UK is set to decrease further in the long term in order for the UK to meet its 2050 climate change objectives and rebalance the economy towards more sustainable and secure energy supplies.

[45] https://www.gov.uk/government/consultations/downstream-oil-supply-resilience

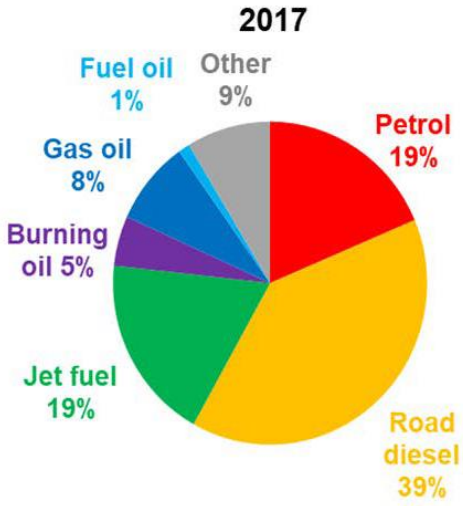
Chart 3.1: Production and consumption of key petroleum products 2017



Source: DUKES 2018[46]

Chart 3.2: UK 2017 oil demand by petroleum product type

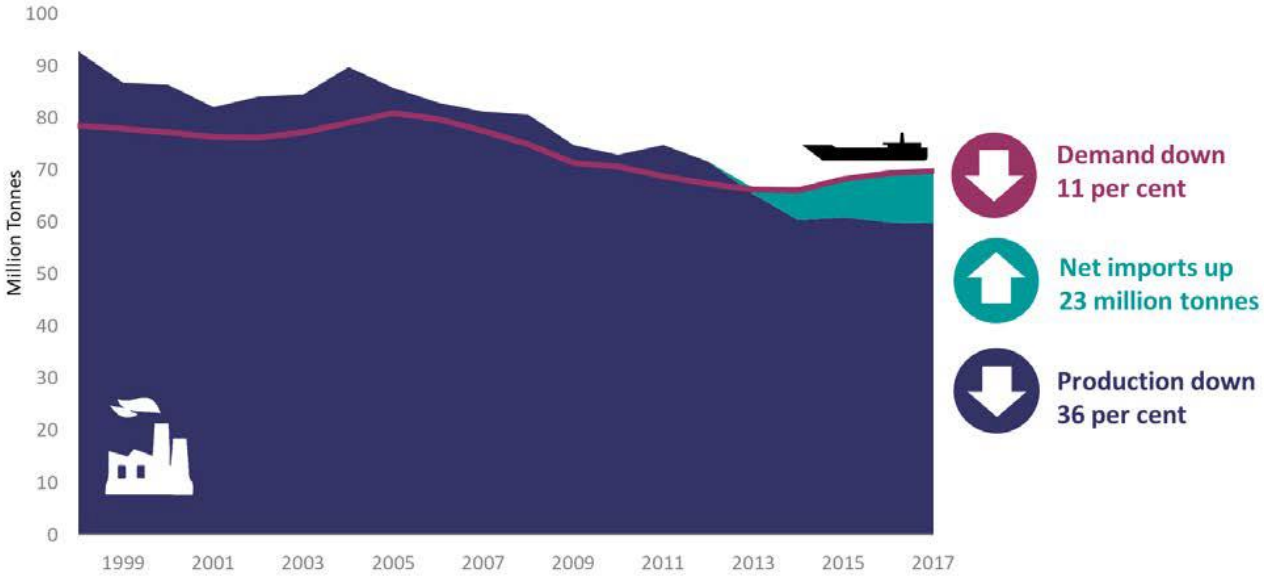
Petroleum Product Type	Quantity (Million Tonnes)
Petrol	11.7
Road Diesel	24.9
Jet Fuel	11.8
Burning Oil	3.2
Gas Oil	5.3
Fuel Oil	0.7
Other	5.5



Source: Energy in Brief 2018[47]

[46] Digest of UK Energy Statistics 2018
[47] UK energy in brief 2018

Chart 3.3: UK Petroleum product demand, production and imports



Source: DUKES 2018[48]

Supply

UK Oil Production

37. From its peak of 137 million tonnes at the turn of the century UKCS production has dropped nearly two-thirds to 47 million tonnes. Production fell by 2 per cent in 2017 however this was due to disruption at the Forties Pipeline System in December without which production would likely have been stable on 2016. The long-term future will depend on the level of investment and the success of further exploration.

38. The Oil and Gas Authority estimates that there are 501 million tonnes of proven and probable (2P) oil reserves at the end of 2017, of which 330 million tonnes are proven reserves. The volume produced plus 2P reserves have grown substantially since 1980, increasing by 116%. The increases reflect new discoveries, new technology allowing exploitation of resources that were previously regarded as uncommercial, and the inclusion of already-known fields as they entered production or moved from 'prospective' to 'probable' status.

Crude Oil

39. The UK is a significant exporter of crude oils as well as an importer and the direction of this trade is dependent on the prevailing market conditions. Crude oil exports increased in 2017 to reach over 34 million tonnes due to strong demand from refineries in the Middle East. Principal export destinations for

[48] Digest of UK Energy Statistics 2018

crude oil have historically been the Netherlands, Germany, France and the US, which together comprised 60 per cent of total crude exports in 2017.

40. The UK's own production of crude oil would have been sufficient to meet roughly 80 per cent of UK refinery demand in 2017, but the increase in the diversity of sources coming into the UK reduced the impact of a disruption to any one source of supply on the UK. In 2016, 15% of UK crude oil production was used by UK refineries.

Refined product

41. UK oil refineries have continued to rationalise and optimise their operations but despite this throughput was stable in 2017 (down just 0.3 per cent on 2016). The market will continue to drive changes in the supply sector and HMG recognises the benefit of ensuring that a mix of domestic refining and imports remains viable in the UK, so far as market conditions allow.

42. In 2017, UK refinery production was 31% petrol, 24% diesel and 9% aviation fuel, with the remaining volumes primarily being other light and heavy distillates. This is significantly different from the demand pattern. To balance demand, the UK trades widely and is one of the largest importers of jet fuel and road diesel in the OECD and one of the largest exporters of petrol.

43. Approximately 39% of fuel produced by UK refineries in 2017 was exported, of which 47% was petrol and 13% fuel oil.

44. Imports of diesel road fuel and jet fuel to the UK are increasing. In 2013, the UK became a net importer of petroleum products for first time since 1984. In 2017, the UK was a net importer by 10.4 million tonnes, 3 per cent down on 2016.

45. The UK has a well-developed infrastructure for the trade of both crude oil and petroleum products and sources its petroleum products from a diverse range of countries. In the main, European countries export large volumes of diesel to the UK, and the United Arab Emirates, Saudi Arabia and Kuwait are major trading partners for jet fuel.

Resilience

46. Overall the UK remains well supplied by a combination of domestic refining and imported fuels. The Winter of 2017-2018 saw the unplanned shut-down of the Forties Pipeline System in December, followed by an exceptional sequence of disruptions at key Liquefied Petroleum Gas supply sites in England and Wales and a period of unusually severe winter weather (the 'Beast from the East'). To mitigate shortfalls in supply to end users, the industry was granted a temporary relaxation of the European Union Regulations that enforce drivers' hours for the drivers of vehicles transporting LPG to local distribution depots in England and Wales. Some fuel delivery companies also claimed Emergency Exemptions from rules on drivers' hours to help local fuel deliveries of both heating oil and LPG to get through to households who were running short due to the severe weather.

Emergency oil stocks

47. 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. In 2017, the UK's obligation was approximately 12 million tonnes of crude oil equivalent, similar to levels in 2016.

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