DEPARTMENT OF ENERGY & CLIMATE CHANGE

Statutory Security of Supply Report

A report produced jointly by DECC and Ofgem

November 2011

ofgem

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Presented to Parliament pursuant to
section 172 of the Energy Act 2004

Ordered by the House of Commons
to be printed 8 November 2011

HC 1604 LONDON: THE STATIONERY OFFICE £15.50

Any enquiries regarding this publication should be sent to us at correspondence@decc.gsi.gov.uk.

This publication is available for download at www.official-documents.gov.uk.

This document is also available from our website at www.decc.gov.uk.

ISBN: 9780102975147

Printed in the UK for The Stationery Office Limited
on behalf of the Controller of Her Majesty's Stationery Office

ID 2461666 11/11

Printed on paper containing 75% recycled fibre content minimum.

Contents

Introduction

About this report

1. This report discharges the Government's and Ofgem's obligation under section 172 of the Energy Act 2004[1] to report annually to Parliament on the availability of electricity and gas for meeting the reasonable demands of consumers in Great Britain; and the Government's obligation under certain EU legislation[2] to monitor gas and electricity security of supply issues and publish reports.

2. This is the second annual Statutory Security of Supply Report (previously known as the Energy Markets Outlook) and is intended to provide forward-looking energy market information to the Market including identification of risks and drivers. The technical data presented here have been provided jointly by DECC, Ofgem and National Grid.

3. This is a technical report focusing on gas and electricity. Other fuels (coal, nuclear fuel, renewables) are also mentioned in the electricity chapter in the context of electricity generation. While not a statutory requirement, the report includes a chapter on oil for completeness.

4. This year the Government is publishing a Risk Assessment for the purpose of Article 9 of the EU Regulation on Gas Security of Supply alongside the Statutory Security of Supply Report.

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

[2] Directive 2009/73/EC of 13 July 2009 concerning common rules for the internal market in natural gas and repealing 2003/55/EC, augmented by Article 13 of Regulation 2010/994/EC of 20 October 2010 concerning measures to safeguard security of natural gas supply and repealing Council Directive 2004/67/EC; Directive 2009/72/EC of 13 July 2009 concerning common rules for internal market in electricity and repealing Directive 2003/54/EC, augmented by Article 7 of Directive 2005/89/EC of 18 January 2006 concerning measures to safeguard security of electricity supply and infrastructure investment and other relevant legislation.

Comments?

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Executive Summary

6. This report provides the necessary information to meet the statutory reporting requirement set out in Section 172 of the Energy Act 2004. This requirement was previously met by the Energy Markets Outlook. This report provides a technical assessment of the outlook for the supply of electricity, gas and oil up to 2025, drawing on analysis by Government, National Grid, Ofgem and others.

Security of supply outlook – Electricity

7. National Grid project that peak electricity demand will remain relatively stable at around 60 gigawatts (GW), although there is a range of sensitivities around this. These sensitivities include fuel prices, energy conservation, household numbers, power generation capacity and output, combined heat and power (CHP) capacity, embedded generation and exports, as well as an assessment of individual market sector growth in electric vehicles and heat pumps.

8. Generation capacity in the United Kingdom (UK) currently stands at 90.2 GW. However, the coming decade will see many changes in the electricity markets, in particular, the closure of a number of coal and oil fired plant that are considered too polluting by modern standards, and nuclear plant that are scheduled to come to the end of their working lives. The Large Combustion Plant Directive[3] will lead to closure of around 12 GW of coal and oil-fired generation by the end of 2015 at the latest. The Industrial Emissions Directive[4] could also lead to further closures by 2023. In addition, according to current timetables, up to 7.1 GW of existing nuclear generating capacity is reaching the end of its operational life and will have closed by 2020. Some 19.1 GW could therefore close by 2020, with further closures by 2023.

9. Around 8.3 GW of new plant that will connect to the National Grid is already being built. 4.3 GW of this is gas plant and 3.6 GW is renewable generation. A further 13.2 GW has planning permission, of which 8.7 GW is gas-fired generation and 3.7 renewable. The total of new and consented plant is 21.5 GW. Replacement nuclear capacity may also be constructed by around 2025 following the electricity market reforms. Given the significant closures of plant in the middle of this decade it is important this new plant comes on as scheduled to avoid risks to security of supply.

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[3] Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants.

[4] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (Recast).

10. Latest figures from National Grid's Seven Year Statement (updated to reflect any changes that have occurred in the period to August 2011) show that in addition to the 7.3GW of renewables projects that will connect to the National Grid that are either under construction or consented, there is also a further 5.7 GW of projects that have submitted planning applications. These are predominantly offshore and onshore wind and biomass generation projects, with the majority of the capacity being over 50 MW.[5]

11. In addition, the Government, together with Ofgem is undertaking a series of reforms intended to improve electricity security of supply. These reforms are summarised in box 1 on page 19.

Security of supply outlook – Gas

12. The analysis in this report suggests that in the short to medium term, the UK gas supply infrastructure is resilient to all but the most unlikely combination of severe infrastructure and supply shocks. There are, however, challenges in the medium to long term. While the National Grid scenarios presented show gas demand broadly flat or declining there are also plausible scenarios where gas demand increases. Gas demand is expected to increase in the electricity generation sector as gas plant replace coal fired power plant, which will close due to the requirements of the Large Combustion Plant and Industrial Emissions Directives.

13. While gas production from the UKCS is projected to continue to decline, Great Britain (GB) has an increasingly large and diverse range of import sources on which to draw.

14. In recent years the gas market has delivered substantial investment in new supply infrastructure and there have been no firm customer interruptions. Parliament has given Ofgem (through the Energy Act 2011) a new power to direct National Grid to implement changes to the Uniform Network Code where Ofgem considers these will reduce the likelihood of a gas supply emergency. Ofgem is conducting the Gas Security of Supply Significant Code Review (Gas SCR) to consider how current market arrangements could be improved to give further reassurance about security of supply. This review is considering potential changes to the gas emergency arrangements as well as the rationale for further interventions including obligations on shippers, suppliers or the system operator.

Security of supply outlook – Oil

15. Oil products play an important role in the UK economy, providing around a third of the primary energy used in 2010. We currently rely on oil for almost all of our motorised transport needs. Transport accounted for around 75 per cent of final consumption of oil products in the UK in 2010, some 49 million tonnes of oil.

[5] All these figures are for Transmission connected projects only therefore they will differ from those reported on the DECC Planning database report which included projects connecting to Distribution networks. These figures may also differ due to definitional and methodological differences.

16. Significant reductions in oil demand are not expected over the next 20 years. This is primarily because the transport sector is the main consumer of oil and will continue to be heavily dependent on it over this period. Whilst overall demand is relatively static, the consumption of petrol in the UK is expected to fall but diesel and aviation fuel are expected to show significant growth. In the longer term the UK needs to reduce its dependence on oil by improving vehicle efficiency and using new alternative fuelled vehicles.

17. Oil production in the UK peaked in 1999 and is now declining. Oil imports are forecast to increase in response to this decline. DECC continues to work with its international partners to improve the effectiveness of oil markets and encourage the necessary investment in both increasing oil supplies and reducing oil demand.

Conclusion

18. This Security of Supply Report is intended to inform and facilitate decision making by energy market participants and stakeholders. We welcome views and comments on the document to that end.

Electricity

Introduction

19. This chapter sets out future supply and demand forecasts for electricity, and provides a discussion of risks and drivers.

20. Electricity security of supply is, at a high level, determined by: the ability to produce or import power when it is needed, future demand levels, the ability of the demand side to respond to prices, and the network infrastructure needed to deliver electricity to where it is used. A particular issue for electricity is that it is expensive and difficult to store, so supply and demand must be closely matched on a moment to moment basis.

21. Forecasts for both the demand for electricity and the level and nature of capacity that will be available to produce it are subject to a range of sensitivities when looking forward over the next decade.

22. Where analysis in this chapter draws on data provided by National Grid it refers to electricity supply and demand in GB and does not include Northern Ireland unless otherwise stated.

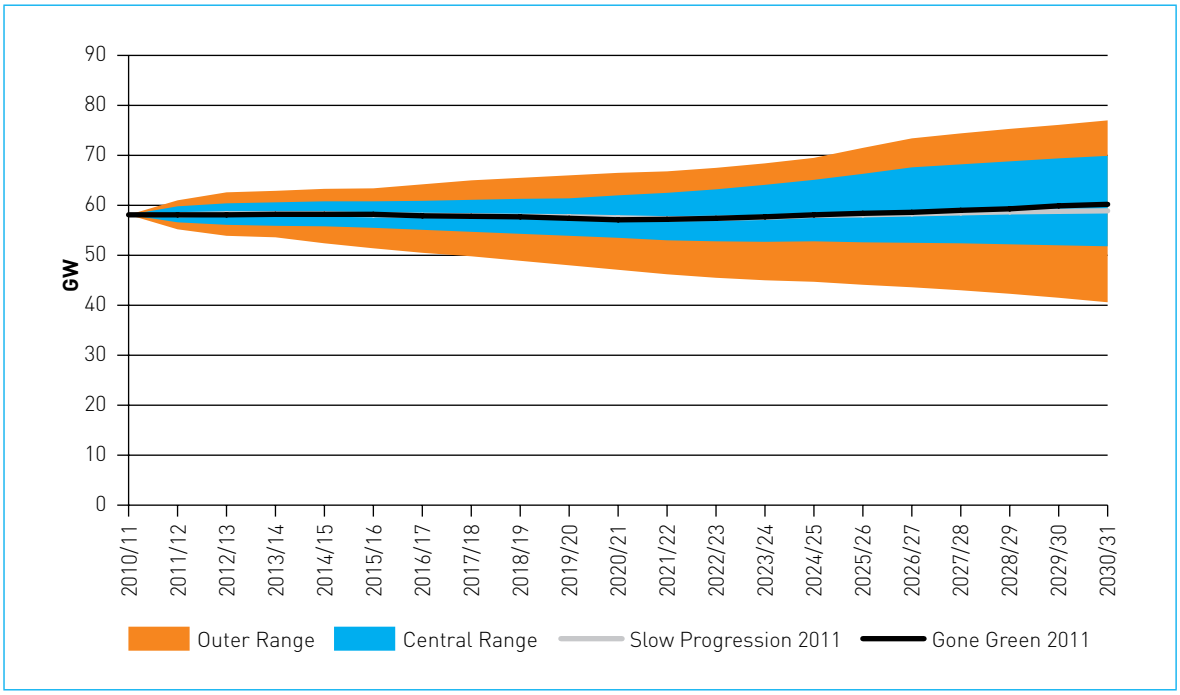
Electricity demand

23. Electricity security of supply depends on the amount of generation capacity available to produce sufficient electricity to meet demand at any point in time. Hence, peak demand is a key metric in the determination of security of supply.

24. Chart 1 shows projections of future peak electricity demand from National Grid. National Grid's projections for peak electricity demand is for this to remain relatively stable at around 60 GW. More detail on both the Slow Progression and Gone Green scenarios produced by National Grid can be found in the Development of Energy Scenarios[6] document. It is worth noting that peak demand is very similar across the different scenarios.

[6] http://www.nationalgrid.com/NR/rdonlyres/2450AADD-FBA3-49C1-8D63-7160A081C1F2/47855/DevelopmentofEnergyScenariosTBE2011.pdf

Chart 1: Future development of peak demand on the national transmission system



Source: National Grid

25. In addition to the scenarios, the chart also shows an outer fan (illustrating a simple summation of all sensitivities) and an inner fan illustrating combinations of sensitivities more likely to occur together. For example, the highest levels of demand shown in Chart 1 are likely to be reached only if the relevant factors (such as the rate of economic growth, or the take-up of electric vehicles) were all stimulating demand growth and no factors were acting to reduce demand. In practice it is unlikely that they would all combine to push electricity demand in one direction. A narrower central range of more probable demand levels has therefore been highlighted on the chart. However, even within this range, there are still significant variations. The demand associated with the National Grid 'Gone Green' scenario developed as a plausible scenario to meet the 2020 EU environmental targets falls within the central band and is similar to the Slow Progression demand.

26. The sensitivities assessed include: fuel prices, energy conservation, household numbers, power generation capacity and output, CHP capacity, embedded generation, exports, electric vehicles and heat pumps.

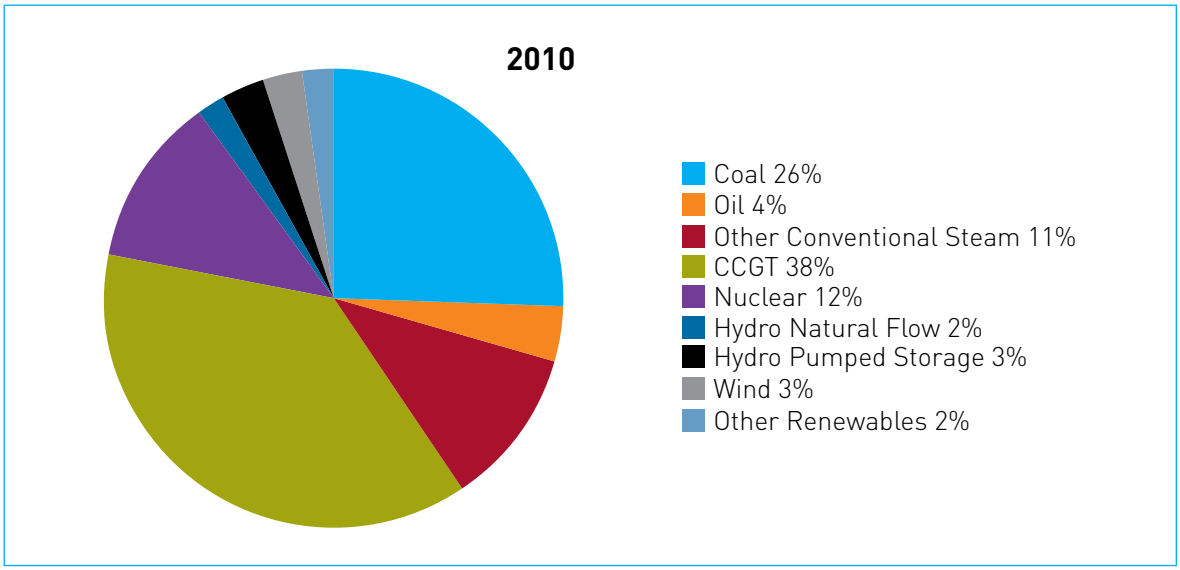
27. It should be noted that the range of potential demand increases in the future, and in particular in the period post 2020 with uncertainty surrounding the impact of new technologies such as smart metering, electric vehicles and heat pumps.

Electricity supply

Present capacity

28. As at the end of 2010, the UK as a whole had a total of 90.2 GW of electricity generating capacity of various kinds (source: DUKES[7]). GB had the capacity to import and export the equivalent of 2.5 GW from and to France and Ireland. From 1 April 2011, the 1GW Britned interconnector with The Netherlands became operational (this interconnector can run at up to 1.2 GW in exceptional circumstances).

Chart 2: Electricity generating capacity in the UK, by technology[8], in 2010 (total: 90.2GW)



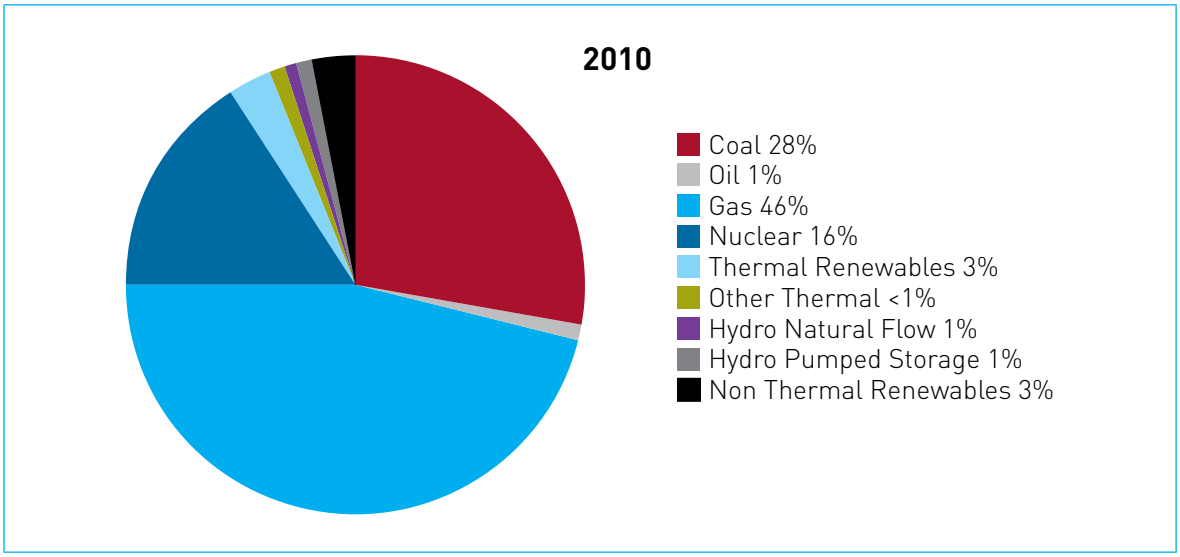
Source: DECC, Digest of UK Energy Statistics, Table 5.7

29. This represents an increase in capacity from 84.7 GW at the end of 2009. Most of the increase has come from combined cycle gas turbine (CCGT) power plant (CCGT's) which have increased their share of total capacity from 34% to 38%.

7 http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/source/electricity/electricity.aspx

8 "Other conventional steam" includes mixed or dual fired thermal capacity and gas fired stations that are Open Cycle Gas Turbines, or have some CCGT capacity but mainly operate as conventional thermal stations.

Chart 3: UK electricity generated in 2010 (total: 381TWh)



Source: DECC, Digest of UK Energy Statistics 2010, Table 5.6

30. The respective shares of generating technologies in electricity production are different from shares in capacity, since some plant generates more or less continuously (e.g. nuclear), some only at times of extremely high prices and/or demand (e.g. oil) and some depending on the availability of the power source (e.g. wind). Of the 381 TWh of electricity generated in 2010 (broadly stable compared with the 377 TWh generated in 2009), the breakdown by technology type is shown in Chart 3. The share of generation from the different technologies was broadly similar to 2009 with coal increasing its share from 27% to 28%, gas increasing from 44% to 46%, nuclear decreasing from 18% to 16% and renewables increasing their share from 6.7% to 6.8%.

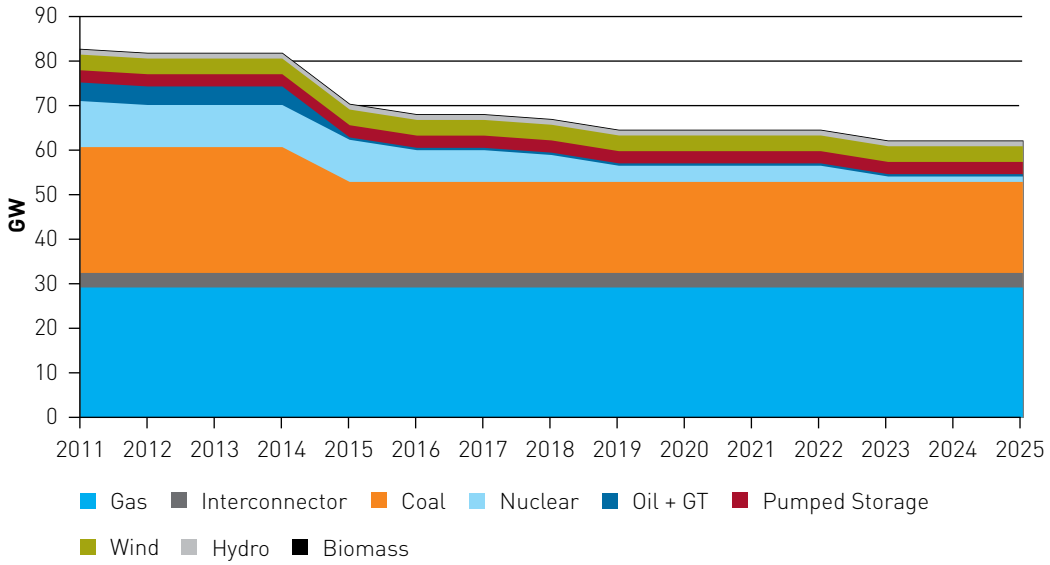
Plant closures

31. A substantial proportion of the GB's electricity generating capacity is expected to close over the next few years. Electricity generation capacity has a finite lifetime, and faces increasingly strict environmental regulation. Both these factors will lead to closures of some existing plant over the next decade. The Large Combustion Plant Directive (LCPD) will lead to the closure of around 12 GW of coal and oil-fired generation by the end of 2015 at the latest. The Industrial Emissions Directive could also lead to further closures by 2023. In addition, according to current timetables, up to 7.1 GW of existing nuclear generating capacity which is reaching the end of its operational life will have closed by 2020. Some 19.1 GW could therefore close by 2020 with further closures by 2023.

32. Chart 4 shows the development of existing GB generating capacity, based on existing grid-connected capacity and an assessment of likely regulated closures of coal, oil and nuclear plant. The GB market is not the only one affected by closures; some 600 MW of gas-fired capacity at the Ballylumford plant in Northern Ireland will also have to close by the end of 2015.

33. It should be noted that Chart 4 does not make allowances for plant closing and/or opting out under the terms of the Industrial Emissions Directive, which could lead to the closure of certain coal plant by 2023. The Industrial Emissions Directive is discussed in more detail in the next section.

Chart 4: Development of existing GB generating capacity



Source: National Grid/DECC

Reasons for expected closures

1: Large Combustion Plant Directive and Industrial Emissions Directive

34. The Large Combustion Plant Directive (LCPD) aims to reduce the emissions to air of certain pollutants known to damage human health and contribute to acid rain. As a consequence of the emissions limit values set by the Directive, a number of GB power generation plant will need to take steps to meet these or opt out of the requirements and run for a limited number of hours until 31 December 2015, at which point or sooner they will cease to operate. Table 1 shows the current status of the GB generation units captured by the LPCD. The table indicates that the generation units at Cockenzie and Kingsnorth have used a significant portion of their allowed hours; the data suggest that these plants will close earlier than 2015. The high price of gas for the coming winter, relative to coal, may suggest that other opted-out coal plants will use up their remaining hours more quickly than previously thought.

Table 1: LCPD hours remaining

LCPD Stack	Status	Total to Date	Hours Limit
Cockenzie Unit 1 and 2	Opted Out	16128	20000
Cockenzie Unit 3 and 4	Opted Out	15180	20000
Didcot A	Opted Out	9996	20000
Fawley	Opted Out	802	10000
Ferrybridge C Unit 1 and 2	Opted Out	9814	20000
Grain	Opted Out	1230	10000
Ironbridge	Opted Out	7830	20000
Kingsnorth	Opted Out	13744	20000
Littlebrook	Opted Out	1270	10000
Tilbury LCP 1 Boilers 7 and 8	Opted Out	12166	20000
Tilbury LCP 2 Boilers 9 and 10	Opted Out	12555	20000

Source: Environment Agency

35. The next phase of environmental constraints may have a significant effect on the future generation outlook. The Industrial Emissions Directive came into force on 6 January 2011 and consolidates seven environmental directives, including the Integrated Pollution Prevention and Control Directive and the Large Combustion Plant Directive, into a single directive. The Industrial Emissions Directive introduces tougher emission limit values for oxides of sulphur (SOx) and nitrogen (NOx) across a range of installations including combustion plants.

36. Under the terms of the Industrial Emissions Directive, affected plant can:

- Opt out and continue running under previous (Large Combustion Plant Directive) emission limits, which will mean plants can operate for a maximum of only 17,500 hours between 1 Jan 2016 and 31 Dec 2023;
- Opt in under the Transitional National Plan (TNP), which will impose a cap on annual mass NO_X emissions and a decreasing cap on annual mass SO_X emissions on all plants operating under a country's TNP until mid-2020. At that point they will have to decide whether to fit appropriate emission reducing equipment to comply with the Directive, be limited to run a maximum of 1,500 hours a year or close;
- Opt in and comply fully from 1 Jan 2016 which will mean fitting selective catalytic reduction equipment or additional flue-gas desulphurisation technology for some plants.

37. One of the key elements of the Industrial Emissions Directive is that it affects any gas plant commissioned before 2002, which is most of the UK CCGT fleet. This means that up to 40 GW of existing coal and gas plant could be affected. That said, a number of plants could retrofit abatement equipment to reduce their emissions and comply with the new directive. Some of the existing plant may already comply with the new legislation and may not have to take any action.

2: Lifetime of nuclear plant

38. According to current timetables, up to 7.1 GW of existing nuclear generation capacity will have closed by 2020; relevant stations are shown in table 2 below. All but one of the UK's existing nuclear power stations (Sizewell B) are scheduled to close by 2023.

Table 2: Expected nuclear closures

Station	Installed capacity (GW)	Current scheduled closure date
Wylfa	1.0	2012
Oldbury	0.2	2012
Hartlepool	1.2	2019
Heysham 1	1.2	2019
Hinkley Point B	1.2	2016
Hunterston B	1.2	2016
Dungeness B	1.1	2018

Source: DECC[9]

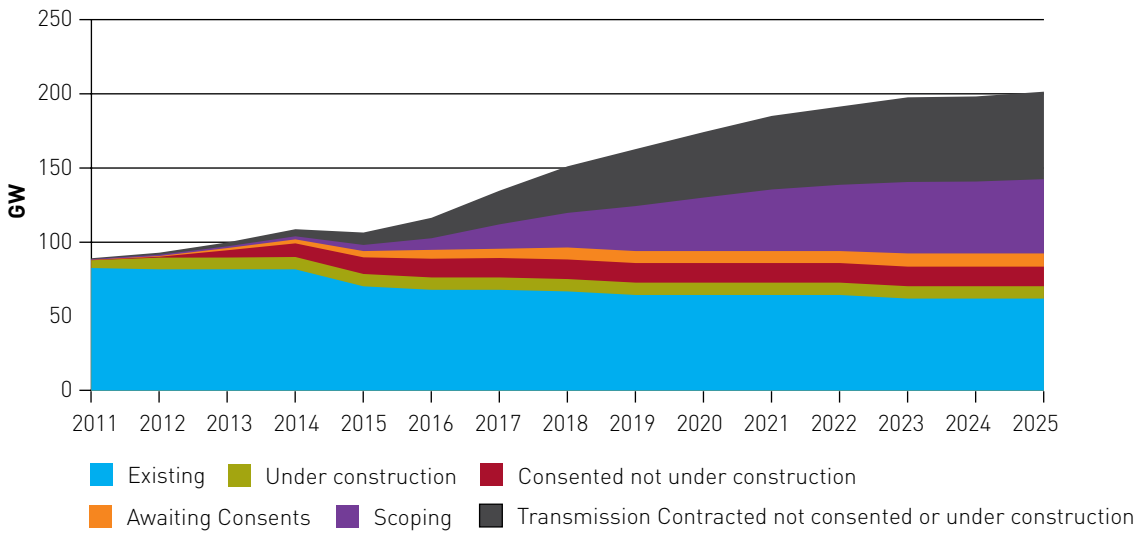
[9] http://www.decc.gov.uk/en/content/cms/meeting_energy/nuclear/current_nuclea/current_nuclea.aspx

39. The operating lives of nuclear power plants can be extended, but only with the approval of the Office for Nuclear Regulation. The decision whether to seek to extend the scheduled closure date is a commercial decision for the operators. 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.

New build: quantity

40. Based on National Grid's Seven Year Statement and updated to reflect the latest position, there is 13.2 GW of electricity generating capacity with consent to build, of which 8.7 GW is conventional gas capacity. In addition there is 8.3 GW of new capacity under construction of which 4.3 GW is gas-fired capacity.[10] New capacity which is now at various stages of the planning, consent and construction process is presented in the following chart. The dates shown are from National Grid's Seven Year Statement with figures updated to reflect any changes since the publication of this document.[11] The further into the future we look, the fewer firm commitments have been made.

Chart 5: Existing and anticipated GB electricity generating capacity (non-derated)



Source: National Grid Seven Year Statement

41. Chart 5 shows existing and anticipated GB electricity generating capacity on a non-derated basis. In terms of plant closures, this takes account of closures under the Large Combustion Plant Directive, but does not allow for potential closures arising from the Industrial Emissions Directive. In terms of new build coming forward, assumptions are based on the National Grid data outlined above. In practice, the type and total amount of new build could turn out to be higher or lower, particularly over the longer term. Generators'

[10] As at October 2011

[11] http://www.nationalgrid.com/uk/Electricity/SYS

investment decisions fundamentally depend on expected future profitability, which is largely informed by investors' views of such factors as: likely future developments in the supply-demand balance, Government and regulatory policy, relative movements in fossil fuel and CO_2 prices, and the capital cost of new plant.

42. It may be noted that capacity identified as "Transmission Contracted, not consented or under construction" entails only limited commitment on the part of investors involved, particularly looking farther ahead.

New build: Planning

43. The Localism Bill (currently going through Parliament) will abolish the Infrastructure Planning Commission and replace it with a new Major Infrastructure Planning Unit (MIPU) as part of the Planning Inspectorate. The MIPU will examine applications for major energy infrastructure and then make a recommendation to Ministers. The Secretary of State for Energy and Climate Change will take decisions on major energy infrastructure.

44. Energy National Policy Statements (NPSs) will be the primary consideration for decisions on planning applications for major energy infrastructure under the Planning Act 2008. The House of Commons debated and approved the energy NPSs on 18 July 2011 and the Secretary of State designated the energy NPSs on 19 July 2011. The energy NPSs are available at: http://www.decc.gov.uk/en/content/cms/meeting_energy/consents_planning/nps_en_infra/nps_en_infra.aspx.

Gas- and Coal-fired Generation

45. 16.4 GW of gas-fired generation is at various stages in the planning and development process and has a connection agreement with National Grid and is thus included in the current Transmission Entry Capacity (TEC) register.[12] At present, there is no new coal plant with planning consent.

New build: Nuclear

46. The nuclear industry has announced intentions to build up to 16 GW[13] of new nuclear capacity in the UK by 2025.

47. An application for preliminary works (prior to any application for new build) at Hinkley Point C was agreed by the local authority in Summer 2011. Applications for development consent for any new nuclear power station will be considered using the guidance within the Nuclear NPS. This lists the 8 sites which the Government has found to be potentially suitable for the deployment of new nuclear power stations. Parliament approved the Nuclear NPS and it was adopted in Summer 2011.

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[12] National Grid

[13] Overarching National Policy Statement for Energy (EN-1), DECC, July 2011 http://www.decc.gov.uk/en/content/cms/meeting_energy/consents_planning/nps_en_infra/nps_en_infra.aspx

New build: Renewables

48. Latest figures from National Grid's Seven Year Statement (updated to reflect any changes that have occurred in the period to August 2011) show that 3.6 GW of Transmission connected renewable electricity projects are under construction. An additional 3.7 GW of projects have planning permission and are awaiting construction and a further 5.7 GW of projects have submitted planning applications. These are predominantly offshore and onshore wind and biomass generation projects, with the majority of the capacity being over 50 MW[14].

Embedded or Distributed Generation

49. As well as large power generation that connects to the high-voltage transmission network, there are smaller generation plants connected to the distribution networks. Generation plant can also be located at consumer premises, either on an industrial/ commercial site or micro-generation in homes.

50. For the purposes of investors in large scale generation, this embedded or distributed generation may be treated as a reduction in demand for large scale generation. This sector is expected to grow as the future energy network is made smarter and as local energy generation and storage increases (both heating and transport are likely to become a larger part of the overall electricity system in coming decades). This anticipated future growth of embedded or distributed generation is therefore a factor in forming a view about future demand for large scale electricity generation, and thus in investors' decisions. The Government set out in the EMR White Paper that there is a need to better understand the potential benefits of distributed energy.

Electricity Networks

Current network reliability

51. The three Transmission Owners (TOs) in GB face regulatory incentives and statutory obligations that, among other things, create an operating environment designed to minimise energy unsupplied. Historically, the record of the electricity transmission network in GB has been impressive. For instance, for 2009/10, the National Grid transmission network in England and Wales experienced energy not supplied of only 983.6 MWh. This equates to a transmission reliability of approximately 99.99969% , measured in terms of the index of unsupplied energy to energy actually delivered.

[14] All these figures are for Transmission connected projects only therefore they will differ from those reported on the DECC Planning database report which included projects connecting to Distribution networks. These figures may also differ due to definitional and methodological differences. DECC figures can be found at https://restats.decc.gov.uk/app/reporting/decc/datasheet.

Network reliability

52. The operators of electricity distribution networks in GB also face incentives to reduce the number and duration of interruptions to supply over their network. Since these "quality of service" incentives were introduced, an average distribution service customer would have experienced around seven interruptions in total over the nine years from 2001-2 to 2009-10. The average duration of such interruptions is about 86 minutes.

53. The size and location of our network infrastructure is important in minimising any transmission constraints, both now and in the future with a lower carbon generation mix. The construction of future network capacity is considered below.

Future development of electricity networks

54. There is a significant programme of investment underway in GB electricity networks. The investment programme includes replacement and maintenance of network assets, in order to ensure continued network reliability, as well as for network expansion in order to accommodate new generation projects including those remote from the main inter-connected transmission system. The latest Distribution Price Control (DPCR4) that covers 2010-15 has allowed approximately £7.2bn investment in the distribution network and Ofgem has already approved around £4bn of investment under the current transmission price control period (TCPR4) which runs from 2007-12. Ofgem recently published its Initial Proposals for a one year extension of TPCR4 setting out allowances for £1.1bn for network investment.

55. The Government and Ofgem have been involved in the industry process to examine possibilities for developing the transmission network further to support the connection of new generation developments including up to 35 GW of renewable generation and potential new nuclear power stations. The Electricity Networks Strategy Group (ENSG), a high level industry group chaired by DECC and Ofgem, published a report in March 2009 (the '2020 Vision'), which set out the TO view of the potential extra strategic transmission investments that may be needed in advance to connect the significant changes in the generation mix to 2020 including growth in both onshore and offshore wind generation. This estimated that upgrading the onshore grid could require up to an extra £4.7bn of such anticipatory strategic investment not included in TPCR4 over the next decade. Using the findings of the report the TOs have been identifying and submitting proposals for specific investments to Ofgem. Ofgem has already approved £414m of priority upgrades from the '2020 Vision' report within the current price control period (to 2012), this is in addition to the original price control settlement referred to above. Ofgem is also currently considering information from TOs on further investment proposals. In order to ensure the '2020 Vision' remains up to date the ENSG met in February 2011 and agreed plans to refresh its analysis.

56. Ofgem has also developed the approach for setting price controls, RIIO (RIIO stands for Revenue = Incentives + Innovation + Outputs) that will apply to the TOs from 2013 to 2021. This represents a departure from the previous approach to regulation (RPI-X), which focused on reducing costs and achieving efficiencies, with a framework that involves Ofgem setting a number of delivery outputs (with incentives/penalties attached). This should help ensure that energy networks are able and incentivised to meet the changing network challenges ahead, including meeting renewable energy targets to 2020 and beyond and ensuring security of supply. The latest company forecasts estimate £5.7bn of additional investment over the next decade.

57. Offshore wind generation has a key part to play in meeting energy and climate change targets. Government has therefore put in place an innovative regulatory regime to deliver offshore energy connections in a cost-effective, timely and secure manner. A key element of the regime is the competitive tender process run by Ofgem to appoint Offshore Transmission Owners (OFTOs) to construct (where a generator chooses not to do so itself) and own and operate the offshore transmission assets. This should deliver cheaper and timelier offshore grid connections, encourage innovation through competition and enable new entrants to compete in the market. Ofgem started the first tenders for transitional (already constructed) assets in Summer 2009 and following full implementation of the transitional regime in July 2010 (Go-Live) it announced the preferred bidders of that round. The second tender round was launched in November 2010. Following a series of consultations, Government have also implemented a generator-build option to give generators the option of constructing their own transmission assets, before transferring them to an OFTO upon completion. By providing this enhanced choice, the regime provides maximum flexibility for generators to progress their projects, in a way that is compatible with the competitive regime and the desire to deliver large amounts of offshore renewable energy.

58. In recognition of the importance of developing a coordinated offshore and onshore transmission network and the potential benefits this could bring, Government and Ofgem have launched a project to undertake further work on coordination in 2011 to consider and advise on whether additional measures might be required within the competitive offshore regime to encourage the sharing of transmission assets between different offshore developers in GB waters and, if so, what these measures might look like in practice.

Interconnection

59. The UK currently has a 2 GW link to France, a 500 MW link between Northern Ireland and Scotland (max flow into GB is 295 MW) and a 1 GW connection with The Netherlands, which became operational in April 2011 (this interconnector can run harder (up to 1.2 GW) in exceptional circumstances).

60. Increased interconnection may provide important security of supply benefits, such as access to additional power supplies which could help manage supply fluctuations. On the other hand, with greater interconnection, there can be circumstances where tighter markets and higher prices outside the UK could result in electricity being exported, thereby tightening the market in the UK. However, it would be expected that UK prices would rise at times of market tightness, and depending on the supply/ demand balance with interconnected markets, this would cause electricity flows to reverse, and create flows that support the system in times of stress. Interconnection also introduces an additional variable when balancing the system, and an additional uncertainty to be managed, although the ability to access other markets could help system balancing.

61. Uncertainty around interconnector variability can be mitigated if wholesale market prices adequately reflect underlying system conditions. There is evidence from the US and Europe that extensive interconnection across System Operator boundaries can lead to difficulties in predicting power flows, particularly when faults occur and circuits trip. However, this can be managed through close cooperation and information exchange between System Operators and is less of a problem with direct current interconnection, as power flows can be controlled. National Grid is a member of the CORESO grouping of European TSOs. CORESO is a coordinating body that gathers real-time system information from all member TSOs and assists with system planning to avoid/mitigate such emergency situations and maximise the use of cross border capacity.

62. Increased interconnection with other countries also implies that GB is more affected by policy decisions in other countries. The recent decision of the German Government on nuclear may have an effect on the GB electricity market, impacting imports and exports and possibly at peak demand. The immediate loss of approximately 8 GW of nuclear generation in Germany has resulted in Germany becoming a net importer of electricity, from neighbouring countries, when before it had been a net exporter of electricity. Given that the UK is interconnected with France and The Netherlands, this could result in demand for GB electricity increasing at periods of high demand.

63. In September 2012 the East-West Interconnector (linking the UK and Irish electricity grids) will go-live. This is a 500 MW link. In addition, National Grid Interconnector Limited (NGIL – a subsidiary of National Grid) has several planned further links, with Belgium, Norway and France. A number of other third party developers have also expressed an interest in building links between GB and Norway, Denmark, France, Spain and Iceland.

64. It is not clear which of these links will be realised; a conservative estimate is that by 2020 an additional 2-3 GW of interconnection will be built, representing just less than 10% of installed generation.

Grid Access

65. If the UK is to meet its climate change and renewable energy targets and ensure security of supply, large amounts of renewable and other low carbon generation need to be able to connect in the next decade. Until recently, grid access arrangements had in some instances resulted in potentially long lead times for the connection of new renewable and other generation needed to help meet climate change targets and ensure energy security. In some cases, as a result of the need for wider network reinforcement to accommodate the large volumes of new generation seeking connection, new generators were being offered grid connection dates as late as 2025. Timely and effective enduring reform was therefore recognised as essential.

66. In August 2010, a new enduring 'Connect and Manage' grid access regime was introduced, enabling new generation to apply for an accelerated connection based on the time taken to complete their 'enabling works', with wider network reinforcement carried out after they have been connected.

67. This built on the successful interim arrangements introduced by Ofgem, and has provided greater certainty for new generators about the rules for grid access over the long term. To date, 73 proposed large generation projects – representing a total capacity of 26 GW- have advanced their expected connection dates under 'Connect and Manage' by an average of six years. In addition, 76 small-scale generation projects have also benefitted. The 'Connect and Manage' regime will result in increased constraints costs[15], which will be shared evenly across all users of the transmission network, and Ofgem and National Grid will consider the full range of options available to them to minimise these.

Reforms to improve Electricity Security of Supply

68. There are a number of reforms currently being progressed by both DECC and Ofgem which are intended to improve electricity security of supply. These are discussed in box 1 below.

Box 1 Proposed reforms to improve electricity Security of Supply

Capacity Mechanism

The Government set out the case for a Capacity Mechanism in the Electricity Market Reform (EMR) White Paper published in July. The Government argued that a Capacity Mechanism was required in order to reduce the risk of energy unserved. The White Paper identified market failures in the electricity market which could lead to reduced security of supply. These market failures would be exacerbated by increased intermittency on the system. As part of the analytical

[15] Constraint costs are the costs of managing congestion on the transmission network. National Grid has provided outputs from two scenarios for the anticipated constraint costs arising from earlier connection under 'Connect and Manage'. Under these scenarios, total constraint costs to 2018/19 are expected to range from £282.7m (National Grid's 'More Likely' assessment) to £1,349.8m.

Box 1: Proposed reforms to improve electricity Security of Supply *(continued)*

case for a Capacity Mechanism, DECC commissioned Redpoint to carry out economic modelling of the electricity market to 2030. The assumptions around demand and the endogenous economic modelling of supply were not necessarily the same as the assessments presented in this document. This modelling suggested that without a Capacity Mechanism, margins by the early 2020's would be such that there would be larger risks of energy unserved than today.

The Government undertook a consultation on the design of a Capacity Mechanism. This closed on 4 October. More information on the consultation can be found at: http://www.decc.gov.uk/en/content/cms/legislation/white_papers/emr_wp_2011/emr_wp_2011.aspx.

A technical update to the EMR White Paper is to be published at the turn of the year and will include a decision on the choice of Capacity Mechanism.

Annual Report by Ofgem on capacity margins and risks to security of electricity supply

The Energy Act 2011 places an obligation on the Gas and Electricity Markets Authority to produce a report for the Secretary of State with an assessment of different electricity capacity margins and the risk to security of supply associated with each alternative. Ofgem's capacity assessment report is to be delivered to the Secretary of State every September, starting in 2012. It is anticipated that the report will be used as an input into a potential capacity mechanism under the Electricity Market Reform (EMR).

Ofgem Cash out reform

In August 2010, Ofgem consulted on whether to undertake a Significant Code Review (SCR) of cash out. Cash out prices that accurately reflect the costs of balancing the system within that settlement period should make the spot market price more cost reflective. A more cost reflective spot market price would in itself improve security of supply by providing greater incentives to market players to invest in development and/or retention of capacity. In addition, some forms of Capacity Mechanism, under consideration as part of the EMR, would need a robust reference price, which could be provided directly by the cash out price or indirectly by influencing the price in the spot, day ahead and forward markets.

In December 2010 Ofgem published an open letter which set out the next steps for a potential SCR, this can be found here: http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=373&refer=Licensing/IndCodes/CGR.

Ofgem Market liquidity

Improvements to wholesale market liquidity should help to facilitate a competitive generation and supply market and promote long term security of supply. In March 2011, Ofgem put forward two proposals for intervention to improve GB power market liquidity. The proposals were (i) a Mandatory Auction

Box 1: Proposed reforms to improve electricity Security of Supply *(continued)*

of up to 20% of generated output from large vertically integrated players, and (ii) Mandatory Market Making arrangements. Both were intended to provide the liquidity that market participants, in particular independent market players, require to compete effectively and encourage competition between vertically integrated players. Ofgem is due to publish more detailed proposals and an impact assessment at the end of 2011. In June Ofgem published an update and next steps on its liquidity proposals, which can be found at: http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=59&refer=Markets/RetMkts/rmr.

Conclusions

69. National Grid's projection for peak electricity demand is for this to remain relatively stable at around 60 GW, although there are a range of sensitivities around this. These sensitivities relate to: fuel prices, energy conservation, household numbers, power generation capacity and output, CHP capacity, embedded generation and exports.

70. Generation capacity in the UK currently stands of 90.2 GW. However, the coming decade will see many changes in the electricity markets, in particular, the closure of a number of coal and oil fired plant that are considered too polluting by modern standards, and nuclear plant that are scheduled to come to the end of their working lives. The Large Combustion Plant Directive will lead to closure of around 12 GW of coal and oil-fired fleet by the end of 2015 at the latest. The Industrial Emissions Directive could also lead to further closures by 2023. In addition, according to current timetables, up to 7.1 GW of existing nuclear generating capacity is reaching the end of its operational life and will have closed by 2020. Some 19.1 GW could therefore close by 2020, with further closures by 2023.

71. Around 8.3 GW of new plant that will connect to the National Grid is already being built, and a further 13.2 GW has planning permission. The total of new and consented plant is 21.5 GW. Replacement nuclear capacity may also be constructed by around 2025 following the electricity market reforms. Of the new capacity with planning permission, 8.7 GW is gas-fired generation.[16] Given the significant closures of plant in the middle of this decade it is important this new plant comes on as scheduled to avoid risks to security of supply.

72. Latest figures from National Grid's Seven Year Statement (updated to reflect any changes that have occurred in the period to August 2011) show that 3.6 GW of Transmission connected renewable electricity projects are under construction. An additional 3.7GW of projects have planning permission and are awaiting construction and a further 5.7 GW of projects have submitted planning applications. These are predominantly offshore and onshore wind and biomass generation projects, with the majority of the capacity being over 50 MW.

[16] National Grid

Gas

Introduction

73. This chapter provides a range of projections and assesses the key risks and drivers which have a bearing on gas security of supply over the coming years.

74. The level of future gas demand in the UK will depend on a number of factors, including economic growth, global gas demand, renewables penetration and fuel prices, which are hard to project accurately. In addition to meeting demand in GB, supplies are also needed to meet demand for gross exports to Ireland (Northern Ireland and the Republic). Gas is also exported from GB to the Continent through the IUK Interconnector, particularly in the summer months when seasonal swing in demand means UK prices tend to be lower. Furthermore, non physical (interruptible-reverse flow) exports to The Netherlands via the Balgzand–Bacton line (BBL) have been possible since February 2011.

75. There are a number of sources of supply of gas to meet UK gas demand. These include:

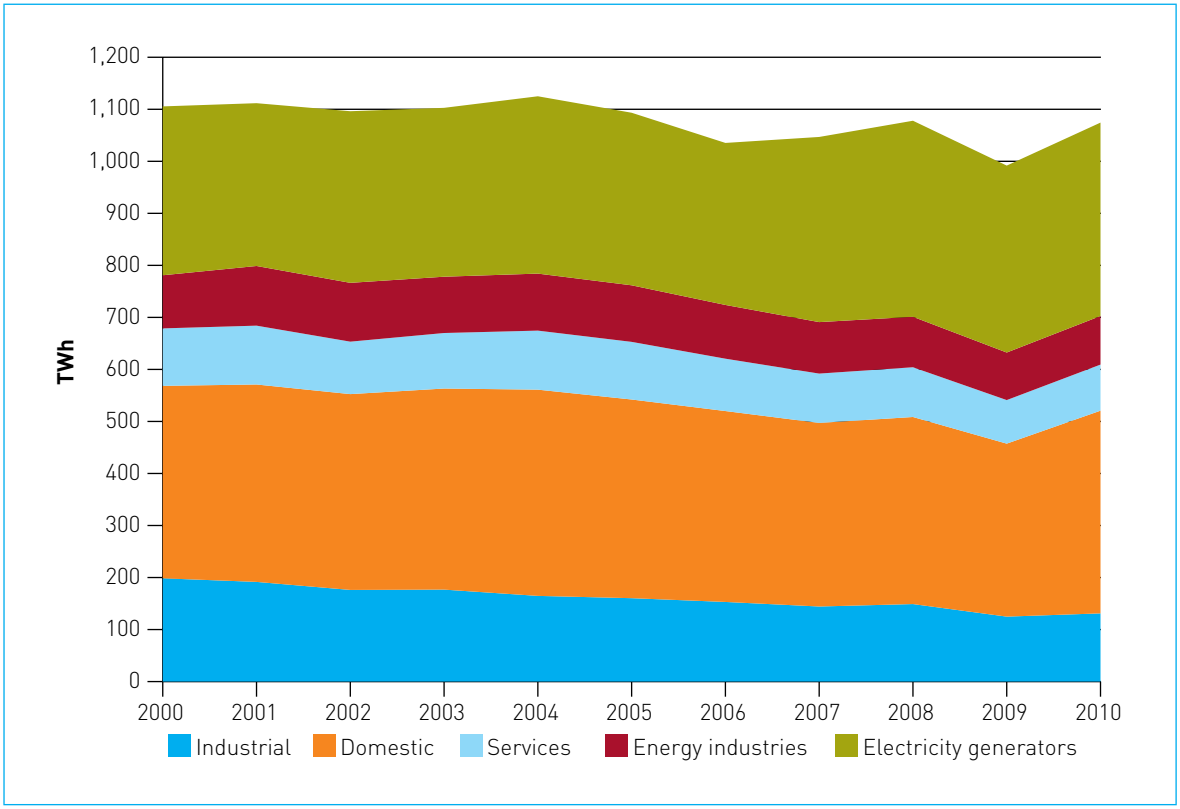
- Production from the UK Continental Shelf (UKCS) – which peaked in 2000 and is expected to continue to decline;
- Imports by pipeline from Norway (including via Langeled to Easington and via Vesterled and the Tampen and Gjoa Links through FLAGS to St Fergus);
- Imports from the Continent through the IUK Interconnector with Belgium and the Balgzand–Bacton Line (BBL) pipeline from the Netherlands;
- Imports of liquefied natural gas (LNG) by tanker (to the Isle of Grain, the two terminals at Milford Haven and through Teesside GasPort);
- Production onshore UK – though this is small at present, unconventional sources such as shale gas could increase in importance; and
- Gas storage facilities also provide a role in balancing supplies from these sources and demand, particularly seasonal and peak demand.

Demand

76. Chart 6 shows that gas consumption is split roughly equally in thirds between electricity generation and domestic use, with the remaining third going to a combination of industry/services and energy industries. Most gas for electricity generation is used in Combined Cycle Gas Turbine (CCGT) stations. Gas use for electricity generation has fluctuated with changes in the relative price of coal and gas. Price increases during 2005 and 2006 saw gas use for

generation fall in both years. In 2007, however, gas use by generators rose by 14 per cent and by a further 5.9 per cent in 2008 to a record high of 376 TWh. Gas use for generation fell by 4.6 per cent in 2009 following a decrease in electricity demand. This was followed by an increase of 3.5 per cent in 2010.

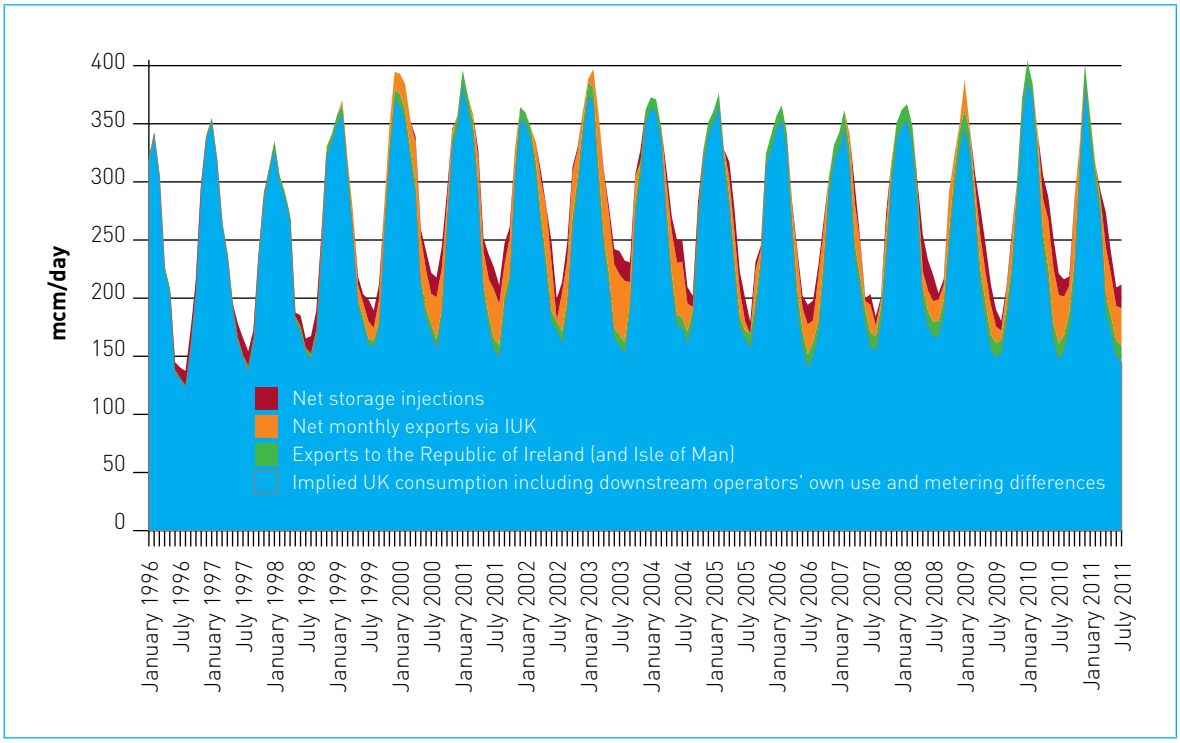
Chart 6: Consumption of natural gas 2000 to 2010



Source: DECC, Digest of UK Energy Statistics, Table 4.2

77. Demand for gas varies day-by-day although it tends to be much lower in summer than in winter, despite gross exports and injections into storage, as shown in Chart 7. This seasonality is driven by household and business demand for gas for space heating, which is driven largely by temperature levels. For this reason, wholesale prices for gas – which are largely influenced by demand patterns in the Northern hemisphere – also tend to show a seasonal pattern. Demand for industrial purposes and electricity generation tends to be much less seasonal and tends to be driven more by the price of gas relative to the prices of other fuels and the price of electricity.

Chart 7: UK Monthly Gas Demand



Source: DECC Energy Statistics (September 2011)

Annual Demand

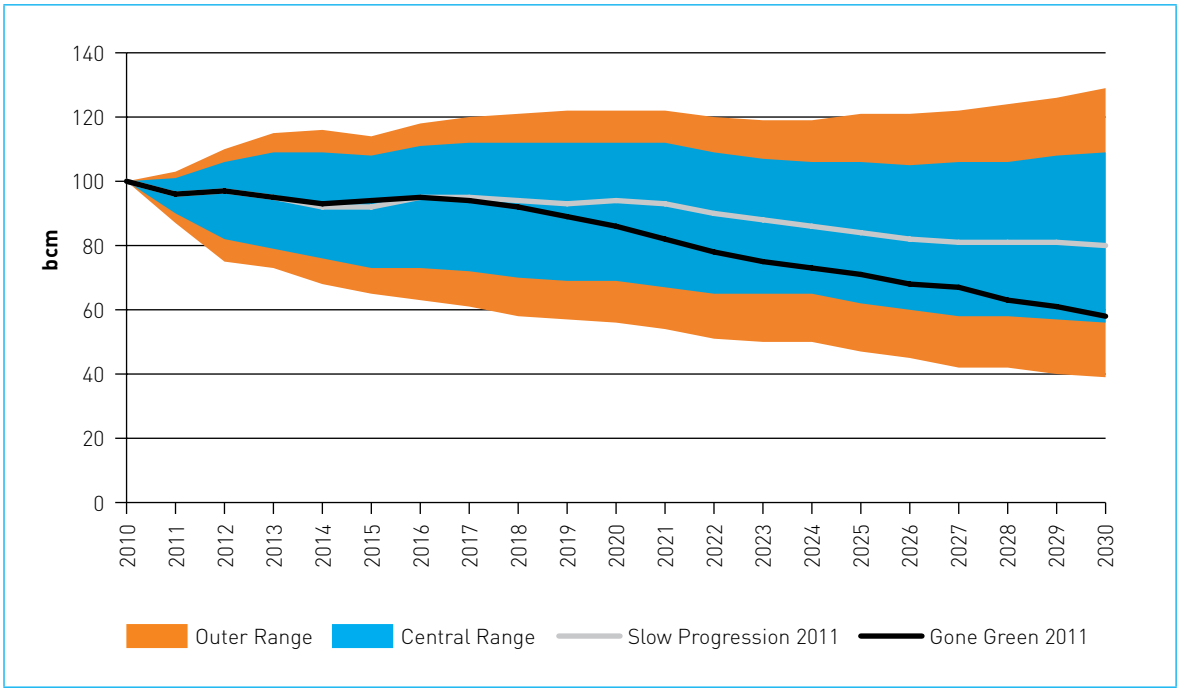
78. Chart 8 shows a range of projections for annual gas demand. A number of sensitivities to the Slow Progression[17] forecast of gas demand have been assessed. These include strong and weak economic growth, high and low fuel prices, high and low household numbers, high and low cases for power generation capacity and exports. This shows that a range of outcomes are possible, depending on the assumptions. More detail on scenarios produced by National Grid can be found in the Development of Investment scenarios document.[18] The Gone Green scenario shown on the chart has been developed as a plausible scenario to meet the 2020 EU environmental targets.

[17] In a "Slow Progression" scenario the emphasis is on a slow progression towards the EU 2020 targets for renewable energy, carbon emissions reductions and energy efficiency improvements and the UK's unilateral carbon emission targets. In this scenario, the EU 2020 renewables targets are not met until around 2025.

The "Gone Green" scenario represents a potential generation and demand background which meets the environmental targets in 2020 and maintains progress towards the UK's 2050 carbon emissions reductions target. The scenario takes a holistic approach to the meeting of the targets, assuming a contribution of the heat and transport sectors towards the renewable energy target. The generation and demand background supporting this scenario is one approach in achieving this aim.

[18] http://www.nationalgrid.com/uk/Gas/OperationalInfo/TBE/

Chart 8: GB Annual Gas Demand Sensitivity Analysis



Source: National Grid

79. GB annual gas demand is projected to trend downwards from around 100 bcm per year currently to 94 bcm in 2020 in the Slow Progression scenario. There are however sensitivities around this, leading to a wider potential range of outcomes, depending on factors such as relative fuel prices of gas and coal, the amount of wind/gas fired generation in the electricity generation mix, and economic growth.

80. The outer case assumes that all factors are acting independently and pushing demand in one direction. In practice these variables are not mutually exclusive. For example, it is possible that weaker fuel prices and weaker economic growth could coincide, thus cancelling each other out to a certain degree, as far as the impact on demand is concerned. The central range case takes this into account.

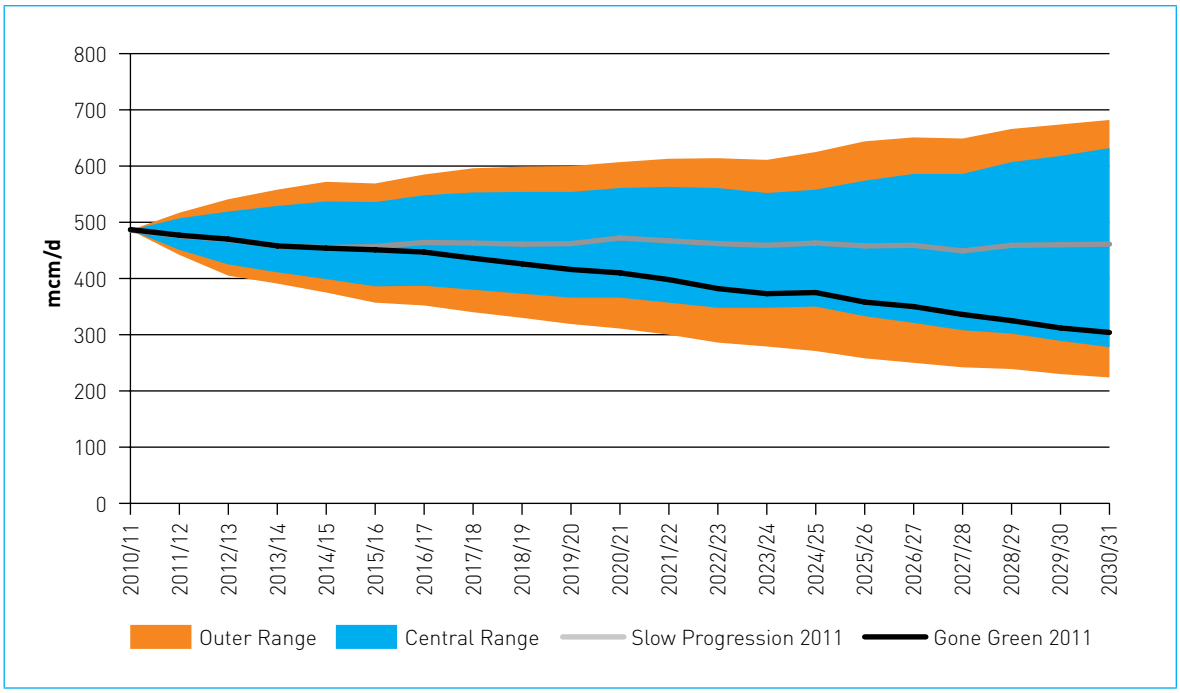
81. National Grid's central range is noticeably wide, reflecting a number of uncertainties over the level of future demand. The key driver behind this is the uncertainty in the power generation sector. There are two main aspects to this sensitivity. The first is the amount of gas-fired generation capacity that is connected in the future. This will be driven by underlying electricity demand, environmental legislation, government policy and the role of other fuel types such as nuclear and wind generation. The second aspect is driven by relative fuel prices. The relationship between gas, coal and carbon prices will determine the fuel mix going forward and whether gas or coal-fired generation is used as base load generation.

Peak Demand

82. The ability to meet demand, whether on a particular day or over a more prolonged period, such as over a severe winter, is particularly important in a security of supply context. This is also true for demand during average weather conditions. Chart 9 shows a range of potential peak gas demands using the same sensitivity analysis as for annual demand.

83. There could be changes to the pattern of demand which raise new challenges. Increasing amounts of wind generation, which is variable and relatively unpredictable, could increase the volatility of gas demand as gas-fired generators are likely to play a key role in balancing the electricity market. The gas market will need to respond to this challenge in the coming years by becoming increasingly flexible; for example by increasing the rate at which gas can flow into and around the network, or through greater provision of demand-side response. It is worth noting that this increased requirement for flexibility comes in the context of the closure of 12 GW of coal and oil power generation capacity (due to the Large Combustion Plant Directive (LCPD) – see the chapter on electricity and which currently provides significant demand-side response potential.

Chart 9: GB Peak Demand Sensitivity Analysis



Source: National Grid

84. Projections for peak demand show this gradually trending down from current levels (around 500 mcm/d) to 462 mcm/d under Slow Progression scenario 2011 or to 416 mcm/d over the period 2010 to 2020 under the Gone Green scenario 2011. There is, however, a range of sensitivities around this central case. These are illustrated as a central and an outer range.

85. The central and outer ranges are constructed on the same basis as in Chart 8, with the outer range a summation of factors acting in concert, and the central range taking into account the dynamic interaction between different factors leading to some cancelling out the effects of others. The central range is less pronounced than in the annual demand assessment. Although power generation again has the biggest influence on demand, the uncertainty is limited to the impact of different levels of capacity rather than the combined effect of capacity and plant operation. This also results in a more symmetric range of demands around the Slow Progression scenario.

Demand-side Response

86. At times of market tightness, mechanisms on the demand-side are also used to ensure demand and supply balance. Most demand-side flexibility is provided from the power generation sector, which can switch between a range of technologies – at present, primarily coal, oil and gas, though in future the scope for such switching will decline as the 12 GW of coal and oil-fired power generation capacity closes due to the LCPD. It should be noted that if gas is the marginal source for power generation (due to coal being lower cost), any demand side response may be limited.

87. Some large users of gas can also be flexible in their gas use. During a period of high prices these customers may, where technically feasible, choose to switch to an alternative fuel or to scale back or cease production. The incentive on suppliers to offer interruptible contracts may not be sufficient. Ofgem's ongoing Significant Code Review on Security of Gas Supply is considering measures to address these incentives (see box 3).

88. A key element for sending signals to bring about efficient demand-side response (or greater supply) at times of tightness is the GB's liquid wholesale gas market, which helps to ensure that prices reflect market tightness. Customers (and producers) exposed to these price signals will therefore have incentives to respond. Non-daily metered customers (such as households and small businesses) are not exposed to fluctuations in wholesale gas prices and therefore do not reduce demand when wholesale prices are high. In future, smart-metering could play a role in ensuring security of supply in a cost-effective way by signalling the true costs of consuming gas at times of market tightness.

89. For winter 2011/12, the relative gas and coal prices favour coal as base load reducing demand for gas. National Grid estimate demand-side response to be about 0-10 mcm/d from the power generation and 10 mcm/d from other sources, if the price was high enough and sustained. This is much lower than historical levels, as the gas burn for power generation is the marginal plant. However, conditions exist for the DSR to be appreciably higher, namely:

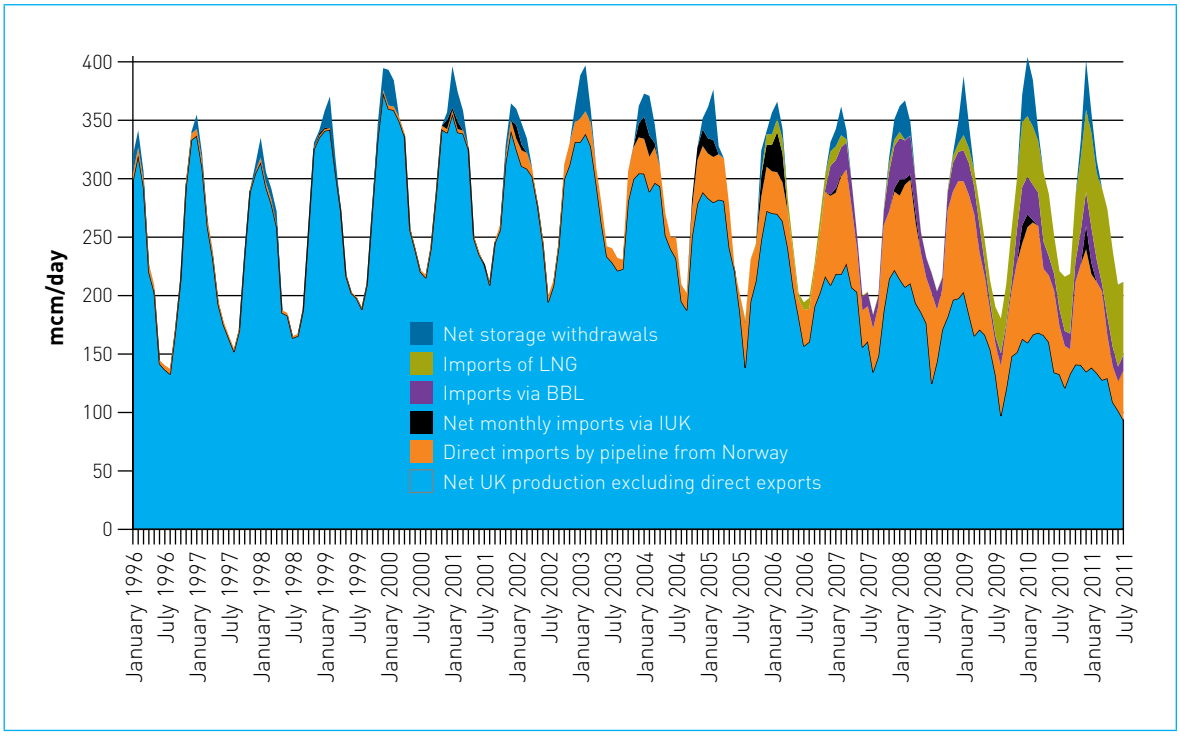
- Higher wind
- Electricity imports
- Mild weather

Supply

90. The production of gas from the UK Continental Shelf (UKCS) peaked in 2000 and since then has been steadily declining. Chart 10 illustrates the monthly variation in the principal sources of UK gas supply. The seasonal flexibility in supply from UK production, the so-called 'swing supply', has also reduced. This partly reflects a greater share of production from associated gas fields and less from dry gas fields[19], partly because producers are reluctant to switch off fields and partly also because a smaller proportion of production is sold under long-term buyer-nomination contracts.

91. Demand has increasingly been met by imports. Norwegian, LNG and Continental gas have become important sources of supply, not only at peak times but throughout the year. Additionally, as UKCS production has declined and the UK has become integrated with the global gas market, gas from storage is important not only at times of peak demand but also throughout the year.

Chart 10: UK Monthly Gas Supply



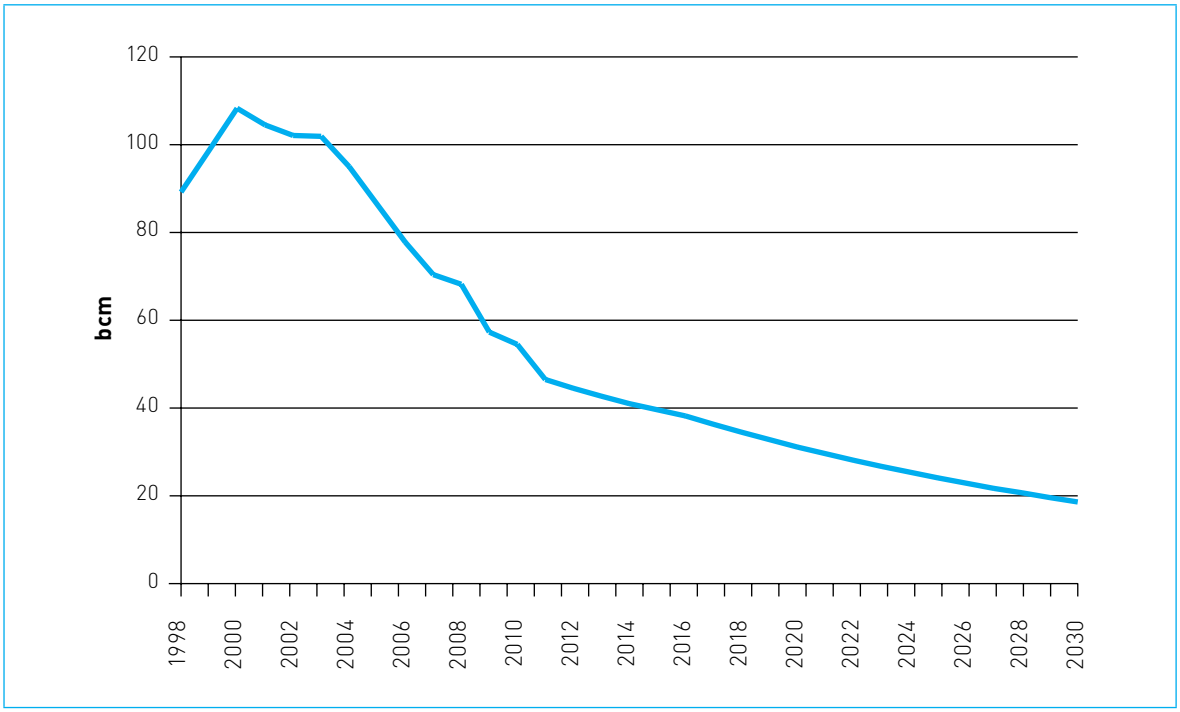
Source: DECC Energy Statistics (September 2011)

[19] 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.

UK Production

92. Production of gas from the UKCS is expected to continue to decline. As with projections of demand, projections of UK gas production are inherently uncertain and should be treated as indicative rather than definitive.

Chart 11: Actual and projected UK gas production



Source: DECC[20]

93. Plans are in place to bring gas from the West of Shetland region from around 2014. There are also currently small scale plans for gas production from unconventional sources including biogas, shale gas and coal-bed methane. However, it is unlikely that significant production of unconventional gas will occur in the UK, at least in the next few years, so it is prudent to take a cautious view of the likely contribution to the UK energy mix.

Imports

94. Since 2004 the UK has been a net importer of gas. Import reliance, although neither new to the UK nor uncommon around the world, can bring additional risks of disruption to supply sources. This section considers the UK's projected demand for net imports, import capacity and potential sources for imports and risks associated with the deliverability of imports.

95. Table 3 shows the net imports to and exports from the UK since 2006. Over this period net imports have increased from 11 bcm per year to 37.5 bcm, with LNG making up a large share of this growth.

[20] https://www.og.decc.gov.uk/information/bb_updates/chapters/Section4_17.htm

Table 3: Natural gas imports and exports

	2006	2007	2008	2009	bcm 2010
Imports from:					
Belgium	2.77	0.59	1.11	0.72	1.23
The Netherlands	0.83	6.96	8.23	6.32	7.92
Norway	14.28	20.52	25.79	23.68	25.16
Liquefied Natural Gas	3.42	1.35	0.81	10.05	18.53
of which:	–	–	–	–	–
Algeria	1.88	0.60	0.28	1.76	1.05
Australia	–	–	–	0.07	–
Egypt	1.13	0.16	–	0.53	0.11
Nigeria	–	–	–	–	0.33
Norway	–	–	–	0.17	0.81
Qatar	0.07	0.24	–	5.56	14.54
Trinidad & Tobago	0.33	0.35	0.53	1.96	1.51
Yemen	–	–	–	–	0.16
	–	–	–	–	–
Total Imports	**21.30**	**29.43**	**35.94**	**40.77**	**52.84**
Exports to:	**–**	**–**	**–**	**–**	**–**
	–	–	–	–	–
Belgium	5.47	4.67	4.18	5.64	8.72
The Netherlands	0.31	0.58	0.94	1.19	1.44
Norway	–	0.01	0.04	0.02	0.01
Republic of Ireland	4.30	4.63	4.93	4.94	5.12
	–	–	–	–	–
Total Exports	**10.07**	**9.90**	**10.09**	**11.80**	**15.29**
	–	–	–	–	–
Net Imports	**11.22**	**19.53**	**25.85**	**28.97**	**37.55**

Source: DECC, Digest of UK Energy Statistics, 2011 (table 4.5)

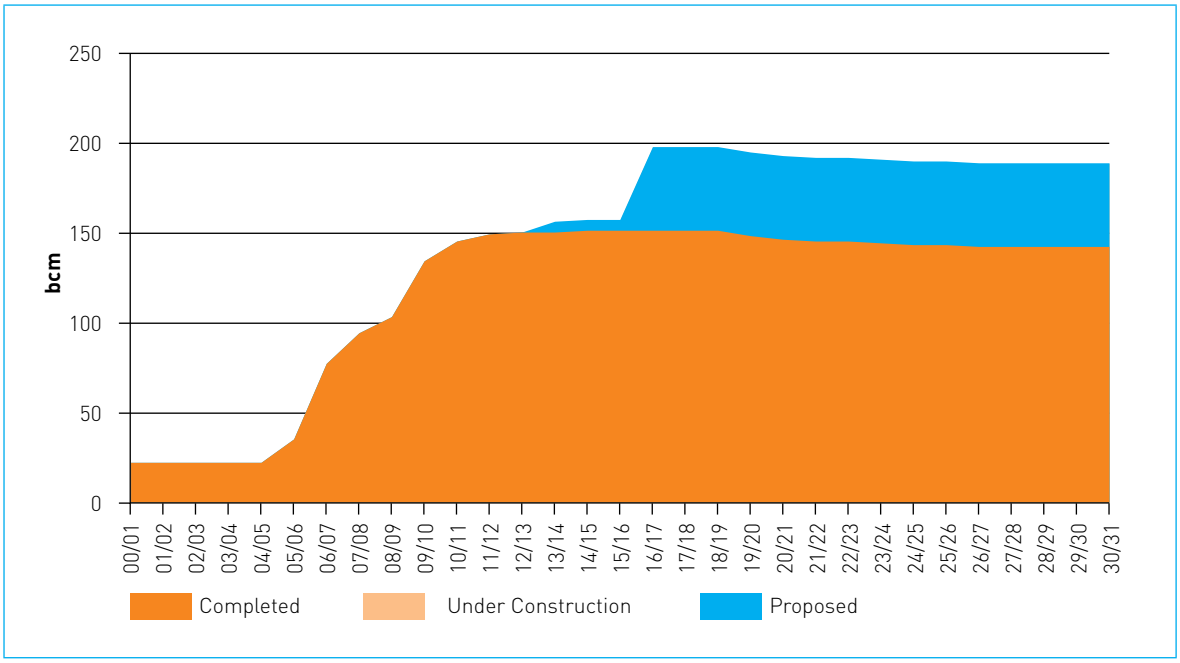
Import Capacity

96. The UK has a large import capacity which will contribute to security of supply by enabling gas imports to be received from a diverse range of sources. This combination of diversity and capacity could also help to deliver competitive prices since it makes it possible to import significant volumes of gas from whichever is the cheapest source. However, while sufficient capacity is a requirement for promoting security of supply, it is also essential that there is sufficient availability of gas (i.e. gas molecules flowing).

97. Actual data based on the last 12 months suggest that, compared to 2010/11 annual (NTS) demands of ~98 bcm/y, the UK currently has UKCS production of ~42 bcm/y and import capacity totalling ~156 bcm/y. This breaks down into ~54 bcm/y from Norwegian pipelines, ~56 bcm/y from LNG importation facilities and ~46 bcm from capacity connecting the UK to the Continent.

98. Since last year over 10 bcm of additional import infrastructure has become available through expansion of the BBL pipeline and increased import capacity at Grain LNG. Further import projects have been proposed though the extent to which all those plans will come to fruition is uncertain. Chart 12 shows current and proposed import capacity (note: annual capacity is not a measure of utilisation).

Chart 12: Possible evolution of UK gas import capacity (total)



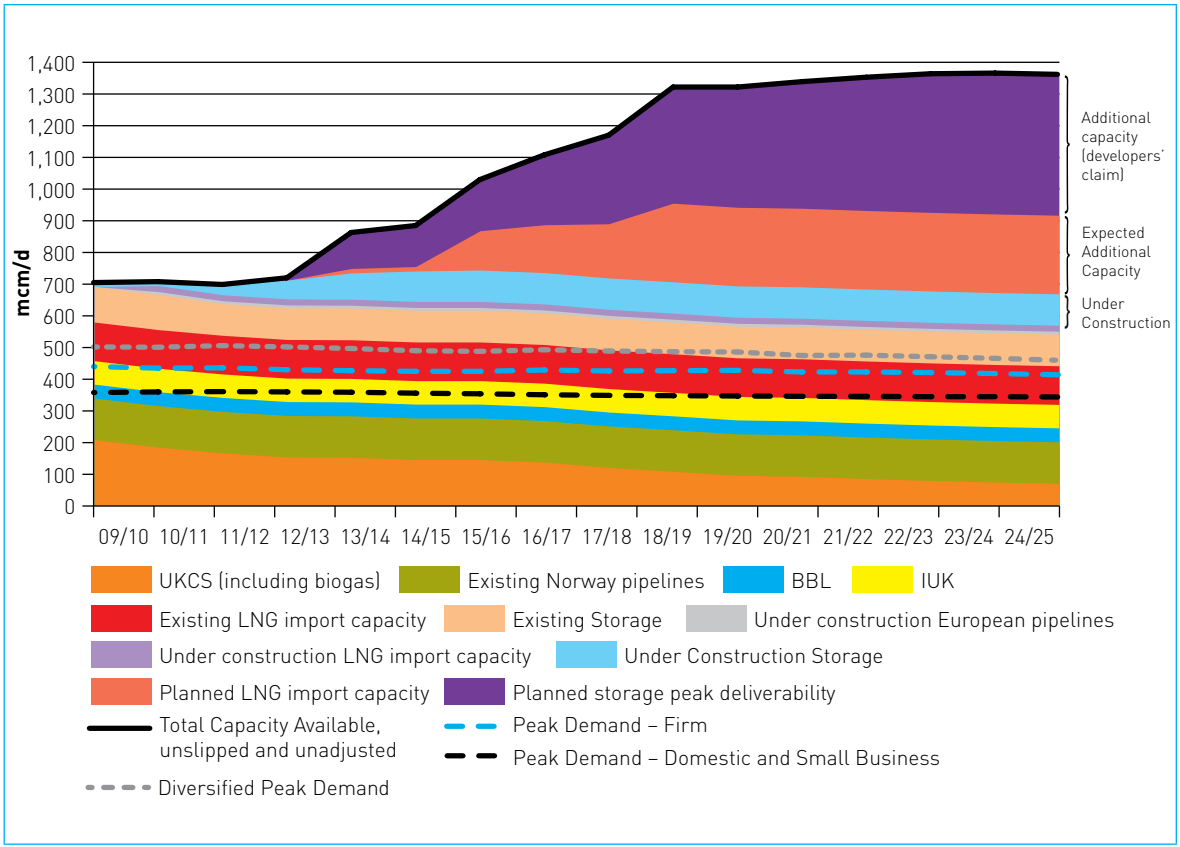
Source: National Grid (September 2011)

99. Chart 13 shows peak winter gas demand projections overlaid on supply capacity (physical import pipeline capacities, peak storage deliverability and capacity of the UKCS to supply). Import capacity is shown in terms of 100% availability. This level of availability would not be expected in practice (due to availability of supply, planned maintenance and repair as well as

unexpected outages). It suggests that in nominal terms, even without planned projects, there is sufficient existing import and storage capacity (and under construction) to meet all of National Grid's theoretical peak day demand scenarios to the end of the decade.

100. Chart 13 shows that, although (in nominal terms) there appears to be sufficient spare capacity, market operators may choose to develop further infrastructure to ensure there is sufficient contingency to meet peak demand.

Chart 13: GB Peak Daily Winter Gas Demand and Supply Capacity (nominal) including possible projects

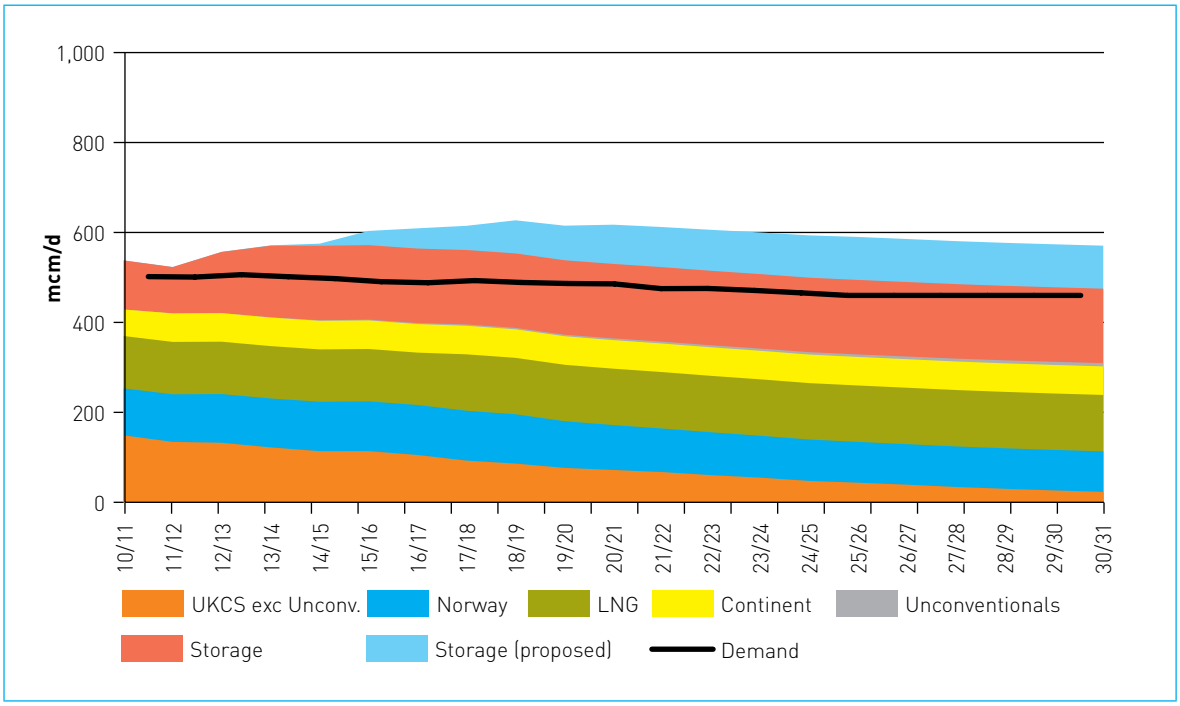


Source: National Grid

101. While sufficient capacity is a requirement for ensuring security of supply, it is also essential that there is sufficient availability of gas. Chart 14 shows the same build up of UK supply capacity though it has been adjusted ('de-rated') to reflect typical winter operational characteristics of import infrastructure. For this analysis, the following factors have been applied: UKCS at 90%, Norwegian import pipelines at 85%, LNG operating at 80% and continental supplies at 50%. To reflect development uncertainty, potential LNG import projects are included at 25% and potential storage projects are included at 20%.

102. De-rating supply capacity can be useful in so far as the de-rating factors reflect the expected flow rates at a time of peak demand. However, caution needs to be exercised in using derated data where the derating factors reflect factors unrelated to the infrastructure itself – for example, if the factors reflect issues at other points in the supply chain which might limit the amount of gas available[21]. In this case if estimated derated capacity falls short of peak demand it does not necessarily indicate that more import (or storage) capacity is needed. Capacity utilisation could be higher or lower than indicated or rise or fall over time. All other things being equal, we would expect more gas to be available when GB wholesale prices increase – as we would expect at a time of peak demand.

Chart 14: GB Peak Daily Supply Availability – Slow Progression (de-rated values)



Source: National Grid September 2011

Norway

103. Norway is a crucial gas supplier to the UK, supplying about a quarter of our total gas demand in 2010. Norway currently has the infrastructure capacity to export 54 bcm a year to the UK and 92.6 bcm a year to Continental Europe. Infrastructure built this decade includes: the 25 bcm Langeled pipeline commissioned in 2006; the Tampen link commissioned in 2007; and the Gjoa link, commissioned in 2010. Norwegian gas production is projected to increase over the next few years due to new discoveries in the Arctic (Barents Sea and Norwegian Sea). Consequently, Norway is considering options for new pipeline infrastructure to transport these potential new volumes of gas to European customers, including the UK.

[21] For example, the availability of gas in Europe for export through the IUK or the availability of LNG into import terminals.

The Continent

104. The UK gained its first interconnection to Continental Europe in 1998. Today, import capacity through Interconnector UK is around 26 bcm per year and 20 bcm per year through the BBL.

105. Continental pipeline imports (excluding Norway) to the UK totalled 7 bcm in 2009 (17% of total imports) and 9 bcm in 2010 (17% of total imports).

106. With the UK being increasingly import-dependent, its access to the European gas market on the mainland is important. However, though on the one hand the UK gains some measure of increased security of supply because it can access a wider (EU) pool of gas, on the other hand the UK may be more exposed if there are significant gas supply disruptions. For example, the EU as a whole is dependent on Russia for over 30% of its gas imports. Norway and Algeria are also significant suppliers to Europe. Disruptions in any of those sources, depending on the severity, will affect the available pool of gas and therefore may, in some limited circumstances, have an impact on the UK market, particularly since mainland Europe's market is still considerably less liquid than the UK's.

107. That said, the measures introduced through the EU Third package (listed in box 2) will improve market functioning, and access to transmission and storage will be facilitated to a far greater extent than is currently possible. European gas security of supply is best ensured by an open and integrated EU market so that customers and shippers in the UK, and across Europe, have access to a wide range of gas supplies at prices which reflect market fundamentals.

108. There are also measures and obligations on Member States, Competent Authorities and Natural Gas Undertakings in the Gas Security of Supply Regulation (which entered into force in December 2010) which will enhance EU security of supply. Based on well-functioning market principles, it is intended to improve transparency and market functioning, facilitate better emergency preparedness and more effective response mechanisms in the event of supply disruptions, ensure supplies to protected customers even in severe weather conditions, and lead to greater regional co-operation with more effective and bidirectional cross-border pipeline interconnection. The measures in the Gas Security of Supply Regulation should therefore help improve EU (and therefore UK) energy security supply.

Box 2: EU Third Energy Package and other measures/proposals to enhance security of supply

The Third Package is a significant step forward in building a single EU energy market and improving security of supply for the UK by removing trade barriers within the European Union. The Third Package requires all National Regulatory Authorities (NRAs) to achieve the objectives of the promotion of an internal European Market and the elimination of restrictions to trade between member states. Cross-border consultation and co-operation is embedded by the Third Package provisions with NRAs obliged to consult and cooperate with the Agency for the Co-operation of Energy Regulators (ACER) and other NRAs across their range of responsibilities. The package gives NRAs a range of new monitoring duties and information gathering powers, that will be used to assess national positions on such things as transmission system investment plans and the level of market opening and competition, in order to consider their consistency with European-wide plans and objectives.

One of the central provisions of the Third Package is the requirement for Transmission System Operators (TSOs) to unbundle from generation/production and supply interests. TSOs will not be permitted to control, have a majority shareholding in or exercise shareholder rights over relevant generation/production and supply undertakings and vice versa. This will ensure the effective separation of transmission networks from the activities of generation, production and supply and avoid any risk of discrimination not only in the operation of the network but also in the incentives for vertically integrated undertakings to invest adequately in their networks. This will mean that investment will be based on market signals alone and will therefore contribute to security of supply because investments will be made where they are needed most across the transmission network.

The Security of Supply Regulation that came into force in December 2010 will not only lead to enhanced resilience in the event of supply disruption through obligations to have robust preventative and emergency plans in place and meet supply standards set out in the Regulation, but will also lead to more cross border pipeline interconnection with reverse flow capabilities to meet the infrastructure standards also required by the Regulation. This will help ensure that gas will be able to flow more freely around the Union and be more responsive to market signals than has been the case in the recent past when there have been major disruptions in supply.

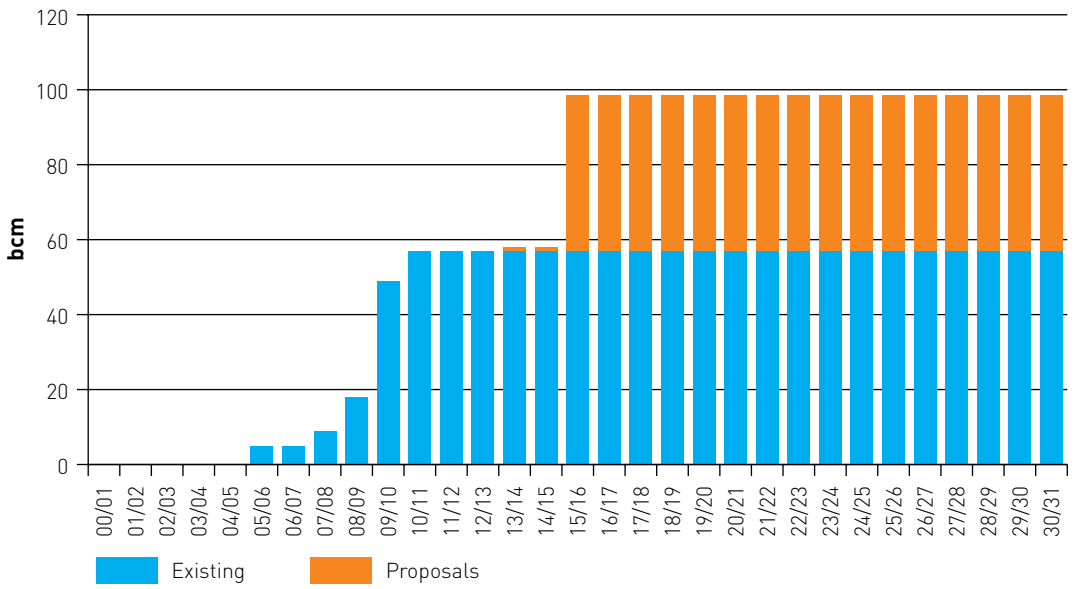
There are also Commission proposals currently being developed that will seek to ensure more efficient EU-wide infrastructure investment (the 'infrastructure package'). The legislative proposal, expected in late October 2011, is aimed, inter alia, at removing regulatory and planning barriers across borders in order to realise the huge investments needed between now and 2020 to meet the Union's increasing energy import needs. It seeks to build on Third Package requirements placed on industry to produce biannual ten year EU wide development plans. A core aim of the new infrastructure package will be to identify projects of European common interest that meet certain criteria and develop mechanisms to help unlock the investment potential.

For details of GB implementation see The Electricity and Gas (Internal Markets) Regulations 2011: http://www.legislation.gov.uk/ukdsi/2011/9780111513965/introduction

Imports from the rest of the world

109. In recent years the UK's LNG regasification capacity has increased significantly, with terminals at Milford Haven and the Isle of Grain, and the Teesside GasPort facility. LNG imports have risen from less than 5% of total imports in 2005 to 35% (19 bcm) in 2010, which is 18% of total gas consumption and 7% of total energy demand. Chart 15 shows the recent rapid build-up in the UK's LNG import capacity and the proposed additions going forward. LNG imports surpassed pipeline imports of natural gas for the first time in September 2010 and were also higher for the first six months of 2011 in aggregate.

Chart 15: Existing and Proposed build in LNG capacity



Source: National Grid

110. Though most LNG is sold (notably in the Far East) through long term contracts, more broadly the LNG market is slowly moving towards globalisation due to a number of factors:

- World regasification capacity is larger than world liquefaction capacity. Having surplus regasification capacity allows for a large degree of flexibility in where LNG cargoes can be shipped to. This facilitates price arbitrage on the part of producers such that LNG can be delivered to where the price is highest.
- An increasing proportion of LNG is not contractually committed to one specific destination.
- Advances in liquefaction, regasification and LNG shipping technology have pushed down costs and increased trading between the Atlantic and Pacific basins. Average shipping distances have increased considerably in recent years.

- High current and forecast US unconventional gas production (tight gas, shales and coal-bed methane) has made LNG supplies available that would otherwise have gone to North America. As a result of technology advances, developing markets such as China have also started significant exploration efforts for this resource which could free up future LNG production for other destinations such as Europe and the UK.

111. These developments are encouraging – since they foster the growth of a deeper and more liquid global market for LNG. Such a market would mean that the UK would need to compete on price with a larger range of other markets to attract gas, although it would also mean an increase in the number of potential suppliers competing to supply LNG to the UK too. The impact on LNG prices that the UK would face is not clear, but on balance a global gas market is welcome since it spreads risk (it makes it easier to attract large volumes of gas that the UK may need in the event of a supply disruption or surge in demand).

112. Risks remain to the development of a global gas market. These risks are both economic and political in nature. For instance:

- global investment in the LNG (and upstream) supply chain will need to keep pace with future world demand despite the recent global recession, and

- the increasing concentration of reserves could allow suppliers to exercise market power either individually or collectively if this facilitates the creation of a cartel.

113. In the short term, the market conditions for LNG flows to the UK remain favourable with UK gas winter 2011/12 prices much higher than those in the US. However, even with full production from Qatar and new production in Australia and Algeria (Pluto and Skikda) expected in 2012, there has been some concern that the LNG market may tighten following the recent disaster in Japan.

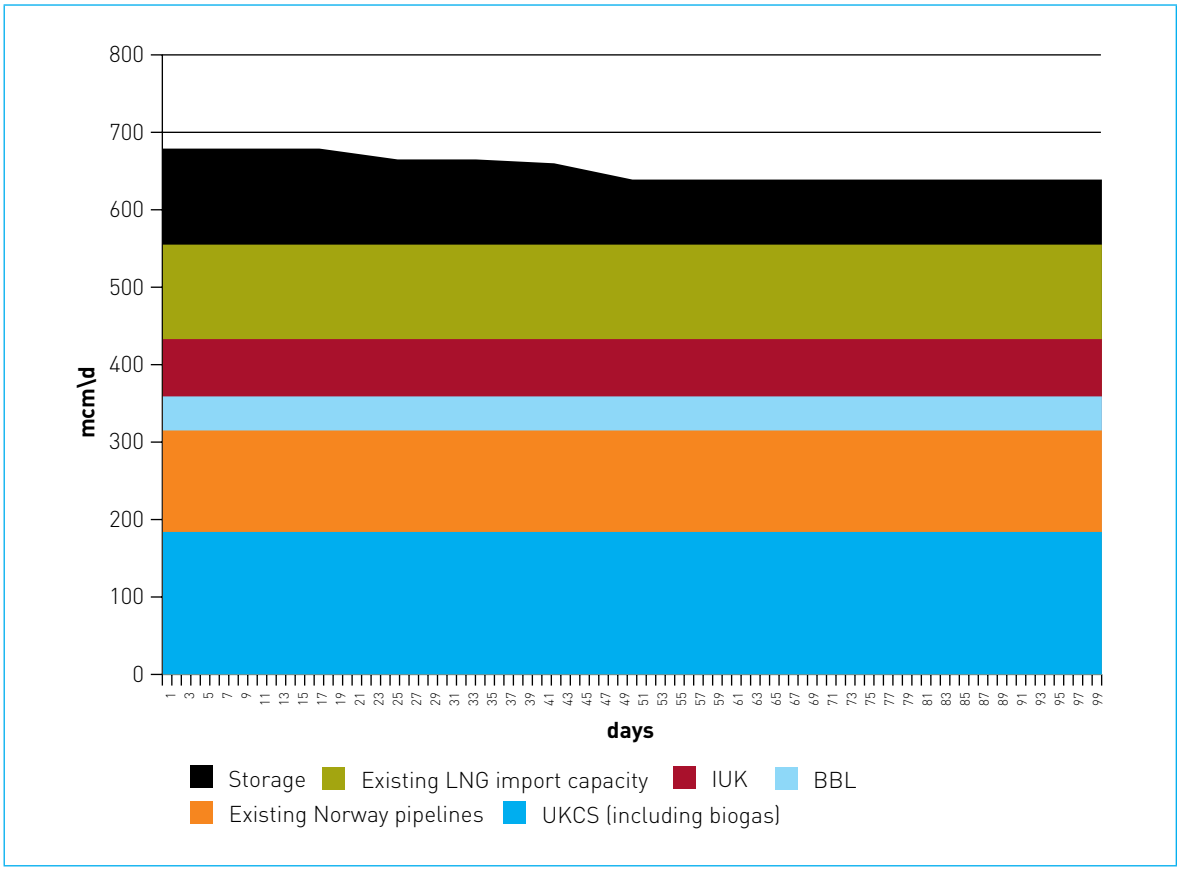
114. It should be noted that even with a more liquid LNG market, the responsiveness of LNG supplies will always be limited by how quickly it can be shipped to the UK. This constraint may be reduced, but will not be eliminated, as the global gas market increases in sophistication, enabling a single long-distance trade to be replaced with a series of short distance trades or swaps. The market may need to find ways to cope with any delays between when the gas is needed and when LNG cargoes can arrive – to prevent any increased reliance on LNG from translating into greater market volatility. Rising material costs, a shortage of skilled labour and increased uncertainty, particularly around long term sales, also threaten the development of future LNG liquefaction facilities.

Storage

115. Storage is one means of managing seasonal demand fluctuations. Historically gas has tended to be put into storage in the summer months when gas is cheap and abundant and taken out in the winter months when the demand for gas is highest and prices higher. Storage is also one option for dealing with short-term demand fluctuations or supply disruptions, which the UK may be further exposed to as it becomes increasingly import dependent. Storage will also become increasingly important as the power contribution from wind increases, whereby gas fired CCGTs are expected to provide cover for wind intermittency. The flexibility of storage sites – expressed in terms of the withdrawal (and injection) rate – will be key in helping to meet short-term demand fluctuations.

116. Storage capacity is often described in terms of a number of days' worth of supply. But this is not a particularly satisfactory or meaningful measure, since stored gas is never used on its own to meet demand. Chart 16 shows aggregate storage deliverability and nominal supply from other sources.

Chart 16: Nominal supply capacity by source in mcm

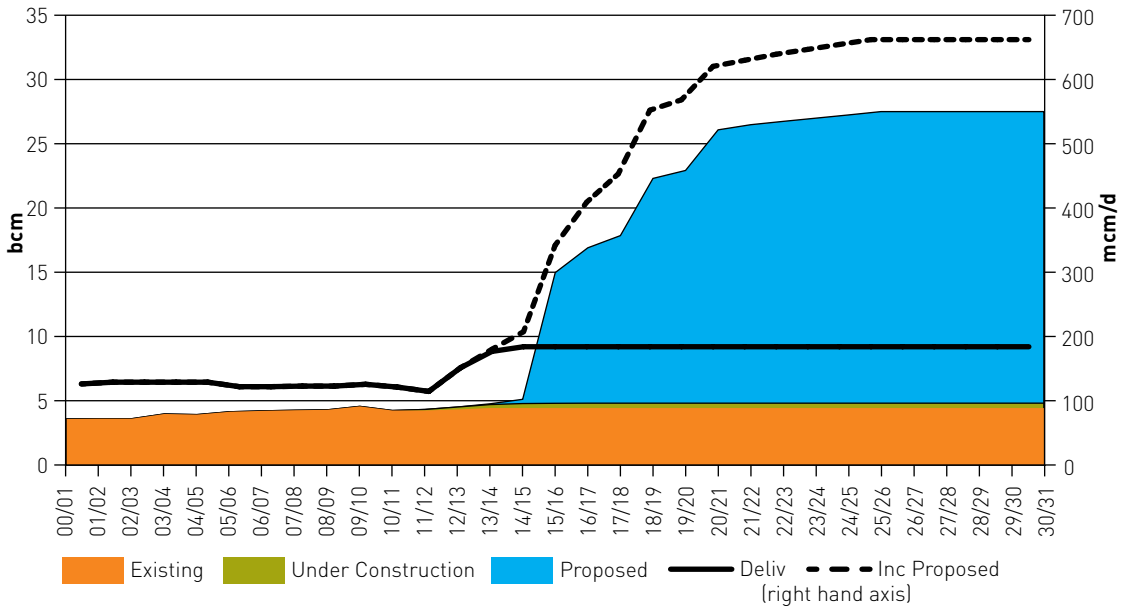


Source: DECC

117. Gas from storage is used to supplement supply from other sources to a greater or lesser extent depending on overall demand and the availability of other supplies. For example, the UK's largest gas storage facility, Rough, is capable of delivering over 10% of typical UK winter daily demand and could do so continuously for about eleven weeks if it started from full; other facilities can collectively deliver more per day, but would run out of gas much more quickly if they were to run at their maximum rate.

118. At present there are 9 commercial gas storage facilities in GB. Three new facilities[22] are also under construction, as well as the Aldbrough facility in Yorkshire which began commercial operations in 2009/10 and is currently undergoing expansion. There are another 16 proposed storage facilities, 9 of which have the necessary planning consents[23].

Chart 17: GB Gas Storage Capacity and Deliverability



Source: National Grid (information as of August 2011)

119. Chart 17 shows storage space and deliverability in terms of existing facilities, those under construction and those proposed. Whilst the facilities under construction may only add modest additional space, they are expected to increase deliverability by about 80%. If all current storage proposals were to go ahead as proposed then the maximum storage deliverability would increase from about 120 mcm/day currently to around 600 mcm/day in 2020/2021, far in excess of the central range forecast peak day demand.

[22] The three gas storage facilities currently under construction are: Holford in Cheshire, due in 2011/12; Hilltop Farm in Cheshire, due in 2011/12 and Stublach in Cheshire, due in 2013/14.

[23] National Grid, "Gas Transportation Ten Year Statement 2010" (Dec. 2010)

Outlook for Supply

120. In recent years the GB gas market has shown its resilience to shocks and firm customer interruptions have not occurred as a consequence of commodity shortages. However, DECC and Ofgem have expressed concerns that the arrangements currently in place may not provide sufficient incentive for the industry to deliver the level of supply security that consumers desire (see box 3). These concerns have been exacerbated as the UK becomes increasingly reliant on imported supplies of gas. Ofgem is currently conducting the Gas SCR to address these concerns.

Box 3: Further measures to increase resilience to low probability/high impact events

Independent studies commissioned by DECC[24] concluded that there are certain scenarios, with a low but not negligible probability, which could have a high impact on gas consumers in Great Britain (GB). The impacts of such events could lead to gas supply disruption. Parliament has given Ofgem powers to direct National Grid to make changes to the Uniform Network Code where Ofgem considers these will reduce the likelihood of a gas supply emergency occurring through the Energy Act 2011. Under current arrangements, the cash-out price (the marginal cost to National Grid of buying gas to balance the system) is frozen at the level immediately before a gas supply emergency[25]. This could reduce the ability of the GB market to attract imports of gas – e.g. where the price of gas in North West Europe increases after the start of the emergency. Through the Energy Act 2011, Ofgem can now, following consultation with industry, direct National Grid to make changes to the Uniform Network Code if Ofgem considers that the modification will either decrease the likelihood of a gas supply emergency occurring or the severity or duration of a gas supply emergency.

In January 2011, Ofgem launched the Gas SCR, which is considering changes to the gas emergency arrangements as well as the need for further interventions including the introduction of new obligations on shippers, suppliers or National Grid. Ofgem will publish a draft policy decision on the Gas SCR shortly on its website.[26]

[24] See GB Gas Security of Supply and options for improvement (March, 2010) http://www.decc.gov.uk/en/content/cms/meeting_energy/markets/gas_markets/gas_markets.aspx

[25] A Gas Supply Emergency would occur if the gas pressure in the network was insufficient to maintain supplies to all customers safely. The outcome would be that gas consumers could be directed to stop taking gas or have their gas supplies isolated by their gas transporter. For the pressure in the network to be maintained there has to be a balance between gas supply and demand.

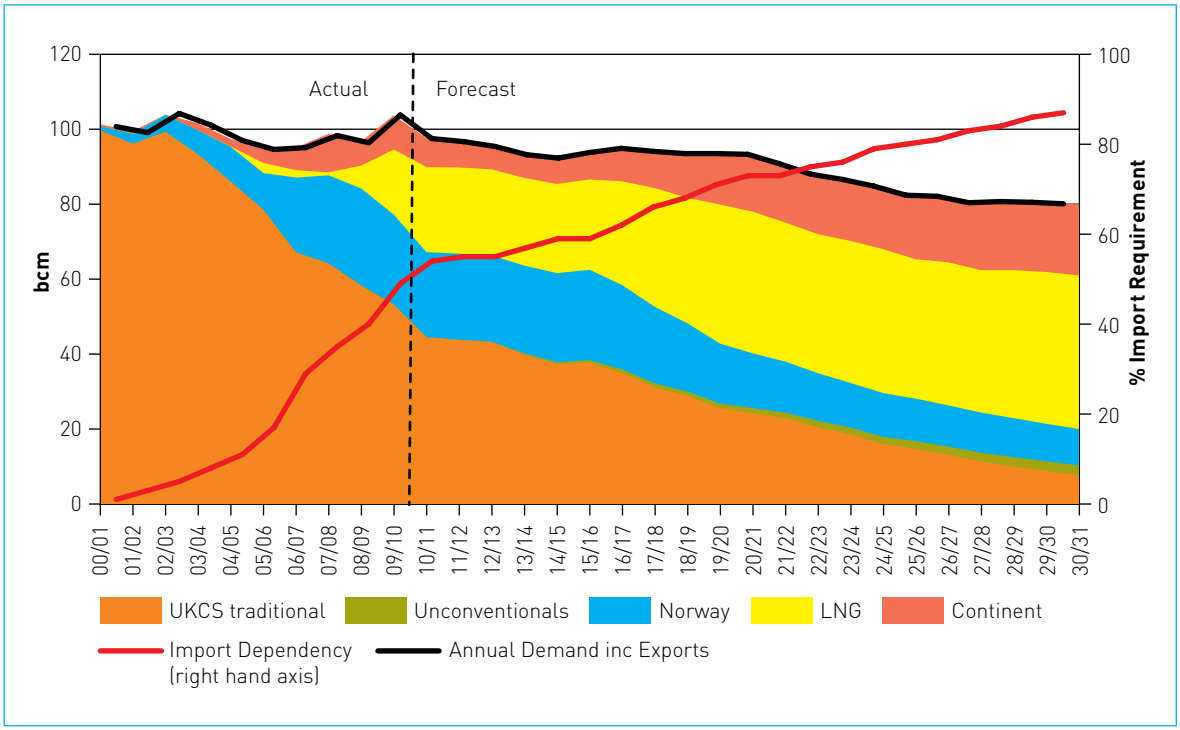
[26] http://www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/GasSCR/Pages/GasSCR.aspx

121. The ability to meet gas demand, whether on a particular day or over a more prolonged period such as a severe winter, is particularly important in a security of supply context. Each of the sources of supply – UK production, imports from Europe or LNG, and storage – will deliver a greater or lesser proportion of demand at any time depending on several factors which vary daily or seasonally and with varying levels of predictability or manageability, such as price, production conditions and contractual arrangements.

122. The extent to which flows from each of the different sources and supply routes (including the UKCS) would respond to price signals resulting from changes in the supply–demand balance within the UK market is subject to considerable uncertainty deriving from a range of factors including commercial, technical, weather-related, geopolitical, seismological, industrial-relations led, for example.

123. In summary there is a wide range of possible supply sources that could be used to meet the UK's gas demand out to the medium term. Chart 18 shows how GB annual demand could be met in National Grid's Slow Progression demand scenario and assuming National Grid's profile of UKCS production; supply is met with pipeline gas from Europe and a rapidly growing amount of LNG. It should be noted, however, that this chart considers gas flows on an annual basis and not a seasonal or peak basis.

Chart 18: National Grid Annual Supply–Demand Match (slow progression)



Source: National Grid (information as of September 2011)

Network reliability

124. The GB gas transmission network achieved 100% reliability in 2010/11. System reliability is assessed as no supply losses to firm supply points. During winter 2010/11, 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.

Conclusion

125. There is general consensus that the gas market should be well supplied in the near term, though some uncertainties remain in the second half of the decade. UK annual gas demand is projected to trend downwards slightly in DECC and National Grid's Slow Progression scenarios. There are, however, sensitivities around this leading to a wider potential range of outcomes, depending on factors such as relative fuel prices of gas and coal, the amount of gas fired generation in the electricity generation mix, and economic growth. Projections for peak demand show this gradually trending down from current levels over the period 2010 to 2020 under the Gone Green scenario 2011.

126. While production from the UKCS is projected to continue to decline, GB has an increasingly large and diverse range of import sources on which to draw. New import and storage capacity is identified at various stages of development and delivery. Should this come forward, the UK would continue to be well-served. In practice, it is noted however that projects might slip, and some of this capacity might not come forward.

127. We believe that it is important that the market arrangements provide sufficient incentives to deliver appropriate investment. Ofgem's ongoing Gas Security of Supply Significant Code Review is seeking to identify whether reforms to current arrangements are required and what form such reforms might take in order to improve security of supply.

Oil

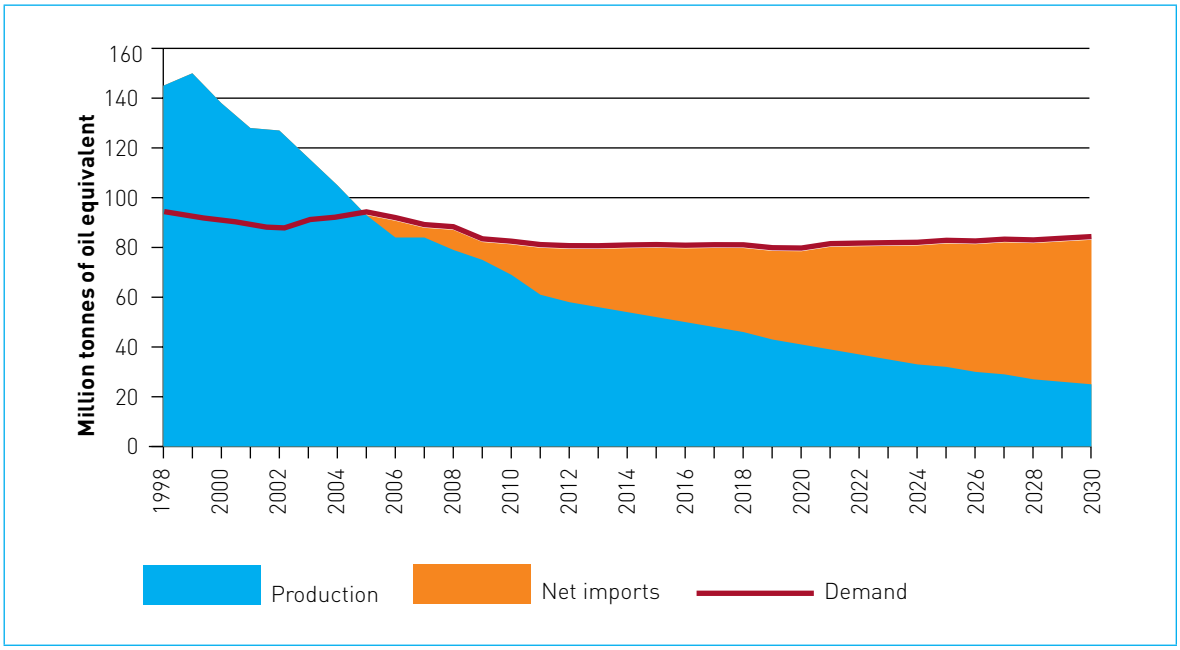
Introduction

128. This chapter presents a brief summary of key facts on UK oil production and demand. It also briefly reviews the actions DECC is taking to monitor oil markets and ensure continued energy security.

UK Oil Production

129. UK oil production peaked in 1999 and on average has been declining at around 7 per cent per year since then. DECC's latest central projection indicates UK production (including Natural Gas Liquids) will fall to 52 million tonnes of oil equivalent in 2015, down from 69 million tonnes in 2010, 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 19 shows the declining production profile, and how imports will be increasingly important in meeting a broadly flat demand profile.

Chart 19: UK oil production and demand, forecast to 2030



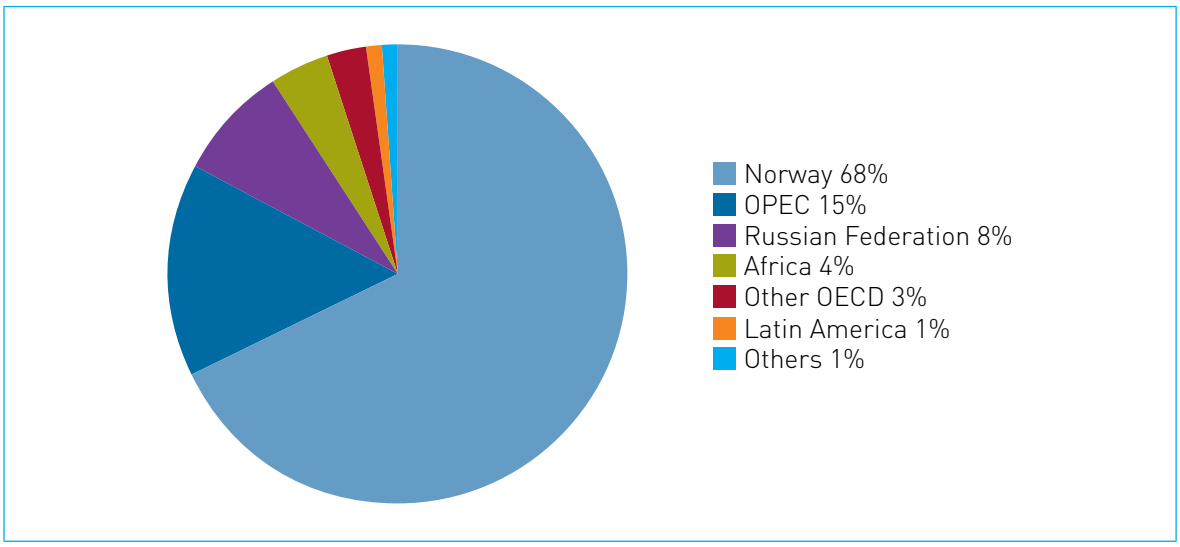
Source: DECC Production and Demand Projections

130. Since 2005, the UK has consistently been a net importer of crude oil, as production from the UK Continental Shelf has declined.

131. Most of the UK's crude imports come from Norway, with the remainder largely supplied from Russia and the OPEC countries (see Chart 20). Although supplies tend to be sourced nearby in order to minimise transport costs, the

UK imports from a diverse range of sources which reduces the impact of a disruption to any one source of supply.

Chart 20: Sources of UK crude oil imports, 2010



Source: IEA Annual Oil Questionnaire

UK Oil Demand

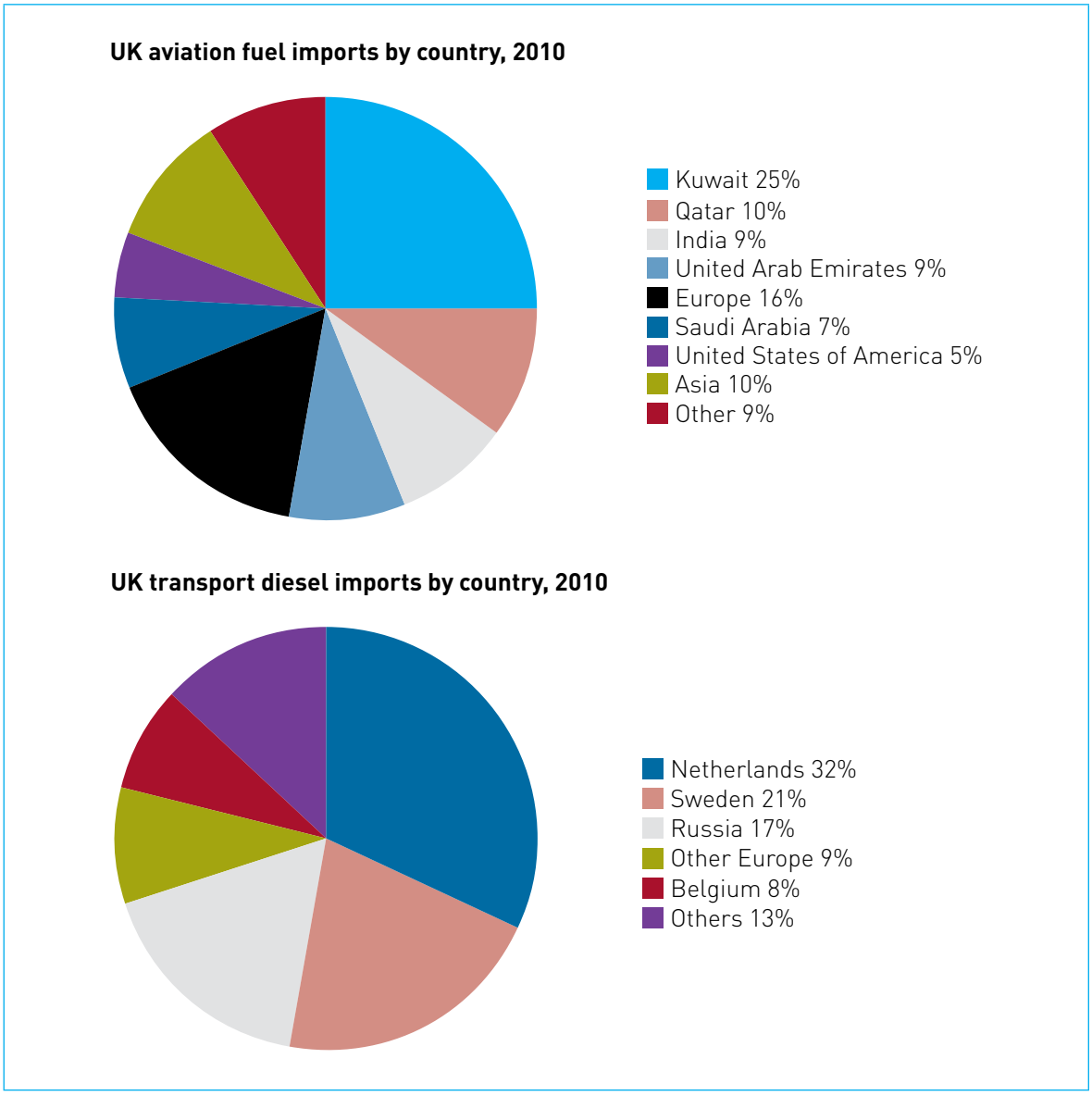
132. Oil products play an important role in the UK economy, providing around a third of the primary energy used in 2010. We currently rely on oil for almost all of our motorised transport needs. Transport accounted for around 75 per cent of final consumption of oil products in the UK in 2010, some 49 million tonnes of oil.

133. The UK demand for oil products has changed over the last 10 to 15 years, driven by growth in the aviation sector, the increased proportion of diesel vehicles in the car fleet, and a reduction in the use of oil for power generation. Although aggregate demand has fallen (from 81 million tonnes in 2005 to 72 million tonnes in 2010) there has been a more significant shift in the mix of products consumed.

134. UK refineries have not matched the changing pattern of demand. Compared to the current UK demand, they produce a surplus of petrol and fuel oil and relatively little middle distillates (such as diesel and aviation fuel), as they remain configured to meet the historically higher levels of petrol demand. For refineries to reconfigure their processes to produce more middle distillate requires substantial investment in new processing/conversion units.

135. Accordingly, whilst the UK is a net exporter of petroleum products (total exports of around 26 million tonnes, a third of which is petrol), the UK is increasingly reliant on importing other products to meet demand, with significant volumes of diesel road fuel (around 8 million tonnes) and aviation fuel (around 7 million tonnes). The UK has a well developed infrastructure for the trade of both crude oil and petroleum products, and, as chart 21 illustrates, sources its supplies from a diverse range of countries and suppliers.

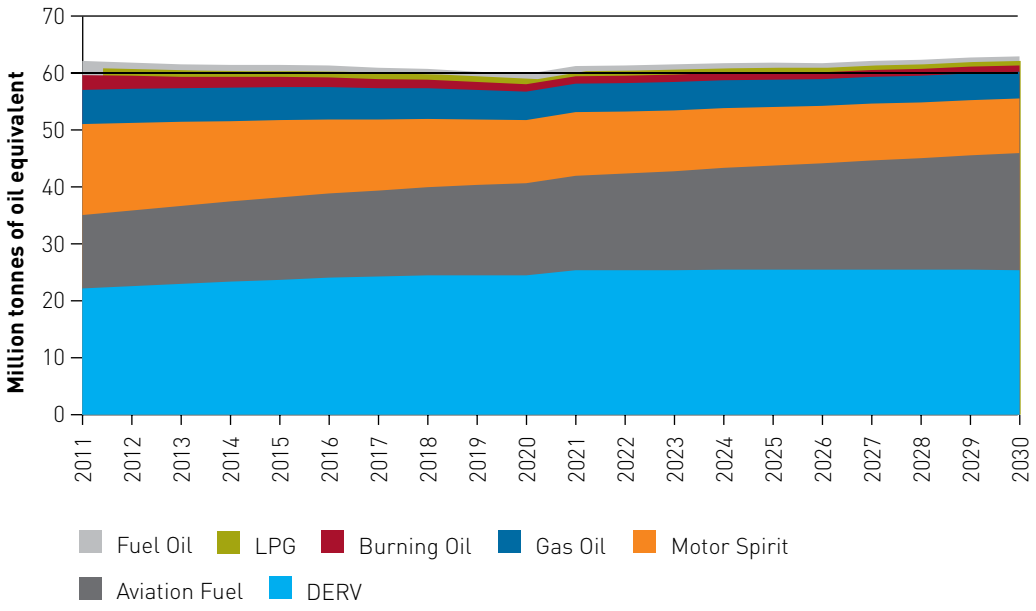
Chart 21: Sources of UK aviation and diesel imports, 2010



Source: IEA Annual Oil Questionnaire

136. Chart 22 illustrates that reductions in demand are not expected over the next 20 years. This is primarily because the transport sector is the main consumer of oil and will continue to be heavily dependent on it over this period. Whilst overall demand is relatively static, the consumption of petrol in the UK is expected to fall but diesel and aviation fuel are expected to show significant growth. In the longer term the UK needs to reduce its dependence on oil by improving vehicle efficiency and using new alternative fuelled vehicles.

Chart 22: Forecast UK oil demand by petroleum product type



Source: DECC Updated Energy Projections, October, 2011

Emergency oil stocks – the UK's international obligations

137. The UK is required to hold significant 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.

138. The obligations are currently on slightly different bases although the same stocks can be used to meet both obligations. The UK is obliged to hold 67.5 days of final consumption as its EU obligation and 90 days of net imports as its IEA obligation. As UK production declines, the IEA's requirement to hold stock will become more important but the EU requirement is currently larger. At the end of 2010, the UK held stocks equivalent to around 84 days of final consumption.

Global oil issues

139. Global oil demand is projected to increase by around 18 per cent by 2035 compared to 2009 levels (IEA WEO 2010 analysis – New Policies Scenario), driven by the emerging economies of China and India. Domestically North Sea oil production peaked in 1999 and we are increasingly dependent on imported primary oils, having been a net importer since 2005.

140. The oil market is a global one so, even when the UK was a net exporter of oil, it has always been exposed to the risk of global events driving higher and more volatile oil prices which can have significant impacts on the economy. This highlights the need for DECC to continue to monitor oil markets and ensure continued energy security.

141. Recent unrest in the Middle East and North Africa (MENA) region, in particular the disruption of supply from Libya and Yemen that removed around 1.7 million barrels per day of oil from the global market, had a significant impact on oil markets. The IEA assessed that there was the risk of a short-term shortage of supply, until increased production from Saudi Arabia could reach the market. The IEA therefore coordinated a release of emergency stocks to the market, the third time in its history that such a measure was taken. On June 23 the IEA orchestrated the release of 60 million barrels of oil over 30 days from member stocks, with the UK contributing some 3 million barrels.

142. DECC continues to work to ensure that the UK has access to secure supplies of oil at stable, affordable prices, including:

- Working multilaterally through the International Energy Forum, the IEA and the G20 to ensure oil markets function effectively, encourage the necessary investment in oil production, and reduce oil demand by:
  - Making more and better information available through the Joint Organisations Data Initiative (JODI), in which over 90 countries participate;
  - Supporting the removal of inefficient fossil fuel subsidies that can encourage wasteful consumption;
  - Promoting improved dialogue between oil producers and consumers through the International Energy Forum;
  - Promoting closer dialogue between the IEA and OPEC to deliver the best possible forecasts of oil supply and demand.
- Working bilaterally with key countries, such as Saudi Arabia, to share analysis and identify actions that can be taken to increase the stability of the global oil market.

Conclusion

143. Oil products play an important role in the UK economy, providing around a third of the primary energy used. Transport accounted for 75 per cent of final consumption of oil products in the UK in 2010.

144. Oil production in the UK peaked in 1999 and is now declining. Oil imports are forecast to increase throughout the 2030 timeframe to meet a broadly flat overall demand for oil.

145. 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, will reduce demand for oil in the long term. Significant reductions are not anticipated in the near term.

146. DECC continues to work with its international partners to improve the effectiveness of oil markets and encourage the necessary investment in both increasing oil supplies and reducing oil demand.

Glossary of Acronyms

ACER:	Agency for the Cooperation of European Regulators
BBL:	Balgzand-Bacton Line- Gas import pipeline
BCM:	Billion Cubic Metres
CCGT:	Combined Cycle Gas Turbine
CCS:	Carbon Capture and Storage
CHP:	Combined Heat and Power
CO2:	Carbon Dioxide
DECC:	Department of Energy and Climate Change
DERV:	Diesel Engined Road Vehicle (diesel fuel)
DUKES:	Digest of United Kingdom Energy Statistics
EU:	European Union
ENSG:	Electricity Networks Strategy Group
EP:	European Parliament
FLAGS:	Far North Liquids and Associated Gas System
GB:	Great Britain
GBA:	Gas Balancing Alert
GW:	GigaWatt
IEA:	International Energy Agency
IED:	Industrial Emissions Directive
IUK:	Interconnector UK
LCPD:	Large Combustion Plant Directive
LNG:	Liquefied Natural Gas
LPG:	Liquid Petroleum Gas
MCM:	Million Cubic Metres
MENA:	Middle East and North Africa
MIPU:	Major Infrastructure Planning Unit
MW:	MegaWatts
MWh:	MegaWatt hours
NOX:	Nitrogen Oxides
NPS:	National Policy Statement

NTS:	National Transmission System
OCGT	Open Cycle Gas Turbine
OFGEM:	Office of Gas and Electricity Markets
OFTOs:	Offshore Transmission Owners
OPEC:	Organisation of Petroleum Exporting Countries
SCR:	Significant Code Review
SOX:	Sulphur Oxide
TBE:	Transporting Britain's Energy
TNP:	Transitional National Plan
TOs:	Transmission Owners
TSO:	Transmission System Operator
TWh:	TeraWatt hours
UEP:	Updated Energy and Emissions Projections
UK:	United Kingdom
UKCS:	United Kingdom Continental Shelf

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URN 11D/870

ISBN 978-0-10-297514-7
9 780102 975147