Summer Outlook

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

April 2025

NESO
National Energy
System Operator

Welcome

Welcome to the National Energy System Operator (NESO) *Summer Outlook 2025* report, detailing our assessment of electricity security of supply and operational expectations for the period from April to October 2025.

This report summarises our view of supply adequacy at peak demand, system flexibility at minimum demand, and the wider energy market context. It is designed to support the energy industry in its preparation for summer.

Kayte O'Neill
Chief Operating Officer
National Electricity System Operator

Great Britain's energy sector is undergoing a fundamental transformation, with the pace of change continuing to accelerate. Our analysis for summer 2025 highlights some of the ways this transformation is affecting the electricity system, as embedded generation alters demand patterns and new technologies provide additional sources of flexibility.

As in winter, maintaining security of supply remains a priority. The daily surplus is typically higher in summer, as heating demand falls away and embedded generation on the distribution networks reduces peak demand. Minimum forecast generation for this summer is expected to remain comfortably above peak demand, which should enable Great Britain to support exports to neighbouring countries if required. We will continue to assess margins against a range of possible scenarios and will monitor market conditions and available supply throughout the season.

In summer, our focus extends to the challenge of managing minimum demand. Operating the system at low demand is one of the most complex challenges we face – and this complexity is increasing as the nature of low demand periods evolves. The growth of renewable generation connected to the distribution networks is increasing the variability of minimum demand, broadening the range of weather patterns that result in low demand, and extending the duration of low demand events. During these periods, the systems, operational tools, balancing services and network service procurements delivered by NESO in support of our zero carbon ambition will provide significant cost savings for consumers and operational benefits for our control room.

We are confident we have the right tools to enable the safe, reliable and efficient operation of the system, but we expect to see an increase in the number of everyday actions in the control room required to achieve this. We anticipate periods where nuclear generation, inflexible generation (such as combined heat and power systems), interconnector imports and renewable output will exceed minimum demand – requiring us to use a range of operational tools, including pumping and charging storage, curtailing excess supply, and trading on the interconnectors to reduce imports or secure exports.

Looking ahead, we have already begun preparations for winter 2025/26 and will share our early view with the industry in June.

We will continue to keep stakeholders up to date with any changes to our outlook via the NESO Operational Transparency Forum. National Gas publish a separate *Gas Summer Outlook* report.

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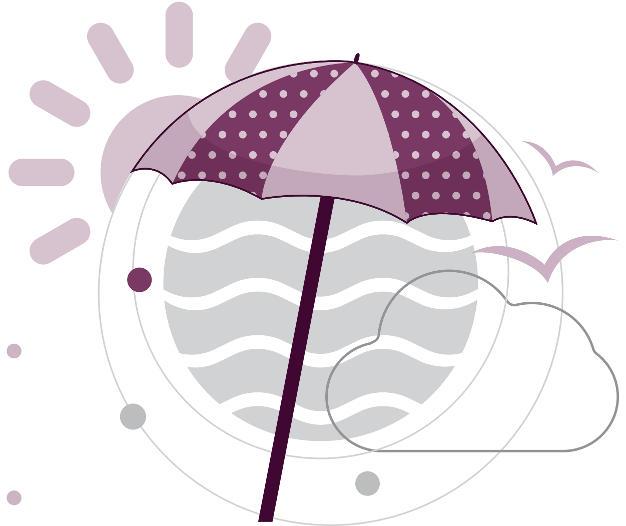


Summer Outlook 2025 at a Glance

1

Security of supply

We expect there to be sufficient supply to meet demand – and our reserve requirements – at all times this summer.

We also expect to be able to support exports to interconnected countries if needed and will continue the close working and coordinated support with our neighbouring transmission system operators (TSOs).

2

Managing low demand

We are confident we have the tools in place to reliably operate the system.

We expect the changing nature of low demand periods, along with the reduced availability of pumped storage this summer, to increase the number of everyday actions required to balance supply, demand and system needs.

There may be periods when we need to use our full range of operational tools, including issuing a Negative Reserve Active Power Margin (NRAPM) notice, an explanation of which is provided later in this report.

3

Electricity markets

Prices indicate that Great Britain is likely to be a significant net importer of electricity this summer.

High forecast generation availability in continental Europe has resulted in lower wholesale prices in key interconnected markets. These price differences have been reflected in interconnector capacity auctions, with import capacity pricing significantly above export capacity.

The growth in renewable generation in continental Europe suggests the potential for oversupply in solar-peak hours in key interconnected markets.

4

Operations and resilience

We continue to innovate and adapt to efficiently operate a rapidly changing electricity system. The systems, tools and services developed in support of our zero carbon ambition will reduce costs, cut carbon and support reliable operations this summer.

In line with our expanded responsibilities, we are working closely with Government, Ofgem, National Gas and the wider industry to build resilience to potential risks facing the energy system, and to ensure readiness for the season ahead.

Security of Supply

Operational surplus

We expect to have a sufficient operational surplus throughout the summer when considering natural variations in demand, wind and solar generation and generator availability.

Our analysis shows peak demand – and our reserve requirement – can be met throughout summer. Figure 1 shows the central forecast and a range of credible outcomes for the daily margin. To derive this range, we assess the daily surplus under typical conditions using average weather conditions for demand, wind and solar generation, and scheduled availability for conventional generation. We then simulate 30,000 variations around this central view, using multiple scenarios for weather, demand, conventional generation availability, wind generation, solar PV output and interconnector availability. This provides us with a forecast range (the pink plume in Figure 1 shows the 90% confidence range of this forecast, while the dashed line in Figure 1 shows the 98% confidence range).

While there may be some days where the surplus falls below this range, current data suggests that large revisions to generator availability would be required for the operational surplus to approach our reserve requirement. Scheduled generator outages follow the pattern of peak demand forecast across the season, leading to a broadly flat operational surplus. Variation in the peak demand forecasts is shown on page 7, while planned availability is detailed on page 8 and in the accompanying data workbook.

Our analysis also indicates that we will be able to export to neighbouring countries if required. However, power prices and capacity auction results suggest that Great Britain will, in aggregate, be a significant net importer across the summer.

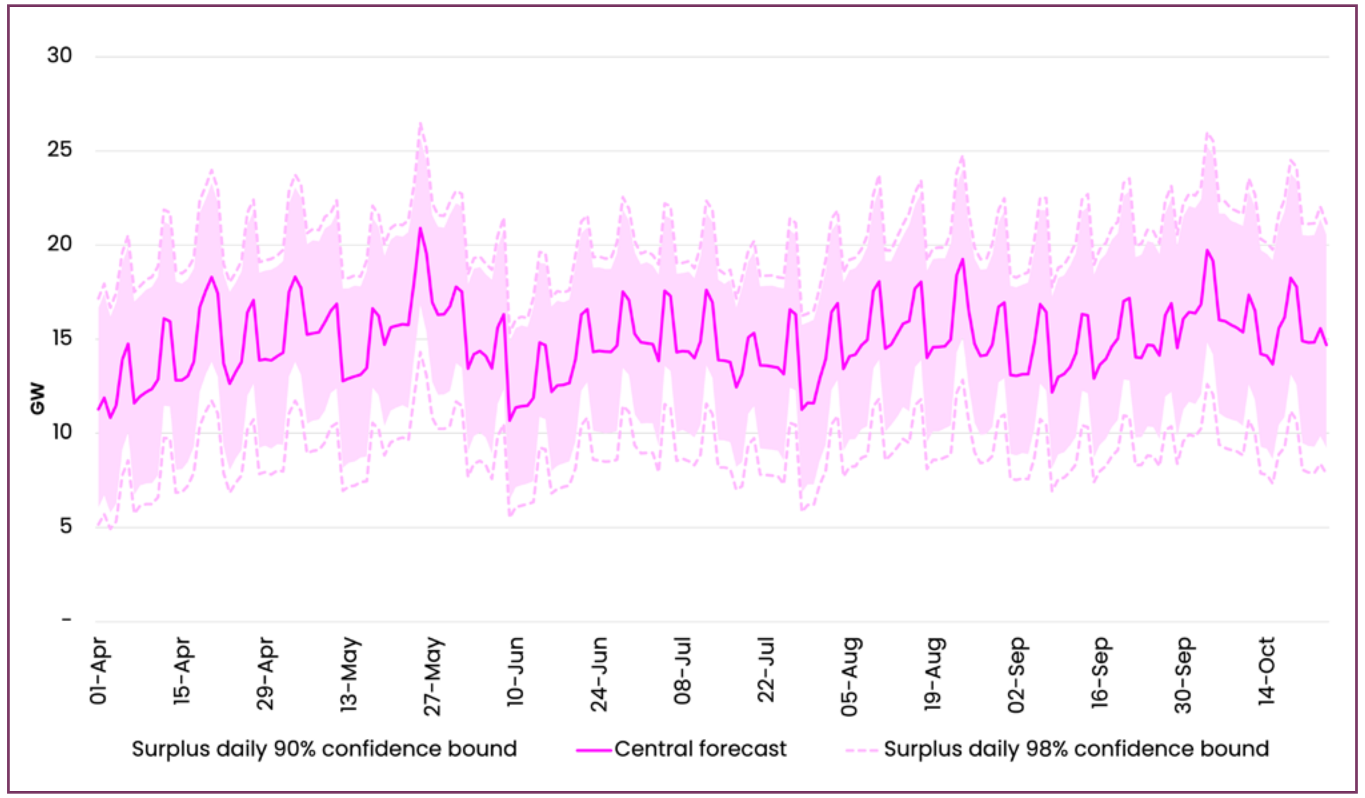


Figure 1: Range of outcomes for the daily operational surplus under different supply and demand conditions

Peak demand

Peak demand for summer 2025 is expected to be slightly lower than last summer's weather-corrected outturn, due to the growth of embedded generation.

Throughout this report, we forecast 'National Demand'. This represents the demand we observe on the transmission system. It excludes demand from pumping and charging storage, as well as interconnector exports, which are dependent on prevailing weather and market conditions. National Demand also excludes any consumer or industrial demand met by generation connected to the distribution networks. As such, prevailing weather conditions can cause National Demand to vary significantly. As the capacity of solar PV, wind generation and battery storage connected to the distribution networks increases, so does the variability in National Demand.

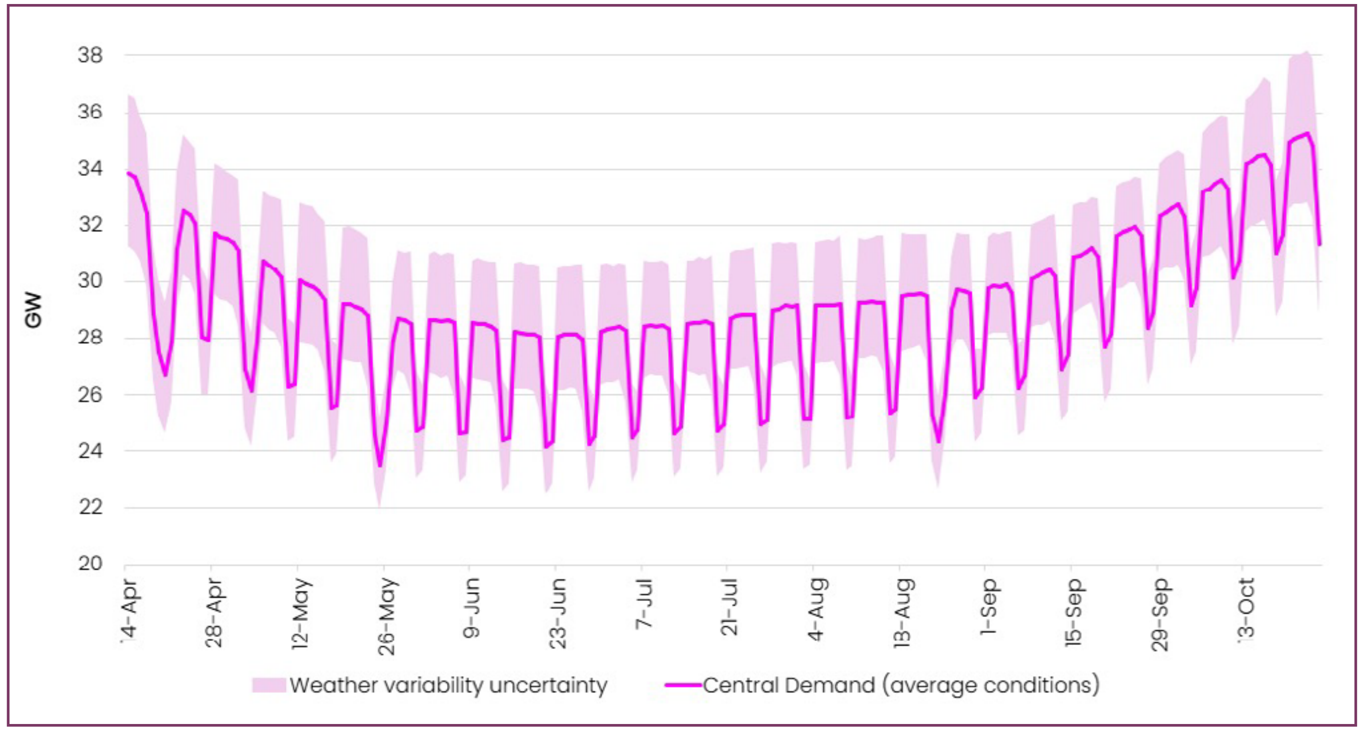


Figure 2: Daily peak National Demand for our central scenario and the impact of weather variation

To produce a meaningful forecast of expected demand, it is necessary to take this weather variability into account. For this reason, we simulate a wide ensemble of weather conditions to produce a forecast range.

Table 1 shows the historic peak National Demand for each year since 2019. To enable comparison of year-on-year changes, we also produce 'weather-corrected' values by removing assessed weather effects from the observed data. A summary of weather-corrected demand data is provided in the data workbook. Appendix A provides a visualisation of the different demand definitions.

Table 1: Historic peak National Demand between 1 June and 31 August

Year	Observed High Summer Peak Demand (GW)
2025 forecast	29.7
2024	30.3
2023	29.9
2022	31.3
2021	32.9
2020	32.9
2019	34.9

Peak supply

We are confident there will be sufficient supply to meet peak demand, and our positive reserve requirement, at all times throughout the summer.

During the summer months, power stations often carry out planned maintenance, as lower demand typically leads to lower electricity prices. Figure 3 shows the day-by-day generation forecast compared to the upper end of our peak demand forecast range. Across the summer, our analysis indicates that we will be able to support exports during peak periods if required.

We expect the minimum available weekday generation to be 34.9 GW, and to occur in July (this figure excludes interconnector capacity). Our modelling suggests peak demand on this day will fall between 27.0 and 31.3 GW.

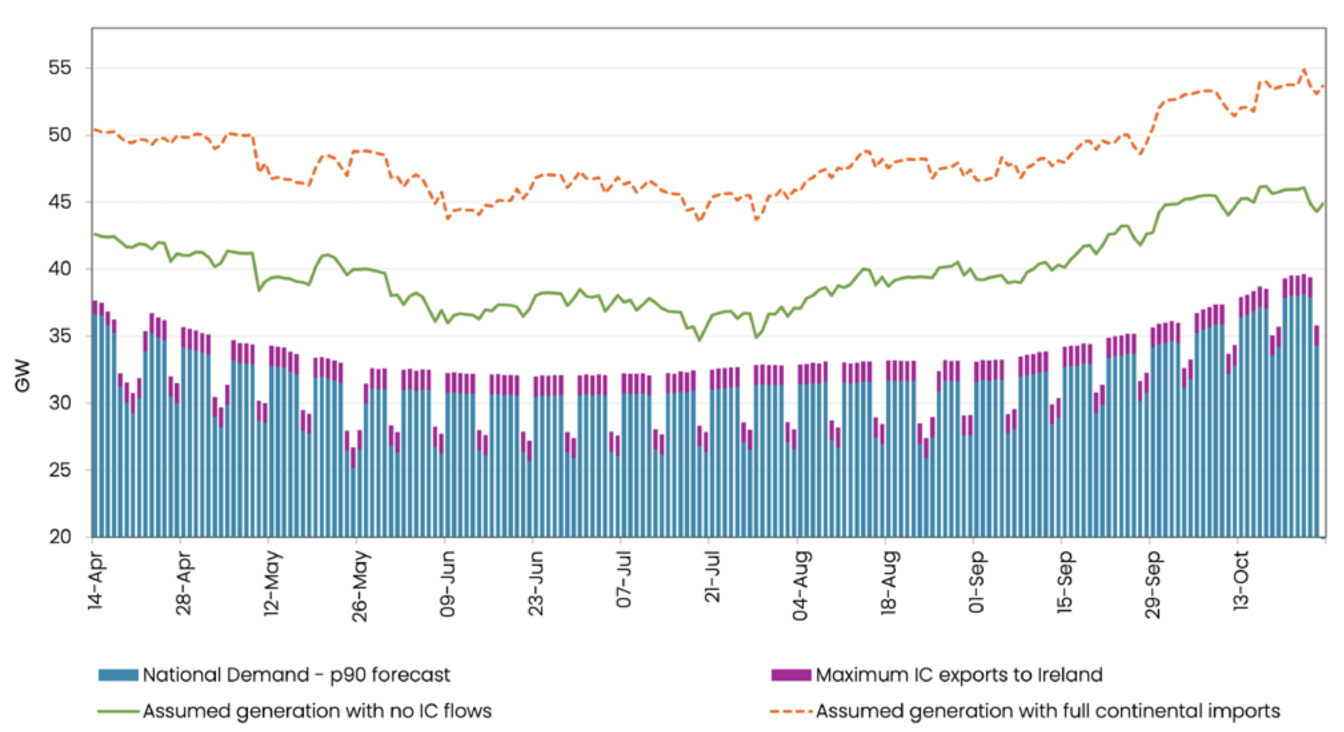


Figure 3: Day-by-day generation forecast for summer 2025 compared to the upper bound of peak simulated demand

The 'shoulder' months of April and October can experience higher demand relative to the rest of the summer period, due to the credible risk of colder temperatures. While current market submissions suggest a healthy operational surplus during these periods, significant downward revisions to generator availability could result in some tight days.

As a prudent system operator, we plan and prepare for a wide range of eventualities, working closely with Government, Ofgem and National Gas. We will continue to monitor generator availability and evolving risks in global energy markets that might affect available supply.

Did you know?

Our generation forecasts are based on published market data, to which we apply an unavailability rate. This rate attempts to capture unplanned outages, capacity curtailments and within-season planned outages.

Based on industry feedback, we are currently reviewing and updating our unavailability rate methodology. Details will be provided in the *Winter Review and Consultation* document.

Managing Low Demand

Minimum demand variability

Embedded renewable generation is increasing demand variability and broadening the range of weather patterns that can result in low demand.

Figure 4 shows the variation in demand that can occur – at a 1 in 10-year risk level – due to weather alone. The late May bank holiday has the greatest probability of extremely low demand (14 GW or below). However, the lowest demand day could credibly occur on any weekend between early May and late August.

Figure 5 shows the potential range of minimum demand during overnight and afternoon periods. Year on year, there is a growing probability that the lowest daily demand will occur in the afternoon. This occurred 12 times during 2024 and has already been observed 6 times in March 2025. The wider range of weather patterns that result in low demand has increased the probability (to ~50%) that we will observe a new record low National Demand (below 13.4 GW) this summer.

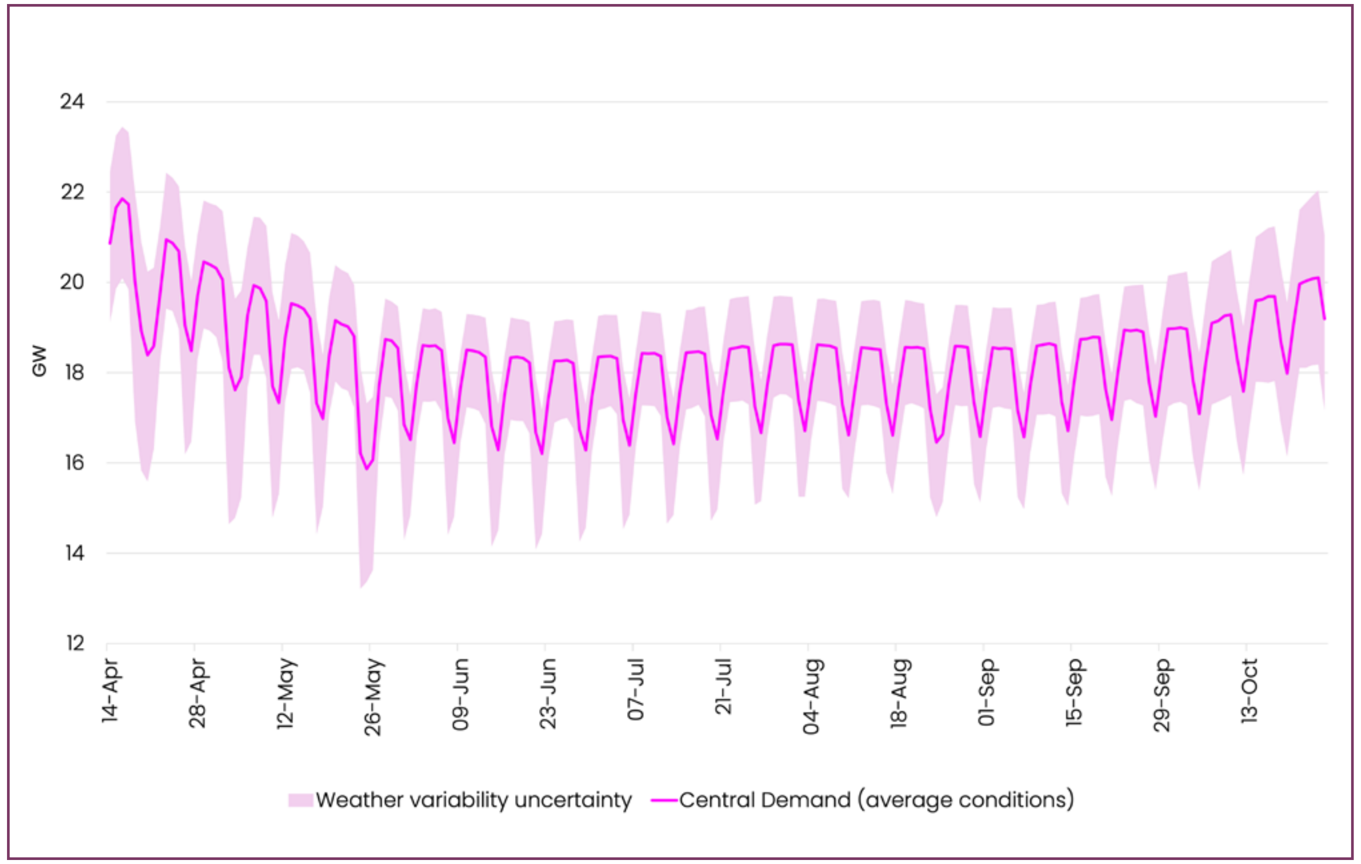


Figure 4: Daily minimum National Demand for our central scenario and the impact of weather variation (80% confidence range)

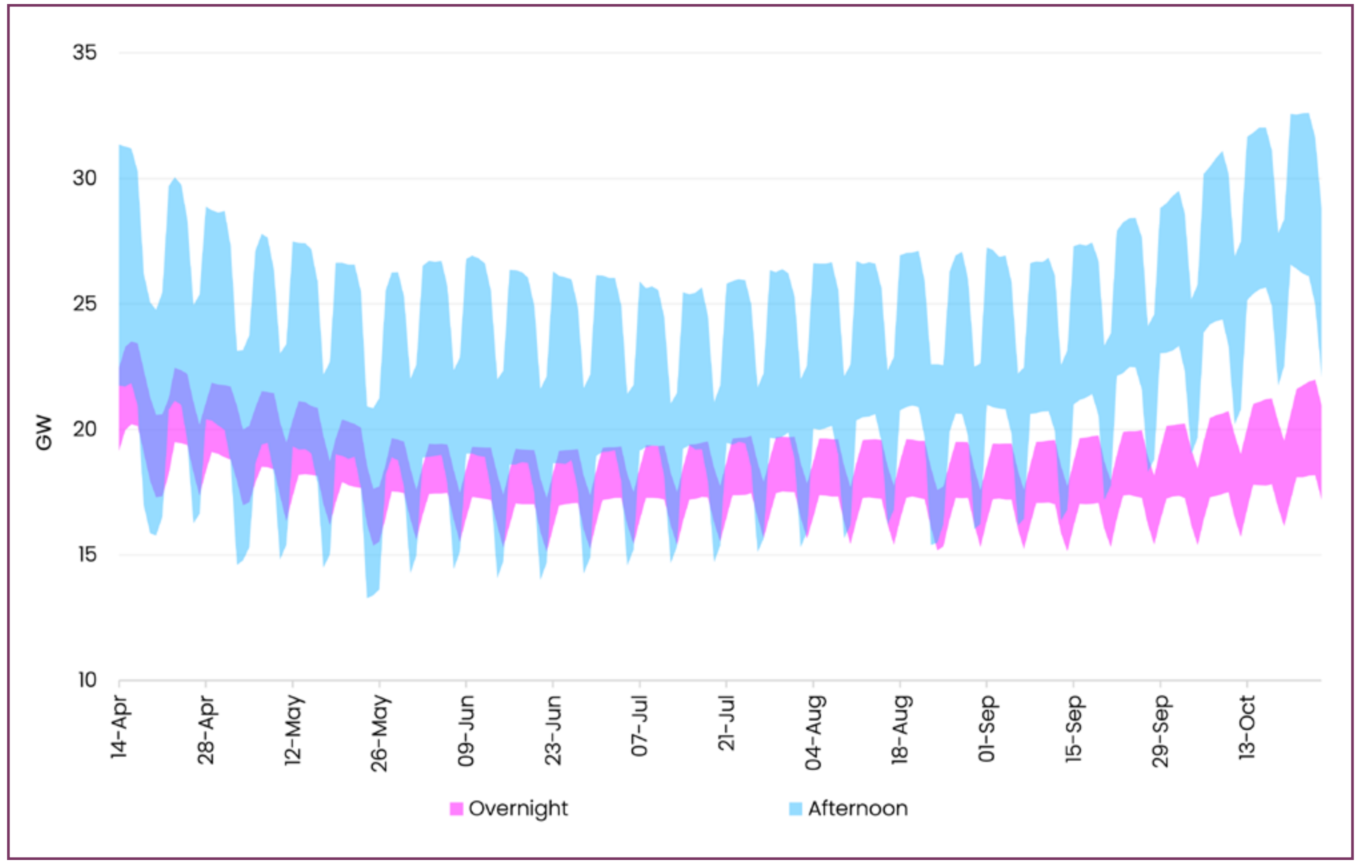


Figure 5: Daily minimum demand forecast range (80% confidence range) by time of day

Operating the system at low demand

We are confident we have the right tools to enable the safe, reliable and efficient operation of the system.

To balance supply, demand and system needs, we must take action when demand is low. We have a range of tools at our disposal, including balancing services, interconnector trading and the balancing mechanism.

This summer, we forecast periods where inflexible generation, units meeting system requirements, and wind output will exceed demand. Figure 6 shows the lower bound of the forecast demand range against illustrative high wind output, interconnector imports, scheduled inflexible generation, and a high requirement for additional units to provide system stability or reactive power.

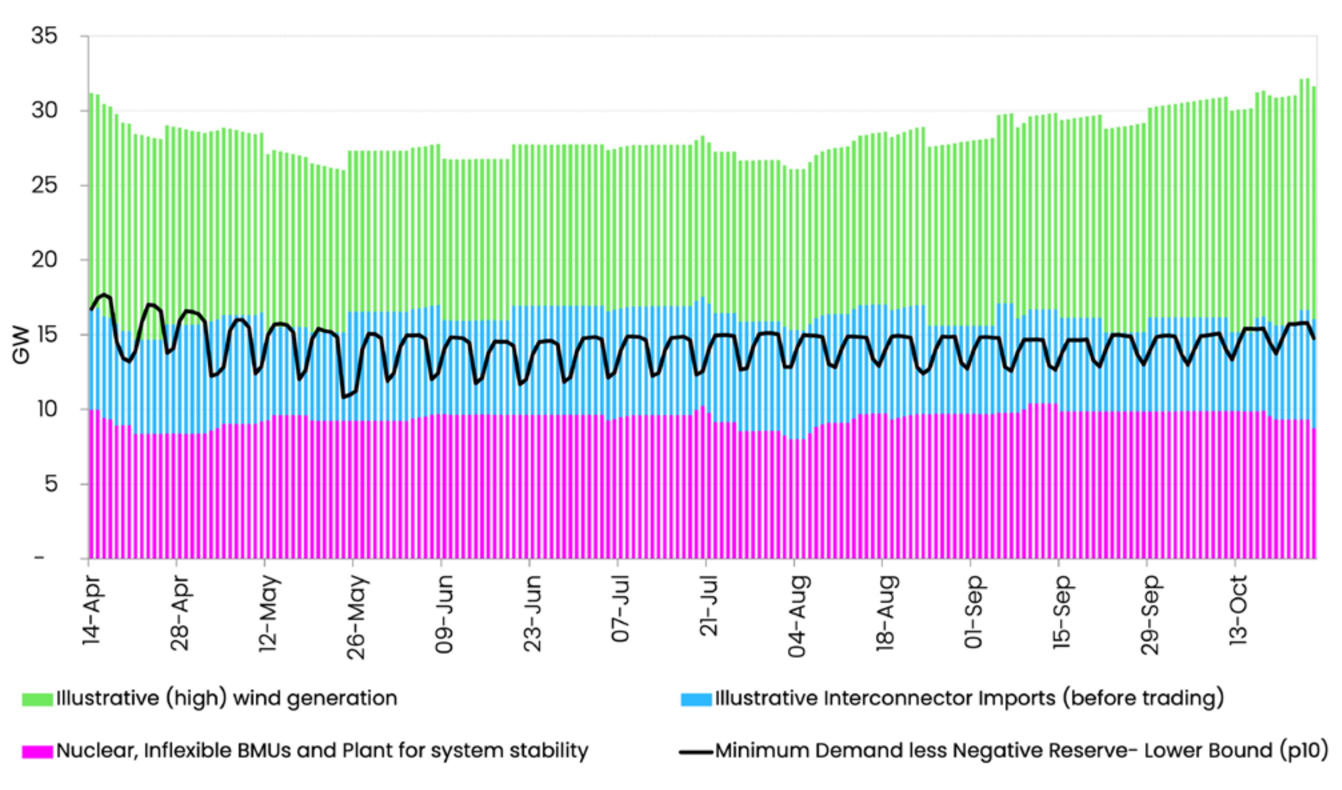


Figure 6: The lower bound of the forecast minimum demand range shown against inflexible generation, units providing system stability and wind output at the 70th percentile for each day. While It is not credible to expect the 1-in-10-year level to occur every day over summer, it may occur on individual days across the period.

In these situations, the ability to shift energy across time (using battery or pumped storage) or between markets (via interconnectors) is key to balancing demand and supply on the transmission system.

Between April and September, there are several outages at pumped storage stations, which will limit the ability to create transmission system demand – by approximately 1 GW compared to summer 2024. This reduced flexibility could lead to an increase in the number of everyday actions required to operate the system.

There may be isolated days this summer when we need to use our full range of operational tools, including the use of a Negative Reserve Active Power Margin (NRAPM) notice.

What is a Negative Reserve Active Power Margin (NRAPM) notice?

At times of low demand, or in periods where generation connected directly to distribution networks makes up more of the supply, we might identify that we need some additional flexibility on the system. If our forecasts indicate that matching supply and demand through the normal mechanisms may not be possible, we will issue a message to the electricity market to signal that additional flexibility is required. This message is referred to as an NRAPM and is part of a range of system notices available to us. System notices are standard operational tools and do not indicate that supply, or the system, is at risk.

NRAPM notices are rare – to date only a small number of local NRAPMs have been issued and none at the national level.

- A **local NRAPM** would be issued if we forecast that the combination of demand and inflexible generation within a constraint group will exceed the constraint limit on that portion of the network.
- A **national NRAPM** would be issued if we forecast insufficient flexibility to ensure that generation can match demand across the system.

Enduring low demand events

The nature of low demand periods is changing, with low-probability weather events creating the potential for enduring periods of low demand.

On any given day, there is a 10% probability that demand will fall below the forecast range shown in Figure 4 (page 10). These lower probability conditions – a combination of high solar irradiance, high wind and mild temperatures – can lead to extremely low demand and enduring low demand events.

Figure 7 shows the expected demand if the weather conditions of 7 and 8 of June 2018 occurred on a June weekend this summer. Under these conditions, we could see a minimum (afternoon) demand of 12.6 GW, with a prolonged period of low demand (below 15 GW) for approximately 10 hours.

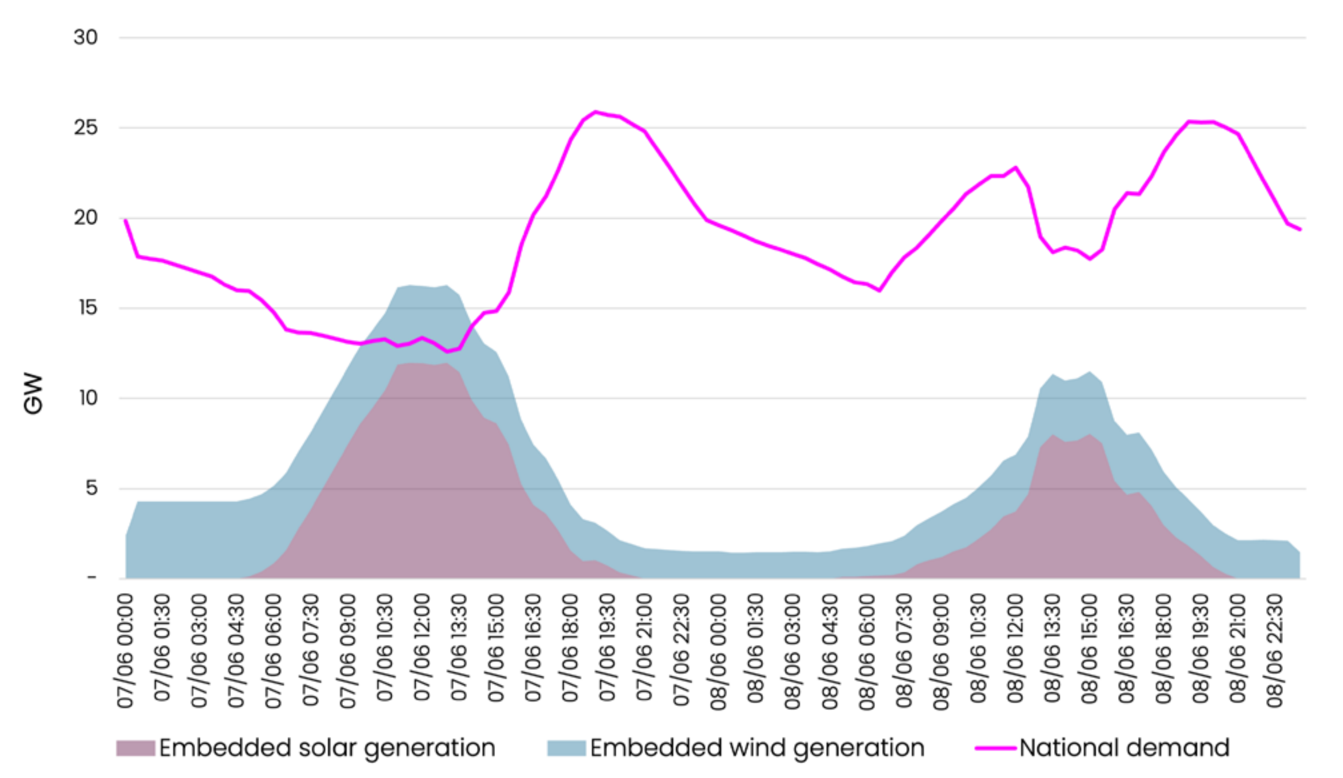


Figure 7: Example profile of National Demand over a weekend in June 2025 during a low-probability credible weather event

During these periods, we expect the growing battery storage fleet to provide significant within-day flexibility – both through regular cycling to help match supply and demand, and through the provision of vital system services such as fast-acting frequency response (see 'Operational view', pages 19–20, for more details on these services). We will also expect to derive significant operational benefits from available pumped storage units.

We continue to expect interconnectors to be mutually beneficial for adequacy and flexibility across the season. Given strong conventional availability and significant renewable growth in neighbouring markets, we expect Great Britain will regularly be a net importer – even when demand is low. This is likely to occur during solar-peak hours, when interconnector trading into well-supplied markets may be needed to reduce imports or secure exports.

Complexity compounds at low demand

Operating the system safely and securely requires us to manage stability, frequency, thermal constraints and voltage requirements simultaneously. The complexity of meeting these needs increases at lower demand.

Reducing wind generation to balance supply and demand can change network flows, which in turn alters local voltage profiles and increases the need for additional voltage support from reactive power providers. This support may come from additional generators that become functionally inflexible, creating a need for further actions to balance supply and demand.

In these periods, the systems, tools and services developed in support of our zero carbon ambition will be crucial – providing our control room with greater flexibility and materially reduce balancing costs.

Markets

Interconnected markets overview

We will continue to work closely with our neighbours in Europe, adopting a coordinated approach, providing reciprocal support, and ensuring that interconnectors remain mutually beneficial.

Electricity flows across interconnectors are primarily driven by price differentials between neighbouring markets. Baseload electricity prices in Great Britain for summer 2025 are £15–£40/MWh higher than in continental Europe. An explanation of the fundamental factors driving this premium are detailed on pages 15–16. We expect to see strong net imports into Great Britain. Figure 8 shows how this premium has been reflected in interconnector capacity auction results, with import prices clearing significantly higher than export prices and above summer 2024 levels. While actual interconnector flows will be determined by prevailing conditions on the day, the capacity auction results indicate the premium that market participants are willing to pay for the right to flow power to Great Britain, on average, across the season.

Our operational surplus analysis suggests there will be spare capacity on the system this summer. We are therefore well equipped for potential uncertainty over interconnector imports and exports. We will maintain a close and coordinated approach with our neighbouring TSOs to offer reciprocal support where required. Current prices suggest a typical pattern of exports from Great Britain to Ireland and Northern Ireland.

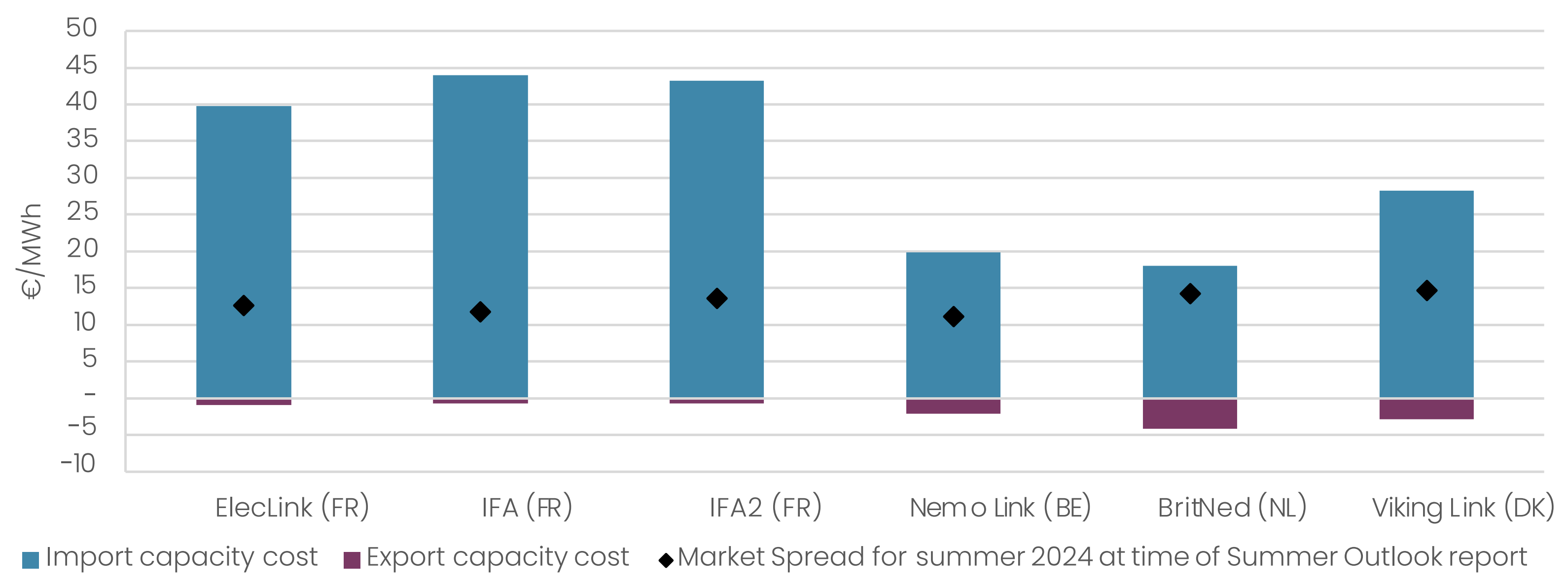


Figure 8: Summer 2025 interconnection capacity auction prices for interconnectors that hold long-term auctions (source: JAO)

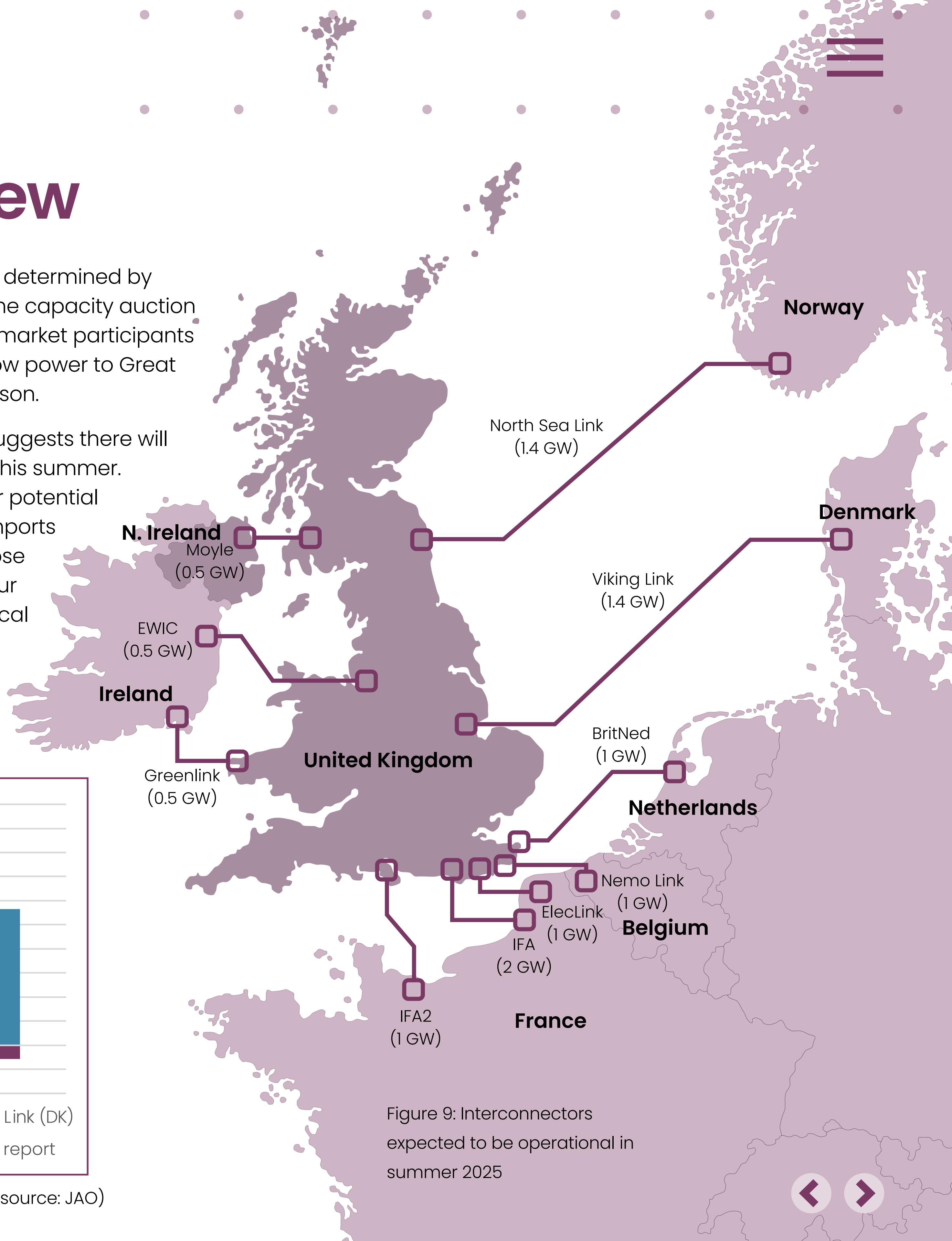


Figure 9: Interconnectors expected to be operational in summer 2025

Europe: power and gas markets

Significant growth in renewable generation – alongside healthy conventional generation availability in interconnected markets – suggests potential oversupply during solar peak hours.

Electricity prices in continental Europe reflect high forecast generation availability, including strong nuclear availability from France. Figure 10 shows scheduled French nuclear availability for this summer compared with recent years and the historic range. Allowing for revisions to this schedule, we still expect French nuclear production to be towards the upper end of the recent range. This suggests France will be able to support a high level of exports to neighbouring markets, including Great Britain, throughout the summer.

The structural increase in renewable generation – particularly solar PV – is changing price patterns in key European markets. Q2 2025 peak contracts (7am–7pm) are trading at a discount to baseload contracts (24 hours). We anticipate a rise in the number of negative price periods during solar peak hours in interconnected markets. This oversupply may result in interconnector imports, even when demand in Great Britain is low. This will require us to take action on the interconnectors to reduce imports.

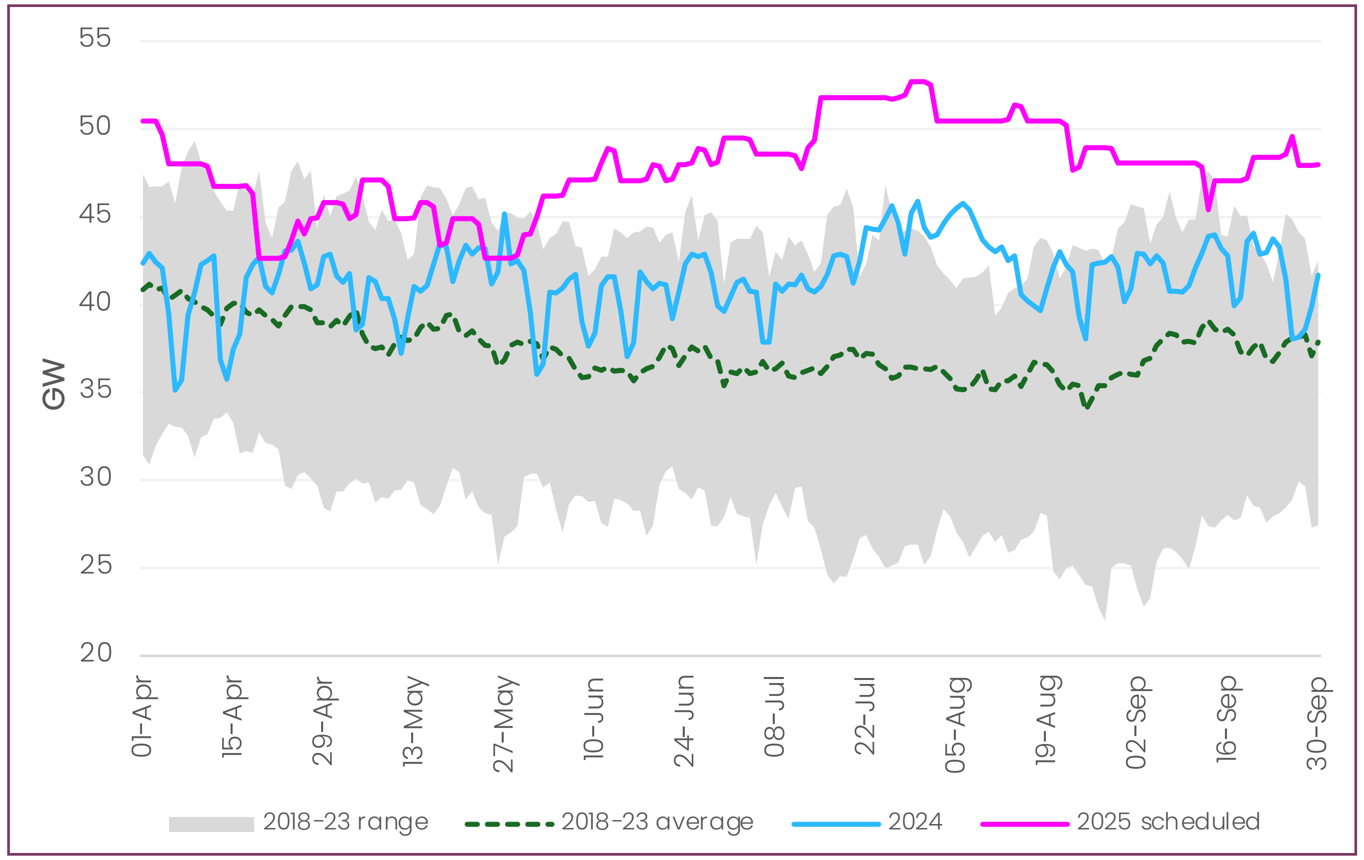


Figure 10: Scheduled French nuclear availability (source: RTE)

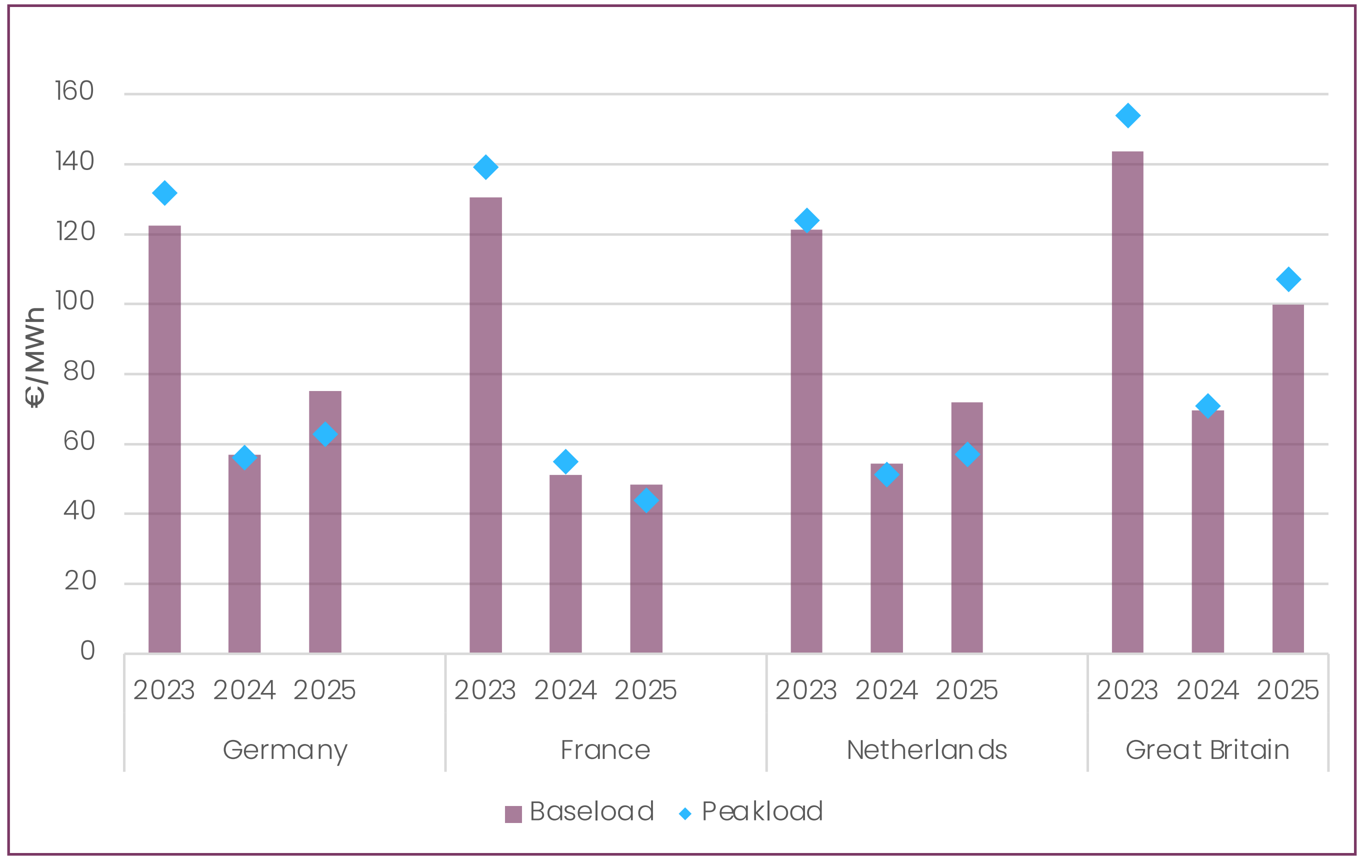


Figure 11: Q2 baseload and peakload prices for recent years, as of 1 March in each respective year (source: Argus Media)

Great Britain: power and gas markets

We continue to work closely with strategic partners to monitor potential risks in global energy markets.

Increasing renewable generation and interconnector capacity, coupled with lower demand, has reduced the forecast wholesale market returns for gas generation compared with recent years. The summer 2025 baseload clean spark spread (CSS) – the profit that a gas generator makes for selling electricity once fuel and carbon costs have been accounted for – suggests marginally reduced load factors relative to summer 2024 (see figure 12). We continue to monitor market signals and generator submissions to assess how these weaker spreads may affect generator availability and dispatch.

Gas prices for summer 2025 in both Great Britain (NBP) and the European benchmark (TTF) are, compared with recent years, elevated relative to winter contracts. The forward curve for these benchmarks is shown in Figure 13. We continue to work closely with Government, Ofgem and National Gas to monitor energy markets – assessing how geopolitical events, evolving policy mandates (such as EU storage requirements), and price signals may affect available supply. National Gas publishes a separate *Gas Summer Outlook* report.

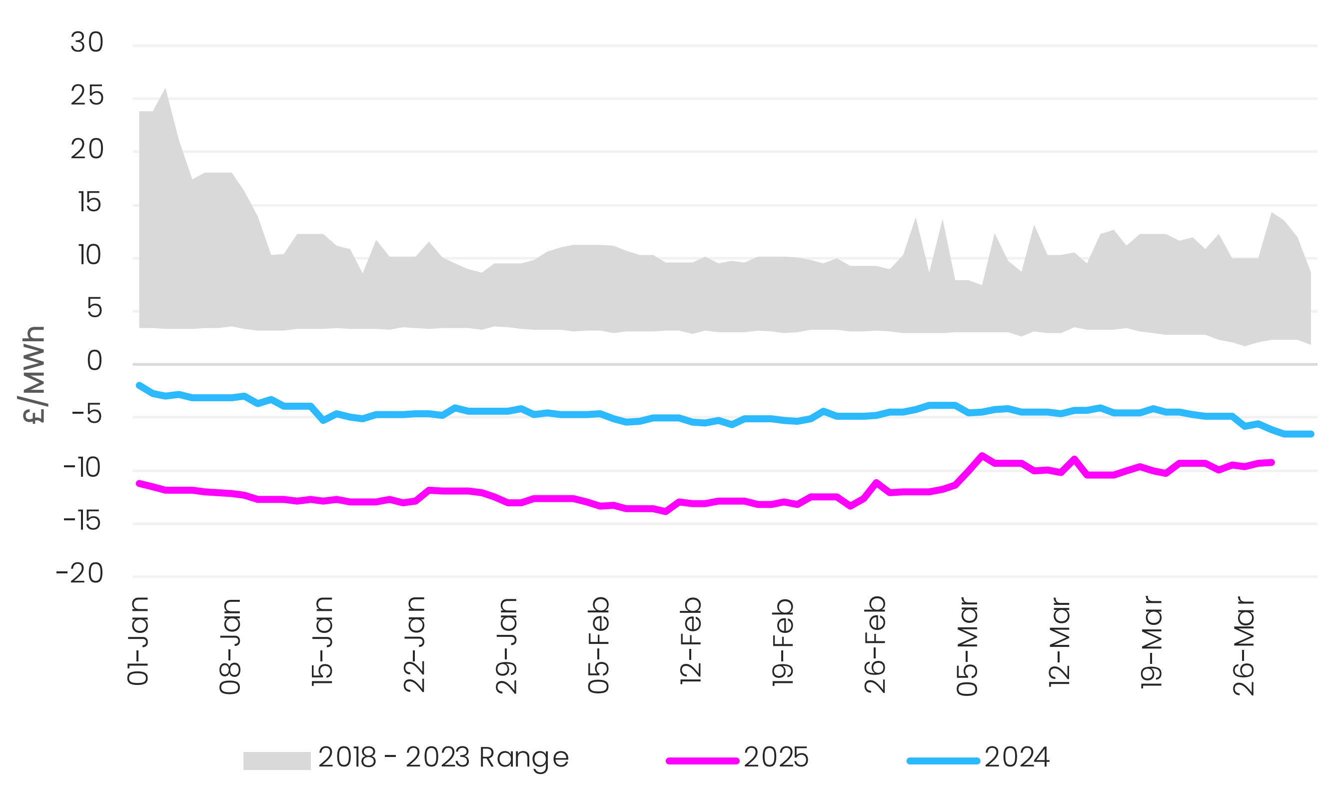


Figure 12: Baseload 49.13% efficiency clean spark spread evolution for summer 2025 and previous summers (source: Argus Media)

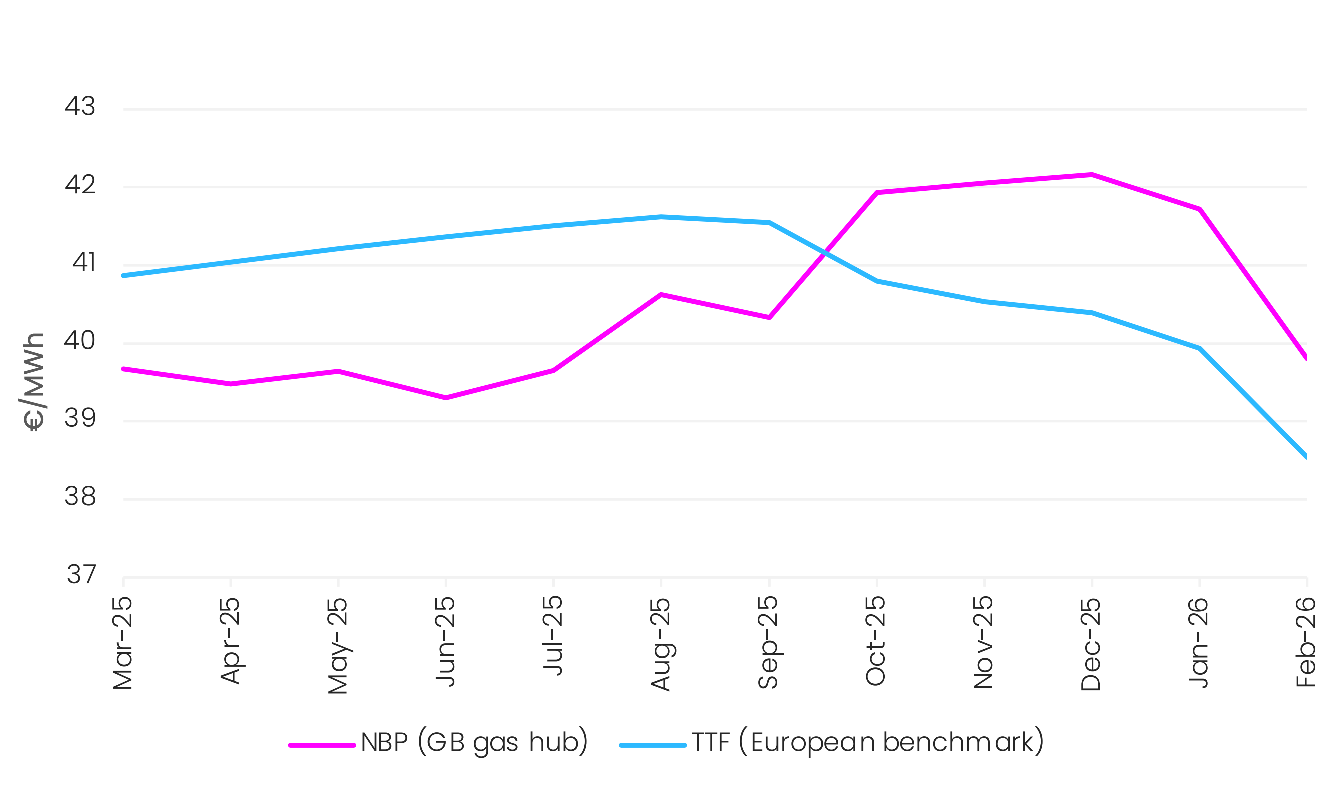


Figure 13: Forward gas prices in Great Britain (NBP) and the equivalent European benchmark (TTF) as at 28 March (source: Argus Media)

Operations and Resilience

Resilience and industry readiness

In line with our expanded responsibilities, we will work closely with Government, Ofgem and strategic partners to build resilience and ensure readiness for the season ahead.

Our energy system is complex, with an increasing number of interconnections and critical dependencies. This means that disruption to one part of the system can have implications for another. A single organisation with the remit and expertise to identify, understand, and mitigate the possible risks facing all parts of the energy system, will create a more resilient and adaptable system.

NESO acts as a single entity tasked with delivering whole energy benefits and coordination across resilience and emergency management.

Our new roles and responsibilities include:

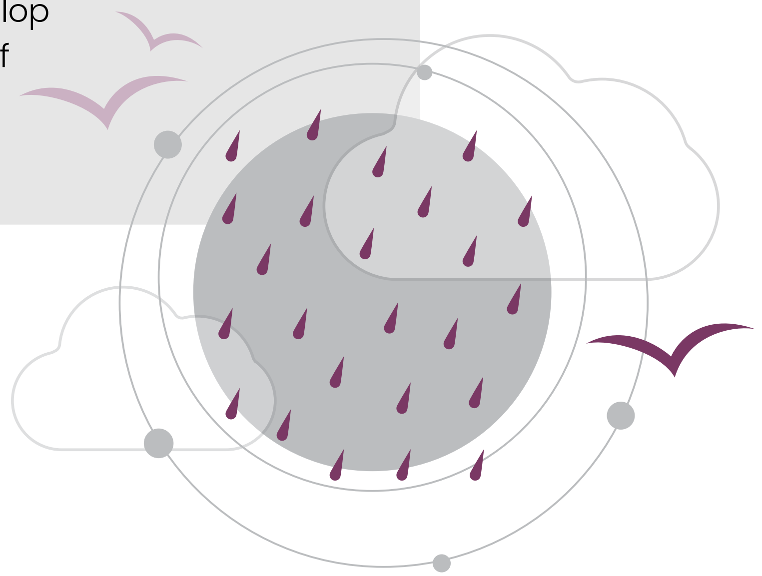
- undertaking whole energy risk assessments to identify vulnerabilities to the energy system
- conducting whole energy resilience assessments with industry partners, taking account of multiple energy vector interactions
- coordinating preparation for emergency response across the energy sector and investigating specific events and emergencies across the system
- providing insight and recommendations on security of supply through seasonal Outlook Reports, Capacity Market modelling, Gas Security of Supply Assessments and Resource Adequacy Studies
- leading industry preparedness and compliance with the new Electricity System Restoration Standard (ESRS)

Seasonal readiness

To provide sound whole energy reviews, analysis and insight, we collaborate with our stakeholders and strategic partners, to ensure industry readiness and preparedness.

The Electricity System Operator Licence (C7 Part E) and the Gas System Planner Licence (C6 Part E) require NESO to assess whole-energy industry readiness for the summer and winter periods, in cooperation with electricity and gas customers.

Our engagement process provides insights and analysis on industry preparedness ahead of each season, enabling NESO, DESNZ and Ofgem to develop a shared understanding of challenges and support coordinated action.



Operational view

The systems, operational tools and balancing services developed by NESO in support of our zero carbon ambition[1] will reduce balancing costs, cut carbon and support safe, reliable and efficient operations this summer.

Our zero carbon ambition is to be able to run Great Britain's electricity system carbon free for one thirty-minute settlement period in 2025, if the market provides us with electricity purely from renewable sources.

To decarbonise Great Britain's electricity system and to operate a zero carbon network, we are delivering transformational new systems, and world-first products and services.

Frequency

The Security and Quality of Supply Standard (SQSS) requires NESO to produce a *Frequency Risk and Control Report* (FRCR) every year. The FRCR sets out the right balance between risk and cost to consumers when managing frequency on the electricity system.

The 2023 FRCR recommended reducing the minimum inertia requirement from 140 GVA.s to 120 GVA.s, with a forecast reduction in operational costs of approximately £65 million per year, while maintaining our risk profile in frequency control.

We successfully implemented the reduction to 130 GVA.s in February 2024 and to 120 GVA.s in June 2024. By January 2025, balancing cost savings from the lower minimum inertia totalled over £200 million – well above the FRCR 2023 projection.

Did you know?

The 'stored' energy in synchronous machines slows the rate at which the frequency changes in the event of a sudden supply loss. Our minimum inertia requirement ensures that, in the event of the largest loss on the system, the rate of change of frequency will remain within 0.5 Hz/s – allowing response services, and our control room, to restore balance. When demand and prices are low, fewer generators self-dispatch, thereby reducing system inertia. A lower minimum inertia requirement reduces the number of generators our control room must instruct, saving cost and creating operational flexibility.

The 2025 FRCR explores the cost benefits of further reducing the minimum inertia requirement to 102 GVA.s. Supporting documents can be found by visiting *Frequency Risk and Control Report* on our website. We will continue to operate at 120 GVA.s through summer 2025 to gain more operational experience before progressing to 102 GVA.s. This reduction is planned as a phased implementation and will be communicated to industry via the Operational Transparency Forum and other relevant events.

Response

As there is less inertia on the system, our ability to maintain the system frequency close to 50 Hz to balance real-time supply and demand requires a quicker response. Our suite of dynamic response services – including Dynamic Containment (DC), Dynamic Moderation (DM) and Dynamic Regulation (DR) – enables us to manage system changes effectively under lower inertia conditions.

- **DC** is our post-fault service that arrests sudden, large changes in frequency, such as the loss of a generator.
- **DM** provides fast-acting pre-fault delivery during volatile periods.
- **DR** is our slower pre-fault service.

The DC requirement is set according to the FRCR's minimum inertia policy and is designed to secure against the largest loss on the system.

In early February 2025, we increased DR low and high services by 150 MW each. We also increased DM low from 170 MW to 300 MW, and DM high from 200 MW to 300 MW. These increases help us manage volatile system frequency more effectively. This summer, we will continue to monitor system conditions and revise dynamic service requirements as needed.

Reserve

In 2024 we launched the Balancing Reserve (BR) and Quick Reserve (QR) services.

- **Balancing Reserve** provides a day-ahead price signal to secure volume ahead of the real-time procurement of operating reserve.
- **Quick Reserve** has been brought in to replace Fast Reserve as our fast-acting reserve service to manage sudden imbalances between supply and demand.

In 2025, we expect further reform of QR and BR, alongside the launch of our new Slow Reserve service, which will replace the current Short Term Operating Reserve (STOR) service. STOR is used to secure the system's largest generation loss.

1 Read more about Zero Carbon Operation on our website.

We expect Quick Reserve phase 2 to go live in summer 2025, supported by the continued development of our Open Balancing Platform (OBP), which will enable QR instructions to be issued outside of the Balancing Mechanism.

Thermal Constraints

There are times when the physical capacity of the network cannot transfer the amount of electricity required. When this happens, generation output on one side needs to be reduced and this is called a 'constraint'. Summer is a key period for network reinforcements and new connections, as lower peak demand and generator outages enable network upgrades. This can result in a greater number of constraints. [2]

There is a comprehensive transmission network outage plan for the summer to connect new generation and improve system capacity. All major constraint boundaries in Scotland will continue to experience a high number of outages throughout the season.

Work is continuing from 2024 across the B2 and B4 constraint boundaries to reinforce the network by upgrading the 275 kV circuits to 400 kV. Multiple outages are scheduled across Scotland to connect new synchronous compensators and battery energy storage systems (BESS) contracted with NESO under Stability Phase 2, as well as several new generators. Synchronous compensators are machines which provide the network stability benefits inherent to conventional generation, but do so without generating power.

In the South, there are several major schemes on the B9 and LE1 boundaries. Outages will be required for new generation and customer connections, which will affect capacity across these boundaries.

The summer plan for the North includes a mix of outages to improve system capacity and connect multiple new generators to the grid. A major outage is also scheduled across the DRESHEX constraint boundary to support reinforcement works in preparation for the Eastern Green Link 2 connection.

Where possible, we align network outages with planned generator outages to minimise constraint costs. Commercial intertrip contracts with generators on the B6 and EC5 boundaries, can be armed to manage constraints. These automatic control arrangements reduce or disconnect generation following a system fault event. This allows fewer pre-fault actions, reducing curtailment costs and allowing more renewable to meet demand across the wider network.

Stability

To ensure the system can securely and reliably withstand unplanned events, there needs to be enough inertia and short circuit level (SCL). The Stability Pathfinders enhance stability and reduce the operability risk of the electricity system, unlocking new opportunities to secure the future resilience of the network. These initiatives achieve this through the procurement of inertia and short circuit level from a variety of technologies.

The first units under Stability Phase 2 have now gone live in Scotland, including the connection of Great Britain's first grid-forming battery site. The estimated cost-savings over the 10-year life of the awarded contracts are approximately £500 million. In total, NESO has secured 7.66 GVA of SCL in Scotland and 7.3 GVA.s of inertia across Great Britain, delivered by five synchronous condensers and five grid-forming batteries. Additional Phase 2 units are scheduled to go live throughout 2025.

In 2024, NESO launched its first enduring stability market – the mid-term (Y-1) market. The first round sought to competitively procure inertia at a lower cost than current alternatives. In November 2024, we announced contracts with five units to provide 5 GVA.s of inertia. These agreements are due to begin delivery in October 2025 and are projected to deliver approximately £47 million in consumer benefits.

Assets contracted under previous stability pathfinder projects will continue to provide valuable services to the grid through their long-term agreements. the availability and utilisation of these assets can be found on our Stability Pathfinder service information webpage.

Voltage

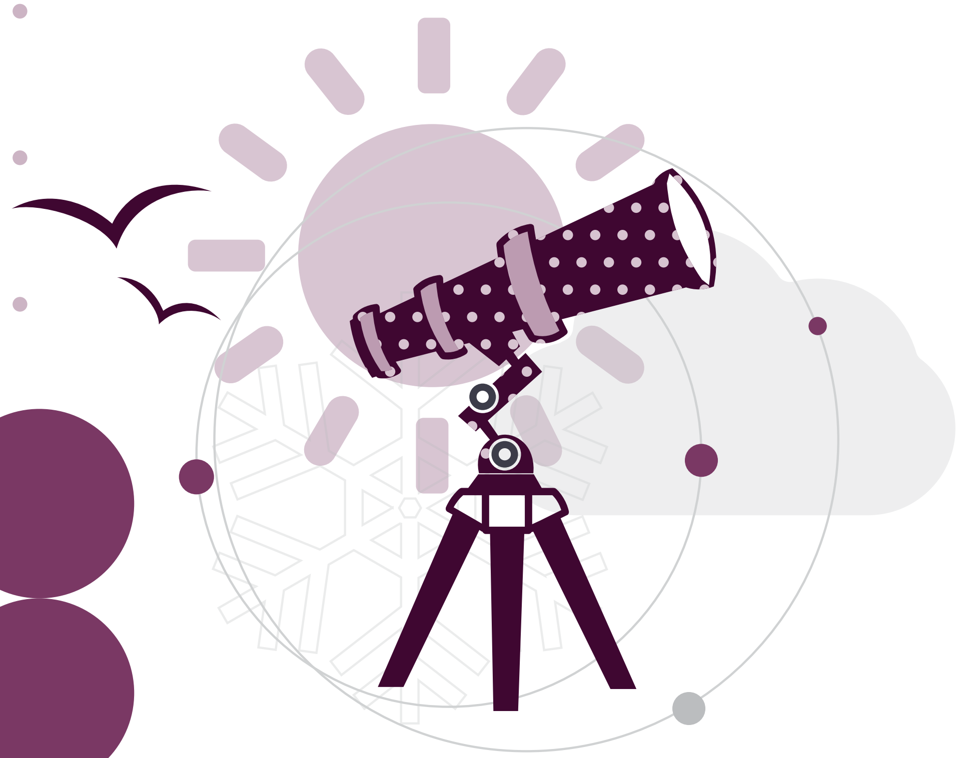
System voltage must be kept within acceptable operational limits using reactive power. During periods of low demand, we need to ensure there is enough voltage support from reactive power providers in specific locations.

This support is typically more expensive in summer, when fewer generators are self-dispatching. However, various pathfinder projects and transmission owner assets are now available across the transmission system, enabling high voltage management with zero carbon intensity.

2 Network diagrams showing the location, limits and flows of relevant boundaries are available on our Day Ahead Constraint Flows and Limits webpage.

Future readiness

We continue to innovate and adapt to securely and efficiently operate a rapidly changing electricity system. Our *Operability Strategy Report* defines future system needs, while the *Markets Roadmap* sets out how our markets will meet these needs in the most efficient way.



Operability Strategy Report

The electricity system is undergoing a fundamental transformation, requiring a corresponding shift in how we operate it. From large-scale offshore wind to domestic solar panels and increased demand-side participation, integrating newer technologies is critical to ensuring safety, reliability, lower consumer bills and reduced carbon emissions.

To help forecast future requirements and develop solutions to emerging operational challenges, NESO publishes an annual *Operability Strategy Report*.

As the generation mix continues to evolve, we are monitoring and forecasting system needs, defining requirements and ensuring the correct tools are in place for system operation. We have already delivered a range of transformational systems, products and services. Our stability and voltage pathfinders have reduced our reliance on fossil-fueled generation for critical transmission system services.

We have also delivered new frequency response services fit for operating a zero carbon network and are developing groundbreaking system operability solutions for within-day flexibility to help balance the system.

Markets Roadmap

NESO's balancing services markets are crucial to facilitate zero carbon electricity system operation for short periods by 2025, support Government's Clean Power 2030 ambitions, and drive net zero transformation. Efficient design and operation of balancing services markets is essential in reducing costs for end consumers while maintaining security of supply at all times.

Reforming markets to be more efficient, accessible and liquid is crucial if we are to meet future system needs in the most efficient way. This requires NESO to provide a clear view of how we see these markets developing.

The *Markets Roadmap* sets out what we are doing to reform NESO markets and why. The Roadmap details our objectives, design principles and plans to reform and evolve our markets. It consolidates and presents information in a clear, coherent way to support investment and build confidence with our stakeholders. The report details our vision for response, reserve, thermal, voltage, stability, restoration markets, revenue stacking and the Balancing Mechanism.

Summer 2024 Retrospective

Supply and demand

Margins were adequate throughout summer 2024. Minimum demand remained largely within our forecast range ahead of the season.

Demand

Minimum demand in summer 2024 was generally higher than the central forecast, but remained largely within our expected range. This was driven by cooler-than-average weather conditions and low solar generation across the season.

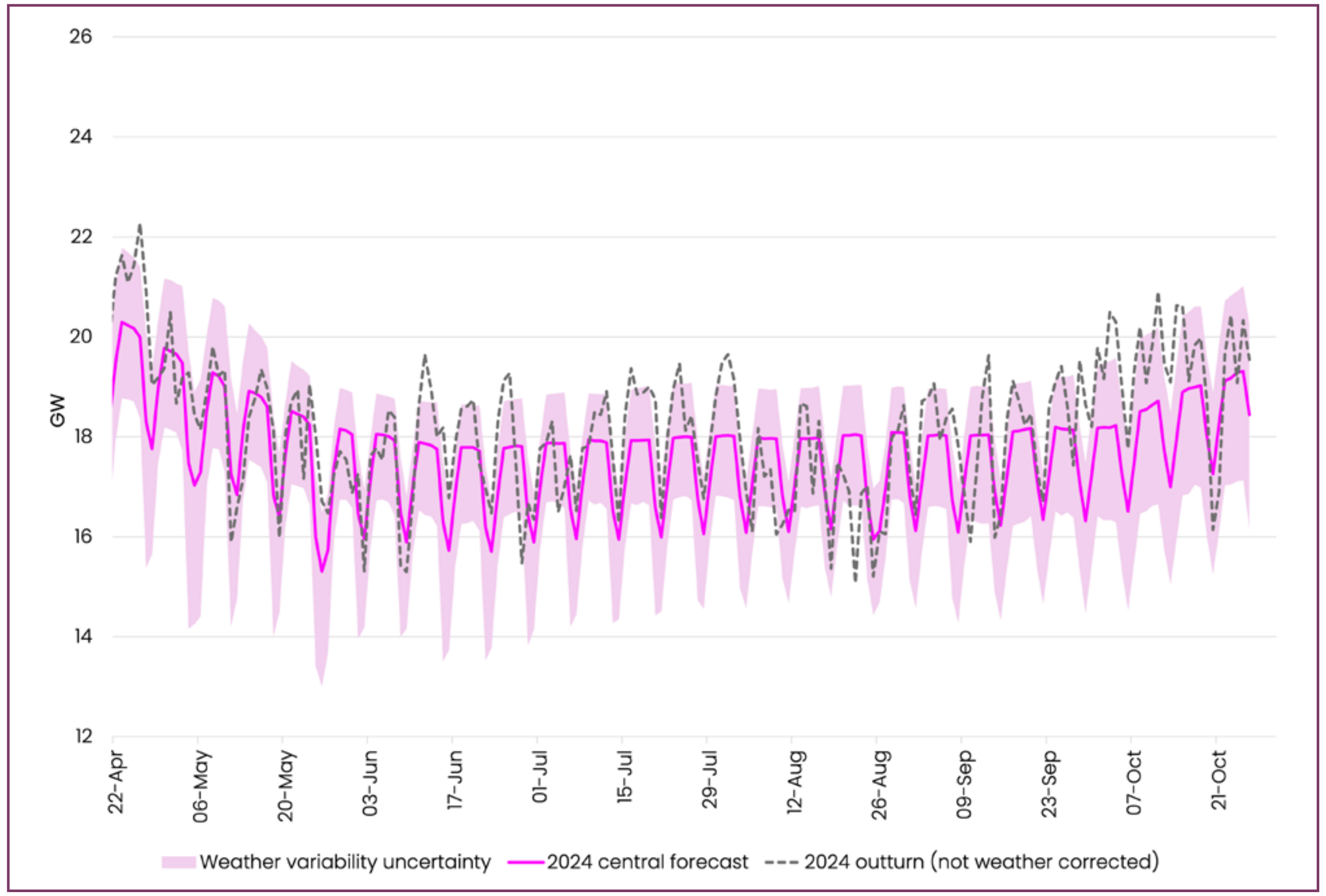


Figure 14: Daily minimum demand forecast for summer 2024 against the minimum outturn (actual outturn has not been weather corrected)

Supply

Supply was sufficient to meet peak demand at all times last summer. Generation was slightly lower than expected during the second half of the season, largely due to unforeseen plant outages.

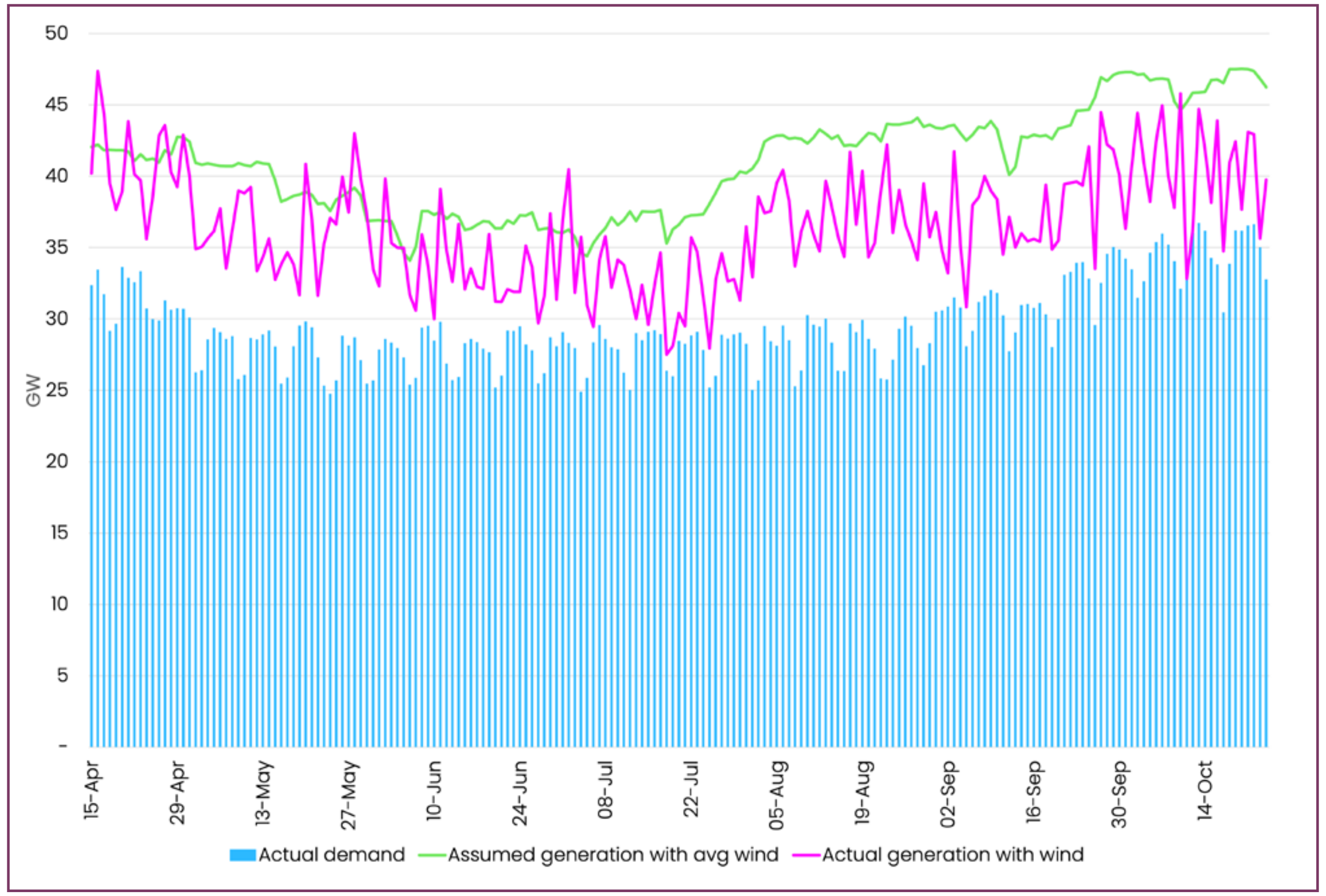


Figure 15: Summer 2024 day-by-day view of generation (excluding interconnectors) and demand. Forecasts from the *Summer Outlook* report of demand are compared to actual available generation and demand

Interconnected markets

Great Britain was a net importer from continental Europe during summer 2024.

Great Britain saw high levels of imports via the interconnectors with continental Europe during summer 2024, with flows into Great Britain occurring 78% of the time during peak periods. The highest levels of imports were seen during daytimes, with a relatively higher proportion of exports occurring overnight.

Conversely, Great Britain was largely exporting to Ireland and Northern Ireland – via the EWIC and Moyle interconnectors – during all periods.

Interconnector imports into Great Britain were driven by lower electricity prices in continental Europe. Figure 17 shows the day-ahead electricity price spread (converted to GBP) between Great Britain and border countries during summer 2024. A positive price spread indicates Great Britain's electricity prices were higher than its European counterpart.

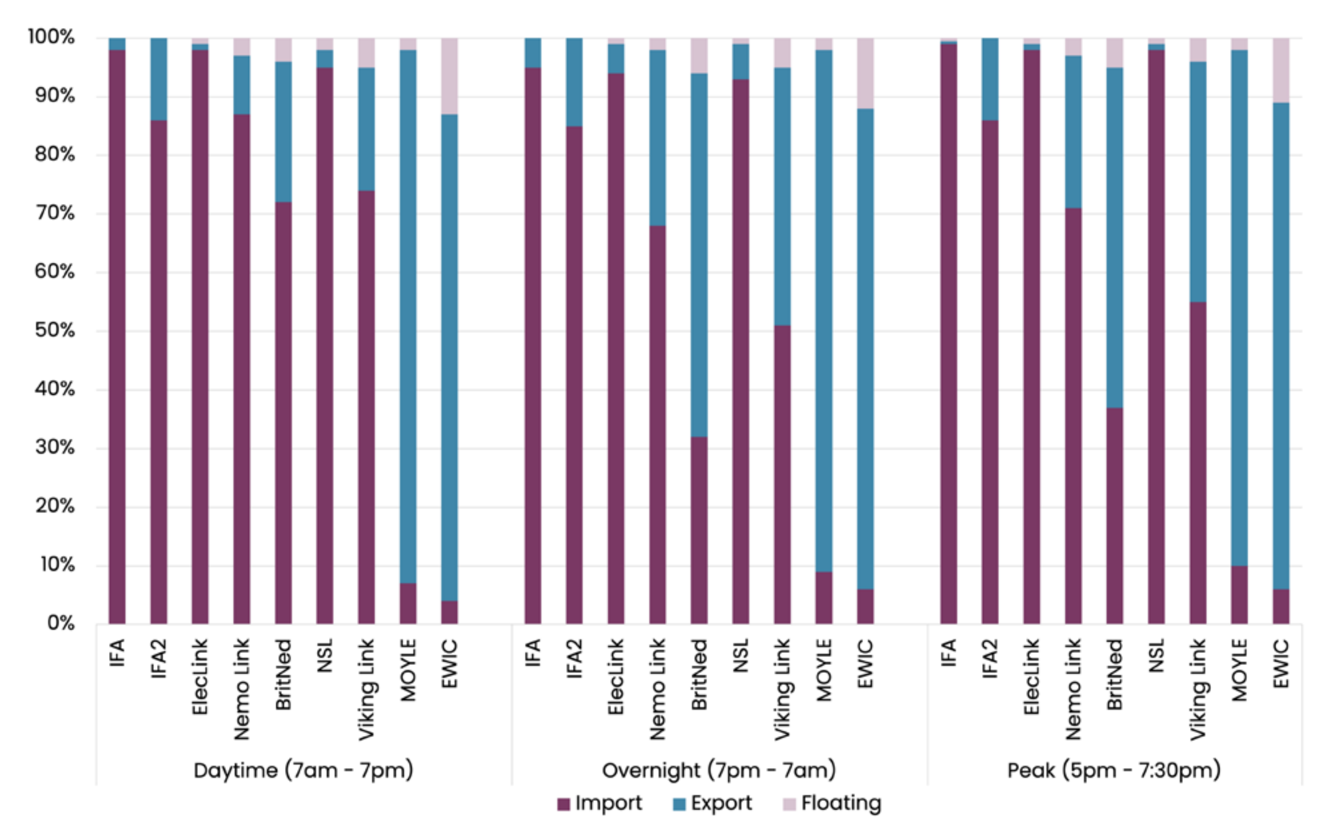


Figure 16: Proportion of imports and exports for continental and Irish interconnectors in summer 2024

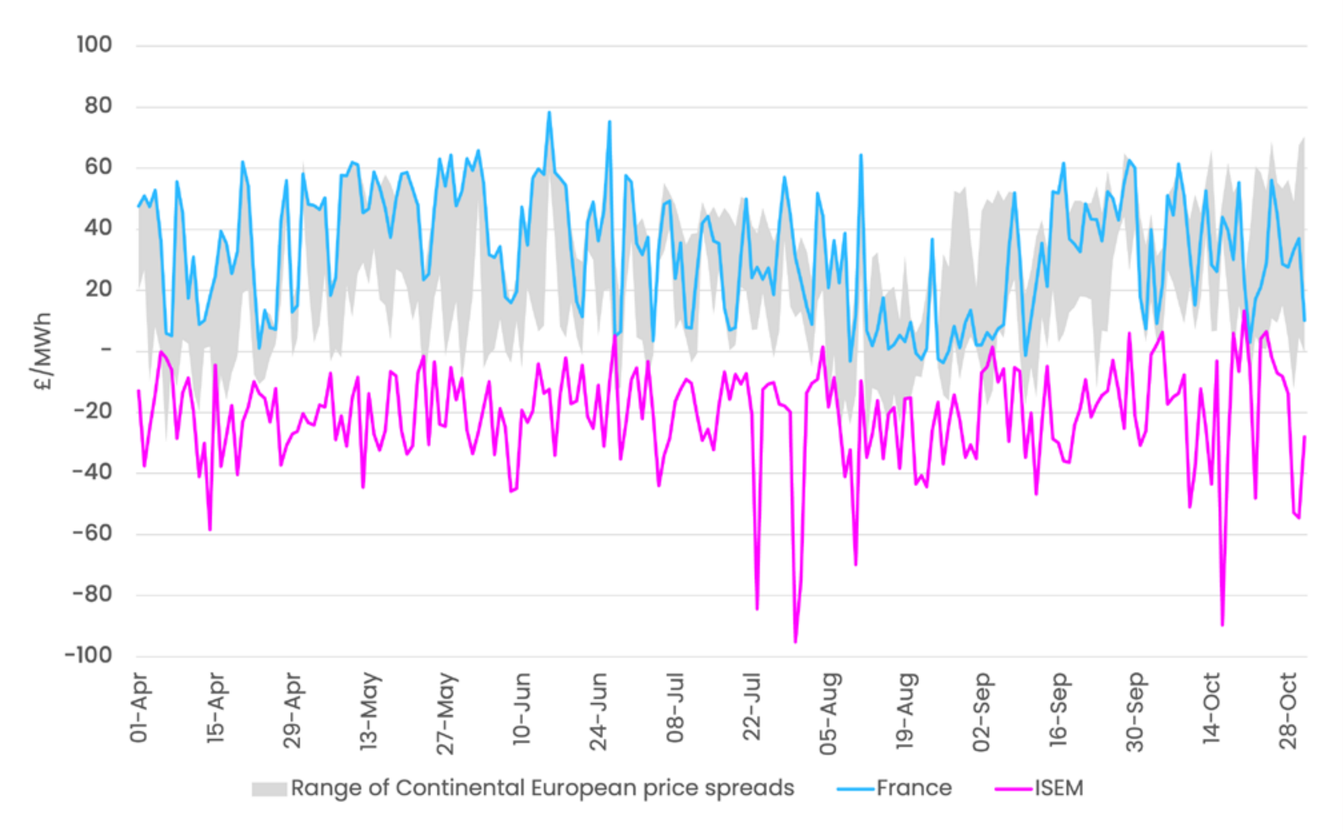


Figure 17: Day-ahead price spread between Great Britain and border countries in summer 2024 (positive values indicate Great Britain was more expensive)

Looking Beyond Summer

Winter 2025/26

Winter 2025/26

We have already begun working with stakeholders to prepare for winter 2025/26.

An *Early View* for winter 2025/26 will be published in June, alongside our review of last winter. We expect to publish the full *Winter Outlook* report by October.

We will continue to work closely with stakeholders and strategic partners as we undertake our seasonal preparations. This includes Government, Ofgem, National Gas, Transmission Owners, Distribution Network Operators and our neighbouring electricity Transmission System Operators in Europe.

We also continue to closely monitor developments in global energy markets to help identify and assess any potential uncertainties that could affect winter operations.

In Great Britain, the T-1 Capacity Market auction for delivery in winter 2025/26 has already concluded, securing 7.9 GW of capacity[3].

We will share our analysis with industry in the coming months through our winter publications.

Upcoming publications

Early View 2025/26

We expect to publish our *Early View* for winter 2025/26 by June, alongside our review of last winter. This will invite stakeholder feedback through our annual winter outlook consultation. The *Early View* will set out our developing assessment of both system margin and daily operational surplus for the coming winter.

Winter Outlook 2025/26

The full *Winter Outlook* report is expected to be published by October. It will provide our final assessment of system margin for winter and our latest view of daily operational surplus throughout winter. It will also include a supporting data workbook and more detailed information on demand, supply and potential flows on electricity interconnectors compared with the *Early View*.

National Gas will publish a separate *Gas Winter Outlook* report.

3 NESO's final auction report.

Appendices and Glossary

Appendix A: List of Figures and Tables

Figures

Tables

Appendix B: Relationship between Types of Demand

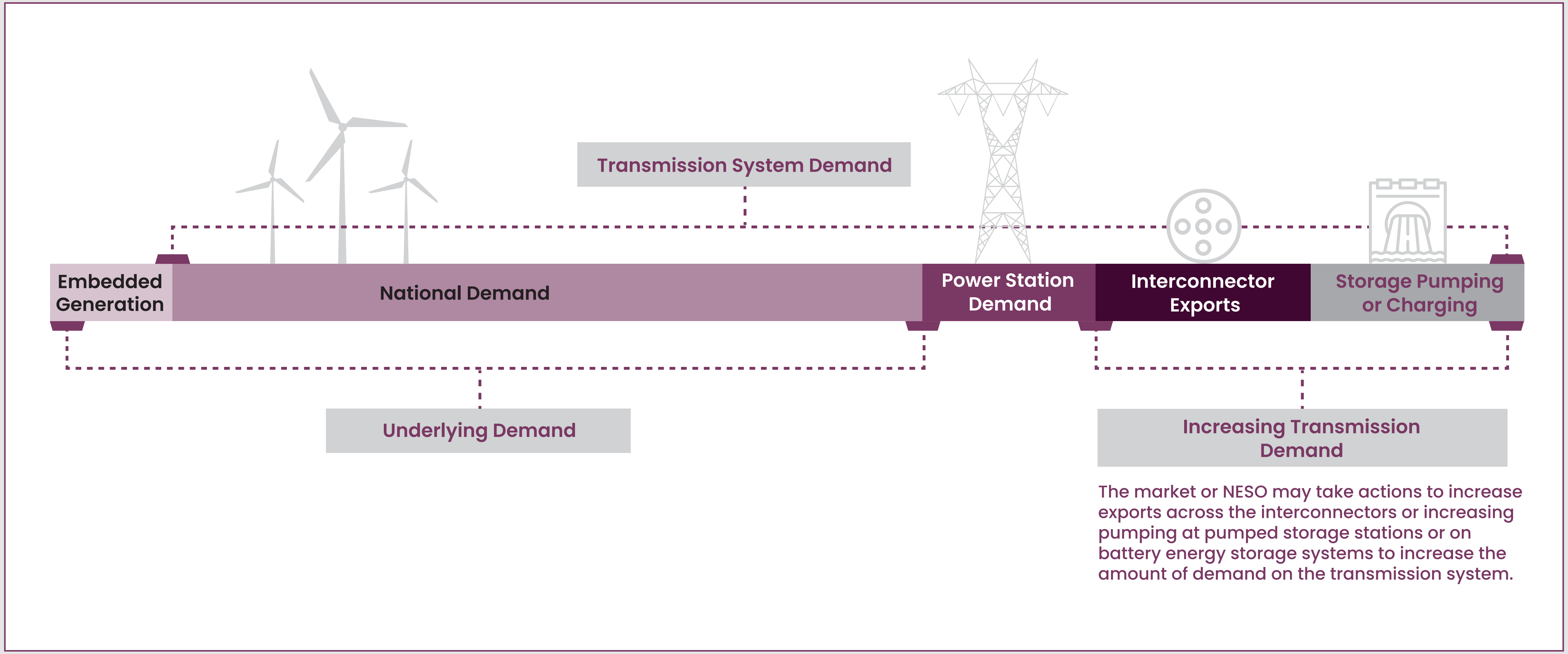


Figure 18: Relationship between some types of demand

Glossary

Accelerated Loss of Mains Change Programme (ALoMCP)
A joint initiative between the (then) ESO, Energy Networks Association, distribution network operators (DNOs) and independent distribution network operators (IDNOs). It provided funding to non-domestic distributed generators to upgrade their loss-of-mains protection to be compliant with the Distribution Code by September 2022.

Baseload electricity
A market product for a volume of energy across the whole day (the full 24hrs), or a continuous running pattern for power sources that are inflexible and operate constantly, such as nuclear.

BritNed
BritNed Development Limited is a joint venture between Dutch TenneT and National Grid in the UK that operates the electricity interconnector between Great Britain and the Netherlands. It is a bidirectional interconnector with a capacity of 1 GW.

Capacity Market (CM)
The Capacity Market is designed to ensure security of electricity supply. It provides a payment for reliable sources of capacity, alongside their electricity revenues, ensuring they deliver energy when needed.

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

Demand side response (DSR)
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 consumption. We observe this behaviour as a reduction in transmission demand.

Distributed (embedded) generation
Any generation or storage connected directly to the local distribution network, as opposed to the transmission network. It includes combined heat and power schemes of any scale, including wind generation, solar and battery units. This form of generation is not usually directly visible to NESO and reduces demand on the transmission system.

Dynamic Containment
A fast-acting post-fault service to contain frequency within the statutory range of +/-0.5 Hz in the event of a sudden demand or generation loss. The service responds quickly and proportionally to frequency deviations, but is only active when frequency moves outside of operational limits (+/- 0.2 Hz).

Dynamic Moderation
A pre-fault frequency service aimed at correcting sudden, large imbalances between generation and demand – for example, due to erroneous wind or solar forecasts.

Dynamic Regulation
A pre-fault frequency service designed to correct random but small deviations in frequency around the target of 50 Hz.

East West Interconnector (EWIC)
A 500 MW interconnector that links the electricity transmission systems of Ireland and Great Britain.

ElecLink
A power interconnector through the Channel Tunnel, providing a transmission link between the UK and France with a capacity of 1 GW in either direction.

Float
When an interconnector is neither importing nor exporting electricity.

Forward prices
The predetermined delivery price for a 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.

Frequency risk and control report (FRCR)
Published at least once a year, the FRCR sets out the results of an assessment of the operational frequency risks on the system.

Greenlink
A 0.5 GW interconnector between Ireland and Wales, commissioned in early 2025.

GW Gigawatt (GW)
A measure of power: 1 GW = 1,000,000,000 watts.

Gigavolt Amp Seconds (GVAs)
Synchronous generators producing electricity rotate at the right frequency. The kinetic energy 'stored' in these synchronous machines is system inertia. If there is a sudden change in system frequency, the stored energy slows the rate of change of frequency while our control room restores balance. Power is measured in MW or GW, but inertia is measured in GVAs.

High summer period
The period between 1 June and 31 August (weeks 23 to 35.), when the greatest number of planned generator outages is expected.

Interconnexion France–Angleterre (IFA)
A 2 GW interconnector between the French and British transmission systems. Ownership is shared between National Grid and Réseau de Transport d'Electricité (RTE).

Interconnexion France–Angleterre 2 (IFA2)
A 1 GW interconnector between the French and British transmission systems, commissioned in early 2021. Ownership is shared between National Grid and Réseau de Transport d'Electricité (RTE).

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

Interconnector
A transmission asset that connects the electricitymarket in Great Britain to other markets, including continental Europe, Norway, Ireland and Northern Ireland. Interconnectors allow electricity trading between these markets.

Load factors
The amount of electricity generated by a plant or technology type over a year, expressed as a percentage of its maximum possible output. It is calculated by dividing total electricity output across the year by the maximum possible generation for each plant or technology type.

Minimum demand
The lowest demand on the transmission system.

Maximum demand
The highest demand on the transmission system.

Moyle
A 500 MW interconnector between Northern Ireland and Scotland.

National electricity transmission system (NETS)
The high-voltage system that transports electricity from where it is generated to where it is used. It consists of overhead lines, underground cables and substations across Great Britain and nearby offshore waters. The NETS is owned and maintained by regional transmission companies and operated by NESO.

Negative reserve active power margin (NRAPM)
A NRAPM is issued when there is insufficient flexibility to ensure generation can match demand during periods of low demand. The 'insufficient NRAPM' warning encourages more flexible generator parameters and informs participants of the potential for emergency instructions. A local NRAPM may be issued when the combination of demand and inflexible generation within a constraint group is forecast to exceed the constraint limit for that part of the network.

Nemo Link
A 1 GW interconnector between Great Britain and Belgium.

Normalised transmission demand
The demand seen on the transmission system, forecast using long-term trends and adjusted to remove the effects of the weather and the day of the week. It also accounts for station load (electricity used by generating stations) and interconnector exports.

OC2 data
Power generation operational data submitted under Operating Code No.2 of the Grid Code.

North Sea Link (NSL)
A 1.4 GW HVDC sub-sea link from Norway to Great Britain.

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

Outturn
Actual historical operational demand, as measured by real-time metering.

Positive and negative reserve
NESO maintains positive and negative reserve to increase or decrease supply and demand in response to manage system frequency as required.

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

Reactive power
The movement of energy across a network which 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.

Renewable generation
Electricity generation from renewable resources, which are naturally replenished, such as sunlight and wind.

Reserve requirement
To manage system frequency and respond to sudden changes in supply and demand, NESO maintains reserves. These reserves, known as positive and negative reserves, help to increase or decrease supply and demand as needed. Positive reserve, or headroom, allows for additional generation or reduced demand, while negative reserve, or footroom, enables lower generation or increased demand. These reserves are made available across all generators synchronised to the system, ensuring stability and reliability in the power grid.

Restoration
Services used to restore power in the event of a total or partial shutdown of the national electricity transmission system, previously referred to as Black Start services.

Seasonal normal conditions
The average set of conditions we could reasonably expect to occur. We use industry-agreed seasonal normal weather conditions, which reflect recent changes in climate conditions, rather than being a simple average of historic weather.

Super-SEL
A service designed to directly reduce the total minimum megawatt (MW) level, also known as the Stable Export Limit (SEL), of generators synchronised to the system. It achieves this by lowering the minimum generation level at a synchronised generator.

Technical capability
The capacity of connected plant expected to be generating in the market, based on the Capacity Market auctions and other sources of market intelligence, but does not account for potential breakdowns or outages.

Transmission system demand (TSD)
Demand that NESO sees at Grid Supply Points, which are the connections to the distribution networks.

Unavailability rates
A calculated value to account for unexpected generator unit breakdowns, outages, restrictions or losses. NESO applies forecast breakdown rates to operational data submitted by generators. These rates are based on average generator performance by fuel type during peak demand periods (7am to 7pm) over the last three winters.

Underlying demand
Demand varies from day to day, depending on the weather and the day of week. Underlying demand is a measure of how much demand there is once the effects of the weather, the day of the week and distributed generation, have been removed.

Viking Link
A 1.4 GW high voltage direct current (DC) electricity link between the British and Danish transmission systems connecting at Bicker Fen substation in Lincolnshire and Revsing substation in southern Jutland, Denmark.

Voltage
Unlike system frequency, voltage varies by location across the network depending on supply, demand and the level of reactive power in the area. Broadly, when electricity demand falls, reactive power increases – raising the likelihood of high voltage conditions.

Weather-corrected demand
Outturn demand adjusted to remove the impact of weather. This is calculated using a 30-year average of relevant weather variables for each week of the year. These averages are applied to linear regression models to estimate what demand would have been under standardised weather conditions.

Get in Touch

Email us with your views on the *Summer Outlook* report at marketoutlook@nationalenergyso.com and we will get in touch.

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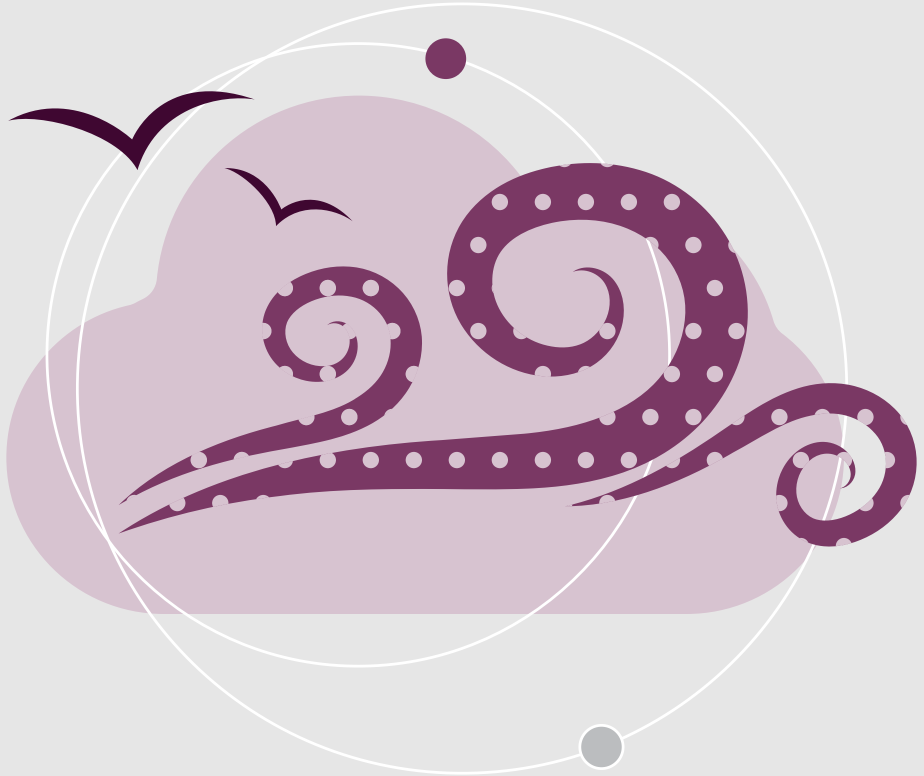
The *Summer Outlook* report is part of a suite of documents prepared by NESO.
Visit neso.energy for more information.



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