Summer Outlook Report 2012

Outlook for summer 2012

Introduction

1. This document sets out National Grid's analysis and views for the coming summer. Previous outlook reports are published on National Grid's website[1].

Industry Feedback

2. National Grid continually seeks feedback on its outlook reports to increase their usefulness to the industry and to reflect all changes in trends when they become apparent. To feed back comments on this outlook report please contact us at energy.operations@uk.ngrid.com.

Roles and Responsibilities

3. The competitive gas and electricity markets in Great Britain have developed substantially in recent years and have successfully established separate roles and responsibilities for the various market participants. In summary, the provision of gas and electricity to meet consumer demands and contracting for capacity in networks is the responsibility of suppliers and shippers. National Grid has two main responsibilities: first, as the primary transporter, for ensuring there is adequate and reliable network capacity to meet anticipated transportation requirements; second, as system operator of the transmission networks, for the residual balancing activity in both gas and electricity. The structure of the markets and the monitoring of companies' conduct within it are the responsibility of Ofgem, whilst the Department for Energy and Climate Change (DECC) has a role in setting the regulatory framework for the market.

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[1] https://www.nationalgrid.com/uk/Electricity/SYS/sumOutlook/

5. National Grid has prepared this consultation document in good faith, and has endeavoured to prepare this consultation document in a manner which is, as far as reasonably possible, objective, using information collected and compiled by National Grid from users of the gas transportation and electricity transmission systems together with its own forecasts of the future development of those systems. While National Grid has not sought to mislead any person as to the contents of this consultation document, readers of this document should rely on their own information (and not on the information contained in this document) when determining their respective commercial positions. National Grid accepts no liability for any loss or damage incurred as a result of relying upon or using the information contained in this document.

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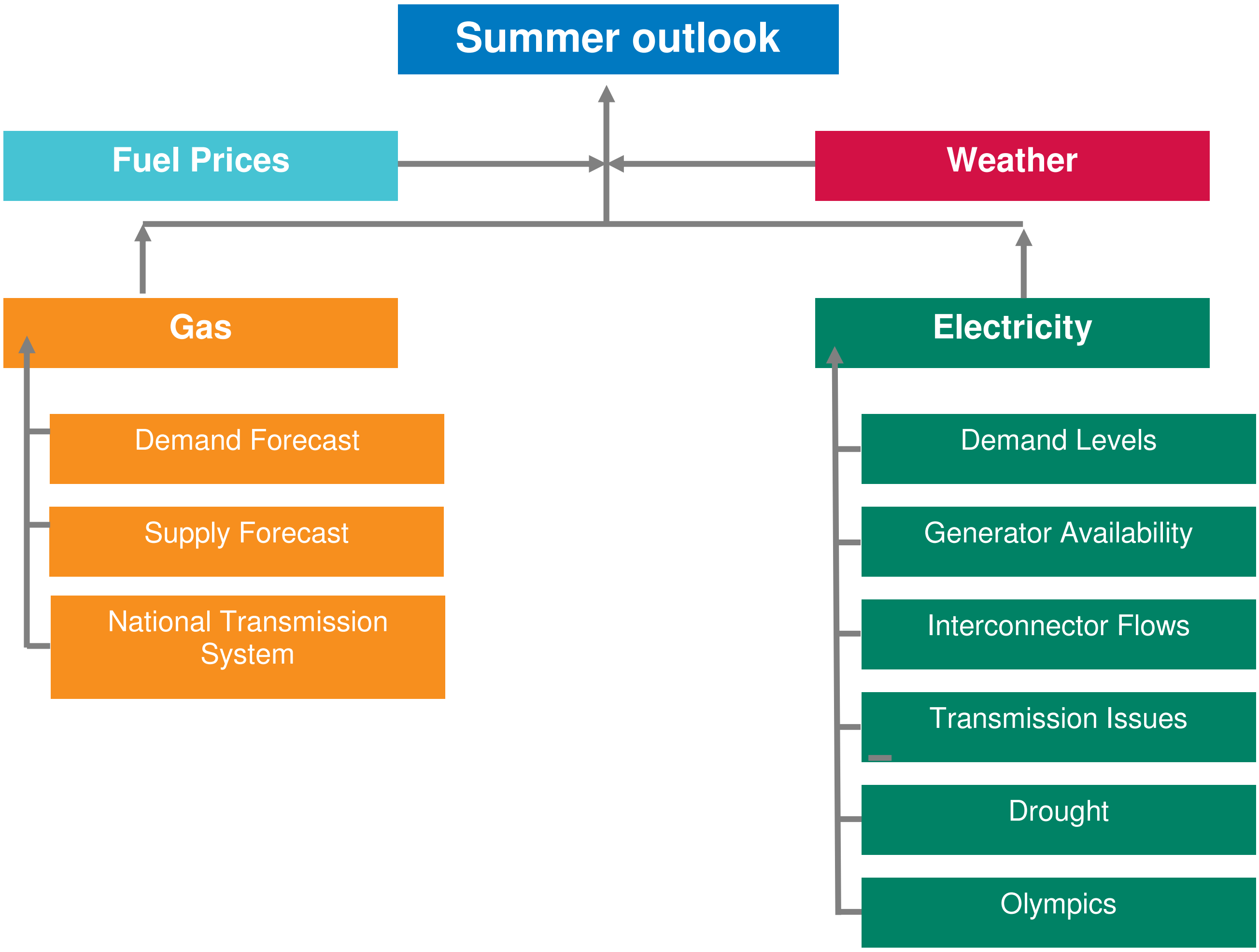
Overall Summary



Summer Outlook - Key Details

Weather

The Met Office probabilities for summer temperatures show a slight weighting towards above normal.

Fuel Prices

Over the past 12 months energy prices have remained high with the exception of lower coal prices since Q3 2011. Forward prices show a decline for oil, an increase for coal whilst those for gas and base load power show some seasonality for next winter.

For power generation, current fuel prices strongly favour coal burn over gas for the summer and next winter.

Gas

Demand Forecast (maximum) – cold April day	375 mcm/d
Demand Forecast (minimum) – mid summer day, limited exports / storage injection	140 mcm/d
Average Summer Demand – lower through less power, lower storage refill and possibly lower exports	199 mcm/d
Summer Supplies – due to Far East demand and prices there is uncertainty over LNG supplies. Forecasts assume lower UKCS, lower LNG and potentially higher imports from Norway. The impact of the Elgin gas leak is uncertain but may result in displacement of up to 2.3 bcm. This is expected to be made up from other UKCS fields or possibly from Norway.	36.4 bcm

Electricity

Demand Levels (maximum)	40.0 GW
Demand Levels (minimum)	19.0 GW
Generator Capacity	79.2 GW
Generator Availability (maximum)	74.1 GW
Generator Availability (minimum)	63.6 GW
Forecast Surpluses (maximum)	22.0 GW
Forecast Surpluses (minimum)	14.0 GW

Electricity surpluses are forecast to be healthy across the summer. Under overnight low demand conditions with high interconnector imports, high wind and high levels of inflexible plant, there may be a requirement for NGET to re-dispatch generation to maintain downward regulation.

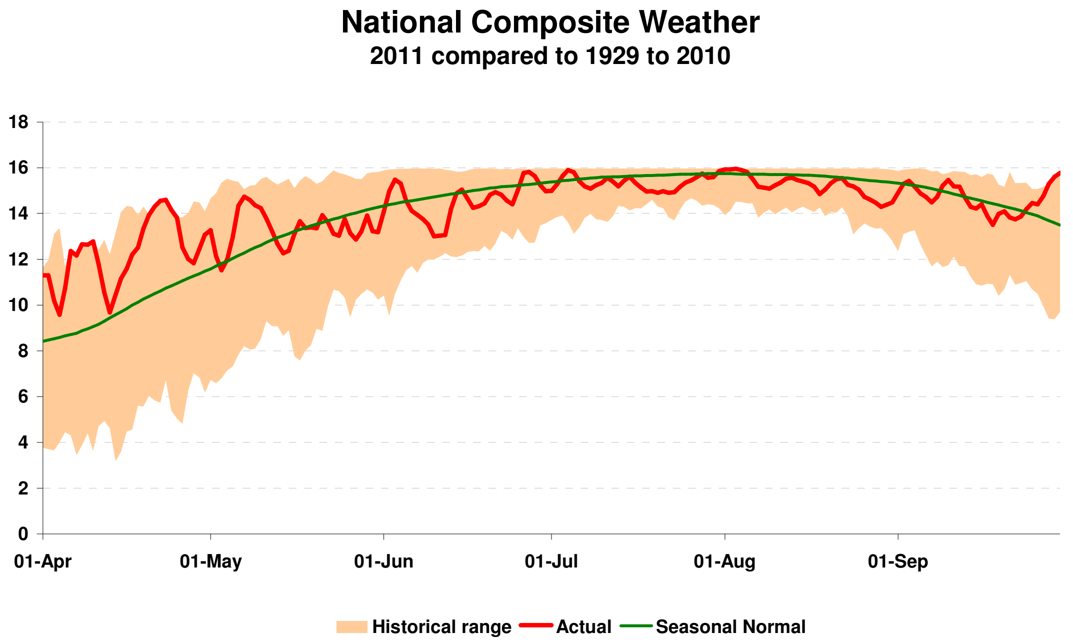
Contents

Weather

7. Rather than produce a seasonal forecast, the Met Office report 'global long-range probability maps' on their website[2]. For the UK, as shown on the website's map for Europe, for the period April to July, the temperature data reported in March shows a weighting towards above normal temperatures rather than below normal temperatures. In terms of probabilities, the charts for the UK show:
   - a 40 – 60% probability of above normal temperatures
   - a 20 – 40% probability of near normal temperatures
   - a 0 – 20% probability of below normal temperatures.
8. In terms of precipitation for the UK, there are similar levels of probabilities for above, near and below normal.
9. **Figure W1** shows the historical Composite Weather Variable (CWV, essentially a proxy for temperature), seasonal normal conditions and actual conditions for summer 2011. The CWV is capped at 16°C as there is little or no influence of temperature sensitive gas demand above this. This means that in the warmer months (June, July and August) there is very little variation in CWVs.

[2] http://www.metoffice.gov.uk/research/climate/seasonal-to-decadal/gpc-outlooks/glob-seas-prob

Figure W1 - Summer Composite Weather (2011 compared to 1929 – 2010)



10. The chart shows that colder conditions are essentially restricted to April, May and, to a lesser extent, September. Hence only in these months are the weather sensitive gas demands (non daily metered i.e. domestic) noticeably influenced by the weather.

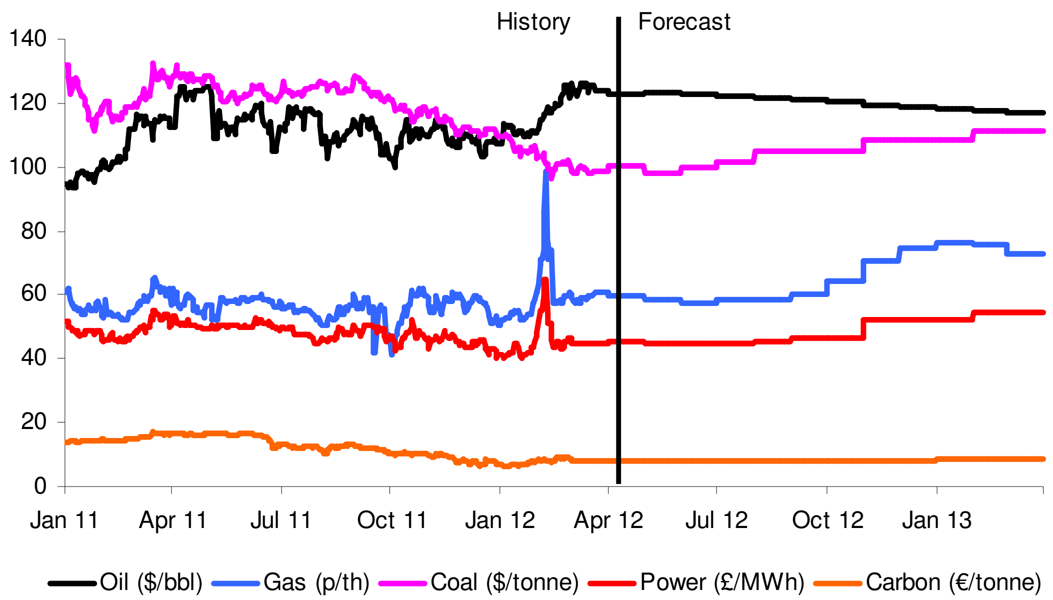
11. For summer 2011, all 3 of these months experienced very warm weather. This resulted in an early switch off and delayed switch on of heating demand.

Fuel Prices

12. **Figure F1** shows the recent history of energy prices for coal, oil, gas, power and carbon, and the future prices, at the time of writing.

Figure F1 - Energy Prices - history and forwards

Source: Heren, Platts & ICE



13. The chart shows a mixed picture of energy prices over the last 12 months:

- Oil prices increased in Q1 2011 back through $100/bbl due to unrest in the Middle East, notably in Libya. For the remainder of 2011 oil prices trended slightly lower only to increase again in Q1 2012 due primarily to political events in Iran
- Coal prices were relatively stable until late Q3 2011. Since then coal prices have declined by approximately 20%, possibly due to the demand outlook in Asia and increased Chinese coal production. The reduction in coal price has in part shifted the economics of power generation away from gas to favour coal
- Gas prices have been remarkably stable since Q1 2011 with the exception of a price spike during the cold period of February 2012. This was driven by supply concerns on the Continent rather than the UK
- Power prices appear to have close linkage with the UK gas price, however the decline in the coal price since late Q3 2011 has resulted in lower power prices. The chart shows that since Q3 2011 the variation between gas and power prices has slowly diverged and the coal price now appears to be setting the power price rather than gas. This may not be immediate obvious on the chart due to the scale used, but with the exception of the price spike in February the fall in the

power price has tended to follow the lower coal price rather than the increasing gas price

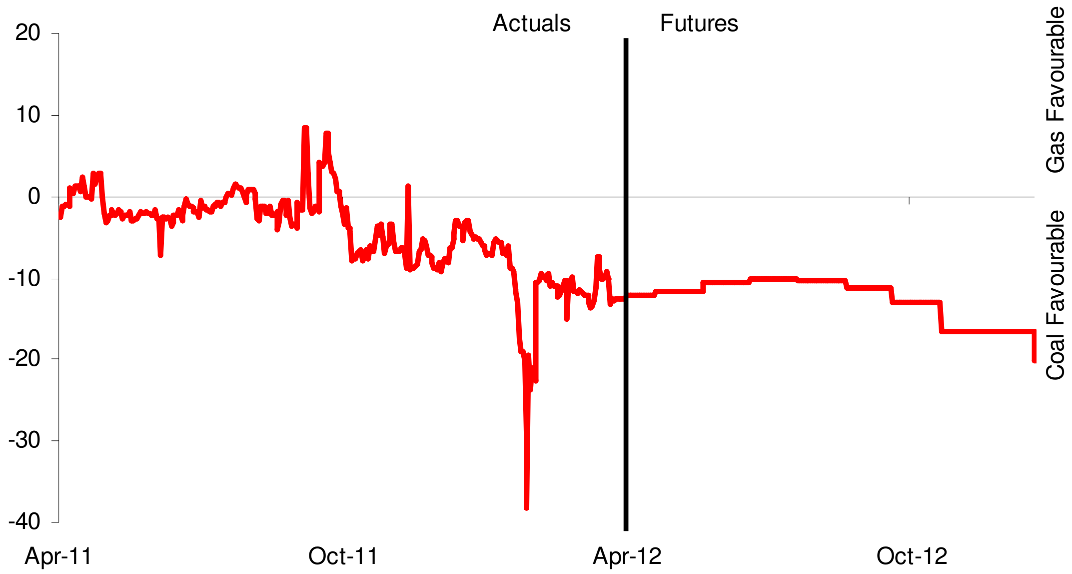
- The EU Allowances (EUAs) market for carbon shows a significant fall since Q2 2011 from about €16/tCO2 to about €7/tCO2. The fall was believed to be due to the release of additional EUAs by Germany and concerns over European markets.

14. In terms of forward prices, the chart shows:
    - Oil prices slowly declining to about $115/bbl in Q1 2013
    - Coal prices slowly rising to about $110/tonne in Q1 2013
    - Gas prices remaining flat until winter seasonality commences in Q4 2012
    - Power prices rising in line with the forecast increases in coal and gas
    - Carbon prices remaining flat.

15. **Figure F2** shows a view of the relative economics for generating electricity from burning coal compared to gas based on historic and forward gas and coal prices.

Figure F2 - Relative power generation economics (1)

Source: Heren, Platts & ICE



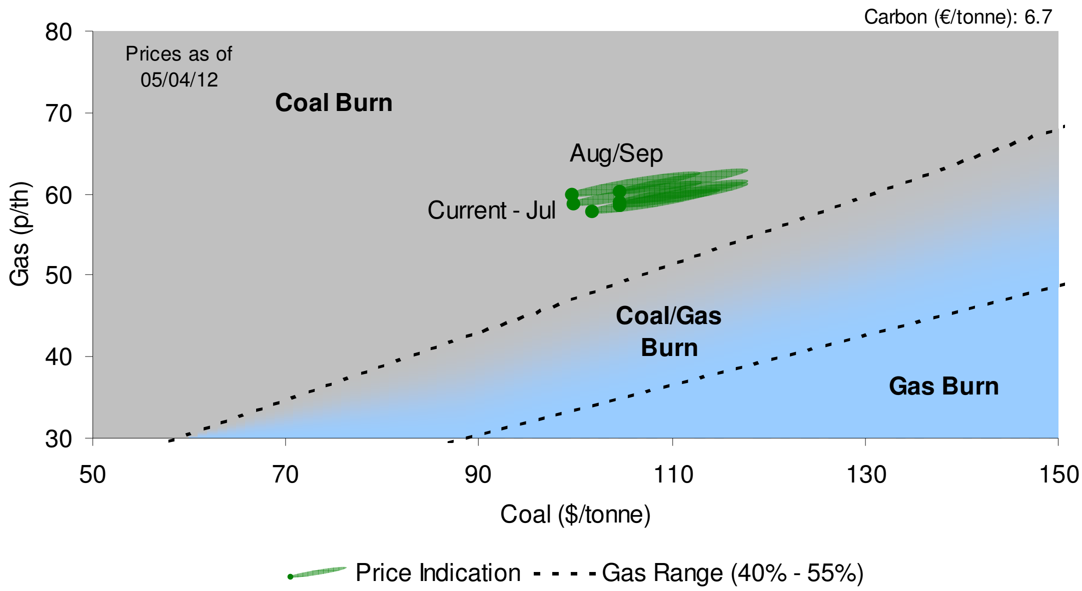
16. The chart shows a general trend over the past year of a shift from gas to coal as the 'preferred' source of UK power generation. The forward outlook for the summer 2012 continues with coal.

17. This simplified approach does not fully address other factors such as individual station efficiencies, generators' portfolios (including fuel stocks and contracts), environmental restrictions under the LCPD and plant outages. All of these may affect the amount of gas fired generation in the summer.

18. **Figure F3** looks at the effect of station efficiency in terms of the future summer prices for coal and gas.

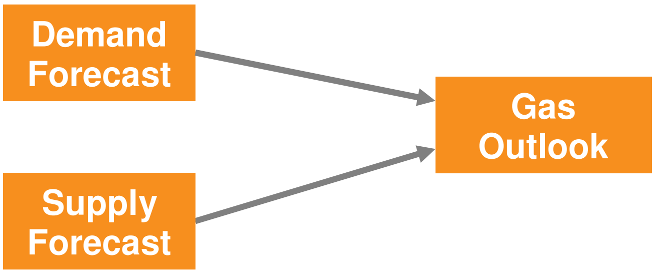
Figure F3 - Relative power generation economics (2)

Source: Heren, Platts & ICE



19. The chart shows a very strong bias throughout the summer period for coal to be the favoured source of fuel for power generation over gas. The chart also highlights that a price reduction of about 20 p/therm for gas or a price increase of about $40/tonne for coal would shift the economics to a more balanced position.

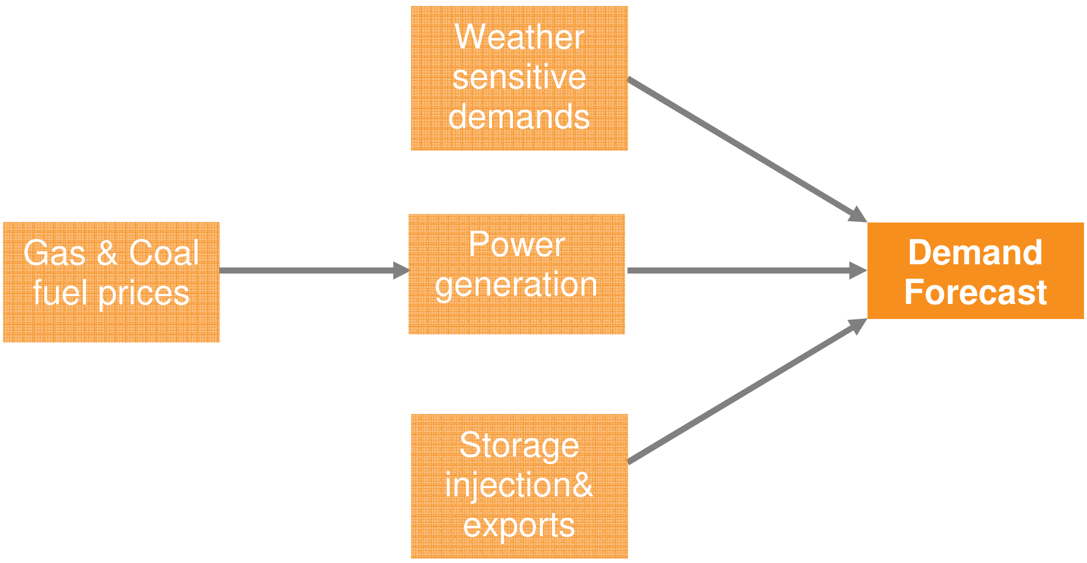
Gas



Overview

20. This chapter covers the gas supply-demand outlook for the forthcoming summer. Despite storage injection and Continental exports, demands during mid summer are about half those in the winter. Supply availability during the summer is generally high but at times is reduced due to periods of maintenance and this can result in relatively high flow ranges in terms of supply source and entry terminals.

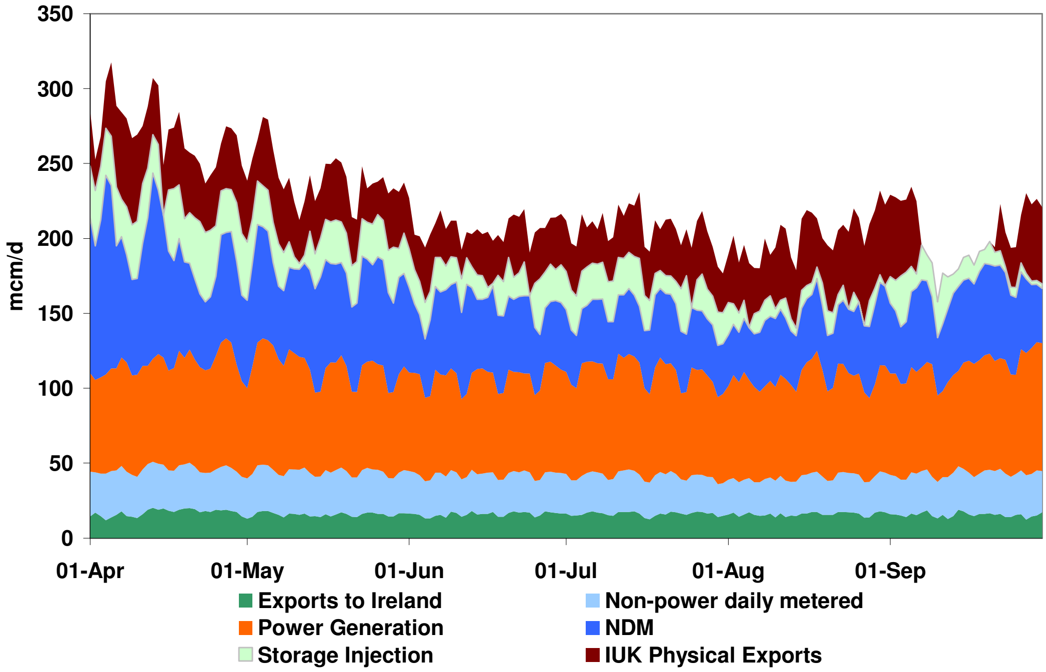
Demand Forecast



21. **Figure G1** shows the actual demands in summer 2011. Interesting features are:

- Moffat exports, DM demand and power station demand were all relatively stable across the summer
- At times NDM demand was almost down to mid-summer levels in April due to the very warm weather
- Low NDM demand encouraged high storage injection and IUK exports from early April onwards with storage injection declining towards the end of the summer as storage stocks became near full (see Figure G3)
- A maintenance period for IUK in September combined with warm weather resulted in very low demand levels, partly offset by increased storage injection.

Figure G1 - Actual Summer Gas Demand 2011



22. **Figure G2** and **Tables G1** and **G2** show the forecast for summer 2012 produced in May 2011. This has been adjusted for our latest view of lower demand for power generation and storage injection.

Figure G2 - Forecast Gas Demand Summer 2012

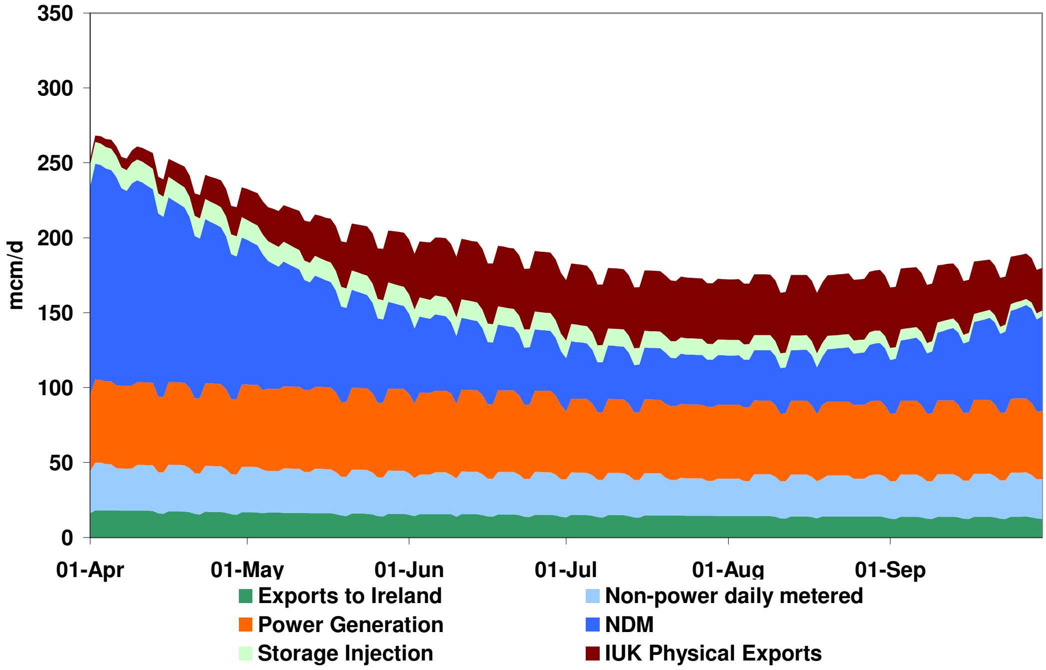


Table G1 - Forecast Average Daily Gas Demand for Summer 2012 (mcm/d)

April to September	Daily average			Actual range		Forecast range[3]	
mcm/d	2011 actual	2011 weather corrected	2012 forecast	2011 low	2011 high	2012 low	2012 high
NDM	54	59	59	33	133	27	218
DM + Industrial	27	28	28	22	31	23	34
Ireland	16	16	15	12	20	12	20
Total Power	69	70	51	54	86	43	100
Total demand	168	173	155	130	246	120	364
IUK export	34	34	33	0	59	0	60
Storage injection	21	21	11	0	48	0	66
GB Total	**223**	**229**	**199**	**159**	**320**	**140**	**375**

[3] Range totals do not add up due to diversity i.e. for cold conditions and high demand maximum IUK exports or maximum storage injection would not be expected

Table G2 - Total Volume of Summer Demand for 2011 and Forecast for 2012 (bcm)

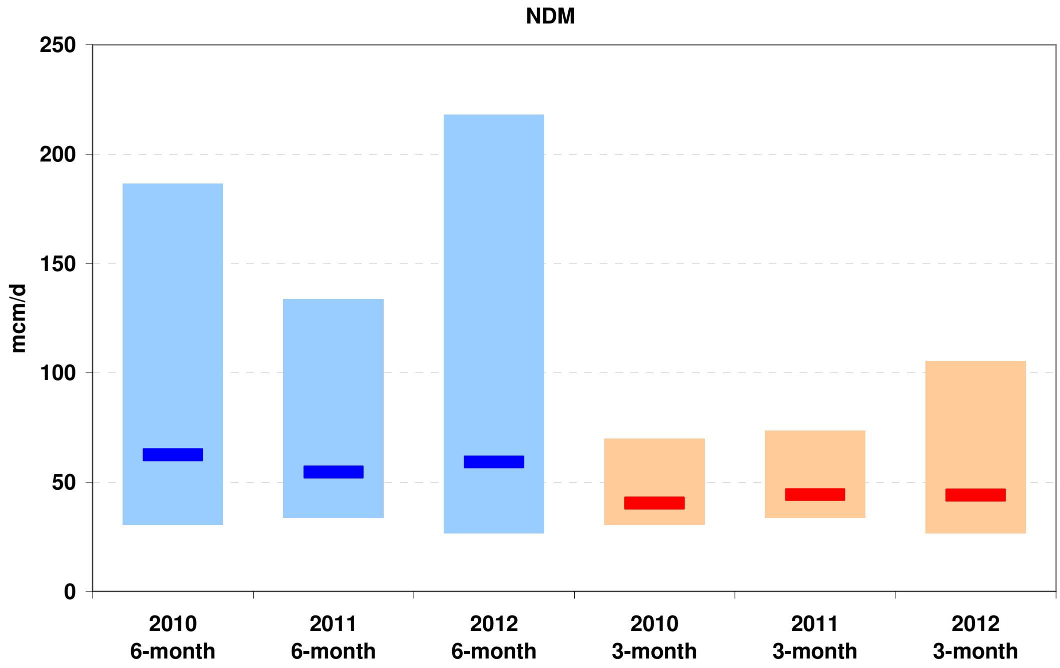
Bcm	Summer total		
	2011 actual	2011 weather corrected	**2012 forecast**
NDM	9.9	10.7	**10.8**
DM + Industrial	4.9	4.9	**5.0**
Ireland	2.9	3.0	**2.7**
Total Power	12.6	12.6	**9.3**
GB Total	30.7	31.5	**28.4**
IUK Export	6.3	6.3	**6.0**
Storage Injection	3.8	3.8	**2.0**
Total	**40.8**	**41.6**	**36.4**

23. **Table G1** shows the daily average and forecast range in demand compared with the actual values in 2011. The forecast range for 2012 is wider than 2011. This is because 2011 was mild so there is potential for much higher NDM demands at the start of the summer and with future prices indicating it will be cheaper to generate using coal the reduction in power generation demand for gas could lead to lower demands in mid summer.

24. **Table G2** shows a much lower forecast for the total volume of summer gas demand in 2012. This is driven by our assumptions of lower gas burn for power generation and to a lesser extent lower storage refill and lower IUK exports. Whilst we are relatively confident on the level of storage injection there is considerable uncertainty over IUK exports as described in the supply section.

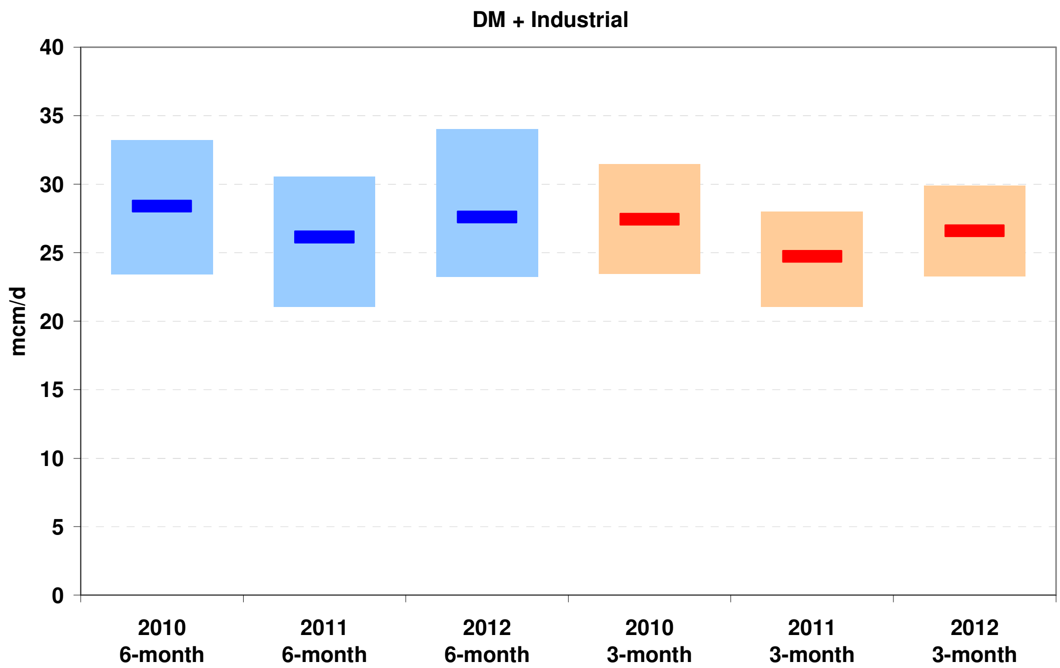
25. **Figures G3** to **G6** show the summer demands for NDM, DM and Industrial, Moffat exports and power generation for the last two years and the forecast for 2012. Each chart shows a line to represent the average and a shaded area to show the range in daily demand. The blue bars show the figures for the 6 months from April to September and the brown bars show the figures for the 3 warmest months from June to August.

Figure G3 – Forecast NDM Gas Demand



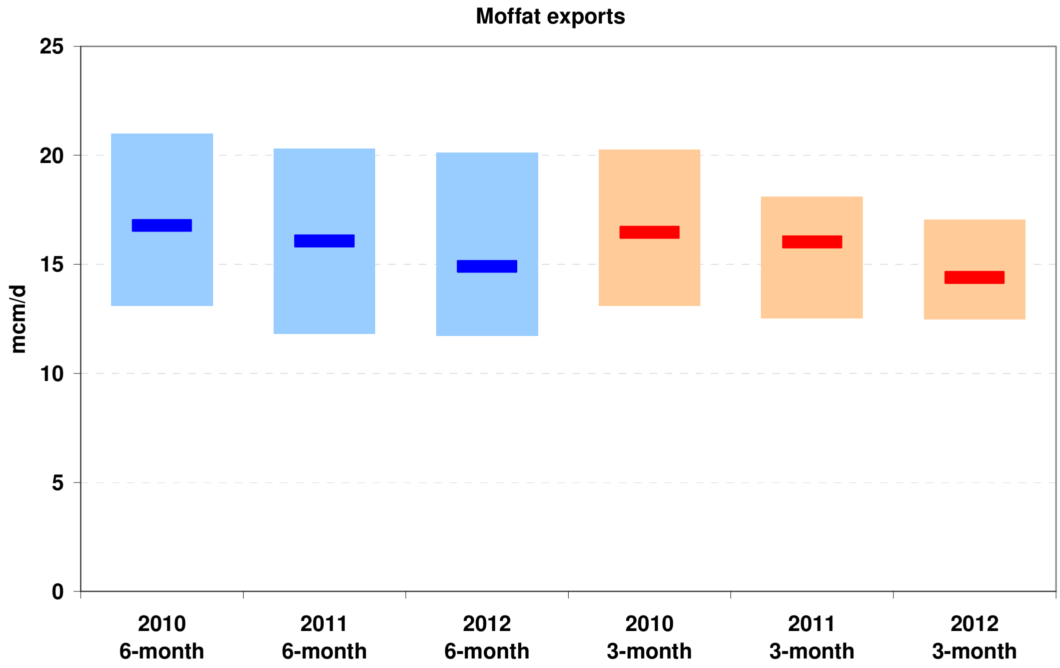
26. The chart clearly shows the impact of colder weather on NDM demand in the shoulder months compared to the warmest months of the summer.

Figure G4 – Forecast DM and Industrial Gas Demand



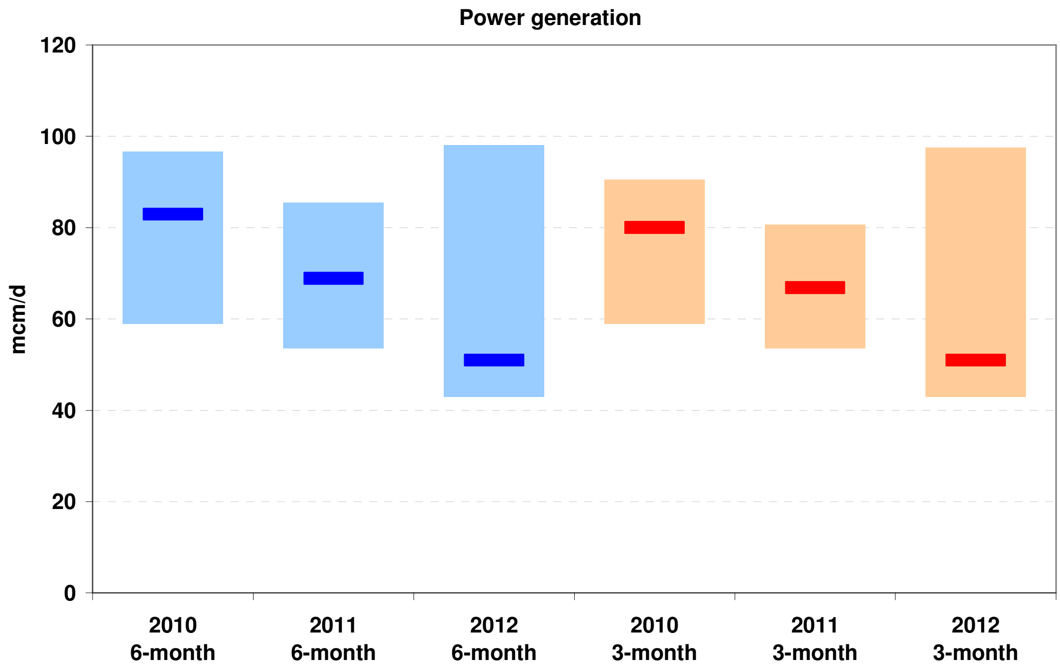
27. The chart shows relatively tight ranges highlighting limited weather sensitivity for DM and Industrial demand.

Figure G5 – Forecast Moffat Exports Gas Demand



28. The chart shows a decline in Moffat exports. This is primarily due to the decline in the Irish economy, potentially less use of gas for power generation due to relatively high gas prices and increasing renewable generation.

Figure G6 – Forecast Power Generation Gas Demand



29. The chart shows the possibility of a considerable range in terms of the power generation demand forecasts for 2012. If power generation gas demand reverts to

base load, as it often has in the summer, then demand may be higher than last year. However, if the current gas and coal prices are maintained into the summer it will be much more economical to generate using coal resulting in lower demands.

30. Recently, a number of the older CCGTs have been modified, or are in the process of being modified, to act as more flexible generation. This also may reduce gas demand for power generation as the modifications are for responsive operation rather than for base load.

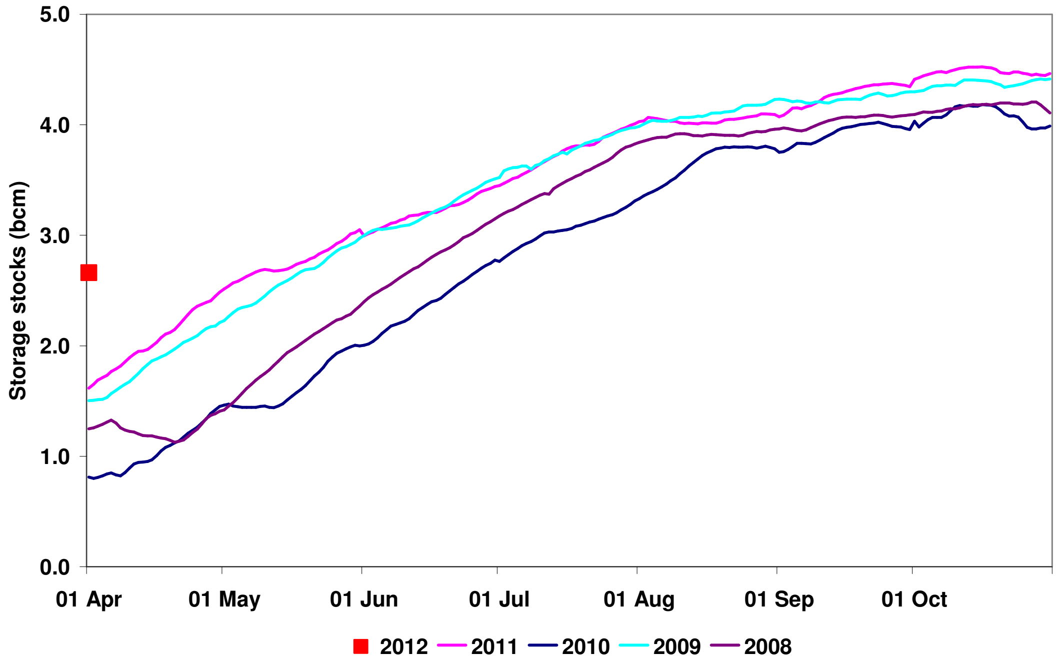
31. For summer 2012 we are anticipating the commissioning of approximately 3.4 GW gas fired power stations at Pembroke and West Burton. No closure of coal plants as a consequence of the LCPD limits are expected until 2013 when Kingsnorth and Cockenzie have announced closure dates.

32. Despite the prospect of filling additional space at Aldbrough, Holford and Hill Top Farm for next winter, overall storage injection is forecast to be lower in summer 2012 compared to summer 2011. This reflects higher storage stocks in March 2012 compared to March 2011. Overall storage net injection for next winter is approximately 2 bcm.

33. **Figure G7** shows the refill of storage during the last 4 summers and the storage level as of the start of April 2012. The stock level as of April 1st was approximately 2.7 bcm, this is higher than in previous winters reflecting the mild winter of 2011/12. This is consistent with relatively high storage stocks across Europe.

34. The economics of many storage sites is driven by the price spread between summer and winter. The current price spread between April 2012 and Q1 2013 is approximately 15 p/therm, this is comparable to the corresponding differential in 2011 (15 p/therm). For the other recent summers the differentials were; 18 p/therm in 2008, 28 p/therm in 2009 and 10 p/therm in 2010. In future years the summer / winter differentials are typically 10 p/therm (10 in 2013, 9 in 2014, 9 in 2015 and 10 in 2016).

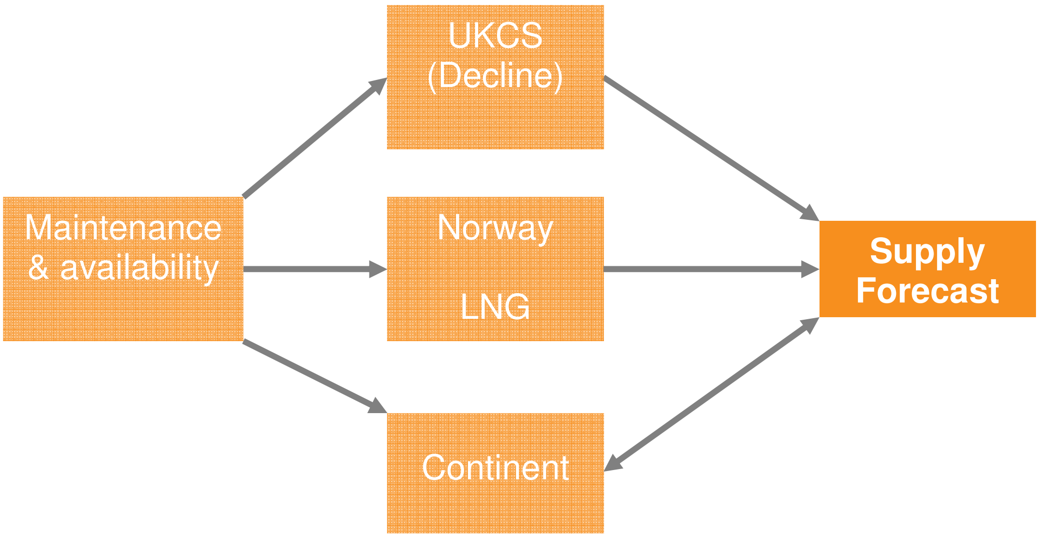
Figure G7 - Summer Storage Stocks 2008 – 2011



35. IUK exports in summer 2011 were 6.27 bcm, marginally lower than 2010 exports of 6.57 bcm. These two years represent the highest exports since summer 2003 (7.89 bcm). For summer 2012 IUK exports are again forecast to be high but lower than in 2011 due to:

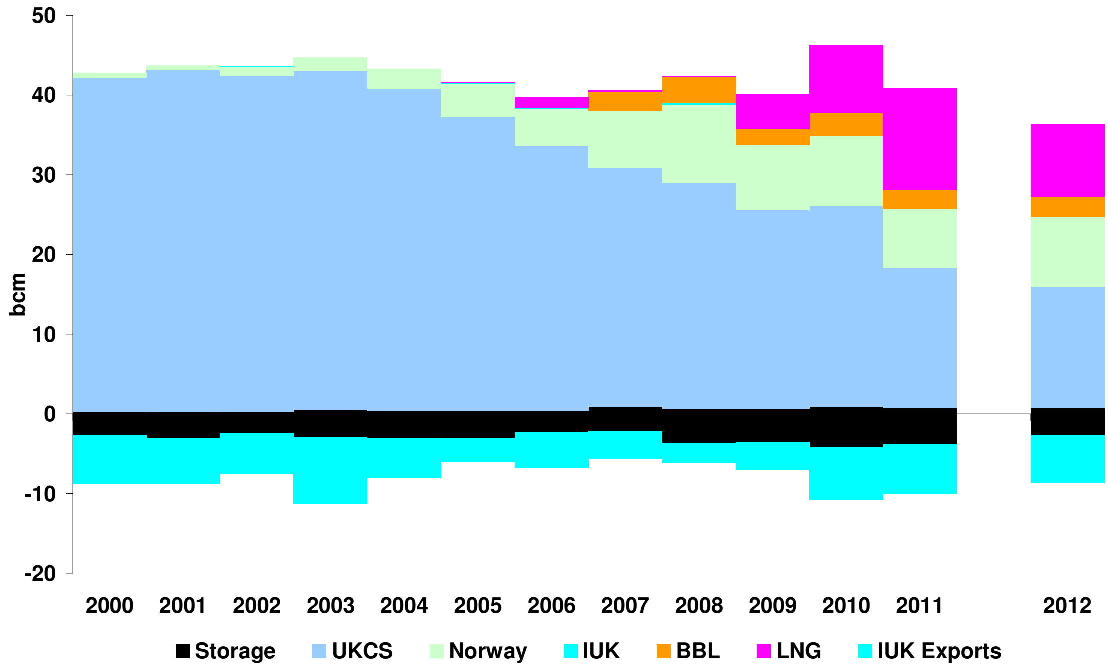
- The tightening of the global LNG market due to increased LNG supply to the Far East due to Japan's closure of most nuclear power stations and LNG growth in other markets
- Relatively high storage stocks across most of the Continent as a consequence of a mild winter (albeit the weather was very cold in early February)
- The possibility that some Continental market participants may have to take additional contracted gas this summer following reduced gas consumption in 2011.

Supply Forecast



36. **Figure G8** shows the make up of summer supplies by supply source since 2000 and also the forecast for 2012. The forecast for 2012 is based on recent trends of summer supply with the recent growth in LNG imports reversed to reflect the tightening global LNG market as a consequence of the nuclear closures in Japan.

Figure G8 - Historic and Forecast Summer Gas Supplies by Source



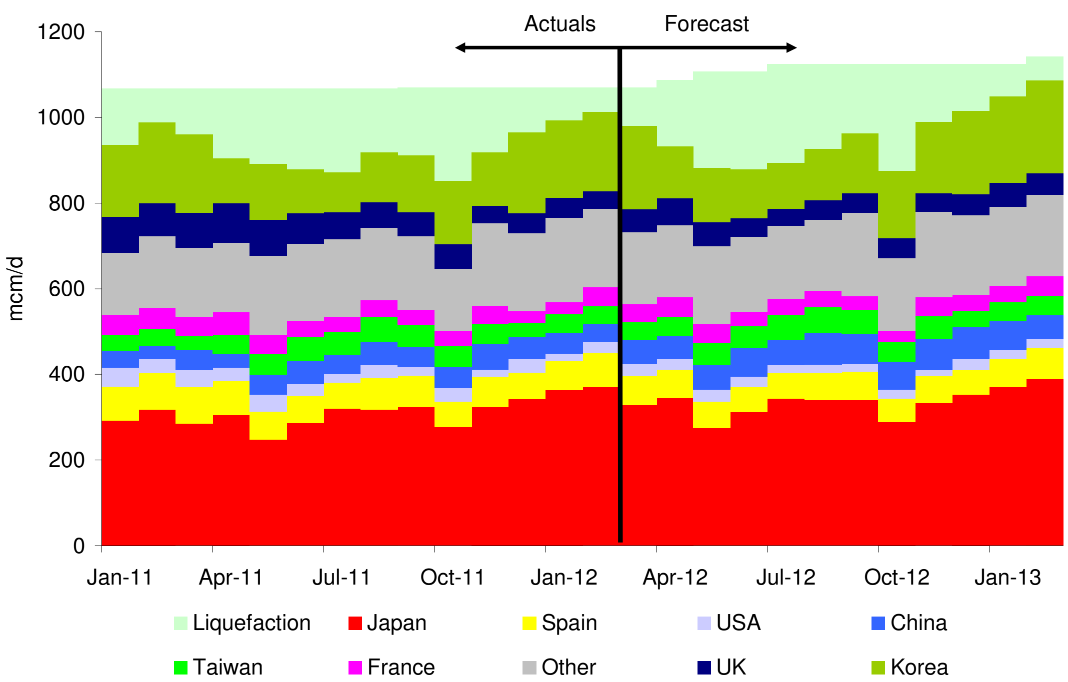
37. **Figure G8** shows:

- Lower levels of summer supply / demand of about 36 bcm. As detailed previously the lower gas demand is due to assumptions for power generation, storage refill and IUK exports
- Higher imports from Norway but lower imports of LNG and supplies from the UKCS.

38. Our view of lower LNG imports for summer 2012 is driven by the reduction in LNG deliveries to the UK during winter 2011/12, as a consequence of increased demand for LNG in Japan and other Far East markets. These movements of LNG reflect the higher prices paid in these markets compared to the UK, Europe and US. Forward prices suggest this trend of more LNG deliveries to Far East markets will continue through summer 2012 and beyond. **Figure G9** shows our internal analysis of LNG demand on a historic and forward basis.

Figure G9 – Global LNG Supply / Demand

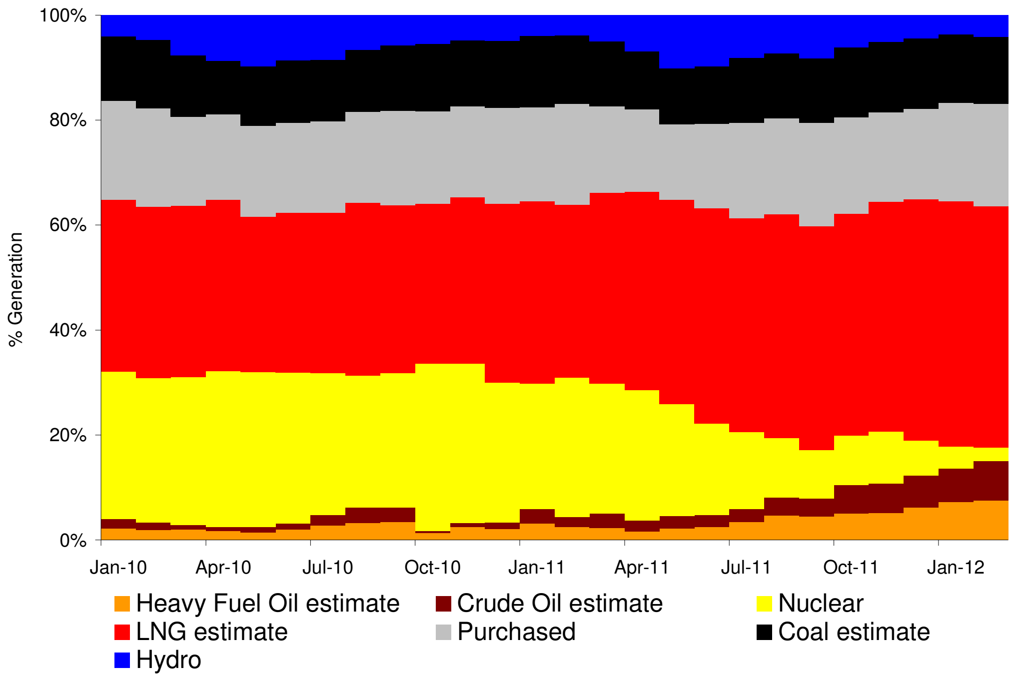
Source: Lloyd's List, LNG Journal, NATS Pan EurAsian



39. In terms of LNG production, the chart shows an increase in capacity during 2012 with new plants in Algeria, Angola and Australia. In terms of LNG demand the chart shows an overall increase in demand, primarily through Japan, Korea and China, whilst markets in Spain, the UK and the US have all declined in recent months. Despite the closure of most Japanese nuclear plant, our view of future growth in Japan is now modest as our analysis suggests that most Japanese CCGTs are now operating at close to maximum workings levels. This is reflected by the increase use of inefficient and expensive oil burn to make up for the loss of nuclear power as shown in Figure G10 which shows the estimated generation mix in Japan since January 2010.

Figure G10 – Estimated Japanese Power Generation Mix

Source: Federation of Electric Power Companies Japan (FEPC), National Grid

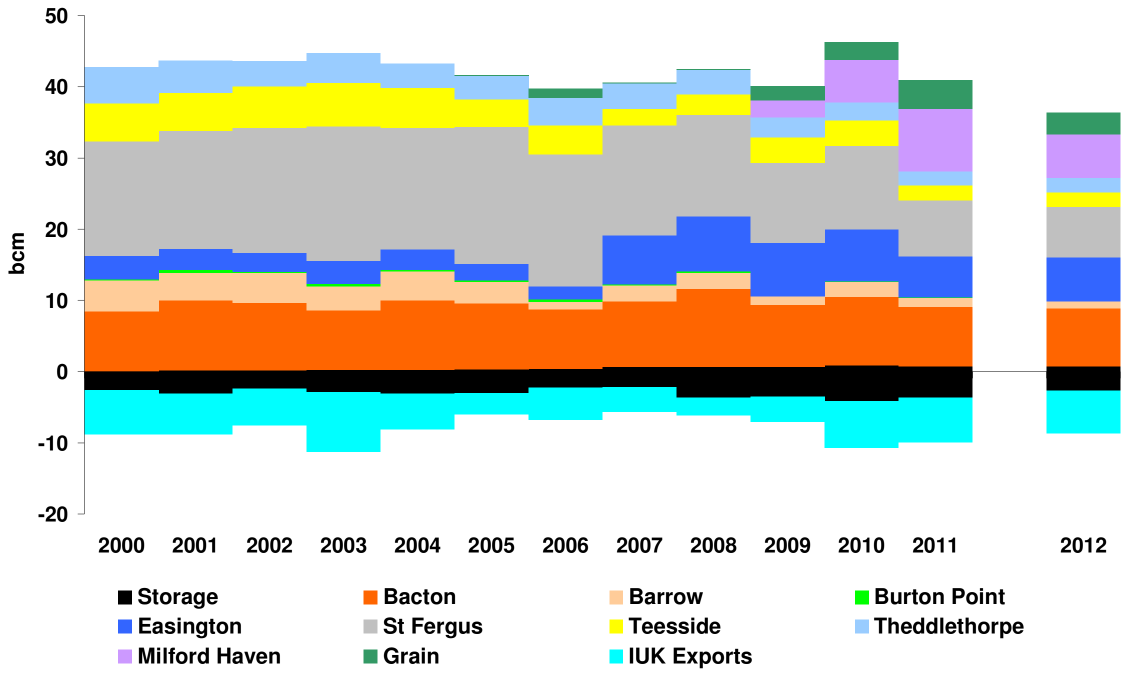


40. The chart clearly shows how LNG has been used to make up for most of the loss of Japan's nuclear generation. Coal's contribution has also increased along with increased oil burn.

41. **Figure G11** shows the make up of summer supplies by terminal since 2000 and also the forecast for 2012. The chart shows:

- Declining levels of entry at the three northern terminals, namely St Fergus, Teesside and Barrow
- Similar levels of entry at Bacton throughout the last decade and Easington since 2007
- Increasing levels of entry at Grain and Milford Haven.

Figure G11 - Historic and Forecast Summer Gas Supplies by Terminal



42. **Table G3** shows entry flows by supply source for the past 4 summers and the forecast for summer 2012. **Table G4** shows the same data broken down by entry terminal.

43. The forecast was made before the gas leak on the Elgin platform and the subsequent loss of all supplies through the SEAL[4] pipeline to Bacton. Early press reports suggested that the loss of production could be throughout the summer, though later[5] press report suggests the well leak could be fixed by the end of April.

44. There is therefore some uncertainty whether the loss of supplies for the summer period will be just the loss of Elgin for a few months ranging to the possible loss of all flows through SEAL; these include Elgin, Franklin, Shearwater and other smaller fields for the duration of the summer.

45. If the loss of gas through SEAL is for the duration of the summer, the forecasts for UKCS production and flows through Bacton will be overstated. The average flow through SEAL during last winter was approximately 15 mcm/d, this represented 13% of total UKCS output. Historically due to summer maintenance periods, flows from SEAL have been typically 15% lower in the summer than the winter. Applying a 15% reduction could therefore reduce the UKCS production and flows through Bacton by up to 2.3 bcm. If this volume was to be lost then additional flows from other UKCS fields or imports from Norway are most likely to make up the shortfall.

[4] SEAL – Shearwater Elgin Area Line
[5] Platts European Gas Daily 12th April 2012

Table G3 - Historic and Forecast Summer Gas Supplies by Source

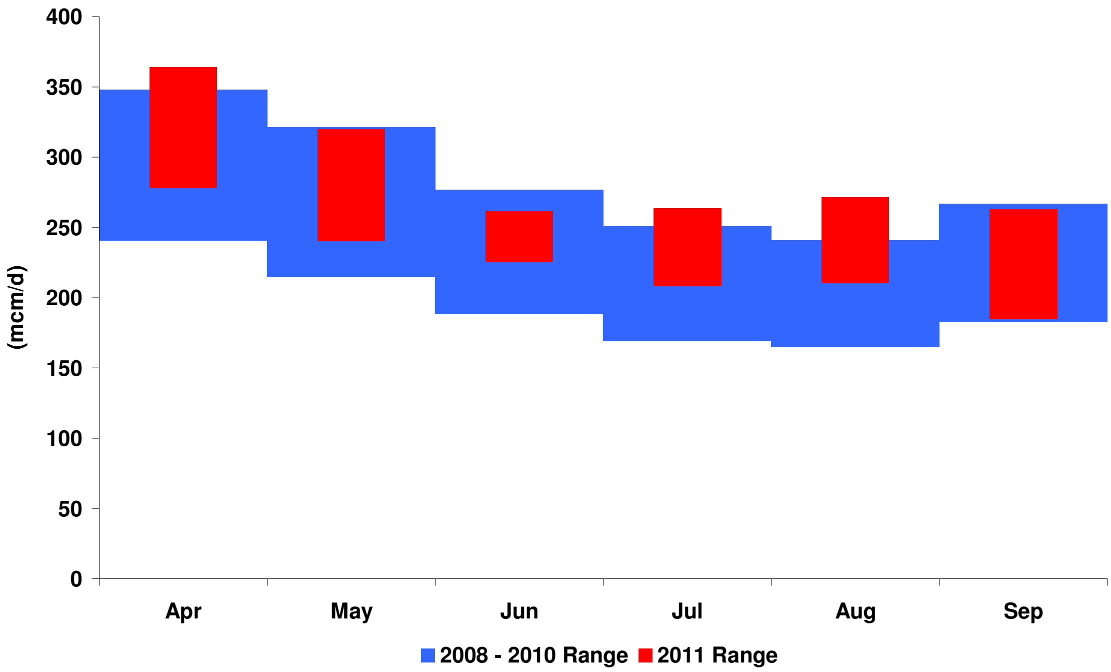
(bcm)	UKCS	Norway	LNG	Continent	Storage	Total
2008	28	10	0	4	1	42
2009	25	8	4	2	1	40
2010	25	9	8	3	1	46
2011	18	7	13	2	1	41
Average	24	9	6	3	1	42
2012	**15**	**9**	**9**	**3**	**1**	**36**

Table G4 - Historic and Forecast Summer Gas Supplies by Terminal

(bcm)	Bac	Bar	BuP	Eas	IOG	M H	St F	Tee	The	Storage	Total
2008	11	2	0	8	0	0	14	3	3	1	42
2009	9	1	0	7	2	2	11	4	3	1	40
2010	10	2	0	7	2	6	12	4	3	1	46
2011	8	1	0	6	4	9	8	2	2	1	41
Average	9	2	0	7	2	4	11	3	3	1	42
2012	**8**	**1**	**0**	**6**	**3**	**6**	**7**	**2**	**2**	**1**	**36**

46. **Figure G12** shows the supply ranges for the summer months from 2008 to 2010 and also specifically for summer 2011. Theses ranges are nearly identical to those for total demand.

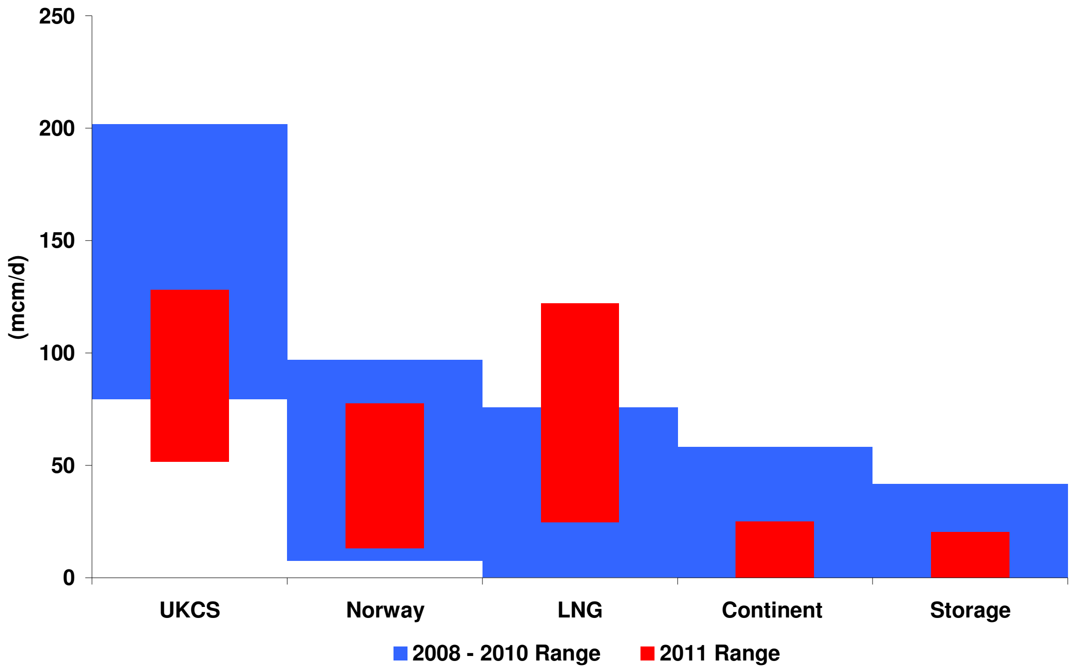
Figure G12 - Monthly Supply / Demand Range



47. The chart shows demands for 2011, towards the upper end of the 2008-10 range due to relatively high gas demand for power generation and high IUK exports. The forecasts for 2012 are for demands to be on average 30 mcm/d lower.

48. **Figure G13** shows the summer supply ranges by supply source from 2008 to 2010 and also specifically for summer 2011. **Figure G14** shows similar ranges by entry terminal.

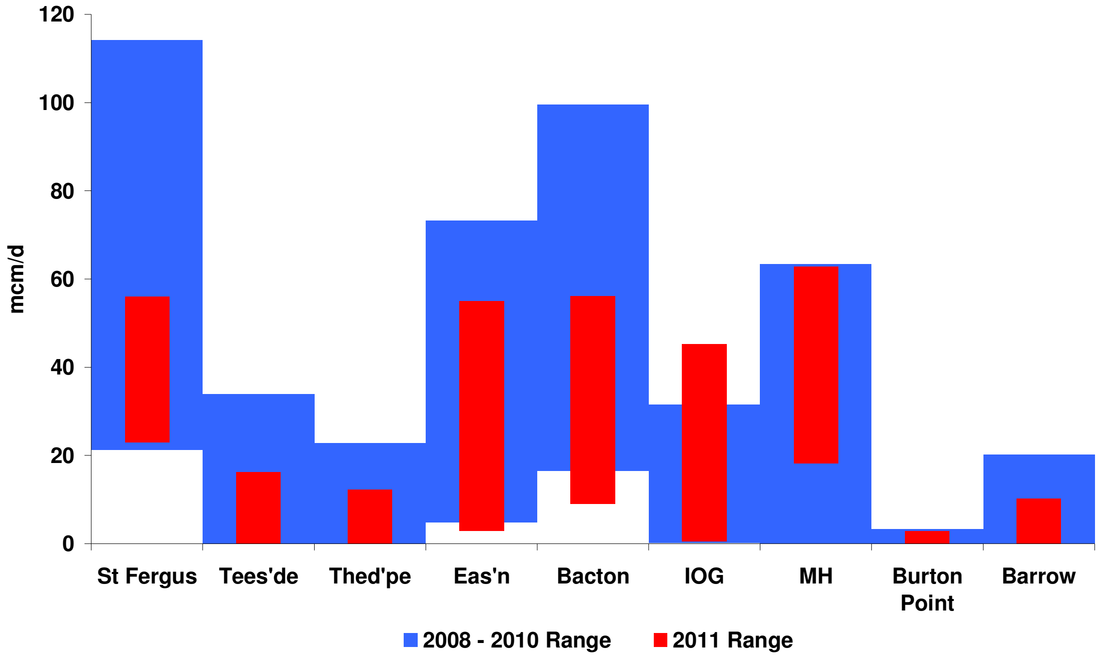
Figure G13 - Summer Supply Range by Source



49. The chart shows for 2011 a lower and tighter range for UKCS, Continent and storage, together with similar Norwegian flows and higher LNG imports.

50. For summer 2012, a similar position is expected though UKCS and LNG are forecast to be lower.

Figure G14 - Summer Supply Range by Terminal



51. The chart shows for 2011 a lower and tighter range for just about all terminals except the LNG import terminals at Grain and Milford Haven.

52. For summer 2012, a similar or lower position is expected at all terminals.

Summer 2012 NTS Maintenance Programme & Network Expansion

53. To ensure a high level of safety and reliability in operation, it is essential that a system of inspection and maintenance exists for assets associated with the transmission of natural gas. Effective maintenance is essential to minimise the safety and environmental risks caused by failure of pipelines and plant.

54. In accordance with National Grid's Gas Transporter Safety Case, maintenance activities shall comply at all times with any statutory or legislative requirements, in order to meet legal obligations. These practices are robustly designed and seek to minimise overall operating cost by increasing the useful life of pipelines and plant, reducing the risk of failure and reducing the risk of emergency repairs.

55. The NTS investments delivered last summer for capacity expansion for winter 2011/12 have provided additional capacity and network flexibility.

56. These projects included, connection of new storage facilities in Cheshire, a new network offtake in Scotland and connection of a new power station in the East Midlands.

57. This summer will see the commissioning of the gas and electric drive compressors at Felindre for the 2012/13 winter and further progression of an additional electric unit at Hatton as part of the project to reduce compressor emissions.

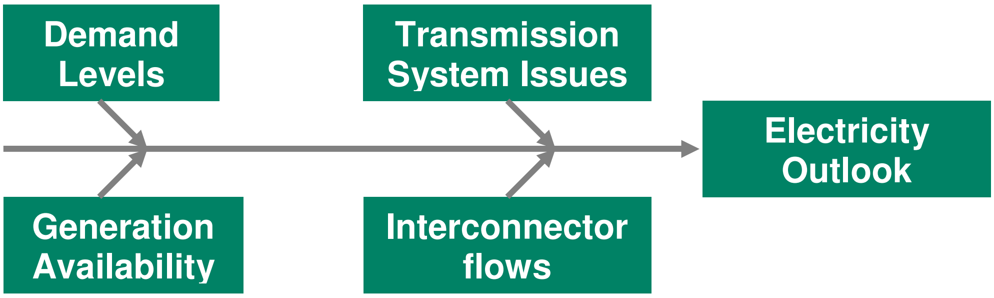
58. In addition, construction works are ongoing and commissioning activities are anticipated ahead of the 2012/13 winter for the Pressure Reduction Installation at Tirley in Gloucestershire, required as part of the South Wales Expansion Project.

59. Further information on some of these and other expansion projects can be found at http://www.nationalgrid.com/uk/Gas/Pipelines/.

60. National Grid’s maintenance plan includes the impact of network reinforcement, annual maintenance programme and supply outages. Published documents can be found on the National Grid website at: http://www.nationalgrid.com/uk/Gas/OperationalInfo/maintenance/.

61. The documents detail Aggregated System Entry Points (ASEP) capacity for each month, based on Seasonal Normal Demand conditions for the period where scheduled maintenance has most impact on capability. The figure has been generated by National Grid and assumes the particular ASEP is favoured at the expense of other terminals. Where no volume has been given, this indicates that the maintenance scheduled has no adverse effects on the ASEP capability. The document also details maintenance work for each month and affected Exit Points.

Electricity

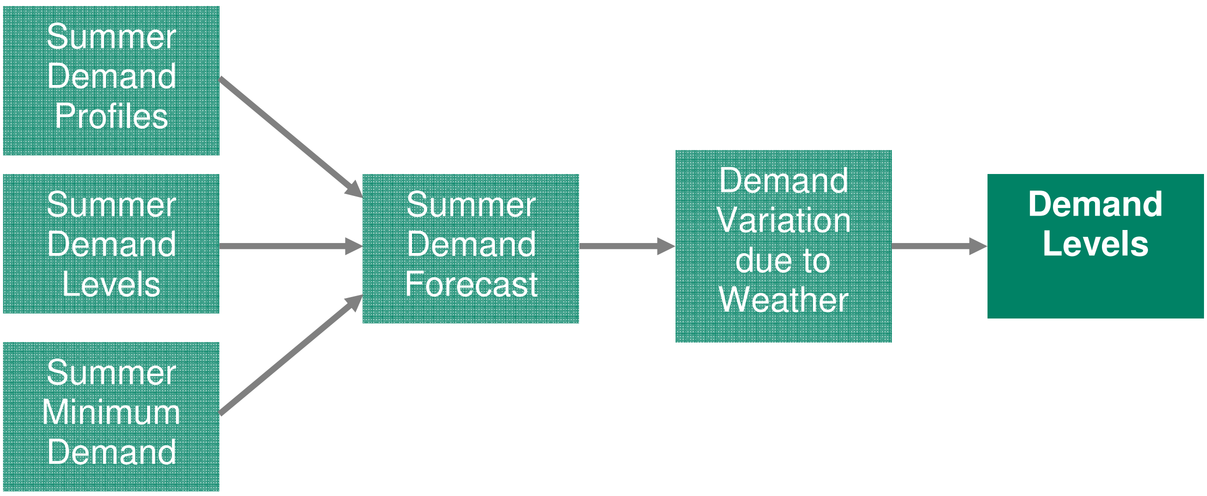


Overview

62. This chapter covers the electricity supply-demand outlook for the forthcoming summer. Demands during the summer are around two thirds the winter demands. There also tends to be a high level of generation unavailability during the summer months due to maintenance and lower prices.

Demand Levels

63. Unless otherwise stated, demand discussed in this report excludes any flows to or from France, Netherlands and Northern Ireland.

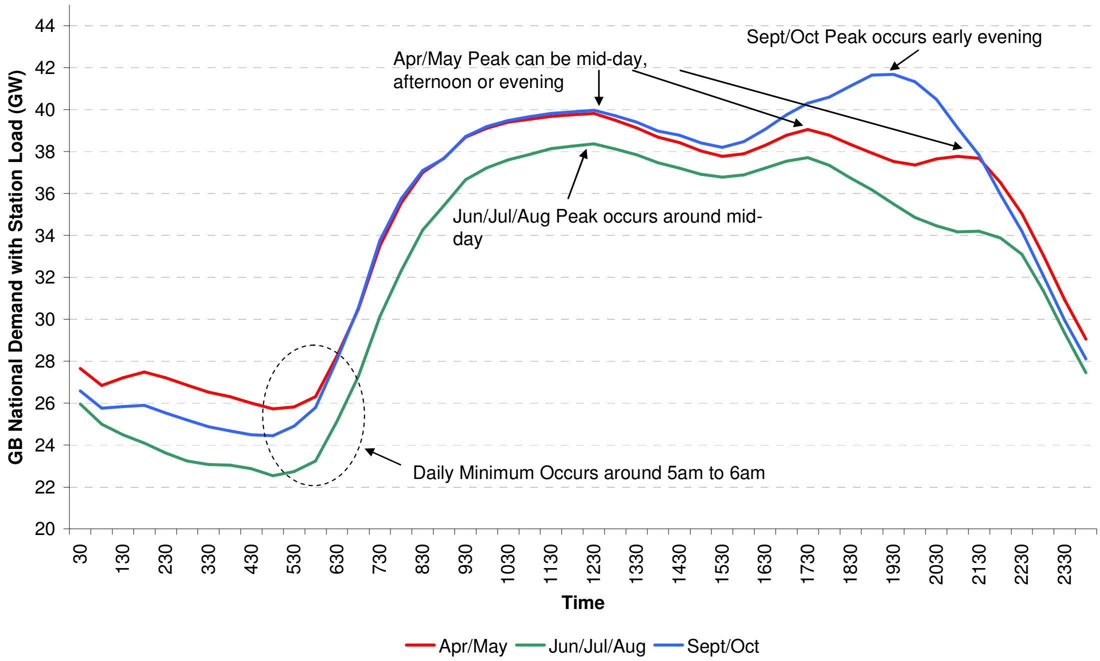


Summer Electricity Demand Profiles

64. **Figure E 1** depicts the average daily demand profile of summer months. The figure shows that the daily peak figure that is used throughout the rest of the report does not necessarily occur at the same time of the day throughout the summer.

- During April and May demand is reasonably flat across the working day, but there is a higher chance the demand will peak in the late afternoon, dependent upon weather conditions
- In the high summer (June, July and August) demand is also reasonably flat across the working day (08:00 - 18:00) with a strong tendency to peak at mid-day
- During September and October the daily peak occurs in the evening due to the earlier lighting effect
- The daily minimum occurs around 05:00 - 06:00 through out the summer.

Figure E 1 - Half hourly Demand Profiles



Summer Electricity Demand Levels

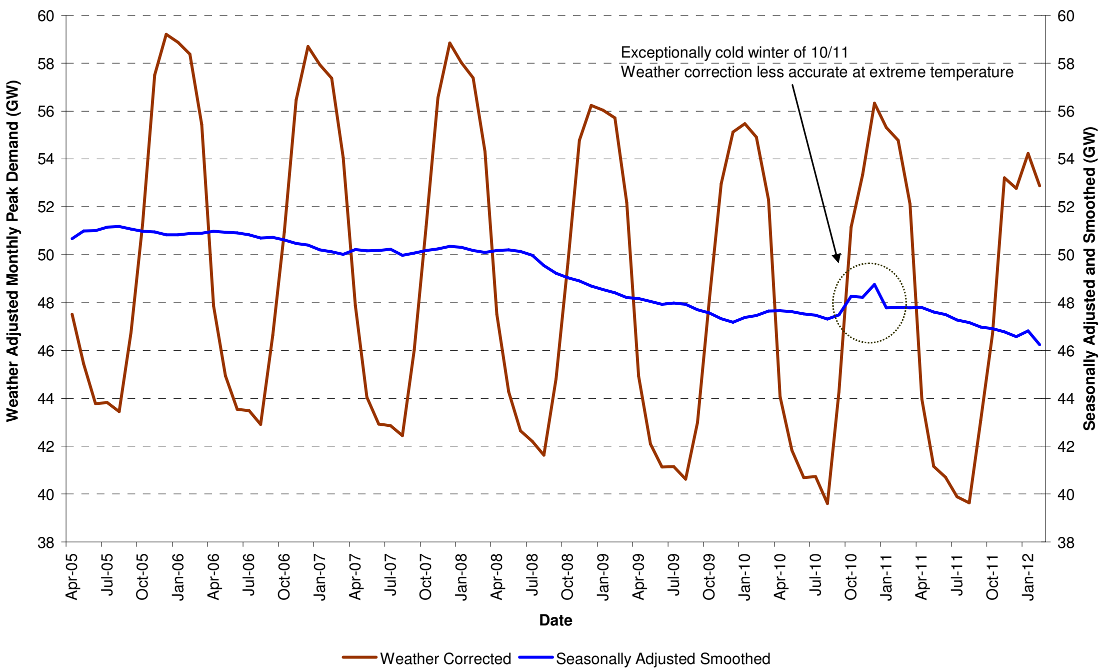
65. **Figure E 2** shows the demand levels corrected for season and for weather (blue line). The extreme nature of the cold weather during the winter period of 2010 has created a peak in the normalised demand.

66. Referring to **Figure E 2**, prior to August 2008 demand levels had remained fairly stable. After June 2008 the effect on the demand levels due to the economic environment can be seen by a decline in demand levels. From August 2009 to April 2011 the demand levels remained relatively similar. From April 2011 there has been a further decline in normalised demand levels. The economic forecasts from several

different institutions suggest that the average GDP growth rate[6] in 2012 will be marginally positive. It is expected that demand levels will begin to return to summer 2010 levels.

67. Current estimates are for demand levels during summer 2012 to be similar to the demand levels during summer 2011. The forecast will continue to be updated as part of our normal process and will be published on www.bmreports.com[7].

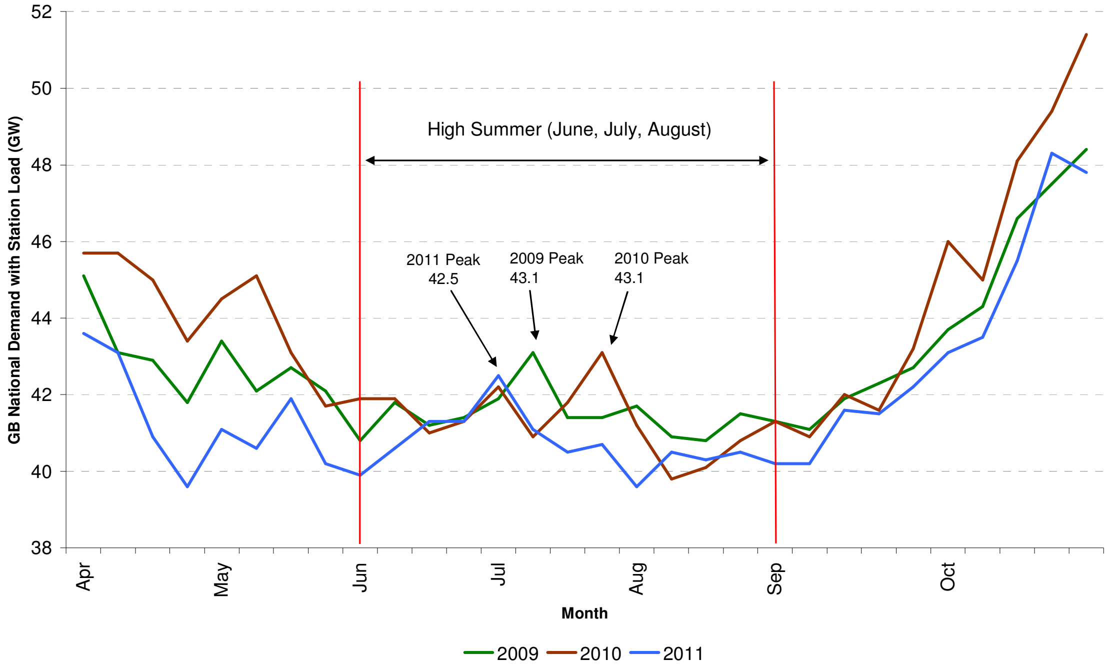
Figure E 2 - Seasonal and Weather Corrected Monthly Peak Demand



68. **Figure E 3** shows the previous 3 years high summer demand peaks. The slight reduction in demand levels during summer 2011 can clearly be seen.

6 http://www.hm-treasury.gov.uk/forecasts
7 http://www.bmreports.com/bsp/BMRSSystemData.php?pT=WEEKFC

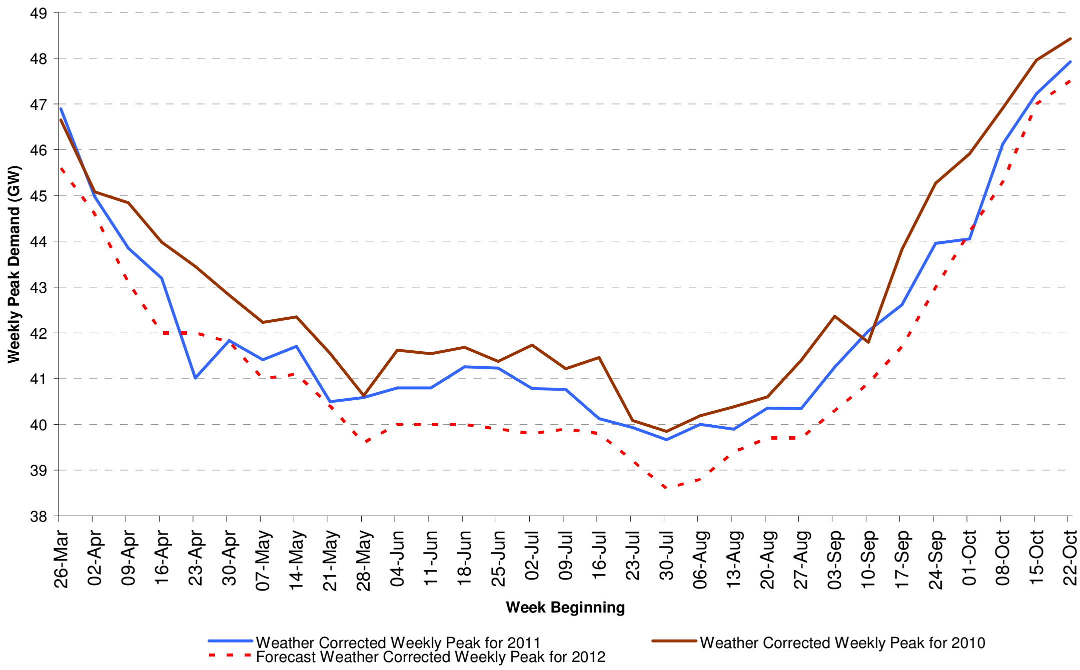
Figure E 3 - Weekly Peak Demand of Last 3 summers



Summer Demand Forecast

69. **Figure E 4** shows the forecast demand levels for 2012. For the high summer period of June, July and August, the peak weather corrected summer demand for 2012 is expected to be 40.0 GW against an actual outturn of 40.8 GW for 2011.

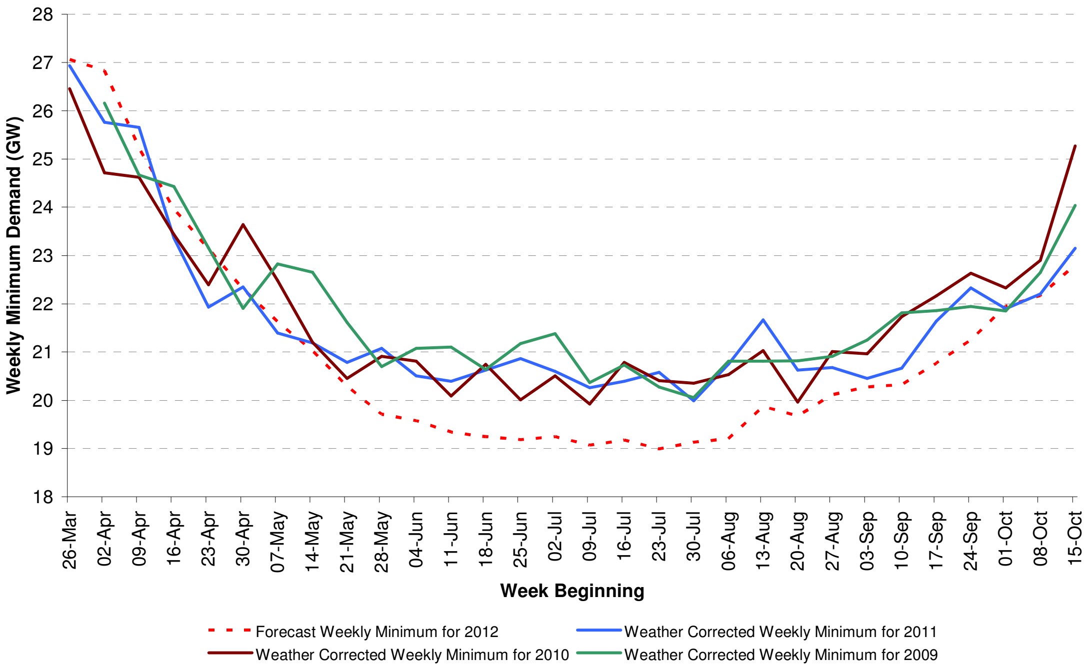
Figure E 4 - Weekly Peak Weather Corrected Demand Forecast for summer 2011



Summer Minimum Demands

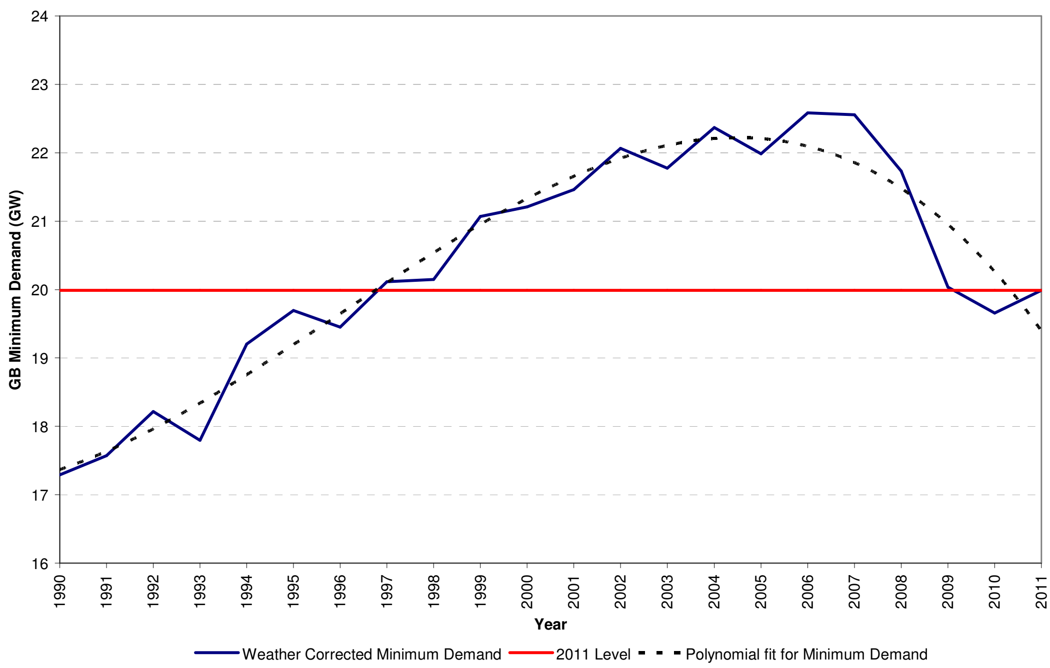
70. The summer minimum demand is expected to occur on a Sunday around 05:00 to 06:00 in early August as shown in **Figure E 5**. This figure also shows the forecast minimum demands for the summer 2012. The minimum demand for summer 2012 is forecast to be 19.0 GW.

Figure E 5 - Weekly minimum weather corrected demands



71. There has been a decline in the summer minimum demand since 2006. This is shown in **Figure E 6.** To be able to show a long trend, pre-BETTA data for England and Wales has been scaled to GB levels. The drop in minimum demand between summer 2008 and summer 2009 is consistent with the overall drop in normalised demands shown in Figure E-2.

Figure E 6 - Weather corrected minimum demands



72. The likely causes of the decrease in summer demand is:

- Increasing amounts of embedded generation that from the transmission system are seen as a reduction in demand
- Continuing effects of the economic environment with summer shut-downs of industrial customers
- Energy efficiency, driven by price sensitivity.

73. The decrease in the summer minimum combined with an increase in the volume of inflexible generation is a key area of uncertainty that may impact on the operation of the system. An increase in inflexible generation is expected as a result of the new wind farms coming on to the system. Inflexible generation consists of:

- Nuclear generation due to its current inflexible nature
- Combined Heat and Power (CHP) stations which have to run to produce steam and/or electricity for the associated industrial processes
- Generation required to manage high voltages on certain parts of the transmission system
- Wind power – wind generation is determined by the prevailing wind conditions.

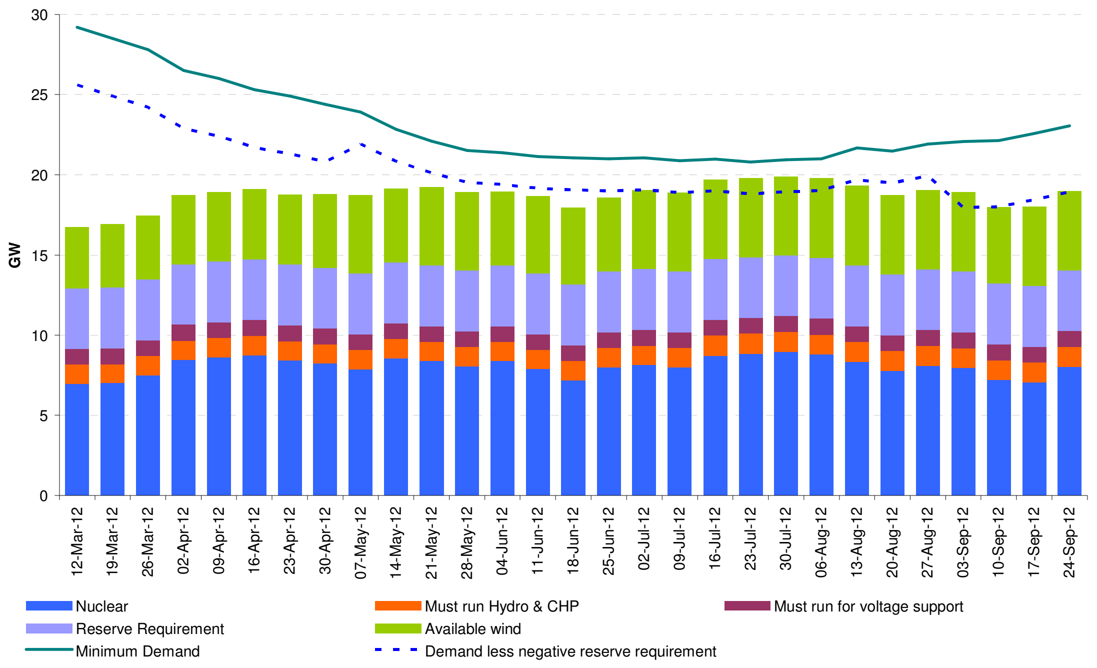
74. As the minimum demand decreases and the volume of inflexible generation increases the amount of controllable flexible plant that can be synchronised is reduced. There has to be a certain amount of flexible plant on the system to provide operating reserve according to the following criteria:

- The operating reserve requirements are defined by National Grid and are based around the largest single generation loss and the volume of synchronised wind generation
- The total volume of flexibility from all units must be enough to meet the operating reserve requirements of the system
- This volume defines the Reserve Requirement.

75. The reserve requirement detailed above is to protect against loss of generation causing a low frequency event. There is also a requirement to protect against loss of demand causing a high frequency event. This requirement is referred to as the negative regulating reserve requirement. It is normally physically held by machines running at a level above their minimum level which can then reduce their output to match any loss of demand.

76. **Figure E 7** shows analysis of the summer minimum, including the inflexible generation and reserve requirements as detailed above. It is based on declared plant availability, zero interconnector imports, forecast demand and assumes the demand would include 1.8 GW of pumped storage pumping load. The dotted blue line is demand less the negative reserve requirement. The sum of inflexible generation and positive reserve must not be allowed to exceed this level.

Figure E 7 - Detailed Summer Minimum Analysis with no Interconnector Imports

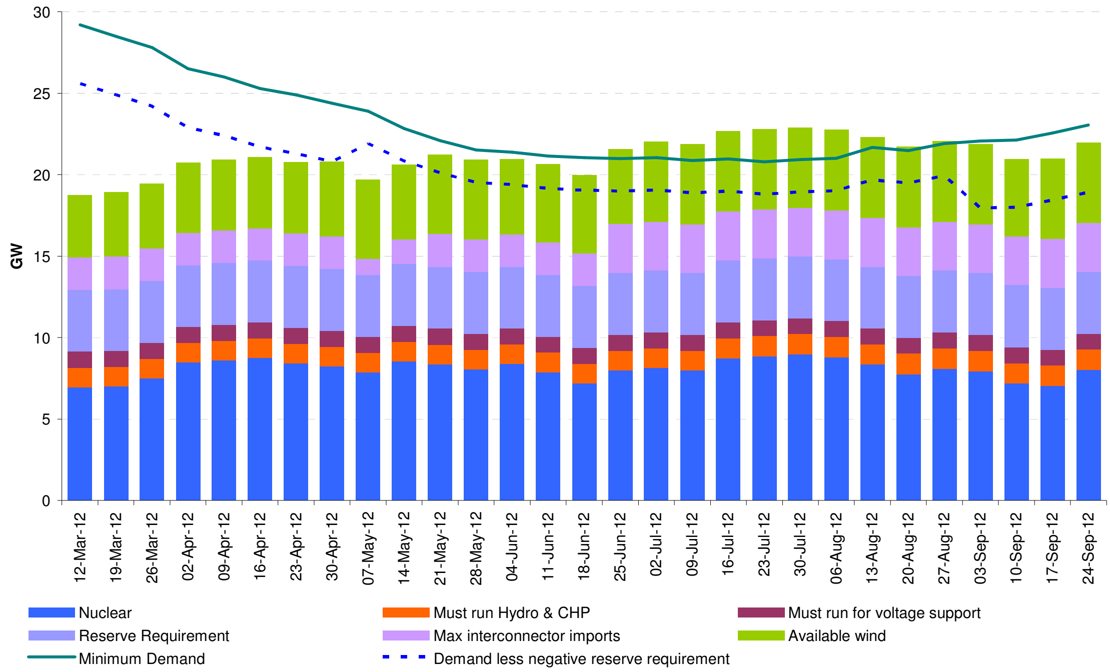


77. The nuclear generation, must run CHP and generation for voltage support are likely to be running in such a way that the only action available to reduce the output of a unit is to de-synchronise the unit from the system. Hence there could be a requirement to reduce the output of the wind generation to allow additional more controllable flexible generation to be synchronised.

78. **Figure E 7** indicates that a small reduction in wind generation may be required from mid-July to early August and again in early September if the prevailing wind conditions were allowing the wind farms to generate at maximum.

79. In **Figure E 8** the maximum import capability of the interconnectors is included. The capability allows for planned outages on the Interconnectors as detailed further in the report under Interconnector Flows. From May to September, if the interconnectors were importing at the planned maximum capability, there may be a requirement to take some action depending on the output of the wind farms at the time. If the market had not already responded, the action would either be in the form of System Operator trades where available to reduce some of the import from the continent or a reduction in wind output to allow more flexibility to be created on other units.

Figure E 8 - Detailed Summer Minimum Analysis with maximum Interconnector Import capability



80. It should be noted that in this analysis wind availability figures refer to the directly connected wind generation metered by National Grid. Metered wind generation is now around two thirds of the total, the balance being wind farms embedded within the distribution networks. During high wind, the output from both the directly connected generation and the embedded generation increases but the latter is accounted for by a reduction in demand.

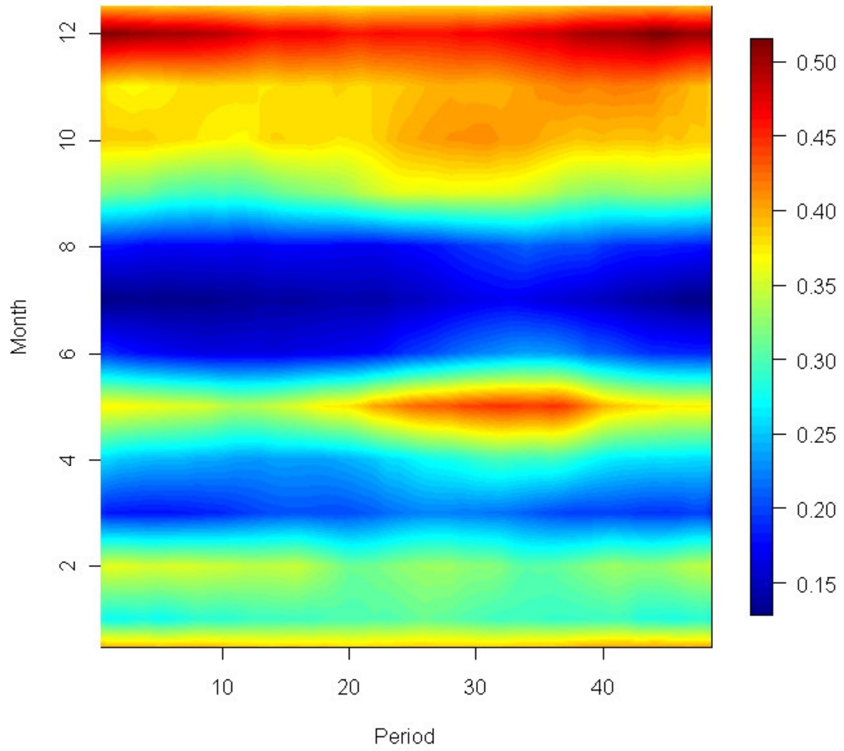
81. **Figure E 9** shows the load factor of wind across 2011. The chart is created from the directly connected wind operational metering. Month is plotted on the vertical axis, and trading period on the horizontal axis, with Period 24 corresponding to the half hour ending at noon. The summary points derived from this data are:

- Average annual load factor for 2011 is 30%
- Average winter load factor for 2011 is 37%
- Average spring load factor for 2011 is 28%
- Average summer load factor for 2011 is 17%
- Average autumn load factor for 2011 is 37%.

82. The lowest average load factors occur overnight in the summer period.

83. Looking in detail at the summer minimum period during 2011, the maximum wind load factor during the overnight trough (Periods 8 to 14) was 56%. Hence the scenario detailed previously requiring action when the interconnectors were importing at the maximum would be considered a realistic situation this summer.

Figure E 9 - Great Britain Mean Wind Load Factor 2011 Heat Map

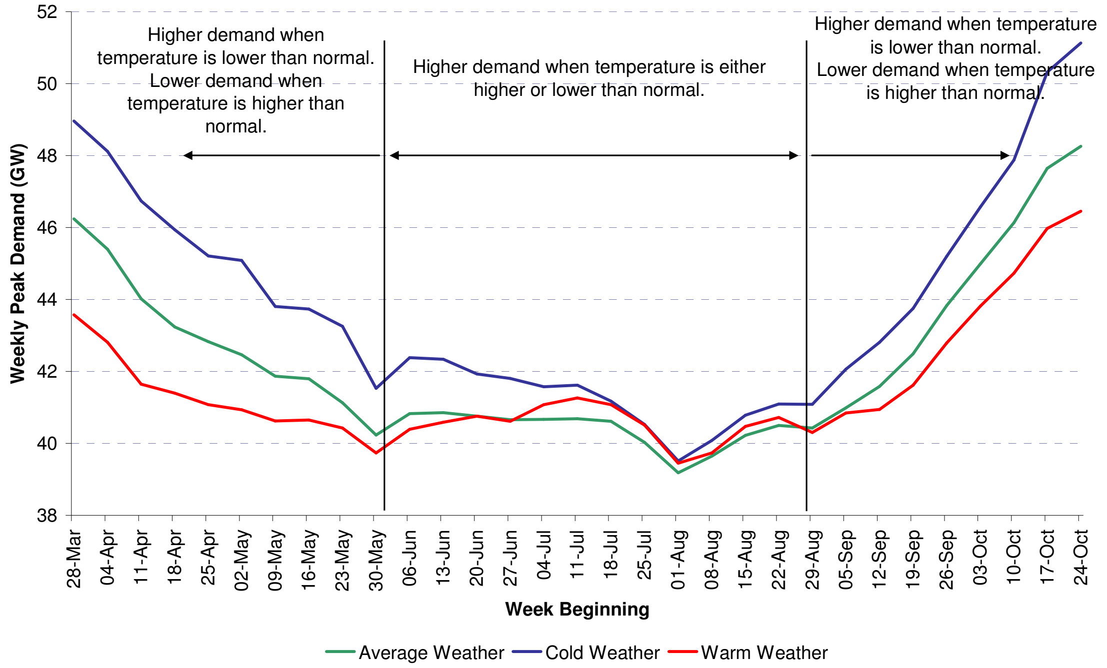


Electricity Demand variation due to weather

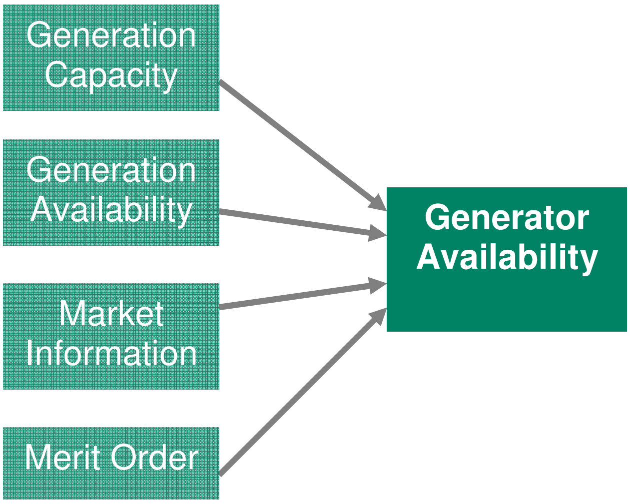
84. Demand response to weather conditions varies during the year and also varies over different years as demand characteristics change. **Figure E 10** depicts the relationship between summer demand and weather, at different times of the summer based on historic demand and weather data.

- Demand is generally higher when the temperatures are abnormally cold. This is normally between April and mid-June, and also from September onwards
- In the high summer, mid-June to mid-August, the temperature is often close to the comfort temperature of 16-17 degrees. Either an increase or decrease in the temperature will cause the demand to increase.

Figure E 10 - Electricity Demand under average, warm and cold conditions



Generator Availability



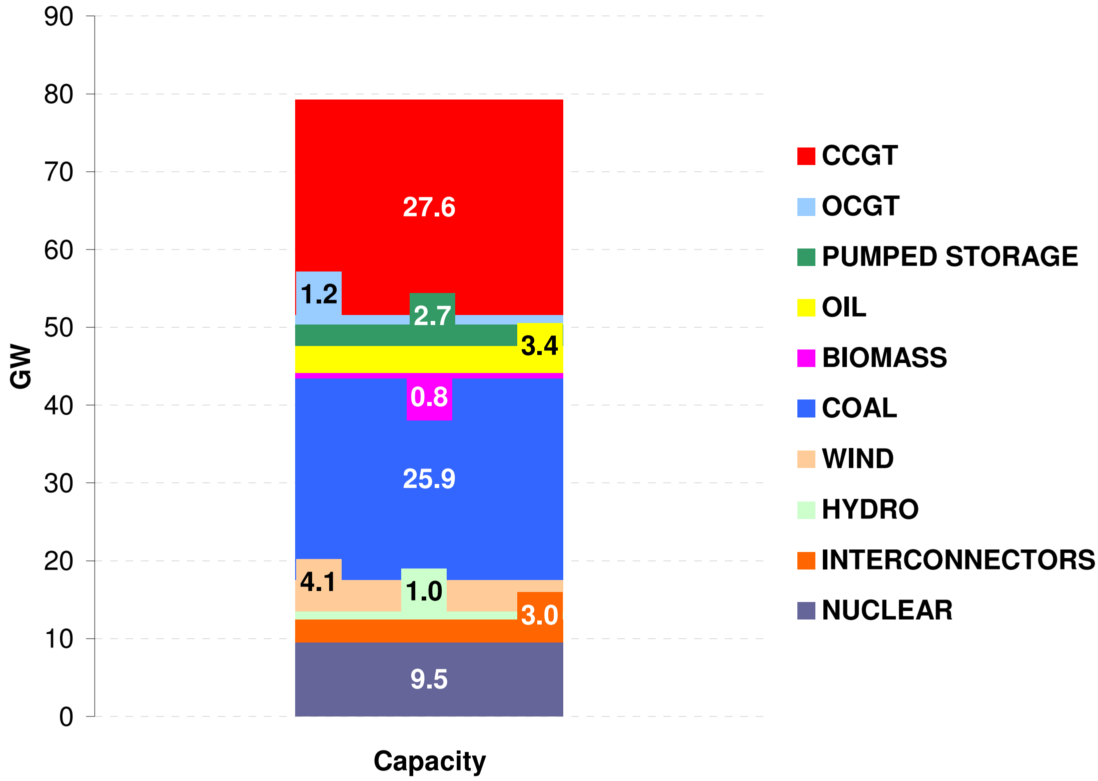
Generation Capacity

85. As shown in **Figure E 11**, the Operational Rated Capacity (ORC) has decreased by 2.5 GW to 79.2 GW since the Winter Outlook Report. This net decrease is due to various factors including;

- A decrease of 0.6 GW due to the closure of Oldbury and the decommissioning of Wylfa Units 3 and 4
- A decrease of 1.0 GW due to Transmission Entry Capacity (TEC) reductions at Cockenzie and Didcot A
- A decrease of 2.3 GW due to the mothballing of Keadby, Medway, Kings Lynn, Peterborough and Roosecote
- A decrease of 0.3 GW due to reduced output at Tilbury following conversion to biomass firing
- An increase of 0.7 GW due to the addition of new wind farms and an increase in the available capacity of ones that are in the process of being built
- An increase of 0.9 GW due to the expected commissioning of the first two units at Pembroke.

86. There is potential for an increase in generation capacity as the summer progresses due to the commissioning of the other three units at Pembroke and the commissioning of West Burton B.

Figure E 11 - Generation Capacity - Summer 2012



Generation Availability

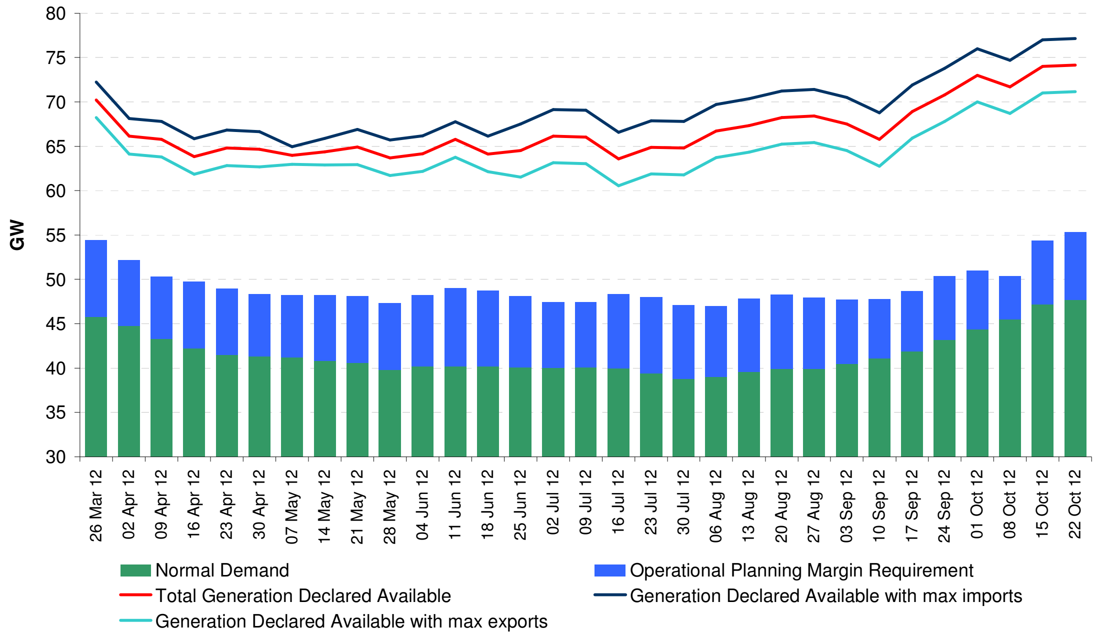
87. As usual over the summer period there will be a significant generation outage programme that will reduce the amount of available generation plant. Generation surplus, which is the excess of generation availability over demand and reserve requirements, is published on www.bmreports.com[8].

88. At present there is a comfortable surplus for every week in the summer on the current generation outage programme provided by the generators. Therefore no problems are expected in being able to meet demand over the summer.

[8] http://www.bmreports.com/bsp/BMRSSystemData.php?pT=WEEKFC

89. **Figure E 12** shows the normal demand levels and the generator availability declared to National Grid by Generators under Grid Code Operating Code 2 (OC2). The chart also superimposes notified French and Britned interconnector capability in both import and export directions. The capability allows for planned outages on the interconnectors as detailed further in the report under Interconnector Flows. The interconnector to Northern Ireland has been excluded from this analysis as over the summer the flows impact the amount of constrained generation in Scotland rather than the National surpluses.

Figure E 12 - Declared Generation Availability



90. It is necessary to hold varying levels of reserve such that within-day there is adequate reserve to cover for:

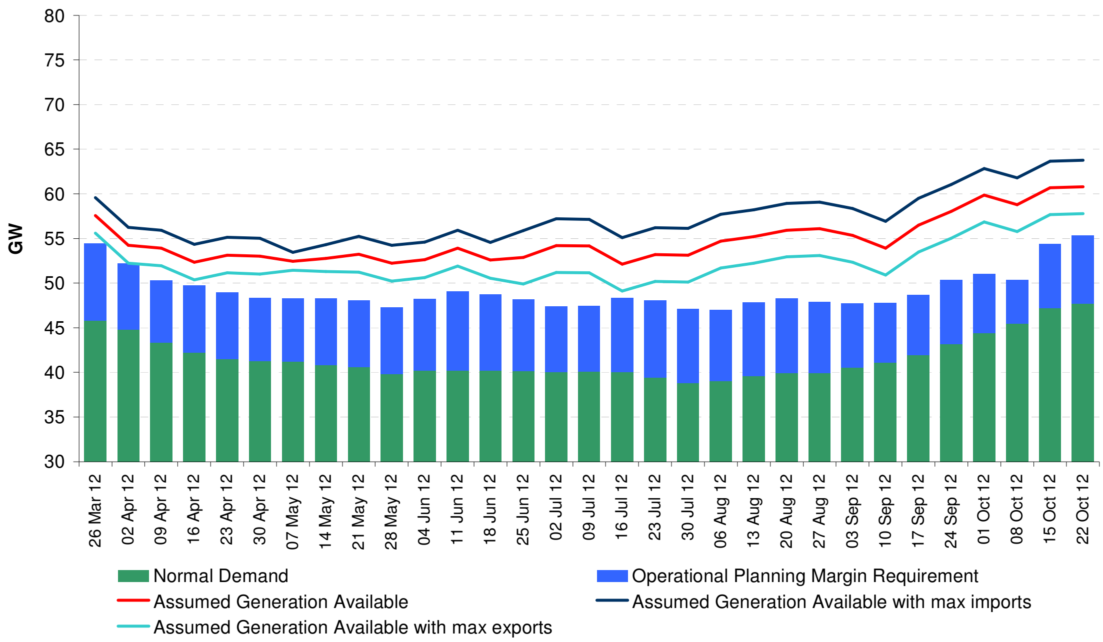
- Short-term generator breakdowns
- Demand forecast errors
- Other specific issues including effects of transmission system constraints and generator commissioning.

91. This reserve requirement at the planning stage is forecast to be a maximum 9 GW and is shown in **Figure E 12** as OPMR (Operational Planning Margin Requirement). A more detailed explanation of OPMR and a breakdown of its categories are shown on the National Grid website[9].

[9] http://www.nationalgrid.com/uk/Electricity/Data/reserve/bmrs/

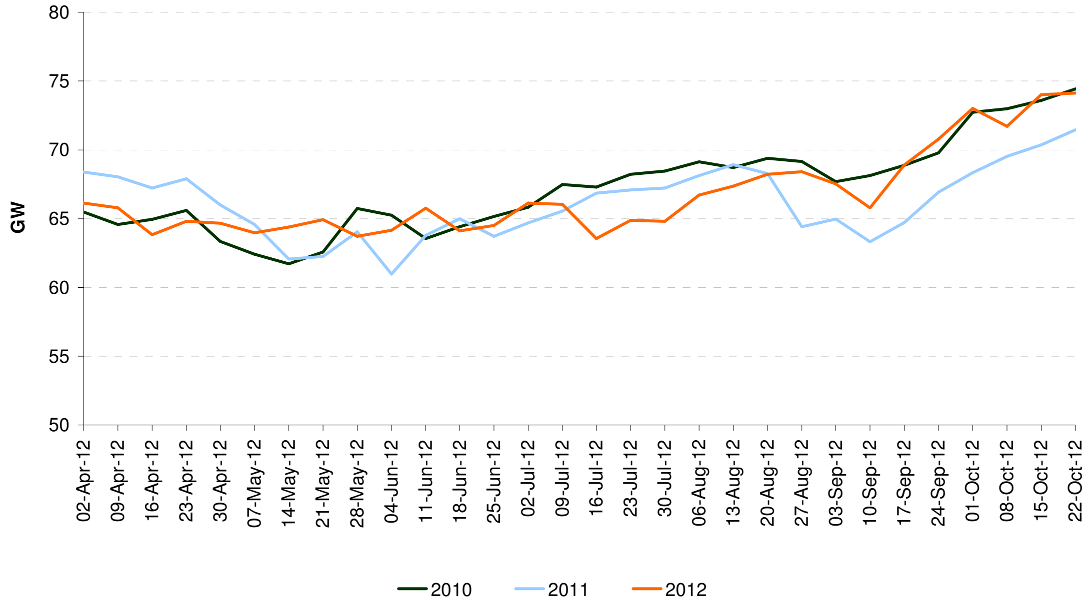
92. Using the historic average breakdown rate from the past three summers of 13% combined with an assumption of 10% for wind output and 50% for hydro generation gives the assumed generation availability as show in **Figure E 13**.

Figure E 13 - Assumed Generation Availability



93. **Figure E 14** shows notified generation availability is currently similar to last year for the first half of the summer but slightly lower in July and August due to the combined effects of reduced capacity and the incidence of planned outages.

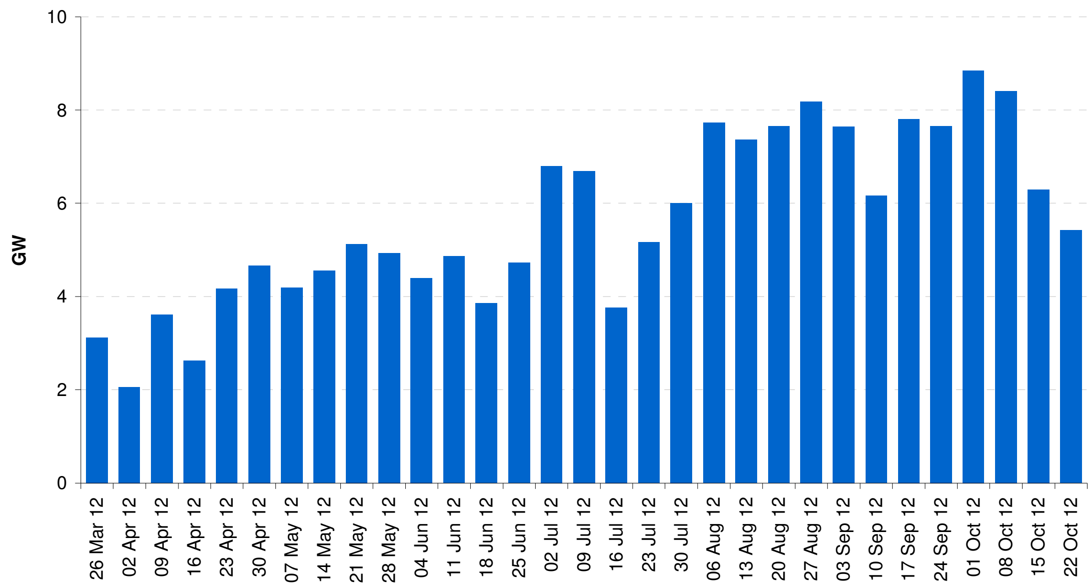
Figure E 14 - Declared Generation Availability including the last 2 summers



94. It is expected that some LCPD (Large Combustion Plant Directive) opted out coal and oil fired generation will again go “summer cold” so that the affected units would only be available with long notice periods. If there was an erosion of the surpluses it is assumed that the generators would be able to respond in time to the appropriate market signals.

95. The current surpluses over the summer, calculated as the excess of available generation over the forecast demand and reserve requirements, are show in Figure E 15. Surpluses range from 2 GW to 9 GW across the summer. The surpluses are calculated with the interconnector flows at zero and are based on assumed availability in order to allow for breakdowns and plant shortfalls.

Figure E 15 - Generation Surplus



Market Information

96. Modifications to the Balancing Services Code have enabled further transparency by enabling the publishing of additional generation capacity availability information by the Balancing Mechanism Reporting System. The following information is now published on www.bmreports.com:

- 2-14 days ahead aggregated national Output Usable data by fuel type, daily resolution
- 2-52 weeks ahead aggregated national Output Usable data by fuel type; weekly resolution
- 2-14 days ahead Output Usable by BMU, daily resolution
- 2-52 weeks ahead Output Useable by BMU, weekly resolution.

System Warnings

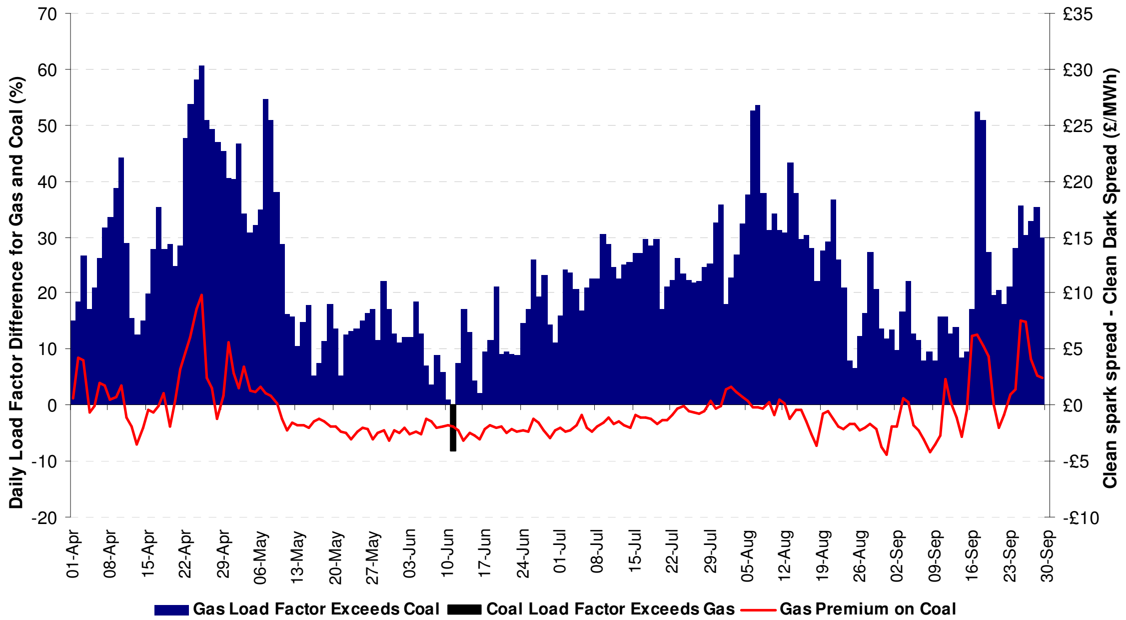
97. System warnings may occur at any time of year. No system warnings were issued during the summer of 2011.

98. System warnings during past summers have most often been associated with short term generation unavailability relative to demand and as such the warnings are a useful tool for informing the market in order to provide additional generation.

Merit Order

99. **Figure E 16** shows a good correlation between fuel cost and output for gas and coal fired generation last summer although gas fired generation was run at a slightly higher load factor than coal even when the clean dark spread was higher than the clean spark spread. This was possibly be due to coal stations opted out of the LCPD saving their remaining operating hours for the winter when the dark spread was even higher. Other factors such as individual station efficiencies, generators' portfolios (including fuel stocks and contracts) and plant outages will also influence the choice of plant. However, the gap between coal and gas prices is much larger this summer, strongly favouring coal fired generation as discussed in the fuel price and gas sections. As a result, coal fired generation is expected to run at higher load factors than gas this summer.

Figure E 16 - Summer 2011 Coal and Gas Load Factors and Clean Spreads



Interconnector Flows

100. BritNed[10] is expected to remain fully available this summer apart from a 3 day outage in May followed by a week at half capacity.

101. The valve replacement work on the French Interconnector that started last year will continue this summer and as a result there will be another bi-pole outage from March to the end of June. The valve replacement outages reduce the capability of the IFA from 2,000 MW to 1,000 MW. Full details of the outages can be found on National Grid's website[11].

102. There has been some wheeling of power through the UK from the Netherlands to France this winter but over the summer it is expected that BritNed and IFA will both flow predominantly into the UK as the prices on the Dutch and French markets are expected to be lower than the UK prices. Imports overnight are expected to be greater than during the day.

Transmission Issues

103. 2012 sees the continuation of major works associated with the Transmission Investment for Renewable Generation (TIRG) works. This work is to construct or rebuild major sections of the transmission system in Scotland and the North of England, to deliver additional transmission capacity to transport energy from new renewable generation (wind) in Scotland.

104. Additionally, significant outages are required for construction works within the North West, South East and South Wales, primarily to facilitate generation connections.

105. The network outages to undertake the work will reduce the available transmission system capacity between Scotland and England, as well as between the North and South of England, and in the South East.

106. To manage the resulting constraint volumes, we will use a combination of (i) contracts to limit the output of certain power stations; (ii) arming of intertrips to automatically disconnect generation in the event of a transmission fault, (iii) actions on the day in the Balancing Mechanism, and (iv) trades to resolve these constraints efficiently and effectively. These transmission system reinforcements form part of a substantial development of the networks to accommodate new generation and to replace assets to ensure the continued reliable performance of the GB transmission system. Details of planned reinforcements are shown in National Grid's Seven Year Statement[12].

107. In addition to the decrease in summer MW demand there has been a significant decrease in MVAr demand. This has resulted in a requirement to run additional generation in order to utilise their reactive capabilities.

[10] http://www.britned.com/
[11] http://www.nationalgrid.com/uk/Interconnectors/France/GeneralInfor/
[12] https://www.nationalgrid.com/uk/Electricity/SYS/

108. To manage the resulting constraint volumes, we will be using a combination of (i) contracts to run certain power stations, (ii) actions on the day in the Balancing Mechanism, and (iii) trades to manage this constraint efficiently and effectively.

Drought

109. According to the Met Office rainfall amounts across many parts of the UK have been below average for the last two years. Importantly, this includes two dry winters – the periods when we would normally expect our rainfall to replenish river, reservoir and groundwater levels.

110. 2010 was the eleventh-driest year in the series from 1910 and the driest since 2003. The dry weather continued during 2011 with large parts of central, eastern and southern England having well below average rainfall – several Midland counties – such as Shropshire, Nottinghamshire, Leicestershire and Warwickshire had their driest year on record.

111. The impact extreme of drought conditions on transmission system include:

- Receding river levels at inland Power Stations could potentially result in some shortfall in generation output if the water inlet is compromised and reduced flows especially with high temperatures could lead to higher cooling water input temperature reducing efficiency and power output
- Restriction by the Environment Agency in the amount of water that can be abstracted will limit the ability to top up cooling water and eventually curtail the ability to generate
- Reduced rainfall will limit run of river hydro generation schemes although most of these are in Scotland and Wales
- Long periods of no rain can lead to pollution and salt build up on insulators, particularly coastal substations or overhead line routes. Precipitation after such a period can lead to flashover from insulation breakdown and trips
- Grass or forest fires under overhead lines or near other assets can result in the circuits being switched out to prevent damage or allow access to fire fighters
- If accompanied by high temperatures then demand would rise as a result of increased air conditioning and refrigeration demand
- Long dry spells can be accompanied by isolated heavy thunderstorms or increased lightning activity.

112. High temperatures and extended periods with no rain are not infrequent in past British summers and are managed as part of the normal demand forecast and risk mitigation processes. The plant margin will be monitored as more information becomes available with particular attention to inland fossil fuelled plant.

113. In addition to normal procedures the weather information that National Grid receives will additionally be monitored for long periods with no precipitation. Thunderstorms can often end periods of drought and National Grid has a dedicated lightning

detection system. Information is received from the Environment Agency and Met Office through the joint Hazard Manager system for emergency responders.

Olympics 2012

114. National Grid's Olympic Project has been working across the business to identify key actions that need to be undertaken ahead of the Olympic Games to ensure secure and reliable energy supplies.

115. To achieve this, reviews have been undertaken of asset preparedness; ensuring, where possible, known risks are managed. Work has also been undertaken to ensure it remains possible to efficiently manage the network during these unprecedented events.

116. To ensure National Grid is able to effectively and efficiently respond to emergencies during the period, active management of constraints placed upon our operations have been undertaken. This includes engaging with external stakeholders within the Olympic authorities and government agencies to allow access to restricted roads. Many of these preparations have been tested through emergency exercising and assurance has been sought through internal and external audits.

117. The activities undertaken include:

- Avoiding planned outages on key assets to maximise network availability supplying the games venues (while retaining focus on all of our customers)
- Manning key substations to enhance our response capability
- Planning for a wide range of scenarios and contracting with strategic generation to ensure standards are maintained for; transmission constraint management and voltage control
- Regular strategic calls; both internally and with key external parties
- Holding and participating in emergency exercises
- Ensuring we can cope with supply and demand variations
- Increased testing of protection systems on key sites
- Ensure Voltage profiles can be maintained at times of low demand by confirming reactors and generators available to compensate for reactive power.

118. While recent Olympics, athletics events or Commonwealth Games have had little effect on the electricity demand it is possible the GB Olympics will have a significant effect along the lines of Remembrance silences or national football matches. Information from Olympic transmission system operators has been obtained and scenarios devised from experience of similar events.