June 2020

Winter Review and Consultation

Helping to inform the electricity industry and prepare for the winter ahead.

nationalgridESO

Welcome

Welcome to our 2020 *Winter Review and Consultation* publication. This annual document provides a review of last winter's forecasts compared to what actually happened, and an opportunity to share your views on the winter ahead.

In previous years, the *Winter Review and Consultation* has covered both gas and electricity. This will be the first year where two separate documents are published. This document covers only the electricity perspective. We will continue to engage with National Grid Gas Transmission to ensure consistency of approach. The Gas *Winter Review and Consultation* can be found **here**.

We are keen to engage with industry on preparations for the coming winter. If you would like to share your views, please refer to the consultation section in this publication, or join us for a discussion on winter preparedness at our weekly Electricity National Control Centre (ENCC) webinar on 1 July. Information on these webinars, including a link to registration, can be found **here**.

If you have any general queries or comments, don't hesitate to email us at **marketoutlook@nationalgrideso.com**, or you can join the conversation at the Operational Forum, weekly ENCC webinars or by using social media via LinkedIn, Facebook and Twitter.

Contents

Consultation / Introduction

The purpose of this annual consultation is to gather stakeholder insight each June to inform our analysis for the upcoming *Winter Outlook Report*, published in October 2020.

Your views on the market and related issues are always important to provide a comprehensive picture of the challenges and opportunities of the forthcoming winter.

However, this year, we have also included questions on the impact of Covid-19 to ensure that any potentially relevant impacts are reflected in our planning.

It also allows us to test how useful the suite of Outlook documents are and to identify areas for improvement with our engagement.

This year's consultation closes on 29 July 2020.

Refer to the next slide for questions. You can send us your views via email: marketoutlook@nationalgrideso.com

On 1 July, the ENCC weekly webinar will feature the topic of 'winter readiness,' where you can also share your views on the winter ahead and ask us questions. Please register here.

Consultation / Questions

Winter 2020/21 preparations

1. Is there anything you would like to share with us on your preparations for the forthcoming winter period? For instance, to what extent have your preparations been impacted by Covid-19 and related restrictions?

2. Do you foresee any challenges in fulfilling your role in the energy system this winter, for example, in relation to:

- plant reliability;
- outage planning;
- European price spreads;
- delays to commissioning new capacity; or
- the UK's exit from the European Union?

3. Do you have any other comments in relation to winter 2020/21 in relation to electricity demand, supply or operability?

Triad avoidance

4. Did you or your customers participate in triad avoidance over the winter 2019/20, and what were your primary reasons for doing so?

5. Do you think that the peak level of triad avoidance will increase or decrease in winter 2020/21, and what do you think the reason will be for this change?

Winter Outlook Report

6. In the *Winter Outlook Report*, we usually only publish a single figure for peak demand and the associated margin. However, the current Covid-19 situation presents additional uncertainty.
In terms of how you use *Winter Outlook Report*, are single values preferred, or would ranges that reflects the uncertainty be more appropriate? If we presented ranges, what impact would this have for you?

7. Is there anything different you would like to see in the *Winter Outlook Report,* published in October 2020?

Winter Review and Consultation

8. What do you use the *Winter Review and Consultation* document for? What information in the report is most useful to you for this?

9. Is there anything else that could be included in the *Winter Review and Consultation*?

10. How do you think the *Winter Review and Consultation* could be improved to increase benefit for consumers?

11. Do you have any other feedback on this report or the other Outlook documents?

This year's consultation closes on
29 July 2020.

You can send us your views via email: **marketoutlook@nationalgrideso.com**

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Review / Key messages 2019-20

Winter 2019/20 was a season of variable weather with mild, wet and windy periods throughout. February 2020 was the wettest on record for England and Wales.[1] Our operations across the electricity network responded flexibly throughout the winter period to continue to deliver a reliable supply of electricity during these variable weather conditions.

As anticipated in the *Winter Outlook Report*, no additional adequacy or operability challenges were experienced as a result of the UK entering the transition period, following the UK's exit from the European Union.

1 Meeting demand

Electricity margins were in line with expectations.

There was sufficient supply available to meet demand at all times during the winter period.

Demand levels were close to our forecast.

2 Managing the system

The variable weather conditions caused some operational challenges that were overcome on the electricity system.

There were extended periods over the winter where actions were required to manage operability challenges that have historically been associated with the summer months.

This included inertia management.

3 Carbon intensity

Winter 2019/20 was the lowest carbon intensity winter on record for electricity generation.

High wind and low coal generation resulted in a continued reduction in the average carbon intensity of electricity, to 206 gCO2e/kWh.

This represents a 14% decrease compared to last winter.

1. February 2020 was the second wettest February for Scotland

Review / Electricity demand

With above average rainfall in some months, winter 2019/20 experienced fairly mild temperatures, along with high winds. Both peak and minimum transmission system demands[2] were close to forecasts from the *Winter Outlook Report*.[3]

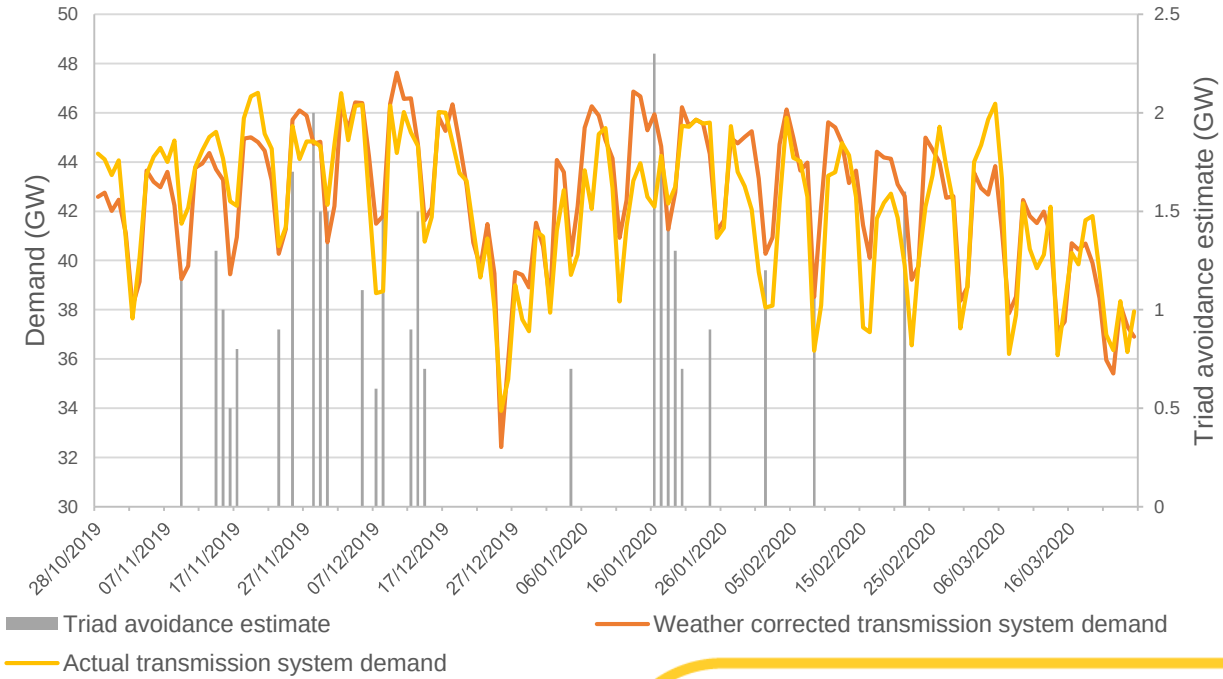
Peak transmission demand was slightly higher than forecast on a weather corrected basis, most likely as a result of a lower outturn from distribution connected generation than anticipated (see table 1).

	Winter Outlook 2019/20 forecast (GW)	Actual 2019/20 (not weather corrected) (GW)	Actual 2019/20 (weather corrected) (GW)
Peak demand	46.4	46.8	47.6
Minimum demand	19.7	20.9	20.3

Table 1. Peak and minimum transmission system demands for winter 2019/20

As shown in figure 1, the demand in mid-March decreases significantly, as a result of Covid-19 effects. We are already looking at the long term towards the winter to assess potential impacts on the electricity network. More details will be included in the *Winter Outlook Report* in October. To help us with our analysis, please see our consultation questions on slide 4.

Figure 1. Daily actual and weather corrected transmission system peak demands with triad avoidance estimates.



2. Transmission system demands include station load (600 MW) and nominal interconnector import (750 MW).
3. The last two weeks of winter were impacted by Covid–19. No adjustments have been made for this.

Review / Triad avoidance

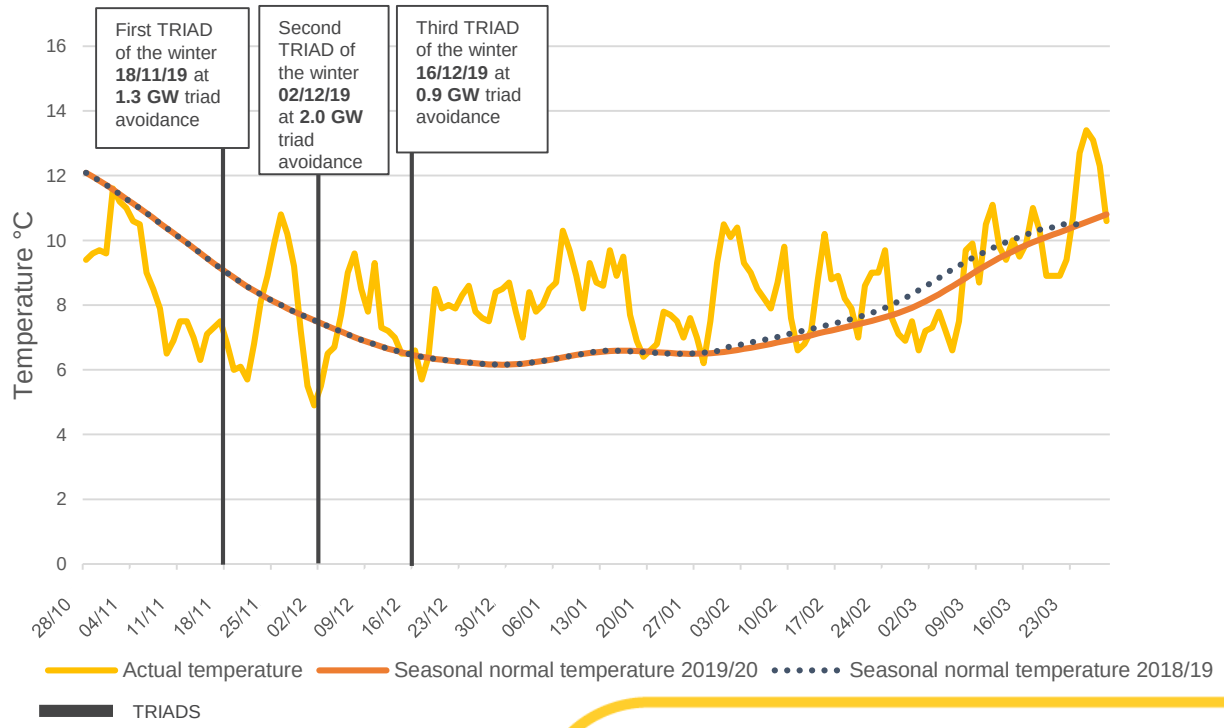
Triad avoidance occurs when industrial and commercial users alter their pattern of energy use during peak periods to avoid transmission charges. The three half hourly periods with the highest demand over the winter are known as Triads. There was a decreased level of Triad avoidance over winter than anticipated in our forecasts.

	What we said in the *Winter Outlook*	What actually happened	Why was there a difference?
Triad avoidance	Maximum forecast triad avoidance: 2.6 GW	Triad avoidance levels varied between 0.5 GW and 2.3 GW. The values corresponding to the three Triad dates were 0.9 GW,1.3 GW and 2 GW (see figure 2).[4]	This is likely to be a result of slightly suppressed demands, and the implementation of CMP264/265, as reducing energy consumption over triad periods becomes less valuable.

Table 2. Triad avoidance commentary for winter 2019/20

As shown from the graph below, the three triad dates for winter 2019/20 all fell on a Monday between November and December. In addition, there is a strong correlation between the triad dates and when there were low temperatures over the winter. The seasonal normal temperatures for this winter period are similar to winter 2018/19.

Figure 2. Daily actual and seasonal normal temperature for winter 2018/19 and 2019/20 alongside the date of the three Triads, and our estimates of Triad avoidance for these.



4. The triad avoidance estimate is not based on demand reduction data provided to us by suppliers, customers or aggregators.

Review / Electricity supply

As anticipated, generation and interconnector imports were sufficient to meet demand at all times across the winter period. Wind generation continued to grow its generation share, increasing from 18% to 23% over the winter period. Coal generation declined further, making up only 4% of the supply mix. This led to the lowest carbon intensity winter on record of 206 gCO2e/kWh.[5]

	What we said in the *Winter Outlook*	What actually happened	Why was there a difference?
Clean dark spreads versus clean spark spreads	Gas-fired generation will have a cheaper marginal cost, and therefore run ahead of coal-fired power stations in the generation merit order.	The higher production costs of coal compared to gas led to a slight decrease (as a percentage of total supply) of coal compared to last winter.	This was in line with our expectations. High EU ETS prices supported the relative cost of gas compared to coal generation.
Breakdown rates (This term covers all aspects of plant reliability, including restrictions and unplanned generator breakdowns)	Breakdown rates are expected to range from 3% for biomass, to 7% for coal plants, and 9% for nuclear.[6]	While breakdown rates were largely as expected (i.e. within a small range of our forecast) for most generation types, coal and biomass were significantly higher than our assumptions (28% for coal and 12% for biomass).	The difference in forecast and actual breakdown rates for coal was due to commercial unavailability. Similarly, biomass unavailability levels were higher than what was notified in advance over the winter. If the system margins had been lower, biomass availability may have been higher.
Margins	Normalised and average cold spell (ACS) demand can be met in all weeks across the winter under all interconnector scenarios and in all but three weeks under the low import scenario (for ACS only).	There was sufficient generation and interconnector imports to meet demand throughout the winter period.	This was in line with expectations. Refer to data workbook for further detail.

Table 3. Electricity supply commentary for winter 2019/20

Figure 3.1. Percentage energy provided by each fuel type over winter 2018/19 (transmission connected)

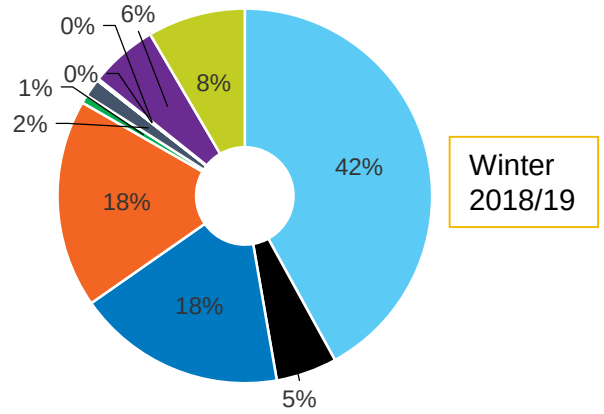
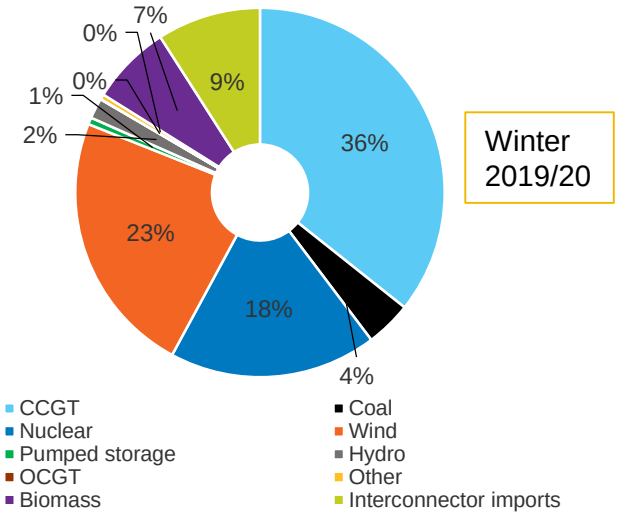


Figure 3.2. Percentage energy provided by each fuel type over winter 2019/20 (transmission connected)



5. See Data Workbook or National Grid ESO's carbon intensity app to view real time and historical information on how our electricity is produced.
6. Further detail on all generation plant breakdown rates can be found in the data workbook.

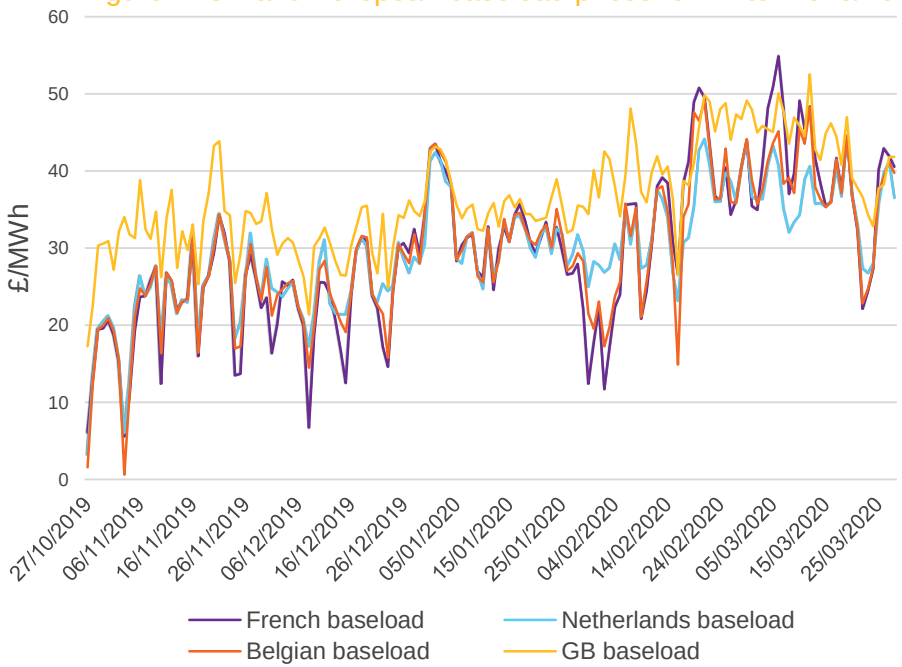
Review / Europe and interconnected markets

Interconnector imports were largely as expected throughout the winter period. Currently, five interconnectors link Great Britain's (GB) electricity market with continental Europe and the island of Ireland. Flows on these interconnectors are driven by electricity price differentials between the connected markets.

	What we said in the *Winter Outlook*	What actually happened	Why was there a difference?
Physical capabilities	There are planned outages for the East West Interconnector (EWIC) between 31 October – 1 November; and 5 – 6 February.	EWIC ran during the planned outage periods but did have a four day outage in mid-March.	Unplanned outages impacted interconnector availability. Refer to the data workbook for further detail.
European forward prices	Forward electricity prices for winter 2019/20 in continental Europe will be lower than in GB. We expect net imports of electricity on interconnectors from continental Europe to GB for most of the winter.	For most of winter 2019/20, forward prices in continental Europe were lower than in GB (see figure 4). This meant we saw a net flow of electricity from the Continent to GB for most of the winter period.	This was in line with expectations. Refer to the data workbook for further detail.
European outages	Planned French nuclear power station outages for this winter are lower than the previous winters, which should lower France's demand for interconnector imports, particularly in cold spells.	Available French nuclear capacity in winter 2019/20 was higher than or similar to winter 2018/19.	This was in line with our expectations. Refer to the data workbook for further detail.

Table 4. Europe and interconnected markets commentary for winter 2019/20

Figure 4. GB and European baseload prices for winter 2019/20



Review / Europe and interconnected markets

Interconnector peak flows were largely as expected. GB typically received full imports of electricity from France and the Netherlands. As anticipated, there was a net flow of electricity from GB to Ireland over the winter.

	What we said in the *Winter Outlook*	What actually happened
Overview of Continental European interconnectors (Interconnexion France Angleterre - IFA, BritNed, Nemo Link)	We expect there to be sufficient interconnector imports to meet demand at peak times from IFA, BritNed and Nemo Link, although occasionally not at full import and subject to weather variations.	Peak flows were as expected. IFA, BritNed and Nemo Link imported to the extent that they were available throughout the winter.
	A new electricity interconnector, ElecLink, is under construction, which may come into operational service towards the end of the winter period. However, our core scenarios assume that it does not come into service over winter.	ElecLink did not come into service over the winter period.
Overview of Irish interconnectors (Moyle and EWIC)	We expect GB to export to Ireland during peak times on both Moyle and EWIC interconnectors. This may be reversed to import into GB during periods of high wind in Ireland or system stress in GB.	Both Moyle and EWIC exported electricity to Northern Ireland and the Republic of Ireland at peak times for the majority of the winter.

Table 5. Europe and interconnected markets commentary for winter 2019/20

Figure 5.1. IFA, BritNed and Nemo Link flows at peak times.[7]

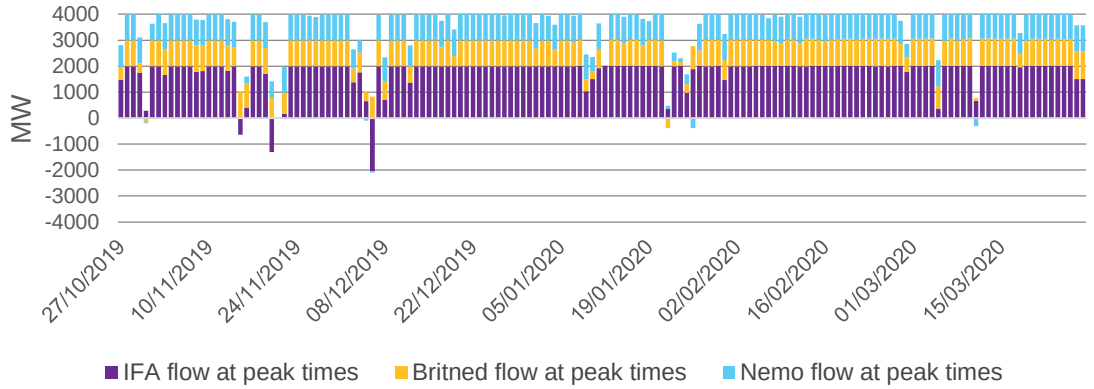
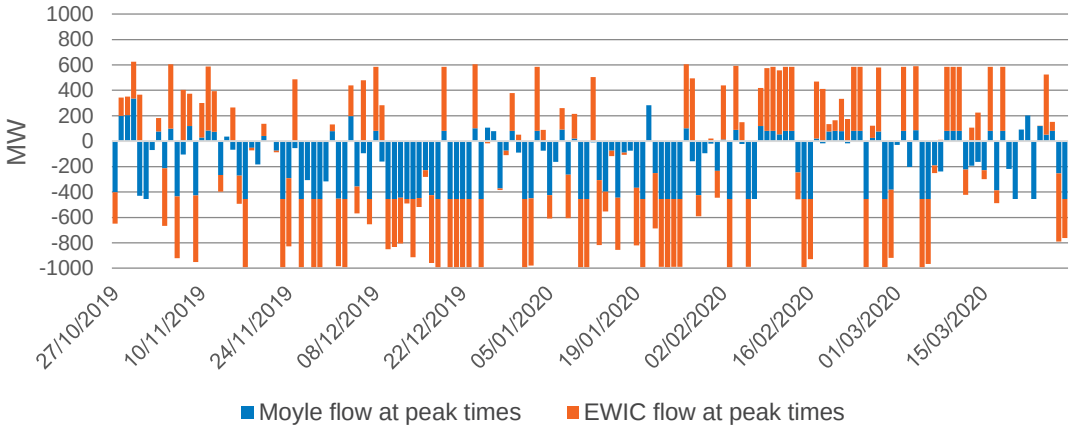


Figure 5.2. Moyle and EWIC flows at peak times.[8]



7,8. Positive MW signifies imports.
Note the 'why was there was a difference' column is not included here, since what actually happened was as expected in last year's *Winter Outlook Report.*

Review / Operational view

The mild, wet and windy weather, and subsequent periods of high renewable output, meant that we saw similar operability challenges on the system compared to those faced in the summer months. We took action across the five core areas to ensure operational security over the winter period.

Thermal
Generation, including interconnector flows was managed as appropriate to mitigate any constraints and faults or outages presented on the system. The import and export from Scotland continued to present operability challenges, particularly due to Hunterston power station not returning as indicated, and the reduced availability of the western HVDC link. Fine tuning response levels on the Scottish and English transmission networks were key to ensure post-fault system security. Potential operability challenges in the south east of England did not materialise, primarily because of the outage of Dungeness power station and the ElecLink interconnector being delayed.

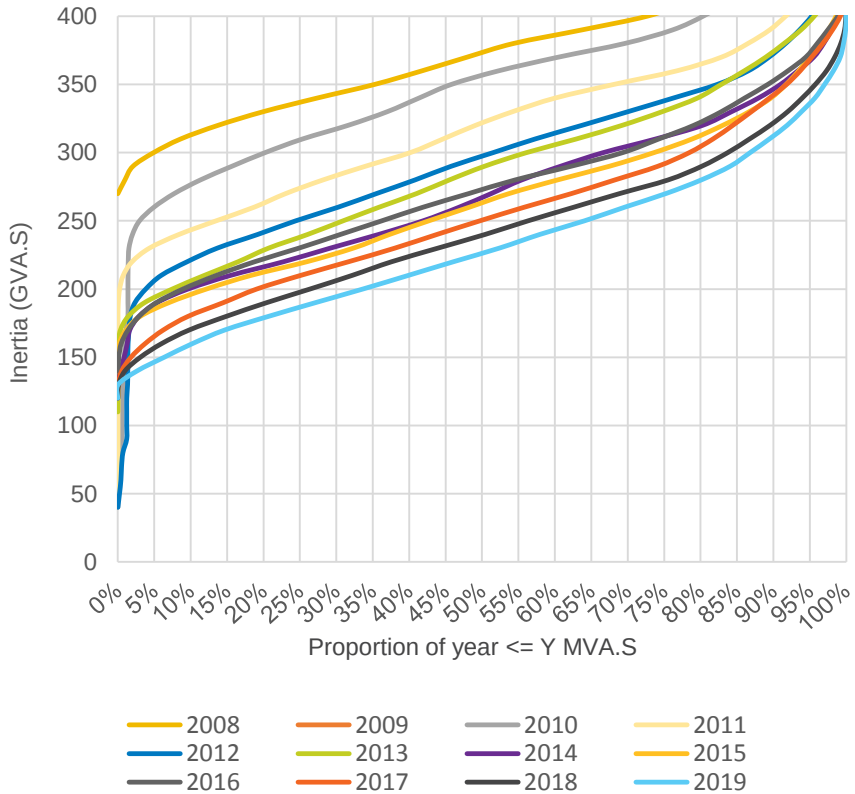
Voltage
Managing reactive power and voltage levels continued to be required, particularly during lower demand periods over the winter.This was notable in London, South Central, West Midlands and North West England. Contracting units to be generating (and therefore providing reactive power) ahead of time, alongside trading and Balancing Mechanism actions, were the main approaches used to manage voltage over the winter.

Stability and frequency
During periods of low demand, high volumes of low inertia generation can cause operational challenges such as high rate of change of frequency (RoCoF) and vector shift.

Figure 6 shows the distribution of inertia levels experienced on the system from 2008 to 2019. Last year saw a continuation of the recent trend of year-on-year reductions in inertia levels. Therefore, there have been more periods across the year where the ESO has taken action to manage low inertia levels on the electricity system.

Restoration
Our Black Start capability was maintained over the winter period as per our requirement.

Figure 6. Inertia history load duration from 2008 to 2019



See our operability strategy report for more information on the future challenges we face in maintaining an operable electricity system and what we are doing about them.

Glossary

Active Notification System (ANS)
A system for sharing short notifications with the industry via text message or email.

Breakdown rates
A calculated value to account for unexpected generator unit breakdowns, restrictions or losses. Forecast breakdown rates are applied to the operational data provided to the ESO by generators. They account for restrictions and unplanned generator breakdowns or losses close to real time. Rates are based on how generators performed on average by fuel type during peak demand periods (7am to 7pm) over the last 3 winters.

BritNed
BritNed Development Limited is a joint venture between 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)
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 intensity
A way of examining how much carbon dioxide is emitted in different processes. It is usually expressed as the amount of carbon dioxide emitted per kilometre travelled, per unit of heat created or per kilowatt hour of electricity produced.

Clean dark spread
The revenue that a coal fired generation plant receives from selling electricity once fuel and carbon costs have been accounted for.

Clean spark spread
The revenue that a gas fired generation plant receives from selling electricity once fuel and carbon costs have been accounted for.

CMP264/265
Changes to the Charging and Use of System Code (CUSC). These changes were phased in from 1 April 2018 and reduce the value of avoided network charges over Triad periods.

CO2 equivalent/kWh
The units ‘gCO2eq/kWh’ are grams of carbon dioxide equivalent per kilowatt-hour of electricity generated. Carbon dioxide is the most significant greenhouse gas (GHG). GHGs other than carbon dioxide, such as methane, are quantified as equivalent amounts of carbon dioxide. This is done by calculating their global warming potential relative to carbon dioxide over a specified timescale, usually 100 years

Combined cycle gas turbine (CCGT)
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.

Distribution connected
Any generation or storage that is connected directly to the local distribution network, as opposed to the transmission network. It includes combined heat and power schemes of any scale, wind generation and battery units. Generation that is connected to the distribution system is not usually directly visible to National Grid as the system operator and acts to reduce demand on the transmission system.

East West Interconnector (EWIC)
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/**

European Union Emissions Trading System (EU ETS)
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.

Floating
When an interconnector is neither importing nor exporting electricity.

Glossary

Footroom
is when a generator can reduce its output without going below minimum output levels.

Forward prices
is the predetermined delivery price for an underlying commodity, such as electricity or gas, as decided by the buyer and the seller of the forward contract, to be paid at a predetermined date in the future.

GW Gigawatt (GW)
is a measure of power. 1GW = 1,000,000,000 watts.

Interconnexion France–Angleterre (IFA)
The England–France Interconnector is a 2,000 MW link between the French and British transmission systems. Ownership is shared between National Grid and Réseau de Transport d'Electricité (RTE).

Inertia
System inertia is how resilient a system is to frequency change. System inertia will depend on what types of generation are connected to the system. Typically, generators with large moving parts have high inertia – because their moving parts continue to move even after they are switched off or turned down. In contrast, some types of generation that have no moving parts, such as solar panels, are classed as low inertia generation

Inflexible generation
Types of generation that require long notice periods to change their output, do not participate in the Balancing Mechanism or may find it expensive to change their output due to commercial arrangements or technical reasons. Examples of inflexible generation include nuclear, combined heat and power (CHP) stations, and some hydro generators and wind farms.

Interconnector (elec)
Electricity interconnectors are transmission assets that connect the GB market to Continental Europe. They allow suppliers to trade electricity between these markets.

Load factors
are an indication of how much a generation plant or technology type has output across the year, expressed as a percentage of maximum possible generation. These are calculated by dividing the total electricity output across the year by the maximum possible generation for each plant or technology type.

Margins Notice Issued
if forecast demand for the day ahead exceeds a pre-defined forecast of supply.

Moyle
A 500 MW bi-directional interconnector between Northern Ireland and Scotland. You can find out more at **www.mutual-energy.com**

National electricity transmission system (NETS)
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 Electricity System Operator (ESO).

Nemo Link
The Nemo Link is an HVDC sub-sea link between GB and Belgium.

Positive and negative reserve
To manage system frequency and to respond to sudden changes in demand and supply, the ESO maintains positive and negative reserve which is the capability to increase or decrease supply and demand.

Pumped storage
A system in which electricity is generated during periods of high demand by the use of water that has been pumped into a reservoir at a higher altitude during periods of low demand.

Glossary

Rate of Change of Frequency (RoCoF)
How quickly system frequency changes on the electricity network. Usually measured in Hertz per second. Some generators have a protection system that will disconnect them from the network if the Rate of Change of Frequency goes above a certain threshold.

Reactive power
describes the movement of energy across a network and is measured in MVAr. Different types of network assets and generators can generate or absorb reactive power. The flows of reactive power on a system affect voltage levels.

Renewables
Forms of electricity generation from renewable resources, which are naturally replenished, such as sunlight, wind.

Reserve requirement
To manage system frequency and to respond to sudden changes in demand and supply, the Electricity System Operator maintains positive and negative reserve which is the capability to increase or decrease supply and demand. Reserve can be thought of as the requirement for a total amount of head room (positive reserve) and foot room (negative reserve) provided across all generators synchronised to the system.

RoCoF limit
The maximum loss we can allow on the system. A loss of generation larger than this limit has a high risk of resulting in a RoCoF of 0.125Hz/s.

Seasonal normal conditions
A set of conditions representing the average 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.

Transmission system demand (TSD)
Demand that National Grid, as the system operator, sees at grid supply points, which are the connections to the distribution networks.

Triad avoidance
When demand side customers reduce the amount of energy they draw from the transmission network, either by switching to distribution generation sources, using on-site generation or reducing their energy consumption. We observe this behaviour as a reduction in transmission demand. This is sometimes referred to as customer demand management, but in this section we are considering customer behaviour that occurs close to anticipated Triad periods, usually to reduce exposure to peak time charges.

Triads
The three half-hourly settlement periods with the highest electricity transmission 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. Typically they take place on weekdays around 4.30 to 6pm.

Vector shift
The sudden change in voltage phase angle in a part of the network. When this happens a generator's protection settings may disconnect it from the network to protect the equipment.

Voltage
Unlike system frequency, voltage varies across different locations on the network, depending on supply and demand for electricity, and the amount of reactive power in that area. Broadly, when electricity demand falls, reactive power increases and this increases the likelihood of a high voltage occurrence.

Weather corrected demand
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.

Western High Voltage (HVDC) link
The Western Link uses DC technology to reinforce the existing UK transmission system and move electricity across the country in very large volumes between Hunterston in Scotland and Deeside in North Wales.

Winter period
The winter period is defined as 1 October to 31 March.

Join our mailing list to receive email updates on our Future of Energy documents.

www.nationalgrideso.com/research-publications/winter-outlook

Email us with your views on the *Winter Review and Consultation* at: marketoutlook@nationalgrideso.com and we will get in touch.

You can write to us at:
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The *Winter Review and Consultation* is part of a suite of documents prepared by the Electricity System Operator on the future of energy. They inform the energy debate and are shaped by feedback from the wider industry. Visit our website for more information.

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