Gas Winter Outlook 2022/23

October 2022

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Welcome

Welcome to this year's Gas Winter Outlook. The invasion of Ukraine by Russia and resultant reduction in gas supplies to continental Europe has created unprecedented uncertainty for energy markets. Whilst Great Britain is not reliant on Russian gas to the same extent as continental Europe, energy security in Great Britain and Europe are related. The potential for a shortfall in gas supplies within continental Europe could have a range of knock-on impacts in Great Britain, creating risks around the ability of GB to import from continental Europe if required.

GB uniquely benefits from a range of diverse and flexible sources of gas. Last winter, 70% of British gas supplies came from the UK continental shelf and Norway alone. Flexible and reliable infrastructure, combined with robust market arrangements support these sources of supply which have historically delivered energy security for Britain. Even during times of market tightness, the most recent example being the Beast from the East cold snap in 2018, Britain was able to secure sufficient supplies to meet demand.

Despite this context, no one can accurately predict what will happen this winter against such a complex and uncertain backdrop. In light of this uncertainty, we have developed three scenarios to illustrate how the market could balance supply and demand on the National Transmission System (NTS). These scenarios complement our assessment of peak supply and demand capability that has been central to previous Winter Outlooks and illustrate the extent to which GB energy security is dependent on flexible sources of imported gas supplies (such as LNG) throughout winter.

It is important to note that these scenarios are not forecasts, nor are they intended to illustrate a best or worst case. The actual mix of supplies on any given day will be determined by the market.

Given the scale of uncertainty and risks associated with the current geopolitical situation as we head into this winter, we have reviewed the physical, commercial, and market-based tools which enable us to respond to a supply and demand imbalance, should one arise, in our capacity as Residual Balancer. There may be days this winter when we will need to utilise these tools, such as Margins Notices. Further details of the tools available to us, and how we are enhancing them, are set out in this publication.

In the unlikely event there is insufficient gas supply available in GB to meet demand, and should the market be unable to resolve the resultant imbalance, we have the tools required to ensure the safety and integrity of the gas system in the event of a Gas Supply Emergency. All possible measures would be taken to minimise the extent to which we use these tools.

Finally, we continue to closely monitor the market and it is possible that the information and analysis underpinning this document may change as we progress through winter. This is likely to be a challenging winter for energy supply throughout Europe. Factors beyond our control such as the weather, the potential for a shortfall of gas supplies within continental Europe and the wholesale cost of gas will all influence the prevailing gas supply and demand situation in Great Britain.

To that end, we very much see this publication as the start of a conversation and part of our continued commitment to engage in open dialogue with our stakeholders as we move through the winter. We hope that this year's expanded publication helps you feel more informed and prepared as we enter the winter period, and we look forward to continuing the conversation with you over the coming months.

Additional information about this publication

We have structured this document to walk you through our analysis and assessments of those scenarios. We have included important contextual information up front, such as our role in operating the network and historic supply and demand analysis. We hope this complements the existing forecast and margin information you're used to seeing in the Outlook, as well as helping to contextualise our scenario analysis and explain why they are different to the central forecast.

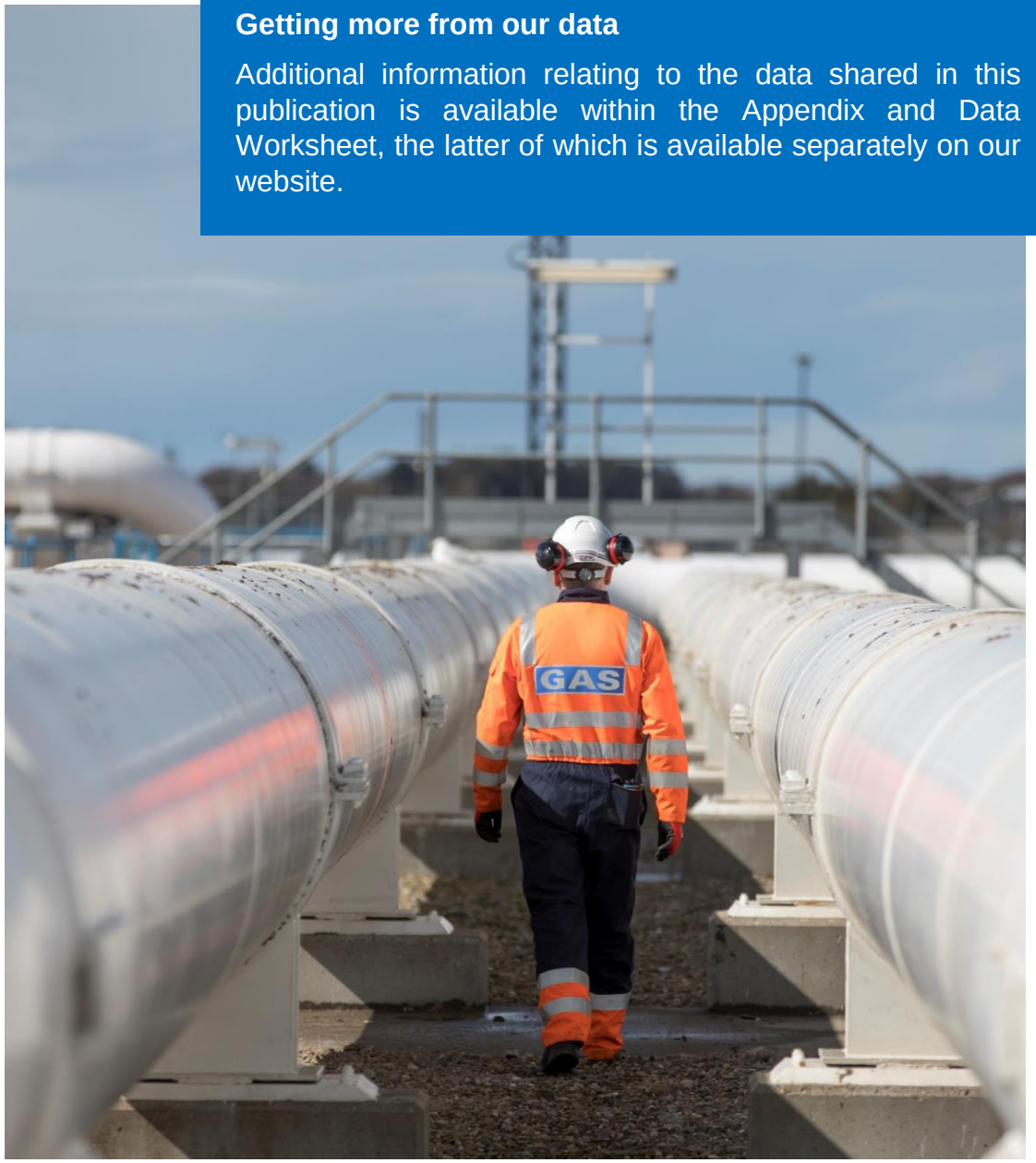
Other Gas Transmission publications in this suite:

- Gas Summer Outlook, published annually, with the next due in April 2023.
- Annual Network Capability Assessment Report (ANCAR) published annually in June.
- Gas Ten Year Statement (GTYS) including the ANCAR Annex, with the next due in November 2022.
- Gas Future Operability Planning (GFOP), with the most recent published in October 2021.

Contents page

Getting more from our data

Additional information relating to the data shared in this publication is available within the Appendix and Data Worksheet, the latter of which is available separately on our website.



01

Executive Summary

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Executive summary
Key Messages

Infrastructure

- GB gas infrastructure has sufficient capability to meet peak (1 in 20) demand, with a positive supply margin under both intact and N-1 network conditions

Markets

- GB is dependent on various sources of imported gas throughout winter to meet demand, the actual mix of supplies on any given day will be determined by the market
- A potential shortfall in gas supplies within continental Europe could impact the ability for GB to attract imports, should they be required
- A positive market price differential to both global and European markets will be needed for GB to attract sufficient LNG and imports from continental Europe, when required
- We anticipate LNG to act as the primary source of supply flexibility this winter, supplementing UKCS and Norwegian supplies, with imports from continental Europe only occurring during periods of elevated demand
- We anticipate the continuing high wholesale gas prices to result in a reduction in both domestic and industrial demand
- We anticipate elevated gas demand for power generation in GB in response to low imports / higher exports of electricity to Europe
- We anticipate continuing gas exports to Europe at times where there is a supply surplus in GB
- We expect GB storage to provide flexibility to the market by responding to imbalances between supply and demand, when required

Tools

- We have the necessary physical, commercial and market based tools to manage a supply and demand imbalance, including those related to a Gas Supply Emergency, should it be necessary

Forecast (mcm/d)	2021/22	2022/23
1-in-20 peak demand	505	483
1-in-20 non-storage supply	492	488
1-in-20 storage supply	117	117
Total 1-in-20 supply	**609**	**605**
1-in-20 margin	104	122
Cold day demand	420	440
Cold day non-storage supply	397	387
Cold day storage supply	94	94
Total Cold day supply	**491**	**481**
Cold day margin	71	41

02

Our role in Operating the Network

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Our role

In our role as the National Transmission System (NTS) Owner and Operator, we have three key responsibilities:

- Infrastructure provider
- Residual balancer
- Market facilitator

Our licence is established under the Gas Act 1986. It requires us to develop, maintain, and operate economic and efficient networks and to facilitate competition in the supply of gas in Great Britain. We have a responsibility to keep the NTS within safe operating limits.

The underlying market arrangements in GB are predicated on the basis that the market will provide the gas itself, and that the market will balance supply and demand. Throughout the winter period, we will conduct daily assessments of gas margins and communicate this to the industry via our market information portal.

When there is an imbalance between supply and demand, we act as residual balancer by taking energy balancing actions via the On The Day Commodity Market (OCM). The actions are designed to encourage shippers who are out of balance to take action themselves and, if required, we can buy or sell volumes of gas to balance the system.

In the unlikely event there is insufficient gas supply available in GB to meet demand, and should the market be unable to resolve the resultant imbalance, we have the tools required to ensure the safety and integrity of the Gas system in the event of a Gas Supply Emergency. These emergency tools include requesting additional gas supplies be delivered to the NTS, or requiring gas consumers, starting with the largest industrial consumers, to reduce or stop using gas. These tools will be used, if required, subject to the authorisation of the Network Emergency Coordinator.

To read more about the tools available to us please visit our balancing website.

Preparing for Winter

As a prudent system operator, we are working closely with BEIS, Ofgem, and National Grid ESO to assess the potential scenarios and associated risks that may arise this winter. We have taken several steps to ensure we are well prepared to maintain safe and secure operation of the gas transmission system. Specific areas of work include:

1. Margins notice forecast

We have added a new margins notice forecast in addition to our existing five-day-view. This is intended to provide a view of what the day ahead trigger level might be on any day out to D-7.

We have based this forecast on the week ahead demand forecast and different storage and LNG assumptions.

Our intent is to publish daily on National Grid Prevailing View from October to March.

2. Operating Margin Tender

The Operating Margin (OM) is gas we can use to manage the system at times of stress, as a short term measure. The Operating Margins Portfolio is comprised of LNG, gas in storage and demand reduction contracts (including power generation). Currently we have 869GWh of OM procured for 2022/23.

During summer 2022, a reassessment was made of the requirement for 2022/23 following developments in the gas market since February, which found that an additional 75GWh was needed.

As a result of these findings, we are tendering for additional OM, for a service from 01/12/2022 until 30/04/2023.

3. Demand side response reform

We have reviewed Demand Side Response (DSR) as part of our winter preparedness activities.

Following extensive engagement with customers and stakeholders, we are exploring various enhancements to the existing DSR process.

The objective of these enhancements is to increase the attractiveness of, and maximise participation in, DSR should the need arise.

4. Exercise Degree

We have expanded our regular emergency exercise to ensure it focuses appropriately on Network Emergency Coordinator (NEC) communications with all industry participants, through all stages of an emergency, both in the lead up, during, and post a National Grid Supply Emergency (NGSE).

The exercise will be held over four days during September and October this year and will cover the following scenarios:

- Emerging issues
- Pre-emergency
- Emergency
- Restoration

5. MIPI winter changes

We are making a number of changes to the Market Information Provision Initiative (MIPI) to make it easier for stakeholders to access data and information.

Some of the key changes include:

- Week ahead view updated to show the difference between Margins Notice Trigger and Demand Forecast Values
- Live export flows to be made available for each individual Interconnector
- Instantaneous flow graphs to be updated to show flow changes across a period of time rather than one individual snapshot
- An additional two years worth of historical supply and demand data to be provided.

Operating the Network

Every winter our Gas Transmission system assets are configured and operated to respond to, and deliver, the changing flows of gas on and off the network. The operational configuration of the NTS changes throughout the winter period and within day as it is highly dependent on the varying sources of gas coming into the GB network, and the locations of demand.

Gas demand during the winter is largely driven by the requirement for domestic heat. Demand tends to be highest in the south, particularly around the Greater London area, where the population density is higher. This year, due to the significant reduction of Russian gas supplies to continental Europe, we may see continued gas exports to Europe through the interconnectors, which are also located in the south of the network. We therefore expect to have a greater reliance on the assets that move gas to the south of England.

Gas supplies have become increasingly driven by market dynamics and global prices, and the gas market has been particularly volatile this year. This means the flexibility of the gas network will be more crucial than ever, with the potential for interconnector flows to switch between large demands and large supplies throughout the winter period. We are preparing the network, particularly our compressors, to ensure they are available and flexible enough to react to changing market conditions and subsequent supply patterns.

We will continue to review what asset capability is required, included as part of the Annual Network Capability Assessment Report (ANCAR) and associated engagement.

03

Supply & Demand information

Contextual and historical information relating to supply and demand

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GB Sources of Demand

The various types of GB demand, and what they mean, are split out below.

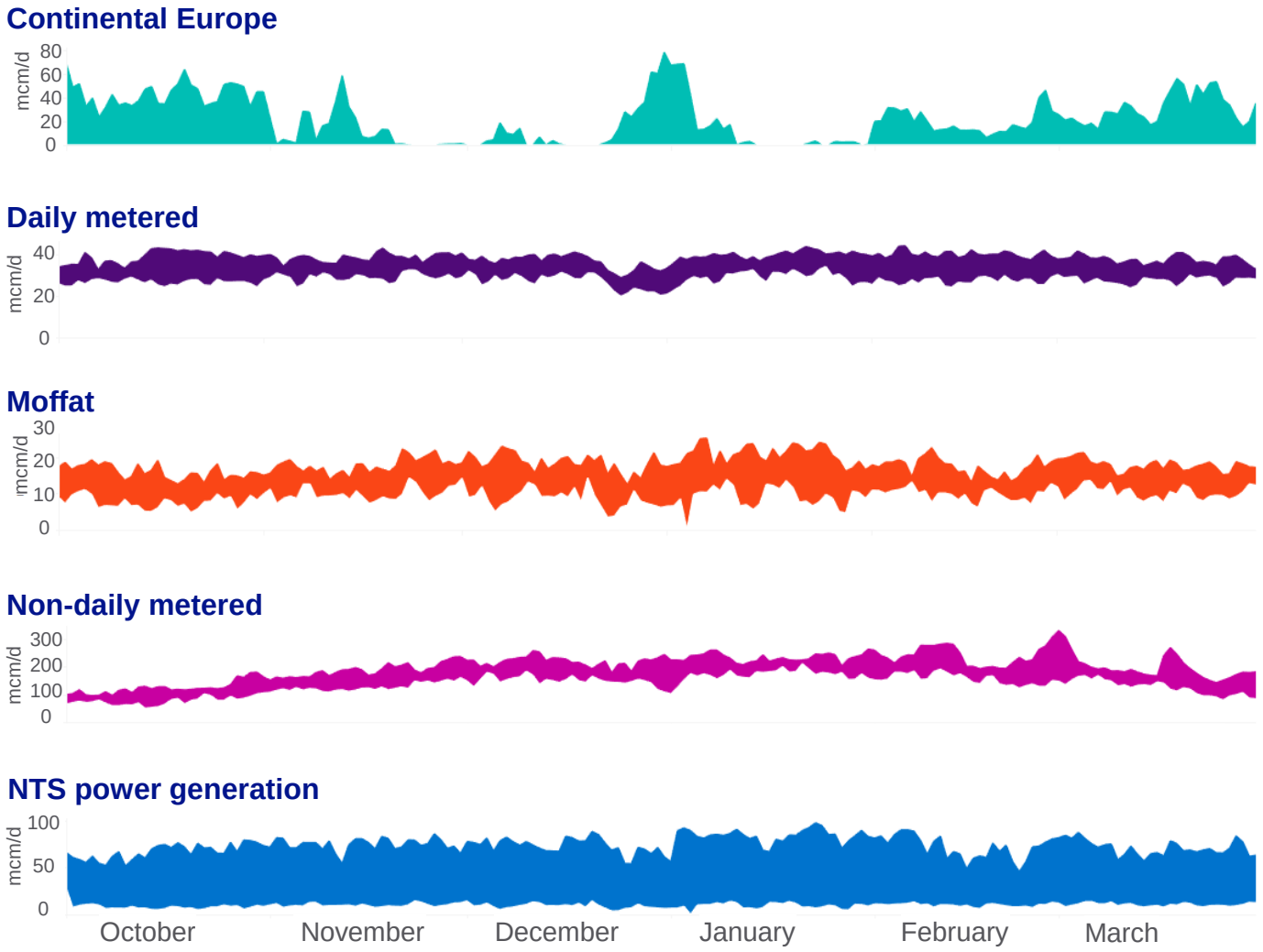
Non Daily Metered Demand	Non daily metered (NDM) demand is associated with users where the meter is not read every day, such as residential properties and small to medium-sized industrial premises. This demand is predominantly for heating and is therefore strongly weather driven. On cold days NDM consumption will be the highest proportion of demand.
Daily Metered Demand	Daily metered (DM) demand is associated with users where the meter is read every day, such as large industrial premises and small generators connected to the distribution networks. DM demand also includes a few large industrial loads directly connected to the National Transmission System (NTS).
NTS Power Generation	NTS power generation demand is associated with large power stations, usually Combined Cycle Gas Turbines (CCGTs), that are directly connected to the NTS. Gas-fired generation usually acts as a 'balancer' on the electricity network, filling the gap when more variable sources of generation such as wind and interconnectors are not available.
Island of Ireland exports	The island of Ireland has some indigenous gas supplies, provided by the Corrib gas field. This field is in decline and imports from the NTS meet around 75% of the island of Ireland's gas demand, which predominantly consists of power generation, industry and residential.
Continental Europe exports	This source of demand is responsive to prevailing market conditions and is highly flexible. GB is physically connected to continental Europe via two gas interconnectors (Belgium and Netherlands). Both interconnectors can export from GB to continental Europe with a combined maximum export capability of 75mcm/d.

Historic demand behaviour by source

The historic behaviour of GB demand can be visualised by reviewing the range (minimum to maximum) over the past five winter periods.

- Exports to continental Europe predominantly occur in the earlier and later months of winter when GB demand is generally lower. However, in winter 2021/22 exports to continental Europe in late December and beyond were higher due to the higher price of gas in continental Europe.
- Daily metered demand range is fairly consistent throughout winter with limited variability due to weather.
- Non daily metered demand is strongly weather driven and therefore there is historically a rise in demand during the typically colder months of winter.
- NTS power generation is historically highly dependant on the levels of renewable electricity generation available and whether electricity interconnectors are importing to GB.

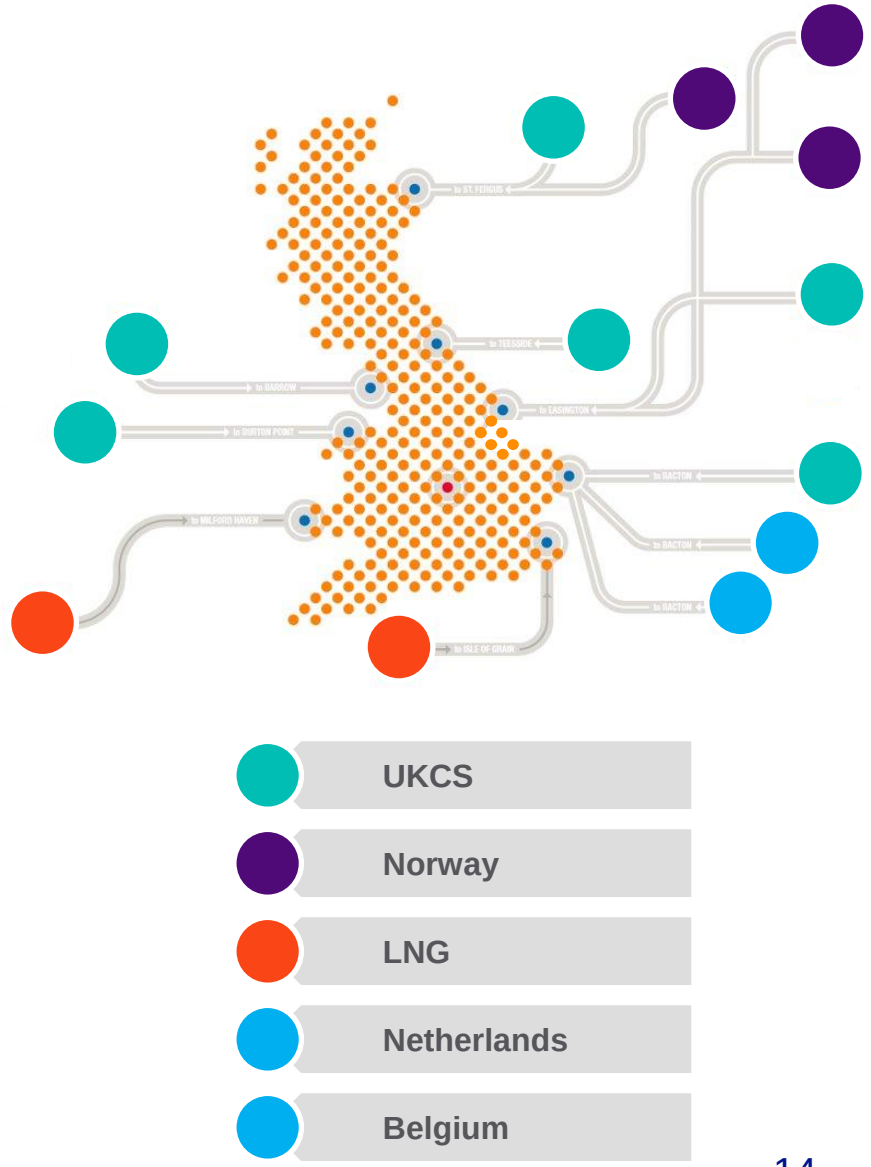
Figure 1
Demand volume ranges over the last five winters.



GB Sources of Supply

GB benefits from diverse and flexible sources of supply via several large supply points. The physical capability of these supply points, in aggregate, can deliver daily volumes of gas in excess of that required to meet maximum (peak day) GB demand.

UK Continental Shelf (UKCS) and Norway	These sources of supply historically deliver up to 117mcm/d (UKCS) and 100 mcm/d (Norway) throughout winter. Norway's maximum supply capability to GB is 141mcm/d, approximately 40mcm/d of this supply capability is price sensitive at maximum production rates. GB market conditions need to be favourable to continental Europe for this additional 40mcm/d of supply capability to flow to GB.
GB Storage	This source of supply typically provides a means of short-term balancing, with withdrawals increasing to meet periods of high demand or responding to unforeseen supply interruptions. Sites typically maintain stock levels in the earlier part of the winter by limiting delivery, or take advantage of lower demand periods by restocking their storage position. Deliverability varies depending on storage stock levels, with a maximum capability of 117mcm/d.
Liquefied Natural Gas (LNG)	This source of supply is responsive to prevailing market conditions. GB has one of the largest LNG re-gasification capabilities in Europe, with the ability to deliver up to 141mcm/d. Sustaining flows at this level would require regular LNG cargoes throughout winter. LNG is a global commodity; GB market conditions would need to be favourable to other markets to attract LNG cargoes not secured via long-term contracts.
Continental Europe imports	This source of supply is responsive to prevailing market conditions and is highly flexible. GB is physically connected to continental Europe via two gas interconnectors (Belgium and Netherlands). Combined, these interconnectors have the capability to deliver up to 125mcm/d.



Historic supply behaviour by source

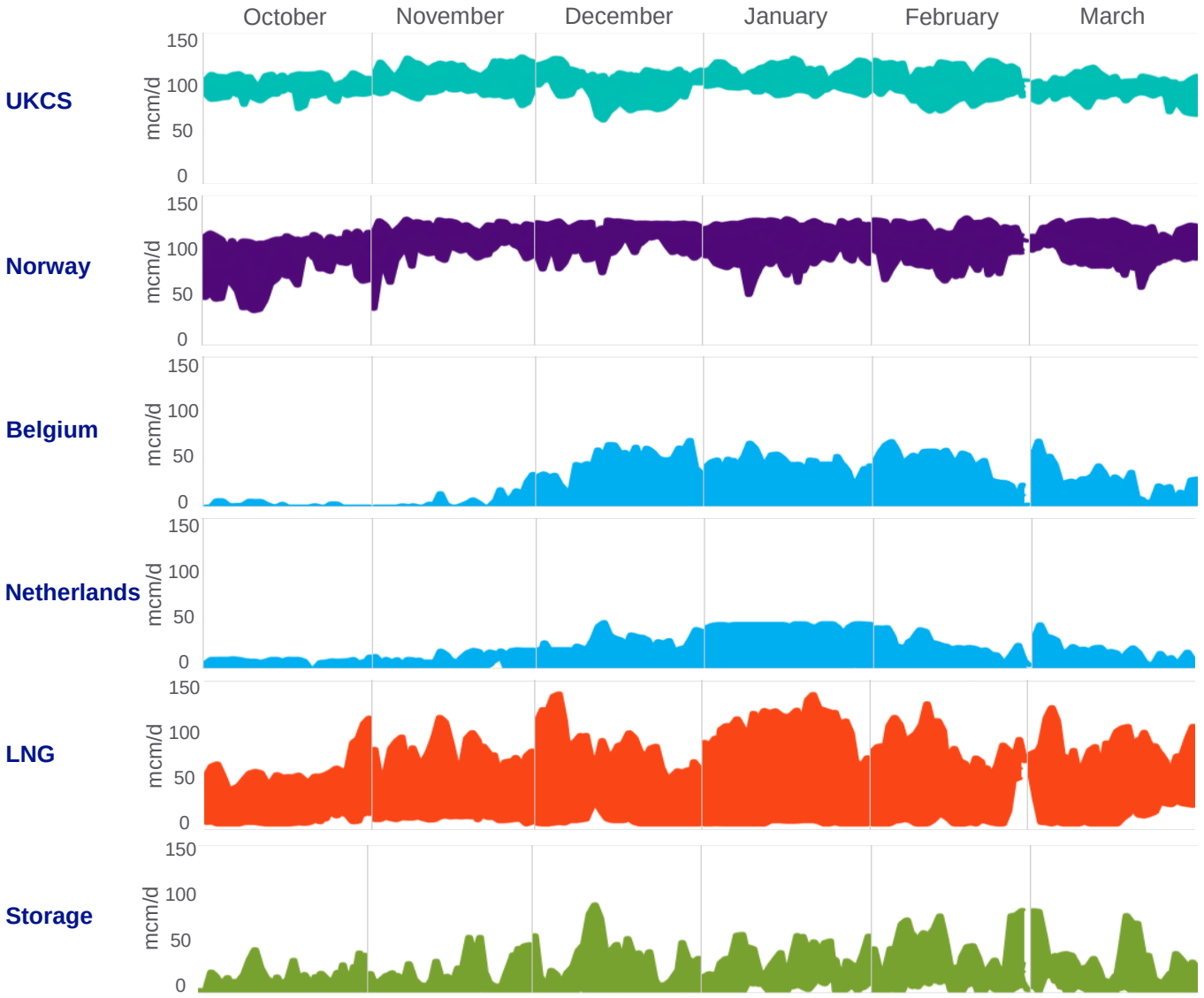
The historic behaviour of GB supply points can be visualised by reviewing the range (minimum to maximum) of deliveries over the past five winter periods. Key observations include:

- UKCS and Norway have provided a continuous base load of supply throughout the period. Reductions in deliveries are predominantly driven by short-term asset faults, with minimal price sensitivity.
- Interconnectors have predominantly supplied gas to GB in the winter, although as observed in winter 2021/22, can also export gas to continental Europe based on the price differential.
- LNG is highly flexible and responds heavily to price signals. Deliveries during the coldest periods of the previous five years have approached the theoretical maximum capability of our LNG terminals, whilst reducing to near zero when the supply has not been required.
- Storage withdrawal is highly flexible and is used to manage short-term supply disruptions, or to top-up base supply during peak periods.

Table 1
Historic supply by source for the last five winters

Supply source	Historic winter supply (bcm)				
	17/18	18/19	19/20	20/21	21/22
UKCS	19.7	18.6	18.3	17.1	16.8
Norway	21.0	18.6	15.8	18.6	19.0
LNG	1.8	7.8	13.4	8.9	11.4
Continental Europe	7.8	2.3	0.3	4.8	0.5
Storage	3.8	1.9	2.4	2.1	1.9
Total	**54.1**	**49.2**	**50.2**	**51.5**	**49.6**

Figure 2
Supply volume ranges over the last five winters



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Demand this winter

The demand forecast for this winter

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Demand forecast

Key messages:

- Total gas demand for winter 2022/23 is forecast to be higher compared to the last five winters
- Domestic and industrial demands are forecast to reduce from last winter due to high wholesale gas prices
- Gas demand for power generation is forecast to increase in response to low imports/higher exports of electricity to continental Europe
- We expect continued exports of gas from GB to continental Europe during the early part of this winter

Non-daily metered demand, which represents the demand from domestic consumers and small to medium business premises, is expected to decrease from last winter as these users reduce their demand in response to high prices.

Similarly, daily metered demand, which represents larger business premises and energy intensive users, is also expected to decrease.

Although electricity demand overall is expected to reduce, gas demand for power generation is expected to increase due to higher electricity exports, particularly to France.

Gas demand in the island of Ireland is expected to [fall due to fuel switching], however the continued decline of the Corrib gas field is expected to result in an overall increase in exports to Ireland compared to last winter.

Table 2

Forecast total gas demand for winter 2022/23, and weather corrected historical data for 2017/18 – 2021/22

Winter demand (bcm)	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	Actual demand, weather corrected					forecast
Non-daily metered (NDM)	30.6	30.0	30.9	30.3	29.7	28.2
Daily Metered (DM) (excluding NTS power generation)	4.8	4.5	4.5	4.4	4.0	3.8
NTS power generation	12.8	12.3	10.6	11.0	10.1	12.3
Total GB demand[1]	48.2	46.8	46.0	45.7	43.8	44.3
Island of Ireland exports	1.8	2.1	2.6	3.0	2.8	3.2
Continental Europe	0.7	0.0	0.5	0.0	3.7	4.0
Storage injection	2.3	1.5	1.4	1.6	1.3	1.4
Total gas demand[2]	53.3	50.7	50.8	50.7	51.9	53.1

[1] Excludes exports to continental Europe and storage injection flows. Total gas demand includes NTS shrinkage and will therefore not tally

[2] Includes exports to continental Europe and storage injection flows. Total gas demand includes NTS shrinkage and will therefore not tally

We have seen a high level of gas exports from GB to continental Europe over the summer as Europe fills their storage ahead of the winter. We expect this trend to continue in the early part of the winter, supported by high LNG imports into GB terminals.

GB and Island of Ireland demand

Demand levels are difficult to forecast due to the significant influence changing weather conditions have on energy requirements. This year is no different in terms of the challenge of understanding the prevailing weather conditions we might see this winter or how cold a winter we should expect, but there are also additional uncertainties to consider in the current geo-political climate.

Our forecast demand profiles for GB are split out from the previous table below and we've outlined some of the key elements that could influence the accuracy of this forecast.

Please see our Spotlight section 'Connections to Europe' for our view of Interconnector export demand

Table 2a

Forecast total gas demand for winter 2022/23, and weather corrected historical data for 2020/21 – 2021/22.

Winter demand (bcm)	2020/21 weather corrected	2021/22 weather corrected	2022/23 forecast
Non-daily metered (NDM)	30.3	29.7	28.2
Daily Metered (DM, excluding Generation)	4.4	4.0	3.8
NTS power generation	11.0	10.1	12.3
Island of Ireland	3.0	2.8	3.2

Factors that could influence the accuracy of this year's forecast:

NDM demand

- The weather – cold weather usually means that demand increases as people turn up their heating and/or have the heating on for longer periods
- Prices – we are all seeing increasing energy costs and this may lead to consumers turning their heating down and therefore lowering demand levels.
- Increased working from home – more people in their homes will mean a higher level of demand for heat and electricity. Whether this will be affected by higher prices (more people returning to the office/turning their heating down) remains unclear.

DM demand, including industrial customers

- The weather – cold weather usually means that demand increases as offices and factories require more heat
- Prices – we are all seeing increasing energy costs and this, conversely, may lead to reduced demand levels as businesses prioritise their spending
- Economic growth – the level of demand for industrial and commercial use will be related to the level of activity in the economy

Electricity generation

- The level of renewable generation – when the wind blows and/or the sun shines, electricity is generated from renewables. This will increase or decrease the level of renewable generation, which may have a direct impact on how much gas demand is required for electricity generation
- The level of electricity exports to continental Europe – if there are significant exports of electricity to Europe, it is likely there will be additional gas demand for electricity generation.

Island of Ireland

- Continuing declines in production from the Corrib gas field off the Irish coast may mean that we see demand increase.

05

Supply this winter

Including supply forecasts and additional detail relating to LNG and storage

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Supply range and capability

Supply sources to GB continue to be diverse and flexible. Our network has sufficient physical capability to accept gas from each of these sources in response to how the market chooses to balance demand and supply (Table 3).

Gas from UKCS and Norway continue to be the main source of supply to GB, with LNG, GB storage, and the European interconnectors providing flexible supplies to meet total demand.

It is difficult to forecast exactly which type of supply will turn up on any given day. This is because flexible supplies are price driven and the pattern of historical behaviour we've observed in the past has been impacted by several risks and uncertainties this winter due to the wider geo-political climate.

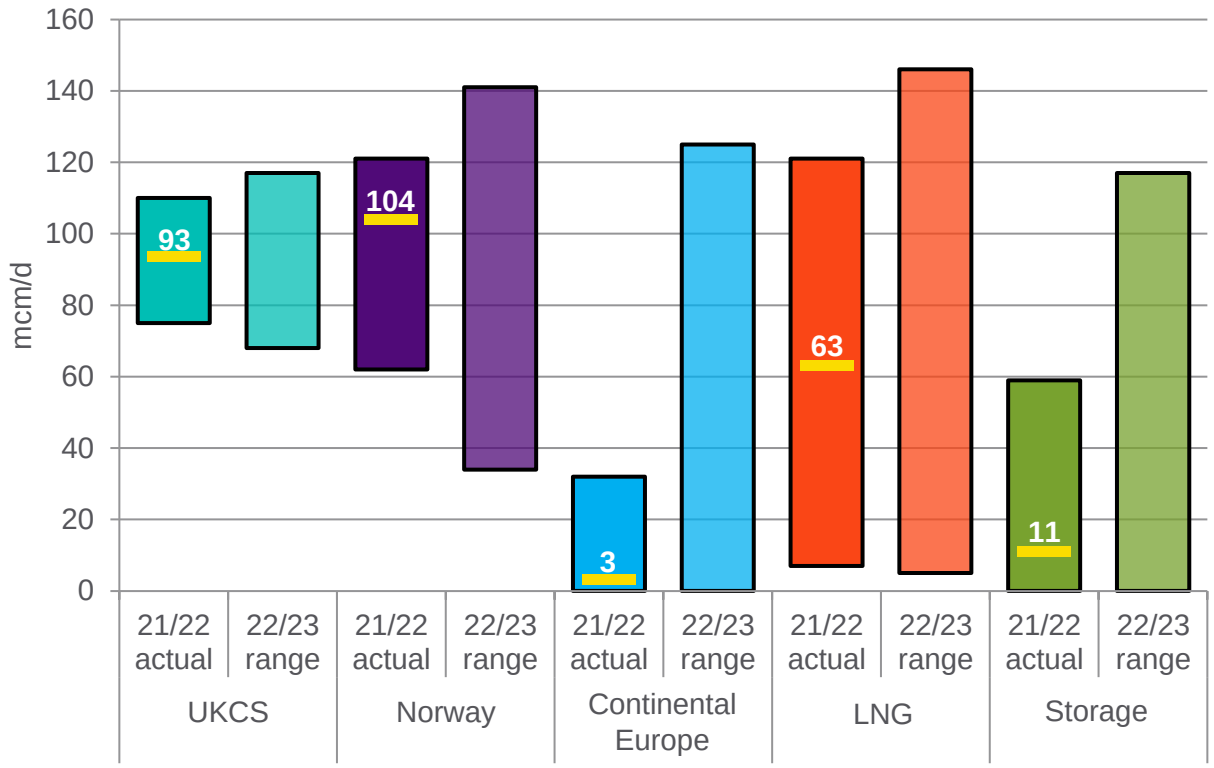
The next few pages will provide a focus on the sources of supply we expect to flex the most over the winter period.

Table 3
Actual and projected supply ranges for winter 2021/22 and winter 2022/23.

Winter supply (mcm/d)	2021/22		2022/23
	actual range	mean	projected range
UKCS	75-110	93	68-117
Norway	62-121	104	34-141
Continental Europe	0-32	3	0-125
LNG	7-121	63	5-141
Storage	0-59	11	0-117

The observed range of supply for winter 2021/22, and the range of supply that we could see at each of the supply sources for the coming winter is shown in Figure 3.

Figure 3
Comparison of actual ranges of supply capability (mean flow indicated by labelled yellow bars, and Table 3) from last winter, against projected ranges over winter 2022/23.



A focus on liquefied natural gas

Great Britain has one of the largest re-gasification capabilities in Europe, and we have witnessed higher than average LNG supplies flow into GB so far this year. These have enabled significant exports to continental Europe, supporting European targets to fill storage stocks ahead of winter.

LNG (along with the interconnectors) has the greatest potential to respond when GB demand is high. Last year we observed:

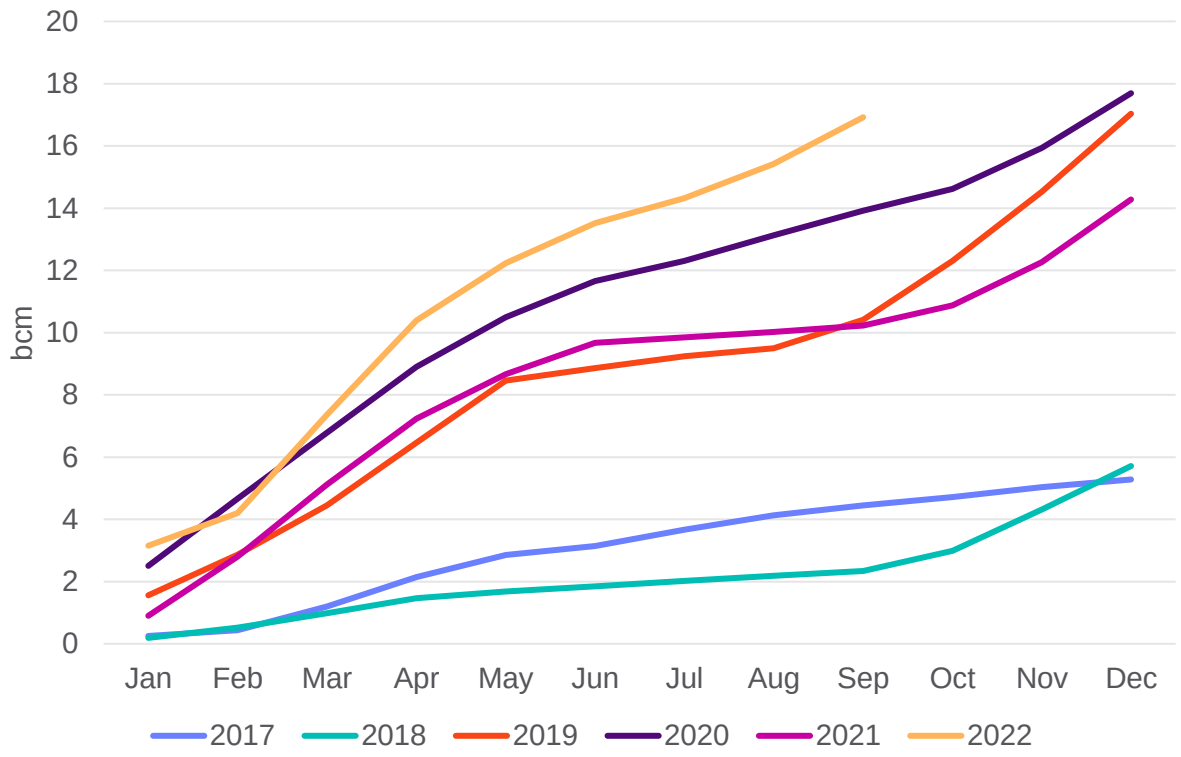
- A mean daily total LNG flow of 63 mcm/d
- A maximum daily total of 121 mcm/d.

The peak possible daily LNG supply for this coming winter remains at 141 mcm/d, however actual flows will be determined by global markets.

Analysis by Mike Fulwood, Senior Research Fellow at the Oxford Institute for Energy Studies, suggests that the flow of flexible LNG into the EU and GB in 2022 so far is likely to continue, even in a cold winter, in the absence of a dramatic rebound in Asian demand for LNG. GB is especially well placed to receive LNG if NBP prices are competitive, with more than enough spare capacity in our LNG import terminals, compared to the import terminals in Northwest Europe which are running at very high utilisation levels.

Similarly, a market-based report produced by Baringa indicates that the volumes of uncommitted flexible cargoes of LNG should be sufficient to meet GB demand, subject to GB successfully securing such volumes by paying a sufficiently high price.

Figure 4
Historical cumulative annual LNG supply flows for the past five calendar years and 2022 (to-date)



A focus on storage

Storage facilities connected to the NTS continue to be predominantly fast cycle, with the potential to both increase to maximum stock levels in a small number of days, and export large volumes of gas onto the NTS within short time periods.

The amount of gas in GB storage at the start of winter 2022/23 is at the high end of the five-year average (as shown in Figure 5). Storage levels have remained comparatively high compared to previous years and have refilled quickly over the summer period when there has been less demand on the NTS.

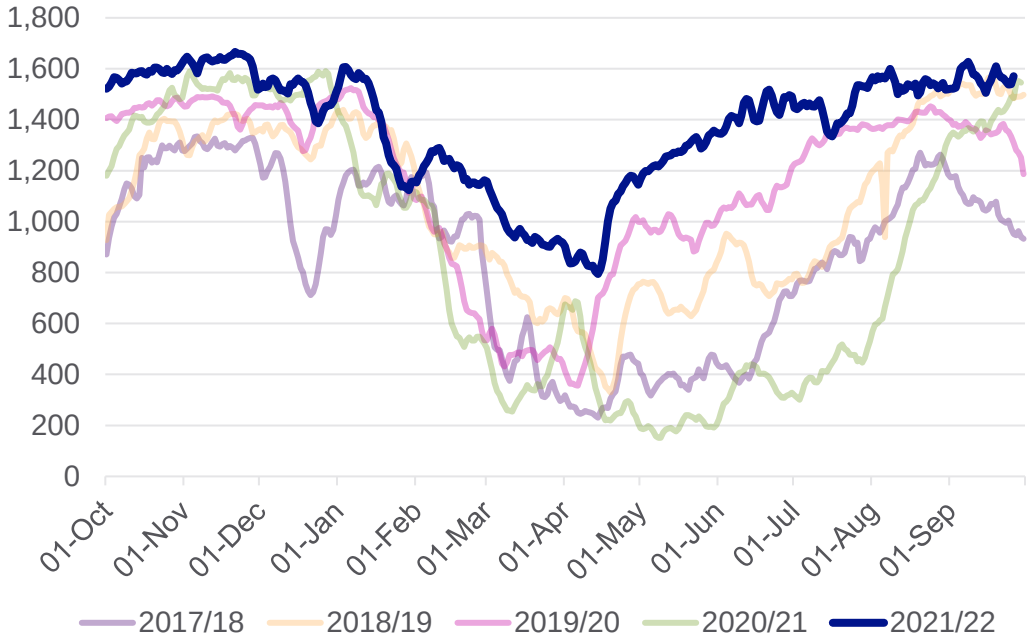
European storage levels as a whole are also in a positive position ahead of winter, having met their target of 80% storage fullness earlier than expected. More information is available in *Spotlight: connections to Europe*.

Last year, we observed that:

- Storage facilities acted as expected, providing supplies onto the NTS in response to market signals
- Increased deliveries of LNG supported the replenishment of storage stocks in January

NB: we are aware of the Rough storage site resuming partial operation. Rough injection and withdrawal numbers have not been included in this publication.

Figure 5
GB storage stock levels from October 2017 – September 2022.



06

Spotlight: Connections to Europe

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The European context

Russian gas flows to North West Europe have now fallen to zero with the closure of the Nordstream 1 pipeline. Flows are not expected to recover this winter given recent reports of damage to both Nordstream pipelines in the Baltic Sea.

Until the cancellation of European buyers contracts from Q2, Russian gas flows via Nordstream 1 had been fairly steady, operating at close to its 55bcm/yr. capacity level, but a sharp drop in flows took place in July ahead of the pipeline's maintenance. Flows have continued to decline until the pipe was halted at the end of August with Gazprom citing a lack of parts due to sanctions. Gazprom has the ability to re-route contracted flows to European buyers via other routes, but has opted not to do so. Overall, Russian pipe supply to Europe is currently around 20% of the 2020 gas year average

Figure 6

LNG imports to Europe (bcm/month).

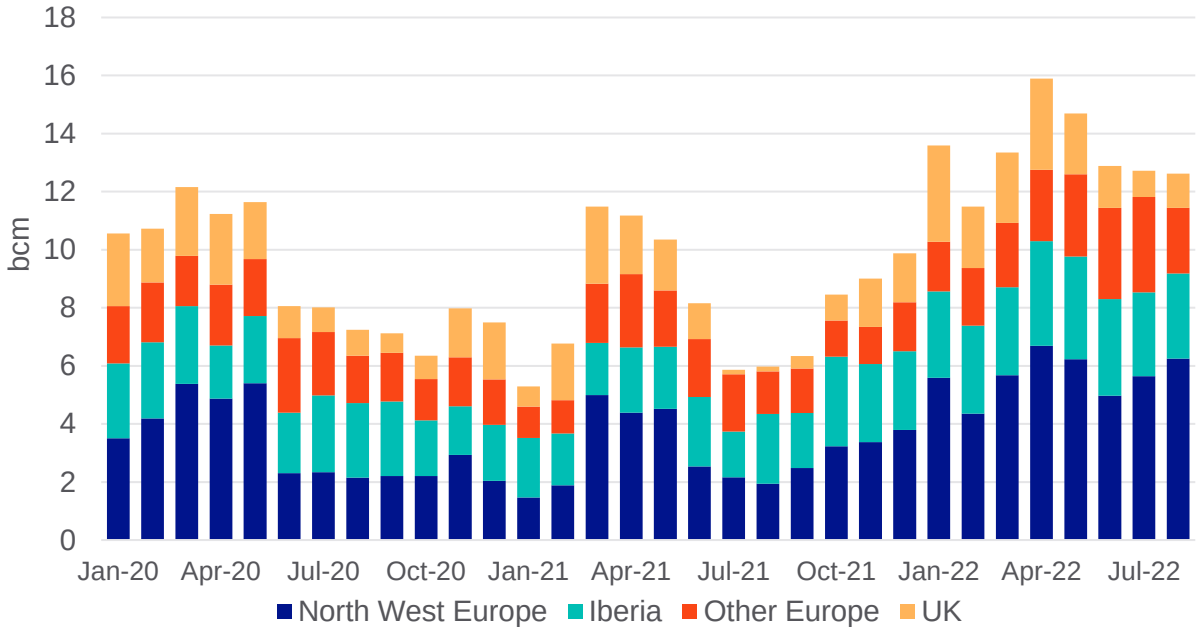
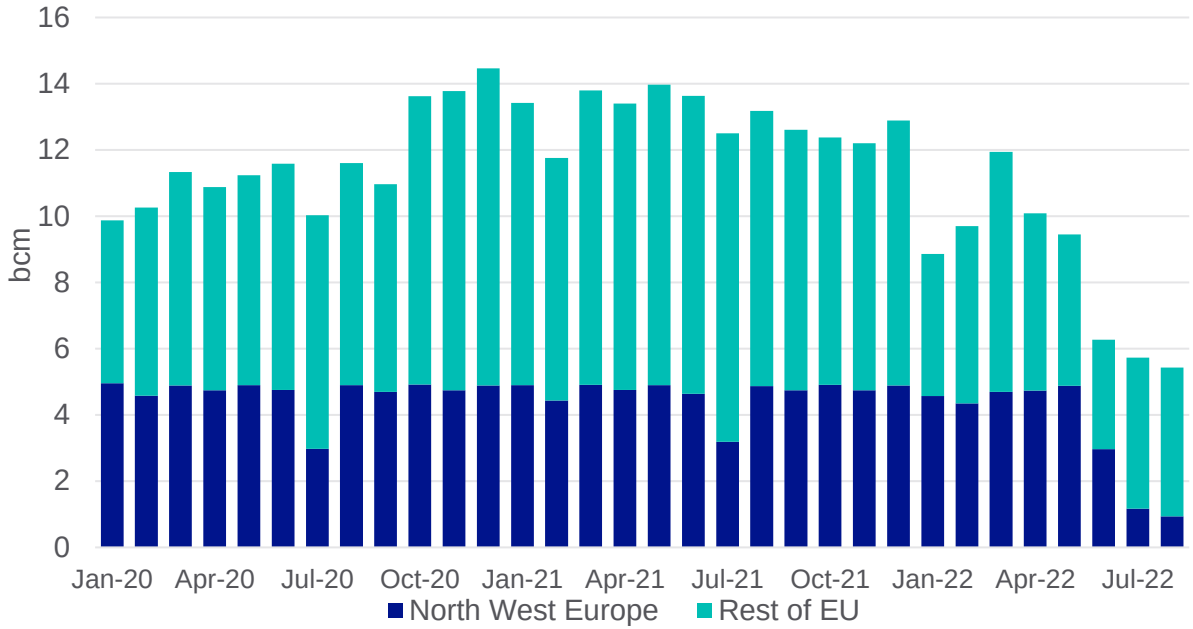


Figure 7

Russian pipeline imports to Europe (bcm/month).



LNG imports into Europe have significantly increased to help fill the gap from a drop in Russian gas supply. Year to date imports of LNG to Europe have amounted to ~90bcm, up from ~50bcm imported during the preceding period. Over 45bcm of LNG has been imported into North West Europe's LNG terminals, double the volume of the previous year, with many running at above nameplate capacity for most of the summer.

Nearly 20bcm of additional LNG import capacity is expected to be bought online this winter across North West Europe. The Eemshaven Floating Storage and Regasification Unit (FSRU) in The Netherlands has already started receiving cargoes while Germany's Brunsbuettel FSRU is expected to receive its first cargo from the UAE in Q1 2023.

The impact on GB of this additional import capability in Europe is uncertain. On the one hand, it may increase competition for scarce LNG spot cargoes; on the other, it should provide additional resilience to European gas supply and therefore increase the likelihood of interconnector imports to GB.

Impact on interconnector flows

We have seen record levels of interconnector exports to continental Europe over recent months (see figure 9). The rise in exports of gas from GB to Europe is largely due to the impact of reduced gas flows from Russia, combined with Europe's target to have storage stocks 80% full by 1 November.

The supply constraints and demand levels being observed in Europe have caused the market to respond as expected, with the price of gas in Europe higher than the prices seen in GB, causing additional flows to be directed into continental Europe.

We expect exports to continue to be higher than usual during the early part of this winter. This is evident in the exit capacity bookings for this winter when compared to the previous winter (see figure 8).

Figure 8
Bacton exit capacity bookings

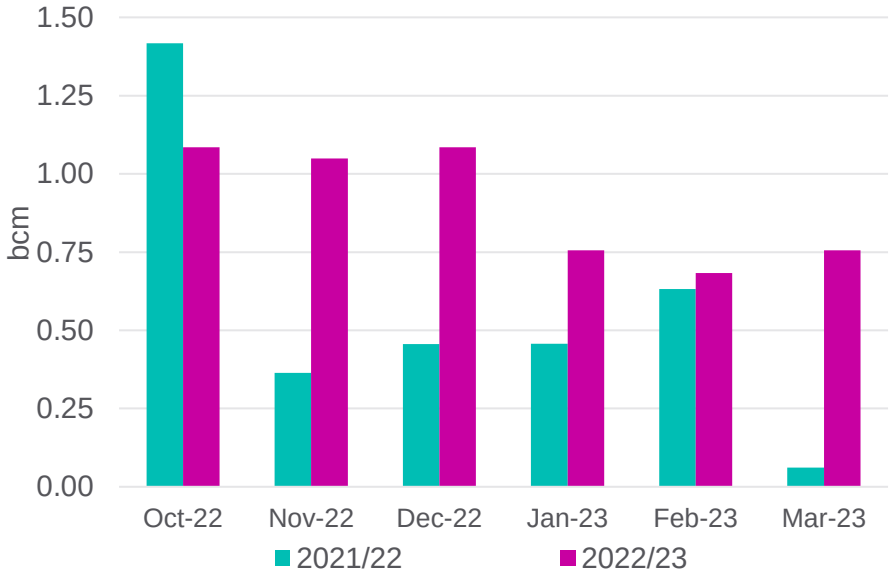


Figure 9
Continental Europe export levels for 2020/21 and 2021/22.

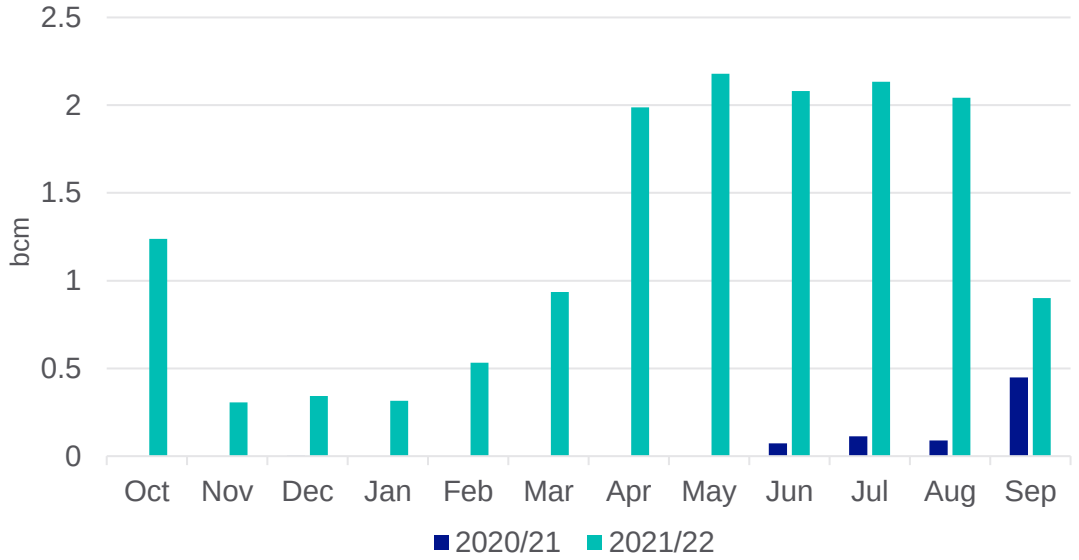
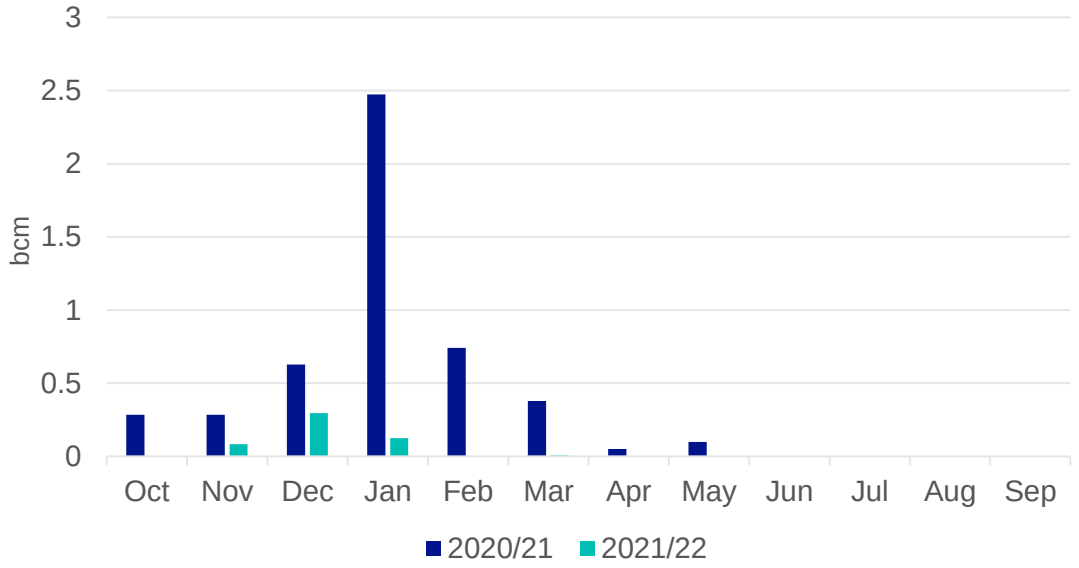


Figure 10
Continental Europe import levels for 2020/21 and 2021/22.



Implications for this winter

During winter, the GB market relies on flexible supplies (LNG and imports from continental Europe, as well as additional flows from Norway) on higher demand days. Over the past five winters, imports from continental Europe have contributed an average of around 6% of total supply.

Gas flows between GB and continental Europe are price-driven, with gas flowing to the market where the price is highest.

Whilst there is still significant uncertainty around the impacts of further disruption of supplies to continental Europe, there are several factors that may positively influence the ability of GB to import gas from continental Europe:

- Whilst prices have been high and volatile, the market has continued to function, directing supply to where the price is highest. As shown in figure 12, there is a strong correlation between price differential and interconnector flows.
- European storage stocks are currently over 80% full, having met their target earlier than expected (see figure 11).
- The EU have reached an agreement on a voluntary reduction of natural gas demand by 15% between August and March, in light of the disrupted flows of gas from Russia. This agreement becomes mandatory if a supply alert is triggered.
- Import and export capacity are currently being booked and sold on both interconnectors, suggesting that the market is preparing for both imports and exports over winter.

Figure 11

European Storage levels per year from April 2017 to September 2022

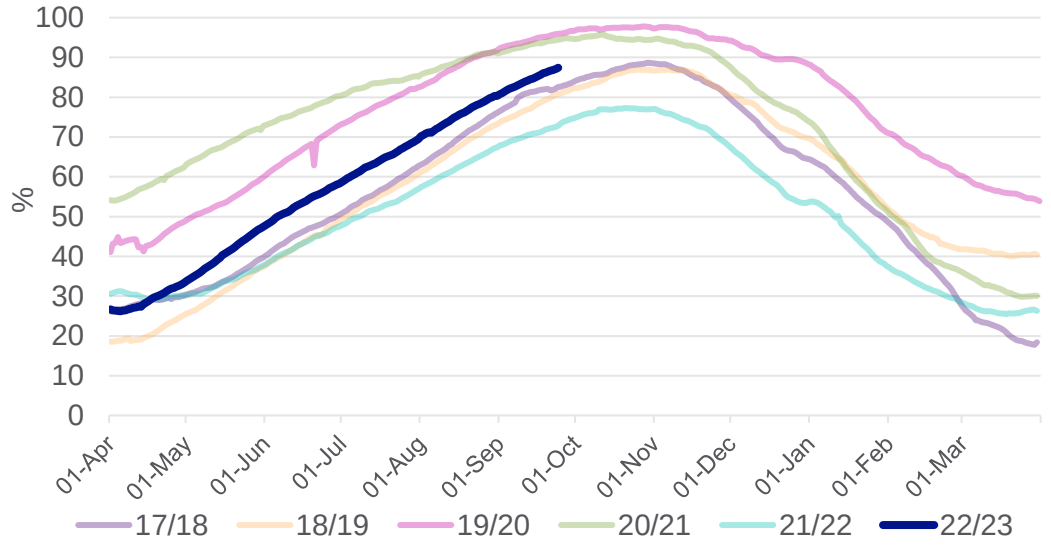
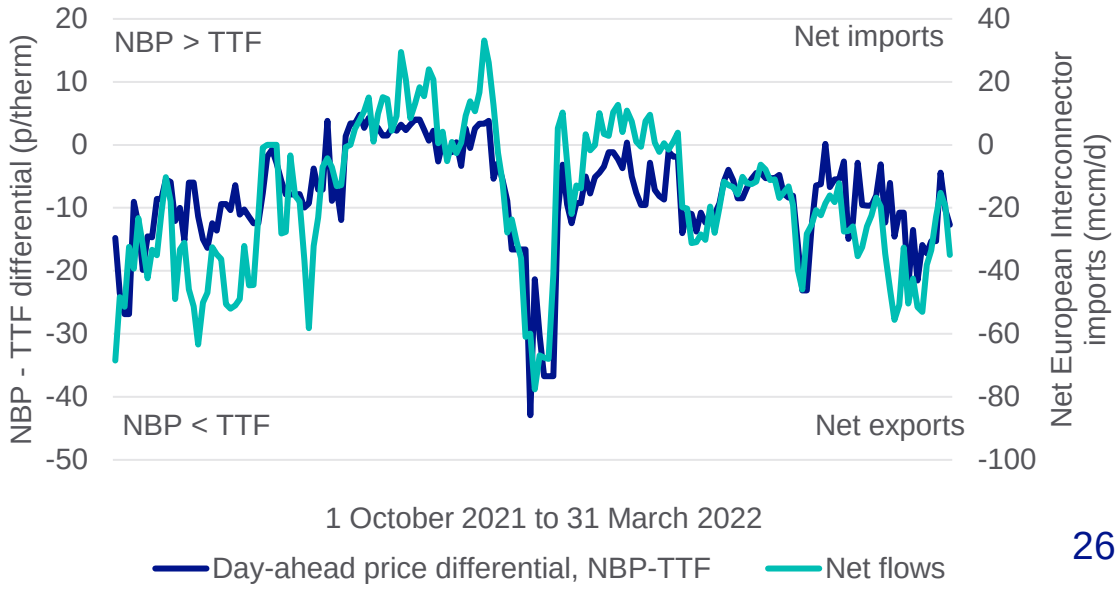


Figure 12

NBP-TTF price differential compared to European interconnector flows



07

Supply Margins

Peak day
Cold day

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Introduction

Capability

The GB gas network has significant flexibility in its infrastructure, with a potential capability in excess of the anticipated peak demand that can be reasonably assumed during the winter period.

Market participants utilise this flexibility to deliver gas to a variety of supply points across the network, to match supplies to the expected demand level on any given day.

The charts on the following pages illustrate the supply capability for each of the supply components and the supply margin against peak day and cold day.

NB: as a consequence of how our network has evolved due to changing supply patterns over the years, it is not possible to achieve the maximum deliveries of continental European imports and LNG deliveries at the same time for the Bacton and the Isle of Grain terminals. Our figures have been adjusted to reflect this.

Commodity

The capability of the National Transmission System (NTS), as described above, does not equate to the physical flow of gas (the commodity), which we do not have control over. The price and source of supply that is delivered each day is driven by market participants and the global market.

The charts shown on the following pages refer to capability, not commodity.

Peak day supply margin

Forecast 1-in-20 peak demand has reduced by **22** mcm/d to **483** mcm/d. Expected reductions in domestic and industrial demand in response to higher prices have been partially offset by higher demand for gas for power generation.

Peak supply is at a similar level to last winter, although we now expect LNG to form a higher proportion of imported supply given the impact of reduced Russian supplies to continental Europe and resultant lower imports via the interconnectors.

The margin between forecast peak supply and 1-in-20 peak demand for winter 2022/23 is **122** mcm/d compared to a margin of **104** mcm/d last winter. (Figure 11, Table 4).

Under N-1 conditions (an event resulting in the loss of the single largest piece of NTS infrastructure) the supply margin at peak 1-in-20 demand has increased from last winter to **50** mcm/d.

Table 4

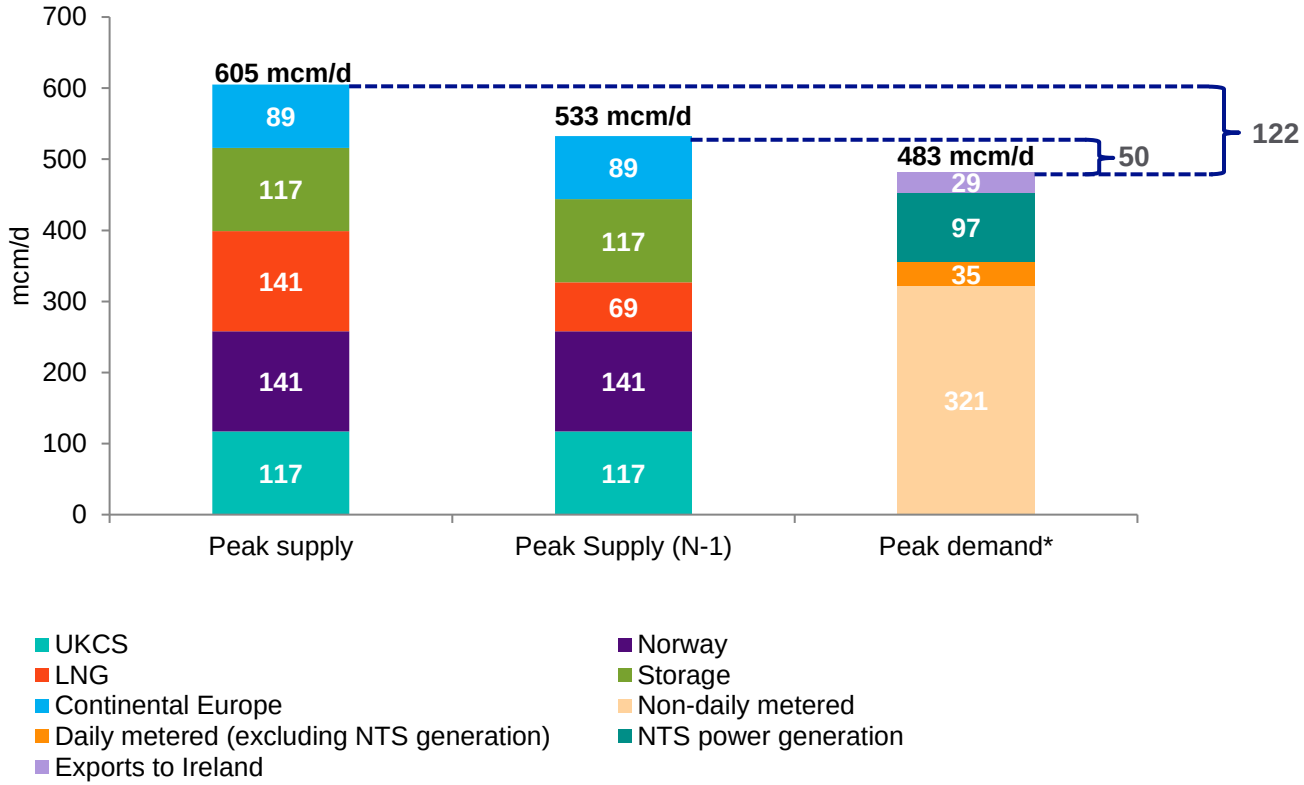
Peak day, N-1 largest loss supply and demand totals and margins, for the 2022/23 winter

Forecast (mcm/d)	2021/22	2022/23
1-in-20[3] peak demand	505	483
1-in-20 non-storage supply	492	488
1-in-20 storage supply	117	117
Total 1-in-20 supply	609	605
1-in-20 supply margin	104	122
N-1 largest loss	-72	-72
N-1 supply margin	32	50

[3]The 1-in-20 peak day demand is a level of daily demand that in a long series of winter, with connected load held at the levels appropriate to the winter in question, would be exceeded in 1 out of 20 winter, with each winter counted only once.

Figure 13

Peak day, N-1 largest loss supply and demand totals and margins, for the 2022/23 winter



**Peak day total demand contains shrinkage and therefore will not tally*

Cold day supply margin

The Cold day is more representative of the likely level of demand on a very cold winter's day than the peak 1-in-20 demand.

Forecast Cold day gas demand has increased by **20** mcm/d to **440** mcm/d. This shows that reductions in demand due to higher prices (estimated impact of 21mcm/d based on domestic properties turning their thermostat down by half a degree) have been more than offset by higher demand due to power generation.

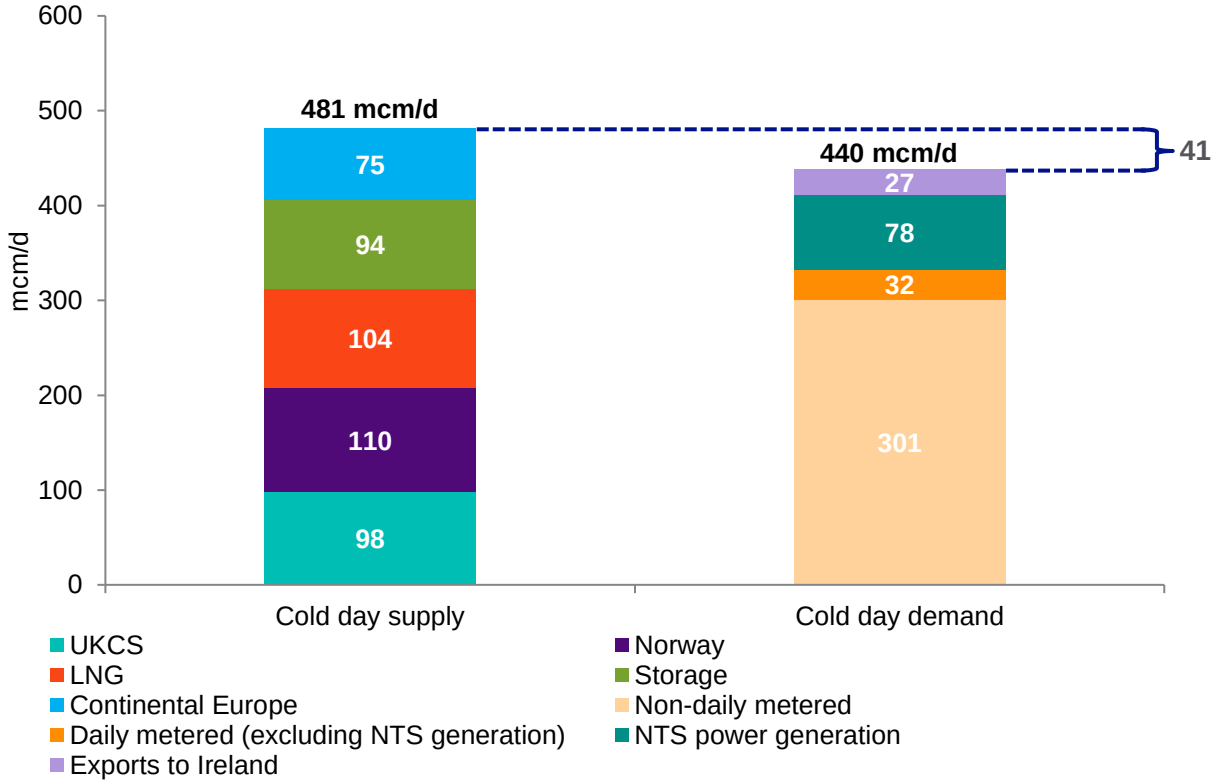
The margin between forecast Cold day supply and Cold day demand for winter 2022/23 is **41** mcm/d compared to a margin of **71** mcm/d last winter. (Figure 14, Table 5).

Table 5
Cold day supply and demand totals and margins, for the 2022/23 winter

Forecast (mcm/d)	2021/22	2022/23
Cold day demand[4]	420	440
Cold day non-storage supply	397	387
Cold day storage supply	94	94
Total Cold day supply	491	481
Cold day supply margin	71	41

[4]The supply of demand for the coldest day in an average (or seasonal normal) winter. The Cold day is taken as day 1 of the Average Load Duration Curve, this is not a forecast based upon current conditions. It is based on historic data over the period 1960 – 2012.

Figure 14
Cold day supply and demand totals and margins, for the 2022/23 winter



** Cold day total demand contains shrinkage and therefore will not tally*

08

Supply & Demand scenarios

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Our demand scenarios

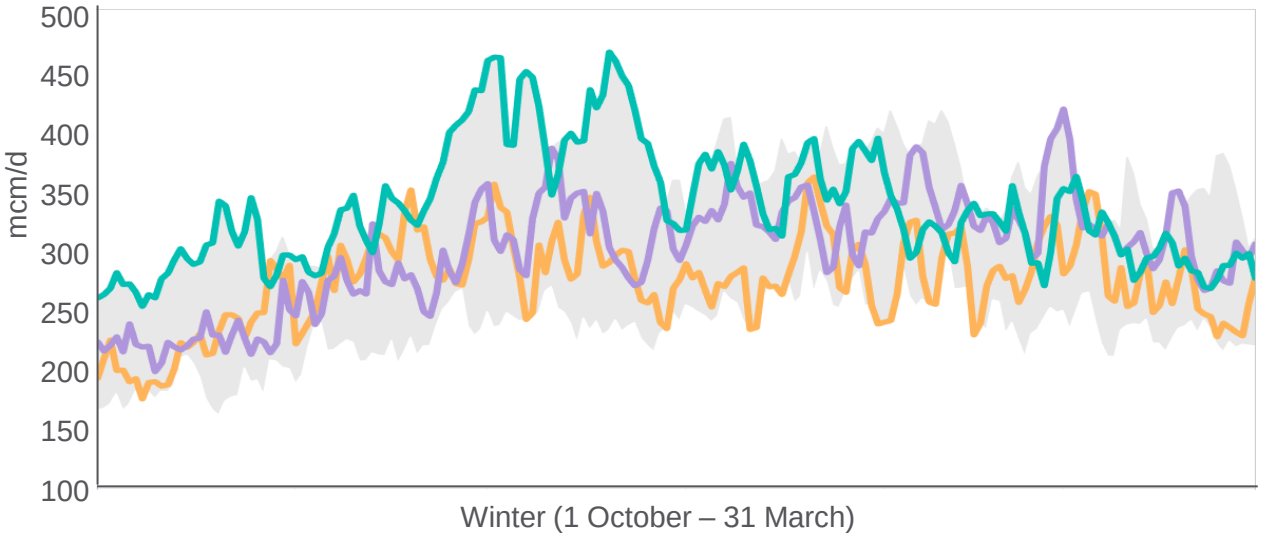
In light of the high level of uncertainty over demand and supply this winter, this year's Winter Outlook presents three scenarios that illustrate how the National Transmission System could be balanced under a range of credible demand profiles.

It is important to note that none of our scenarios are intended to illustrate a best or worst case for the forthcoming winter. The aim is to provide a range of scenarios that highlight the extent to which flexible sources of supply are available to GB to meet different demand levels.

The chart to the right shows the range of NTS demands experienced over the last 12 winters, represented by the grey shaded area. Highlighted on this chart are our three demand scenarios, as summarised in the table below.

Scenario	Rationale
Scenario 1: typical winter (2019/20)	We have chosen demands from winter 2019/20 as being representative of the daily demand we would experience in a typical winter.
Scenario 2: cold winter (2010/11)	We have chosen demands from winter 2010/11 as representative of a cold winter, as this period contains the highest-ever daily gas demand level seen on the NTS, with sustained high demands throughout the majority of the winter.
Scenario 3: cold snap (2017/18)	We have chosen demands from winter 2017/18 as representative of demand levels during an extreme cold snap as this period contains the 'Beast from the East' which resulted in some of the highest daily demand levels seen in the last five years.

Figure 15
NTS demand range for the last 12 winters with the three scenarios highlighted.



How we've defined our demand scenarios

How have we defined typical and cold demand?

The demand profile on the GB gas network has changed dramatically since natural gas was first introduced in 1972, and as such it is not possible to use historic demand levels to categorise our different scenarios.

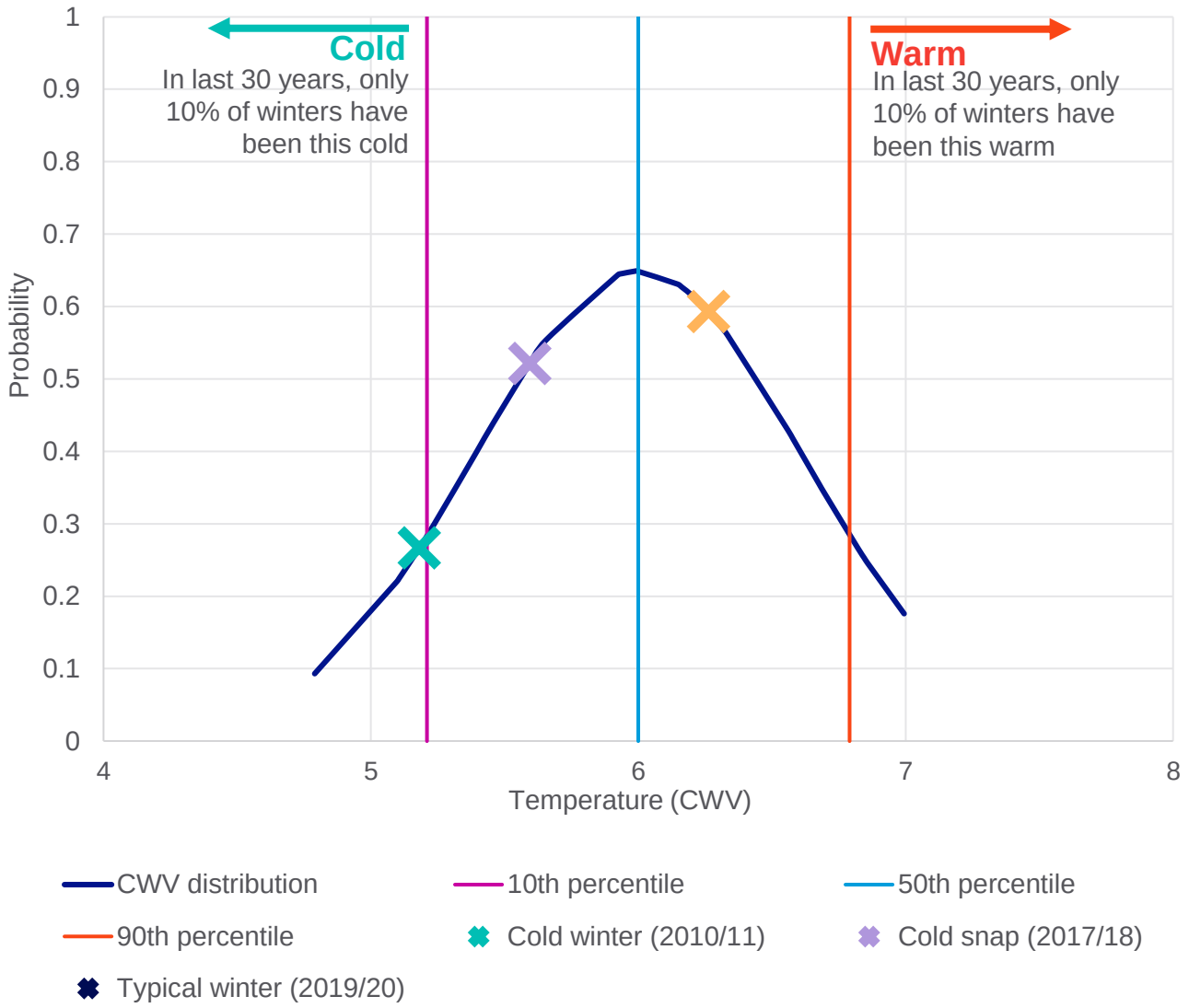
During the winter period, the majority of GB gas demand has historically been driven by domestic gas central heating and therefore is highly influenced by the weather, particularly temperature. The Composite Weather Variable (CWV) is a single measure of weather which takes into account the actual temperature, wind speed, effective temperature and seasonal normal effective weather and has a linear relationship with domestic gas demand. By taking recent winters with supply/demand conditions and infrastructure similar to the current environment we are able to display them against historic winter CWVs to define cold and mild scenarios.

The chart to the right (figure 16) illustrates the distribution of temperature in the UK from 1992 to 2022, expressed as a function of the CWV.

- Our **typical winter** scenario is within the top 50% of winter temperatures that have been observed over the previous 30 years and was experienced in 2019/20.
- Our **cold snap** scenario is generally close to the mean temperature observed over the previous 30 years, but contains a short cold period experienced in 2017/18.
- Our **cold winter** scenario is within the coldest 10% of the previous 30 winters and was experienced in 2010/2011.

Figure 16

The normal distribution of temperature (expressed as CWV) in the UK from 1992 to 2022.



Our modelling assumptions - demand

Our scenarios are based on actual historical demand data, to provide a realistic level of variability due to weather and other factors. To make our scenarios as relevant as possible, we have made several adjustments to these historic demand numbers to reflect the expected situation for this winter, particularly in respect of the impact of higher gas prices and the likelihood of higher exports of electricity to continental Europe.

Please see our 'Continental Europe imports/exports' assumptions on the next slide for our view of Interconnector export demand

Non-Daily Metered Demand	Non-daily metered demand (domestic properties and small to medium-sized industrial premises) has been reduced by 6%, equivalent to all properties turning down their thermostats by half a degree in response to higher prices. This assumption was included in the Consumer Transformation scenario in this year's Future Energy Scenarios publication. We recognise that recent government intervention has been announced to mitigate the impact of higher prices on domestic and business consumers, but we believe it is still reasonable to expect some element of price response in consumer demand this winter.
LDZ Daily Metered Demand	LDZ daily metered demand (such as large commercial and industrial premises) has been reduced by 6%, reflective of the actual reduction in demand that we have observed over the past 12 months. We recognise that recent government intervention has been announced to mitigate the impact of higher prices on domestic and business consumers, but we believe it is still reasonable to expect some element of price response in consumer demand this winter.
NTS Industrial Demand	NTS industrial demand has been reduced by 43%, reflective of the actual reduction in demand that we have observed over the past 12 months. We expect a larger reduction in this sector of demand as energy is a much higher proportion of these users' costs.
NTS Power	We expect higher levels of electricity exports from GB to France this winter, driven by planned nuclear outages and high European market prices. We have modelled the impact of this by converting *all* actual electricity interconnector exports to continental Europe in the 2019/2020 winter to an equivalent gas volume. This represents a relatively high case and could be regarded as an upper bound on the likely increase in gas demand. The GB generation landscape has changed considerably since 2010/2011 with a significant increase in renewable generation capacity and some gas generation moving from baseload to providing flexibility. We have therefore used the adjusted power demand for 2019/2020 in both the typical winter and cold winter scenarios. While this does not make a specific adjustment for the colder weather in 2010/2011, as described above we consider our modelling assumption provides a credible upper bound for generation demand this winter.

Our modelling assumptions - supply

Due to the complex global economic factors involved, no one can predict precisely how the GB and global markets will behave throughout winter. However, based on historical GB market behaviour and our knowledge of market operation, we can outline the potential order in which supplies may respond to balance the NTS in different situations.

Our key assumptions, which underpin our scenario analysis, are as follows:

UKCS and Norway	We expect the drivers that will influence both UKCS and Norwegian supplies this winter will be very similar to last winter. In particular, high prices will continue to incentivise both sources to maximise production; and high European prices will incentive Norwegian supplies to maximise supply to continental Europe in preference to GB. We have therefore used historical data from last winter (2021/22) for both UKCS and Norwegian supplies to build some natural variability into our scenarios and represent a likely supply profile for this winter.
GB Storage	In line with historic behaviours, we have assumed that GB storage will act as a short-term balancing source of supply, with withdrawals increasing to meet periods of higher demand or responding to unforeseen supply interruptions. Storage sites typically maintain stock levels in the earlier part of the winter by limiting delivery, or taking advantage of lower demand periods to restock their storage position. We have assumed GB storage will re-fill when there is a GB supply surplus.
LNG	We assume LNG supplies will increase throughout the winter period based on overall GB demand and act as the primary supply-side balancing mechanism. The potential for reduced imports from continental Europe would necessitate increased LNG supplies, all other factors being equal. The reverse is true whereby imports from continental Europe will reduce GB reliance on LNG.
Continental Europe Imports / exports	Typically, the behaviour of the European interconnectors is price sensitive and therefore highly flexible. We assume a continuing drive for exports from GB to continental Europe throughout the first half of winter when there is a supply surplus in GB. Should GB require gas imports beyond the levels that can be fulfilled by LNG, we assume the market will respond accordingly and create the required pricing signals for continental Europe to export to GB.

In summary, our scenarios seek to achieve a network balance in the following manner:

Supply Surplus

In the event the NTS is over-supplied, gas is presumed to be injected into GB storage and/or gas exports to continental Europe will increase, before LNG supplies are reduced.

Supply Deficit

In the event the NTS is under-supplied, it is presumed there will be an increase in storage withdrawal and LNG deliveries, whilst reducing any continental Europe exports, prior to requiring continental Europe imports and maximising storage withdrawal.

Visualising winter

We are presenting additional charts and data this year relating to our scenarios and assumptions. The visual aids to the right have been created to explain how we are presenting our scenarios. Please note that the tables and charts on this page contain simulated data for illustrative purposes only and do not represent any of our Winter Outlook scenarios.

Winter supply and demand

Illustrates the demand profile for the entire winter period (dark blue line), with the volume of each supply source used to meet this demand illustrated below it.

Peak Day capability

Each winter supply and demand chart is compared with the Peak Day capability forecast. This allows you to compare the modelled supply and demand chart levels with the full potential supply capability.

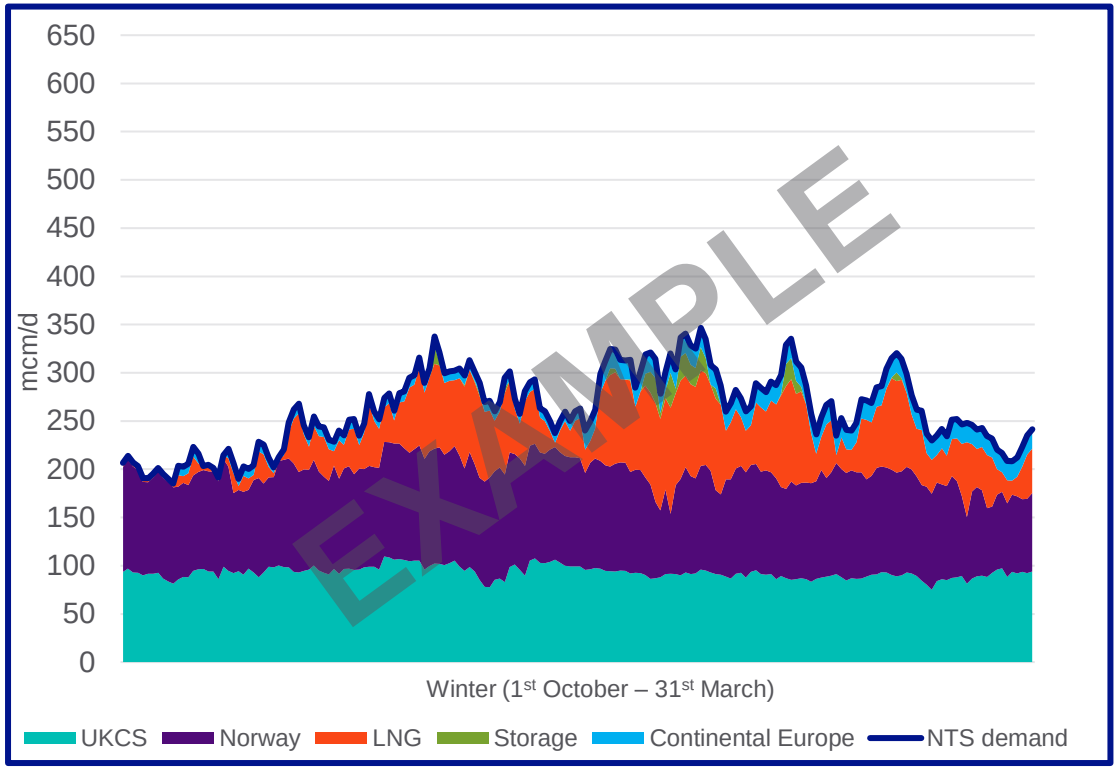
Demand table

Provides a trace between the historic actuals for the base demand scenario, and the aggregate impact of the adjustments made for the impact of gas prices and higher levels of gas for electricity generation.

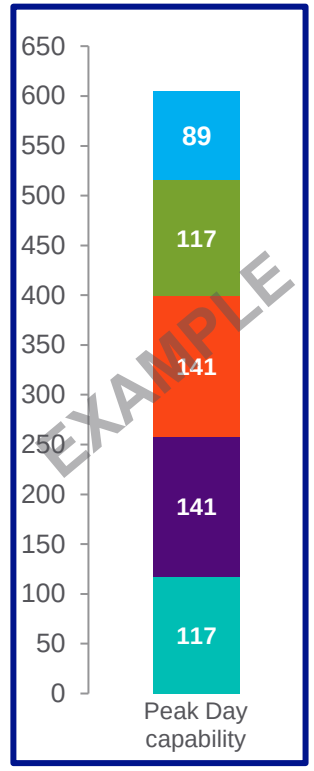
Supply table

Illustrates the aggregate volume of supply from each source for that scenario and the percentage of the total supply. Percentage utilisation is calculated as the average daily supply divided by the peak day capability, except for storage where utilisation is calculated as total withdrawals divided by total working gas volume across all of the sites (excluding Rough).

Winter supply and demand



Peak Day capability



Demand table

Type	Total winter demand (bcm)		
	Base year	Change	Scenario x
Non-daily metered	36	- 2	34
Daily metered	5	0	5
NTS power generation	11	+ 3	13
Continental Europe	1	+ 3	4
Ireland	3	- 1	2
Total	**56**	**+ 3**	**59**

Supply table

Source	Total winter supply		Utilisation (%)
	bcm	%	
UKCS	16.9	29	79%
Norway	18.8	32	73%
LNG	19.3	33	75%
Continental Europe	2.2	4	10%
Storage	1.8	3	118%
GB Total	**59.0**		

Scenario 1: typical winter, increased gas for power, European imports minimised

This scenario is based on the consumption demand experienced in the 2019/20 winter. We have applied a reduction to the level of NDM and DM demand to reflect the impact of the increased price of gas this winter. Power generation demand has been increased by assuming no electricity interconnector imports are available.

In line with prevailing forward price differentials, we have assumed exports to continental Europe in October and November, with the volume of export shown in table 6.

This scenario illustrates a level of LNG supply that could be required to achieve a supply-demand balance in winter with a typical weather profile, and elevated demand for gas for power, without requiring any imports from continental Europe.

Figure 17
Scenario 1 supply and Peak Day capability.

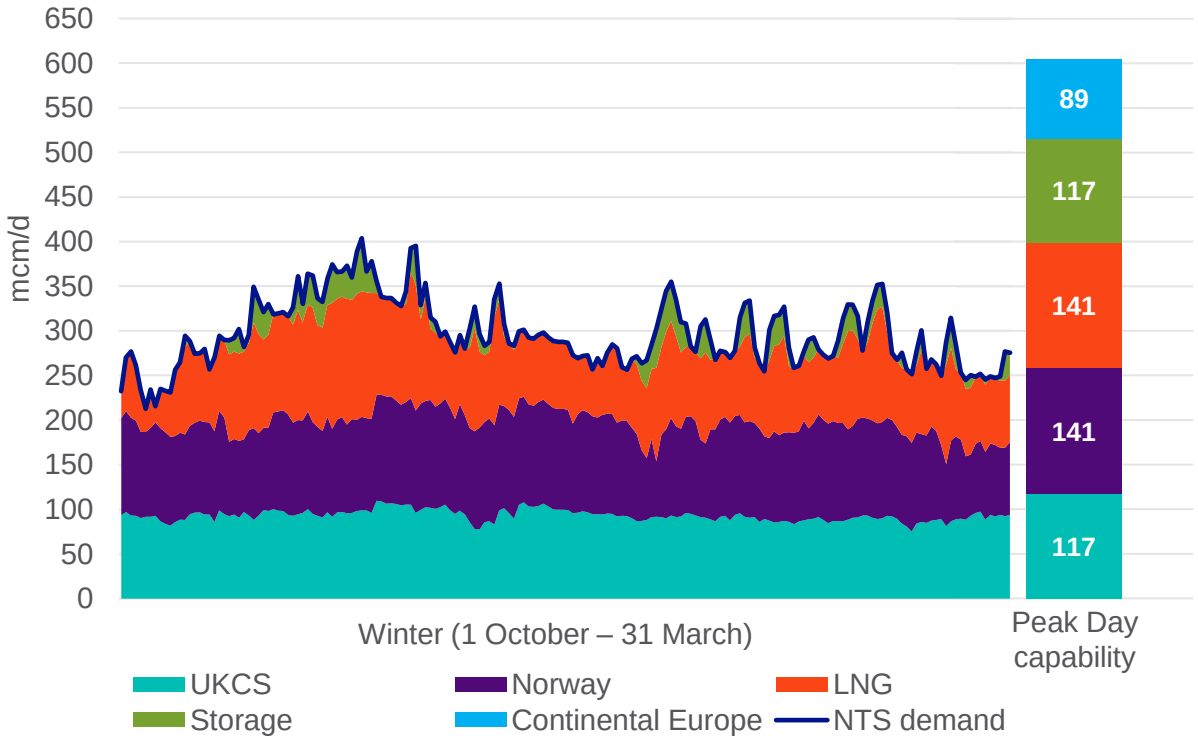


Table 6
Total winter demand in scenario 1.

Type	Total winter demand (bcm)		
	2019/20	Change	Scenario 1
Non-daily metered	30.9	-2.6	28.3
Daily metered	4.5	-0.3	4.2
NTS power generation	10.6	+3.1	13.7
Continental Europe	0.5	+3.2	3.7
Ireland	2.6	0.0	2.6
Total	**50.5***	**+3.4**	**54.0***

**Total demand includes storage injection so values will not tally. Change does not include storage injection difference.*

Table 7
Total winter supply and utilisation of peak capability.

Source	Total winter supply (bcm)		Utilisation (%)
	bcm	%	
UKCS	16.9	31	79%
Norway	18.8	35	73%
LNG	15.9	29	62%
Continental Europe	0.0	0	0%
Storage	2.4	4	157%
GB Total	**54.0**		

Key Observations:

- European imports are not required in this typical winter scenario if sufficient alternate flexible supplies come to GB. Our scenario prioritises LNG supplies to illustrate a level of supply that is elevated compared to recent Winters, but well within system capability.
- The volume of LNG required to balance the scenario could be reduced by higher supplies from UKCS or Norway, or by lower levels of exports earlier in the winter.
- GB storage is utilised throughout the winter to meet higher demands. Periods of lower demand provide the opportunity for GB storage to refill.

Scenario 2: cold winter, increased gas for power, European imports minimised

This scenario is based on the consumption demand experienced in the 2010/11 winter. We have applied a reduction to the level of NDM and DM demand to reflect the impact of the increased price of gas this winter. Power generation demand has been increased by assuming no electricity interconnector imports are available.

In line with prevailing forward price differentials, we have assumed exports to continental Europe in October and November, with the volume of exports shown in table 8.

This scenario illustrates that in a very high demand winter, imports from continental Europe may be required to achieve a supply-demand balance. In such a scenario, in which GB prices would need to show a premium to those at European hubs to incentivise imports, we would also expect to see a response from other sources, particularly Norway.

Figure 18

Scenario 2 supply and Peak Day capability.

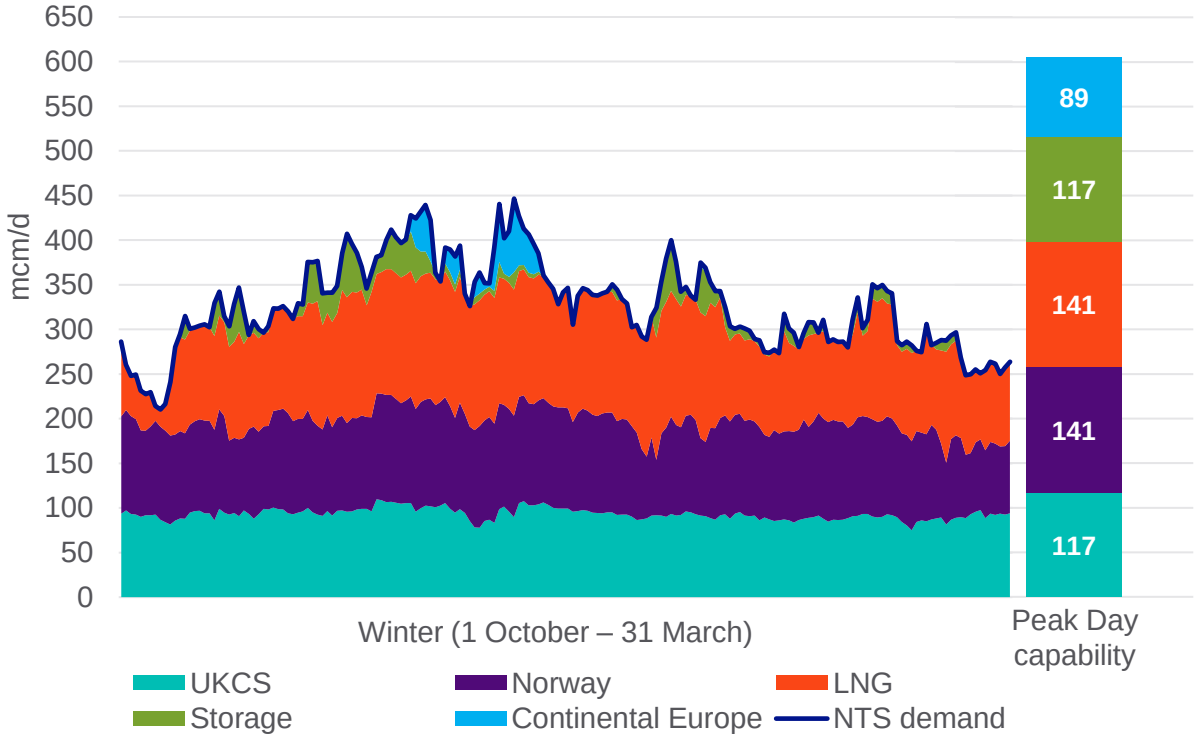


Table 8

Total winter demand in scenario 2.

Type	Total winter demand (bcm)		
	2010/11	Change	Scenario 2
Non-daily metered	34.6	-1.9	32.7
Daily metered	5.8	-1.1	4.7
NTS power generation	12.5	+1.2	13.7
Continental Europe	2.1	+1.3	3.4
Ireland	3.6	0.0	3.6
Total	**60.4***	**-0.5**	**59.4***

**Total demand includes storage injection so values will not tally. Change does not include storage injection difference.*

Table 9

Total winter supply and utilisation of peak capability.

Source	Total winter supply (bcm)		Utilisation (%)
	bcm	%	
UKCS	16.9	31	79%
Norway	18.8	35	73%
LNG	20.6	35	80%
Continental Europe	0.8	1	4%
Storage	2.2	4	144%
GB Total	**59.4**		

Key Observations:

- Additional flexible supplies are required in this cold weather scenario to supplement LNG, which reaches maximum capability on several days during the winter.
- The volume of European imports shown could be reduced by higher supplies from UKCS or Norway, or by lower levels of exports earlier in the winter.
- GB storage is utilised throughout the winter to meet higher demands. Periods of low demand provide the opportunity for storage to refill.

Scenario 3: cold snap

This scenario is based on the 'Beast from the East' cold snap experienced in February and March 2018. This cold snap period was the most recent example of market tightness in Great Britain. We cannot accurately predict this far in advance if and when a cold snap may occur this Winter, or what level GB storage stocks would be at that point. Therefore these illustrations highlight the deliverability difference of GB storage at stock levels of 75% and 25% full and how that impacts the need for alternative sources of supply.

Figures 19a and 19b are focussed on the flexible sources of supply LNG, GB storage, and imports from continental Europe. UKCS and Norway supplies are consistent with our other scenarios.

Maximum storage deliverability is shown on the charts as a percentage. This is the maximum percentage of supply storage can provide at its current stock level.

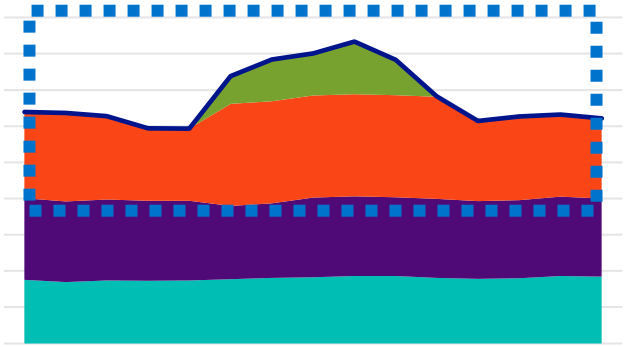


Table 10

Storage stock levels for scenario 3.

Storage % full	Total storage stock on first day of cold snap (mcm)	Total storage supply during cold snap (mcm)
75	1117	238
25	386	97

Key Observations:

- GB storage historically acts as a short-term balancing source of supply during periods of higher demand as shown in this scenario.
- Additional flexible supplies are required when storage levels are low to supplement LNG, which reaches maximum capability during the cold snap.
- The higher demand is a partial reversal of the reduction in domestic consumption due to prevailing high energy prices, demand may not respond to the weather trigger if price is still a critical factor for consumers.
- The volume of European imports shown could be reduced by higher supplies from UKCS or Norway.

Figure 19a

Cold snap supplies with 75% full storage

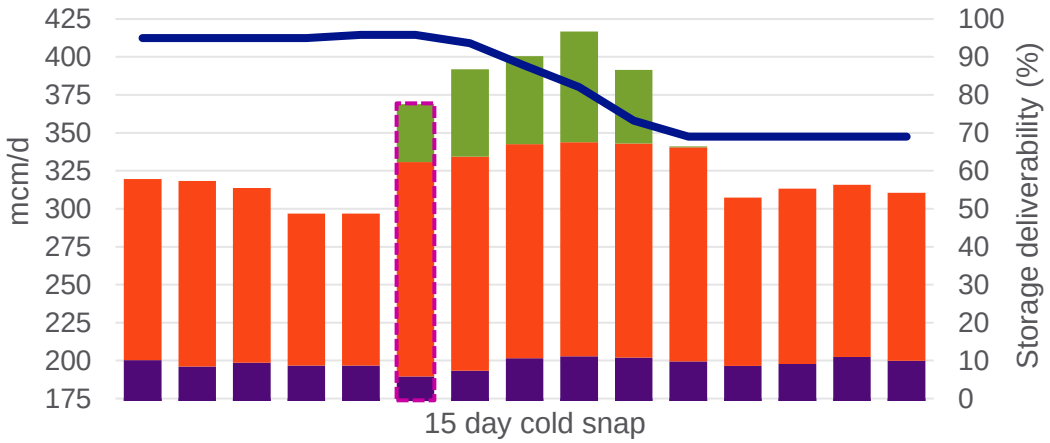
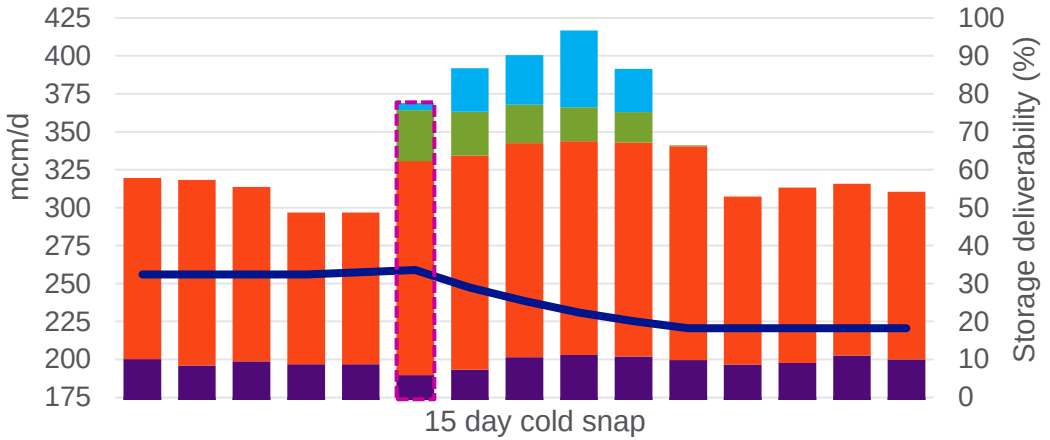


Figure 19b

Cold snap supplies with 25% full storage



09

Contact us

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Continuing the conversation

We look forward to continuing the conversation with you at our upcoming engagement forums. The dates for our next Gas Operational Forums are available in the box to the right.

You can find details about the forums, and how to sign up to attend them, on our website.

Your feedback is so important to us

Letting us know what you think of the information we share with you, and how we're sharing it, helps us shape our future communications to ensure we're communicating what matters most, in a way that suits you.

Email us with your views and feedback on our publications at:

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For any press enquiries, or if you have any comments or questions about the content contained within this publication specifically, please get in touch with our Corporate Affairs team:

Contact Jake Tudge for any enquiries for our leadership team.

Contact Ntobeko Chidavaenzi for any media enquiries.

Contact Andrew Marsh for any general enquiries.

National Grid

Upcoming Gas Operational Forum Dates:

- 20 October 2022
- 24 November 2022

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10

Appendix

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Appendix – mcm to GWh conversion

Executive Summary

Key messages (GWh)

Forecast (GWh)	2021/22	2022/23
1-in-20 peak demand	4,934	4,719
1-in-20 non-storage supply	4,807	4,767
1-in-20 storage supply	1,143	1,143
Total 1-in-20 supply	5,950	5,911
1-in-20 margin	1,016	4,719
Cold day demand	4,103	4,299
Cold day non-storage supply	3,878	3,781
Cold day storage supply	918	918
Total Cold day supply	4,797	4,699
Cold day margin	694	401

Table 1

Historic supply by source for the last five winters (GWh)

Supply source	Historic winter supply (GWh)				
	17/18	18/19	19/20	20/21	21/22
UKCS	192458	181712	178781	167058	164127
Norway	205158	181712	154357	181712	185619
LNG	17585	76202	130911	86948	111372
Continental Europe	76202	22470	2931	46893	4885
Storage	37123	18562	23447	20515	18562
Total	**528526**	**480658**	**490427**	**503126**	**484565**

Table 2

Forecast total gas demand for winter 2022/23, and weather corrected historical data for 2017/18 – 2021/22

Winter demand (GWh)	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	Actual demand, weather corrected					forecast
Non-daily metered (NDM)	298,945	293,083	301,876	296,014	290,152	275,498
Daily Metered (DM) (excluding NTS power generation)	46,893	43,962	43,962	42,986	39,078	37,124
NTS power generation	125,049	120,164	103,556	107,464	98,671	120,164
Total GB demand[5]	470,887	457,210	449,394	446,463	427,901	432,786
Island of Ireland exports	17,585	20,516	25,401	29,308	27,354	37,124
Continental Europe	6,839	0	4,885	0	36,147	46,893
Storage injection	22,470	14,654	13,677	15,631	12,700	12,700
Total gas demand[6]	520,711	495,311	496,288	495,311	507,034	530,481

Table 3

Actual and projected supply ranges for winter 2021/22 and winter 2022/23 (GWh).

Winter supply (GWh)	2021/22		2022/23
	actual range	mean	projected range
UKCS	733-1075	909	664-1143
Norway	606-1182	1016	332-1377
Continental Europe	0-313	29	0-869
LNG	68-1182	615	49-1377
Storage	0-576	107	0-1143

Conversions from mcm to GWh have been made with a CV of 35.17MJm[3]

Appendix - mcm to GWh conversion

Table 4
Peak day, N-1 largest loss supply and demand totals and margins, for the 2022/23 winter

Forecast (mcm/d)	2021/22	2022/23
1-in-20 peak demand	4,934	4,719
1-in-20 non-storage supply	4,807	4,767
1-in-20 storage supply	1,143	1,143
Total 1-in-20 supply	5,950	5,911
1-in-20 supply margin	1,016	1,094
N-1 largest loss	-703	-703
N-1 supply margin	313	488

Conversions from mcm to GWh have been made with a CV of 35.17MJm^3

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Glossary

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Term	Description
Bacton exit capacity bookings	The amount capacity that has been pre-booked to exit the NTS, via Bacton, through the interconnectors to be exported to Europe. Exports booked in advance provide a view of the level of exports that will be observed over winter.
Bcm	Billions of cubic metres.
BBL (interconnector)	A bi-directional gas pipeline connecting Bacton in the UK and Balgzand in the Netherlands .
Combined Cycle Gas Turbines (CCGT)	A combined-cycle power plant uses both a gas and a steam turbine together to produce up to 50% more electricity from the same fuel than a traditional simple-cycle plant. The waste heat from the gas turbine is routed to the nearby steam turbine, which generates extra power.
Compressor	Compressors are used to move gas around the transmission network through high pressure pipelines. There are currently 71 compressors at 24 sites across the country. These compressors move the gas from entry points to exit points on the gas network. They are predominantly gas driven turbines that are in the process of being replaced with electric units.
Cold day	The supply or demand for the coldest day in an average (or seasonal normal) winter. The cold day is taken as day 1 of the Average Load Duration Curve, with calculations using weather history over the period 1960 – 2012.
Combined Weather Variable (CWV)	The Composite Weather Variable (CWV) is a single measure of daily weather in each LDZ and is a function of actual temperature, wind speed, effective temperature and seasonal normal effective temperature.
Demand Side Response (DSR)	Demand Side Response is a service that was developed by gas industry representatives to encourage daily metered (DM) consumers to offer to reduce their gas demand during times of system stress.
Electricity (power) generation	Electricity generated by the burning of gas.
European interconnectors	A term used to describe both of the bi-directional gas pipelines that connect Bacton in the UK to Balgzand in the Netherlands (BBL) and to Zeebrugge in Belgium (Interconnector Limited).
Export	Gas demand on the NTS from interconnectors to continental Europe or the island of Ireland.
GWh	Gigawatt hours.
Injection	Gas for storage injection This is gas which is put (‘injected’) into a gas storage facility.
Interconnector Limited	The Interconnector (UK) Limited is a bi-directional gas pipeline connecting Bacton in the UK and Zeebrugge in Belgium.

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Term	Description
Liquefied Natural Gas (LNG)	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
Margin	The difference between gas supply and demand. A positive margin indicates supply is greater than demand. A negative margin when demand is greater than supply.
Margins Notice Trigger	A Margins Notice will be issued if the day ahead (D-1) total NTS forecast system demand is equal to or greater than the Expected Available Supply (EAC). EAC comprises of the sum of the NTS' Non-Storage Supply (NSS) assumptions plus Liquified Natural Gas (LNG) and Storage Deliverability (SD) that qualifies under the prevailing Safety Monitor requirements. Should the day ahead (D-1) total NTS forecast system demand be within 95% of the Expected Available Supply (EAC) than alert will also be sent to industry informing them of this.
Market Information Provision Initiative (MIPI)	Market Information Provision Initiative (MIPI) is a web-based, information platform that serves market participants with a wide-ranging view of Gas Transmission operational data.
Market participants	Those involved in buying and selling gas on the NTS
Mcm	Million cubic metres.
MRS (Medium-range storage) / GB storage	Gas storage facilities designed to switch rapidly between injection and withdrawal to maximise the value from changes in gas price.
Moffat interconnector	The interconnector pipeline that connects the British system at Moffat, in Scotland to the Republic of Ireland, Northern Ireland and the Isle of Man. Physical gas flows are currently only possible in the direction of exit from GB.
N-1 largest loss / 'Under N-1 conditions'	The N-1 assessment means that we, as the Gas System Operator, have to ensure that: • the NTS 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 • the high pressure gas network has sufficient redundancy to meet a 1-in-20 peak day demand, even with the failure of the single biggest piece of infrastructure.
National Grid Supply Emergency (NGSE)	A network gas supply emergency (NGSE) occurs when we are unable to maintain a supply – demand balance on the NTS using our normal system balancing tools. As a consequence of the imbalance between supply and demand, pressures in the system fall and it may not be possible to safely maintain gas supplies to industrial and domestic gas consumers who are supplied with gas either directly or indirectly from the NTS. A network gas supply emergency (NGSE) may be caused by unforeseen circumstances, such as pipeline or equipment failure, or where system demand exceeds either total supply or planned system capacity.

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Term	Description
National Grid Prevailing View	Our Prevailing View tool provides a snapshot of real time data and associated contextual data that provides a high-level overview of the current status of the NTS.
Network Emergency Coordinator (NEC)	The NEC is responsible for coordinating actions across the affected parts of the gas network to take action to prevent, as far as possible, a supply emergency developing, and where it cannot be prevented, to take timely decisions in order to minimise the safety consequences. The NEC is independent from any commercial interests of gas industry participants. Industry participants such as gas transportation and gas shipping companies have a legal duty to cooperate with the NEC.
National transmission system (NTS)	A high pressure gas transportation system consisting of compressor stations, pipelines, multijunction sites and offtakes. Pipelines transport gas from terminals to offtakes. The system is designed to operate at pressures up to 94 barg.
Non-storage supply (NSS)	Gas that comes from sources other than gas storage. This includes supply from the UK Continental Shelf (UKCS), Norwegian imports, European imports and imports of Liquefied natural gas (LNG).
Norway / Norwegian supplies	Gas supplied to the NTS via pipelines from Norway.
NTS shrinkage	NTS shrinkage is made up of 3 components. Unaccounted for gas (UAG) is unallocated gas or gas that is lost or stolen from the system. Own use gas (OUG), gas that is used in the running of the system e.g. compressor fuel. And calorific value shrinkage (CVS) where gas of a particularly low or high CV enters the distribution network which differs with the flow weighted average CV of gas entering that network.
Operating Margin	Operating Margins (OM) relate to how we use gas to manage short-term impacts of operational stresses (e.g. supply loss) where the market response is not sufficient, or during a gas system emergency.
Peak day capability	This refers to the maximum level of supply capability of the NTS
Peak demand (1-in-20)	This is a 1-in-20 demand which means that statistically, in a long series of winters, it would be exceeded in one out of 20 winters. The 1-in-20 peak day is calculated from a statistical distribution of simulated historical peaks days. It is not the highest demand in the last 20 years, nor is it the demand that would be expected in the cold weather experienced in the last 20 years.
Peak supply	This refers to the maximum supply that can be achieved on any given day
Price differential	The difference in price between markets e.g. GB and continental Europe. Energy supplies tend to flow to whichever market has the highest price.
Renewable	Forms of energy generation from renewable resources, which are naturally replenished, such as sunlight and wind.

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Term	Description
Safety Monitor	The safety monitor describes an amount and deliverability of gas that needs to remain in storage over the winter period in order to supply customers that cannot be safely or immediately isolated from the gas network. The safety monitor calculates how much gas is required to supply these customers across the whole of a severe 1-in-50 winter. The safety monitor exists to maintain the safe operation of the gas system by maintaining adequate pressures on the network, rather than to support security of supply. The space requirement of the safety monitor is made up of the 'protected by monitor' and 'protected by isolation' elements: • Protected by monitor applies to sites that cannot be safely isolate from the gas network; for example, domestic properties. Where there is not enough non-storage supply across the winter to meet this demand, this is the volume of gas that needs to be available in storage to ensure these properties are never isolated from the network. • Protected by isolation applies to sites that could be safely isolated rom the gas network, but not immediately. As a result, there is an additional gas demand associated with the time it would take to safely isolate them from the gas network. The total space requirement from these two elements is then divided across storage facilities. There has not been a breach of the safety monitor level since it was introduced in 2004. We set a preliminary safety monitor well ahead of the winter period, with a further update in the autumn. This is then kept under review for the whole winter. You can find more information about the safety monitor on our website. The preliminary safety monitor storage space requirement for winter 2020/21 has been set at 0GWh of space, with deliverability of 0 GWh/day.
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.
Seasonal normal demand (SND)	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.
UK Continental Shelf (UKCS)	UKCS is 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.
Weather corrected (demand)	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.

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