Department of Energy & Climate Change

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Making a positive difference for energy consumers

Statutory Security of Supply Report 2013

A report produced jointly by DECC and Ofgem, other than the Annexes which are produced by DECC alone

Annex A: Electricity Capacity Assessment Report Response from the Secretary of State

October 2013

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2013

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Annex A: Electricity Capacity Assessment Report Response from the Secretary of State

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Executive Summary

Introduction

This report discharges the Government and Ofgem's obligation under section 172 of the Energy Act 2004[1] as amended by section 80 of the Energy Act 2011, to report annually to Parliament on the availability of electricity and gas to meet the reasonable demands of consumers in Great Britain (GB). It also discharges the Government's obligation under certain EU Directives[2] to monitor gas and electricity security of supply and publish reports.

The technical data presented here has been produced from analysis conducted by DECC, 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.

Last year the Government published its Energy Security Strategy[3] which it sets out the policy considerations relating to security of supply and which assessed key cross cutting risks to energy security and the characteristics that imply a secure system for each key fuel: adequate capacity, diversity, reliability and demand side responsiveness. An annex to this report updates the indicators which were presented in the strategy.

Electricity

To date GB's electricity system has provided secure supplies. However, the system faces some significant challenges over coming years. Older more polluting generation capacity has been closing under EU directives and some generation infrastructure is naturally coming to the end of its working life. In addition the system needs to adapt to ensure the UK can meet its decarbonisation objectives. Ofgem's recent Electricity Capacity Assessment Report published in June 2013[4] re-iterated concerns that the risks to security of supply are expected to increase from their current levels, over the coming decade. Annex A to this report provides the Secretary of State's response to Ofgem's 2013 Electricity Capacity Assessment. In response to tightening capacity margins and increasing risks to security of supply, Government is legislating to run a Capacity Market in 2014 for delivery in year 2018/19. In light of the uncertain outlook to security

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[1] Available from http://www.statutelaw.gov.uk/Home.aspx

[2] Directive 2009/73/EC of the European Parliament and the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC augmented by Regulation (EU) 994/2010 of the European Parliament and the Council of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC; and Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC augmented by Directive 2005/89/EC of the European Parliament and of the Council of 18 January 2006 concerning measures to safeguard security of electricity supply and infrastructure investment.

[3] Can be found at https://www.gov.uk/government/policies/maintaining-uk-energy-security--2

[4] Can be found at https://www.ofgem.gov.uk/ofgem-publications/75232/electricity-capacity-assessment-report-2013.pdf

of supply during the middle of the decade DECC, National Grid Electricity Transmission plc. (NGET) and Ofgem have been working together to explore options for additional safeguards for consumers in the form of new balancing services, aimed at enabling NGET to maintain system balance.

GB's electricity transmission and distribution networks remain extremely reliable. Nevertheless, continued investment is needed to maintain high quality networks and to ensure they facilitate the move to a decarbonised system.

Gas

Great Britain has the most liquid and one of the largest gas markets in Europe with extensive import infrastructure and a diverse range of gas supply sources. GB is therefore well placed to manage gas supply risks.

In 2012, around half of UK gas demand was supplied through UK production, and GB's import infrastructure has increased five-fold over the past decade, reflecting the predicted decline from domestic sources. As a result, GB has increased the diversity of supply sources and routes to market, and if necessary, could meet nearly double (189 per cent) its annual demand from imports alone. This flexibility means that if there is a problem with one source there are other sources to fall back on. It also allows gas suppliers to source gas from wherever is cheapest. Currently, GB can obtain gas from North Sea producers, via pipelines from Norway and the rest of Europe, via shipments of Liquefied Natural Gas (LNG) from further afield, or from gas storage.

All these sources can and are providing significant gas to meet the GB's requirements and mean that the GB gas market is resilient to all but the most extreme supply disruption scenarios. The Government and Ofgem continue to actively plan towards low probability but high impact scenarios and take action where appropriate to ensure the continuation of a robust GB gas supply. To further strengthen security of supply for gas, the Government is facilitating exploration activity for shale gas, as GB production of shale could further diversity of supply sources. In addition, Ofgem is in the process of reforming the cash-out regime in an attempt to sharpen the incentives on gas market participants in order that they invest in measures to enhance security of supply.

Oil

Oil currently meets around a third of the energy demand and is the main energy source for transport meeting virtually all of the UK's needs. Oil from the UK Continental Shelf could meet nearly two thirds of current refinery demand; however oil markets are international by nature and GB also exports and imports crude oil and refined products. Due to the historical configuration of GB's refineries sector, GB runs trade surpluses on some refined products including petrol and trade deficits on others including diesel.

GB has enjoyed extremely good security of supply in recent years with supplies coming both from the UK Continental Shelf and from a diverse range of international sources. The majority of GB's imports come from secure and stable markets such as Norway. The international nature of oil markets mean that if there are issues with a particular supply source this is likely to impact on prices paid, as opposed to physical supplies, as other supplies step in to take advantage of higher prices on offer. However GB's dependence on imports is expected to increase as oil demand globally continues to rise, and as global production becomes more complex.

Chapter 1: Electricity

Introduction

1.1 The electricity chapter of this report covers four main areas:

- Electricity Demand - the future development of peak demand and the role of demand side response.
- Electricity Supply – the current amount of capacity to meet requirements as well as that under construction and in the planning pipeline.
- The network – the current reliability levels of GB's electricity transmission network and the need for future investment.
- Market Functioning – changes to the electricity market to ensure competition and cost reflective prices for consumers.

This chapter relies on data and analysis from DECC and Ofgem's own work, as well as from National Grid (NG).

1.2. Earlier this year Ofgem set out their security of electricity supply outlook in their Electricity Capacity Assessment Report 2013[5]. This set out the risks associated with closures and potential low levels of investment over the coming six winters (2013/14 to 2018/19). Ofgem's latest capacity assessment report shows an increased risk to electricity security of supply towards the middle of the decade. Electricity de-rated margins, (the amount of spare generation capacity on the system,) could fall from around the 6 per cent level which is expected this coming winter to around 4 per cent in 2015/16. The Secretary of State's response to Ofgem's Electricity Capacity Assessment can be found at **Annex A** to this document.

Electricity Demand

Peak Demand

1.3 Chart 1.1 shows projections of future peak electricity demand from NG. This includes demand met by generation which is connected to the transmission network as well as generation that is connected directly to the distribution network (embedded generation).

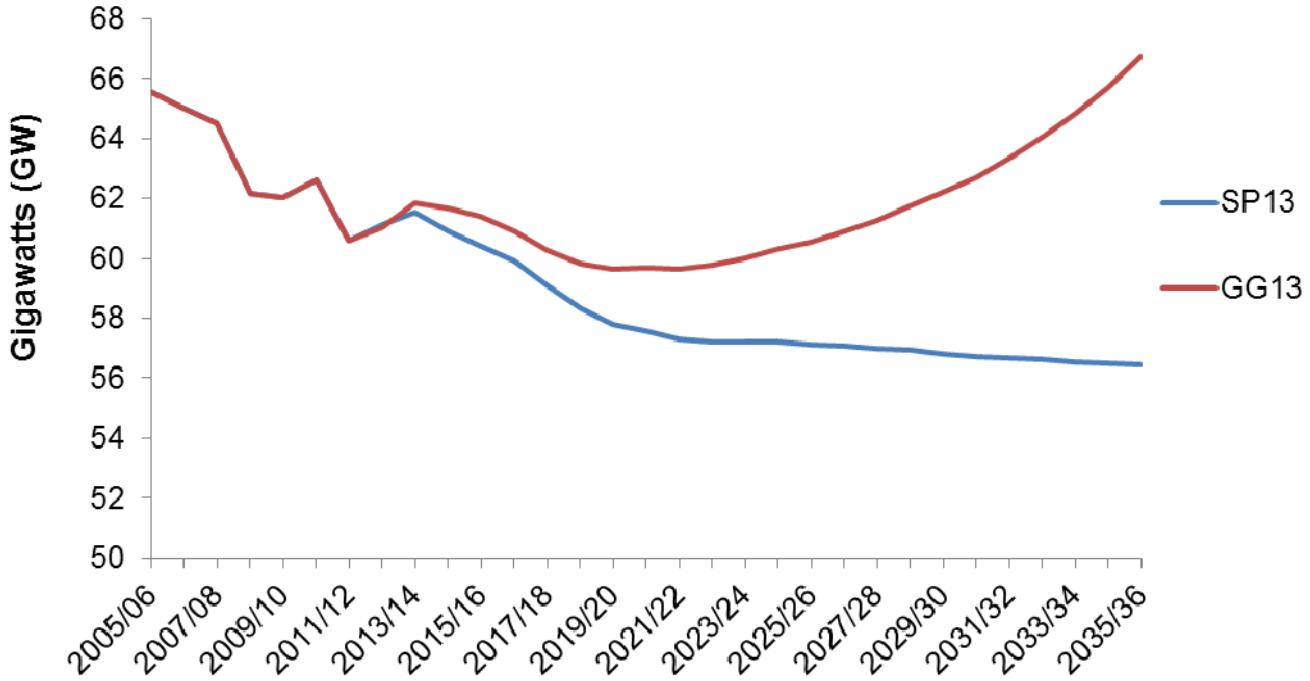
1.4 Peak electricity demand has been declining in recent years; peak demand levels were around 62 GW over the winter 2012/13 down from around 66 GW in 2005/06. Declining

[5] https://www.ofgem.gov.uk/ofgem-publications/75232/electricity-capacity-assessment-report-2013.pdf

electricity demand is the result of the economic downturn as well as the impact of improvements to electricity efficiency.

1.5 NG have published two scenarios for electricity demand as part of the UK Future Energy Scenarios work: under their Gone Green (GG)[6] 2013 scenario, it will take roughly 20 years to see peak electricity demand rise to the level it was in 2005/06; whereas the slow progression (SP)[7] scenario sees peak electricity demand steadily decline over the next 20 years to around 56 GW in 2035/36. More detail on the Slow Progression and Gone Green scenarios produced by NG can be found in their UK Future Energy Scenarios document[8].

Chart 1.1: Future development of peak demand



Source: NG Future Energy Scenarios, 2013

Demand Side Response

1.6 Demand side response (DSR) involves electricity users varying demand due to changes in the balance between supply and demand, usually in response to prices.

1.7 National Grid currently utilise DSR as part of its role as residual balancer of the electricity transmission system – fine tuning the balance between the demand and generation of electricity in real time. National Grid contracts power sources, including

[6] In the "Gone Green" scenario it is assumed that renewable energy and carbon targets are met and energy efficiency policy delivers leading to a reduction in demand.

[7] In the "Slow Progression" scenario low economic growth, low fuel prices, a failure of government policy to meet energy efficiency and renewable energy targets and a lack of change in consumer behaviour lead to sustained demand for gas.

[8] http://www.nationalgrid.com/uk/Gas/OperationalInfo/TBE/Future+Energy+Scenarios/

DSR, for balancing the system through its Short Term Operating Reserve (STOR)[9], among other balancing services. DSR is seen as any action which reduces the demand seen on the transmission system at a specific time. DSR balancing services are made up of those that:

- Lower demand directly through load reduction; or
- Generation that offsets electricity demand on the transmission network level, so that NG no longer see the consumption as demand. This generation could be of the form of back up generation that connects either to the transmission system or directly to the distribution network (see next section).

NG estimates that around 1.4 GW of their contracted Short Term Operating Response (STOR) is in the form of DSR[10].

Electricity Supply

Present Capacity

1.8 Electricity generating capacity is typically transferred to a high voltage transmission network which subsequently feeds into a lower voltage distribution network that connects to households and firms. Generation that takes this route is referred to as transmission connected, whereas generation that is connected directly to the distribution network is referred to as distributive or 'embedded' generation.

1.9 As of the end of May 2013, the UK had a total of around 77.6 GW of installed electricity capacity connected directly to the transmission system[11]. The overall figure is down by around 4 GW from the year before, largely due to a reduction in coal and oil capacity. This is shown in Chart 1.2 below.

1.10 In addition to transmission connected capacity, there is an estimated 10.5 GW of electricity capacity connected directly to the distribution network also known as 'embedded' generation[12].

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[9] http://www.nationalgrid.com/uk/Electricity/Balancing/services/STOR/

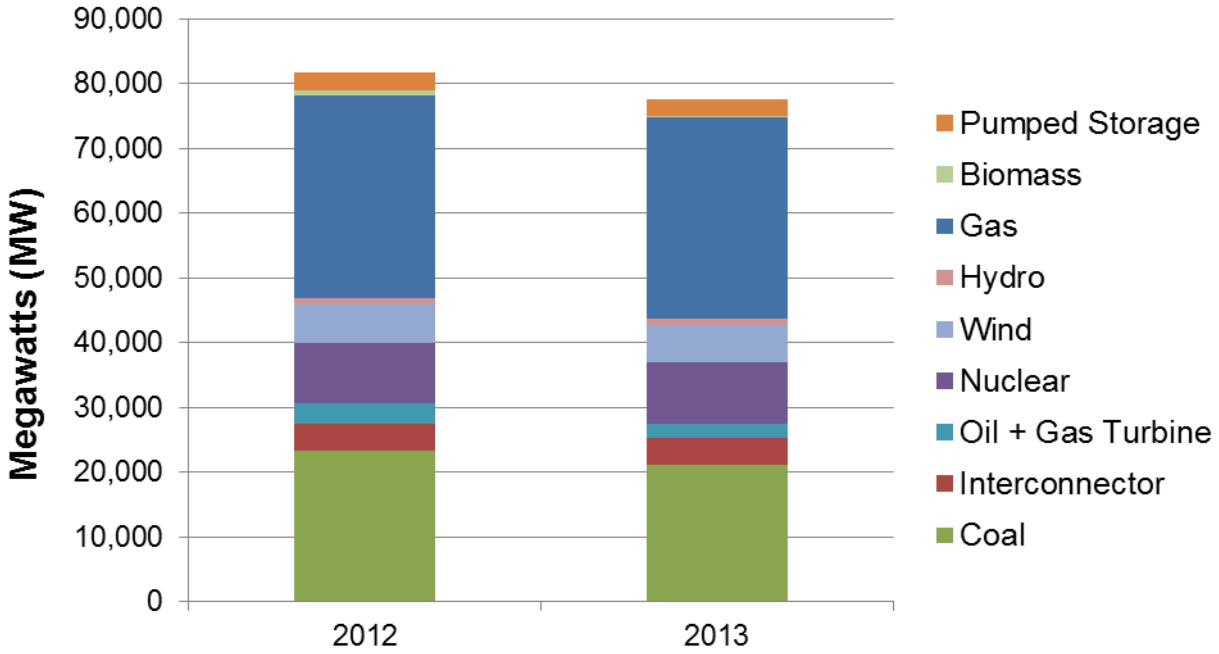
[10] In 2012 this report cited that 0.2 GW of DSR participated in the STOR market. This figure included DSR in the form of load reduction only.

[11] National Grid (NG) 2013, UK Future Energy Scenarios: http://www.nationalgrid.com/uk/Gas/OperationalInfo/TBE/Future+Energy+Scenarios/. Installed capacity refers to the maximum potential generating capability of the power station. Other measures, such as de-rated capacity, adjust the capacity figure to account for the reliability characteristics of the plant.

[12] Source from NG as above in footnote 11. Figure excludes micro-generation.

1.11 GB also has the means to import from and export to other countries; the equivalent to just under 4 GW of capacity can be transmitted to and from France, the Netherlands and Ireland.

Chart 1.2: Transmission connected capacity, by generation technology, in 2012 and 2013



Source: NG 2013[13]

1.12 The proportion of electricity produced by each generating technology is different from the proportion of each technology's total potential capacity. This is because some plant generates more or less continuously (for example nuclear, due to its low marginal cost), some only at times of extremely high prices and/or demand (for example, oil), and some depending upon whether the power source is available, for example whether the wind is blowing.

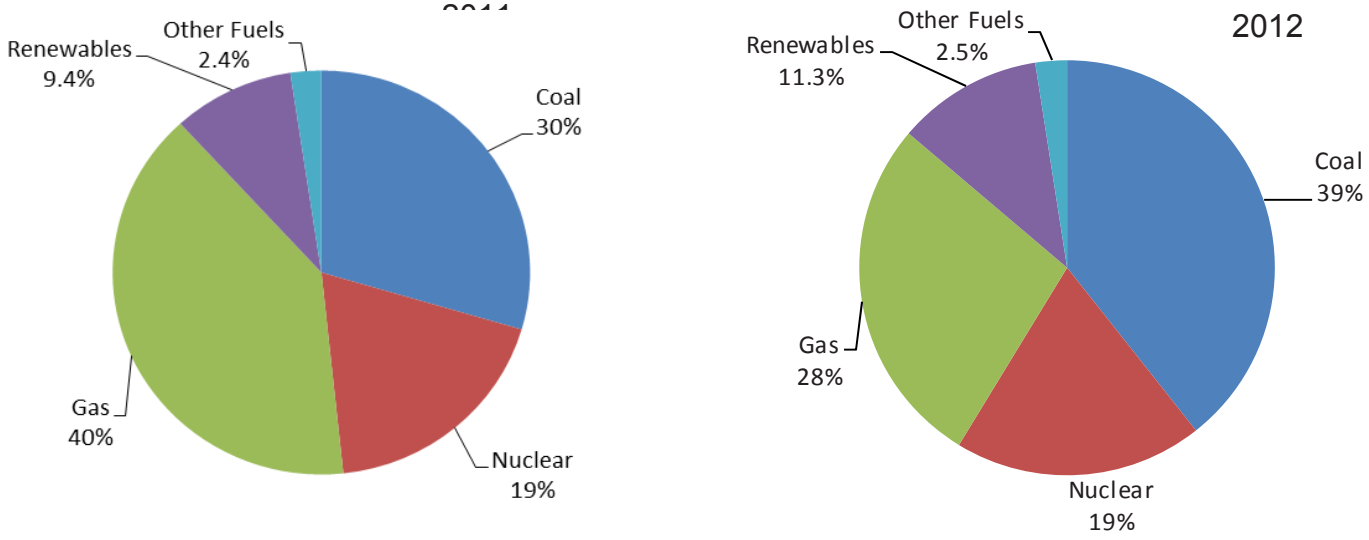
1.13 In 2012, there was 361 TWh of indigenous electricity production, down from 365 TWh in 2011[14]. The breakdown of this by technology type is shown in Chart 1.3. Coal increased its share from 30 per cent to 39 per cent while the proportion of gas generation fell from 40 per cent to 28 per cent. This shift reflects a broader change in the generation mix across Europe as coal generation has been more profitable than gas generation. This has been due to low coal prices, high gas prices and low EU Emissions Trading System carbon prices[15]. Renewables increased their share from 9.4 per cent to 11.3 per cent and nuclear maintained its share of 19 per cent.

[13] In this chart, biomass refers to dedicated biomass only. Biomass conversions are represented under coal.

[14] DUKES, 2013, Table 5.1. Figure excludes foreign imports of electricity and generation from pumped storage.

[15] The EU Emissions Trading System (EU ETS) is the European Union's cap and trade market for greenhouse gas emissions. Coal is a more carbon intensive form of generation than gas and hence has a higher emission cost under the EU ETS.

Chart 1.3: Shares of electricity generation, by fuel, in 2011 and 2012



Source: DECC, Digest of UK Energy Statistics July 2013, Chart 5.2

Pumped Storage

1.14 In GB there is around 2.8 GW of Pumped Storage capacity. This technology can be operated flexibly, as in come on and off the electricity system within seconds, and is used, alongside other technologies, by NG to maintain the integrity of the electricity system. There are no firm plans for significant new storage sites in GB at present.

Box 1.1: Security of Primary Fuel Source

Coal

Coal-fired generation accounted for 39 per cent[16] of total UK generation in 2012 and is currently central to the security of electricity supply. Most of the UK's coal supply (86 per cent) was used in electricity generation in 2012 with 25 per cent of total supply coming from indigenous production, 70 per cent from imports and the remaining 5 per cent accounted for by stock changes[17].

There are no major concerns for the security of coal supply, now or for the foreseeable future. Recent events, including the large fire at Daw Mill colliery in Warwickshire, have led to a reduction in indigenous coal production. However, on-going confidence in the coal sector is demonstrated by Hargreaves Services PLC recent acquisition of certain surface mine assets in Scotland. There continues to be readily available imports to meet any shortfall, with the current over-supply of

[16] DUKES, 2013, Chart 5.2.

[17] DUKES, 2013, Table 2.1.

thermal coal on European markets keeping spot prices at low levels. In addition, data for 2012 indicates coal stock levels are typically sufficient to meet around 13 weeks of generators' coal demand[18].

Uranium

Nuclear generation accounted for just under 20 per cent of UK generation in 2012[19]. Uranium is supplied on global markets. There is no major concern for the security of uranium supply, now or for the foreseeable future.

The Nuclear Energy Agency (NEA) undertakes a regular and comprehensive analysis of world uranium reserves, production capacity and envisaged global demand. Their findings are made available every two years in their respected publication "Uranium: Resources, Production and Demand (The Red Book)". The latest edition, published in 2011, concluded that total identified global resources are sufficient for over 100 years of supply, based on current requirements. A further edition is expected this year.

Plant Closures

1.15 Ofgem's Electricity Capacity Assessment published in June 2013 sets out the risks associated with plant closures and potential low levels of investment over the period to 2018/19. Box 1.2 at the end of this section provides some detail of the high level results.

1.16 The past three years have seen the closure, capacity reduction, full or partial mothballing[20], or conversion to biomass of several large power stations. These are summarised in the table below.

Table 1.1: Major Power Producers capacity closed, converted or reduced (as at the end of May 2013), since end-2010

Site	Fuel	Status	Previous Capacity (MW)	New Capacity (MW)	Year of closure, capacity reduction or conversion
Fife	CCGT	Closed	123	0	2011

[18] DECC Energy Trend, September 2013, Table 2.6.

[19] DUKES, 2013, Chart 5.2.

[20] Mothballing refers to closing a plant but keeping it in good condition so that it can be called upon if required.

Table 1.1: Major Power Producers capacity closed, converted or reduced (as at the end of May 2013), since end-2010

Tilbury B	Coal (1)	Converted, now closed	1,063	750	2011
Teesside	CCGT (2)	Mothballed	1,875	45	2011
Oldbury	Nuclear (3)	Closed	434	0	2012
Wylfa (Reactor 1)	Nuclear (4)	Partially Closed	980	490	2012
Shotton	CCGT-CHP	Closed	45	0	2012
Kingsnorth A	Coal/Oil	Closed	1,940	0	2012
Derwent	CCGT-CHP	Closed	228	0	2012
Grain A	Oil	Closed	1,300	0	2012
Kings Lynn	CCGT	Mothballed	340	0	2013
Cockenzie	Coal	Closed	1,152	0	2013
Didcot A	Coal/Gas	Closed	1,958	0	2013
Fawley	Oil	Closed	1,036	0	2013
Ironbridge	Coal (1)	Converted	940	900	2013
Drax	Coal (5)	Partially Converted	3,870	3,870	2013
Roosecote	CCGT	Mothballed	229	99	2013
Keadby	CCGT	Mothballed	749	0	2013
Uskmouth	Coal (6)	Partially Closed	363	240	2013

(1) Converted from coal to dedicated biomass

(2) Reduced capacity from 1,875 MW (CCGT 1,830 MW / OCGT 45 MW) to 45 MW (OCGT)

(3) Reactor 2 with capacity of 217 MW closed on 30 June 2011, reactor 1 with capacity of 217 MW closed on 29 February 2012

(4) Reactor 2 with a capacity of 490 MW closed on 30 April 2012

(5) Partly converted to biomass. Overall capacity remains at 3,870 MW (coal 3,225 MW, biomass 645 MW)

(6) One unit closed in April 2013

Source: DECC, Digest of UK Energy Statistics 2013, Table 5B

1.17 Some of these plants have closed as a result of requirements imposed by EU Directives or, in the case of nuclear, reached the end of their agreed economic life.

1.18 Around 8 GW of coal plants and 4 GW of oil-fired plant have to close by the end of 2015 as they have opted out of the EU's Large Combustion Plant Directive (LCPD)[21]. To date 6 GW of coal plant and 2 GW of oil plant has closed.

1.19 Table 1.2 below shows the amount of capacity that is currently scheduled to close in each respective financial year, from NG's GG scenario. This includes remaining LCPD plant closures and current scheduled nuclear closures. It does not include plant covered by the Industrial Emissions Directive (see below) or plant that may opt to shut down for commercial reasons.

1.20 From 1st January 2016, the LCPD will be replaced by the Industrial Emissions Directive (IED)[22], which places more stringent emission requirements on power plants than the LCPD. This will affect the UK coal capacity that has already complied with the LCPD, as well as some gas capacity. These plants will be required to either 'opt in' to the IED and meet its emission requirements from January 2016, opt in via the Transitional National Plan (which allows a gradual adjustment to the new emission requirements between 2016 and 2020), or (as under the LCPD) they can choose to 'opt out', at which point they will be subject to a limited lifetime derogation (of a maximum of 17,500 running hours), and must close by the end of 2023 at the latest.

Table 1.2: Forthcoming scheduled capacity closures under NG's Gone Green scenario (by fuel and in MW)

Fuel	2013/14	2014/15	2018/19	2019/20	2023/24
Gas	780	105			
Coal	1206				
Nuclear	440		1080	2410	4277
Oil + Gas Turbine (GT)		1140			

Source: NG Future Energy Scenarios GG, 2013

[21] Directive 2001/80/EC to be found at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2001L0080:20090625:EN:PDF The LCPD aims to reduce acidification, ground level ozone and particles throughout Europe by controlling emissions of sulphur dioxide (SO_2) and nitrogen oxides (NO_x) and dust (particulate matter (PM)) from large combustion plants (LCPs). The directive applies to any combustion plant with a thermal output above 50 MW and includes power generation.

[22] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2010L0075:20110106:EN:PDF

Nuclear Plant Closures

1.21 Nuclear operators, and in particular EDF energy, have previously published indicative dates that they expect individual nuclear sites to close by. According to current timetables, around 3.9 GW of existing nuclear generation capacity will have closed by the end of 2020[23]. However, the operating lives of nuclear power plants can be extended with the approval of the Office for Nuclear Regulation (ONR). The decision whether to seek to extend the scheduled closure date is a commercial one for the operators.

1.22 These decisions will take into account such factors as plant safety and operating costs, as well as supply, demand and price expectations in the electricity market as a whole. On December 4th 2012, EDF announced that it will undertake a programme of investment that will extend the expected operational life of two of its stations by seven years to 2023: Hinkley Point B and Hunterston B. DECC and Ofgem understand that it remains the intention of EDF to obtain an average life extension of seven years for the rest of their Advanced Gas-cooled Reactor (AGR) nuclear fleet beyond their indicative closure dates, and for the Pressurised Water Reactor (PWR) at Sizewell to run for an additional 20 years.

New plant pipeline

Gas and Coal-fired Generation

1.23 Two new Combined Cycle Gas Turbines (CCGT), Pembroke and West Burton (currently commissioning) have come online since the beginning of 2012, providing around 3 GW of new capacity. Carrington power station (910 MW) is currently under construction and expected to be completed by the end of 2016. Further, approximately 15 GW of CCGT capacity has been granted consent although final investment decisions have not yet been made[24].

Nuclear

1.24 The planning application for the new nuclear plant at Hinkley Point C was consented by the Secretary of State in March 2013, with an agreement on key terms between the Government and EDF on 21 October 2013, first electricity generation is anticipated in 2023. In total, the UK's three nuclear consortia – NNB GenCo, Horizon Nuclear Power and NuGen – have set out plans to develop around 16 GW of new nuclear power in the UK, though these other sites are on a slower trajectory, meaning most new plants are expected to start operations from the mid-2020s onwards.

Renewables

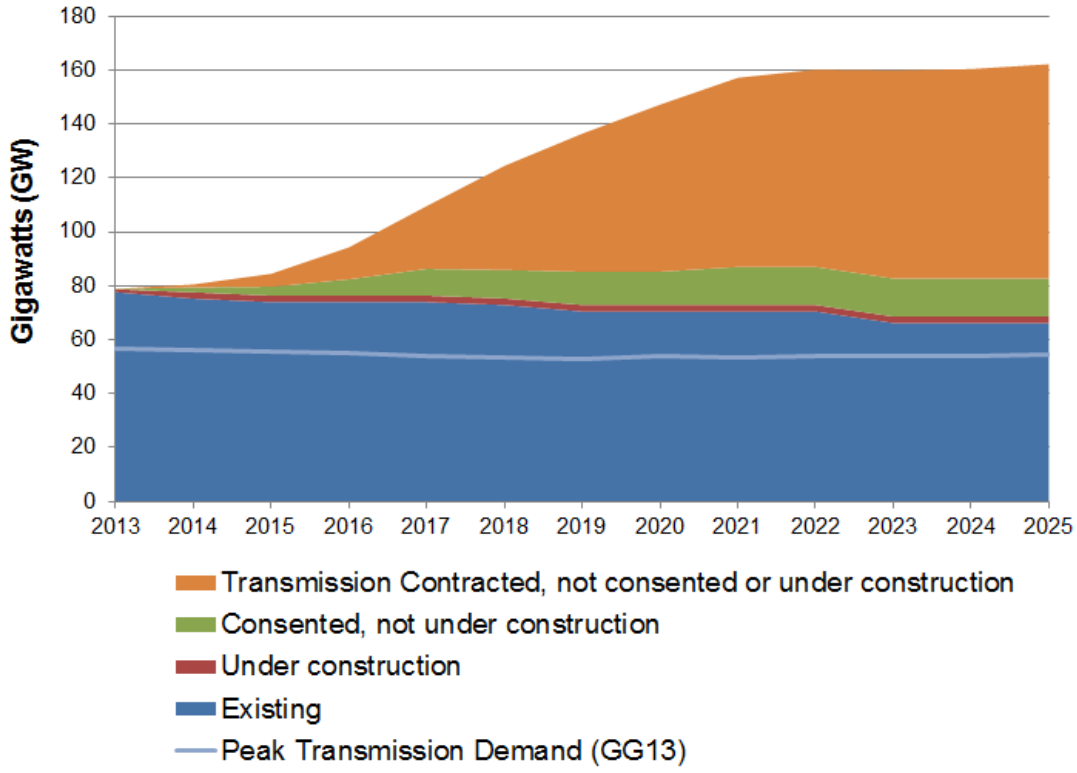
1.25 At the time of publication, there is approximately 3.7 GW of transmission connected renewable electricity generation under construction, in addition to 3 GW that has been built since the start of the year. A further 14.3 GW of projects have been granted

[23] More information on the scheduled closure dates of the current nuclear fleet can be found at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48353/2027-past-and-present-uk-nuclear-reactors.pdf

[24] DECC Energy Infrastructure Portal, recent decisions: https://itportal.decc.gov.uk/EIP/pages/recent.htm

planning permission and are awaiting construction. These projects are predominantly offshore and onshore wind, and biomass[25]. Other forms of renewable technology, such as Solar and Hydroelectricity are also in the pipeline. More information on renewable generation in the planning pipeline can be found at the Renewable Energy Planning Database[26].

Chart 1.4: Existing and potential GB electricity generating capacity (installed)



Source: NG, 2013

Box 1.2: Ofgem's Electricity Capacity Assessment and potential new balancing services for mid-decade

Ofgem's Electricity Capacity Assessment 2013 gives an assessment of the outlook for security of electricity supply for the following six winters. This focuses on the de-rated capacity margins that could be delivered by the market over the next six winters and the risks to security of supply associated with these.

Ofgem's assessment presents a Reference Scenario that provides a view of the outlook for security of supply. The Reference Scenario suggests that the risks to security of supply are expected to increase faster than was expected in Ofgem's previous assessment in Autumn 2012. This is primarily due to deterioration on the supply side outlook with a drop in the available capacity. De-rated margins are expected to decrease from 6 per cent in 2013/14 to just under 4 per cent in 2015/16, before recovering thereafter, primarily due to a projected drop in peak demand.

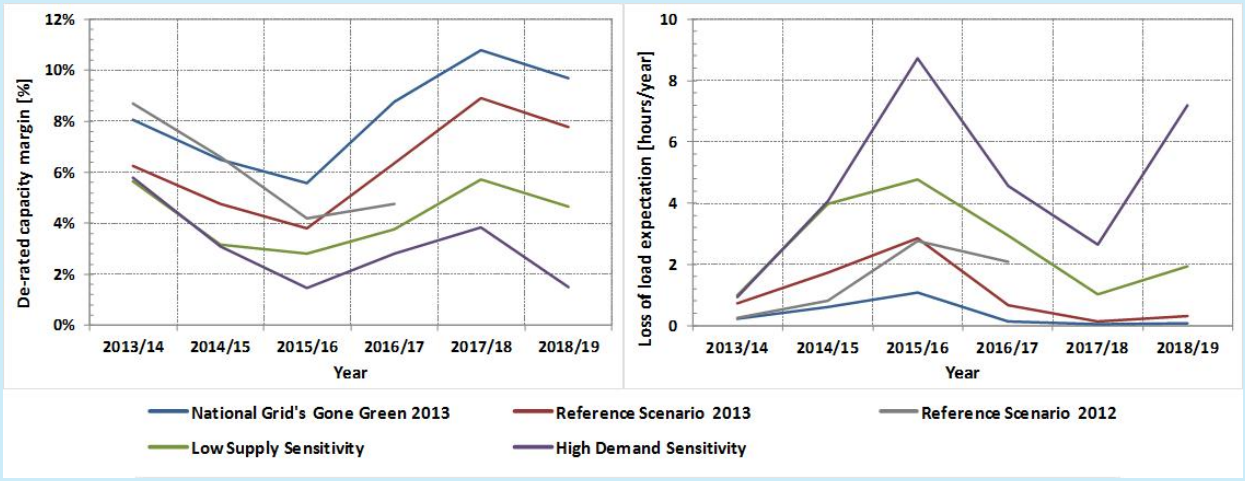
[25] https://restats.decc.gov.uk/app/reporting/decc/datasheet

[26] This excludes small scale projects which do not require planning permission.

Ofgem has also modelled a range of sensitivities around the risks associated with uncertainties to the future level of peak demand, the commercial decisions of generators and the level of interconnector flows with mainland Europe, among other factors. Considering the significant uncertainties around both the supply and demand outlook, the Reference Scenario alone should not be relied upon to assess the risks to security of supply in the coming years.

While de-rated margins illustrate trends in the market, they are not a measure of the risk to security of supply. Instead, Ofgem's assessment presents the risks to security of supply using the "Loss of Load Expectation" or LOLE - this represents the number of hours per year in which supply is expected to be lower than demand before any intervention (eg. voltage reduction) by the System Operator. In the Reference Scenario, Ofgem estimates an increase in LOLE from less than 1 hour per year in winter 2013/14 to just under 3 hours per year in 2015/16 as de-rated margins decrease. The change in LOLE illustrates that small reductions in margins from current levels would result in a significant increase in the risks to security of supply.

De-rated Capacity Margins and LOLE in Ofgem analysis



Ofgem also estimates the risk to customer disconnections. Controlled disconnections of customers - involving industrial and commercial sites before households - would only happen after all mitigation actions available to the System Operator have been exhausted, including voltage control and emergency interconnection services (2 GW in the Reference Scenario). These services are not taken into account in the de-rated margins and LOLE estimations. The chance of an event requiring the temporary controlled disconnection of customers in the Reference Scenario increases from around 1 in 47 years in 2013/14 to 1 in 12 years in 2015/16.

In light of the uncertain outlook to security of supply during the middle of the decade, DECC, NGET and Ofgem have been working together to explore options for additional safeguards for consumers in the form of new balancing services, aimed at enabling NGET to maintain system balance.

Ofgem published an open letter[27], alongside the Electricity Capacity Assessment 2013, seeking stakeholder's view on whether it is prudent to consider introducing

[27] https://www.ofgem.gov.uk/ofgem-publications/75221/consultation-potential-requirement-new-balancing-services-support-uncertain-mid.pdf

new balancing services given the uncertain mid-decade outlook. These services[28] would assist NGET balance the system and provide consumers an extra layer of protection from potential disruptions to supply. They would not be a substitute for other policies aimed at improving security of supply such as DECC's capacity market or Ofgem's electricity balancing significant code review.

More detail on Ofgem's Electricity Capacity Assessment can be found on the Ofgem website[29].

The Secretary of State's response to this assessment can be found at Annex A.

Electricity Networks

Current network reliability

1.26 There are three onshore transmission owners (TOs) in GB: NGET in England and Wales; Scottish Power Transmission Limited (SPTL) in south and central Scotland, and Scottish Hydro Electric Transmission plc (SHET plc) in the north of Scotland.

1.27 Together they face statutory obligations and regulatory incentives to create an operating environment designed to reduce unsupplied electricity. The historic overall reliability of supply has been impressive. For instance, during the financial year 2012/13, overall reliability for the network stood at 99.99975 per cent[30].

Future Development of Electricity Networks

1.28 The electricity network in GB is undergoing a significant programme of investment. This includes expansion to accommodate forthcoming new generation projects and general maintenance of network assets to ensure continued network reliability. Ofgem's framework for carrying out Price Control Reviews, RIIO (Revenue = Incentives + Innovation + Outputs), aims to ensure that transmission and distribution network companies engage with the transition to a decarbonised electricity sector whilst providing long term value for money for consumers.

[28] National Grid has informally consulted on two options for these services. Demand Side Balancing Reserve is a proposed new balancing service for demand side response. Supplementary Balancing Reserve would enable some generators and large users to participate in the provision of additional generation capacity or demand reduction.

[29] https://www.ofgem.gov.uk/

[30] http://www.nationalgrid.com/NR/rdonlyres/83A0A21D-4267-4983-8109-AA9A4E7B83FD/62630/NationalElectricityTransmissionSystemPerformanceReport20122013.pdf

1.29 The 2013 to 2021 transmission price control (RIIO-T1) review period started on 1 April 2013. Ofgem has approved funding of up to £21.5 billion (2009-2010 prices) for expanding, replacing and maintaining the GB transmission network for RIIO-T1[31].

1.30 In addition, the TOs provide quarterly updates on their major projects to the Electricity Networks Strategy Group (ENSG - a high level industry group chaired by DECC and Ofgem). The latest update shows that around 11 GW of network capacity is under construction for delivery by the end of 2016[32] .

1.31 As part of preparation for the next Distribution Price Control (RIIO-ED1), which starts on 1 April 2015, the 14 Regional Electricity Distribution Network Operators (DNOs) submitted initial business plans to the independent regulator Ofgem in July 2013. The business plans set out the DNO funding requests and proposed activities for the period 2015-23. Ofgem aims to come to an initial view in November 2013 (following its review and consultation), on whether any are of sufficient quality to be fast-tracked. Non-fast tracked DNOs would submit updated business plans in March 2014 and Ofgem aims to make its decision on these in November 2014.

1.32 Under the current Distribution Price Control (DPCR5) covering the years 2010 to 2015, up to £10.5 billion of new capital is being invested in the distribution networks.

Interconnection

1.33 Great Britain currently has around 4 GW of interconnected capacity with mainland Europe and Ireland. This consists of a 2 GW link to France (IFA), a 500 MW link between Wales and Ireland (East-West), an 1 GW interconnector with the Netherlands (BritNed), and a nominally rated 500 MW link between Scotland and Northern Ireland (Moyle).

1.34 The technical capacity of Moyle has been reduced to 250 MW since last year due to a failure in one of the cables. Preliminary reports suggest that it is highly uncertain whether and when the full Moyle capacity will become available again. In addition, a number of forced outages on IFA and East-West interconnectors over the past year limited their available capacity to the market[33]. The issues associated with these outages have now been resolved and it is not expected that these will impact on their future availability.

1.35 Currently, a number of new projects are at various stages of development and the market can expect GB interconnection capacity to increase in the future. The UK has supported interconnector projects to France, Belgium, Ireland and Norway as European Projects of Common Interest (PCIs). Potential renewables trading projects with Ireland,

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[31] http://www.ofgem.gov.uk/Media/PressRel/Documents1/RIIO%20Controls%20Come%20into%20Effect.pdf

[32] The updates are available at https://www.gov.uk/government/policy-advisory-groups/107

[33] For more information, see for example NG's Winter Consultation 2013 /14 report: http://www.nationalgrid.com/NR/rdonlyres/D03C2CD6-D81E-4751-AD0A-D4EDF155FE1F/61304/WinterConsultationReport201314FINAL2.pdf

which may lead to further interconnection between the two countries, have also been identified as PCIs[34].

1.36 The EU Third Energy Package is a set of reforms to create a single European energy market, which include provisions for the establishment of a number of electricity Network Codes. The Network Codes aim to remove obstacles to cross-border trading and integration of electricity markets and improve transparency. This should help to increase competition and put downward pressure on energy prices.

Offshore Transmission

1.37 The offshore transmission regime, developed by DECC and Ofgem uses competitive tendering for licensing offshore electricity transmission in a secure, timely and cost-effective manner. The interests of the consumer lie at the heart of the regime, which was specifically designed to bring competition into an area traditionally dominated by regulated monopolies in order to drive down costs. Ofgem has estimated this competitive regime could save the consumer around £290 million in relation to the first £1.1 billion of transmission assets tendered. We believe that further savings are possible for current and future tender rounds.

1.38 The offshore regime has had considerable success in delivering cost-effective investment, with new entrants and new sources of finance demonstrating interest in the sector. Almost £4 billion of investment appetite was attracted for the first £1.1 billion of assets, with a further £1.4 billion having entered the tender process. So far, eight OFTO licences have been granted, attracting over £1 billion of new investment into the UK transmission sector, and there has been a range of participants in bidder consortia.

Grid Access

1.39 To maintain security of electricity supply over the next decade, the transmission companies are to carry out essential projects helping to connect new generation to the grid. In August 2010, the enduring 'Connect and Manage' grid access regime was introduced by DECC. This enables new generation projects to connect to the network once their enabling works have been completed, whereas under the previous regime, 'Invest and Connect', new generation was only able to connect once wider network reinforcement had taken place.

1.40 Ofgem provides an annual monitoring report to the Secretary of State on the impacts of the Connect and Manage regime[35]. To date 'Connect and Manage' has brought forward the connection timescales for around 163 large renewable and non-renewable generation projects by an average of five years as shown in the following chart[36].

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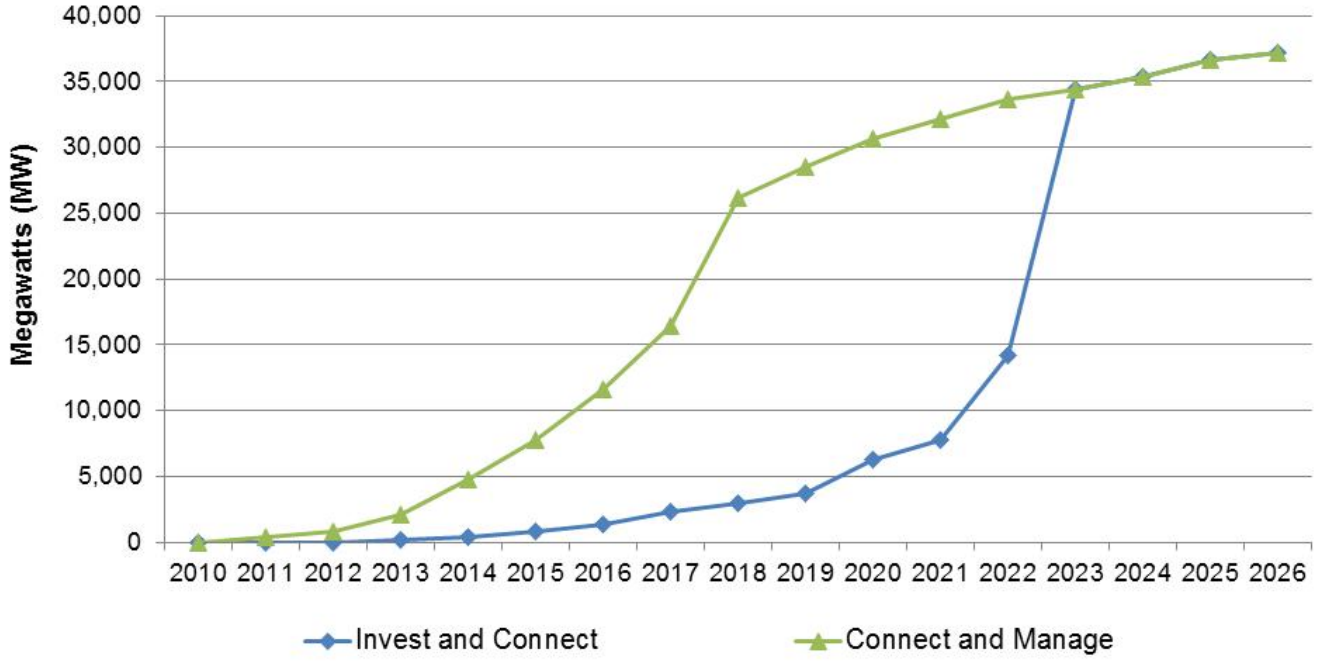
[34] http://ec.europa.eu/energy/infrastructure/pci/pci_en.htm

[35] The most recent report is available at: http://www.ofgem.gov.uk/Networks/Trans/ElecTransPolicy/tar/Documents1/20121120%20Monitoring%20the%20Connect%20and%20Manage%20electricity%20grid%20access%20regime%20third%20report%20from%20Ofgem.pdf

[36] http://www.nationalgrid.com/NR/rdonlyres/093614C6-E56B-43C6-BAE0-4B8CBB5FE0D2/61872/ConnectandManageQuarterlyReport010413to300613v10.pdf

Chart 1.5: Advancement of connections under Connect and Manage



Source: NG 2013

Market Functioning

1.41 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 are indicative of an uncompetitive market.

1.42 Poor liquidity in the market prevents 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 inhibit long term investment decisions in new generating plant with negative consequences for security of electricity supply.

1.43 Ofgem are concerned about the lack of liquidity of the wholesale electricity market. The current wholesale market is not delivering the products and price signals that are needed to facilitate effective competition. This means potential market participants – particularly small players, independent of established companies - may struggle to enter the market and compete effectively. Therefore firms in the electricity market often cannot access the products they need to compete effectively. This problem is particularly severe for independent power producers, who do not have the option of trading with an affiliated generation or supply business.

1.44 Ofgem's liquidity project has examined poor liquidity in the electricity wholesale market and the barriers that this poses to competition and entry in the market. In June 2013,

Ofgem announced final proposals to improve wholesale market liquidity through a 'Secure and Promote' licence condition[37]. Secure and Promote aims to ensure that all parties can access the wholesale market effectively and that robust reference prices are available from the wholesale market.

Conclusion

1.45 This chapter has set out the expected outlook for GB's electricity security of supply in the coming years; it covers many of the key drivers affecting both supply and demand, both of which are subject to significant uncertainties. This analysis is to be read in conjunction with Ofgem's latest Electricity Capacity Assessment report which shows that, in the absence of any policy intervention, there is likely to be an increased risk to electricity security of supply towards the middle of the decade. In light of this, DECC, NGET and Ofgem have been working together to explore options for additional safeguards for consumers in the form of new balancing services aimed at enabling NGET to maintain system balance. The relative outlook for electricity security of supply this winter compared to last winter is also for an increased level of risk as many plants have come off the system. However, in absolute terms, the risks this winter remain low.

1.46 In the long term, Government is legislating for a Capacity Market to ensure security of electricity supply in an energy system where many older power plants are closing and the investment case for reliable capacity is increasingly uncertain. Government expects to run the first Capacity Market auction in 2014 for delivery of capacity from the winter of 2018/19, subject to state aid clearance.

1.47 This chapter has also set out the outlook for the development of networks and the developments of the electricity markets. The networks are undergoing a significant programme of investment currently and plans are in place to enable this to continue. Meanwhile, there are low levels of liquidity in the wholesale electricity market and this issue is being addressed through Ofgem's work on market liquidity in the wholesale electricity market.

[37] https://www.ofgem.gov.uk/ofgem-publications/39302/liquidity-final-proposals-120613.pdf

Chapter 2: Gas

Introduction

2.1 This chapter sets out the robustness of the current security of supply situation for gas in Great Britain (GB)[38]. This year's projections concentrate on the two current scenarios from National Grid (NG), Gone Green (GG) and Slow Progression (SP), with a comparative view from DECC's latest projections.

2.2 Amongst other factors, this year's report highlights how the GB system was able to successfully deliver during the prolonged cold weather in March and April 2013. Temperature is particularly relevant as the main use of gas is for space heating.

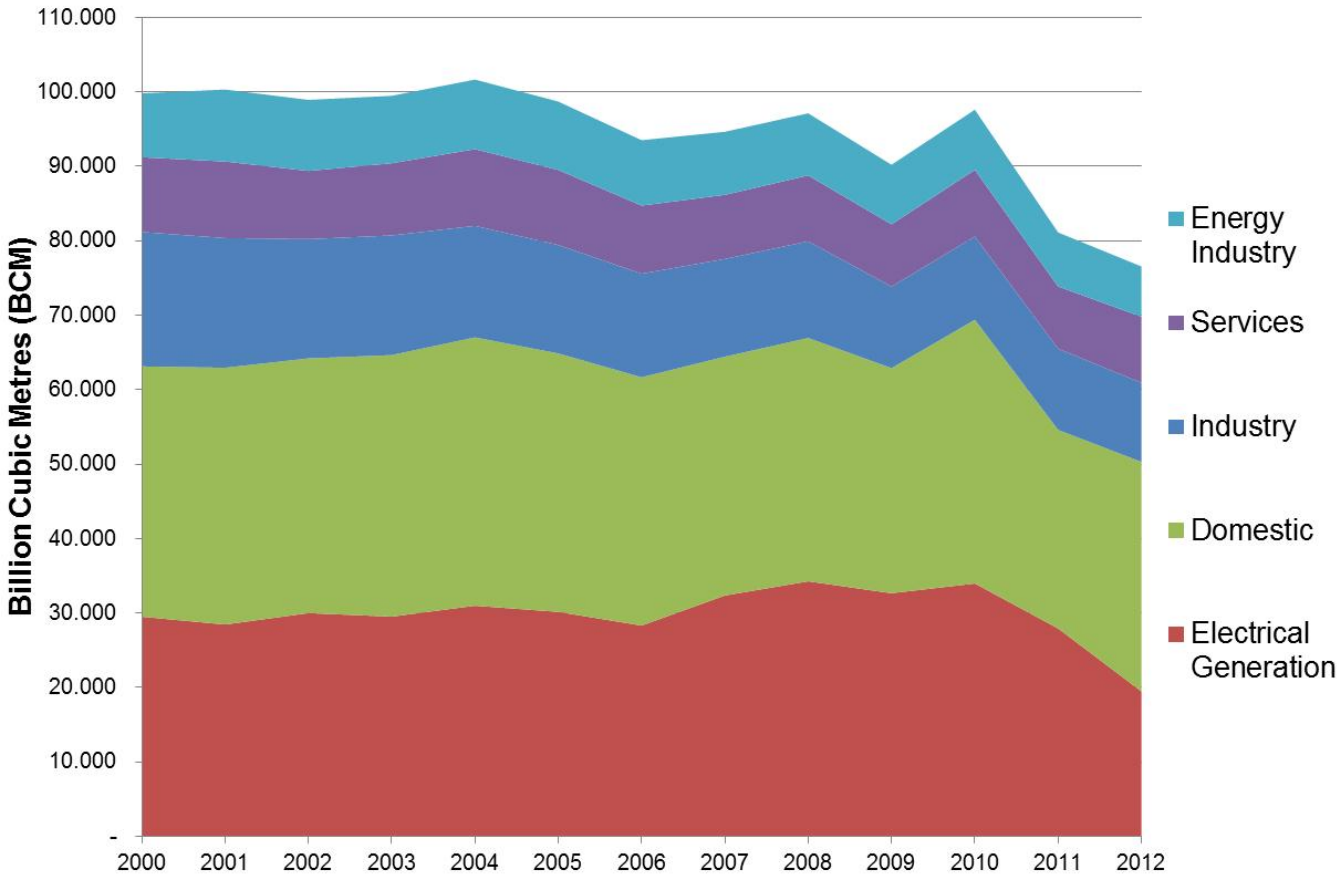
2.3 In addition, the analysis in this chapter draws upon further work being carried out to ensure the security of gas supply. This is through Ofgem's reform plans which include revisiting the incentives to suppliers set out in the Significant Code Review (SCR) and the collective work being carried out by regulators, industry and the government to implement the EU Network Codes.

Demand

2.4 The consumption of gas over the last twelve years is shown in Chart 2.1. The chart shows that demand from electricity generation, domestic and commercial consumers (including the industrial, services, and energy industries), is split into roughly equal thirds.

[38] The statistics relied on in this document are GB stats as far as possible. However, in some cases where it is not possible to split the GB data out from the UK data, UK statistics have been used.

Chart 2.1: Consumption of natural gas 2000 to 2012



Source: DECC, Digest of UK Energy Statistics, July 2013, Chart 4.2

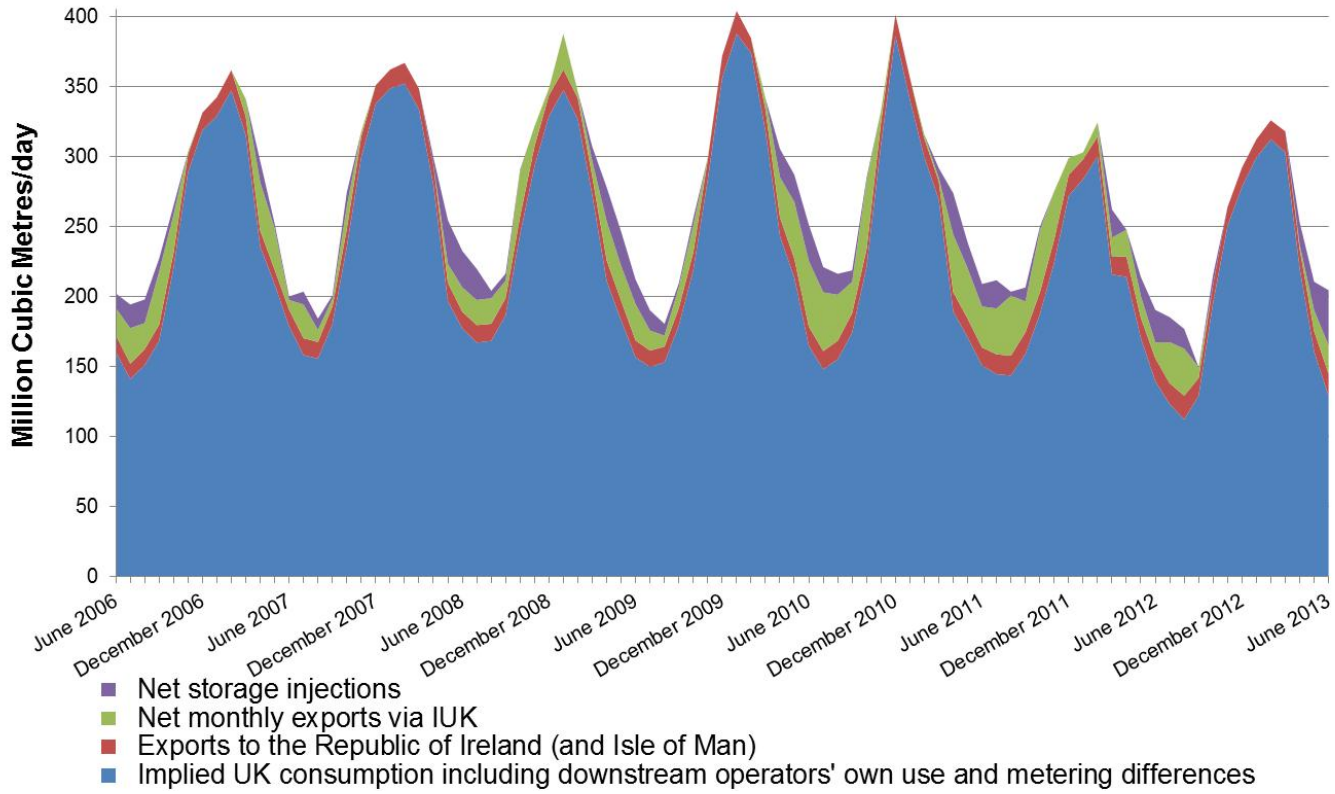
2.5 During 2012 consumption grew in the domestic sector; there was also a slight increase in demand in the services sector. Following the trend seen in 2011, a combination of a significant fall in coal prices across Europe and rising prices for gas resulted in a continued fall in the use of gas for power generation in favour of coal burn. Overall there has been a continued noticeable reduction in total demand for gas.

2.6 Demand for gas varies on a daily basis and is notably higher in winter than in summer as shown in Chart 2.2. A seasonal pattern is created by temperature levels, which generally determine how much gas households and businesses require for space heating. Gas demand for use in electricity generation and industrial purposes tends not to follow this seasonal pattern so closely, but is instead more heavily influenced by the price of gas relative to the price of other fuels and the price of electricity.

Exports to Ireland

2.7 Ireland (Republic of Ireland and Northern Ireland) is 93 per cent dependent on GB for its gas supply and consequently the British and Irish gas markets are coupled. The network operators work closely together and have arrangements in place in case of a supply emergency. During winter 2012/13, 2.5 billion cubic metres (bcm) of gas flowed from GB to Ireland, accounting for 100 per cent of Northern Ireland demand and 92 per cent of the Irish demand. This dependence will lessen for a period as the Republic of Ireland establishes its own gas supplies through offshore production and potential LNG and enhanced storage facilities.

Chart 2.2 UK Monthly gas demand



Source: DECC, Energy Trends 2013

2.8 Chart 2.3 shows projected annual gas demand in five scenarios including NG's Slow Progression (SP)[39] and Gone Green (GG)[40], and DECC's Reference Scenario (DECC)[41].The underlying assumptions behind NG's scenarios have been updated for 2013; more details are published in 2013 Future Energy Scenarios[42].

2.9 It should be noted that DECC and NG measure demand differently. The demand projections provided by NG are higher than the DECC projections because they include exports to Ireland (currently around 6 bcm annually) and gross exports to the Continent via the Interconnector (IUK); the DECC demand projections do not. There are further differences between the scope of the projections: DECC uses calendar years while NG use "gas years"; and NG only look at demand from the National Transmission System (NTS), excluding demand from major users who get their gas directly from offshore suppliers, while DECC measures total UK demand including these "directs".

[39] In the "Slow Progression" scenario low economic growth, low fuel prices, a failure of government policy to meet energy efficiency and renewable energy targets and a lack of change in consumer behaviour lead to sustained demand for gas.

[40] In the "Gone Green" scenario it is assumed that renewable energy and carbon targets are met and energy efficiency policy delivers leading to a reduction in demand.

[41] This is the central scenario from Energy & Emissions Projections data, where only the influence of policy that is significantly advanced enough to be modelled is included. For instance, the influence of Electricity Market Reform.

[42] http://www.nationalgrid.com/uk/Gas/OperationalInfo/TBE/Future+Energy+Scenarios/

2.10 In the short term, both NG scenarios expect demand increases of over 10 per cent for generation over 2013 as some coal and oil plant are forced to close due to the Large Combustion Plant Directive (LCPD)[43]. However, in the medium term, both scenarios show demand for gas used in power generation falling as a result of coal prices favouring coal generation to gas and as more renewable plant comes on the system, taking the place of gas plant. Gas demand under the GG scenario is slightly higher due to carbon prices adding costs to coal generation. In 2020/21, the Slow Progression scenario sees a steep increase in gas demand as more coal generation is forced off the electricity system. However, after 2030, both scenarios see a return to declining demand for gas for use in generation.

2.11 DECC's reference scenario shows continued low demand for generation until the middle of the decade, after which gas use increases as operating coal generating plant becomes more restricted by the effects of the Industrial Emissions Directive (IED)[44] and further coal plant closures. Demand increases a little further during the period 2020 to 2030 as further gas fired capacity comes on stream. Much of the new capacity only operates at low load factors to help meet peak demand while the remainder operates at medium load factors meeting demand that is not met by very low carbon plant.

2.12 For both industrial and commercial, and domestic sectors, both NG scenarios are broadly similar for the first few years, owing to differences between scenarios largely offsetting each other. After this point, in GG gas demand declines in domestic, industrial and commercial and power generation post-2020 leading to a steadily reducing total gas demand. In SP, relatively unchanged domestic demand and increasing gas demand for power generation lead to demand levels in the mid 2020s that are not much lower than current levels. These account for the main differences between their two scenarios. The net result for DECC's projection for total gas demand shows a small overall decrease between 2012 and 2020, then increasing slightly to 2030 reflecting a modest rise in use in power generation. The DECC projection shows little overall change in projected demand in 2030 compared with recent actual experience.

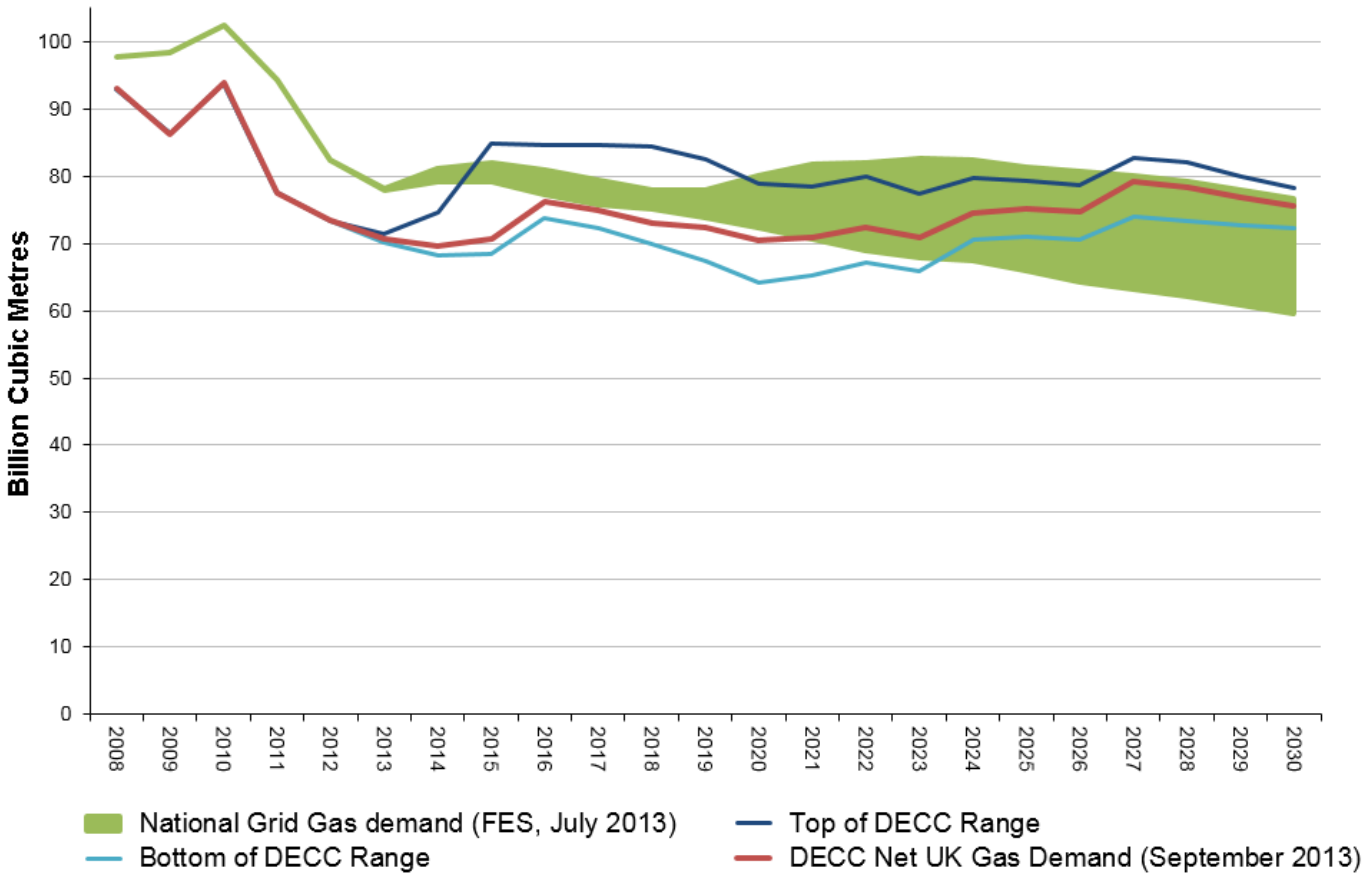
2.13 The factors that influence gas demand become harder to predict in the future, meaning that the range of possible outcomes increases. In 2013 the difference in the range of possible outcomes is 7.6 bcm[45], increasing to 18.8 bcm by 2030.

[43] Directive 2001/80/EC to be found at: http://eur-lex.europa.eu/LexUriServ/site/en/oj/2001/l_309/l_30920011127en00010021.pdf. The LCPD aims to reduce acidification, ground level ozone and particles throughout Europe by controlling emissions of sulphur dioxide (SO_2) and nitrogen oxides (NO_x) and dust (particulate matter (PM)) from large combustion plants (LCPs). The directive applied to any combustion plant with a thermal output above 50 MW and includes power generation.

[44] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2010L0075:20110106:EN:PDF.

[45] The difference at the current time is due to the difference in methodologies highlighted at paragraph 2.9.

Chart 2.3 Annual gas demand sensitivity analysis



Source: NG, Future Energy Scenarios 2013 GG and SP, with DECC's Reference Case

Peak Demand

2.14 The peak winter day demand for 2012/13 was 4323 Giga Watt hours (GWh)[46], which was 792 GWh lower than the highest ever winter peak day demand in January 2010.

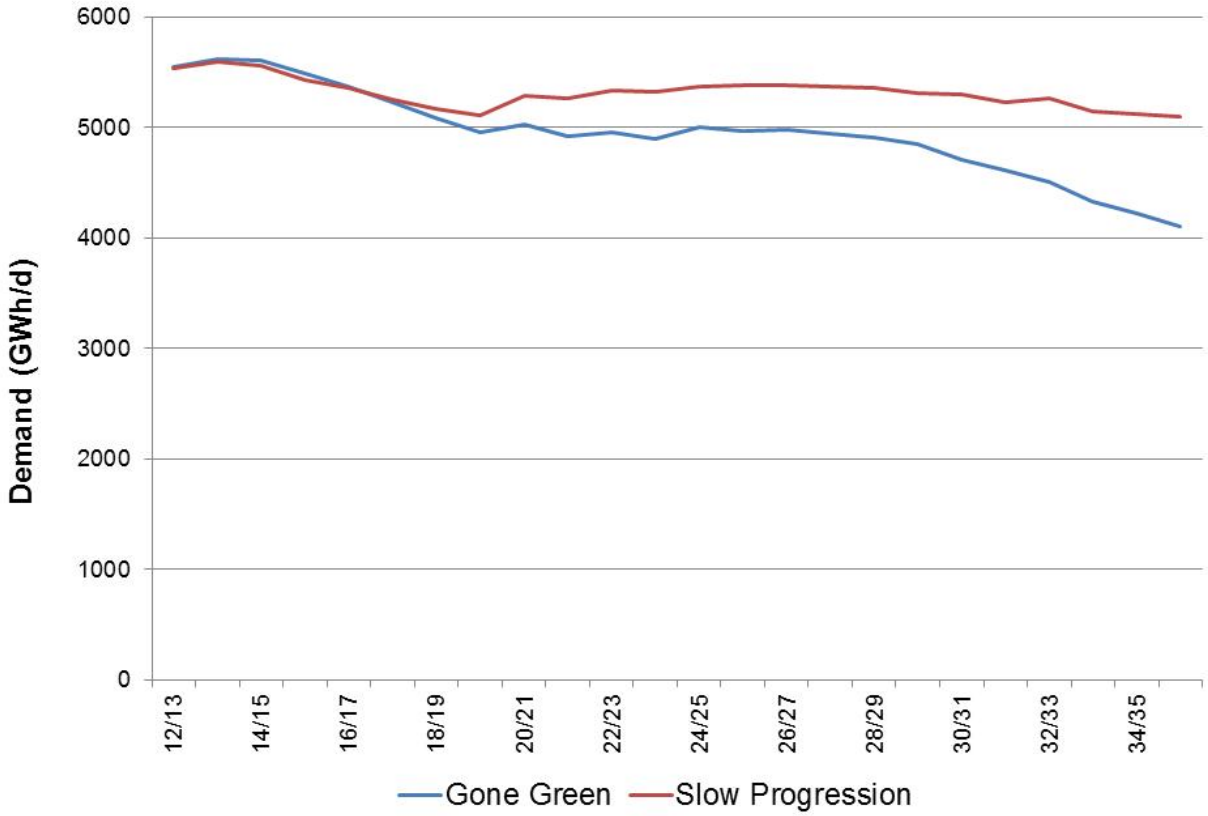
2.15 In addition to meeting annual demand, the gas market's ability to meet demand on a 1 in 20 peak day is important for security of supply. On a peak day the grid has to deliver over double the average daily gas demand. Using 2012/13 figures, in the GG scenario, average demand is forecast to be 2310 GWh/day, whereas on a 1 in 20 peak day demand could rise to 5533 GWh/day.

2.16 A peak day has been modelled in Chart 2.4 to represent a 1 in 20 cold peak day for the whole country. In reality there is no single profile of demand across the country due to differences such as temperature and population density. Chart 2.4 uses NG's two scenarios, GG and SP, and shows the peak demand in both scenarios. Both scenarios are similar up to 2018 reflecting the similarity in the gas demand expected in these

[46] Source; NG Data Item Explorer

scenarios. From 2020, the differences in the peaks become more pronounced, in recognition of the projected differences in domestic demand and demand for power generation.

Chart 2.4: 1 in 20 Peak Gas Demand



Source: NG, Future Energy Scenarios 2013

2.17 The role of gas in the UK energy mix will impact on future peak demand. Increasing amounts of intermittent wind generation will increase the volatility of gas demand, as gas-fired generators are used as back up to intermittent generation. In addition, the amount of nuclear capacity that is built will influence the extent to which gas generation is used to meet baseload demand. The amount of interconnection between GB's electricity market and mainland Europe's will also have an impact[47]. The gas system will need to respond to these challenges by becoming increasingly responsive to the changes in both supply and demand or through greater demand side response.

Demand Side Response (DSR)

2.18 DSR is a mechanism used to ensure that in times of market tightness, supply and demand can be balanced. The power-generation sector provides an opportunity for switching demand away from gas to coal or oil generation, reducing overall gas demand. In recent years, however, this facility has been minimal as low coal prices have meant coal has been favoured over gas generation. More coal and oil generation

[47] This is expanded further in both the electricity chapter of this document and in the Electricity Capacity Assessment Report response to be found at Annex A.

capacity is due to close through the LCPD and the IED, meaning this plant will no longer be available for switching.

2.19 Good levels of liquidity in the GB gas market allows non-domestic consumers to respond to price signals by either changing their demand profile or reducing demand altogether. Larger industrial consumers may have the ability to switch to alternative fuels during times of high gas prices.

2.20 Ofgem's reform of the gas cash-out mechanism, the Gas Significant Code Review (SCR), attempts to sharpen the incentives on gas market participants in order that they invest in measures to enhance security of supply. Currently in the event of a Gas Deficit Emergency (GDE) the cash-out price would be frozen which could mean GB does not receive imported gas at precisely the time it is most needed. Under the Gas SCR it is proposed that the cash-out price is unfrozen. It is expected that, if implemented, the proposals would provide a strong incentive to shippers to undertake actions which reduce the risk of a GDE occurring, such as encouraging gas market participants to invest in new infrastructure.

2.21 Ofgem have consulted on the possibility of a Demand Side Response (DSR) tender[48], and will make a decision on whether or not one should be introduced shortly. Such an auction should encourage greater participation and efficiency of demand-side response actions by commercial and industrial consumers, enabling them to signal their willingness to be interrupted earlier in an emergency in order to avoid further consumers being affected. This would give NG an additional tool to prevent involuntary interruptions to supply.

2.22 Following exit reform the previous transporter interruptible capacity contracts have been replaced by an off-peak capacity product with the scope for transporter curtailment with at least 4 hours' notice. The new arrangements came into force on 1 October 2012.

2.23 Non-daily metered consumers (domestic consumers and small businesses) are not exposed to fluctuations in wholesale prices and therefore have no signal to reduce demand. In the future, it is expected that Smart Meters will affect domestic consumer behaviour to the extent that providing real time consumption and cost information will result in consumers using energy more efficiently, and will incentivise consumers to install energy efficiency measures.

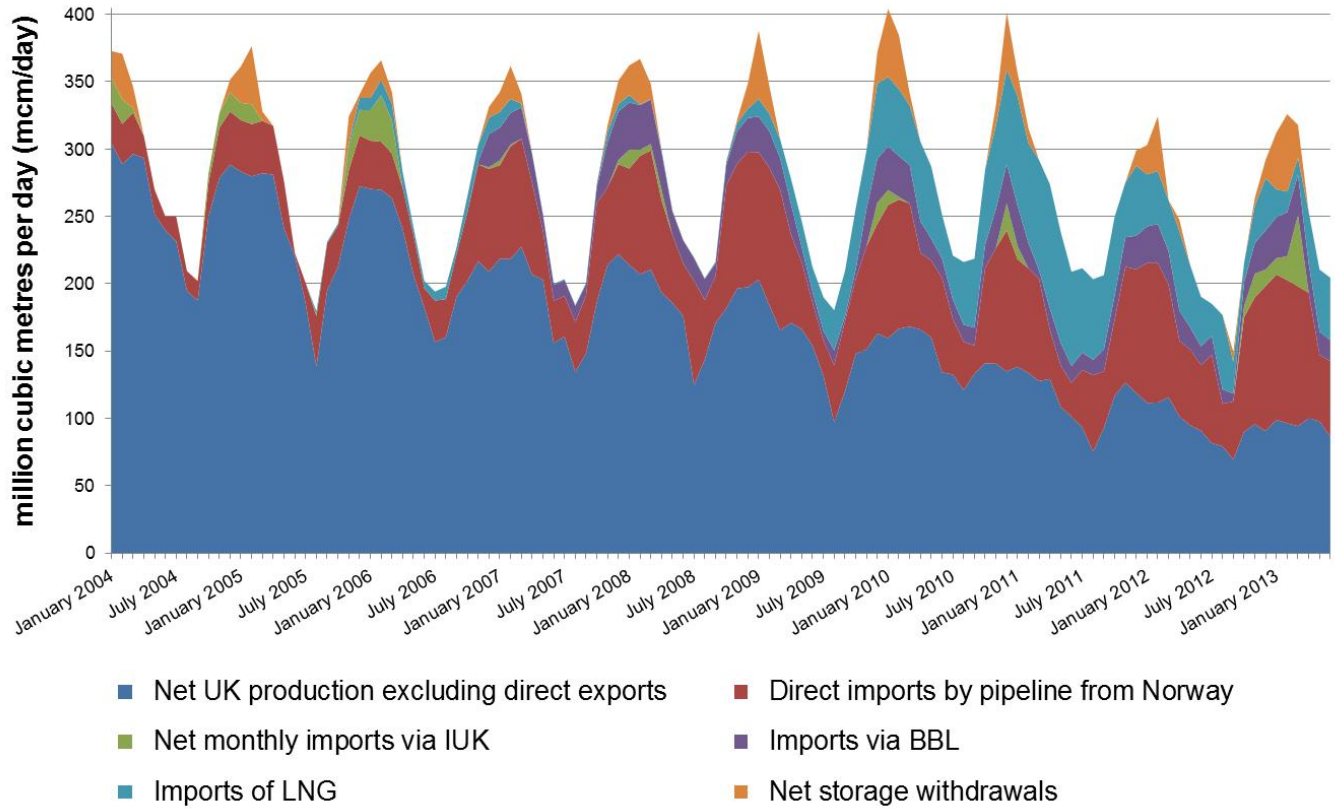
Supply

2.24 The UK has a diverse range of sources of gas supply, including domestic production, pipeline imports from Norway and mainland EU, LNG from global markets, and storage. Chart 2.5 shows that during the prolonged winter of 2012/13 there was a significant increase in imports from the BBL and IUK interconnectors as well as significant

[48] https://www.ofgem.gov.uk/publications-and-updates/gas-security-supply-significant-code-review-%E2%80%93-demand-side-response-tender-consultation

withdrawals from storage. LNG imports fell significantly from the levels seen in the previous two years[49].

Chart 2.5: UK Monthly Gas Supply



Source: DECC Energy Trends, 2013

Peak Supply

2.25 The UK needs to be able to access gas and the gas supply infrastructure needs to be able to deliver gas when it is needed, so that supply can meet peak demand. The infrastructure in the UK is able to deliver approximately 700 mcm/day. Charts 2.6a and 2.6b show two different peak scenarios[50] overlaid on supply capacity in the SP and GG supply scenario. This supply capacity includes physical import pipeline capacities, peak storage deliverability and capacity of the UKCS to supply at 100 per cent availability. The projection suggests that the capacity of the infrastructure would be able to meet demand on a peak day out to 2030 and beyond.

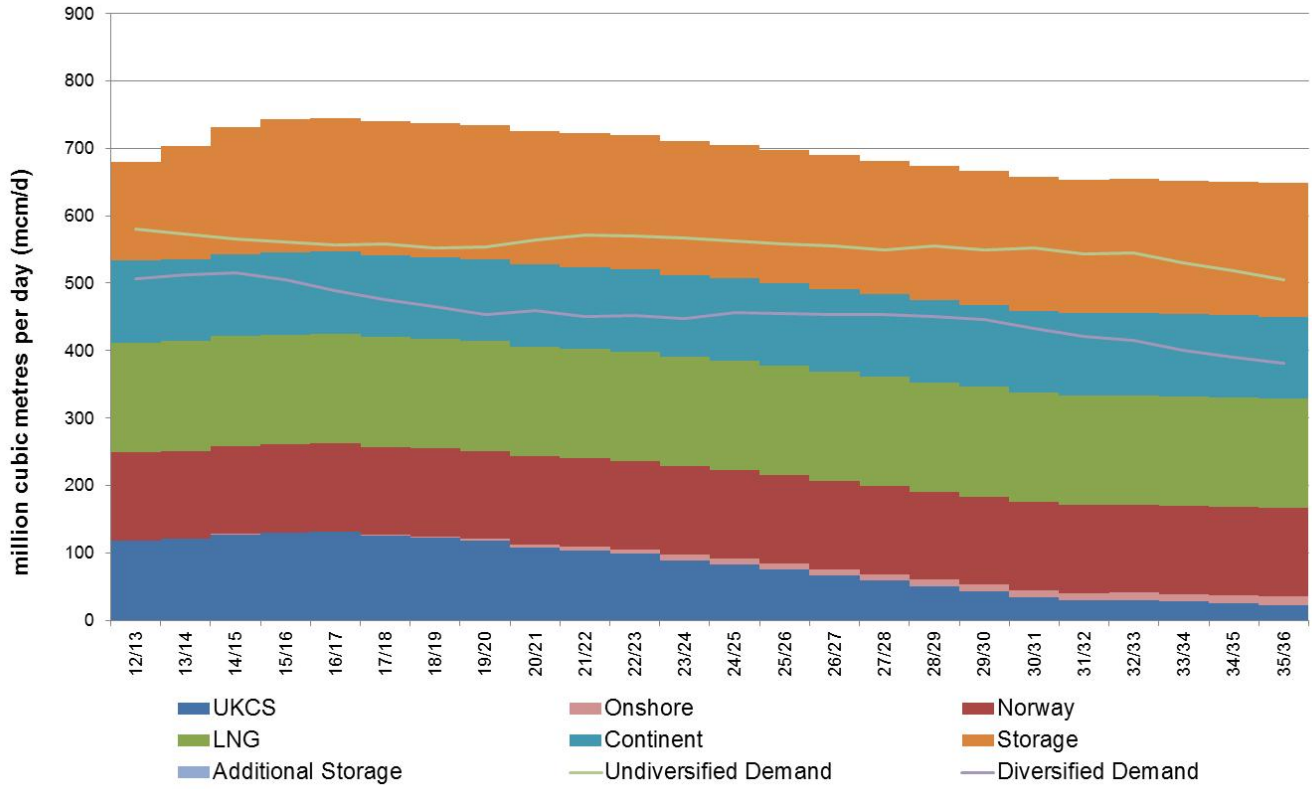
2.26 These charts show each source delivering at maximum rate, assuming each component is at full capacity. While this shows the full potential of these components, the peak

[49] This trend is discussed in more detail in the section title “Imports from the rest of the world” found at paragraph 2.44.

[50] NG’s GG and SP scenarios.

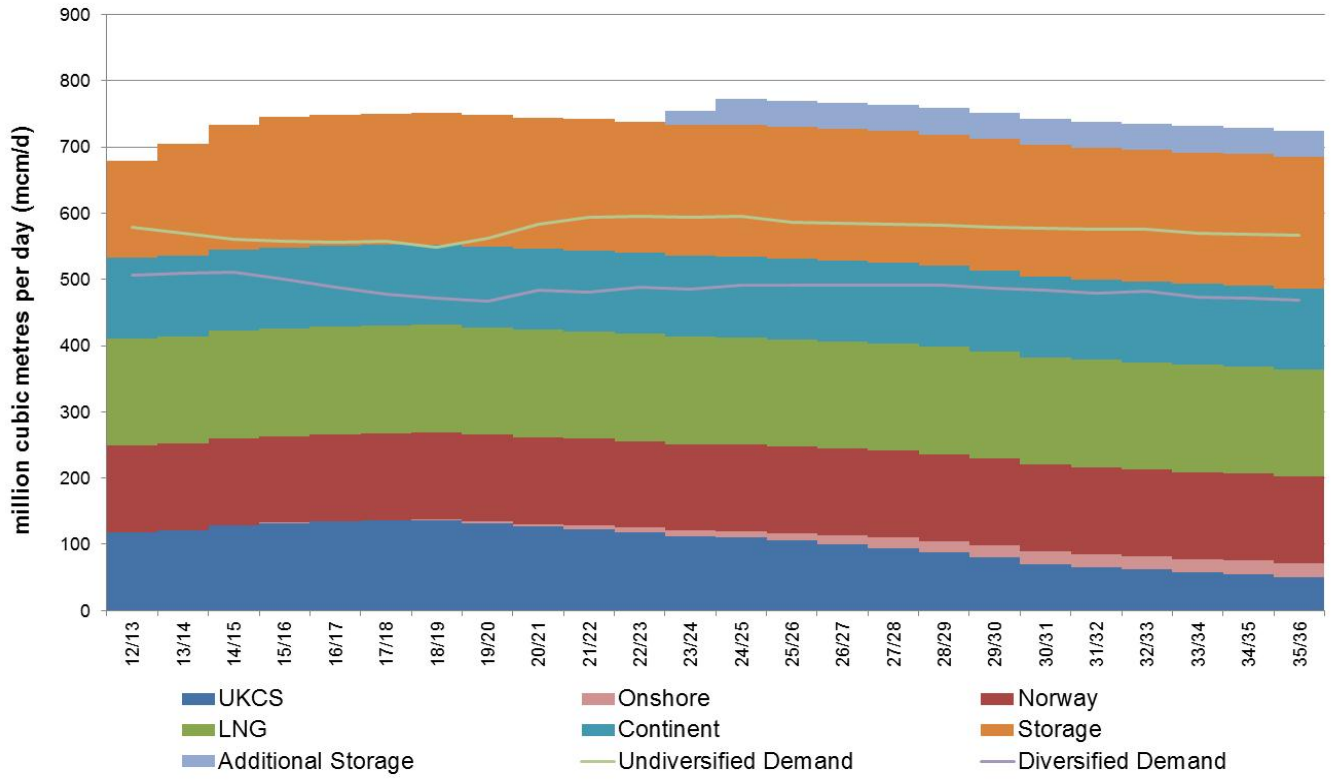
supply is overstated as not all components will necessarily provide supply at a given point in time for technical or commercial reasons. For example, LNG deliverability may be restricted by limited stocks and for many storage sites maximum deliverability may be restricted to just a few days and in the winter storage may be depleted in advance of any peak day.

Chart 2.6a: Peak Day Gas Supply; Gone Green



Source: NG, 2013

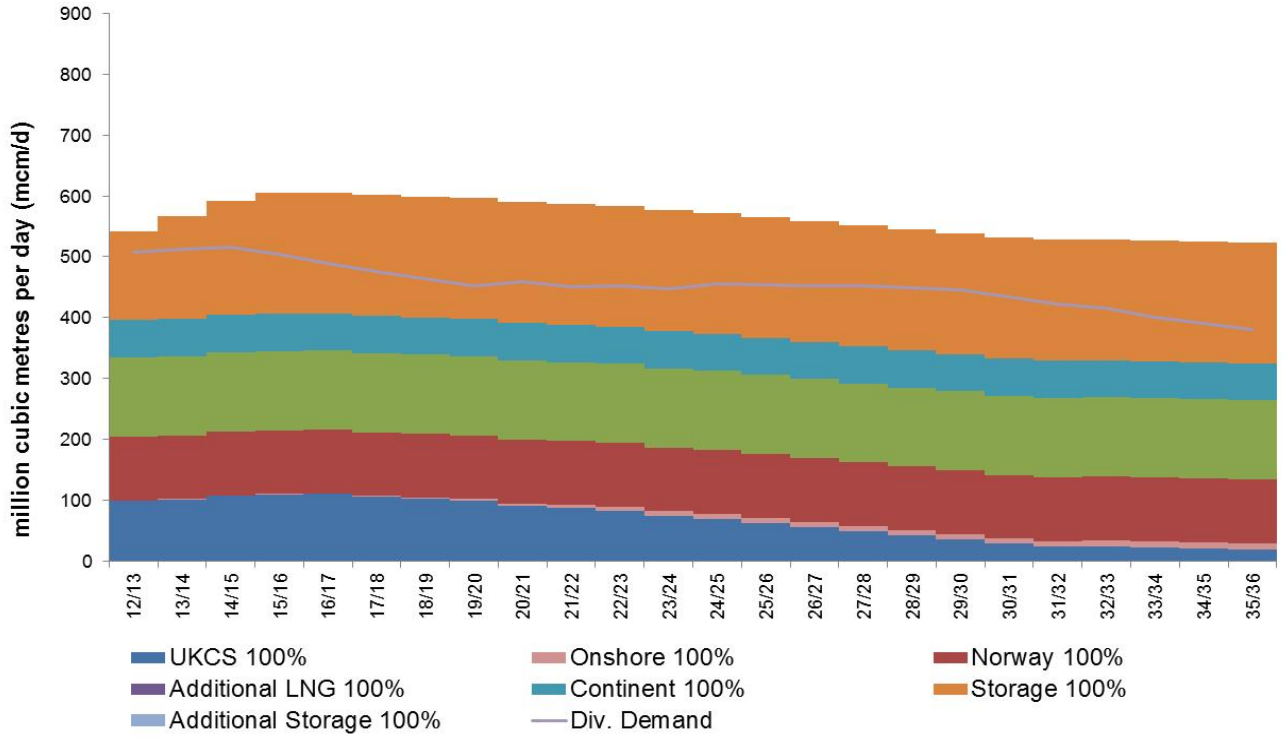
Chart 2.6b: Peak Day Gas Supply; Slow Progression



Source: NG, 2013

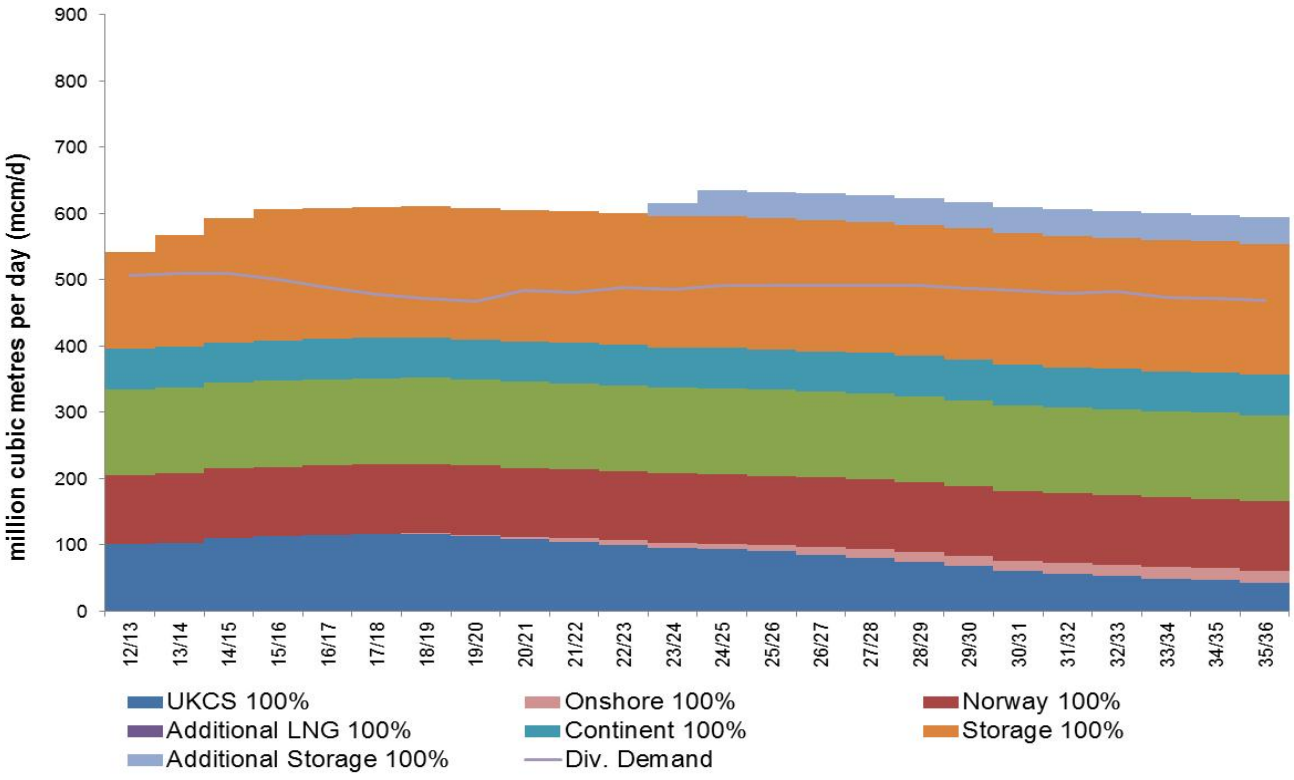
2.27 Charts 2.7a and 2.7b depict the "de-rated" capacity to show typical operational winter characteristics in light of historically observed availability levels. With de-rated capacity values, the supply picture tightens, particularly in the SP scenario. However, while using de-rated values can be useful to reflect expected flow rates at times of peak demand, caution must be exercised as there are a number of factors that influence the availability of actual gas molecules throughout the supply chain. If demand outstrips supply at de-rated capacity it is likely that actual capacity utilisation increases as market participants take advantage of price rises and so ensure demand is met.

Chart 2.7a Gone Green De-rated Peak daily Supply with additional LNG and storage infrastructure, de-rated values



Source: NG, 2013

Chart 2.7b Slow Progression De-rated Peak daily Supply with additional LNG and storage infrastructure, de-rated values



Source: NG, 2013

UK Continental Shelf Production

2.28 In 2012, around half of UK gas demand[51] was supplied through UK production but in the longer term that share is expected to fall.

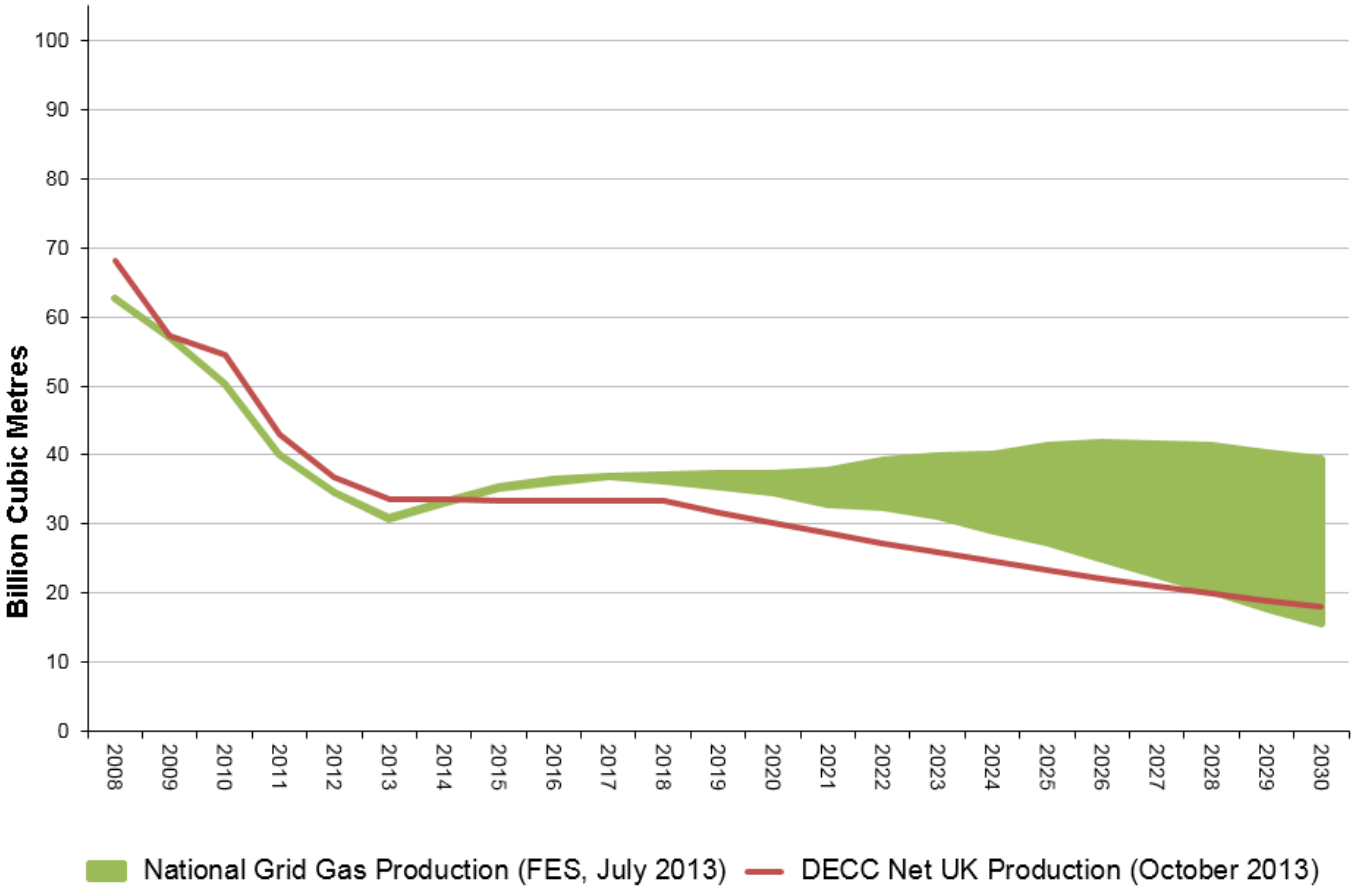
2.29 Chart 2.8 shows how production of gas from the UK Continental Shelf (UKCS) has been declining since 2000. The chart also shows DECC's latest projections of net UK gas production. There are inherent uncertainties involved, therefore the projections should be treated as indicative rather than definitive. As shown by Chart 2.5 the seasonal variation in supply from UK production, termed 'swing supply', has reduced over time. This reduction reflects a greater share of production from associated gas fields, and less from dry gas fields, where producers are more reluctant to flex production[52] and also because a declining share of production is sold under buyer-nomination contracts which allow production to be varied in line with demand.

2.30 The UKCS is one of the most mature basins in the world. Work is underway to upgrade infrastructure in the hope that this will increase production efficiency in existing fields, at the same time fields previously considered not commercially viable are coming on stream.

[51] https://www.gov.uk/oil-and-gas-uk-field-data

[52] Associated gas fields hold both oil and gas, and gas is produced as a joint-product with oil. Since oil is the higher value product, production tends to be governed by conditions in the oil market. Dry gas fields contain only natural gas and so their production is influenced but not determined by short term supply and demand conditions in the gas market.

Chart 2.8 Actual and Projected gas production from the UK Continental Shelf



Source: UK Continental Shelf Oil and Gas Production Projections, DECC with NG Gone Green and Slow Progression for comparison

Unconventional Gas Production in the UK

2.31 A study conducted by the British Geological Survey (BGS) and published in 2013 identified shale gas potential in the Bowland Basin, an area covering 11 counties in the northern half of England. The area stretches from Wrexham and Blackpool in the west, to Nottingham and Scarborough in the east. Scientists from the BGS have estimated, on a central scenario, a likely shale gas resource of 40 trillion cubic metres (approximately equivalent to 1,300 trillion cubic feet). While this does not mean that this amount could be extracted for use, the report published gives industry and regulators an indication of how best to plan future exploratory drilling to determine how much of the gas may be commercially viable to recover. This will be substantially lower than the total amount of gas in place because of technical limitations and commercial viability.

2.32 Work to maximise the prospects of GB's domestic gas resources including from unconventional sources such as coal-bed methane and shale has resulted in the setting up of the Office of Unconventional Gas and Oil at DECC, which aims to promote the safe, responsible, and environmentally sound recovery of the UK's unconventional reserves of gas and oil.

Imports

2.33 Since 2004 the UK reverted to being a net importer of gas. In 2012, net imports of gas decreased slightly relative to 2011 levels because UK demand fell even more than UK production. When separated out in more detail in Table 2.1 below, it can be seen that imports of LNG decreased (notably from Qatar) while imports from Norway and continental Europe increased. This section looks at the different sources of imports the UK receives.

Table 2.1 Natural Gas Imports and Exports, GWh

	2008	**2009**	**2010**	**2011**	**2012**
Imports					
by pipeline from					
Belgium	12,174	7,945	13,568	4,032	14,264
The Netherlands	90,563	69,529	87,120	69,001	78,258
Norway	283,722	260,438	276807	234194	294586
LNG	**8912**	**110579**	**203789**	**270733**	**147879**
of which:					
Algeria	3113	19392	11524	2647	1292
Australia	-	812	-	-	-
Egypt	-	5804	1263	877	143
Nigeria	-	-	3674	12833	468
Norway	-	1862	8904	9965	1709
Qatar	-	61159	159984	230618	144267
Trinidad & Tobago	5799	21550	16646	5816	-
USA	-	-	-	1552	-
Yemen	-	-	-	6425	-
Total Imports	**395371**	**448491**	**581284**	**577960**	**534987**

Table 2.1 Natural Gas Imports and Exports, GWh					
Exports to:					
Belgium	45949	62084	95932	101526	50343
The Netherlands	10389	13094	15830	17544	23729
Norway	389	266	158	125	49
Republic of Ireland	54260	54357	56266	58041	57590
Total Exports	**110987**	**129801**	**168186**	**177236**	**131711**
Net Imports	**284384**	**318690**	**413098**	**400724**	**403276**

Source: DECC, Digest of UK Energy Statistics, 2013 (Table 4.5)

Import Capacity

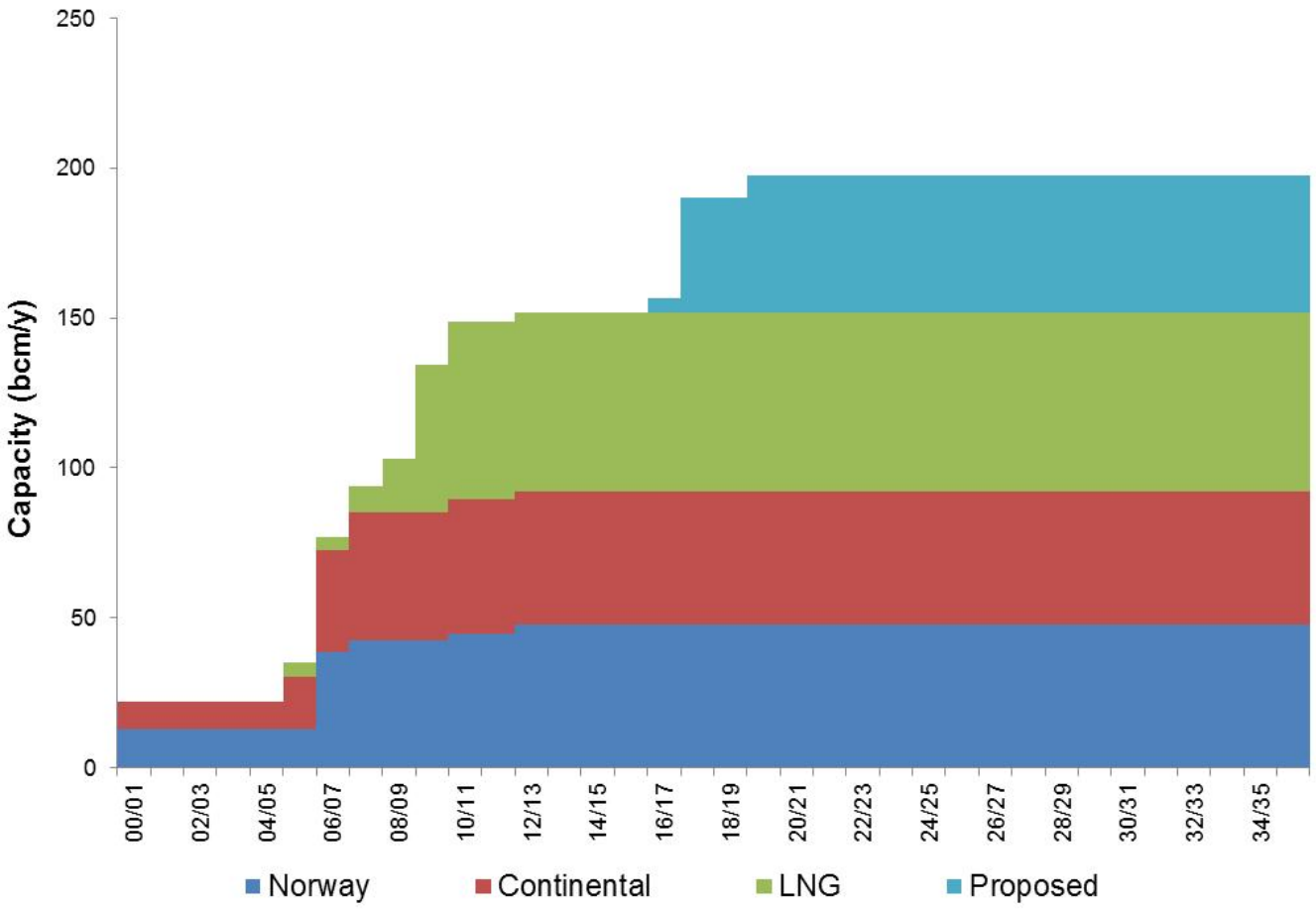
2.34 The UK has a diverse range of sources of gas supply, including domestic production, pipeline imports from Norway and mainland EU, LNG from global markets and storage. GB's gas supply infrastructure is able to deliver approximately 700 mcm/day.

2.35 Chart 2.9 shows that currently the UK has an import deliverability of ~54000 mcm/y from pipelines connecting to Norway, ~46000 mcm/y from capacity connected to the Continent, ~53000 mcm/y from LNG import terminals. It also shows that a further 43000 mcm/y import capacity has been proposed. It is important to note however that capacity is not a measure of utilisation.

2.36 Ofgem's Gas Security of Supply Report[53] highlights the risks associated with the closure of critical LNG shipping lanes and makes the point that the destination of LNG cargoes can go against price signals. The report also notes that in a normal winter the GB gas market would have to lose 50 per cent of non-storage supplies for there to be an interruption to gas supplies to large industrial users and/or the power sector. Between 60 and 70 per cent of all gas sources would have to be lost for there to be an interruption of supplies to domestic customers - equivalent to losing all LNG supply, all imports from the Continent and 50 per cent of indigenous production at the same time. Going forward, it is important that market arrangements properly reflect the importance of security of supply and its value to consumers.

[53] https://www.ofgem.gov.uk/publications-and-updates/gas-security-supply-report

Chart 2.9: Possible evolution of UK gas imports deliverability (Peak)



Source: NG 2013

Box 2.1 Events of 22nd March 2013

March 2013 was the coldest March GB had seen since 1962 with a mean temperature of just 2.2 degrees Celsius across the month. This was colder than the mean temperatures for October 2012 – February 2013 and up until March the winter had been cold but not unusually so, with temperatures within the average range from 1981 - 2011[54]. Gas prices in GB had not been particularly high over most of the winter and GB had not attracted many LNG cargoes.

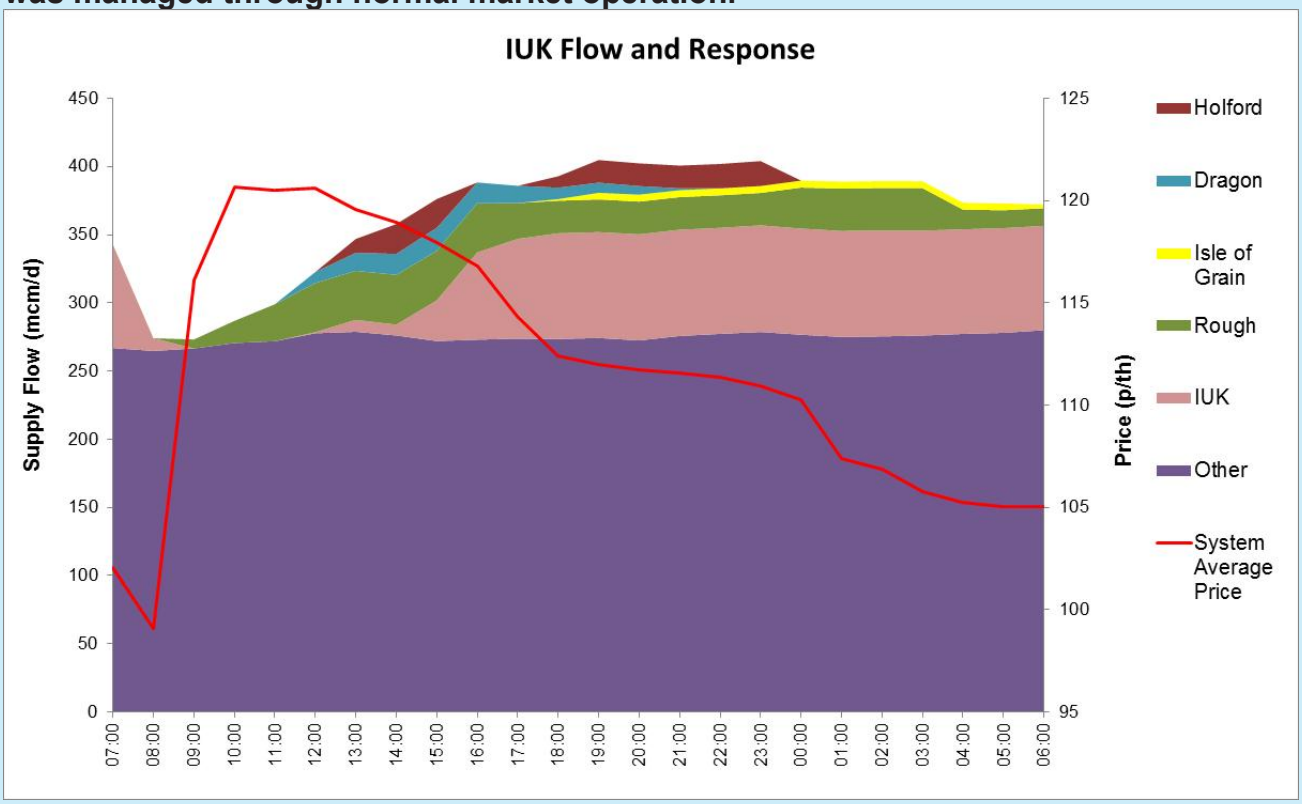
As the winter extended into March, the IUK interconnector from Belgium to GB played an important part of the supply mix, flowing at record import supply levels and accounting for just over 20 per cent of total supplies at the peak of the coldest period.

On the 22 March IUK experienced an unplanned shut down (due to a steam release

[54] Source; Met Office

from a heater pump) that triggered automatic cessation of flows from Belgium. The 'within-day' wholesale price increased in GB in response to the market sourcing alternative gas supplies to make up the shortfall. Within-day prices briefly reached a maximum of £1.50 / therm, before falling back as new replacement supplies came from storage at Rough and Holford and an increase in LNG flows from the Isle of Grain and Milford Haven. The chart below shows the prevailing supply portfolio against the within day System Average Price (SAP), illustrating how new supplies responded following the IUK loss.

IUK resolved the problem by noon the same day, steadily returning flows to previous importation levels by mid-afternoon. By the end of the gas day NG needed to sell gas back to the market to balance an oversupplied system (a combination of the return of IUK and the continued supply from some of the storage sites). Ultimately, the event was managed through normal market operation.



Source: NG

Norway

2.37 Norway is a crucial gas supplier to GB, supplying around 34 per cent of total gas demand in 2012. Norwegian supplies increased last year following the resolution of some operational issues and, in part, replaced declines in LNG imports attracted to higher-priced Asian markets.

2.38 Norway currently has the infrastructure capacity to export 53.8 bcm/y to GB. Infrastructure built to supply the UK includes: the 13.1 bcm/y Vesterled pipeline supplying gas to St Fergus; the 25.3 bcm/y Langeled pipeline supplying gas to Easington; and, the 9.1 bcm/y Tampen link and the 6.2 bcm/y Gjoa link both of which feed into the FLAGS pipeline. Total Norwegian production is currently about 100 bcm/y; forecasts for this decade range from unchanged from today to a 20 per cent increase. There is uncertainty surrounding future Norwegian production beyond 2020 due to lack of knowledge about the extent of gas resources in the Barents and Norwegian Seas.

2.39 Norway decided in 2012 not to expand infrastructure from the existing Snøhvit field, the first development in the Barents Sea, but to focus on optimising the existing infrastructure. However, this does not exclude the possibility of new infrastructure associated with gas finds in the High North and 2013 has seen further development of the Polarled pipeline project to connect gas fields in the Norwegian Sea to the existing Norwegian network serving the UK and continent. Furthermore, Norway concluded its 22nd Norwegian licensing round in June 2013 with the award of 24 new exploration blocks in the Norwegian and Barents Seas. Further information about the possibility of new infrastructure will be available following more hydrocarbon exploration.

Mainland Europe Imports and EU Network Codes

2.40 GB has a gas interconnector with Belgium and a pipeline from the Netherlands. During Winter 2012/13 these import pipelines played a more significant role in meeting the UK's gas demand, supplying 16.5 per cent of the UK's gas supply over the winter period. They are increasingly taking a role in flexing supply by responding to price signals, which ensures the system balances. The pipeline with the Netherlands (BBL) accounted for over 5.6 bcm of the UK's gas supply in winter 2012/13, 464 mcm up from over 5.2 bcm in winter 2011/12. The interconnector with Belgium (IUK) accounted for over 4 bcm of the UK's gas supply in winter 2012/13 up from 37 mcm in winter 2011/12.

2.41 Ofgem, in conjunction with the Belgium and Dutch regulators, has published updated analysis on the price responsiveness of gas flows through the interconnectors as well as the next steps necessary to improve their efficiency[55]. The analysis has found that gas on the IUK link between GB and Belgium mostly flows to where the price is highest. Furthermore, in March 2013, when there were National Balancing Point (NBP) price spikes and very strong price incentives to flow gas from Belgium to GB, the market saw record imports through IUK. However, one of the charges suppliers must pay to bring their gas onto the GB onshore network discourages the import of gas to Britain and encourages the export of gas from GB. On the link with the Netherlands, (which only flows to GB), gas was imported into GB on 60 per cent of the days when the GB price was lower than the Dutch price.

[55] http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=225&refer=Europe

2.42 The EU Third Energy Package[56] set out provisions for the establishment of a number of EU Gas Network Codes. The aim of the Network Codes is to increase competition in the EU gas market and remove barriers to gas trading between Member States. This will have a downward pressure on EU's collective gas bill, benefiting both domestic and non-domestic consumers and should tackle some of the causes of the inefficiencies discussed above.

2.43 On balance, increased interconnection with the continent is thought to improve the UK's energy security of supply, with the positives of being able to access gas from a larger pool outweighing the negatives of increasing exposure to larger supply disruptions on the continent. The UK is currently well supplied in terms of import infrastructure, able to meet 109 per cent of demand on a 1 in 20 peak winters day even with the loss of the most significant piece of gas supply infrastructure. Consequently there are currently no proposals for new gas interconnectors to be built.

Imports from the rest of the world

2.44 Imports from outside of Europe to GB are largely via Liquefied Natural Gas (LNG). From 2011/12 to 2012/13, there was a decline in LNG imports from around 47 per cent to around 28 per cent of UK gas imports as LNG cargoes were diverted away from the European market and towards higher priced markets in Asia.[57] In particular Japan's continued high gas demands following the Fukushima accident continued to ensure higher gas prices in their market. Gas prices in Japan are expected to remain higher than those in Europe for at least the short term. This is not a cause for concern as LNG in the UK is one of a number of flexible sources of supply. The shortfall has been met by higher deliveries through the Continental and Norwegian pipelines.

2.45 Global gas markets have traditionally been regional with three, loosely interconnected markets: North America, Europe and the Asian markets. However, as the gas market continues to develop and the LNG market continues to grow, these markets will increasingly interact and influence each other's prices[58]. This interaction is being aided by market liberalisation, especially in Continental Europe. New or increased LNG production is also expected in Australia.

2.46 The International Energy Agency (IEA)[59] estimate that remaining technically recoverable resources of conventional natural gas worldwide, including proven reserves, reserves growth and undiscovered resources, are just over 460 trillion cubic metres (tcm). Remaining technically recoverable resources of unconventional gas worldwide are estimated at 328 tcm. Taken together, these resources would last more than 230 years at current production rates.

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[56] Directive 2009/73/EC and Regulation (EC) No 715/2009

[57] DECC Energy Trends, September 2013, Table 4.3.

[58] The IEA forecast inter–regional trade (excluding trade with regions such as Europe) will grow from 21% of global demand to 23% between 2008 and 2020, with LNG making up an increasing proportion. Source: IEA WEO 2010 (p.193)

[59] World Energy Outlook 2012 (p 134)

2.47 However the prospects for unconventional gas production are subject to some uncertainty:

- whether the US shale gas experience will be replicated elsewhere in the world, and if so, when this will happen,
- while there is shale potential particularly in Australia and China, the extent, timing and costs of production remain subject to considerable uncertainty, and
- the IEA consider it unlikely that significant production of unconventional gas will occur in Europe in this decade.

2.48 According to IEA, global use of gas will rise by more than 50 per cent from 2010 levels and account for more than one-quarter of global energy demand by 2035. However, it also strikes a cautious note on the climate benefits of such an expansion, noting that an increased share of gas in the global energy mix is far from enough on its own to put the world on a carbon emissions path consistent with a global temperature rise of no more than 2°C.

Storage

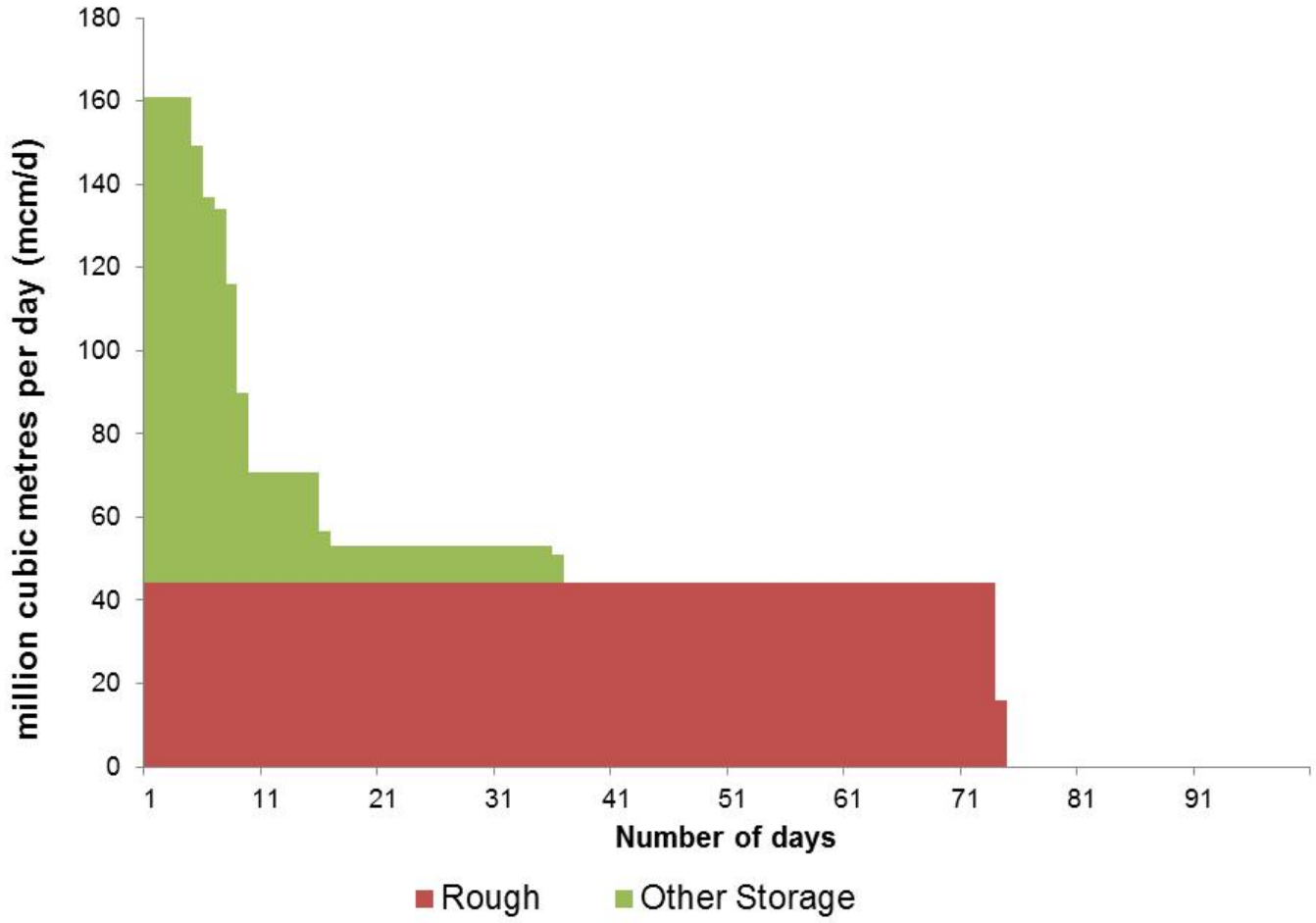
2.49 Storage facilities are another source of flexibility available to GB market participants. Storage is a useful means to mitigate supply disruptions and, alongside diverse supply sources it helps contribute to energy security. Broadly, there are two types of storage facility:

- Seasonal storage which is filled during summer months (when gas can be cheaper) and withdrawn in winter to meet increased demand (when prices are higher). Seasonal storage may be partially refilled during periods of relatively low demand during the winter.
- Fast-cycle storage, which are filled and refilled throughout the year in response to short term variations in price and demand.

2.50 Chart 2.10 shows the aggregate storage deliverability (with Rough, the UK's largest storage facility shown separately). This chart excludes Stublach which is expected to start commercial operations in spring 2014.

2.51 In the early part of 2013 media reports gave an impression that the GB gas market was near to failing to deliver. In fact the GB market responded well to the prolonged cold weather and as gas prices rose, the market responded by increasing flows from Rough and Holford storage, followed by flows from the Dragon LNG terminal. As a result there was enough supply to meet demand without any intervention required by the system operator National Grid. Gas storage only ever meets demand in combination with other supply sources so to characterise gas supply simply in terms of how many days' supply is in storage is misleading. Please see box 2.1 for more detail on this.

Chart 2.10 Nominal Storage Supply Capacity in mcm/d



Source: NG, 2013

2.52 Maximum deliverability for 2013/14 has increased to 153 mcm/day[60] as the storage facilities Aldbrough, Holford and Hill Top Farm became available. Chart 2.11 shows current and proposed gas storage capacity. The capacities shown represent the storage developers' views and in reality actual capacity is uncertain. The market is currently delivering new fast-cycle storage: Aldbrough and Holford have recently been completed, and Hill Top Farm and Stublach are currently under construction. These facilities will increase current capacity by 20 per cent and almost double daily deliverability rates from GB storage compared to 2010. There are several further storage projects with planning consent for more than double the current storage capacity, although the number of proposed storage sites that will become operational is uncertain.

2.53 Analysis commissioned by DECC from Redpoint Energy[61] to examine the case for intervening to incentivise storage or a general supply security obligation, shows that the UK gas market is robust to potential shocks. The probability of an outage affecting

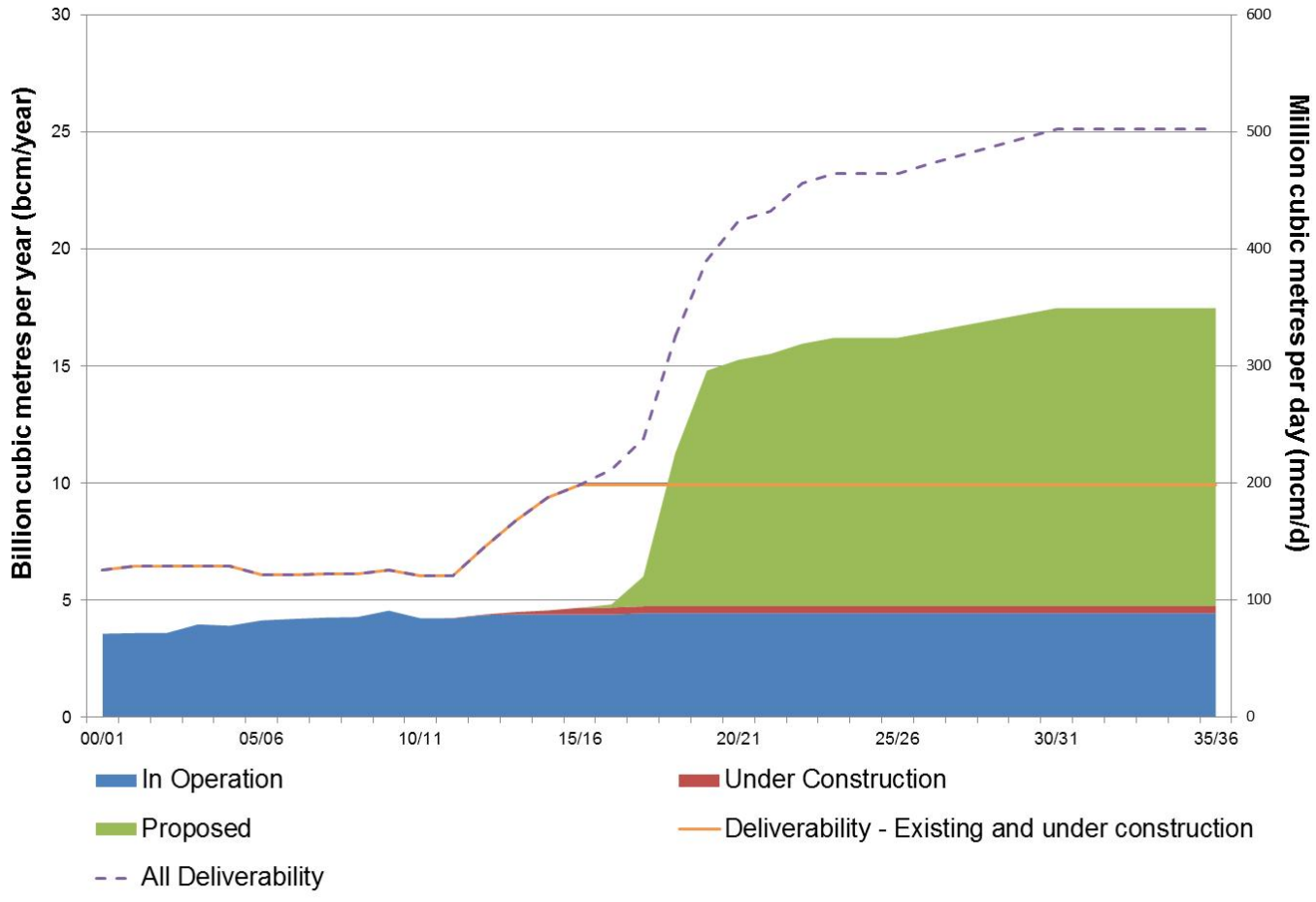
[60] NG Ten Year Statement

[61] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/236757/DECC_FI_Final_report_09072013.pdf

household and small business users in the 2020-2030 period with no further intervention is 1 in 333[62] under the scenario where decarbonisation goals are met. It also shows the costs of intervening outweigh the benefits.

2.54 Therefore, rather than intervene in the market by subsidising additional gas storage, DECC and Ofgem will be pressing ahead with other work to further improve GB's gas security of supply. Ofgem have developed proposals to sharpen incentives on gas suppliers to secure their supply; are considering an annual demand side tender to increase the scope for demand-side market participation; and have reviewed gas interconnector efficiency, identifying several opportunities to help ensure gas pipeline imports flow when the market needs them. Recent changes to European regulations designed to create a better functioning European gas market (modelled on GB gas market arrangements) are already having an effect. The electricity market capacity mechanism should provide further incentives for gas security and DECC & HM Treasury are working to maximise the prospects of UK shale gas production.

Chart 2.11 Storage Development (Space)



Source: NG, Future Energy Scenarios, 2013

[62] 1 in 333 refers to the mean probability of an interruption to firm DM gas users as modelled by Redpoint in 3 modelled years (2020, 2025 and 2030).

Network Reliability

2.55 The UK gas transmission network achieved 100 per cent reliability in 2011/12. System reliability is assessed as no supply losses to firm supply points. During winter 2011/12, there was no requirement to interrupt any customers supplied directly from the NTS on any occasion. No other transporter or emergency interruption to customers supplied directly from the NTS was required.

2.56 In the future the network will need to be able to react to the complications of greater gas demand volatility as gas is used as a back-up fuel for increased wind-power generation capacity. Ofgem is facilitating more network flexibility; RIIO-T1 allowed £26.4 million of *ex ante* expenditure so that National Grid Gas maintains the 1-20 obligation in Scotland and allows the possibility of further funding for network flexibility if Ofgem deems it appropriate.

Market Functioning

2.57 Liquidity in the wholesale GB gas market is relatively high, when compared to the wholesale GB electricity market. Total traded volumes in the GB gas market increased marginally between 2011 and 2012 to almost 19,000 TWh[63]. Over this period there was a decrease in the Over The Counter (OTC)[64] volumes traded and an increase in the volumes of futures and options products traded on the ICE European Futures exchange[65]. OTC remains the dominant form of market activity, although the proportion of trades undertaken on the ICE Futures exchange has risen in recent years.

2.59 One measure of liquidity in the gas market is the tightness of bid-offer spreads; from 2006 to 2013 (August), these have remained broadly steady between 0.4 per cent and 0.6 per cent, and have consistently remained lower than those in the electricity (baseload and peak) markets. For more detail on gas market liquidity please refer to Indicator XI in Annex B below. Ofgem remains committed to promoting liquidity in the UK gas market.

[63] Includes “Over The Counter” (OTC), Exchange (Futures and Options) and OTC cleared through exchange.

[64] Over the Counter means trading undertaken directly between two parties, sometimes referred to as “off-exchange”. With OTC trades the price is not always made public so trading through an exchange can lead to an increase in transparency and measurable market liquidity.

[65] The ICE European Futures exchange is the largest energy futures exchange in Europe.

Conclusion

2.60 Analysis shows that the UK gas market has enough capacity and deliverability to meet demand; this was particularly evident during the prolonged GB winter of 2012/13. However, there is continued awareness and action around the uncertainty of future levels of gas supply and demand at both the GB and global levels. These are affected by factors such as the impact of government policy, changes in consumer behaviour, economic growth and the future profile of the UK energy mix. The Government sees the potential for a bigger role for unconventional gas in the UK energy mix, and is ensuring that the regulatory framework facilitates exploration activity while focussing on safety and the environment. It is still too early to predict the extent to which production will be commercially viable.

2.61 Cross border and international relationships continue with gas coming into GB from around the globe via LNG shipments, interconnectors with mainland Europe, pipelines from Norway and the UKCS. All these components work to enhance gas security. Ofgem's proposals to revise the cash-out scheme to sharpen the incentives on gas market participants are intended to encourage investment in measures to enhance security of supply. The implementation of EU Networks Codes additionally strengthens the GB position.

Chapter 3: Oil

Introduction

3.1 This chapter sets out a summary of key facts on UK oil demand, UK oil production and global supply. Historic data is provided as well as, where possible, forecasts out to 2030. The document has been compiled using DECC data. As with all scenarios, a wide margin of uncertainty is inherent in the projections and future supply and demand will depend on a range of factors.

UK Oil Demand

3.2 Oil currently meets around a third of the energy demand and is the main energy source for transport meeting virtually all of the UK's needs. Oil from the UK Continental Shelf could meet nearly two thirds of current refinery demand; however oil markets are international by nature and GB also exports and imports crude oil and refined products. Due to the historical configuration of GB's refineries sector, GB runs trade surpluses on some refined products including petrol and trade deficits on others including diesel.

3.3 Oil plays an important role in the UK, meeting around a third of overall energy demand in 2012 and virtually all of its transport needs[66]. Whilst the use of oil for transport is significant – equal to around 70 per cent of total demand - the remaining volumes are used for a number of different purposes, including electricity generation, industrial processes, domestic heating and as feedstock for petrochemical, industrial and construction products and processes.[67]

3.4 The UK demand for oil products has changed over the last 10 to 15 years. Although factors such as increased vehicle efficiency and reduced use of oil for power generation have seen aggregate demand fall (from 81 million tonnes in 2005 to 67 million tonnes in 2012), growth in the aviation sector and an increased proportion of diesel vehicles in the car fleet have contributed to a significant shift in the mix of products consumed.

3.5 UK refineries have not matched the changing pattern of demand as shown by Chart 3.1. Compared to the current UK demand, they produce a surplus of gasoline, gas oil and fuel oil and relatively little middle distillates (such as diesel and jet fuel) as they remain configured to meet the historically higher levels of petrol demand. Re-aligning refinery output to better match UK demand would require substantial investment in new processing/conversion units.

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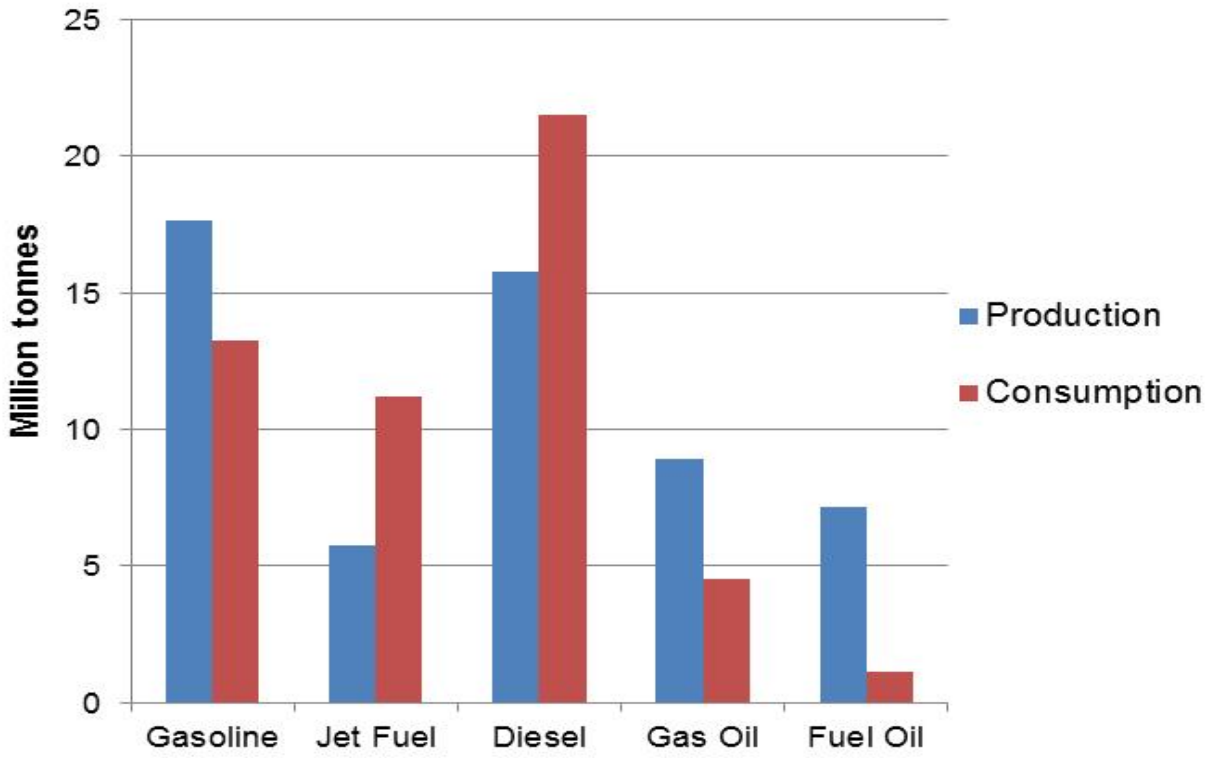
[66] DUKES 2013, Table 1.1

[67] DUKES 2013, Table 3.2

3.6 Tight margins in the European refining sector have led to refinery closures in recent years, including the closure of the Petroplus-operated Coryton refinery in June 2012. In light of the challenges facing the sector, DECC is conducting a cross-government review of the role of the refining sector in a resilient downstream oil supply chain. This review will consider the benefits of the refining sector; further understand the challenges faced and consider what action it is appropriate for Government to take to help the sector improve its competitiveness.

Chart 3.1: Production and consumption of key petroleum products 2012

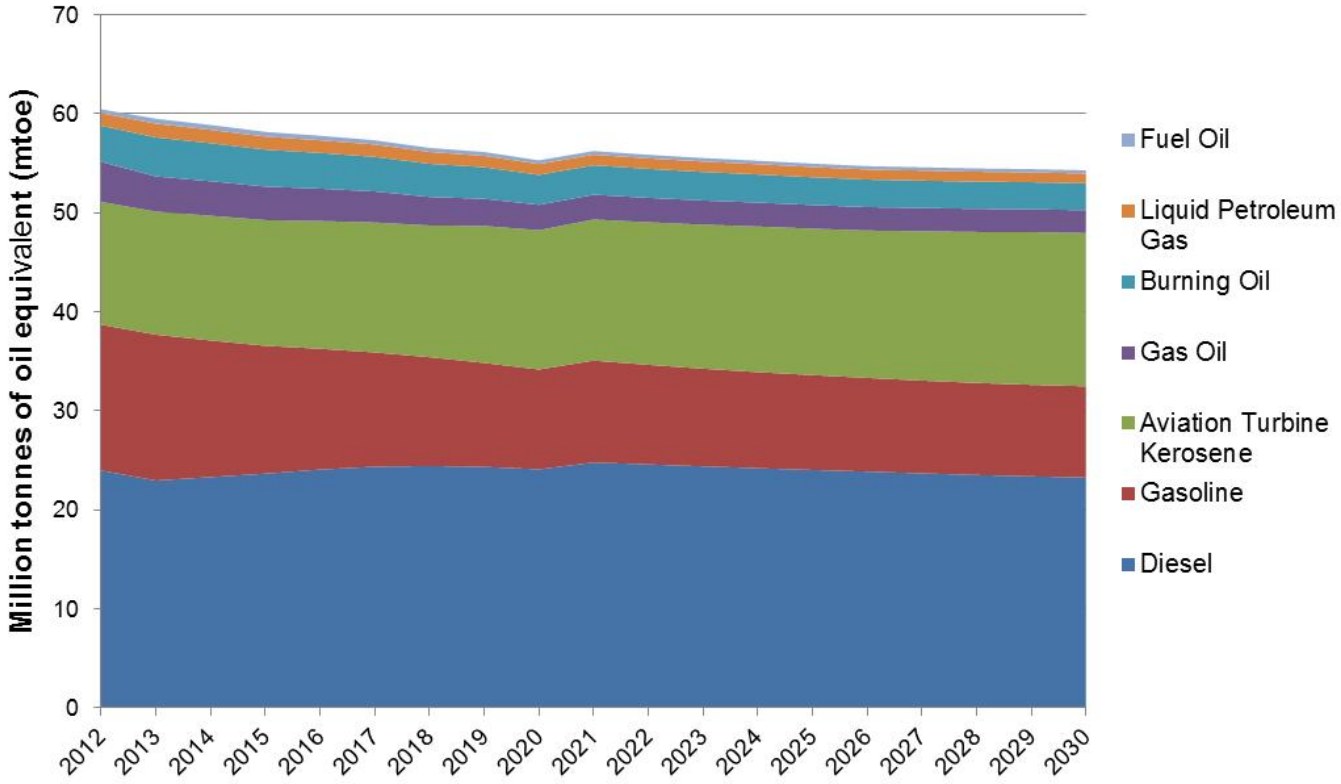


Source: DECC, Digest of United Kingdom Energy Statistics 2013.

3.7 The mismatch between refinery output and demand leads to significant trade of refined products. The UK is a net exporter of petroleum products (exporting around 27 million tonnes in total, around a third of which is gasoline) but with net imports of around 6 million tonnes of diesel and 6 million tonnes of jet fuel to cover the shortfall.

3.8 Demand for oil in the UK is set to decrease 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. However, oil will continue to be the dominant fuel for road and air transport for some time to come. As Chart 3.2 shows, demand for diesel road fuel and aviation fuel is expected to remain strong whilst demand for gasoline will continue to decrease reflecting the continuing dieselisation of the car fleet. The use of oil for heating will continue to be important but decline due to consumers switching to electric heating and schemes such as the Renewable Heat Incentive. Oil will, however, remain an important source of feedstock for petrochemical, industrial and construction products and processes.

Chart 3.2: Forecast UK oil demand by petroleum product type



Source: DECC Updated Energy Projections, September 2013

UK Oil Production

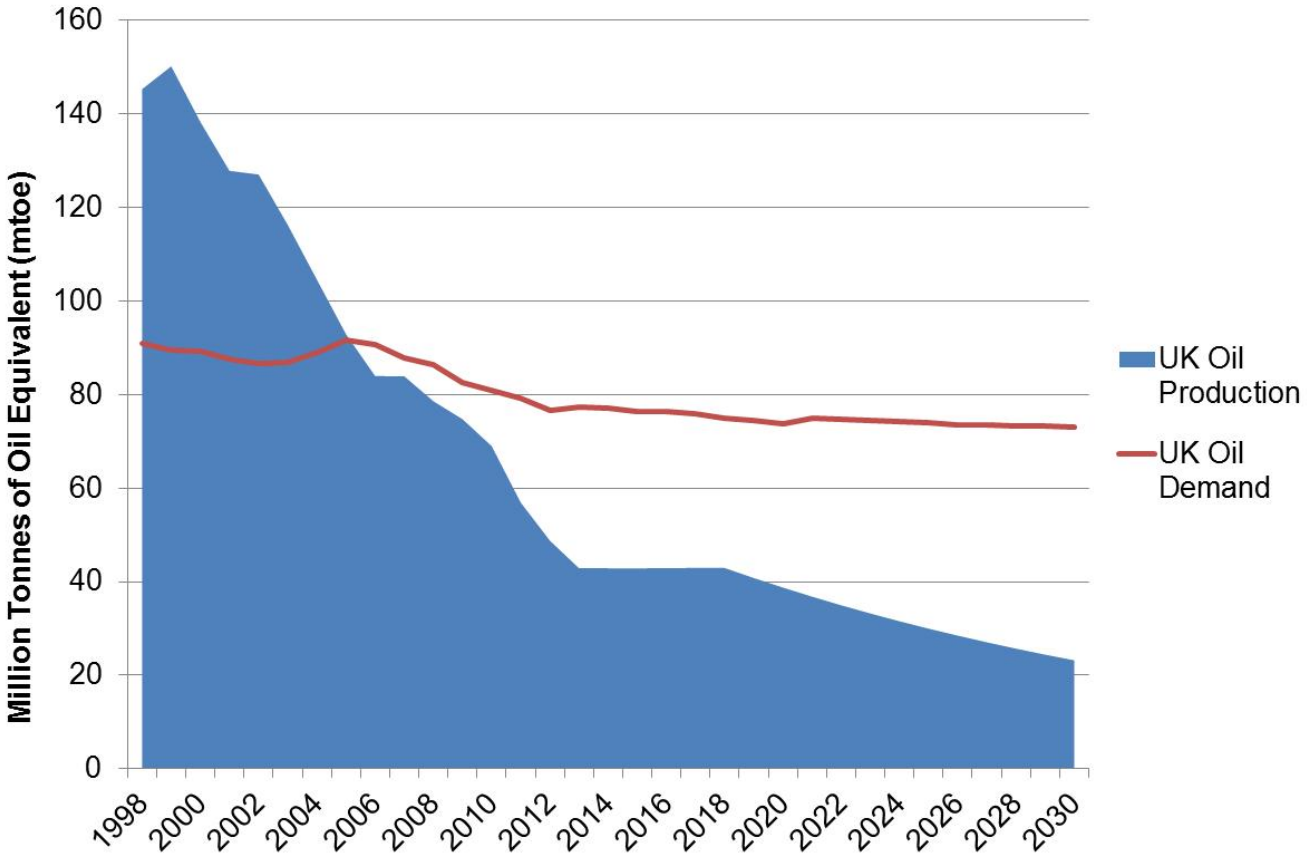
3.9 Oil production from the UK Continental Shelf (UKCS) peaked in 1999 and declined at an average rate of around 7 per cent per year until 2010. In the last couple of years a number of unexpected slowdowns in oil production resulted in an increased rate of decline in UKCS production. These unexpected shutdowns included maintenance of the Buzzard field and production restraints in the Elgin area because of a gas leak from March 2012. Consequently, there was a reduction in oil production of 18 per cent in 2011 followed by a further reduction of 14 per cent in 2012.

3.10 DECC's latest central projections indicate UK production (including Natural Gas Liquids) will be 48 million tonnes of oil equivalent in 2015, similar to the 49 million tonnes in 2012, though there is a wide margin of uncertainty with such projections. The actual rate of future decline will depend on the level of investment and the success of further exploration. Chart 3.3 shows the declining production profile and how net imports will be increasingly important in meeting a broadly flat demand profile.

3.11 The government is keen to ensure the UK continues to maximise economically viable domestic production. The recently-announced review of UK offshore oil and gas recovery, led by Sir Ian Wood, will give recommendations in early 2014 for maximising economic UK offshore oil and gas recovery, including how to tackle the declining

efficiency and poor infrastructure of oil platforms and how to enhance extraction of hard-to-reach oil.

Chart 3.3: UK Oil Demand, Production & Imports



Source: DECC projections of Oil and Gas Production & Energy Projections, October 2013

Crude oil imports

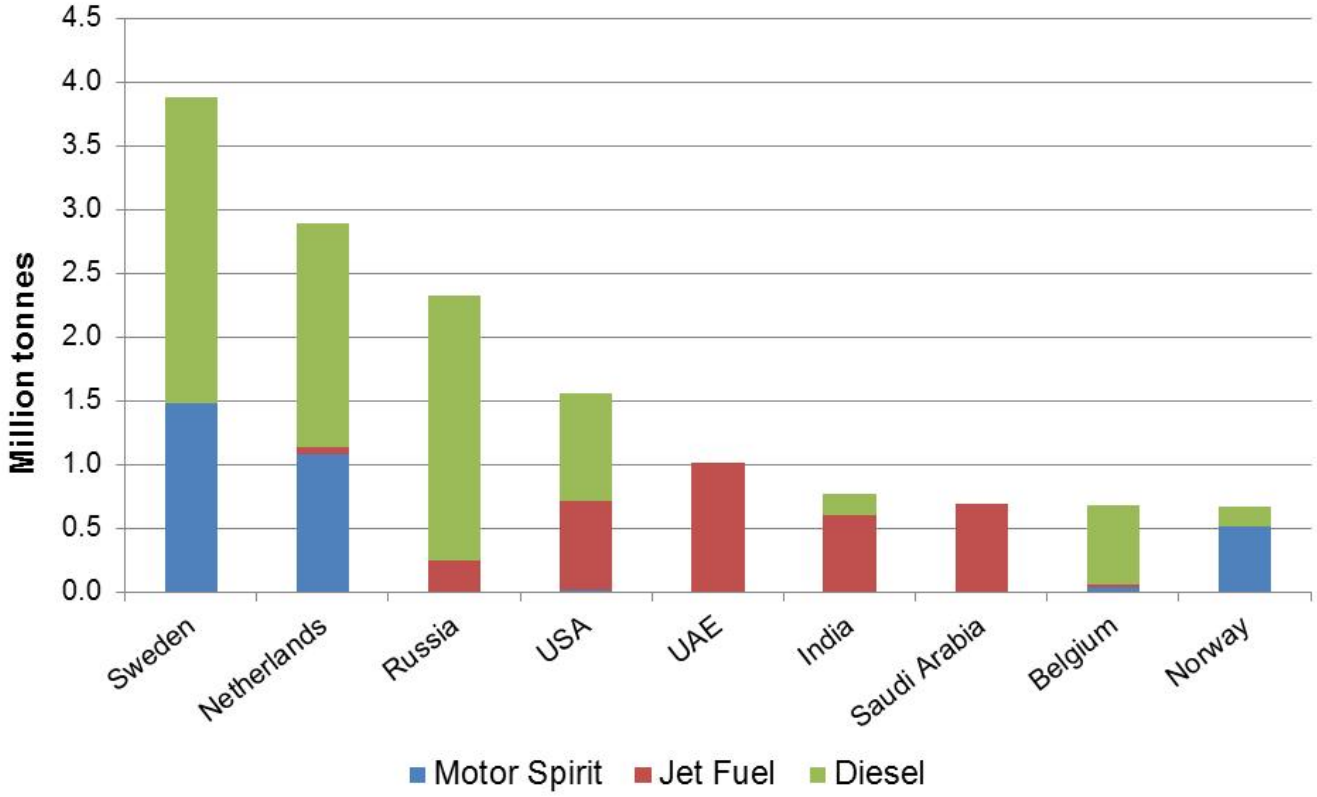
3.12 The UK's production of crude oil would be sufficient to meet over two thirds of UK refinery demand. But there is active trade in oil and in 2012 less than 20 per cent of UK crude oil production was used by UK refineries. The UK imports and exports crude oil and the direction of this trade is dependent on the prevailing market conditions.

3.13 Historically, around 65 per cent of the UK's crude imports have come from Norway, given not only its proximity to the UK, but also because Norwegian crude oil is similar to the UK's in being low in sulphur. However, this decreased to 46 per cent in 2012 due to declining reserves in Norway, resulting in imports from the OPEC countries of Nigeria, Algeria, Angola and Libya increasing significantly. This increases the diversity of sources coming into the UK and would reduce the impact of a disruption to any one source of supply on the UK.

Refined oil imports

3.14 The UK has a well-developed infrastructure for the trade of both crude oil and petroleum products, and, as Chart 3.4 illustrates, sources its petroleum products from a diverse range of countries. Around a fifth of the products come via Sweden, but the fuel might have originated from elsewhere in Europe or beyond. Imports from European countries are mainly transport diesel whilst imports from Asia are mainly jet fuel.

Chart 3.4: UK Oil Product Imports



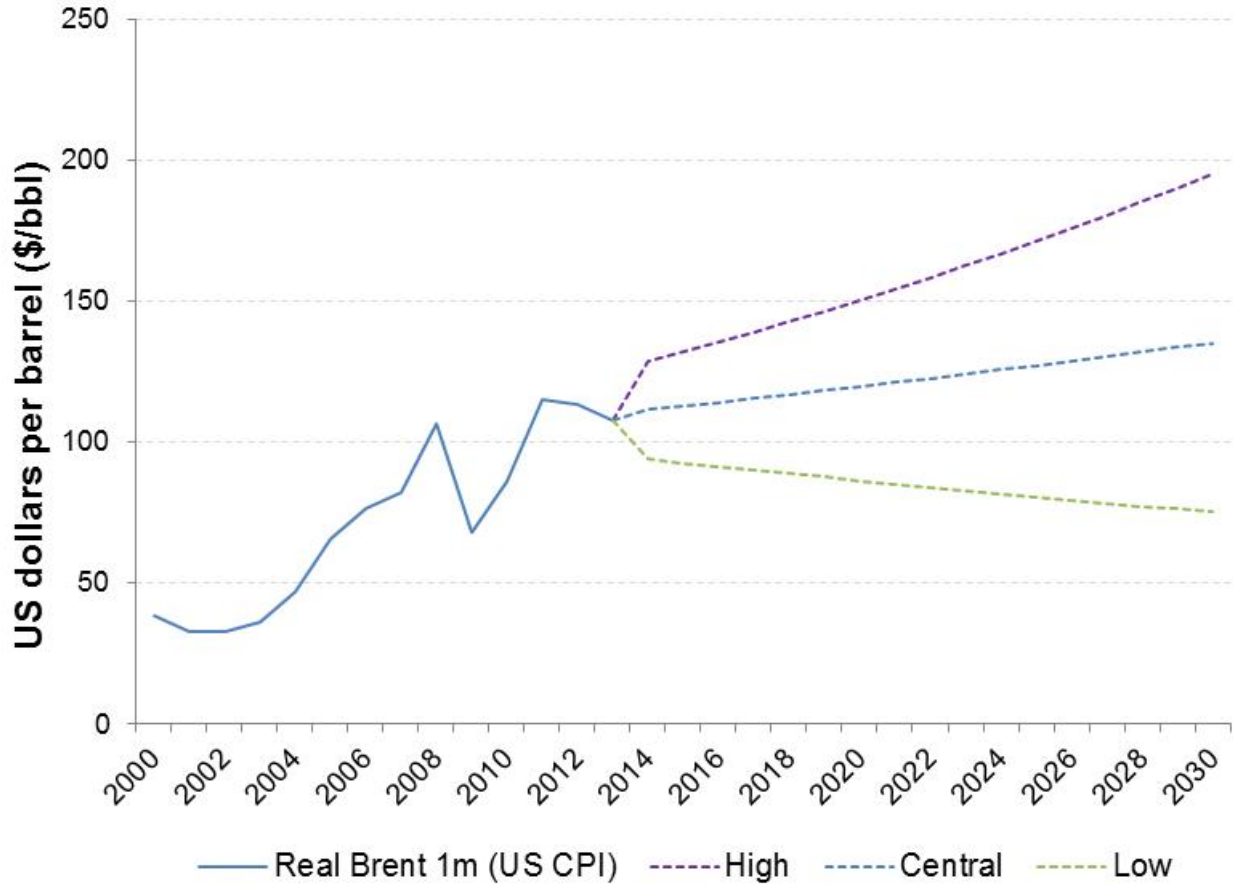
Source: DECC, Digest of United Kingdom Energy Statistics (DUKES) 2013

Global oil issues

3.15 Global oil demand is projected to increase by around 15 per cent by 2035 compared to 2010 levels[68] , driven by the emerging economies of China and India. The historical oil price, and DECC's oil price projections, are illustrated in Chart 3.5; the price of crude increased in the 2000s due to growing demand specifically from Asian economies. The financial crisis in 2008 saw a collapse of the price, which has subsequently recovered.

[68] IEA WEO 2011 analysis – New Policies Scenario

Chart 3.5: Brent oil price 2000 onwards & DECC fossil fuel projections, $ per barrel. (2013 prices)



Source: Adapted from Bloomberg and DECC fossil fuel price

3.16 Higher crude oil prices make affordable energy harder to achieve and have negative implications for economic growth. Whilst there are considerable uncertainties with such forecasts, the central estimate is for an increase in per barrel prices over the next twenty years, as shown by chart 3.5.

3.17 The low scenario represents a position where there is no growth in global oil demand. This could be the case due to policy action to address climate change, a shift in consumption preferences or prolonged weak global GDP growth. In the central scenario, global economic recovery is good, and growth in the short and medium term is on trend. Investment is timely and focused on security of supply and fuel diversification in the developed world, easing some of the pressure on prices. In the high scenario, global economic growth is faster than anticipated in both the short-term and medium-term. Trend growth continues at a faster pace throughout the period. Despite some investment there are supply constraints under this scenario.

3.18 Key drivers for price volatility this year have been strong demand, growth in emerging economies, and concern over developments in the Middle East/North Africa, including Iran, and the impact of sanctions.

Emergency oil stocks

3.19 The UK is required to hold several million tonnes of oil stocks as part of international obligations arising from membership of both the EU and the International Energy Agency (IEA). These emergency stocks can be released onto the market to maintain supply in the event of a significant disruption to global oil supplies.

3.20 From the start of 2013, a new EU Directive[69] came into force, requiring all member states to hold stocks equivalent to either 90 days of net imports (in line with the IEA methodology) or 61 days of final inland consumption, depending on which of the two is largest. As a major producing nation, the UK's consumption figure is the larger of the two, and as such is obliged to hold 61 days of final consumption as its EU obligation.

3.21 The UK held just over 12 million tonnes of petroleum products (equivalent to about 84 days of consumption under the old EU Directive) towards its obligation at the end of 2012; this was similar to the level of stock held in 2011.

3.22 As UK production declines, the net imports figure will increase, and the EU's requirement to hold 90 days net imports will eventually become the larger of the two calculated values. Considering this, a consultation launched by the government in April 2013 sought views on whether alternative mechanisms to manage the obligation may be more efficient, including the option of an industry owned and operated Central Stocking Entity.

Conclusion

3.23 The UK relies on oil products to meet a considerable portion of energy needs. Oil demand is expected to stay relatively constant in the UK in the short to medium term, that is at least to 2030, according to the current projection. Over time, technology changes, including electric vehicles and the generation of more heat from renewables, together with Government energy efficiency policies such as seeking to encourage greater use of public transport, should reduce demand for oil. The timing and scale of these demand decreases is uncertain.

3.24 Whilst still the largest oil producer in the EU, the UK's production of crude oil and natural gas liquids is decreasing. The long term trend is for a continuing but slower rate of decline in production over the next 20 years, as government has put in place a range of measure to maximise UK production and record investment has been seen in the UK continental shelf in 2012/13.

3.25 The UK remains a significant producer of refined products. The UK is a net exporter of petroleum products; it produces more gasoline, fuel oil and gas oil than it needs but

[69] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:265:0009:0023:EN:PDF

insufficient quantities of diesel road fuel and jet fuel. This has led to considerable trading of product between countries.

3.26 In recent years, the UK shifted to a larger number of crude oil import sources, this arguably strengthens security of supply. Import sources for motor spirit, jet fuel and diesel remain large and varied, minimising the impact of disruption of any one of these sources.

3.28 Globally, oil demand is anticipated to increase in the run up to 2035. Over the same period, global production is expected to become more challenging. As requirements for imports increase, the UK will become increasingly exposed to global oil markets.

Annex A

Secretary of State's Response to Ofgem's Electricity Capacity Assessment Report of June 2013

Context

A.1 The Electricity Act 1989 was amended by the Energy Act 2011 to oblige Ofgem [70] to provide the Secretary of State with a report assessing demand for, and supply of, electricity in Great Britain, including an assessment of the different possible capacity margins for that supply and the degree of protection that each would provide against the risk of shortfalls in supply. Ofgem published its second annual report in June 2013 ("Ofgem's Electricity Capacity Assessment"). The report covers the period from winter 2013/14 to winter 2018/19.

A.2 Ofgem's report can be found online at:

https://www.ofgem.gov.uk/electricity/wholesale-market/electricity-security-supply

A.3 This annex fulfils the obligation on the Secretary of State, as set out under Section 172 of the Energy Act 2004, to make an assessment of the amount of capacity required to meet the demands of electricity consumers including a spare margin to account for unexpected demand or unexpected loss of capacity for each of the periods.

Executive Summary

A.4 Ofgem's Electricity Capacity Assessment is broadly consistent with DECC's own analysis of the security of supply outlook. Both sets of analysis point to a strong likelihood that – should no action be taken - de-rated capacity margins would fall over the coming years.[71]

[70] The terms "the Authority" and "Ofgem" are used interchangeably in this document. The Authority is the Gas and Electricity Markets Authority. Ofgem is the Office of the Gas and Electricity Markets.

[71] The de-rated capacity margin is defined as the average excess of available generation capacity over peak demand expressed in percentage terms. Available generation capacity is the part of the installed capacity that can in principle be accessible in reasonable operational timelines, i.e. it is not decommissioned or offline due to maintenance or forced outage.

A.5 Although there are some differences between the two organisations' projections of de-rated capacity margins, these are principally due to reasonable differences in assumptions on the future outlook for electricity demand and interconnection.

A.6 In light of the uncertain outlook to security of supply during the middle of the decade DECC, National Grid Electricity Transmission plc (NGET) and Ofgem have each previously noted that it is prudent to explore options for additional safeguards for consumers in the form of new balancing services aimed at enabling NGET to maintain system balance.

A.7 DECC has also confirmed that it intends to initiate the Capacity Market, with the first capacity auction being run, subject to state aid approval, in 2014, for delivery of capacity in the year beginning in the winter of 2018/19. Separate auctions will also be held for the delivery of Demand Side Response (DSR) and small scale storage in the period 2016-18.

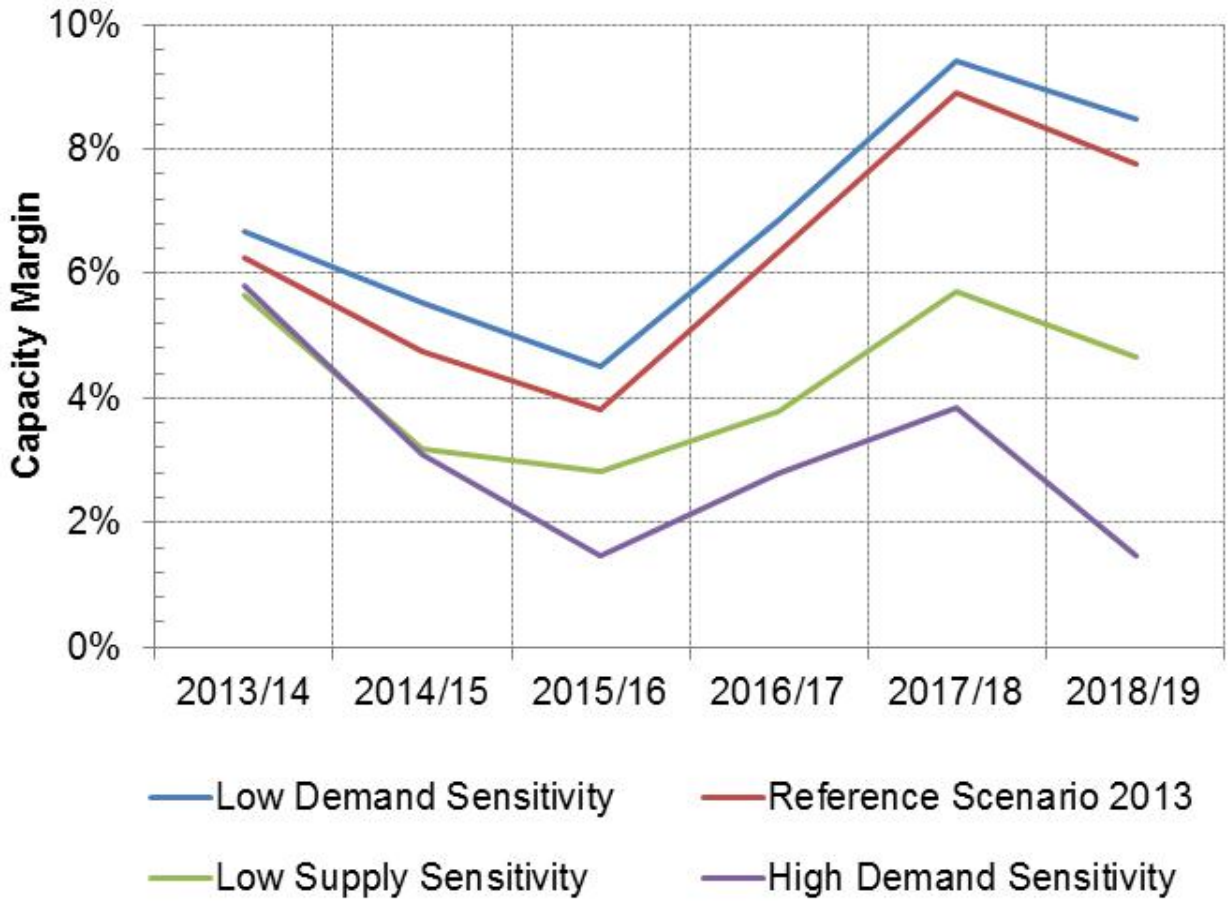
Summary of Ofgem Analysis

A.8 The methodology and assumptions underlying Ofgem's Electricity Capacity Assessment are set out in detail in its report.

A.9 Ofgem's Electricity Capacity Assessment Report 2013 suggests that the risks to electricity security of supply, in the absence of any additional policy interventions, increase faster towards the middle of the decade than expected in Ofgem's first assessment, published in October 2012. Beyond 2015/16, the risks to electricity security of supply are then expected to decrease primarily due to the impact of falling demand, although the report notes that there is uncertainty over the projected reductions in demand. According to the Reference Scenario, presented in Ofgem's report, de-rated capacity margins are expected to fall from around 6 per cent in 2013/14 to around 4 per cent in 2015/16 before recovering to around 8 per cent by 2018/19.

A.10 Given the significant uncertainties around the evolution of both demand and supply, Ofgem has also developed a number of sensitivities. A full list of these sensitivities and the assumptions which underpin them can be found in their report. Figure 1 shows a chart with de-rated capacity margins for a selection of the sensitivities that Ofgem examined. The Ofgem analysis of the outlook for security of electricity supply only considers policies that were already in place or for which a firm decision has been taken by the time of publication (for example in the absence of a Capacity Market).

Figure 1: De-rated Capacity Margins in Ofgem analysis[72]



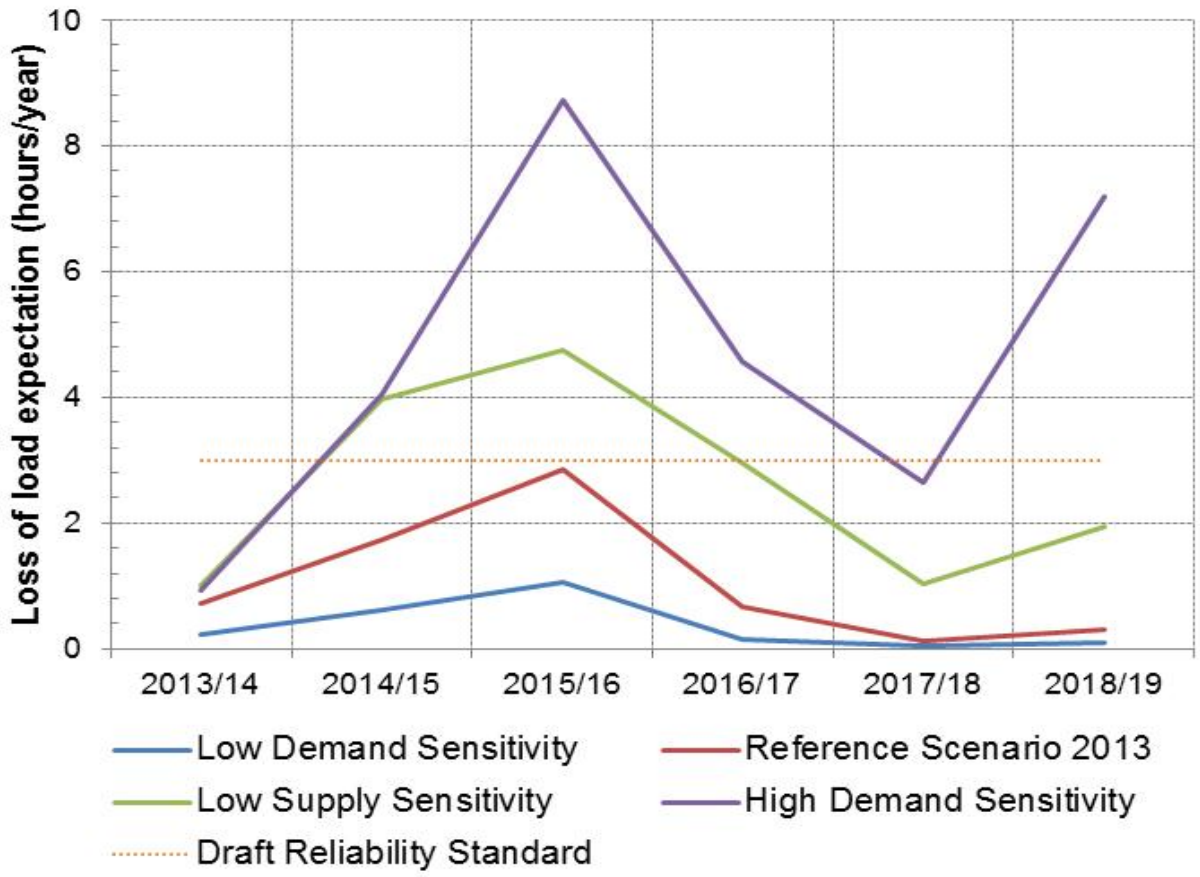
A.11 Ofgem notes that the de-rated capacity margin analysis is more useful for identifying overall trends than being a direct measure of the risks to security of supply. Therefore, in addition to the de-rated capacity margin analysis, Ofgem sets out the risks to security of supply in its analysis using risk based metrics including the loss of load expectation (LOLE)[73], and expected energy unserved (EEU). Figure 2 shows the Loss of Load Expectation for a selection of sensitivities from the Ofgem report. Figure 2 also shows the proposed Reliability Standard of 3 hours/year that DECC has consulted on as part of the draft EMR Delivery Plan to provide some context for the level of risk[74].

[72] The figures in this chart have been recreated by DECC from the Ofgem report.

[73] The Loss of Load Expectation represents the expected number of hours per year in which supply is expected to be lower than demand under normal operation of the system. By normal operation of the system we mean in the absence of intervention (e.g. voltage reduction) by the System Operator.

[74] Details on the reliability standard can be found at: https://www.gov.uk/government/consultations/consultation-on-the-draft-electricity-market-reform-delivery

Figure 2: Loss of Load Expectation in Ofgem analysis and Government's proposed Reliability Standard.



A.12 As an illustration of the impacts on customers, Ofgem also presents analysis of the probability of controlled disconnections, expressed as 1-in-n years.

A.13 Controlled disconnections of customers would only take place if a large supply deficit were to occur, as the system operator can manage supply shortfalls up to a certain level with little or no impact on customers through a set of mitigation actions available to them.

A.14 The mitigation measures include: voltage reduction; instructing generators to increase their output to maximum and calling on emergency services from interconnectors.

A.15 Ofgem assumes that the mitigation measures would be deployed in the order that they are listed above. Once all assumed mitigation measures were exhausted, it would be necessary to disconnect some customers; this would likely be industrial demand first, followed by domestic demand if electricity supplies remained unavailable.

A.16 Just as in last year's report, Ofgem's Reference Scenario estimates that without additional action the likelihood of some customer disconnections occurring in 2015/16 is 1 in 12 years. This compares to the situation this winter where the likelihood of experiencing customer disconnections is estimated to be around 1 in 47 years. If demand reductions fail to materialise in the coming years, as illustrated in Ofgem's high

demand sensitivity, the risk of customer disconnections occurring in 2015/16 increases significantly to around 1 in 4 years.

A.17 It is difficult to determine precisely the impact of disconnections on domestic customers as this would depend on the size and duration of the outage. It would also depend on whether industrial demand could be disconnected first and the size of industrial demand at the time.[75]

DECC Analysis[76]

A.18 DECC uses its Dynamic Dispatch Model (DDM) to make projections of future developments in the electricity sector including future capacity margins reflecting a set of assumptions on fossil fuel and carbon prices and costs. More details on the DDM and how it models the electricity market can be found here:

https://www.gov.uk/government/publications/dynamic-dispatch-model-ddm

A.19 No matter what modelling approach is taken, the future outlook for electricity security of supply is very difficult to project with full confidence because marginal changes in input assumptions which affect either supply or demand can have large impacts on de-rated capacity margins. Key assumptions include:

- Future electricity demand
- Retirement decisions and new build
- Contribution of interconnection
- Availabilities (or de-rating factors) of different technologies.

A.20 DECC has modelled the security of supply outlook. The full analysis goes out to 2030, but only the outputs to winter 2018/19 are shown below to mirror the scope of the Ofgem Electricity Capacity Assessment. The modelling shows the outlook both with and without a Capacity Market. The de-rated capacity margins from these scenarios are shown in Figure 3 below along with the Ofgem Reference Scenario. The full DECC analysis out to 2030 has been included in the Impact Assessment for the introduction of a Capacity Market.

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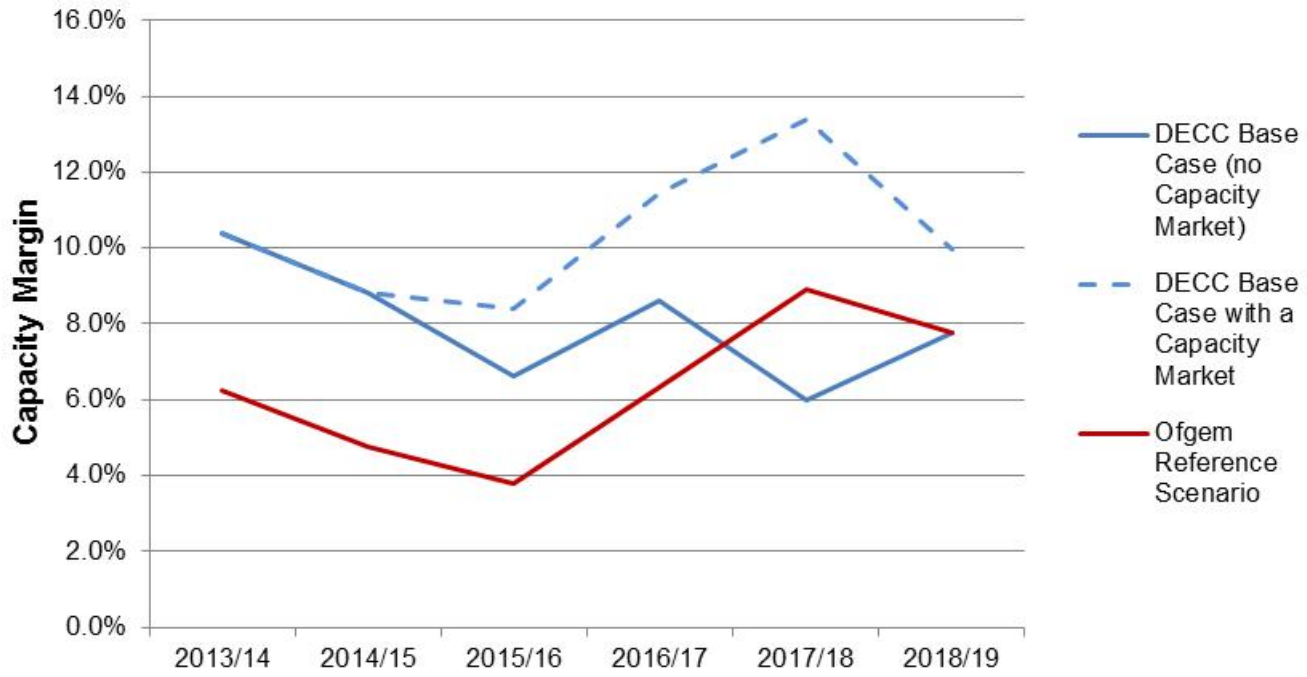
[75] Some information on the impact of disconnections on domestic customers can be found in a report jointly commissioned by Ofgem and DECC, and produced by London Economics, on the Value of Lost Load for Electricity in Great Britain: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/224028/value_lost_load_electricty_gb.pdf

[76] DECC's analysis in this document is consistent with the analysis for the Capacity Market Impact Assessment published in October 2013: https://www.gov.uk/government/consultations/proposals-for-implementation-of-electricity-market-reform

A.21 As can be seen, while the Ofgem reference scenario and the DECC Base Case do not mirror each other exactly, they do present a broadly similar trend in the period up to 2016/17; whereby the de-rated capacity margin is continuing on a downward trend until the middle of the decade, as it has been doing in the past few years. Beyond 2016/17, the Ofgem Reference Scenario and the DECC Base Case differ over the direction that de-rated margins are heading. Ofgem project that de-rated margins will rebound from 2016/17 onwards, whereas DECC project the downward trend to continue. Both organisations show that de-rated margins are to remain low throughout the projection period by recent historical standards.

A.22 Since Ofgem's previous Capacity Assessment, both DECC and Ofgem have been working to understand the drivers behind the trends in their respective analysis and have independently come to a shared view on many areas. DECC and Ofgem share the same view on some of the input assumptions in their respective analysis on security of electricity supply. For example, DECC and Ofgem assume that the same level of reserve is held back to cover the single largest loss on the system and also that the same de-rating factor for different technologies are the same as those that have been used by Ofgem in their analysis[77]. However, not all assumptions align and there are differences in de-rated capacity margins, driven by separate views on the evolution of electricity demand and supply.

Figure 3: DECC and Ofgem estimates of de-rated margins



A.23 The key differences between the Ofgem Reference Scenario and the DECC Base Case are as follows:

[77] This is a difference between the two analyses and DECC assumes a de-rating factor for interconnectors while Ofgem does not.

Demand: The DECC reference scenario, both with and without a Capacity Market, use demand figures based on DECC's Updated Energy Projections published in September 2013[78], whereas the Ofgem reference scenario is based on NGET's 2013 Gone Green projections which form part of their Future Energy Scenarios[79].

The DDM derives peak demand from these annual demand figures which are calibrated to reflect the actual reported figures from last winter. DECC projects a greater reduction in expected peak demand than in the Gone Green 2013 scenario used by Ofgem for the Reference Scenario. This is largely as a result of more optimistic assumptions around energy efficiency, as well as underlying differences in the growth of embedded renewable generation.

Contribution of interconnection: The DECC Base Case assumes that our interconnectors are neither importing nor exporting at times of peak demand through our interconnectors; the Ofgem Reference Scenario assumes 0.75 GW of net exports in the winter season[80]. This is a key area of uncertainty.[81] In general, Ofgem expect that interconnectors will be helpful for security of supply as they assume that we would be able to call on around 2 GW (in the Reference Scenario) of emergency services from our interconnectors before any customer disconnections would take place.

Potential impacts in 2015/16

A.24 The above analysis is consistent with that in the 2012 Statutory Security of Supply Report, which identified that 2015/16 is likely to present the most severe near-term challenge to security of electricity supply. While we present the expected risks in 2015/16, other years in Ofgem and DECC's analysis could potentially present a challenge to security of electricity supply.

A.25 Table 2 sets out the potential impacts to security of electricity supply in 2015/16 from four alternative scenarios.

[78] https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2013

[79] http://www.nationalgrid.com/NR/rdonlyres/2450AADD-FBA3-49C1-8D63-7160A081C1F2/61591/UKFES2013FINAL3.pdf

[80] Both the Ofgem Reference Case and the DECC Base case assume that the Irish Interconnectors, representing around 0.75 GW of capacity will be fully exporting at winter peak. The differences are due to our different assumptions on continental interconnector flows. DECC assume that we will be importing around 0.75 GW from the continent at times of system peak. The Ofgem analysis considers the contribution of interconnectors during the winter season. Ofgem's Reference Scenario assumes that flows with the continent will be at float.

[81] Ofgem acknowledge this with sensitivity analysis on interconnector flows in their report.

Table A1: Security of Electricity supply in 2015/16				
	De-rated capacity margin (%)	**Likelihood of some customer disconnections (1 in n years)**	**Expected amount of energy unserved (GWh)**	**Loss of load expectation (hours per year)**
DECC Reference scenario with a Capacity Market[82]	8.4	1 in 100	~0.2	~0.5
DECC Reference scenario without a Capacity Market	6.6	1 in 44	~0.5	~1.7
Ofgem Reference Scenario	3.8	1 in 12	3.1	2.9
Ofgem High Demand scenario	1.5	1 in 4	11.1	8.7

Note: ~ information in cells containing this symbol has not been estimated from DECC modelling but has been inferred from similar results in Ofgem's modelling.
Note: The likelihood of some customer disconnections gives the probability of some customers facing disconnection after the system operator has made full use of the mitigating measures available to it, including the provision of emergency services from Britain's interconnectors. Industrial customers would likely be disconnected before households.

A.26 In the Ofgem Reference Scenario, it is likely that any energy unserved would be associated with small, occasional shortfalls which could be dealt with by NGET through mitigation action (such as voltage reduction ("brownouts")), with little or no impact on customers. Involuntary disconnection of some customers ("blackouts") would be likely to occur in a small minority of years – 1 in 12 in the Ofgem Reference Scenario, and 1 in 4 years in the Ofgem high demand sensitivity. These could, in the worst case, affect domestic households, though it is expected that industrial customers would be disconnected first where possible.

[82] We have inferred the risks to security of supply in the DECC analysis using the relationship between Capacity Margins and risk measures (LOLE, EEU and the risk of consumer disconnections), contained in Ofgem's Electricity Capacity Assessment. It is therefore not a modelled output from the DECC model. We note that the relationship between the capacity margin and the risk measures is not linear as it varies with the generation mix. Therefore the estimates of risk in the DECC scenarios are illustrative.

Additional Capacity

A.27 Section 172 of the Energy Act 2004 was amended by the Energy Act 2011 to oblige the Secretary of State to make an assessment of the amount of capacity required to meet the demands of electricity consumers including a spare margin to account for unexpectedly higher demand or an unexpected loss of capacity.

A.28 As part of the draft EMR Delivery Plan, Government consulted on the methodology to establish the optimal level of a reliability standard for the GB electricity system. A reliability standard expresses the desired level of electricity security. It is a trade-off between the costs of additional security of supply as a result of additional capacity, and the benefits as a result of reduced lost load.

A.29 At present, the GB market does not have an explicit reliability standard, however for these purposes we have assumed that the reliability standard will be consistent with the standard on which we consulted i.e. it will be expressed in terms of loss of load expectation (LOLE) and the proposed level of reliability is **3 hours of lost load per year**. This is the reliability standard that is used by the RTE, the French System Operator to guide their assessment of whether additional capacity is required.

A.30 However, it is important to note that this choice is illustrative and should not be taken as prejudging the outcome of the consultation and choice of the reliability standard.

A.31 If the reliability standard were to be set at this level, then the amount of additional de-rated capacity required to meet demand is set out in Table 2.

Table A2: Additional Capacity required to meet a 3 hour per year loss of load expectation

Additional Capacity Required to meet a 3 hour LOLE level of reliability (de-rated GW)	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
DDM Baseline	0	0	0	0	0	0
Ofgem Reference Scenario[83]	0	0	0	0	0	0

[83] This assessment of the additional capacity requirement has been carried out by DECC does not form part of Ofgem's Capacity Assessment.

Table A2: Additional Capacity required to meet a 3 hour per year loss of load expectation						
Ofgem High Demand	0	0.3	1.0	0.4	0.0	0.8

Note. This assessment of the additional capacity requirement under the Ofgem Reference Scenario and high demand sensitivity has been carried out by DECC and does not form part of the Ofgem Capacity Assessment. This is a broad estimate used for illustration.

Conclusion

A.32 Ofgem's Electricity Capacity Assessment Report 2013 suggests risks to electricity security of supply are increasing faster towards the middle of the decade than expected in Ofgem's first assessment. This is broadly consistent with DECC's own analysis of the security of supply outlook.

A.33 Given the likelihood of capacity margins falling over the coming years and the need to tackle the underlying failures in the electricity market to bring forward sufficient investment, the Government has decided to run the first capacity auction in 2014 with capacity being in place for 2018/19, subject to state aid approval.

A.34 Finally, the analysis suggests that significant uncertainties exist around the outlook for both electricity supply and demand. This underpins the views expressed by DECC, National Grid (NGET) and Ofgem that it is prudent to explore options for additional safeguards for consumers in the form of new balancing services aimed at enabling NGET to maintain system balance.[84] Any proposals by NGET aimed at enabling the introduction of new balancing services following completion of the consultation process would be subject to the approval of the Authority.

A.35 Further analysis can be found in the Capacity Market Impact Assessment and the EMR Overview Document and Annexes[85].

[84] https://www.ofgem.gov.uk/ofgem-publications/75221/consultation-potential-requirement-new-balancing-services-support-uncertain-mid.pdf

[85] https://www.gov.uk/government/publications/electricity-market-reform-policy-overview--2

Annex B

Secretary of State's Update of the Energy Security Indicators

Introduction

B.1 In November 2012 Government published its Energy Security Strategy[86] in which it committed to updating the Energy Security Indicators used by Government. Government is continuing to implement the policy actions set out in the Energy Security Strategy, as described in the Annual Energy Statement. The Government also continues to monitor the energy security situation, using the three complimentary approaches set out in Annex A of the strategy:

- Horizon scanning for risk;
- Stress testing our energy systems; and,
- Assessing the characteristics of the energy system.

B.2 The indicators initially published in the Energy Security Strategy are updated below. These indicators when considered alongside each other, and in the context of other developments in the energy system, illustrate the UK's current energy security situation. They are published here to provide an aid to stakeholders in assessing the UK's energy security. The Government engages with stakeholders regularly to hear their views on energy security and invites comment on the energy security situation conveyed by these indicators.

Electricity

Indicator I: Electricity Capacity

B.3 We use Ofgem's outlook for security of electricity supply as reported in their Electricity Capacity Assessment Report 2013 as an indicator of the trends in the levels of adequate capacity in the GB electricity market. The indicator is based on the de-rated capacity margin.

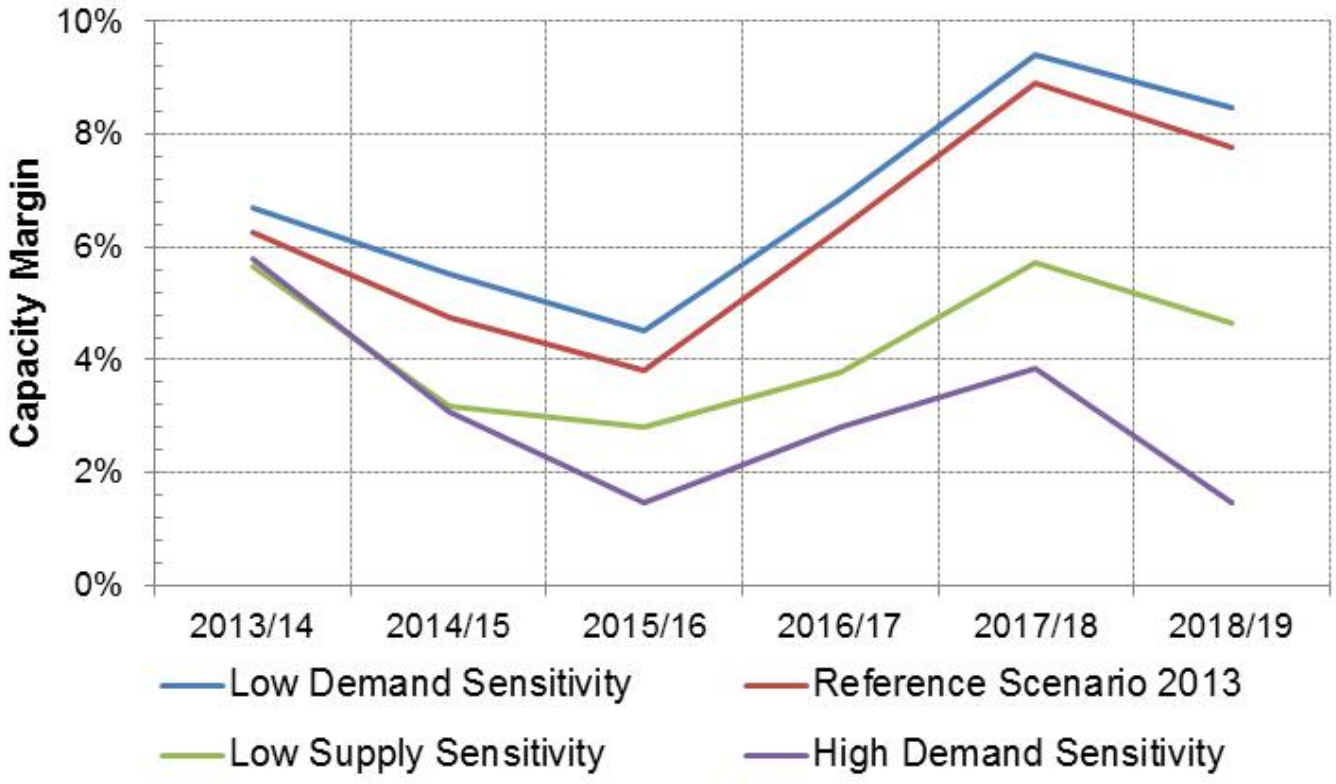
B.4 The Report suggests that the risks to electricity security of supply, in the absence of any additional policy interventions, are greater towards the middle of the decade than in their first assessment, published in October 2012. Beyond 2015/16 the risks to electricity

[86] Found at https://www.gov.uk/government/policies/maintaining-uk-energy-security--2

security of supply are then expected to decrease primarily due to the impact of falling demand, although the report notes that there is uncertainty over the projected reductions in demand.

B.5 According to the Reference Scenario presented in Ofgem's report, de-rated capacity margins are expected to fall from their anticipated level of around 6 per cent this winter to around 4 per cent in 2015/16, before recovering to around 8 per cent by 2018/19.

B.6 In light of potential risks to security of electricity supply in both the near-term and long-term, Government has recently confirmed that it intends to initiate the Capacity Market. The first capacity auction will be run, subject to state aid approval, in 2014, for delivery of capacity in the year beginning in winter 2018/19. In the short term, National Grid are exploring options for additional safeguards for consumers in the form of new balancing services aimed at enabling the System Operator to maintain system balance.

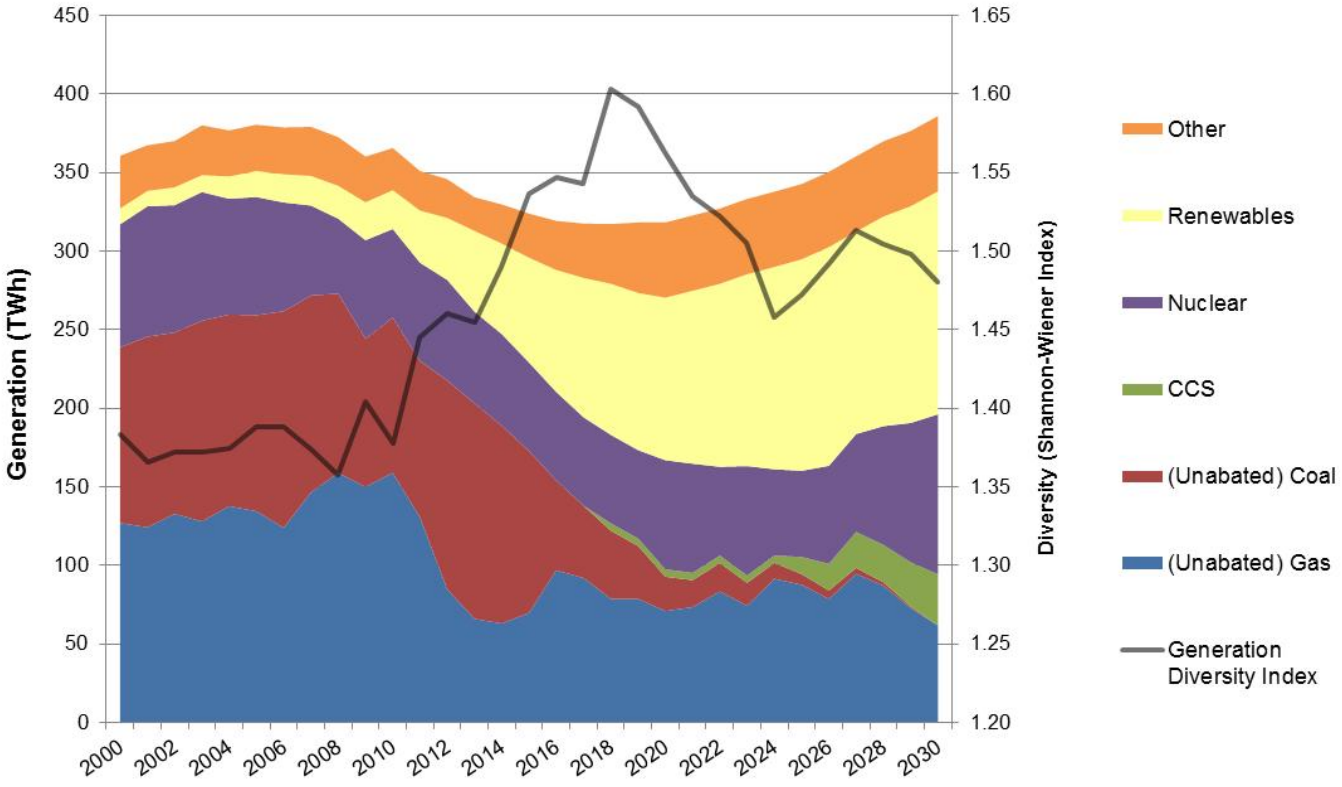


Source: Ofgem Electricity Capacity Assessment, June 2013

Indicator II: Electricity Diversity

B.7 Trends in the composition of electricity generation are indicative of the diversity of fuel source in the electricity market. The chart below illustrates the generation mix for electricity over time. In addition, superimposed over the generation mix is a 'diversity index' line to illustrate how the diversity of generation is expected to evolve[87].

B.8 Looking at this line, the level of generation diversity increases this decade due to a shift away from Coal and Oil and towards a variety of renewable sources (though mostly wind). The pace of these closures is expected to accelerate around the middle of the next decade to such an extent that the overall level of diversity in our electricity generation mix begins to fall.



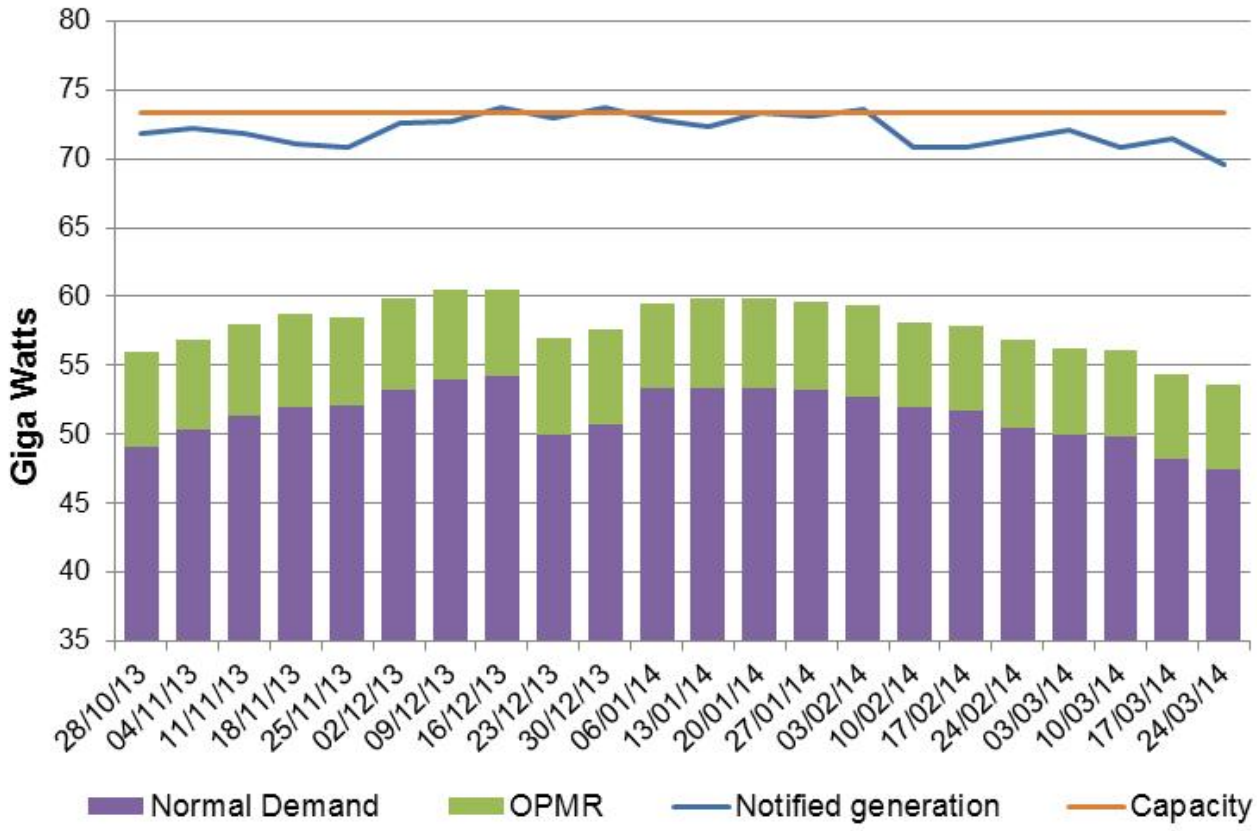
Source: DECC 2013[88]

[87] For the definition of a diversity index see the gas or oil diversity indicators below.

[88] DUKES data on coal and gas is for Major Power Producers only. Other generators are included in 'Other' category.

Indicator III: Electricity Reliability – Short Term Electricity Resilience

B.9 This chart shows National Grid's forecast assumed capacity availability for the coming Winter 2013/14, plotted against expected normal winter demand. It shows how robust the system is in the short-term. The current margin between capacity and the forecast weather corrected demand is more than sufficient to cover National Grid's Operating Planning Margin Requirement (OPMR) over the coming Winter 2013/14. The OPMR is effectively National Grid's buffer of capacity to guard against unexpected changes in supply or demand.



Source: National Grid Winter Outlook 2013, Chart E8

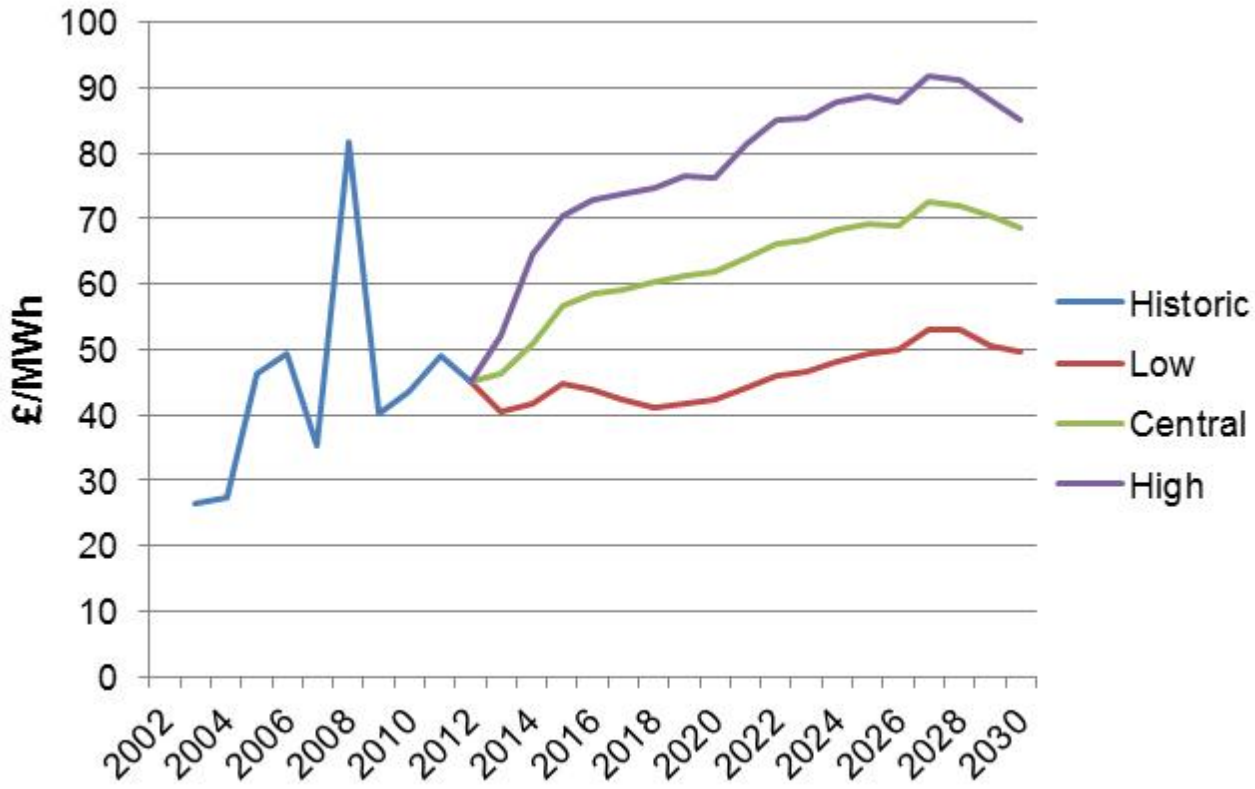
Indicator IV: Electricity Reliability - DECC wholesale market price forecasts (£/MWh)

B.10 To measure reliability we look at the trend in the average annual wholesale electricity price.

B.11 The graph below illustrates the trends in the wholesale market. Volatility in wholesale market prices are bad for making long-term investment decisions; increases in the price level are bad for consumers.

B.12 Wholesale electricity prices are currently relatively stable and under a central scenario are forecast to rise at a steady rate. Projections are useful in identifying the underlying trend in wholesale prices but not the associated level of volatility.

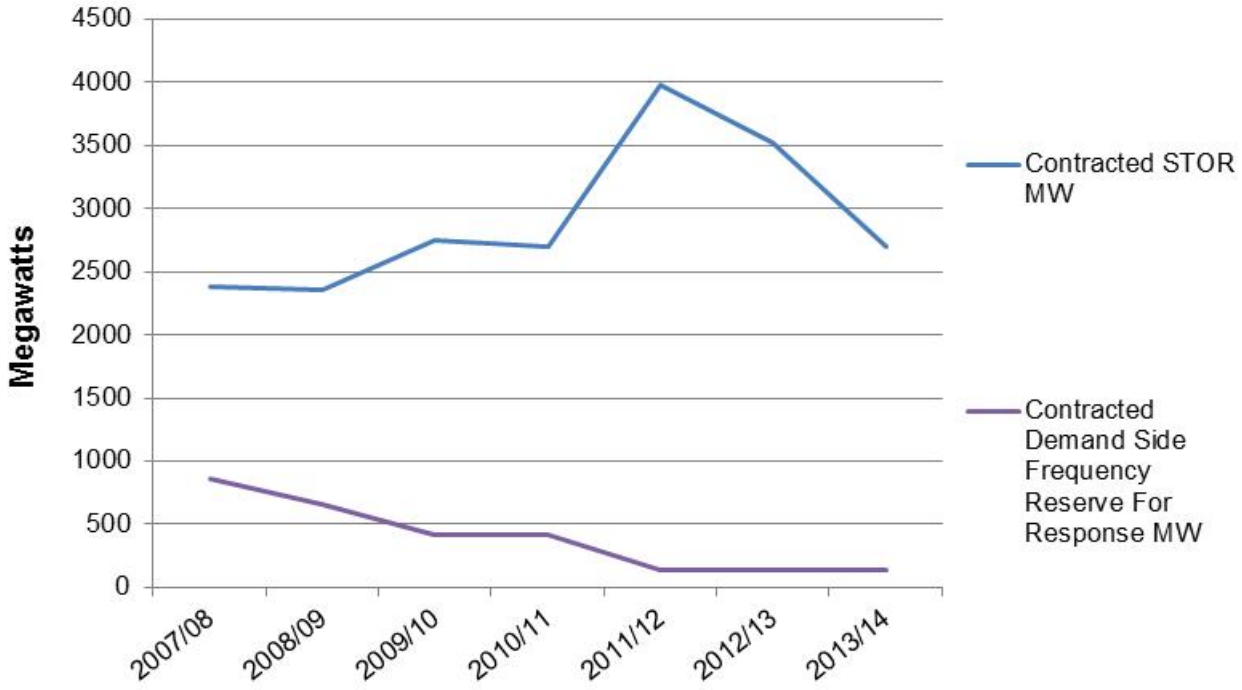
B.13 Much of the volatility in electricity prices is a reflection of the volatility of gas and coal prices. This is because it is generation plant that runs on coal and gas that is setting the price in the electricity market most of the time.



Source: DECC calculations based on LEBA data (www.leba.org.uk); DECC DDM modelling

Indicator V: Electricity Demand Side Response

B.14 This chart below shows changes to amount of capacity contracted through National Grids Short Term Operating Reserve (STOR), made up in part by demand rise response. Currently STOR is around 3000 MW in size[89]. 1400 MW of this this is through non-balancing mechanism providers[90], of which approximately 120 MW is provided by load management or back-up generation offsetting demand with the rest provided by back up generation / embedded generation directly supplying the grid. Contracted Demand Side frequency reserve has remained stable over the last 12 months.



Source: NG 2013

[89] The final tender round for the period from November 2013 to January 2013 is not included in the graph. There is currently ~2700 MW of STOR under contract for winter 2013/14, further volumes will be contracted if tenders received are assessed as economic against the alternative options.

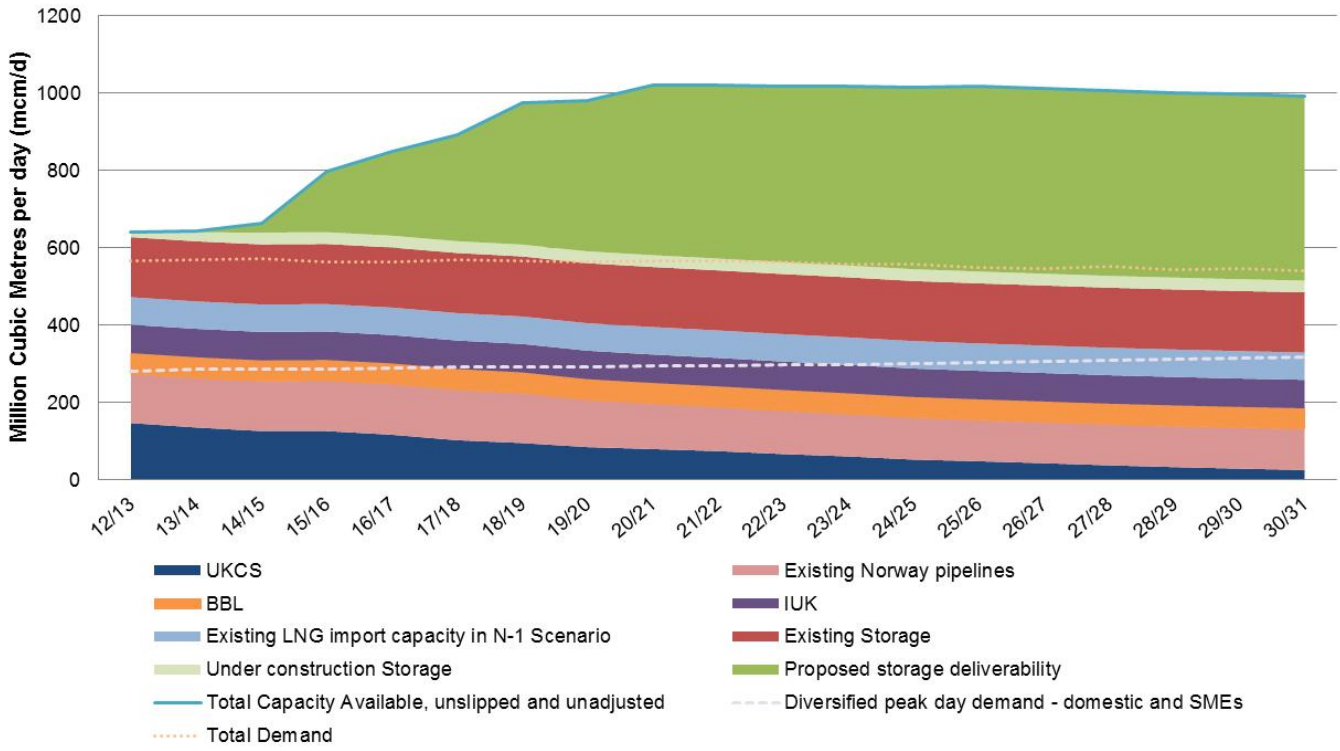
[90] Non balancing mechanism providers include: true demand reduction through load reduction; back up generation offsetting demand, so that the grid no longer sees the consumption as a demand; back up generation supplied to the grid for balancing services purposes; and, embedded generation (non-back up) supplied to the grid for balancing services purposes.

Gas

Indicator VI: Gas Capacity

B.15 This chart sourced from National Grid's Ten Year Statement, when considered alongside the load duration curve and level of storage fullness, indicates the ability of the UK to meet peak demand. The infrastructure capacity has been 'de-rated' using assumptions from National Grid on utilisation.

B.16 It is a European requirement to report the UK's ability to meet demand by calculating n-1[91]. N-1 for Great Britain & Northern Ireland 2013/14[92] is 109 per cent, indicating that the loss of even the largest piece of gas infrastructure, Milford Haven, would not inhibit the supply of gas to consumers in the UK.



Source: NG Ten Year Statement, SSSR, DECC analysis

[91] The ability of infrastructure to meet peak day demand, minus the largest piece of infrastructure

[92] All data from National Grid's 2011 planning basis, flows in mcm/d.

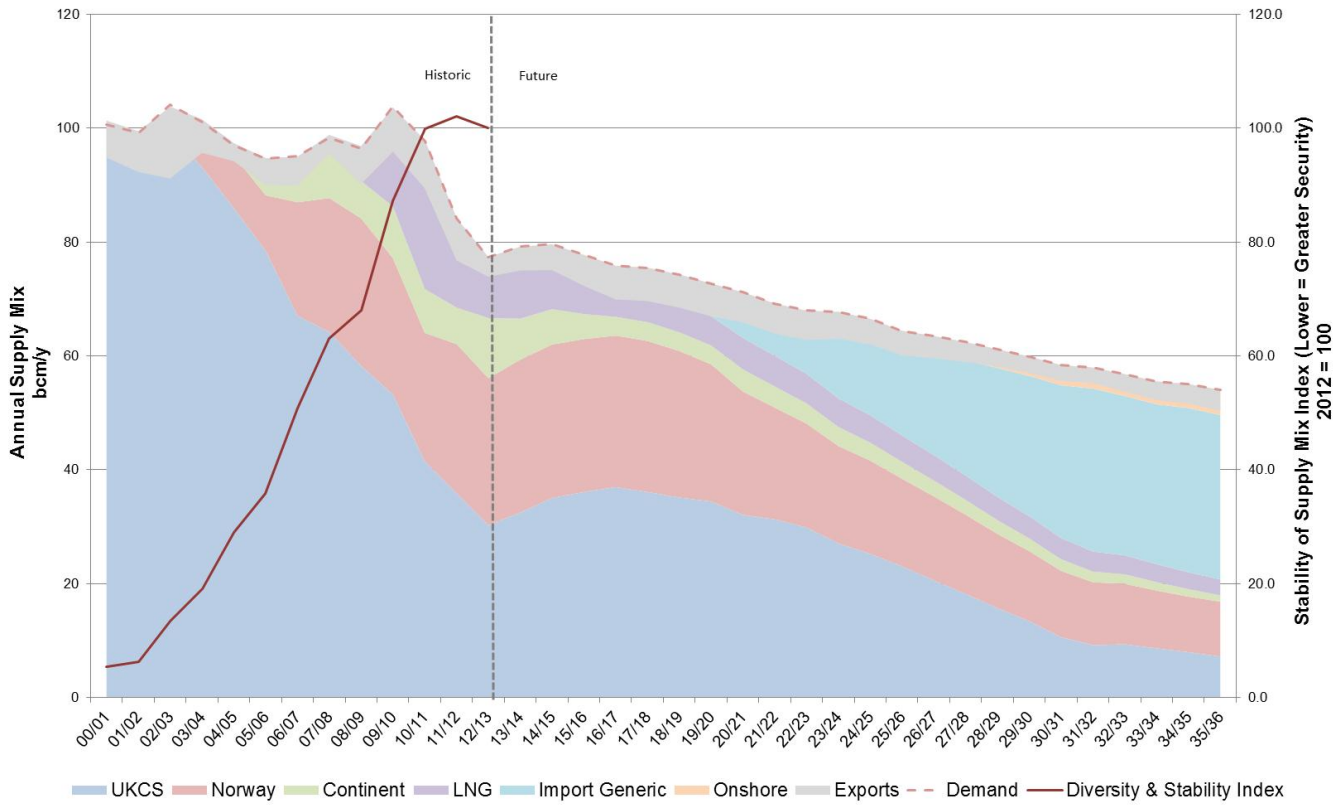
Indicator VII: Gas Diversity

B.17 The chart illustrates supply sources and shows projected supply sources using National Grids 'Gone Green scenario'. A diversity and stability index had been added to track changes in the UK's natural gas supply mix (including indigenous production), according to: i) Number of supply sources, ii) Volume supplied by each source, iii) Geo-political stability of each source. Diversity of market share is calculated using a Shannon-Weiner index augmented for geo-political risk using a World Bank Governance Indicator.

B.18 Shannon-Wiener was chosen here as this represents the data with less skew, as well as placing more weight on the diversity of contributions from smaller countries and lessening the impact of larger nations.

B.19 The World Bank stability Indicator is available for 2011 only. We have applied the 2011 index to all years of the diversity and stability indicator presented here. However, it is possible for geopolitical stability to change over time, which will not be captured by the historical series. As the new versions of the World Bank index are made available, future updates of the DECC indicator will make us of updated geopolitical stability inputs.

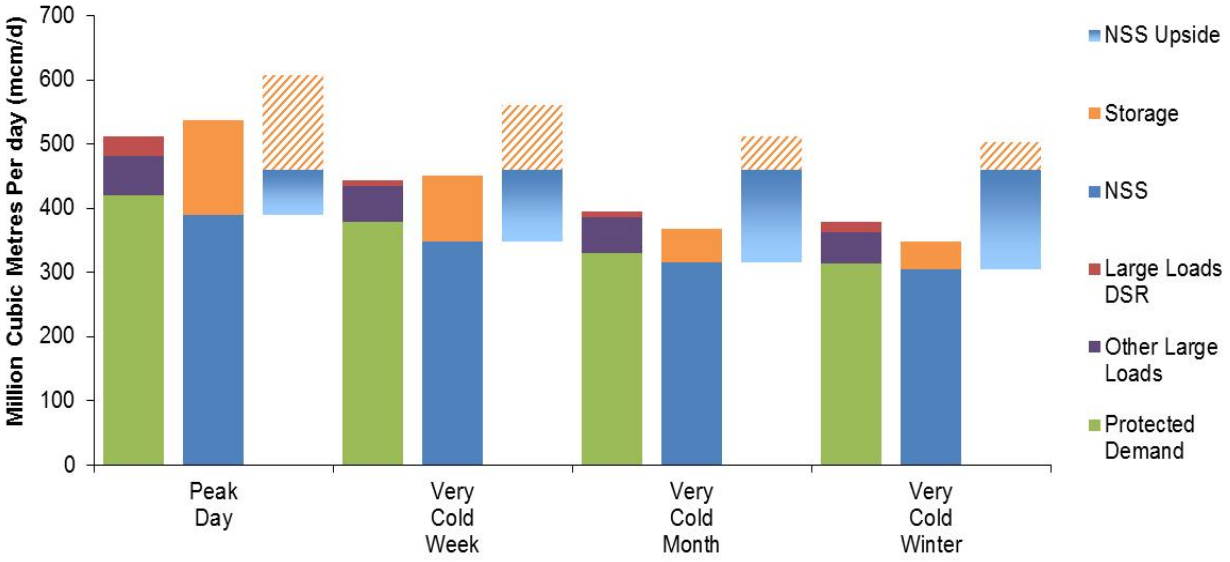
B.20 An increase in the diversity of sources (for example through a decrease in the use of domestically produced gas and increase in imports) and/or an increase in the stability of supply sources act to increase the value of the index. The index cannot be projected forward as the market determines sources of supply.



Source: NG FES 2013, World Bank, DECC

Indicator VIII: Gas Reliability - National Grid Cold Spell analysis, Winter 2013/14 (severe winter conditions)

B.21 The chart below, illustrates the ability of our gas system to meet demand over a range of scenarios; peak day, very cold week, very cold month and very cold winter. Under all scenarios protected demand can be met through non storage supply.



Source; National Grid 2013

Indicator IX: Gas reliability - Market Liquidity

B.22 Market liquidity aids security of supply by:

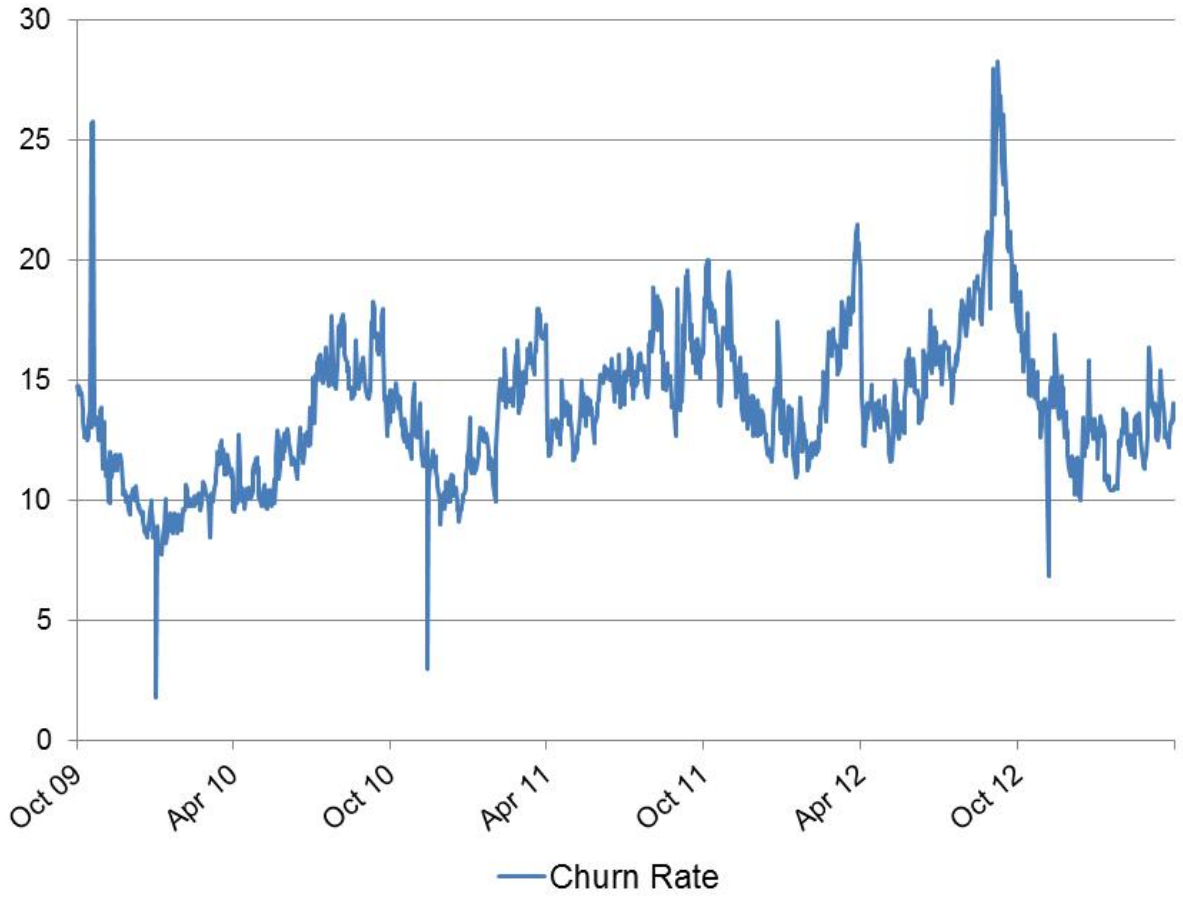
i. encouraging the optimal allocation of gas to where it is valued most,

ii. reducing investment risk,

iii. encouraging new entries and diversity; and

iv. allocating price and quantity risk efficiently.

In general terms, greater liquidity leads to greater market reliability. Liquidity is measured here by the churn rate; the number of times a unit of natural gas is traded and re-traded before reaching the final consumer. Churn rates of greater than ten tend to characterise mature markets with high levels of liquidity. A churn rate of less than ten is therefore undesirable. Current churn rates imply adequate levels of liquidity in the gas wholesale market as shown below.



Source: ICIS Heren

Indicator X: Gas Demand Side Response - Coal plant available to contribute to Gas DSR

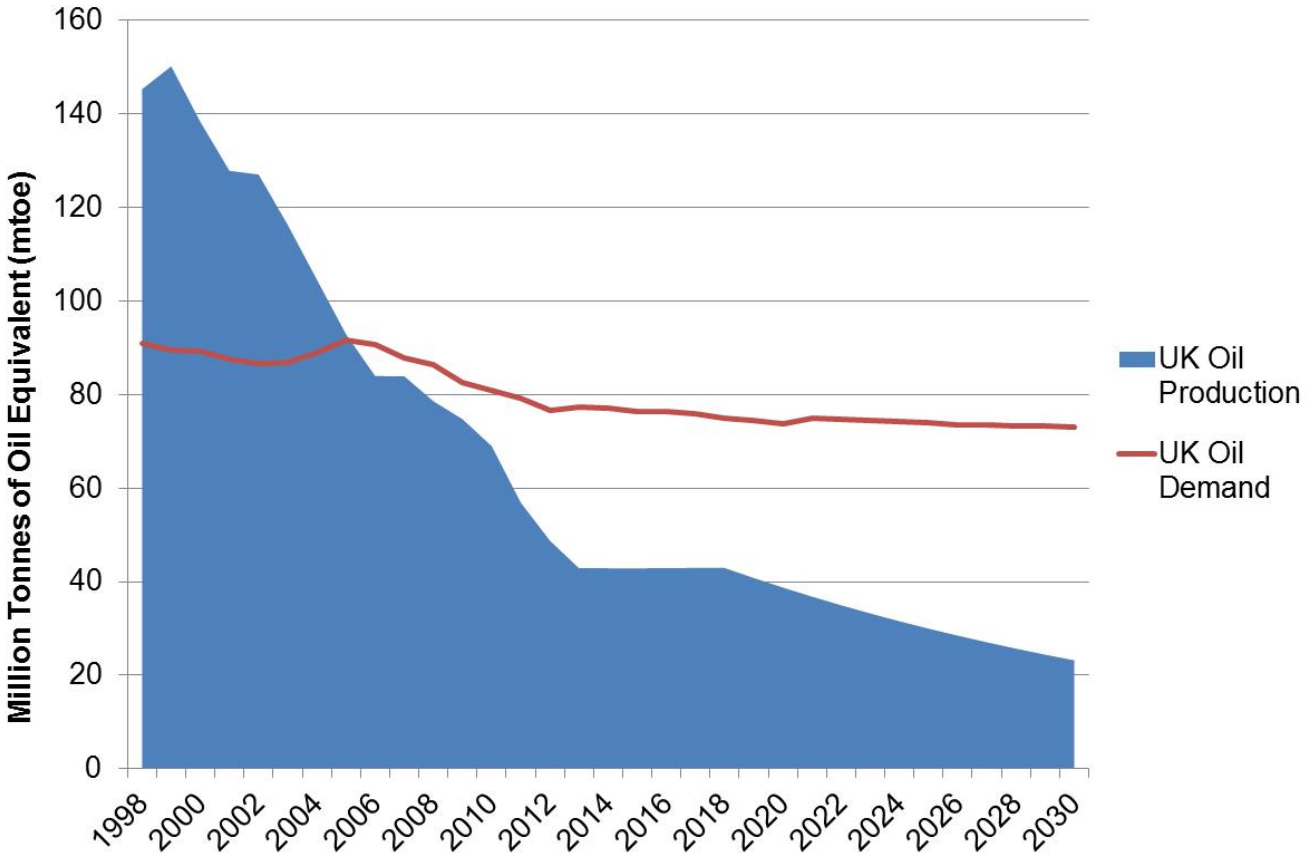
B.23 Currently National Grid estimate demand side response, including DSR provided by the power sector, industry and domestic sectors, to make up 6 per cent of total gas demand on a peak day (severe winter conditions).

B.24 Ofgem's reform of the gas cash-out mechanism, the Gas Significant Code Review (SCR), attempts to sharpen the incentives on gas market participants in order that they invest in measures to enhance security of supply. Currently in the event of a Gas Deficit Emergency (GDE) the cash-out price would be frozen which could mean GB does not receive imported gas at precisely the time it is most important. Under the Gas SCR OfGem proposes that the cash-out price is unfrozen. OfGem is also consulting on the possibility of a Demand Side Response (DSR) tender. This will provide a means for large consumers to signal their willingness to be interrupted earlier in an emergency in order to avoid further consumers being affected. It is expected that the proposals will provide a strong incentive to shippers to undertake actions which reduce the risk of a GDE occurring, such as encouraging gas market participants to invest in new infrastructure.

Oil

Indicator XI: Oil Capacity - UK Continental Shelf (UKCS) production, UK consumption and implied net imports of oil

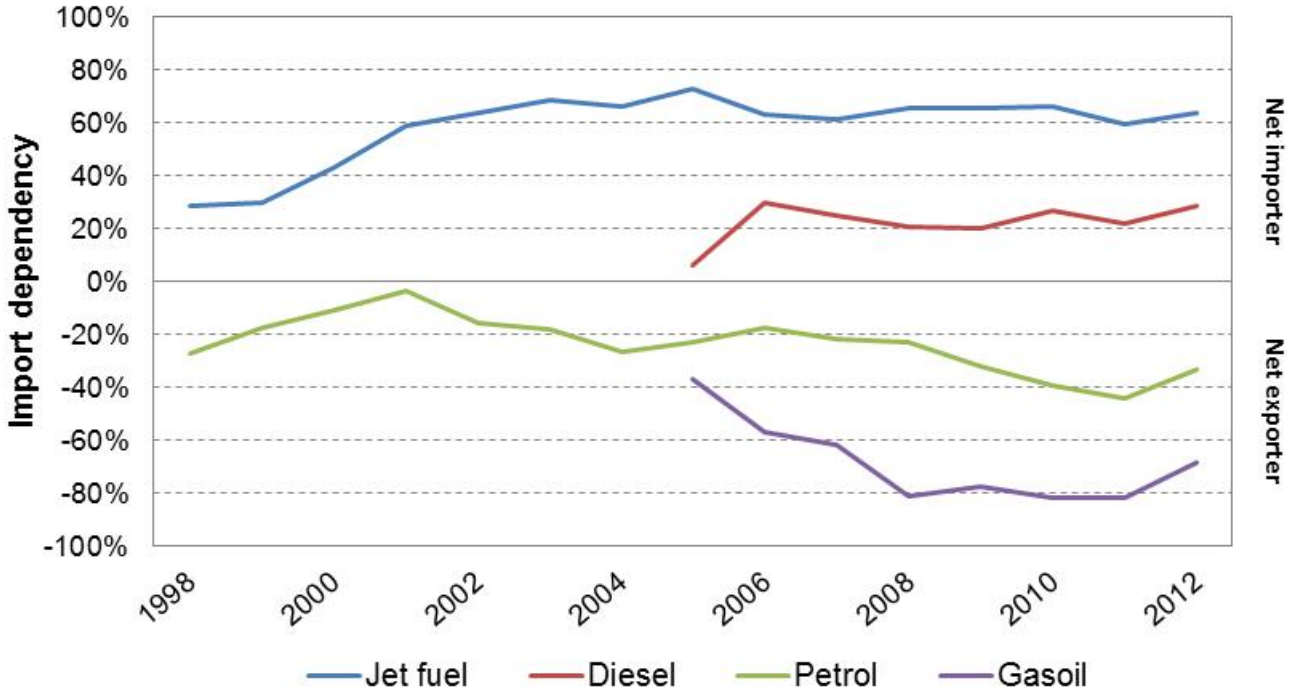
B.25 The chart shows DECC UK Oil Production and Demand Projections (October 2013). DECC's latest central projections indicate UK production (including Natural Gas Liquids) will be 48 million tonnes of oil equivalent in 2015, similar to the 49 million tonnes in 2012, though there is a wide margin of uncertainty with such projections. The actual rate of future decline will depend on the level of investment and the success of further exploration. The chart shows the declining production profile and how net imports will be increasingly important in meeting a broadly flat demand profile.



Source: DECC projections of Oil and Gas Production & Energy Projections, October 2013

Indicator XII: Oil Capacity - UK import dependency of key petroleum products

B.26 Import dependence for jet fuel (also known as aviation turbine fuel), diesel, petrol and gasoil are displayed below. The chart has been modified from last year to illustrate trends over time. The UK is a net importer of jet fuel and diesel; import dependence for jet fuel has been declining slightly due to weak demand; import dependence for diesel has increased to 2006 levels, following an increase in demand. Future projections for import dependency have not been included.



Source: DUKES 2013

Indicator XIII: Oil Diversity - Diversity and stability of UK oil and oil product supply

B.27 The charts below measure the diversity and stability of supply sources for crude oil and oil products. A diversity and stability index (DSI) has been used to track changes in the UK's oil supply mix (including indigenous production), according to:

i) number of supply sources,

ii) volume supplied by each source,

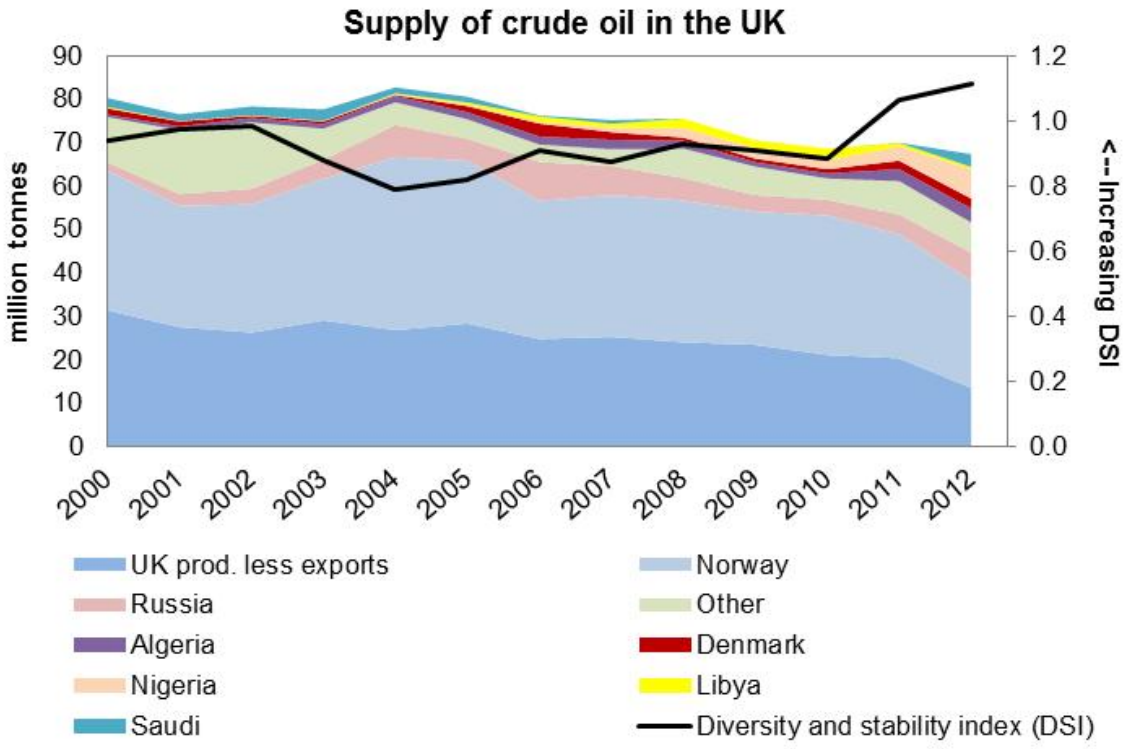
iii) geo-political stability of each source. Diversity of market share is calculated using a Shannon-Weiner index augmented for geo-political risk using a World Bank Governance Indicator.

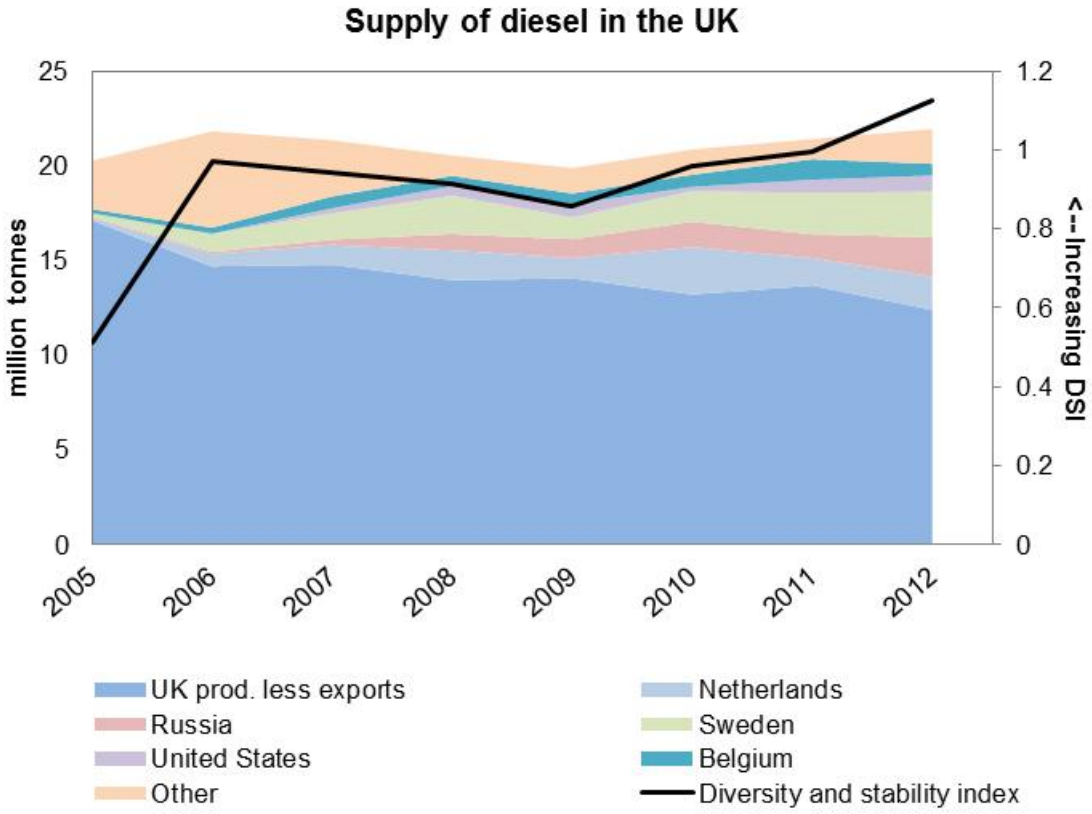
B.28 Shannon-Wiener was chosen here as this represents the data with less skew, as well as placing more weight on the diversity of contributions from smaller countries and lessening the impact of larger nations.

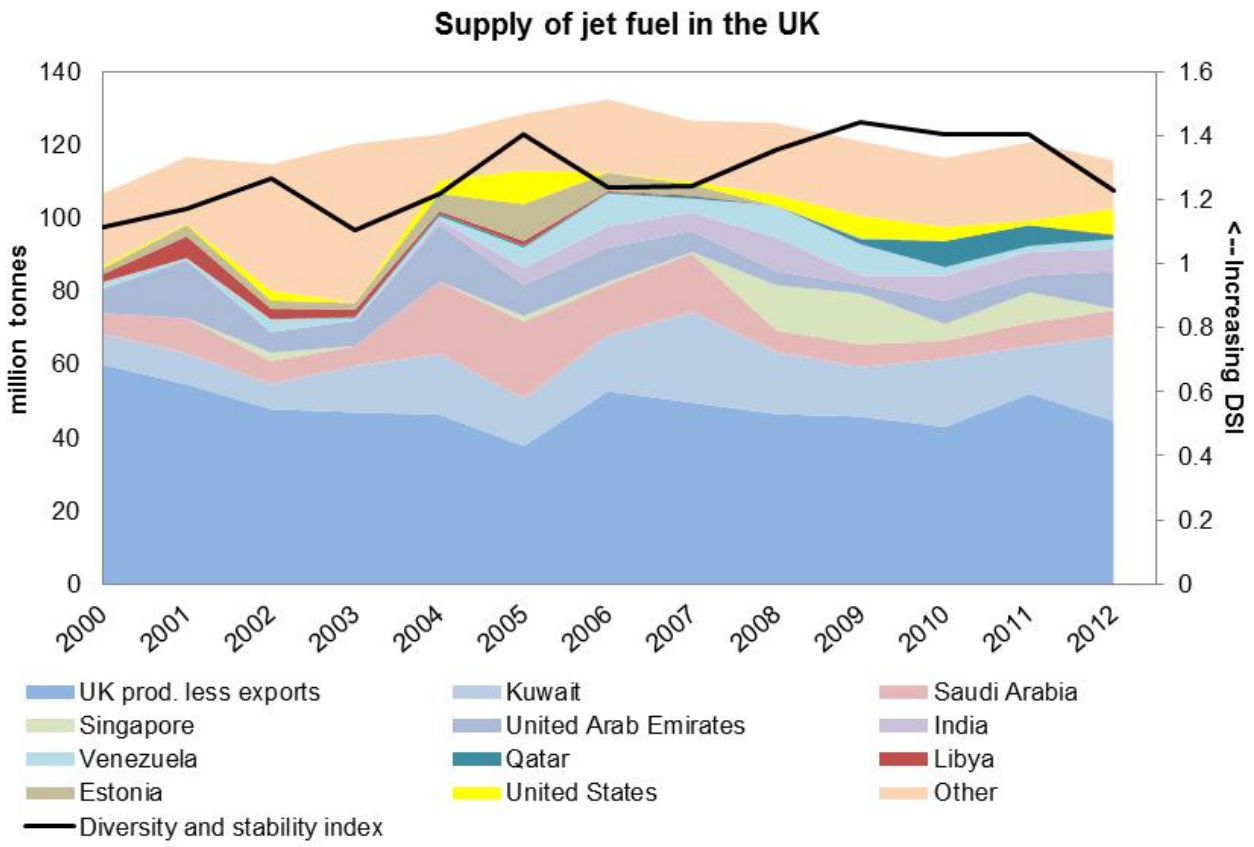
B.29 The World Bank stability Indicator is available for 2011 only. We have applied the 2011 index to all years of the diversity and stability indicator presented here. However, it is possible for geopolitical stability to change over time, which will not be captured by the historical series. As the new versions of the World Bank index are made available, future updates of the DECC indicator will make use of updated geopolitical stability inputs.

B.30 An increase in the diversity of sources (for example through a decrease in the use of domestically produced gas and increase in imports) and/or an increase in the stability of supply sources act to increase the value of the index.

B.31 Where the indicator shows a lack of diversity, such as with crude oil, the main supply source (Norway) is stable. The index cannot be projected forward as the market determines sources of supply.


Supply of crude oil in the UK
million tonnes
<-- Increasing DSI
90
80
70
60
50
40
30
20
10
0
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
UK prod. less exports
Norway
Russia
Other
Algeria
Denmark
Nigeria
Libya
Saudi
Diversity and stability index (DSI)


Supply of diesel in the UK
million tonnes
<-- Increasing DSI
25
20
15
10
5
0
1.2
1
0.8
0.6
0.4
0.2
0
2005
2006
2007
2008
2009
2010
2011
2012
UK prod. less exports
Netherlands
Russia
Sweden
United States
Belgium
Other
Diversity and stability index

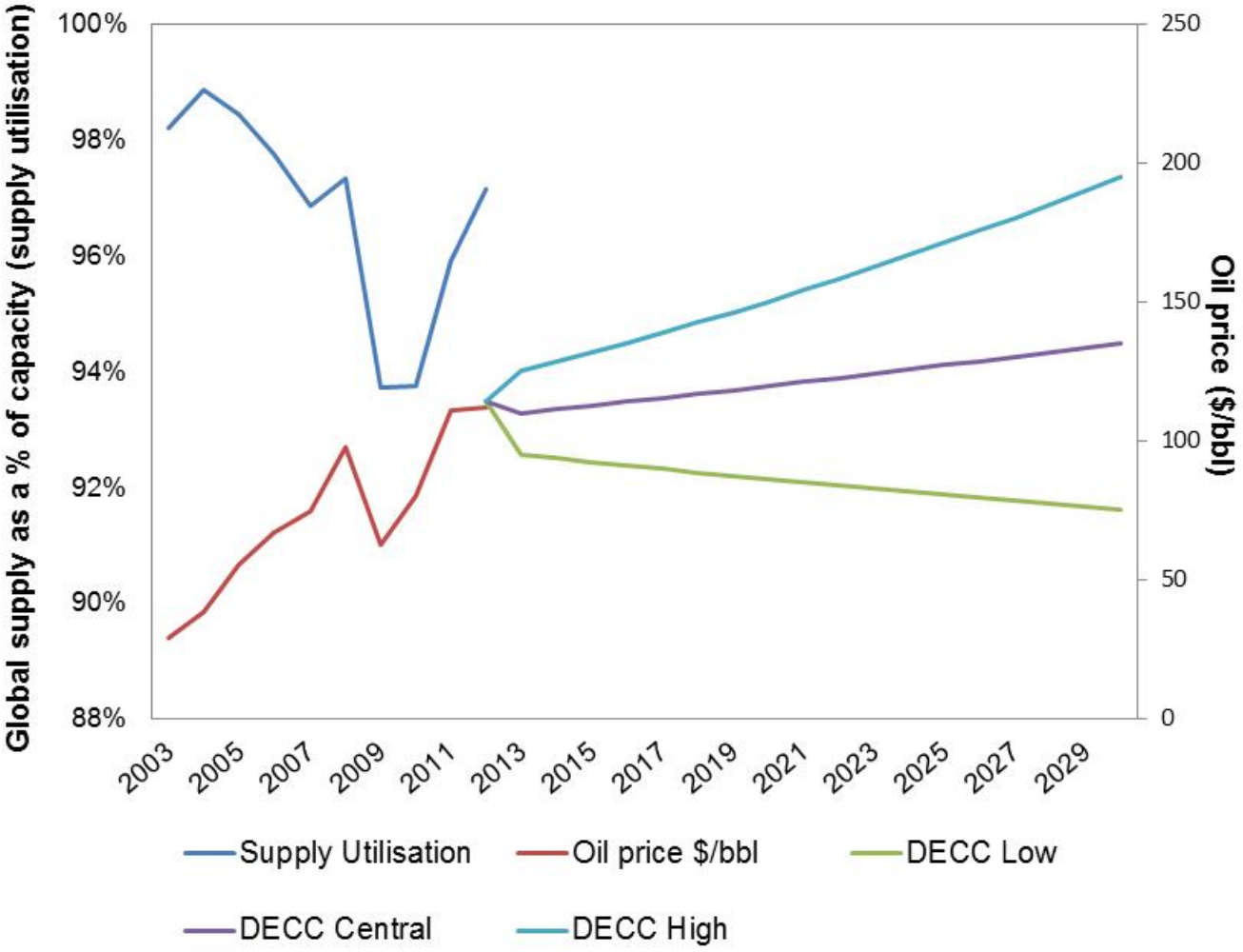


Source: DECC DUKES 2013, IEA Annual Oil Review and the World Bank 2011

Indicator XIV: Oil Reliability - Supply utilisation, Brent oil price and DECC fossil fuel price projections, $ per barrel (2013 prices)

B.32 The chart shows supply utilisation and prices over time. Supply utilisation has been added to the chart as an indicator of how well the market is functioning. Supply utilisation is calculated as 1 less OPEC spare production capacity as a percentage of global demand. OPEC spare capacity provides an indicator of the world oil market's ability to respond to potential crises that reduce oil supplies. Low spare oil production capacity tends to be associated with high oil prices and high oil price volatility. You would expect in a well-functioning market for periods of high prices to be correlated with increases in supply utilisation as producers raced to make the most the high price, this in turn would put downward pressure on the price and some supplies may leave the market.

B.33 Demand growth is likely to increase supply utilisation/reduce spare capacity if production capacity does not grow in line with demand. This chart above shows the correlation between supply in the market and prices to be particularly strong from around 2007 onwards.



Source: IEA, Bloomberg, DECC fossil fuel price projections 2013

Indicator XV: Oil Demand Side Response

B.34 UK oil consumption, as in other countries, is relatively insensitive to price changes. HMT (2008) provide estimates that a 1 per cent increase in oil prices (relative to other prices) would be expected to have reduced UK oil consumption by only 1.6 per cent after five quarters after the price rise with a long-term reduction of only 2.2 per cent.

B.35 We have limited tools over demand reduction for oil, other than promotion of alternative dual fuel technologies and the destruction of consumer demand.

Glossary

AGR	Advanced Gas-cooled Reactor (a type of nuclear reactor)
Associated Gas Field	A well or field which contains both “wet” and “dry” hydrocarbons, as in both gas and oil
BBL	Balgzand-Bacton Line, a gas pipeline from the Netherlands to the UK
bcm	Billion Cubic Metres
CCGT	Combined Cycle Gas Turbine
CCGT-CHP	Combined Cycle Gas Turbine with Combined Heat and Power
DECC	Department of Energy and Climate Change
DNO	Distribution Network Owner, a company which owns the distribution infrastructure
Dry Gas field	A well or field which contains only gas, as opposed to gas and oil
DSR	Demand Side response
DUKES	Digest of UK Energy Statistics, published by DECC
EU	European Union
EU ETS	EU Emissions Trading System
NG FES	National Grid’s Future Energy Scenarios publication, released annually
GB	Great Britain
GDE	Gas Deficit Emergency
GG	“Gone Green”, the name of one of the NG FES scenarios
GWh	Giga Watt Hours, a unit of both electricity and gas
IED	Industrial Emissions Directive (2010/75/EU), an EU directive which replaces the LCPD and places more stringent limits on emissions from combustion plant
Interconnector	A bi-direction pipeline (in the case of gas) or power line (in the case of electricity) where the flow of the product can be switched from import to export and vice versa

IUK	Interconnector UK, a gas interconnection between Bacton in the UK and Zeebrugge in Belgium
LCPD	Large Combustion Plant Directive (2001/80/EC), an EU directive which imposes limits on the emissions of combustion plant over 50 MW in size
LNG	Liquefied Natural Gas
LOLE	Loss of load expectation
mcm	Million Cubic Metres
MTOE	Million Tonnes of Oil Equivalent
MW	Mega Watt
NG	National Grid
NGET	National Grid Electricity Transmission plc.
NGG	National Grid Gas
NTS	National Transmission System
Ofgem	Office of Gas and Electricity Markets
ONR	Office of Nuclear Regulation
PWR	Pressurised Water Reactor – a type of Nuclear Reactor
RIIO	“Revenue = Incentives + Innovation + Outputs”
SAP	System Average Price
SCR	Significant Code Review
SP	Slow Progression
STOR	Short Term Operating Reserve
tcm	Trillion Cubic Metres
TO	Transmission Owner, a company which owns the transmission infrastructure
TWh	Terra Watt Hours

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