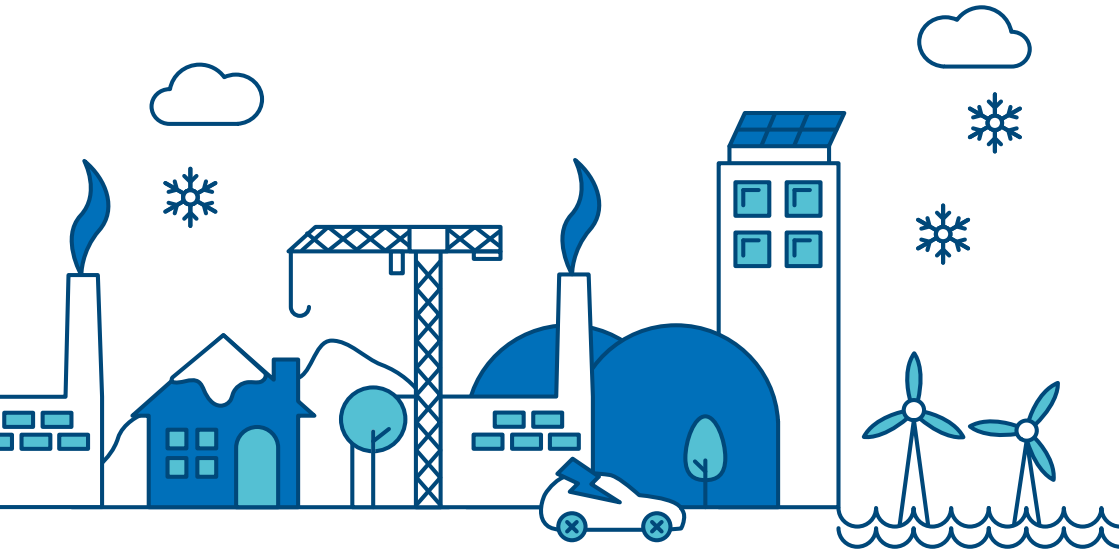
Winter **Outlook Report**

2017/18

nationalgrid



OCTOBER 2017

How to use this interactive document

To help you find the information you need quickly and easily we have published the *Winter Outlook Report* as an interactive document.

Home button
This will take you to the contents page. You can click on the titles to navigate to a section.

A to Z
You will find a link to the glossary on each page.

Arrows
Click on the arrows to move backwards or forwards a page.

Hyperlinks
Hyperlinks are highlighted in bold throughout the report. You can click on them to access further information.

Welcome to our 2017/18 *Winter Outlook Report*. This report draws together analysis and feedback from across the industry to present a view of supply and demand for the winter ahead.

The responses we received to this year's winter consultation provided us with valuable insight on the winter ahead. I'd like to thank those companies and organisations that took the time to share their views, and have engaged with us throughout the year. Your views really are important to the development of this report and help to make sure we can provide a well-informed outlook to the industry.

Acting on the consultation feedback, we have reviewed the report structure and the information it covers. In the gas section, for example, we've separated out different gas supplies into 'beach' and 'non-beach' supplies. Beach supplies include gas from the UK Continental Shelf and Norway, while other sources of supply fall into the non-beach category. Over the last few years there has been a consistent pattern of relatively stable beach volumes across each winter, with variability in demand patterns met by non-beach supplies. This separation allows us to provide more information on non-beach supplies, especially as some act as both supply and demand on the system. We've also introduced an Operational toolbox section for gas to provide additional information on industry notices and warnings. We hope these report changes will make the gas section more transparent and useful to you.

This winter will be the first full year of the Capacity Market. This was developed by the UK Government as part of the Electricity Market Reform programme to incentivise investment in secure, low-carbon electricity, improve the security of Great Britain's electricity supply, and improve affordability for consumers. As a result of this we introduced a change to the methodology we use to assess the electricity security of supply in our *Winter Review and Consultation* that we published in June. This new methodology produces our underlying demand forecast and treats transmission connected generation and distribution connected generation in a consistent manner. The responses we received to our consultation welcomed this change and so this report continues to focus on the new methodology. The responses also told us that more information on other European electricity markets would be useful. As a result we have provided more analysis about our connected markets on GB supply sources and prices. We think that these changes will help to provide you with the knowledge you need to navigate the changing energy market.

The *Winter Outlook Report* is just one publication in a suite of documents from the System Operator exploring the future of energy. I encourage you to read our other publications. In them you can find out more about the evolution of the energy landscape, and how we're working with our stakeholders to build and operate the gas and electricity systems of the future. To find out more, and to register for email updates, go to our **website**.

Thank you for taking the time to read this year's *Winter Outlook Report*. Your input has helped to shape this publication and we hope you will continue to share your views with us. You can contact us in a variety of ways; please email your feedback to us at **marketoutlook@nationalgrid.com**, join the debate on Twitter using #NGWinterOutlook or subscribe to our LinkedIn Future of Energy page.

Phil Sheppard
Director, UK System Operator

Contents

Executive summary

The *Winter Outlook Report* is an annual publication produced by National Grid, which presents our view of gas and electricity supply and demand for the coming winter. The analysis presented here is underpinned by the stakeholder insight we receive via the winter consultation and regular engagement with industry participants. The report is designed to inform the energy industry and support their preparations for the winter ahead.

Overview: Electricity winter 2017/18

We expect there to be sufficient generation and interconnector imports to meet demand throughout winter 2017/18.

This winter will be the first delivery year for the Capacity Market (CM). It aims to ensure security of electricity supply by providing a payment for reliable sources of capacity, alongside electricity revenues, to ensure the delivery of electricity when needed. This will encourage the investment required to replace older power stations and provide backup for more intermittent and inflexible low carbon generation sources. The Capacity Market has increased the amount of available supply in the market.

Previously we have quoted the margin as a percentage of transmission demand. In this approach, generation on the distribution system was treated as a reduction in demand. This year we are moving to quoting margins as a percentage of underlying demand. This is aligned with the approach taken in the CM. This will be explored in more detail in the Winter view section.

In June we published our *Winter Review and Consultation* document; this included a preliminary view of the margins for winter 2017/18 in the range of 3.7 to 4.9 GW. It was based on the results of the Capacity Market auctions and the potential for some plant without a CM contract remaining operational.

Since then, additional plant without CM contracts have indicated they will be operational this winter. As a result the margin forecast has increased to 6.2 GW, or 10.3 per cent, on an underlying demand basis, while on a transmission demand basis the margin is 11.5 per cent. In both cases the equivalent loss of load expectation (LOLE) is 0.01 hours per year.

Similarly to last winter, we expect transmission system demand to peak at 50.7 GW in mid-December. Based on the data provided to us by generators, normalised and average cold spell (ACS) demand can be met in all weeks across the winter under the three interconnector scenarios with low, medium and full interconnector imports from Continental Europe. As the difference between demand and the generation expected to be available changes throughout the winter, we encourage the industry to regularly check the **BM Reports website** for the latest information.

We are confident that we have the right products and strategy in place to help us to balance the system, even under colder conditions than we have experienced in recent years.

Executive summary

Overview: Gas winter 2017/18

GB continues to benefit from a wide range of dynamic supply sources. We expect there to be sufficient gas available from these sources to meet winter 2017/18 demand.

Similarly to last winter, our current view of forward fuel prices would suggest that gas will be cheaper than coal and therefore more profitable for electricity generation this winter.

We expect gas demand for winter 2017/18 to be slightly lower than we experienced in winter 2016/17. The biggest change we expect to see will be in a reduction in gas use for electricity generation. This is a reflection of the higher than forecast gas demand for electricity generation we observed last winter as a result of lower than expected electricity imports to GB. This year we expect electricity imports to be higher than last year and therefore more in line with previous winters.

Gas exports to Continental Europe are expected to be slightly lower than 2016/17. Forward prices suggest the price differential is sufficient to encourage gas flows from Belgium to GB. We foresee gas exports to Ireland remaining stable, with the Corrib gas field continuing to reduce Ireland's demand for GB exports. Total gas demand for the winter is forecast at 51 bcm, with a peak demand forecast for a 1-in-20 winter of 502mcm/day. We expect there to be sufficient gas available to meet this demand.

In June this year, Centrica Storage Ltd announced the permanent end to storage operations at their Rough storage facility. However, they intend to extract all recoverable cushion gas from the gas field.

As a result, this winter we expect storage withdrawal capability to return. Centrica Storage Ltd expects nearly 1bcm of gas to be withdrawn from the facility this winter. Gas withdrawals are expected to begin early October, flowing modest volumes throughout the period. Last year we experienced a winter without Rough; flows from UKCS and Norway were stable with day-to-day variation taken up by the more dynamic supply sources. We observed a lot of cycling of gas in to and out of storage from the medium-range storage (MRS) facilities.

We expect imports from BBL to continue to be reduced. Last year, long term contracts expired in December which reduced imports to no more than 20mcm/day. Flows through BBL may be hindered further in the event of a decision to reduce production at the Groningen field. A decision is due in November.

The last four winters have all been warmer than the long-term average, however, we do not infer that winter 2017/18 will also be as warm. When we plan for winter we assume that the weather will be seasonal normal, however, given the unpredictability of the weather, we ensure we prepare for colder conditions.

We continue to see changes to GB's gas supply and how it is used within the gas day. This changing landscape has an impact on how we configure and operate the transmission system. We're working with the industry to make sure that we can continue to manage variations in gas supply and demand while meeting the needs of all of our customers.

National Grid's role

National Grid plays a vital role in connecting millions of people to the energy they use, safely, reliably and efficiently.

We own and manage the high voltage electricity transmission network in England and Wales. We are also the System Operator of the high voltage electricity transmission network for the whole of Great Britain, balancing the flows of electricity to homes and businesses in real time.

We don't generate electricity and we don't sell it to consumers. It is the role of energy suppliers to buy enough electricity to meet their customers' needs from the power stations and other electricity producers. Once that electricity enters our network, our job is to fine tune the system to make sure supply and demand are balanced on a second-by-second basis.

On the gas side, we own and operate the high pressure gas transmission network for the whole of Great Britain. We are responsible for managing the flow of gas to our connected customers and businesses, working with other companies to make sure that gas is available where and when it is needed.

We do not own the gas we transport and neither do we sell it to consumers. That is the responsibility of the energy suppliers and shippers.

Together, these networks connect people to the energy they use.

Stakeholder engagement

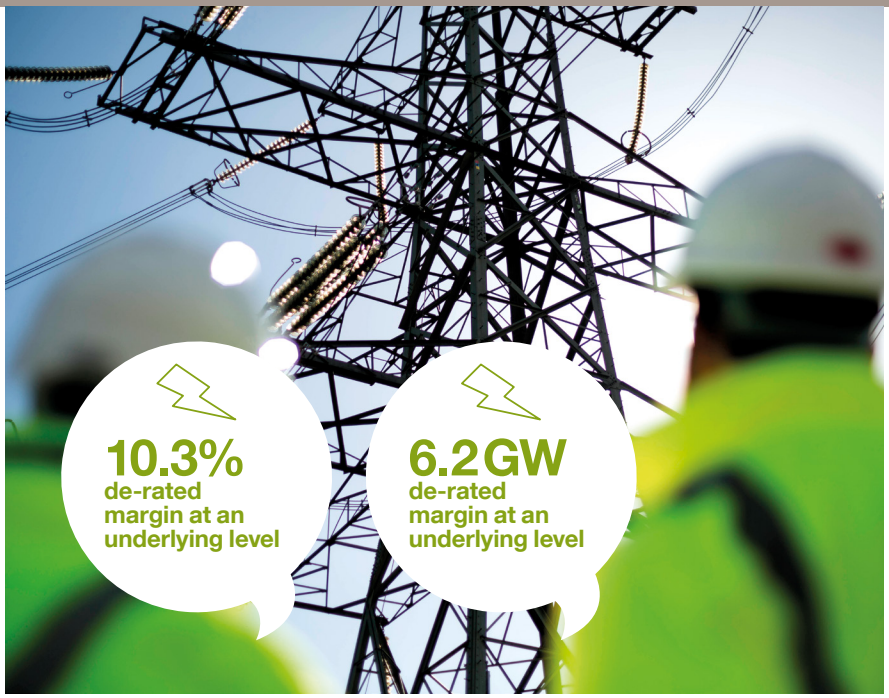
The *Winter Outlook Report* provides our view of gas and electricity security of supply for the coming winter. It is informed by insight received from stakeholders across the energy landscape via the winter consultation and regular conversations with industry participants.

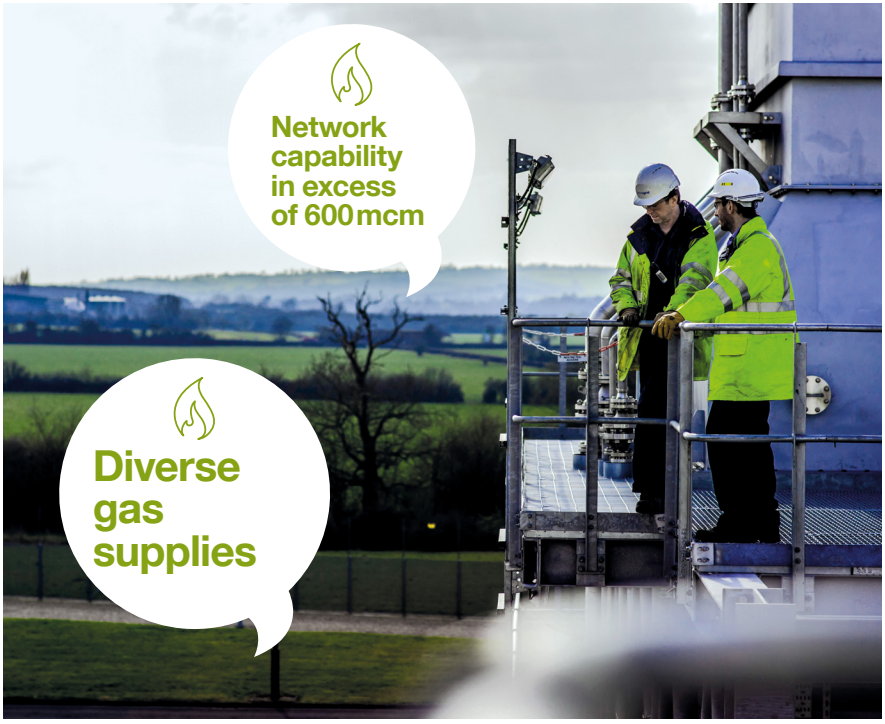
You've told us that you believe the outlook reports provide you with a well-informed, industry-wide view to support your preparations for the winter ahead. In particular you use our analysis of supply and demand, both for electricity and gas, to inform your winter strategy. You also told us that you use the outlook reports as a benchmark for your own forecasts.

Interest in our outlook reports continues. We want to make sure that our reports continue to provide you with the information you need, both for long-standing readers and those who are new to the industry. To find out how to contact us please go to our **'Continuing the conversation'** page.

"We welcome the opportunity to respond to this year's Winter Outlook Report. We find the reports very useful. They provide a review of how the previous winter out-turned against expectations and an opportunity to review and comment on National Grid's views and data for how the forthcoming winter may turn out, alongside any changes to the methodologies used"

Energy Industry Stakeholder


10.3%
de-rated margin at an underlying level
6.2GW
de-rated margin at an underlying level


Network capability in excess of 600mcm
Diverse gas supplies

System Operator publications

The Winter Outlook Report is just one of the documents within our System Operator suite of publications on the future of energy. Each of these documents aims to inform the energy debate by highlighting a particular issue, and is shaped by engagement with the industry.

The starting point for our analysis is the *Future Energy Scenarios (FES)*. This document considers the potential changes to the demand and supply of energy from today out to 2050. The scenarios provide a starting point for much of the analysis in this report, such as our electricity winter view and analysis of gas demand.

The network and operability changes and balancing services that might be required to operate the electricity system in the future are explored in the *Electricity Ten Year Statement*, *System Operability Framework, System Needs and Product Strategy* and *Network Options Assessment*.

For gas, these issues are considered in the *Gas Ten Year Statement* and *Future Operability Planning* publications. We share aspects of our analysis with the industry during the development of these documents to make sure that the proposed solutions meet the needs of our stakeholders.

You can find out more about any of these publications, and how they incorporate insight from our stakeholders, by clicking on the document front covers on the next page or by visiting our **Future of Energy webpage**.

The key SO publications in 2017 and 2018

Network Options Assessment
January 2018

The options available to meet reinforcement requirements on the electricity system.

Winter Outlook Report
October 2018

Our view of the gas and electricity systems for the winter ahead.

Summer Outlook Report
April 2018

Our view of the gas and electricity systems for the summer ahead.

Electricity Ten Year Statement
November 2017

The likely future transmission requirements on the electricity system.

Winter Review and Consultation
June 2018

Compares winter 2017/18 with our forecasts and presents our initial view of the winter ahead.

Gas Ten Year Statement
November 2017

How we will plan and operate the gas network, with a ten-year view.

Future Energy Scenarios
July 2018

A range of plausible and credible pathways for the future of energy from today out to 2050.

Future Operability Planning
November 2017

How the changing energy landscape will impact the operability of the gas system.

Chapter one

Electricity – Winter outlook

This chapter sets out our current view of the electricity system for winter 2017/18. It details our analysis of expected demand and available generation, and outlines the tools and notifications we have available to help us to balance the system.

Our winter view is an assessment of security of supply for winter 2017/18 based on probabilistic modelling. On the other hand, the operational view is based on data provided to us by generators, updated weekly. As a result, while both sets of information are often similar, they are not directly comparable.

The chapter contains the following sections:

- Winter view
- Operational view
- Europe and connected markets
- Operational toolbox.

Winter view

Our electricity analysis presents an assessment of security of supply for winter 2017/18. We published our preliminary analysis of winter 2017/18 in our *Winter Review and Consultation* in the summer. The information in this section provides our updated view, reflecting changes to market information since then and the responses to our winter consultation.

Key messages

- The de-rated margin for winter 2017/18 is projected to be 6.2 GW, or 10.3 per cent, on an underlying demand basis.
- The corresponding loss of load expectation (LOLE) is estimated as 0.01 hours/year.
- This margin includes capacity contracted in the 2017 Capacity Market Early Auction. It also includes additional capacity without a Capacity Market contract that has indicated it will remain available to the market since we published our *Winter Review and Consultation* earlier this year.

Key terms

- **Generation margin:** the sum of de-rated supply sources declared as being available during the time of peak demand plus support from interconnection, minus the sum of the expected demand at that time and basic contingency reserve requirement. This can be presented as either an absolute GW value, or alternatively as a percentage of a value derived from the sum of demand plus contingency reserve minus interconnection support.
- **De-rating factors:** these are scaling factors applied to the maximum technical capability that account for breakdowns, planned outages and any other operational issues that may result in power stations not being able to generate at their normal level. They are based on the historic availability of plant during peak periods.
- **Loss of load expectation (LOLE)[1]:** a statistical metric used to describe electricity security of supply. It is an approach based on probability and is measured in hours per year. It measures the risk across the whole winter of demand exceeding supply under normal operation. It does not mean that there will be a loss of supply for x hours per year. It gives an indication of the amount of time across the whole winter that the System Operator may need to call on a range of emergency balancing tools to increase supply or reduce demand. In most cases, loss of load risk could be managed without significant impact to end consumers.

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/223653/emr_consultation_annex_c.pdf

Winter view

De-rated margin and loss of load expectation

Historically, we have expressed the system margin as a gigawatt (GW) figure, and as a percentage of a value based on the transmission system demand (TSD). National Grid's focus has traditionally been on the transmission system. This is because only a relatively small proportion of total generation was connected to the distribution system. This year we are publishing the headline percentage margin on an underlying demand (UD) basis, i.e. total demand on the transmission and distribution systems. This is used for the Capacity Market (CM) target capacity recommendation in our annual *Electricity Capacity Report*. This approach has the advantage that it treats transmission connected generation and distribution connected generation in a consistent manner. The following table summarises the forecast winter 2017/18 margins at both transmission and underlying demand levels. It shows that the underlying demand margin is forecast as 6.2 GW, or 10.3 per cent.

The transmission demand margin forecast is 11.5 per cent. This is higher than our comparative transmission margin forecasts for winter 2015/16 (5.1 per cent) and 2016/17 (6.6 per cent). As discussed later in this chapter, the higher margin for winter 2017/18 is due to plant remaining operational without CM contracts.

To provide more information about how the margin is made up, we have also calculated the margin forecasts based purely on the level of capacity secured through the CM auction (i.e. excluding generation that has indicated it will be available in the market this winter but which is not contracted to the CM). Using this view the margin would be 6.2 per cent for underlying demand and 6.6 per cent for transmission demand, similar to the last two winters.

Table 1.1
Summary of generation margin forecasts for winter 2017/18

	2017/18
De-rated margin at underlying level	6.2 GW
Margins as a % of underlying demand	10.3%
Margin as a % of transmission demand	11.5%
LOLE at underlying level	0.01 hours

Assumptions for supply, demand and interconnection

In our *Winter Review and Consultation* document we included a preliminary view of the margins for winter 2017/18 in the range of 3.7 to 4.9 GW. We aligned that preliminary margin assessment to the EMR 5-year Base Case[2] assumptions, which were linked to the results of the CM Early Auction and the potential for additional plants without a CM contract remaining operational. Since then new market information indicates that further plants without a CM contract will be available to the market this winter. In the preliminary view Base Case, a coal plant and a combined cycle gas turbine (CCGT) were assumed to remain operational without CM contracts. These generators have now been joined by capacity from one CCGT and two biomass conversion plants plus additional capacity from an existing CCGT already considered in the Base Case. As a result, the total maximum technical capability this winter has been forecast as 101.2 GW (66.1 GW de-rated) to meet underlying demand. This value excludes interconnectors but includes wind and solar.

The latest view of average cold spell (ACS) peak underlying demand remains unchanged from that published in our *Winter Review and Consultation*, at 62.3 GW. This is an unrestricted demand value that includes the 900 MW requirement for contingency reserve to cover the largest in-feed loss. However, our forecast of ACS transmission level demand (also including contingency reserve) has been slightly increased to 52.8 GW, from 52.1 GW. This reflects a reduction in assumed embedded storage volumes, following a reassessment of distribution connected storage projects.

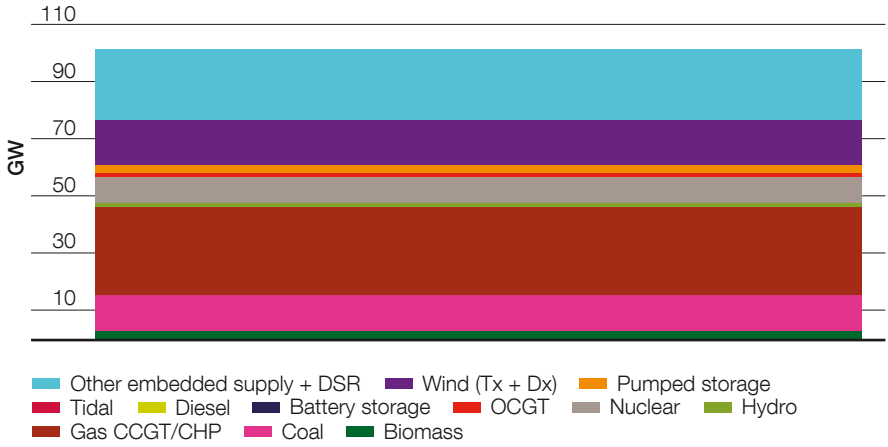
For interconnectors we have assumed a total of 3.6 GW of interconnector capacity for imports, and 4 GW for exports[3]. Based on our modelling of GB and neighbouring energy markets, we have assumed 2.4 GW of net import flows to GB for winter 2017/18. This is made up of 2.1 GW of imports from Continental Europe and 0.3 GW of imports from Ireland. These import levels are based on the de-rated volumes set out in the Capacity Agreements with the interconnector owners. More information on Capacity Market obligations for interconnectors can be found in the Europe and connected markets section later in the report.

[2] https://www.emrdeliverybody.com/Lists/Latest%20News/Attachments/116/Electricity%20Capacity%20Report%202017.pdf

[3] In this Winter view section interconnector volumes are based on a pan-European market model that takes account of historical as well as forecast interconnector data. This is different to the Operational view that is based on the current forward market price differentials, although the net import figures are broadly similar.

Winter view

Figure 1.1
Generation capacity by technology type



Operational view

Our operational view presents the current picture of operational surplus on the transmission system for each week of winter 2017/18. This section continues to focus on transmission system demand, reflecting the generation data available to the market.

Key messages

- The Capacity Market is now fully operational. It has increased the amount of available supply in the GB market and is designed to deliver more supply or reduce demand during times of system stress.
- Based on the current data and seasonal normal weather, the peak transmission system demand forecast is 50.7 GW. This is referred to as normalised demand and is explained in the 'key terms'.
- Both normalised and average cold spell (ACS) demand can be met in all weeks across the winter under all interconnector scenarios.
- Demand forecasts for the coming winter are lower than weather corrected outturns in previous years. This is primarily due to an increase in the distribution connected generation.

Key terms

- **Operational surplus:** the difference between the level of demand and generation expected to be available, modelled on a week-by-week basis. This information lets the market know how much surplus is expected to be available. Generators are then able to take this into consideration when planning their outages.
- **Operational Code 2 (OC2) data:** information provided to National Grid by generators. It includes their current generation availability and known maintenance plans.
- **Transmission system demand (TSD)[4]:** demand that National Grid as the System Operator sees at grid supply points (GSPs), which are the connections to the distribution networks. It includes demand from the power stations generating electricity (the station load) and interconnector exports.
- **Normalised demand:** forecast for each week of the year based on a 30-year average of each relevant weather variable. This is then applied to linear regression models to calculate what the demand could be with this standardised weather.
- **Average cold spell (ACS):** A particular combination of weather elements that gives rise to a winter peak demand, which has a 50 per cent chance of being exceeded as a result of weather variation alone.
- **Equivalent firm capacity (EFC):** An assessment of the entire wind fleets' contribution to security of supply. It represents how much of 100 per cent available conventional plant would be needed to replace the entire wind fleet and leave security of supply unchanged.

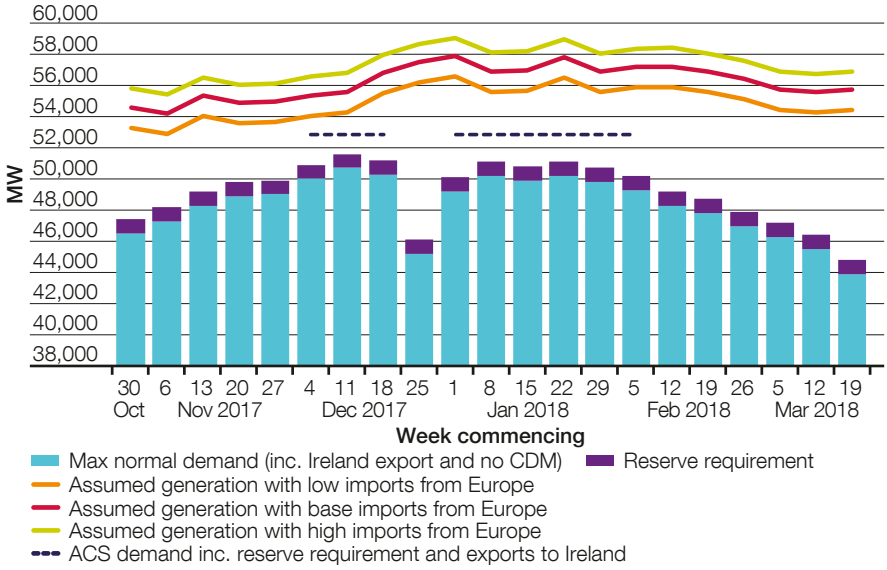
[4] The definition of transmission system demand (TSD) is as defined in the Grid Code. Base station load demand is 600 MW. The base case forecasts of exports at peak demand are 0 MW to France and the Netherlands, and 1,000 MW to Ireland.

Operational view

Our operational view is based on current generation availability data, otherwise known as Operational Code 2 (OC2) data. This data is the generators' expected maximum output on the peak demand of the week. It includes the effect of known maintenance and outage plans. In our analysis we have used OC2 generation data provided to us on 5 October 2017 and demand data that was accurate on 28 September.

A summary of our operational view can be seen in figure 1.2. It includes the expected weekly generation, de-rated to allow for breakdowns (as set out in table 1.3), and differing levels of interconnector flows[5], against the weekly normalised and ACS demand forecast for the winter period. This shows that there is sufficient generation available to provide an operational surplus across the winter.

Figure 1.2
Operational view 2017/18



[5] More information on the interconnector scenarios can be found on page 28.

Currently, the lowest level of operational surplus is expected in the week commencing 11 December under normal weather conditions. This is because it is the week where demand is expected to peak and a number of generating units are on planned outage. The graph shows that normalised demand can be met in this week, and across the entire winter, even with the low interconnector import scenario.

The blue dashed line in figure 1.2 shows the ACS peak demand. Historical analysis shows that ACS peak has never occurred before the first week in December, during the Christmas fortnight or after the first week in February. As a result, ACS demand is not included for these weeks. This chart shows that we expect that ACS demand can be met even with the low interconnector import scenario.

During forecast periods of low operational surplus, generators that might be intending to undertake a planned outage could be incentivised to make their assets available through their Capacity Market obligations, or through the revenue opportunity from higher prices in the market that often occur during these periods.

During daily operations we may see an Electricity Margin Notice (EMN) being issued or a Capacity Market Notice (CMN). These notices and their application are covered in more detail in the Operational tool box section of the document.

Our operational view is based on the best data currently available to us. Adjustments to the notified generation and forecast demand will change this outlook throughout the winter, potentially increasing or decreasing the level of operational surplus. We encourage the industry to regularly view the latest OC2 data. This is published each Thursday on the **BM Reports website**. Using this data we would expect generation to actively move their planned outages where possible, away from those periods when the operational surplus is low.

Table 1.2
Key statistics

Peak demand	50.7GW
Minimum demand	21.3GW

Operational view

1. Demand

All demands in this section are transmission system demands (TSD).

Spotlight: Peak demand

Our peak transmission system demand forecast for the coming winter is 50.7 GW. This peak transmission system demand is made up of: national demand (49.1 GW) + station demand (600 MW) + base load interconnector exports (1 GW).

Peak transmission system demand (based on the seasonal normal weather) is expected to occur between 11 and 18 December 2017.

Spotlight: Customer demand management

Customer demand management (CDM) happens when industrial or commercial customers choose to change their pattern of energy consumption, normally to reduce energy use over the peak demand periods. By avoiding these peak periods, they reduce their transmission and distribution charges.

Our analysis suggests that during winter 2016/17, CDM typically ranged between 500 MW and 1.5 GW, reaching 2 GW on the highest demand days. We expect this to be similar during winter 2017/18.

Spotlight: Embedded generation

Embedded generation is connected to the distribution networks. These generators are visible on the transmissions network through a reduction in transmission system demand. Embedded generation data, either live or historic, is not readily available to the System Operator.

Our 2–52 weeks ahead normalised demand forecasts are adjusted to include a standardised weekly amount of embedded wind and solar generation (based on the seasonal normal weather and historical load factors).

During summer 2017, embedded wind capacity was 5.3 GW and embedded solar capacity was 12.4 GW. A monthly increase of 150 MW of solar capacity is factored into our forecasts. We are not expecting embedded wind capacity to increase significantly over the coming winter.

We are currently working with a number of partners on various projects that will help improve industry understanding of embedded generation behaviour, including the Met Office, Sheffield University, Alan Turing Institute, Reading University and the Smith Institute. These are funded by Ofgem's Network Innovation Allowance (NIA) through separate NIA projects. The aim of these is to explore different approaches to increase the accuracy of embedded generation forecasting, and thus transmission system demand forecasting, for the near to mid-terms.

Figure 1.3
Weekly peak transmission system demand forecast for winter 2017/18

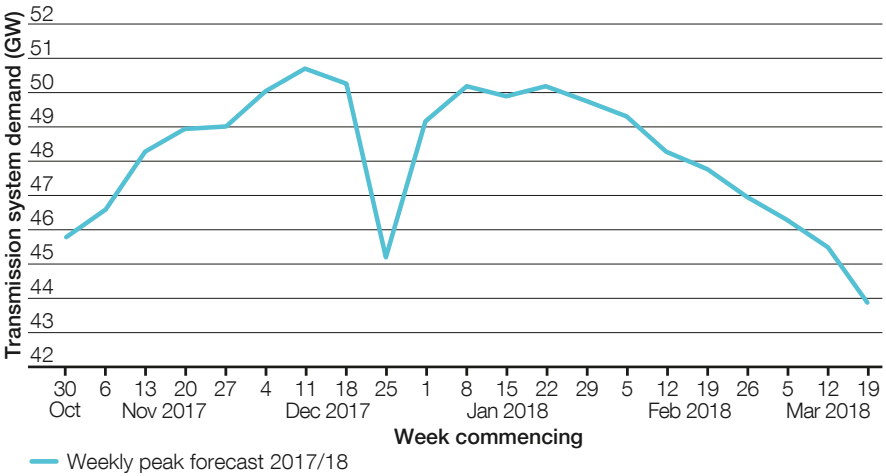


Figure 1.3 shows our current weekly transmission system demand peak forecasts for the coming winter. These are based on seasonal normal weather and are adjusted for normalised levels of embedded wind and solar generation.

The methodology for calculating demand forecasts, based on seasonal normal weather, remains largely unchanged from previous years. A 30-year average of each relevant weather variable is constructed for each week of the year, including temperature, wind speed and solar radiation. This is then applied to linear regression models to calculate the peak weekly demand using normal weather.

Operational view

Figure 1.4
Christmas Day demand

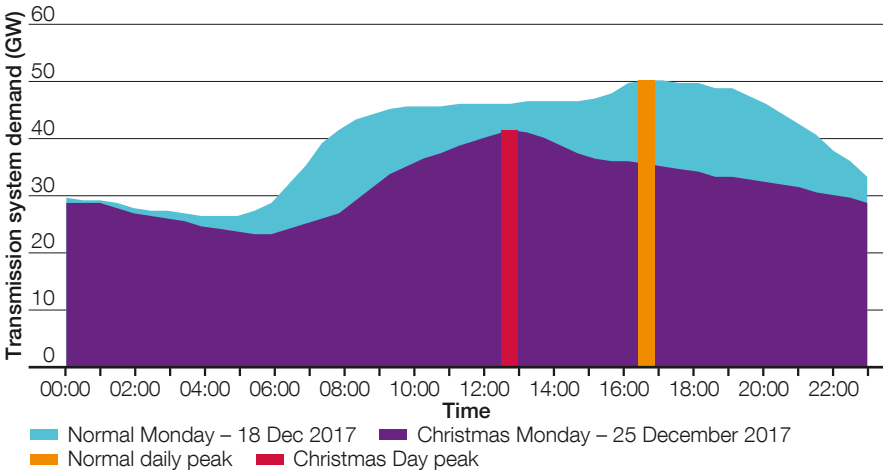


Figure 1.4 provides a comparison between the forecast demand profiles for Christmas Day 2017 compared to a normal Monday (18 December 2017). During a normal winter day, peak demand happens between 5pm and 7pm, however, on Christmas Day, the peak of the day moves to between 12pm and 1pm. This is mainly due to the effect of people cooking Christmas dinner.

Spotlight: Christmas demand

Christmas demands have fallen significantly in recent years. 2015 saw the lowest winter demand since 1998, and 2016 was only slightly higher. It has been driven by the growth in embedded generation, improvements in household energy efficiency, and unusually mild weather.

The shape of the demand profile on Christmas Day is generally different to any other winter day. The demand is nearly all domestic, with very little industrial or commercial activity. The peak of the day occurs at lunchtime because people are at home cooking Christmas lunch; there is a small darkness peak, although this is mostly offset by ovens being turned off. The lighting load is mostly domestic, with Christmas tree lights making up around 1 per cent of total national demand on the Christmas Day darkness peak. Thirty million households each with a 10 W string of lights contributes around 300 MW to the 33 GW evening load.

Demand for the entire Christmas week tends to be much lower than the shoulder weeks. This is because industry has shut down and a large proportion of the country is not at work.

For 2017 Christmas Day falls on a Monday. With average weather, the minimum overnight demand is forecast to be 21.6 GW, including station demand and base interconnector load. The peak demand during Christmas week is forecast to be 45.2 GW, 5 GW lower than the previous week

Assumptions

- Normalised demand is to peak in the week commencing 11 December
- Maximum CDM will be 2 GW, the same as winter 2016/17
- Embedded wind capacity will be 5.3 GW
- Embedded solar capacity will be 12.4 GW.

Operational view

2. Generation

In order to account for unexpected generator breakdowns, restrictions or losses close to real time, we apply a breakdown rate for each fuel type to the OC2 data. This is what we have used in figure 1.2 of our operational view, against forecast normalised and ACS transmission system demands plus a reserve requirement. The level of generation reflects a range of potential interconnector flows. However it does not take into account any market response that might follow as a result of higher demand or a reduced operational surplus. In such conditions, commercial incentives (such as higher prices) might encourage some power stations to maintain availability on units that are experiencing technical issues, or even increase their level of output over the peak demand period.

Table 1.3 shows the breakdown rate applied to each fuel type. This is based on historic data, reflecting how generators performed against what they had planned during peak demand periods[6] over the last three winters.

Table 1.3
Breakdown rates by fuel type

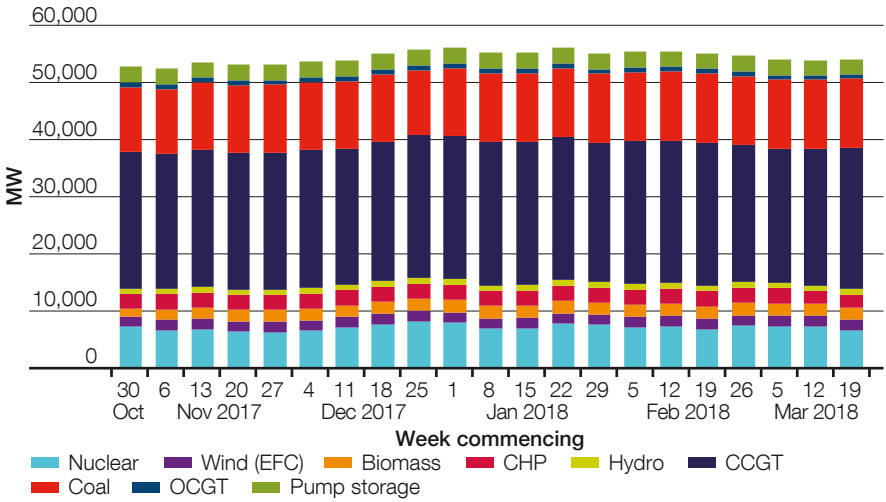
Power station fuel type	Assumed breakdown rate
Nuclear	7%
Hydro	5%
Coal and biomass	11%
Pumped storage	3%
OCGT	3%
CCGT	9%

For wind generation we assume an equivalent firm capacity (EFC) of 17 per cent. This assumes the same level of wind we have used in calculating the winter view.

Figure 1.5 shows the amount of generation expected from each fuel type. It is based on OC2 submissions to which we then apply expected breakdown rates and restrictions. The fluctuations across the weeks reflect planned outages on the power stations. However the figure does not include interconnectors. The order of the column stack reflects our forecast of the running order expected over the winter period based on the cost of producing energy. Since power stations tend to run only when they can make a profit, either by selling their energy in advance or on the day, power stations with the lower production costs will tend to run more often. Based on current forward fuel prices, it is expected that coal will be the marginal fuel. Therefore we expect gas will run above coal in the electricity generation merit order.

[6] Peak demand periods are defined as the highest 20 per cent of demand half hours, during November to February, between 10am and 8pm Monday to Thursday.

Figure 1.5
Generation by fuel type



3. Reserve

The System Operator has a requirement to carry operating reserve to regulate system frequency and respond to sudden changes in demand and supply. We have assumed a reserve requirement of 900 MW for each week of our analysis. This is illustrated in the Operational view chart (figure 1.2) on page 20.

Operational view

4. Interconnectors

Our analysis is based on three interconnector scenarios. All of the scenarios assume full exports to Ireland, which adds 1,000MW to expected demand. Each scenario includes a varying level of import from Continental Europe:

- Low imports of 500MW, resulting in net exports of 500MW.
- Base case of 1,800MW, resulting in net imports of 800MW.
- Full imports of 3,000MW, resulting in net imports of 2,000MW.

The three interconnector scenarios are added to the assumed weekly generation levels, these are shown against the demand and reserve level in the line graph in figure 1.2. The actual flow levels we will see will depend on electricity prices in GB against those in Continental Europe. However, based on the current price differentials (spreads) between our market and Continental Europe, we expect to import during peak hours. Furthermore, the interconnectors connecting GB to mainland Europe and Ireland are incentivised to import through the Capacity Market mechanism at times of system stress. More information on Continental markets and expected flows can be found in the Europe and connected markets section to follow.

Europe and connected markets

Here we explore interconnector activity and Capacity Market obligations along with forward prices in GB and Continental Europe.

Key messages

- For winter 2017/18, we expect there to be a net flow of power from Continental Europe to GB at peak times, occasionally not at full import.
- Based on the current price spread, we expect there to be a net flow from GB to Ireland during peak times, but this may be reversed in cases of high wind levels in Ireland and during periods of system stress in GB.
- All interconnectors are expected to be at full availability during the winter period.
- The growth in renewable energy installed capacity in Continental Europe, especially in Germany, increases the potential for hourly electricity price fluctuations. As a result we would expect occasional variations on the interconnector flows, especially outside of peak periods.

Key terms

- **European Union Emissions Allowances (EUA):** represents a permit to emit one tonne of carbon under the EU Emissions Trading Scheme.
- **Integrated Single Electricity Market (ISEM):** is the new wholesale electricity market regime in Ireland and Northern Ireland that will go live at the end of 2017.
- **XBID:** integrated cross border within-day continuous trading.

Interconnectors

Interconnector flows are closely linked to price spreads between GB and Continental Europe. Due to an increase in renewable generation capacity and the impact of low temperatures on French electricity demand, weather is expected to have a significant impact on hourly electricity prices this winter. As a result, we expect occasional variations on the interconnector flows outside of peak periods, instead of the consistent flows we have seen historically.

Europe and connected markets

France and the Netherlands

Interconnexion France Angleterre (IFA), the interconnector between France and GB, is expected to be at full capability (2 GW) this winter apart from two weeks of essential maintenance planned for 26 March to 6 April 2018.

BritNed is a 1 GW capacity interconnector to the Netherlands. There are no restrictions expected on BritNed this winter.

Ireland

Moyle, the 500 MW interconnector to Northern Ireland, has returned from outage.

The East West Interconnector (EWIC) is expected to be at full capability (500 MW) throughout this winter.

Capacity Market obligations

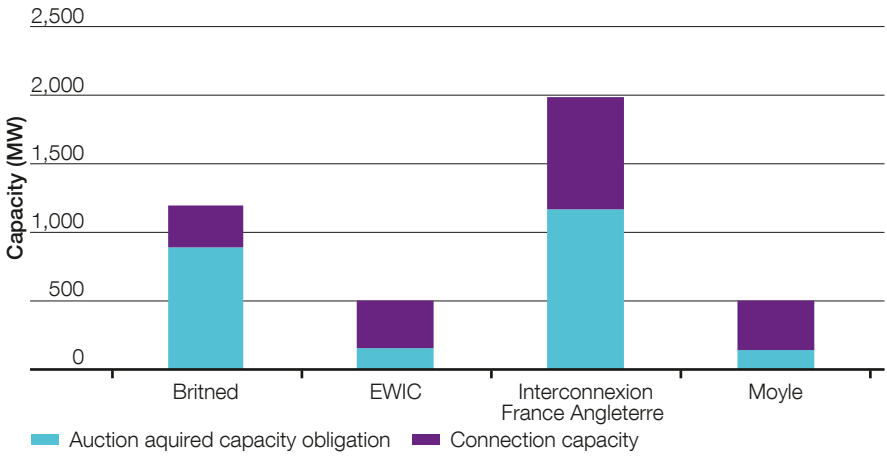
Winter 2017/18 is the first year in which interconnectors have been able to participate in the Capacity Market (CM). IFA, Britned, EWIC and Moyle each won Capacity Agreements in the CM Early Auction held in 2017.

The Capacity Agreement places an obligation on the interconnector owner to deliver the interconnector's de-rated capacity during a period of system stress. The de-rating factors for interconnectors are based on reliability and market-determined flows (that is the likely future direction of flow) during winter peak periods. Capacity obligations are governed by demand which means that the obligation is greater during the highest demand periods of the year.

Should the holder of a Capacity Agreement fail to deliver their de-rated capacity during a system stress event, financial penalties apply.

Market conditions which would increase the probability of a system stress event occurring are likely to be associated with high prices in the UK. Price spreads between GB and Continental Europe are expected to lead to flows on IFA and Britned which complement delivery of their capacity agreements. EWIC and Moyle are most likely to export from GB to Ireland during peak hours. The proportionally smaller obligations held by these interconnectors reflect the lower expectation of their imports to GB. There are a number of options available to capacity providers to manage the risk of penalties, including physical secondary trading and volume reallocation. Secondary trading allows capacity providers to transfer their capacity obligation to a third party. Volume reallocation allows capacity providers who have over-delivered to offer reallocation of their excess to those that have under-delivered.

Figure 1.6
Capacity obligations held by interconnectors for winter 2017/18



Prices

The North Western Europe (NWE) day-ahead coupling regime introduced implicit trading during day ahead. It has resulted in a narrowing of prices between the Belgian, Dutch, French, Austrian and German markets. The introduction of the Cross-Border Intraday Market Project (XBID) in Continental Europe in late 2017 will also contribute to lower power prices on the continent in intraday timescales.

We have used historical price information, combined with the latest forward prices, to forecast interconnector imports this winter.

Europe and connected markets

France and the Netherlands

The forward prices for winter 2017/2018 are higher in France than GB although the Netherlands remains lower than both. We expect net imports to GB during peak periods, via Britned. The forecast for IFA is less certain and will be significantly influenced by weather conditions and the available plant mix in France.

During winter 2016/17 France had a significant reduction in nuclear output capability as a result of maintenance outages. This led to higher power prices than previously experienced. Further inspections on French nuclear plant should not impact the generators' availability during winter 2017/18, however, the market has reacted with slight increases to forward prices factoring in the potential risk to the availability of the French nuclear fleet.

Germany

German forward prices for winter 2017/18 have increased since winter 2016/17. This is a result of increases in the European Union Emission Allowance (EUA) prices and high coal prices. However the forward prices remain lower than the forward prices in GB.

Germany has a good generation capacity. The outlook for gas units is more profitable compared with the least efficient coal units.

A total of 7.6 GW of coal and lignite power plants are being mothballed until the end of 2019, eventually being replaced by mainly renewable energy sources. Wind and solar installed capacity now makes up around 50 per cent of total installed capacity in Germany and may reach 100 GW in the spring of 2018. This capacity is weather dependent, increasing price fluctuations on the intraday German market.

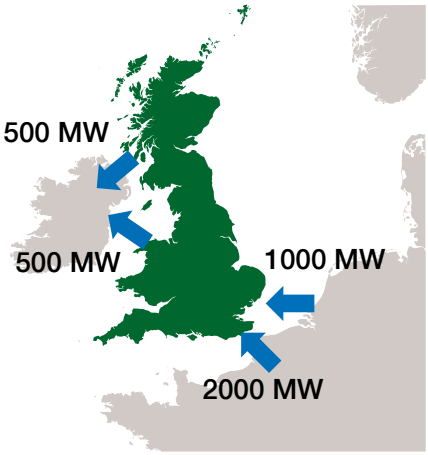
Ireland

During winter 2016/17, EWIC and Moyle exported from GB to Ireland over peak periods, and imported overnight. For winter 2017/18 we expect to see a similar trend. Again we expect to see a net flow from GB to Ireland over both interconnectors during peak times, and we expect imports into GB during periods of high wind power output in Ireland and overnight.

Assumptions

- Forward prices throughout Europe for winter 2017/18 are higher than last year.
- GB forward prices will remain higher than in Continental Europe.
- In Germany, forward prices remain lower than forward prices in GB due to the increase in renewable energy installed capacity, and a gradual transition from old coal-fired plants.
- German electricity generation is increasingly weather dependent and this may increase price fluctuations.
- The introduction of the Cross-Border Intraday Market Project (XBID) may reduce prices in Continental Europe.
- All of the scenarios assume full exports to Ireland, which adds 1,000MW to expected demand.

Figure 1.7
Forecast flows on the interconnectors during peak periods



Operational toolbox

This year is the first full year operating within the Capacity Market. This section provides information to remind the industry about the types of notifications that National Grid may issue this winter in times of system stress.

Overview

New notifications were introduced in winter 2016/17 during the transitional stages of the Capacity Market. These were the Electricity Margin Notice and the Capacity Market Notice.

Here we provide more information about these notices to remind industry of the operational tools we use to ensure security of supply.

Spotlight: Electricity Margin Notice

The Electricity Margin Notice (EMN) is the first of the hierarchy of notifications issued by National Grid to manage security of supply.

An EMN is part of the first level of operational notifications issued by National Grid at times of system stress. An EMN can be issued any time by our control room via BM Reports, but is usually within 24 hours of the suspected period of tightness. It is a routine tool that is designed to inform the industry of the forecasted position and the request for additional capacity to be made available. Additional capacity is most often required for the evening peak demand period.

In response to an EMN being issued, we would typically expect more plant to be made available to the market and existing plant to run more reliably. In most cases this would prevent the need for further action and allow the notification to be withdrawn at a later time.

In addition, a CMN may also be issued. It is independent of the EMN, meaning that one can exist without the other.

If the market does not respond when an EMN is issued (or the response is not enough) there are a number of further actions that the System Operator can take. If all market options have been exhausted we are then able to use other services, such as maximum generation. This is a request made to power stations to generate at their highest possible output, in excess of normal technical and commercial parameters. Should these actions prove insufficient, it is possible to issue instructions to DNOs to request stages of voltage reduction to avoid the shortfall. This can make hundreds of megawatts available and in most cases goes unnoticed by consumers.

Spotlight: Capacity Market Notice

The Capacity Market has been introduced by the UK Government as part of the Electricity Market Reform programme.

It aims to ensure the future security of our electricity supply by providing a payment for reliable sources of capacity, alongside electricity revenues, to ensure the delivery of energy when needed. This aims to encourage the investment we need to replace older power stations and provide backup for more intermittent and inflexible low carbon generation sources. The Capacity Market delivery year runs from 1 October to 30 September.

A decision to issue a Capacity Market Notice (CMN) is based on available data provided by industry participants. It calculates the predicted shortfall between the forecast volume of demand on the electricity transmission system (plus the volume of operating margin held in reserve by National Grid) and the availability declared by generators. Four hours ahead of real time, if there is a heightened risk of a national shortage of generation (500MW or less) which is considered a period of system stress, the automated notice is generated by National Grid. The market is expected to respond to this notice by adjusting its position, with providers either delivering energy or reducing demand against their agreement.

Capacity providers are required to deliver in accordance with their capacity obligations. Failure to do so will result in financial penalties. Capacity providers that over-deliver may be eligible for additional payments.

It should be noted that there is no formal dispatch mechanism in the Capacity Market. In the event of a CMN being activated it is recommended that industry participants make themselves aware of other operational information available to the industry closer to the time the notice is active from. These include, for example, the **BM Reports website**.

A CMN will be issued by National Grid via a dedicated website (**www.gbcmn.nationalgrid.co.uk/**). All industry participants and stakeholders can view this website. They can also subscribe for automated email and SMS alerts. The Capacity Market Notice can be cancelled if the situation improves, based on data being updated in real time.

More information can be found at:
www.emrdeliverybody.com/cm/home.aspx

www.ofgem.gov.uk/electricity/wholesale-market/market-efficiency-review-and-reform/electricity-market-reform/capacity-market-cm-rules

https://gbcmn.nationalgrid.co.uk/faq

www.bmreports.com

Chapter two

Gas – Winter outlook

This chapter sets out our current view of the gas system for winter 2017/18. It details our analysis of supply and demand, and the preparations we have made to make sure we are ready for the winter ahead.

The chapter contains the following sections:

- Gas demand
- Gas supply
- Non-beach supplies
- Network capability
- Operational toolbox.

Gas demand

This section focuses on our forecast expectations of demand levels for winter 2017/18.

Key messages

- We expect gas demand for winter 2017/18 to be lower than the demand for winter 2016/17.
- We expect the biggest reduction in demand to be in gas for electricity generation.
- Less gas is forecasted to be exported through IUK.

Key terms

- **Non-daily metered (NDM) demand:** a classification of customers where gas meters are read monthly or at longer intervals. These are typically residential, commercial or smaller industrial consumers.
- **Daily metered (DM) demand:** a classification of customers where gas meters are read daily. These are typically large-scale consumers.
- **Seasonal normal conditions:** a set of conditions representing the average weather that we could reasonably expect to occur. We use industry-agreed seasonal normal weather conditions. These reflect recent changes in climate conditions, rather than being a simple average of historic weather.
- **1-in-20 peak demand:** The level of demand that, in a long series of winters, with connected load held at levels appropriate to the winter in question, would be exceeded in one out of 20 winters, with each winter counted only once.
- **Shrinkage:** Gas used in the operation of the system.

Gas demand

Overview

In this chapter we consider daily and seasonal demand for the winter for different sectors. We also consider the demand expected under 1-in-20 cold weather conditions and compare this with historical high demands. Gas for export and for storage injection is mentioned here but is covered in more detail in the non-beach supplies section.

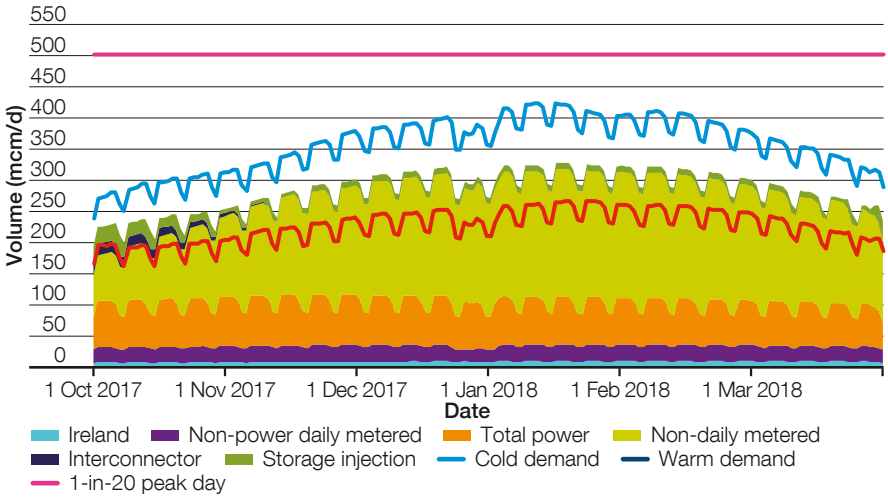
Seasonal demand

Demand for gas can be considered in three categories:

- **Demand for heat in residential and commercial properties.** This sector is very sensitive to weather. Customers in this category are usually on non-daily metered (NDM) contracts. This means that their meters are read monthly, or at longer intervals. Residential demand makes up by far the biggest part of the NDM sector.
- **Demand in industrial properties.** Gas is used to provide space heating, heat for processes, or as a raw material. This sector is much less sensitive to the effects of the weather than the NDM sector. Customers in this category are nearly always on daily metered (DM) contracts. This means that their meters are read automatically every day. They may be connected to the high pressure transmission network, or to a lower pressure distribution network.
- **Gas for electricity generation.** Electricity generation has some sensitivity to weather, but also depends on the hours of darkness. Gas-fired generation, as a proportion of total electricity supply, varies with the amount of electricity from renewable sources and is also dependent on the relative prices of generation at gas-fired and coal-fired power stations.

Figure 2.1 shows the forecast daily gas demand for winter 2017/18. The non-daily metered sector is by far the largest, and also the only one to show significant weather sensitivity.

Figure 2.1
Forecast daily gas demand by sector



Our forecasts for any given period, more than a few days ahead, assume that the weather will be neither hotter nor colder than the long-term average, a condition known as seasonal normal. Figure 2.1 also shows lines for cold and warm demand. These represent the upper and lower limits within which demand might be expected to vary from the seasonal normal solely as a result of variations in the weather.

Gas demand

Table 2.1 shows how our forecast for winter 2017/18 compares with previous winters.

For the history we have shown the demand corrected for the effects of the weather.

Table 2.1
[7]Winter demand – forecast and weather corrected history

Winter demand in bcm	Weather corrected history				Forecast 2016 and 2017	
	2013/14	2014/15	2015/16	2016/17	2016/17	2017/18
NDM	29.0	29.3	29.6	29.7	29.5	30.0
DM ex. generation	5.2	4.9	4.7	5.0	5.0	4.6
Electricity generation	7.9	8.7	10.4	13.8	11.1	12.4
Ireland	2.9	2.9	2.6	1.6	1.4	1.6
IUK export	0.6	1.5	2.7	0.8	0.8	0.4
Storage injection	1.8	0.9	1.2	1.8	1.2	2.1
Total	**47.5**	**48.3**	**51.4**	**52.9**	**49.1**	**51.4[8]**

We are expecting a slight increase in demand in the NDM sector. Demand in individual properties is decreasing from year to year as more insulation is fitted and newer, more efficient boilers replace older models. However, this is more than offset by an increase in the number of properties using gas. Therefore we expect total NDM demand to rise slightly. This is discussed in more detail in our *Future Energy Scenarios*[9].

Demand in the DM sector, which here excludes gas used for electricity generation, is fairly stable, showing no particular trend over the last four winters.

Gas for electricity generation is expected to be lower than we experienced last winter.

Total GB electricity generation was higher than forecast for winter 2016/17. This was as a result of lower than expected imports of electricity from France. We expect gas-fired generation will be cheaper than coal-fired generation and so will run above coal in the generation merit order as it did last year. However, the actual electricity generation we observed last winter was higher than forecast, therefore the forecast for gas for electricity generation this winter is lower.

Gas exports to Ireland are expected to be similar to last year. This is considerably lower than the historical average as the Corrib gas field off the west coast of Ireland is now at full production, reducing the demand for gas from GB.

We are expecting that demand for IUK export and storage injection will be different to last year. These are discussed further in the non-beach supplies section.

[7] Please note that Rough long-range storage has not been included in our forecasts.

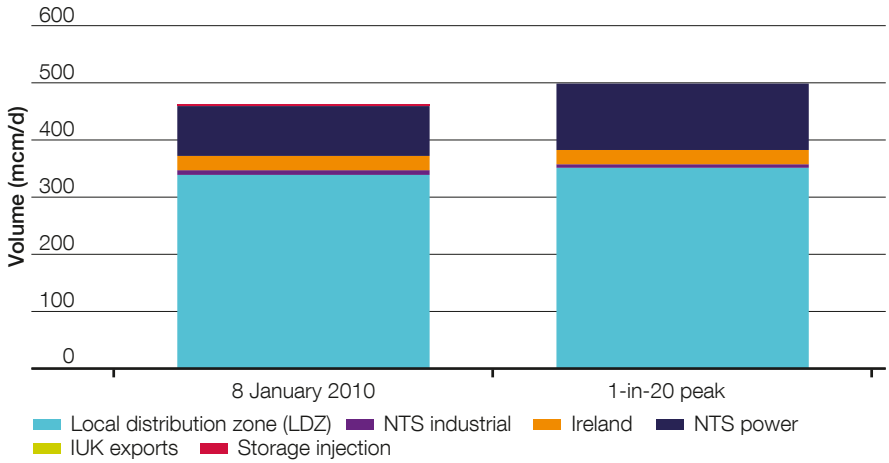
[8] All totals include Shrinkage and therefore columns will not tally.

[9] http://fes.nationalgrid.com/

Peak demand

Figure 2.1 also shows the 1-in-20 peak demand. This is the national demand calculated for a weather condition that might be expected only once in 20 years. The forecast 1-in-20 peak for 2017/18 is 502 mcm/day, significantly higher than the cold demand curve as illustrated in figure 2.1. The last four winters have all been warmer the long-term average, but we do not infer from this that winter 2017/18 will also be warm. We plan for the winter assuming that the weather will be seasonal normal, but we are prepared for colder conditions. Figure 2.2 shows the 1-in-20 peak demand and the highest recorded gas demand, in January 2010, is shown for comparison.

Figure 2.2
1-in-20 peak demand forecast and highest demand



Gas demand

Demand assumptions

- We expect gas demand to be slightly lower in winter 2017/18 than in winter 2016/17. The biggest change is expected to be in gas for electricity generation.
- Demand in the NDM sector should be slightly higher than winter 2016/17. This continues a trend seen over the last four winters.
- We expect demand in the DM market sector to be similar to demands seen over the last four winters.
- We are expecting strong supplies of gas from Europe through the interconnectors and as a result there will be less export demand.
- With no long-range storage available for injection we are expecting more cycling of gas through the medium-range storage facilities throughout the winter. This is covered in more detail in the non-beach supplies section.

Gas supply

The gas supply section provides our forecast view of beach supplies. This section covers gas entering the network from the UKCS and from Norway.

Key messages

- We expect there to be sufficient gas available from a wide range of sources to meet winter 2017/18 demand.
- Supplies from Norway are expected to be high, similar to last year.
- We are expecting imports through IUK to be high.
- There is capacity for imports through BBL to increase beyond last winter's values in response to high prices.

Key terms

- **UK Continental Shelf (UKCS):** made up of the areas of the sea bed and subsoil beyond the territorial sea over which the UK exercises sovereign rights of exploration and exploitation of natural resources.
- **Beach supplies:** Gas produced offshore and brought onshore to the shore/beach gas terminal, but not yet part of the National Transmission System (NTS).
- **National balancing point (NBP) gas price:** the wholesale gas market in Britain has one price for gas, irrespective of where it has come from. This is called the national balancing point price of gas. It is usually quoted in pence per therm.

Overview

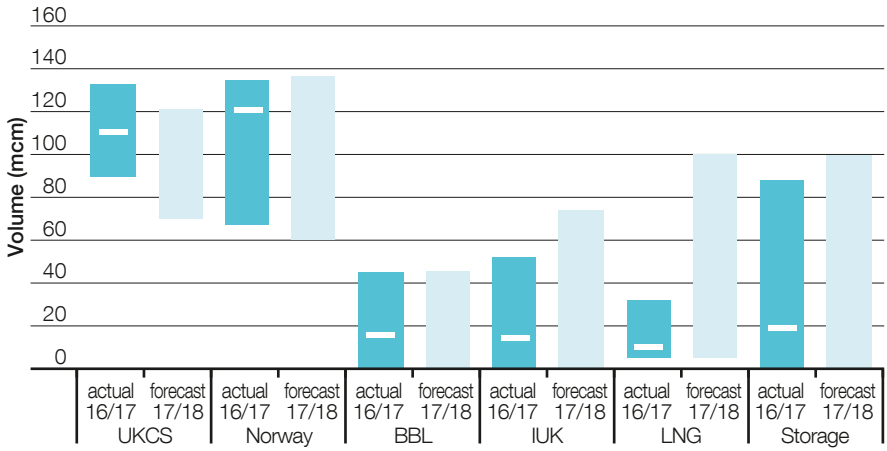
In this chapter we look at the supplies of gas that we expect to receive from different sources. This year we have considered 'beach' supplies as gas from the UK Continental Shelf (UKCS) and from Norway. Beach gas can be expected to run at close to maximum levels through most of the winter, while the non-beach supplies (storage, Liquefied Natural Gas (LNG) and gas imported through the interconnectors) will be more responsive to gas prices, in both the GB and global gas markets.

Gas supply

Total supply

For the winter ahead we do not forecast the total volume of gas that we expect from each source. Instead we have forecast the ranges that we expect for each, as this is more useful from an operational viewpoint. We also consider the flow that we might expect from each source on a cold day. Figure 2.3 shows the forecast range for this winter and the range observed in winter 2016/17 for each supply type. The average flow seen in winter 2016/17 is also shown as the white bar. Our forecast ranges are based on historical flows, market intelligence, and for some sources, on the physical capability of the infrastructure.

Figure 2.3
Historic actual and forecast ranges for gas supply



Forecast and observed ranges are also shown in table 2.2 , but here we have also included our projections for a 'cold day'. The cold day is taken from day 1 on the average load duration curve. Load duration curves are published every year in our *Gas Ten Year Statement*[10]. For winter 2016/17 we have also included the range of flows from all days where total supply exceeded 350 mcm/day.

[10] http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Gas-Ten-Year-Statement/

Table 2.2
Historical and forecast ranges[11]

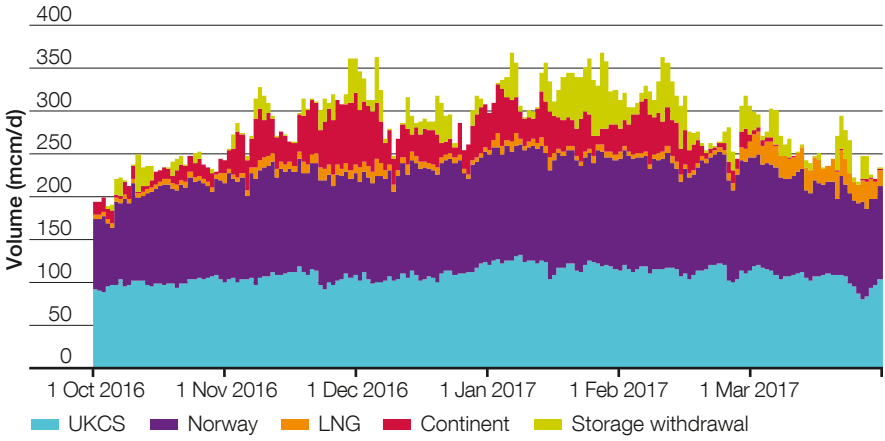
	2015/16	2016/17				2017/18	
(mcm/d)	Observed range	Forecast range	Observed range	Cold day	350 + range	Forecast range	Cold day
UKCS	73 – 118	70 – 118	89 – 132	107	100 – 130	70 – 121	109
Norway	55 – 118	60 – 136	67 – 134	115	115 – 134	60 – 136	120
BBL	0 – 33	0 – 45	0 – 45	35	14 – 45	0 – 45	30
IUK	0 – 14	0 – 74	0 – 51	45	5 – 45	0 – 74	45
LNG	6 – 59	5 – 100	5 – 27	50	5 – 21	5– 100	50
Total NSS				352			354
Storage	0 – 98	0 – 130	0 – 88		40 – 88	0 – 92	

Beach supply

When considering gas supply it can be convenient to treat supplies from the UK Continental Shelf (UKCS) and Norway, jointly. We refer to them as beach supply and they will be explored separately from other, non-beach sources, which will be considered later.

Figure 2.4 illustrates the daily supply flows from winter 2016/17. We see that both UKCS and Norwegian flows showed little variation at least for the colder part of the winter, from November to February. The day-to-day variation is all taken up by non-beach sources.

Figure 2.4
Daily supply flows for winter 2016/17

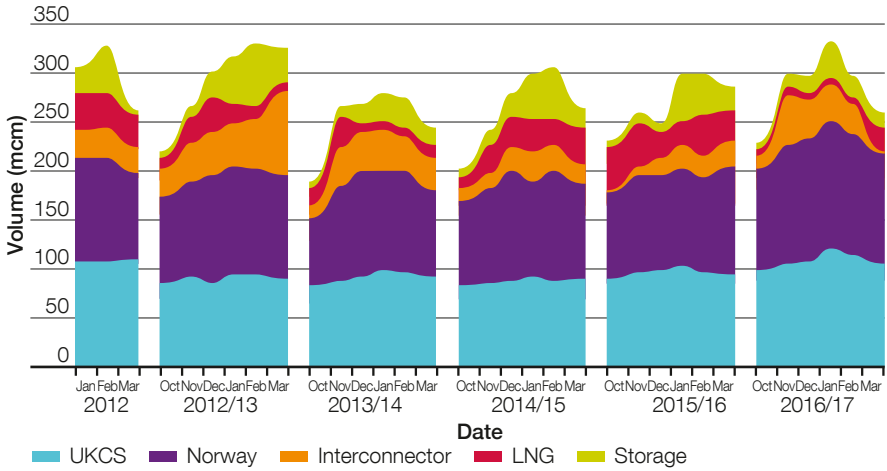


[11] Please note that Rough long-range storage site has not been included in our forecast range

Gas supply

This pattern of stable beach supplies with variation in the non-beach supplies has been consistent for several years, as shown in figure 2.5.

Figure 2.5
Historical winter average daily supply by month



UKCS

Our UKCS projections are based on information received from producers as part of our annual *Future Energy Scenarios* stakeholder engagement process. Last winter the flows from the UKCS were higher than forecast. There were a number of new fields in operation and some of these performed particularly well. Our forecast for this winter is higher than last winter's forecast, but our best available information does not suggest that flows will reach the high levels observed last winter.

Norway

We are expecting supplies from Norway to be similar to winter 2016/17. Supplies last winter were high, and current intelligence suggests that production will be high again this winter. In particular the production cap on the Troll field has been raised from 33 bcm for the 2016/17 gas year, to 36 bcm for gas year 2017/18.

Spotlight: Supply

National Grid ensures that gas is safely and efficiently transported from various supply points to where demand is needed across the network in accordance with customer requirement.

The UK Continental Shelf (UKCS) remains a significant and reliable component of the total supply base. Over the past two years we have experienced a return to the predominance of total flows via beach locations in the North and East of mainland Britain.

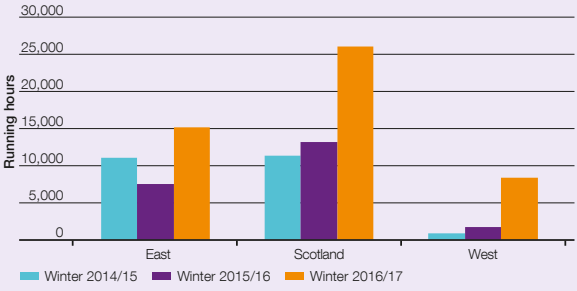
In the winter of 2016/17, around 78 per cent of total gas supply came through St Fergus, Easington and Bacton. St Fergus alone observed flows increase by 24 per cent compared with the same period in 2015/16. Similarly flows through Bacton increased by 37 per cent compared with the same period the previous year. As a result of this, National Grid has to ensure that the compressor fleet is able to move the gas from source to the key demand points across the network. This has resulted in a substantial increase in the use of our compressor fleet, both across the whole NTS and from the key strategic assets.

During winter 2016/17, overall compressor running hours increased by 49 per cent. This can be seen in figure 2.6 below. We expect compressor running hours to continue to be high this winter. This increases reliance on key assets within the fleet. This is further magnified because of the additional duty placed on these assets in having to operate in a much more frequent stop-start mode of operation. This is a consequence of the changing requirements within-day from customers seeking to maximise their portfolios closer to real time.

The capability to respond more dynamically to the market has an impact on system pressure stability. Pressure variability is more pronounced at the extremities of the network or where there are a large number of connected customers in one regional location. While system pressures remain within the contractual and safety tolerances, the changing commercial needs of our customers require us to operate the network very differently.

This very dynamic flow characteristic associated with the supply and demand profile impacts our ability to maintain the stable and smooth pressure transitions that were experienced historically. This has resulted in some customers experiencing significant pressure changes day to day and within-day as the duty placed on linepack becomes a much more dominant central component.

Figure 2.6
Compressor running hours winter 2014/15 to 2016/17



Non-beach supplies

This section looks at the more dynamic supply sources: storage, LNG and interconnectors – referred to as non-beach supplies throughout this document.

Key messages

- LNG flows respond to conditions in the global market, which makes forecasting deliveries to GB challenging.
- Rough storage will be available for withdrawals from early October 2017.
- Similar to winter 2016/17, we expect continued cycling of gas via medium-range storage.
- We expect strong imports from IUK.

Key terms

- **BBL:** a gas pipeline between Balgzand in the Netherlands and Bacton in the UK.
- **IUK:** Interconnector (UK). A bi-directional gas pipeline between Bacton in the UK and Zeebrugge in Belgium.
- **Liquefied natural gas (LNG):** Formed by chilling natural gas to -161˚C to condense as a liquid. Its volume reduces 600 times from the gaseous form.
- **Long-range storage (LRS):** sometimes also referred to as seasonal storage, long-range storage is used to balance supply and demand between winter and summer. Gas is put into storage in the summer when demand is low and withdrawn in the winter when demand and prices are higher. There was one long-range storage site on the National Transmission System: Rough, situated off the Yorkshire coast. Rough is owned by Centrica. Rough closed as a storage site in June 2017.
- **Medium-range storage (MRS):** these commercially operated sites have shorter injection/withdrawal times. This means they can react quickly to demand, injecting when demand or prices are low and withdrawing when they are higher.

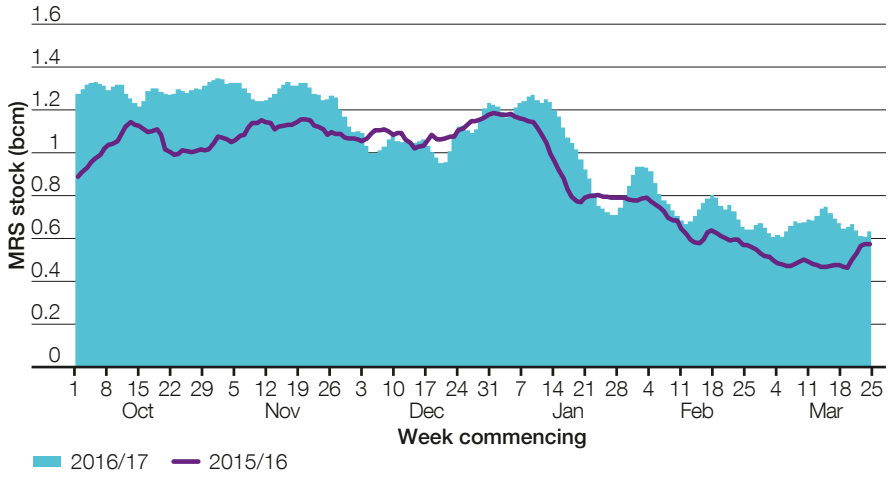
Storage

Storage[12], as a component of non-beach supply, is shown in figure 2.5. In 2015 the storage sites[13] could collectively hold 4.7 bcm of gas, and deliver up to 162mcm /day. However, the largest supply site, Rough, has had technical problems for the last two years and in June 2017 its owners, Centrica Storage Ltd, announced that the site is to close.

There still remains some 4 bcm of gas left in Rough. Centrica Storage Ltd have announced that they expect nearly 1 bcm to be withdrawn this winter. Deliverability will start at around 12mcm/day from early October falling to around 6mcm/d as gas is withdrawn. This is principally a safety measure, designed to lower the pressure in the reservoir. For the latest views on Rough please see the Centrica Storage website[14].

With the impending closure of Rough, there remains 1.4 bcm of storage space and 121 mcm/day of deliverability available across the remaining medium-range storage (MRS) facilities. Significantly, many are capable of a rapid transition between injection and withdrawal, along with strong deliverability. This means these sites can re-cycle or replenish very quickly. Winter 2016/17 was the first time that there was a restriction on the gas available from Rough and consequently we observed more withdrawal and re-injection (cycling) of gas at MRS sites than in previous years, as shown in figure 2.7.

Figure 2.7
Stock held in medium-range storage in winters 2015/16 and 2016/17



[12] Please note that Rough long-range storage facility has not been included in any of our forecasts

[13] Details of storage sites can be found in our *Gas Ten Year Statement* http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Gas-Ten-Year-Statement/

[14] http://www.centrica-sl.co.uk/home

Non-beach supplies

In response to our winter consultation, our stakeholders expressed a variety of views;

- that MRS stocks would remain high until Quarter 1 2018
- that there would be significant withdrawal and re-injection
- that behaviour would be similar to last year.

In our gas demand projections shown in table 2.1 on page 42 we have increased the demand for storage injection, anticipating slightly more withdrawal and re-injection than last year.

Spotlight: Medium-range storage

GB benefits from variable and diverse gas supplies. One important element of GB's gas supply is medium-range storage (MRS).

Typically, supplies from MRS are quite dynamic as opposed to seasonal. They can range from no flow to maximum flow, from all facilities, at times of high gas demand or price. Last winter medium-range storage responded well to market conditions. It provided flexibility in response to restrictions at the long-range storage facility, Rough. Restrictions at Rough meant no gas was injected into the facility last winter, and there were no gas withdrawals until early December. In any winter, storage supplies tend to show considerable variability and flexibility.

The working capacity of storage is an important element of security of supply. Even more important is the injection and withdrawal capability of a facility. Most MRS facilities in GB can change behaviour, rapidly switching from withdrawal to injection and visa versa; this is known as cycling. MRS will typically cycle many times during the winter and can even cycle during a gas day. This means facilities are capable of being constantly replenished to ensure maximum supplies throughout periods of high demand. In comparison, long-range storage was used to provide additional seasonal supplies and so had greater volume, but it did not have the same capability of rapid cycling that MRS has.

Last winter, having no previous experience of a winter with restrictions at Rough, several questions were raised concerning storage behaviour; for example, would shippers continue to cycle medium-range storage between injection and withdrawal? Or, would there be a tendency to hold stocks in storage in anticipation of colder weather or higher prices? What we observed was MRS responding to shifts in the supply and demand dynamics. We experienced an increase in cycling, withdrawing high volumes in late November before refilling when demand reduced over the Christmas and New Year period.

Non-beach supplies

Interconnectors

In winter 2016/17 gas delivered through the BBL and IUK interconnectors made up the largest part of non-beach supplies. Gas flowed from GB to Belgium through summer 2017 at very high rates, on occasions reaching 60 mcm/day, close to the maximum capacity. Forward prices for Zeebrugge and the NBP suggest that gas will flow from Belgium to GB during the winter. IUK has the capacity to deliver 74 mcm/day to the GB market. It has only reached this level on a few occasions, most recently in 2013 when demand was high and storage was depleted after an unusually cold spell in March. Therefore, we have assumed in our forecast ranges that it could do so again.

Flows through BBL have historically been less driven by the price spread between the GB and Dutch markets, than by long-term contracts. In December 2016 some of the long-term capacity contracts held by shippers in BBL expired. Since that date flows through BBL have not exceeded 20 mcm/day. This is a significant reduction from the 45 mcm/day capacity of the pipeline. In response to our winter consultation, stakeholders told us that they think higher flows might happen this winter, with shippers buying capacity on a short-term basis, if the price spread between the Dutch TTF hub and the NBP price is large enough. This will probably not happen until beach supplies, storage, and IUK flows are all at, or near, maximum.

This winter flows through BBL may be constrained by production limits on the Groningen field in the Netherlands. The Netherlands has two separate gas networks for gases of different qualities. Groningen produces gas with lower calorific value; L gas (or sometime referred to as G gas). This is used for all residential heating in the Netherlands but is unsuitable for export to GB. Gas with a higher calorific value, H gas, is produced from some Dutch fields and also imported from other countries. Exports through BBL contain only H gas. If production of L gas is insufficient to meet domestic demand, H gas can be converted to L gas which may leave less gas available for export to GB via BBL.

Production at Groningen has been reduced since 2014 in response to seismic events in the Groningen area. The cap for gas year 2017/18 has been set at 21.6 bcm, down from 24 bcm in gas year 2016/17. A decision on a possible further cut will be made in November 2017.

Liquefied Natural Gas (LNG)

Market intelligence suggested that there would be high deliveries of LNG in winter 2016/17 but in fact they were much lower. Deliveries increased to many Asian markets where higher prices were available. We discussed this at length in our last *Winter Review and Consultation*[15]. This highlights the challenges of trying to forecast deliveries of a commodity that is traded globally.

In July 2017, GB received its first cargo of LNG from the US. However, very few cargoes from the US have been delivered to North West Europe and we are not anticipating any change in this for winter 2017/18.

In June 2017 a number of countries, including Saudi Arabia, UAE and Egypt, broke off diplomatic ties with Qatar. Qatar is the sole supplier of LNG to the South Hook terminal at Milford Haven. Analysis at the time suggested that there would be little impact on deliveries of Qatari gas to GB. Deliveries in July were greater than in June, suggesting that the analysis was correct.

Deliveries of LNG have been lower in every month this year than the corresponding month last year. This reflects higher demands and therefore prices elsewhere rather than any interruption in Qatari supplies. In July and August the aggregate stock level at the three LNG import terminals averaged around 70 per cent of total capacity. With demand in GB low for the summer, and exports through IUK running at close to capacity, there was very little scope for more LNG import.

The three LNG terminals have an aggregate capacity of around 1 bcm. Our forecast cold day range for LNG flows reaches 100 mcm/day.

Supply assumptions

- We expect there to be sufficient gas available from a wide range of sources to meet winter 2017/18 demand.
- Supplies from Norway are expected to be high, similar to last year.
- We are expecting imports through IUK to be high.
- There is capacity for imports through BBL to increase beyond last winter's values in response to high prices.
- There is no indication that LNG imports will be interrupted by the diplomatic crisis in Qatar.

[15] http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=8589940840

Network capability

This section focuses on our responsibilities and obligations for gas security of supply.

Headlines

The System Operator is obliged to:

- Ensure the network has the capability and infrastructure to transport the amount of gas to meet a 1-in-20 peak day demand in a severe winter.
- Ensure there is sufficient redundancy in the network to transport the gas to meet a 1-in-20 peak day demand with the loss of the largest single piece of infrastructure on the network.

Key terms

- **1-in-20 peak day demand:** the level of demand that, in a long series of winters, with connected load held at levels appropriate to the winter in question, would be exceeded in one out of 20 winters, with each winter counted only once.

Network capability and peak day supply margins

National Grid has the responsibility to ensure the safe, reliable and efficient operation of the National Transmission System (NTS). As we mentioned earlier in the document, National Grid own and operate the high pressure network and are responsible for managing the flow of gas to our connected customers. We do not own the gas we transport; neither do we sell it on to consumers, that is the responsibility of the shippers and suppliers. In order to meet National Grid's obligations to our customers we must:

i) Ensure we have a network infrastructure capable of transporting gas
ii) Ensure there is sufficient redundancy in the infrastructure of the network.

We must be able to achieve these requirements even in the most severe winters.

In order to demonstrate compliance, we have to make sure that the network is designed and built to meet a 1-in-20 peak day demand as required under the Gas Transporters Licence. This is defined as the amount of infrastructure (pipes and compressors etc.) needed to transport the gas that would be required by our customers in the coldest day of winter, in the coldest winter we could expect in a 20 year period. This forecast value is higher than the record peak day demand of 465mcm experienced in winter 2010/11.

We are also governed by EU legislation, in particular the European Gas Security of Supply Regulation. This requires us to ensure that the network has sufficient redundancy to meet a 1-in-20 peak day demand even with the failure of a major piece of infrastructure.

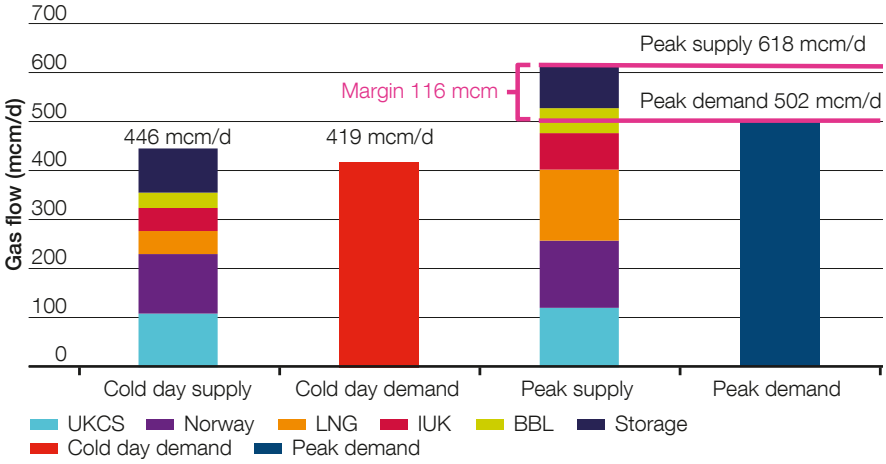
In summary we need to be able to transport the amount of gas to sustain a 1-in-20 peak day demand and, in the event of losing a major piece of the network, we have sufficient capacity in the network to allow us to accomplish this.

Cold day assessment

In table 2.2 on page 47, we showed our forecast for gas supply on a cold day which we defined as day 1 from the average load duration curve. The cold day forecast is used in the calculations for the margins notice assessment as described in the Operational Toolbox section.

For winter 2017/18, the cold day demand forecast is 419mcm/day. The non-storage supply forecast is 354mcm/day, to which 92mcm of storage can be added, giving a total of 446mcm/day. The forecast cold day supply is comfortably in excess of the cold day demand, as shown in figure 2.8.

Figure 2.8
Supply and demand on a cold day and a 1-in-20 peak day



Network capability

N-1 assessment

In the case of a 1-in-20 peak day we would expect supplies to be much higher than the cold day used in the margins notice assessment. Figure 2.8 also shows the supply and demand forecast for a 1-in-20 peak day. The margin of supply over demand here is 116mcm/day.

Security of the gas supply network is assessed by the European Commission using the N-1 test[16]. This tests whether forecast supply would match demand in the event of the failure of the largest single piece of gas supply infrastructure. For example, using this winter's margin of 116mcm/d; if the loss of supply is lower than the margin, the n-1 test is passed.

[16] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/560125/UK_Risk_Assessment_Gas_BEIS_template_Final__4_.pdf

Operational toolbox

This section provides information to help the industry better understand the information provision and processes we may use in times of stress on the network.

Headlines

- There are no changes to the processes available to National Grid this coming winter.
- The winter 2017/18 safety monitor has been set at 647 GWh (58.82 mcm) of space, with 512 GWh/d (46.55 mcm/d) of deliverability.

Key terms

- **Safety monitor:** assesses and ensures that sufficient gas supplies remain in storage to support those gas consumers whose premises cannot be physically and verifiably isolated from the gas network within a reasonable time frame, should there be an event that impacts security of supply. It defines the requirements for both space and the deliverability for the highest demand day. It is made up of two elements: protected by monitor and protected by isolation.
- **Protected by monitor:** applies to sites that cannot be safely isolated from the gas network. Their gas demand is determined over a cold winter. The amount of gas required is compared to the non-storage supply (NSS) for the winter. Where there is not enough NSS to meet this demand, this is the volume of gas that needs to be available in storage.
- **Protected by isolation:** applies to sites that could be safely isolated from the gas network, but not instantaneously. As a result, there is an additional gas demand associated with the isolation process. The time and associated gas demand required to isolate them is established via the results of emergency exercises.

Overview

The market is responsible for trading gas up to the end of the gas day. Shippers have a responsibility to ensure their portfolio is balanced at the end of the gas day. National Grid has a responsibility, in its role as Residual Balancer, to ensure the overall balance of the National Transmission System (NTS) is within safe physical operating limits and is incentivised to do this efficiently. National Grid has a selection of tools that can be used to achieve this. In this section we will explore some of the tools that we are able to use for more challenging conditions.

Operational toolbox

Operational notifications

As the System Operator, we can issue a range of notifications to the market to raise awareness of system conditions. Some of the operational notifications that can be issued in more challenging conditions are described in this section.

Margins notice

This is a day-ahead notice to provide a high level prompt to the market of a potential supply and demand imbalance for the forthcoming Gas Day. The trigger level of demand is published on the National Grid website on the **Prevailing View page**.

The margins notice (MN) is meant to encourage users of the NTS to take notice of the rolling Daily Margins report[17] and to reassess their position in line with the prevailing forecasts. A margins notice will stay in place until the end of the gas day, unless it is superseded by a Gas Deficit Warning when it will be suspended.

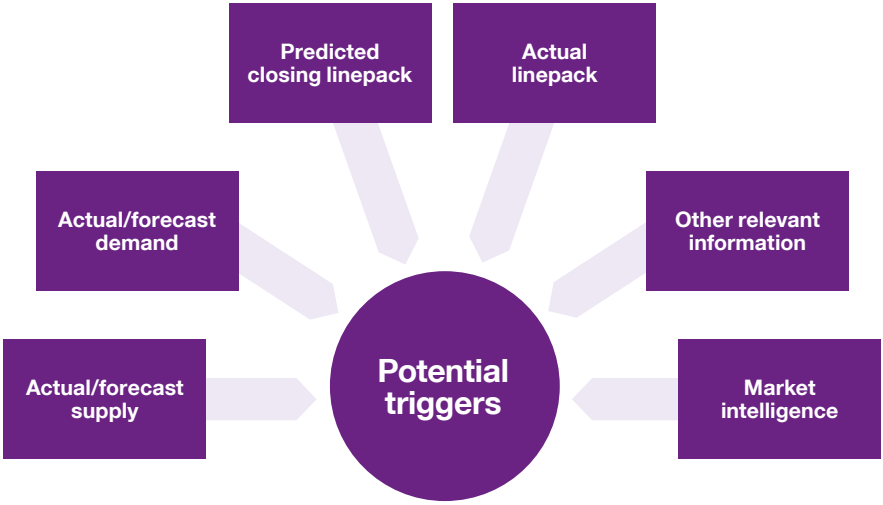
We publish a daily margins notice report providing industry with a rolling five-day view of supply and demand data and information relating to the storage safety monitors.

[17] http://www2.nationalgrid.com/uk/industry-information/gas-transmission-system-operations/balancing/daily-margins-notice-report/

National Gas Deficit Warning

A Gas Deficit Warning notice is designed to encourage market participants to take action to address a forecast physical end of day NTS supply and demand imbalance. There are no predefined triggers and the warning is based on the judgement of the Gas National Control Centre. The decision to issue will be based on the information from any of the sources shown in figure 2.9.

Figure 2.9
Potential triggers of a Gas Deficit Warning



Shippers should seek to balance their portfolio and be prepared to respond to any balancing action requests from National Grid.

Operational toolbox

Safety monitor

The safety monitor[18] is an amount of gas, and the rate it can be delivered, that needs to remain in storage in order to supply those customers that cannot be safely or immediately isolated from the gas network. The safety monitor calculates how much gas is needed to supply these customers for a winter period based on a 1-in-50 winter. It is there to maintain the safety of the system by maintaining adequate pressures on the network, rather than to support security of supply. There has not been a breach of the safety monitor level since it was introduced in 2004.

The space requirement of the safety monitor is made up of the 'protected by monitor' and 'protected by isolation' elements. The total space requirement is then divided equally across all storage types and facilities.

We also calculate the rate that the gas needs to be delivered into the NTS based on the amount of gas being held in storage. Defining space and deliverability helps market participants to plan for the winter ahead and helps to indicate the likelihood of a safety monitor breach.

The safety monitor level for this year has been set at 647 GWh (58.82 mcm) of space, with 512 GWh/day (46.55 mcm/d) of deliverability. This represents 4.5 per cent of available storage space which is slightly higher than 2016/17. This increase is partially due to Rough being excluded from the total storage assumptions.

[18] Please note that Rough long-range storage facility has been excluded from the safety monitor calculations

Chapter three

Glossary

Word	Acronym	Section	Description
Balgzand Bacton line	BBL	Gas	A gas pipeline between Balgzand in the Netherlands and Bacton in the UK. You can find out more at **www.bblcompany.com**
Billion cubic metres	bcm	Gas	Unit of volume used in the gas industry. 1 bcm = 1,000,000,000 cubic metres
BritNed		Electricity	BritNed Development Limited is a joint venture of Dutch TenneT and British National Grid that operates the electricity link between Great Britain and the Netherlands. It is a bi-directional interconnector with a capacity of 1,000MW. You can find out more at **www.britned.com**
Capacity Market	CM	Electricity	The Capacity Market is designed to ensure security of electricity supply. This is achieved by providing a payment for reliable sources of capacity, alongside their electricity revenues, ensuring they deliver energy when needed.
Carbon price floor	CPF	Electricity	A price paid by UK generators and large carbon-intensive industries for CO_2 emissions.
Combined cycle gas turbine	CCGT	Various	A power station that uses the combustion of natural gas or liquid fuel to drive a gas turbine generator to produce electricity. The exhaust gas from this process is used to produce steam in a heat recovery boiler. This steam then drives a turbine generator to produce more electricity.
Compressor		Gas	Compressors are used to move gas around the transmission network through high pressure pipelines. They move the gas from entry points to exit points on the gas network. They are predominately gas driven turbines that are in the process of being replaced with electric units.
Cushion gas	CG	Gas	The minimum volume of gas required in an underground storage reservoir to provide the necessary pressure to deliver working gas volumes to customers.
Daily metered	DM	Gas	A classification of customers where gas meters are read daily. These are typically large-scale consumers.
Demand side response	DSR	Various	A deliberate change to an industrial and commercial user's natural pattern of metered electricity or gas consumption, brought about by a signal from another party.
East West Interconnector	EWIC	Electricity	A 500MW interconnector that links the electricity transmission systems of Ireland and Great Britain. You can find out more at **www.eirgridgroup.com/customer-and-industry/interconnection/**
Electricity distributed generation			Generation connected to the distributed networks, the size of which is equal or greater than 1MW and up to the mandatory connection thresholds of the onshore transmission areas. The thresholds are 100MW in NGET transmission area, 30MW in Scottish Power (SP) transmission area and 10MW in Scottish Hydro-Electric Transmission (SHET) transmission area.
Embedded generation		Electricity	Power generating stations/units that don't have a contractual agreement with the National Electricity Transmission System Operator (NETSO). They reduce electricity demand on the transmission system.
Equivalent firm capacity	EFC	Electricity	An assessment of the entire wind fleet's contribution to capacity adequacy. It represents how much of 100 per cent available conventional plant could theoretically replace the entire wind fleet and leave security of supply unchanged. EFC is currently assumed to be 22 per cent.
EU Emissions Trading Scheme	ETS	Gas	An EU-wide system for trading greenhouse gas emission allowances. The scheme covers more than 11,000 power stations and industrial plants in 31 countries.
European Union	EU	Various	A political and economic union of 28 member states that are located in Europe.

Word	Acronym	Section	Description
Future Energy Scenarios	FES	Various	The FES is a range of credible pathways for the future of energy out to 2050. They form the starting point for all transmission network and investment planning, and are used to identify future operability challenges and potential solutions. You can find out more at **http://fes.nationalgrid.com/**
Gigawatt	GW	Electricity	A measure of power 1 GW = 1,000,000,000 watts.
Great Britain	GB	Various	A geographical, social and economic grouping of countries that contains England, Scotland and Wales.
Grid supply points	GSP	Electricity	A connection point between the transmission system and the distribution system.
Interconnector (UK) limited	IUK	Gas	A bi-directional gas pipeline between Bacton in the UK and Zeebrugge in Belgium. You can find out more at **www.interconnector.com**
Interconnector		Electricity or gas	Interconnectors are transmission assets that connect the GB market to Continental Europe and Ireland. They allow suppliers to trade electricity or gas between these markets.
Interconnexion France-Angleterre	IFA	Electricity	The England-France Interconnector is a 2,000 MW electricity link between the French and British transmission systems. Ownership is shared between National Grid and Réseau de Transport d'Electricité (RTE).
Linepack		Gas	The volume of gas within the National Transmission System (NTS) pipelines at any time.
Linepack swing		Gas	The difference between the amount of gas in the system at the start of the day and at the lowest point during the day.
Liquefied natural gas	LNG	Gas	Natural gas that has been converted to liquid form for ease of storage or transport. It is formed by chilling gas to -161˚C so that it occupies 600 times less space than in its gaseous form. You can find out more at **www2.nationalgrid.com/uk/Services/Grain-lng/what-is-lng/**
Load		Various	The energy demand experienced on a system.
Loss of load expectation	LOLE	Electricity	Used to describe electricity security of supply. It is an approach based on probability and is measured in hours/year. It measures the risk, across the whole winter, of demand exceeding supply under normal operation. This does not mean there will be loss of supply for 3 hours per year. It gives an indication of the amount of time, across the whole winter, which the System Operator (SO) will need to call on balancing tools such as voltage reduction, maximum generation or emergency assistance from interconnectors. In most cases, loss of load would be managed without significant impact on end consumers.
Medium-range storage		Gas	Gas storage facilities designed to switch rapidly between injection and withdrawal to maximise the value from changes in gas price.
Megawatt	MW	Electricity	A measure of power 1 MW = 1,000,000 watts.
Million cubic metres	mcm	Gas	Unit of volume used in the gas industry. 1 mcm = 1,000,000 cubic metres
Moyle		Electricity	A 500 MW bi-directional interconnector between Northern Ireland and Scotland. You can find out more at **www.mutual-energy.com**
N-1		Gas	Condition used in a security of supply test, where total supply minus the largest single loss is assessed against total peak demand.
National balancing point (NBP) gas price	NBP	Gas	Britain's wholesale NBP gas price is derived from the buying and selling of natural gas in Britain after it has arrived from offshore production facilities. The wholesale market in Britain has one price for gas, irrespective of where it has come from. It is usually quoted in pence per therm. You can find out more at **https://www.ofgem.gov.uk/gas/wholesale-market/gb-gas-wholesale-market**

Glossary

Word	Acronym	Section	Description
National electricity transmission system	NETS	Electricity	High voltage electricity is transported on the transmission system from where it is produced to where it is needed throughout the country. The system is made up of high voltage electricity wires that extend across Britain and nearby offshore waters. It is owned and maintained by regional transmission companies, while the system as a whole is operated by a single System Operator (SO).
National Transmission System	NTS	Gas	A high pressure gas transportation system consisting of compressor stations, pipelines, multi-junction sites and offtakes. Pipelines transport gas from terminals to offtakes and are designed to operate up to pressures of 94 barg.
Non-daily metered	NDM	Gas	A classification of customers where gas meters are read monthly or at longer intervals. These are typically residential, commercial or smaller industrial consumers.
Non-storage supply	NSS	Gas	All gas supplies to the National Transmission System excluding short-, medium- and long-range storage.
Normalised demand		Electricity	Demand assessed for each week of the year based on a 30-year average of each relevant weather variable. This is then applied to linear regression models to calculate what the demand would have been with this standardised weather.
Operational code 2 data	OC2	Electricity	Information provided to National Grid by generators. It includes their current generation availability and known maintenance outage plans. You can access the latest OC2 data throughout the year on the BM Reports website at **www.bmreports.com**.
Open cycle gas turbine	OCGT	Various	Gas turbines in which air is first compressed in the compressor element before fuel is injected and burned in the combustor.
Peak		Various	The maximum requirement of a system at a given time, or the amount of energy required to supply customers at times when need is greatest. It can refer either to a given moment (e.g. a specific time of day) or to an average over a given period of time (e.g. a specific day or hour of the day).
Profiling		Gas	The rate at which gas is put into or taken off the transmission system during the gas day. A flat profile corresponds to a consistent rate across the day.
Residual balancer		Gas	Users of the gas system are incentivised to balance supply into, and demand from, the network. If this balance is not expected to be achieved on any given day, the System Operator (National Grid), as residual balancer, will enter the market and undertake trades (buys or sells) to seek to resolve any imbalance.
Seasonal normal demand		Gas	The level of gas demand that would be expected on each day of the year. It is calculated using historically observed values that have been weighted to account for climate change.
Station load		Electricity	The onsite power station requirement, for example for systems or start up.
System operability		Gas	The ability to maintain system stability and all of the asset ratings and operational parameters within pre-defined limits safely, economically and sustainably.
System Operator	SO	Various	An entity entrusted with transporting energy in the form of natural gas or electricity on a regional or national level, using fixed infrastructure. The SO may not necessarily own the assets concerned. For example, National Grid operates the electricity transmission system in Scotland, which is owned by Scottish Hydro Electricity Transmission and Scottish Power.
Transmission system demand	TSD	Electricity	Demand that National Grid as System Operator sees at grid supply points (GSPs), which are the connections to the distribution networks. It includes demand from the power stations generating electricity (the station load).

Word	Acronym	Section	Description
Triad		Electricity	Triads are the three half-hourly settlement periods with the highest system demand. Triads can occur in any half-hour on any day between November and February. They must be separated from each other by at least ten days.
Underlying demand		Electricity	A measure of demand that removes the effect of weather and the day of the week.
UK Continental Shelf	UKCS	Gas	The UK Continental Shelf (UKCS) comprises those areas of the sea bed and subsoil beyond the territorial sea over which the UK exercises sovereign rights of exploration and exploitation of natural resources.
United Kingdom of Great Britain and Northern Ireland	UK	Various	A geographical, social and economic grouping of countries that contains England, Scotland, Wales and Northern Ireland.
Weather corrected demand		Electricity	The demand expected or out-turned with the impact of the weather removed. A 30-year average of each relevant weather variable is constructed for each week of the year. This is then applied to linear regression models to calculate what the demand would have been with this standardised weather.
Weather corrected demand		Gas	The demand expected with the impact of weather removed. Actual demand is converted to demand at seasonally normal weather conditions, by multiplying the difference between actual CWV and expected CWV by a value that represents demand sensitivity to weather.

Legal notice

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