April 2020

Summer Outlook

Helping to inform the energy industry and support preparations for the summer ahead

nationalgridESO

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Welcome

Welcome to our 2020 Summer Outlook Report. This contains our view of the electricity system for the summer ahead and is designed to support the industry in its preparations for the period.

Foreword

This is no ordinary Summer Outlook report. We are currently in an unprecedented situation caused by the global spread of the Covid-19 virus. I want to reassure the millions of homes and businesses that rely on us each day to keep their lights on: we are fully focused on keeping the electricity system running throughout the pandemic.

Measures taken to curb the spread of the virus are driving unprecedented changes to society and the economy. It is too early to be precise about how these measures will play out in the longer term and therefore what impact they will have on electricity demand.

However, we have procedures in place to manage the effects of a pandemic and have analysed anticipated effects on electricity supply and demand of mass self-isolation of the UK's workforce. We are also using evidence from other European countries that have implemented similar controls to the UK's to inform our view.

Whilst the evolving situation is very fluid, we are implementing a number of measures so that consumers in the UK will continue to receive secure and reliable electricity supplies during these uncertain times.

To address the uncertainty around the impact of Covid-19, we have developed a range of scenarios rather than producing a single forecast. This will support longer term planning and help the industry prepare for whichever situations arise.

We hope to be able to refine our understanding of the situation as the summer progresses and are keen to engage with industry to understand the potential impacts of Covid-19 on the wider electricity system. To do this, and to keep stakeholders informed on a changing situation, we will continue to hold weekly webinars run by the Electricity National Control Centre (ENCC).

In previous years, the Summer Outlook has covered both gas and electricity. This will be the first year where two separate documents are published, this document covers only the electricity outlook. We will continue to engage with National Grid Gas Transmission to ensure consistency in approach, the Gas Summer Outlook can be found here.

These are uncertain times and, as always, we welcome your feedback on this or any other topic so we can ensure our documents are as useful as possible.

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.

Fintan Slye
Director, Electricity System Operator

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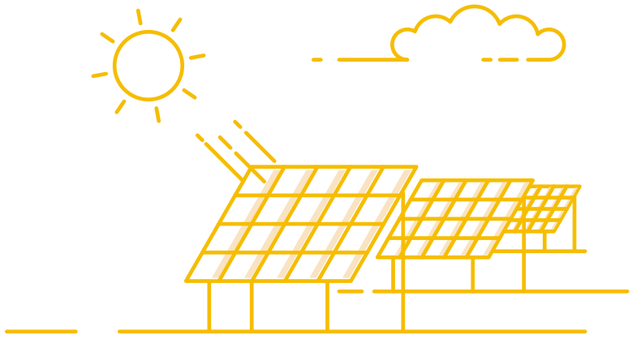
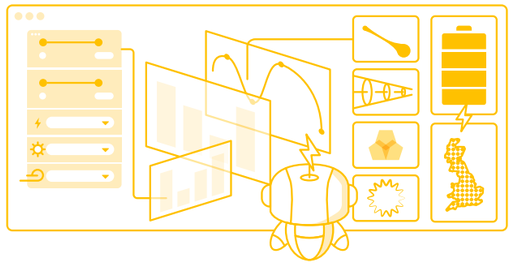




Key messages / Executive summary

Covid-19 has brought unprecedented change to the behaviour of electricity consumers and demand across the country has already reduced as a result. This is largely owing to the decrease in energy use from industrial and commercial consumers being greater than the increase in domestic demand as people stay at home.

The uncertainty of the situation at this time makes longer term demand forecasting challenging and so a range of scenarios has been developed for the summer period to reflect low, medium and high levels of impact from the virus.

1 Meeting demand

We are confident that there will be sufficient supply available to meet electricity demands for the coming summer.

There were no forecasted margin issues ahead of Covid-19 and the downward pressure on summer peak demand is expected to outweigh any potential impact on the supply side.

2 Managing the system

We have past experience of managing the system during periods of low demand and the right tools available to do this.

However, we are also actively developing strategies to manage a wider range of scenarios for this summer than we have previously considered to ensure we have the necessary tools and services for all such scenarios.

Key messages / Executive summary 05

Current situation / Executive summary

Prior to Covid-19, demands were expected to be similar to last summer. To understand the effect Covid-19 could have on operation of the electricity system, we have been conducting analysis to create a range of scenarios for demand levels. All scenarios show a reduction that will take demand down to between 96% and 80% of usual daytime levels.

Lower transmission level demands (i.e. net of distributed generation) than usual this summer will mean we will have to take more actions to manage the system.

As such we are also carrying out planning activities to ensure we can operate the system at even lower summer minimum demand levels.

		Over-night		In-day	
		Demand level	Demand reduction	Demand level	Demand reduction
Impact scenarios	Business-as-usual*	100%	0%	100%	0%
	Low	98%	2%	96%	4%
	Medium	93%	7%	87%	13%
	High	87%	13%	80%	20%

Table 1 – GB Scenarios for Covid-19 related demand reduction (weather corrected).

*Refers to pre-Covid-19 demand forecasts

Industrial pauses and slowdowns, combined with school and commercial establishment closures, have so far reduced UK demand to a level which is between our ‘medium impact’ and ‘high impact’ scenarios as of the week commencing 13 April 2020.

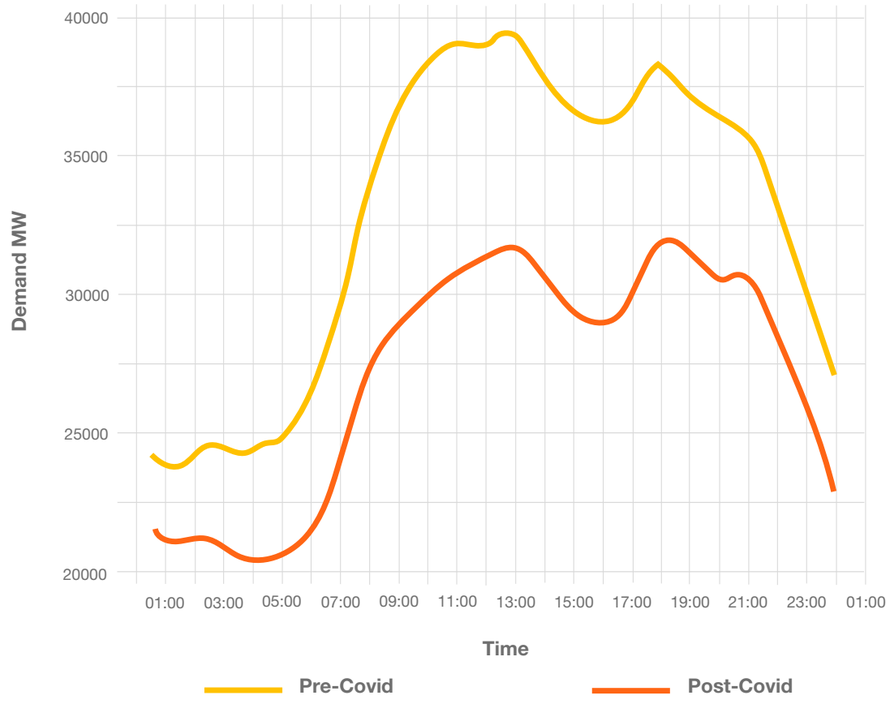


Figure 1 – Outturn and estimated pre-Covid-19 demand on Tuesday 14 April 2020.

Under the ‘medium impact’ scenario we are seeing in April minimum demands normally experienced in July and August. As system operator, it’s just as important for us to manage lower demands for electricity as it is to manage the peak demands. Both bring operational challenges that we plan for and have experience in resolving.

Current situation / Executive summary 06

Impact of Covid-19 on supply and demand / Executive summary

Demand

Our analysis has been benchmarked against the impact that the Coronavirus has had on other European countries which are further ahead in terms of the Coronavirus spread. We can expect electricity demand in the UK to be further impacted over the coming weeks and months. Levels of demand reductions were applied to the UK's demand which has resulted in the range of demand scenarios seen in table 2.

The scenarios were built by taking the known proportions of demand in the UK (residential, commercial and industrial) and forecasting of how those demands could be affected by a number of factors.

Industrial demand is the area with greatest scope for large reductions and a range of demand reductions occur through all of the scenarios. It is also the segment most difficult to assess and therefore provides the greatest uncertainty. A higher rate of economic slowdown will result in more industrial shutdowns.

In addition, regardless of Covid-19, electricity demand at transmission level remains particularly influenced by the weather, with more sunshine leading to increased generation from distribution-connected solar PV and lower transmission system demands.

Generation

Despite potential issues with maintenance due to work being delayed, forecast minimum generation is still expected to be comfortably above the high summer peak demand.

If planned maintenance is cancelled, this may have a knock-on impact by pushing maintenance into the winter and potentially changing the supply profiles of the generation fleet.

We are already looking long term towards the winter to assess potential impacts on the electricity network, more details will be included in the Winter Outlook.

Table 2 – Key statistics with different Covid-19 scenario effects applied.

	Peak demand (High summer) (GW)	Minimum demand (GW)	Minimum generation (GW)
Initial forecast (based on Business-as-usual)	32.1	17.6	34.9
Low impact	30.8	17.3	34.9
Medium impact	27.9	16.4	34.9
High impact	25.7	15.3	34.9

All demands weather corrected and at transmission system level.
(Assumes average levels of distributed generation output).

Impact of Covid-19 on supply and demand / Executive summary 07

Impact of Covid-19 on operability / Executive summary

System operation

In order to balance supply and demand, we can take various day-to-day actions and, in addition, a number of specific tools can be used when system conditions are particularly challenging.

If the summer demand for electricity continues to remain lower than normally experienced due to Covid-19 measures remaining in place, we would expect to need to take more action to balance and operate the power system. As a result we would expect to use these tools more frequently and for longer than in past summers.

Lower summer demands will also likely increase the amount of work needed to manage high voltage levels.

Europe and interconnected markets

Across Europe, we may see changes to market behaviour which falls outside what we have seen historically as industry participants adapt to the constraints that Covid-19 is placing on normal operations.

Despite recent downward pressure on prices across Europe, forward prices for summer 2020 are expected to remain higher in GB than continental Europe. We therefore expect net imports on interconnectors from continental Europe to GB for most of the summer.

Covid-19 may lead to some planned maintenance being cancelled or postponed, leading to changes in planned outage schedules.

Impact of Covid-19 on operability / Executive summary 08

Our publications

The Summer Outlook Report 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.

Summer Outlook Report

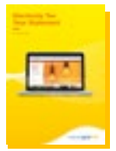
The Summer Outlook Report provides our view of the electricity system for this summer and our plans to manage operability.

Needs case

Options

Future Energy Scenarios

July
A range of credible pathways for the future of energy from today to 2050. Scenarios are unconstrained by network issues.



Electricity Ten Year Statement

November
The likely future transmission requirements on the electricity system.

Network Options Assessment

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

Ten Year Network Development Plan

Overview of the European electricity infrastructure and its future developments.

Summer Outlook

April
Our view of the electricity system for the summer ahead.

Winter Review and Consultation

June
A review of last winter's forecasts versus actuals and an opportunity to share your views on the winter ahead.

Winter Outlook Report

October
Our view of the electricity system for the winter ahead.

Electricity Capacity Report

Capacity Market auctions for delivery in a year ahead and four years ahead.

Electricity demand / Week-by-week view

Our pre-Covid-19 forecast for summer peak demand was 0.8 GW lower than last year's weather corrected demand, while the summer minimum demand was forecast to be similar to 2019.

This summer we expect…

- **Covid-19 to have a significant effect on demand, with reductions against business as usual of 4% in a low impact scenario and up to 20% in a high impact scenario.**
- **The overnight minimum to be lower than the daytime minimum.**

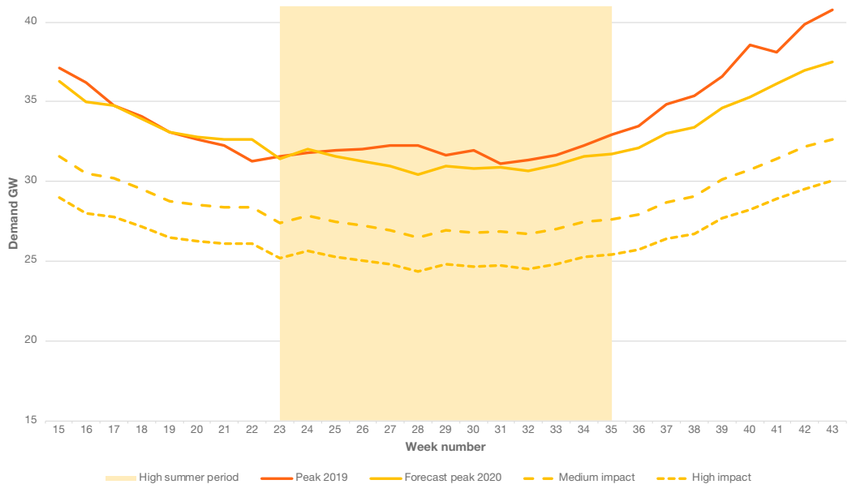


Figure 2: Weekly peak demand for summer 2019 against our summer 2020 peak demand scenarios.

Did you know?

Periods of low demand can have an impact on how we operate the transmission system. As a result, it is important that we understand the minimum levels of demand along with the peak demand that we can expect to see during the summer months.

In 2019, the minimum transmission system demand (TSD) was 17.5 GW (weather-corrected normalised demand based on average historic weather including station load). We publish our most recent demand forecasts on the BM reports website throughout the summer.

The charts below show the range of potential impacts of Covid-19 on peak and minimum demand.

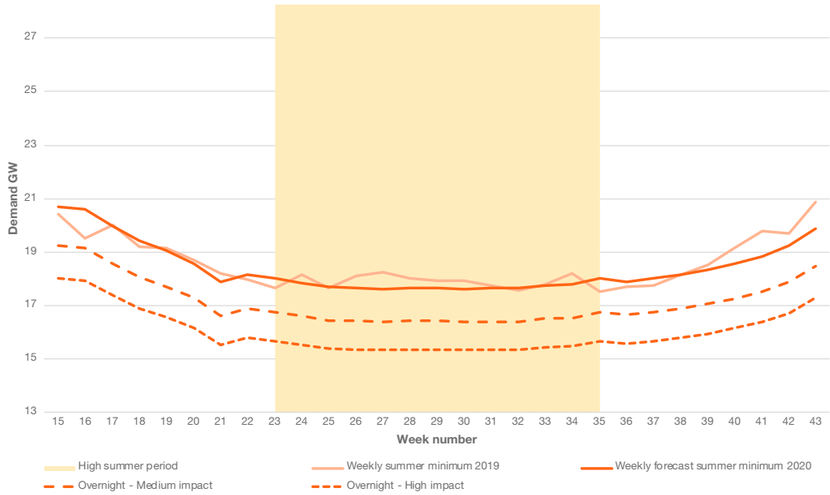


Figure 3: Weekly minimum demands for summer 2019 against our summer 2020 minimum demand scenarios.

The above demand forecasts are transmission-level and weather corrected.

Electricity demand / Week-by-week view 10

Electricity demand / Embedded solar impact

Embedded solar generation connected to the distribution network reduces the daytime demand we see on the transmission network in the summer months.

This summer we expect…

- **Solar generation to continue to have a significant effect on system demand at a transmission level.**
- **Lower overall demands caused by Covid-19 may exacerbate this effect.**

Did you know?

Daily peak and minimum demands are largely influenced by the amount of solar radiation. For example, if the sun is shining all day, the peak demand is likely to occur either between 8am and 9am or after sunset. The daytime demands between 9am and sunset are often suppressed by distribution connected generation (mainly solar PV).

On days with low solar activity, peak demands are more likely to occur between 4pm and 8pm. The variability in demand between high and low solar days leads to challenges in managing the system during the summer.

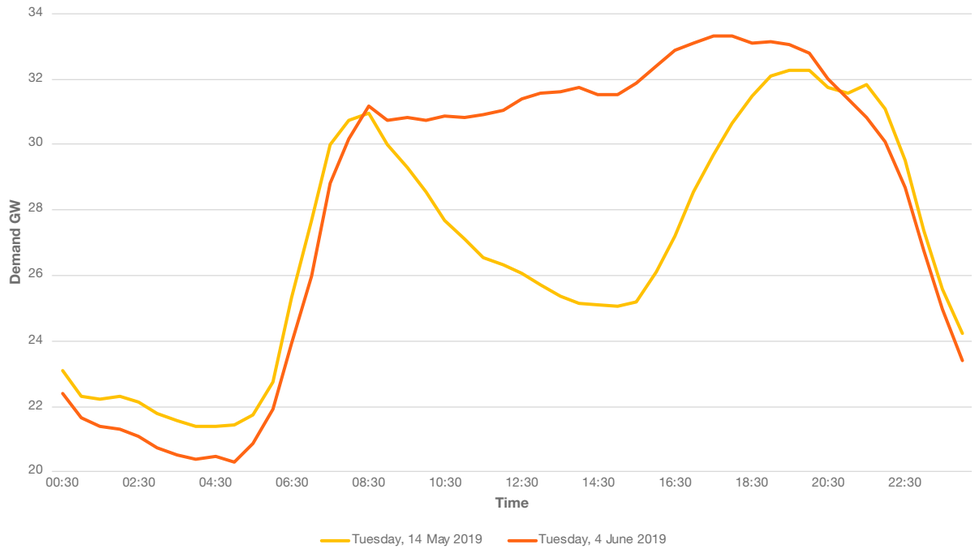


Figure 4: Impact of embedded solar generation on transmission system demand between two days 3 weeks apart in summer 2019.

Figure 4 (above) shows two half hourly demand profiles – orange being a day with high solar generation (14th May 2019) and red with low solar generation (4th June 2019). These two dates share similar temperature and embedded wind properties and were both Tuesdays – the only major difference was 7.5GW of embedded solar generation.

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Electricity supply / Week-by-week view

We expect to be able to meet normalised transmission demand and our reserve requirement at all times throughout the summer.

This summer we expect…

The minimum available generation to be 34.9GW in the week commencing 8th June (no continental interconnector flow scenario) based on current operational data.

34.9GW

Maximum demand in this week to be up to 32.8 GW (before Covid-19 related demand reduction and assuming full export on Irish interconnectors).

32.8 GW

That Covid-19 may affect the availability of some generation plant, either through staff shortages, maintenance contractor availability or through disruptions to supply chains.

Figure 6 (next slide) shows pre-Covid-19 weekly generation and demand forecasts for summer 2020. We are planning for the possibility of Covid-19 impact on generator availability in collaboration with BEIS and Ofgem.

Given the nature of the situation, it is not possible to take a long-term view of this, but ESO is reviewing the situation daily at a 7 day ahead time horizon.

Alongside reviewing the near-term impact to the generation fleet, we also need to consider the impact that this may have on the winter period.

If planned maintenance is cancelled this may have a knock-on impact by pushing maintenance into the winter and potentially changing the supply profiles of the generation fleet.

We are already planning for the winter months and more details will be included in the Winter Outlook document.

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Electricity supply / Week-by-week view

Did you know?

In the summer months, power stations carry out planned maintenance as there is typically lower demand and lower electricity prices than in the winter.

Our generation forecasts are based on published OC2 data, to which we apply a breakdown rate for each fuel type, to account for unexpected generator breakdowns, restrictions or losses close to real-time.

For the latest OC2 data and operational view, see the **BM reports website**, updated each Friday.

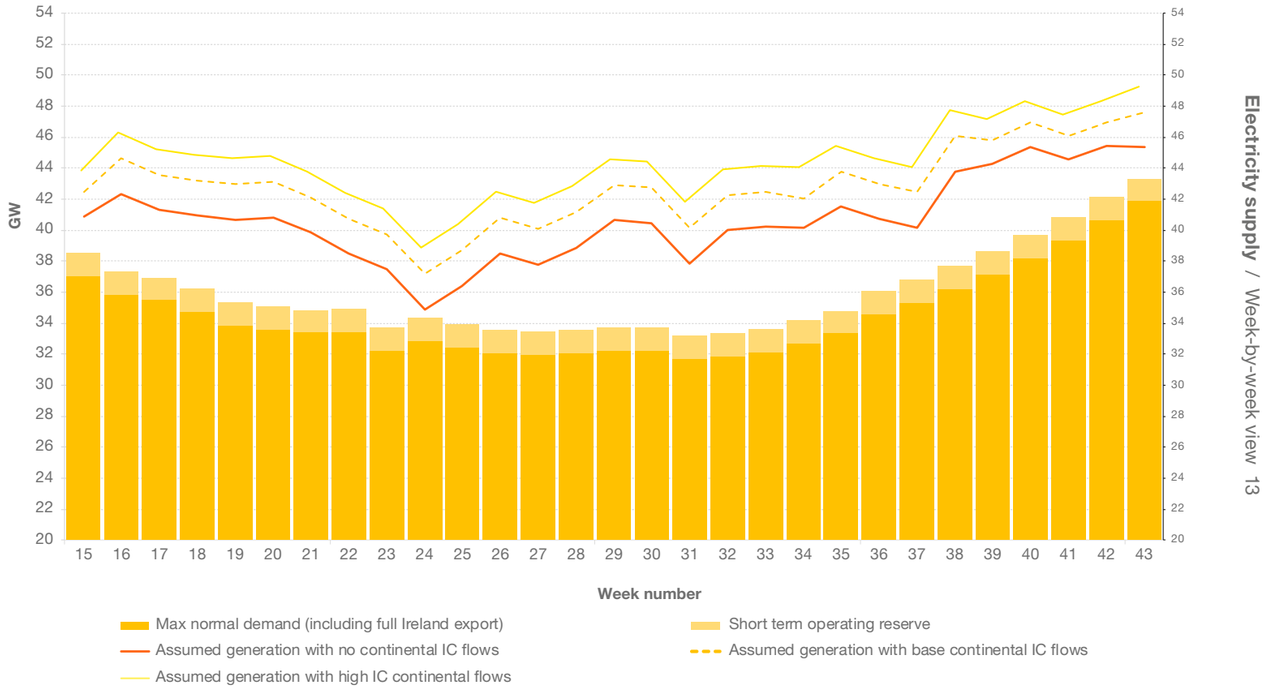

Figure 5: Pre-Covid-19 weekly generation and demand forecast summer 2020.

Electricity supply / Week-by-week view 13

Electricity supply / Managing low demands

While meeting peak demands remains important during the summer period, the majority of challenges are caused by periods of low demand; especially if there are high levels of embedded wind and solar generation.

This summer we expect…

- **Normal summer operability issues to be amplified by the demand reductions due to Covid-19.**
- **Existing balancing services to be used more often and for longer periods than in previous summers.**
- **That additional sources of flexibility may be required.**
- **To engage with industry on existing and new services via our normal Ancillary Services routes as well as through weekly webinars dedicated to Covid-19.**

ENCC COVID-19 Update

The Electricity National Control Centre (ENCC) are working hard to protect our customers and stakeholders from operational impacts from COVID-19.

To ensure you are updated on the actions we are taking and observations from the electricity system, we are hosting a weekly webinar at 2pm every Wednesday. This will include an opportunity to voice your questions, concerns and ideas through live Q&A.

All slides from previous webinars and links to register for all future updates are available on the **data portal.**

Did you know?

In the summer, there is a significant reduction in transmission system demand, as there is less requirement for heating and lighting, and a higher output from distributed generation such as solar.

In these periods, it is important to be able to reduce generation output or increase demand to ensure the system is balanced and frequency remains within operational limits. Therefore flexibility is very valuable.

In addition, whilst having upward margin is important in winter to cover plant losses or demand forecast error, in summer downward margin (or footroom) is similarly important in case demand is lost or demands are lower than expected. This means that procuring suitable frequency response and reserve products is important and also that more responsive plant may have to be retained on the system and other, less responsive, plant constrained off.

Similarly, when low demands coincide with high levels of renewable generation that is not synchronised with the grid, system inertia is lower meaning that the impact of any frequency events are greater. This is where our new inertia services are relevant and another reason why synchronous generation may be required to remain on the system.

If demand levels fall close to the level of inflexible generation on the system, we may also need to issue a local or national Negative Reserve Active Power Margin (NRAPM). To date a limited number of local NRAPMs have been issued, but none at a national level. You can read more about this tool on our **website.**

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Electricity supply / Managing low demands - week-by-week view

Based on current data we expect to be managing periods where inflexible generation output plus flexible wind output exceeds minimum demand more often than usual as a result of Covid-19.

We also expect increased periods where inflexible generation output alone may exceed minimum demand.

This summer we may need to take actions such as:

1. Requesting pumped storage units to increase demand by moving water back to their top lakes – (this increase in demand is shown by the difference between the solid grey and black lines).
2. Curtailing flexible wind farm output at a national level via the Balancing Mechanism or via direct trade.
3. Trading to reduce the level of interconnector imports.
4. Issuing a local or national Negative Reserve Active Power Margin (NRAPM).

We are also currently exploring new sources of flexibility.

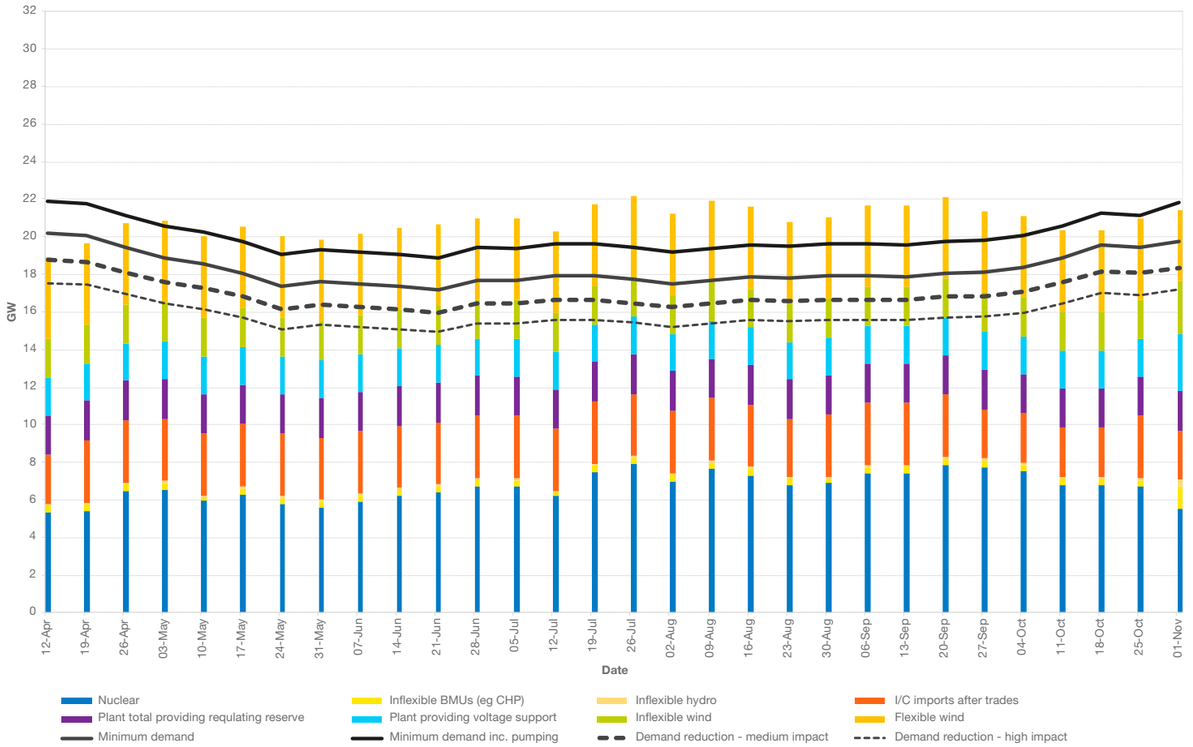

Figure 6: Forecast generation and minimum demand scenarios by week, summer 2020.

Electricity supply / Managing low demands - Week-by-week view 15

Operational view / Summer 2020

In addition to the direct operability challenges of managing minimum demand periods, the lower demand levels as a result of Covid-19 mean other aspects of operability will require careful management.

This summer we expect…

- **Managing reactive power, voltage levels, low transmission demand and high volumes of low inertia generation will continue to be challenging.**

Did you know?

As further Government restrictions are put in place due to Covid-19, the Transmission Owners may need to reduce the volume of maintenance that they undertake on their networks over the summer period.

The impact of this is that we expect to have a more intact network than usual for the time of year. With a reduced demand, this would mean lighter loading on the network and would increase the amount of work to manage high voltage across the network.

In terms of specific services, we will need to:

- Use footroom services in periods of low demand to ensure that there is enough negative reserve on the system.
- Take actions to manage local network constraints. The Western High Voltage Direct Current (HVDC) link will help to relieve congestion on the transmission network between Scotland and England.
- Use tools to manage the rate of change of frequency (RoCoF) and vector shift.
- Manage reactive power in different regions, to keep voltage levels stable. In periods of low demand, this is likely to be actions to reduce the amount of reactive power on the system. These could include:
  - setting up contracts in advance with appropriate generators. These would ensure minimum profitability so that these generators keep generating (and providing reactive power capability) in periods where they might otherwise have been uneconomic. We have tendered for the provision of reactive power services for summer 2020.
  - undertaking trading actions within day, or taking bid / offer acceptances via the Balancing Mechanism so that generators provide reactive power capability.

For more information on the operability issues such as inertia – and the tools, products and services that are used to manage them, please see the System Operability section of the ESO website.

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Europe and interconnected markets / Summer 2020

This summer we expect…

Forward prices for summer 2020 to remain higher in GB than continental Europe and therefore net imports of electricity on interconnectors from continental Europe to GB for most of the summer.

Weather variations will affect flows at all times, including peak.

Covid-19 has put downward pressure on forward prices in GB and in continental Europe, however forward prices in GB remain higher than the prices in the French, Dutch and Belgian markets and therefore we would expect to see a similar import/export pattern to last summer.

As industry participants adapt to the constraints that Covid-19 is placing on normal operations, we may see changes to market behaviour which falls outside what we have seen historically. For example there may be more periods with day ahead negative pricing.

As renewable generation continues to grow in both GB and connected markets, relative prices will be largely influenced by the weather, which impacts demand and the amount of available renewable generation. Flows of electricity may also be impacted by network constraints, and these will be managed by collaboration between the ESO and interconnectors.

EWIC and Moyle interconnectors traditionally export over peak but may reverse to import with high wind output in Ireland or during periods of system stress.
The availability of coal fired generation in Northern Ireland will also impact flows on the Moyle interconnector.

The UK has now left the European Union. Cross-Border trading arrangements will remain unchanged this summer as trade continues along existing protocols throughout the transition period. EU law that has to be implemented in the transition period will be implemented by the relevant parties.

The Government has indicated it intends to agree a future trading relationship with the European Union during 2020, to apply after the transition period. We have looked at all parts of the business and have robust plans to manage our business operations safely and reliably.

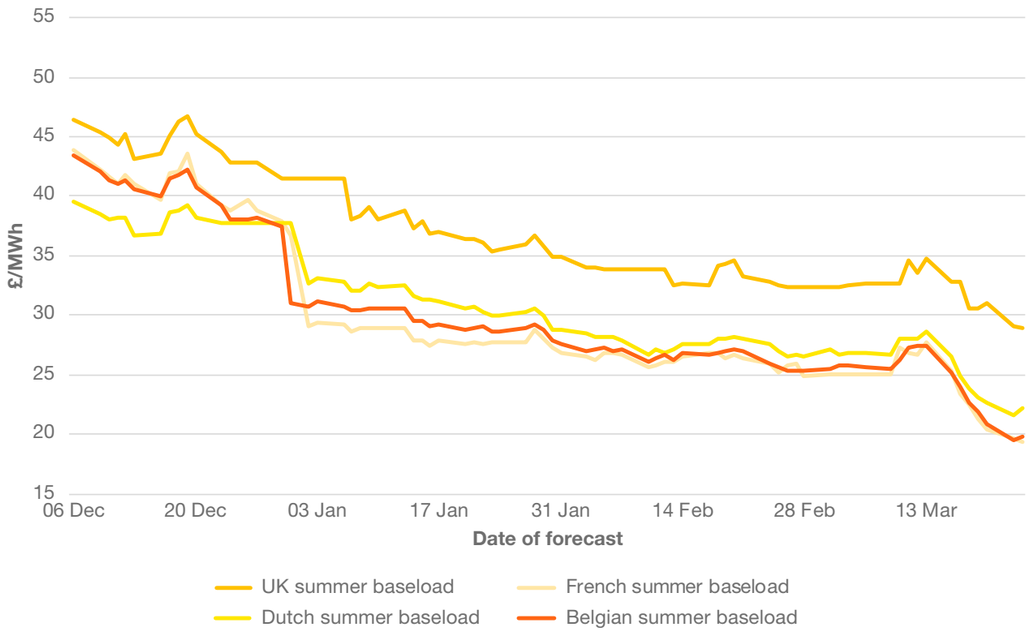

Figure 7: Trend of forward baseload prices for summer 2020.

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Europe and interconnected markets / Summer 2020

Interconnectors may undertake planned outages over the summer, or experience fault outages. Planned outages for each interconnector are listed in Table 3.

This summer we expect…

- **Covid-19 may lead to some planned maintenance being cancelled or postponed leading to changes in these planned outages.**
- **Minimal impact from outage changes on imports into GB at peak times via the IFA, BritNed and Nemo Link interconnectors.**

In previous years, there were some periods when IFA exported from GB to France driven by nuclear outages leading to lower availability of French generation. Planned French nuclear outages for this year are lower than previous summers, so are not expected to significantly affect interconnector flows. More information can be found in the data workbook.

Two new interconnectors are in development, IFA2 and ElecLink, however these will not be fully operational until after the summer.

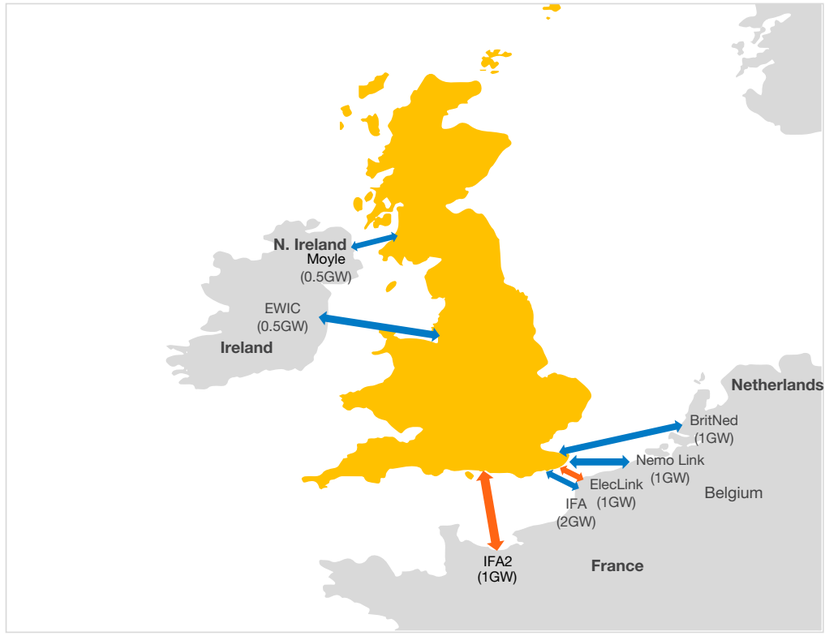

Figure 8: GB interconnectors with Ireland and with continental Europe.

Interconnector (full capacity)	Planned outages (resulting capacity)	Current outage
France: IFA (2 GW)	21 Sep – 16 Oct (1 GW)	None
The Netherlands: BritNed (1 GW)	None	None
Belgium: Nemo Link (1 GW)	21 Sep – 27 Sep (0 GW)	None
Ireland: EWIC (0.5 GW)	19 – 20 Aug (0 GW)	None
Ireland: Moyle (0.5 GW)	29 Jun – 7 Jul (0 GW)	None

Table 3 – Planned and current interconnector outages (summer 2020).

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Glossary

Balancing Mechanism

Is one of the tools used by National Grid ESO to balance electricity supply and demand close to real time. Where National Grid ESO predicts that there will be a discrepancy between the amount of electricity produced and that which will be in demand during a certain time period, they may accept a 'bid' or 'offer' to either increase or decrease generation (or consumption).

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

Constraints

A constraint is where the capacity of the electricity network in a particular area is unable to manage the demand and supply of electricity in that area. This could be due to various factors such as a broken down network asset, or weather conditions leading to high supply of generation for example.

Distribution connected

Any generation 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 ESO as the system operator, and acts to reduce demand on the transmission system.

East West Interconnector (EWIC)

A 500 MW interconnector that links the electricity transmission systems of Ireland and Great Britain. You can find out more at www.eirgridgroup.com/customer-and-industry/interconnection/

ElecLink interconnector

Is a new HVDC 1000MW electricity interconnector which is being built to operate between France and Great Britain via the Channel Tunnel.

Floating

When an interconnector is neither importing nor exporting electricity

Footroom

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.

High summer period

The period between 1 June and 31 August, or weeks 23 to 35. It is when we expect the greatest number of planned generator outages.

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.

Interconnectors (elec)

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

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).

Load factors

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 form each plant or technology type.

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).

Negative reserve

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.

Negative reserve active power margin (NRAPM)

The insufficient NRAPM warning is a request to encourage more flexible parameters from generators, and inform participants of a risk of emergency instructions. A NRAPM may be issued if there is insufficient flexibility available to ensure that generation matches demand during periods of low demand. A localised NRAPM occurs where there is a danger that the combination of demand and inflexible generation within a constraint group can exceed the constraint limit of a portion of the network; in both cases there is a risk that the ESO may need to issue emergency instructions to inflexible and non-BM participating plant. Localised NRAPM are more common in the north of Scotland due to the large volume of wind and water generation and relatively low demand.

Nemo Link

The Nemo Link is a 1,000 MW HVDC sub-sea link between GB and Belgium.

Normalised transmission demand

Normalised transmission demand is the demand seen on the transmission system, forecast using long term trends and calculated with the effects of the weather and the day of the week removed as appropriate. This takes into account the power used by generating stations when producing electricity (the 'station load') and interconnector exports.

Operational Code 2 data (OC2 data)

Information provided to National Grid ESO by generators. It includes their current generation availability and planned maintenance outages. You can access the latest OC2 data throughout the year on the BM Reports website at www.bmreports.com

Operational surplus

The difference between the level of demand (plus the reserve requirement) and generation expected to be available, modelled on a week-by-week basis. It includes both notified planned outages and assumed breakdown rates for each power station type.

Outage

The annual planned maintenance period, which requires a complete shutdown, during which essential maintenance is carried out.

Peak

The maximum requirement of a system at a given time, or the amount of energy required to supply customers at times when need is greatest. It can refer either to a given moment (e.g. a specific time of day) or to an average over a given period of time (e.g. a specific day or hour of the day).

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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.

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 it from the network if the Rate of Change of Frequency goes above a certain threshold

Reactive power

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.

Shoulder months

The start and end of a season. These months are not technically months where we would expect a lot of electricity demand from either heating or cooling requirements. However they could see demand for either heating or cooling or both in the same month.

Transmission system demand (TSD)

Electricity demand that National Grid ESO, as the Electricity System Operator, see at grid supply points, which are the connections to the distribution networks.

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 (electricity)

The demand expected or out turned with the impact of the weather removed. A 30-year average of each relevant weather variable is constructed for each week of the year. This is then applied to linear regression models to calculate what the demand would have been with this standardised weather.

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.

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

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

Email us with your views on the Summer Outlook Report at:
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