Public

Balancing Costs Report

Winter 2024/25

NESO
National Energy System Operator

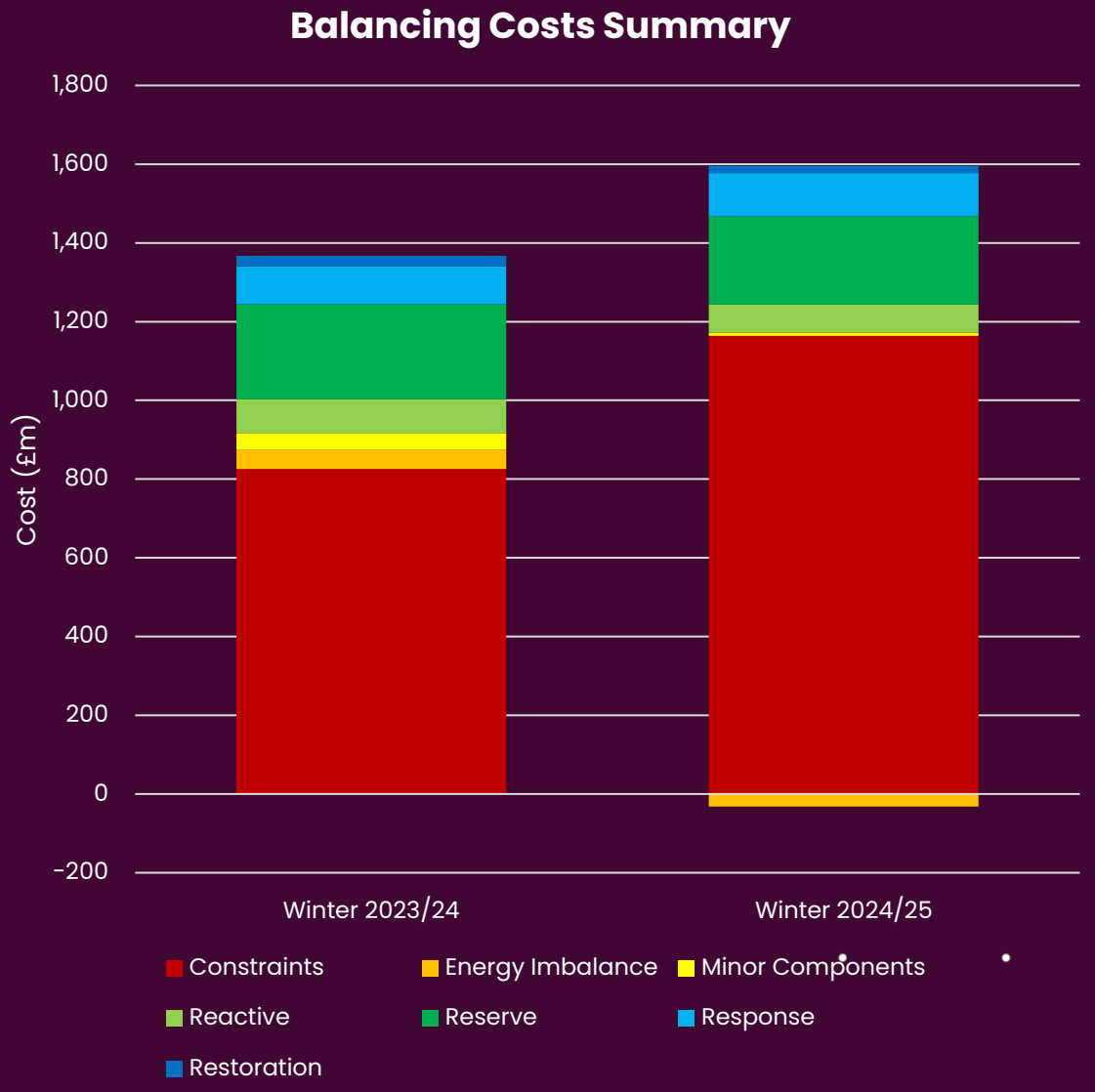
Contents

Executive Summary

Welcome to the Winter 2024/25 Balancing Costs Report. This report provides a look back at balancing costs and associated market dynamics from October 2024 to March 2025.

Key messages:

- Overall, balancing costs and volumes across winter 2024/25 were up 14% and 13% respectively compared to winter 2023/24. Although constraint costs have risen, non-constraint costs have fallen across most categories reflecting work by NESO to develop our balancing services and implement cost saving initiatives.
- The Demand Flexibility Service (DFS) was transitioned from an enhanced action service to an in-merit based margin tool from the 27 November 2024. DFS has been utilised consistently over winter 2024/25 and has contributed to ~£485k savings over this period.
- Despite high demand contributing to tight margin conditions during the second half of the winter period, reserve spending was down compared to winter 2023/24.
- Voltage synchronisation costs have also seen significant reductions across winter 2024/25 compared to the previous year. This has been supported by NESO's Voltage Network Services (NS), delivering ~£22m savings across winter 2024/25, alongside the commissioning of Greenlink interconnector in January 2025 which is providing access to an additional reactive capacity, supporting lower voltage spend.
- The increase in balancing volumes was linked to an increase in thermal constraint volumes which were impacted by planned network outages in Scotland that are facilitating work to enhance the transfer capacity of key boundaries in this region. This work is expected to provide significant cost benefits over the long-term but is contributing to higher thermal constraint costs in the short-term.



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Balancing Costs Overview

Key messages:

- Monthly balancing costs across winter 2024/25 were 19% higher on average than winter 2023/24, driven by an increase in balancing volume over this period.
- Higher costs were linked to an increase in constraint costs year-on-year while non-constraint costs were lower.
- The month with the highest balancing costs was December, due to particularly high constraint volumes linked to high wind outturn and planned outages.

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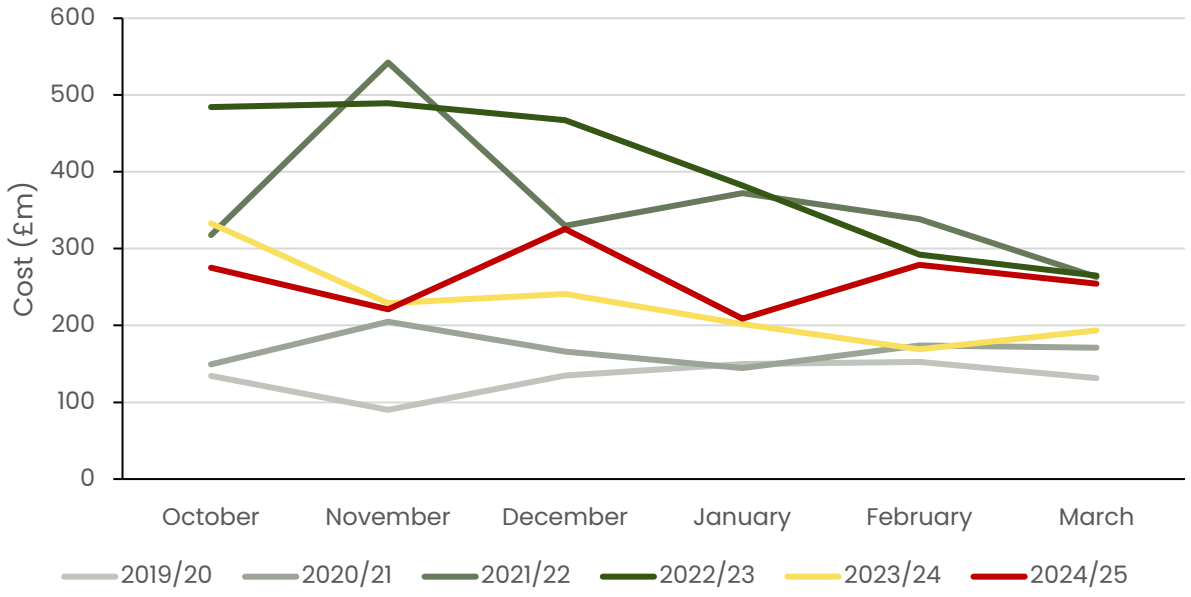
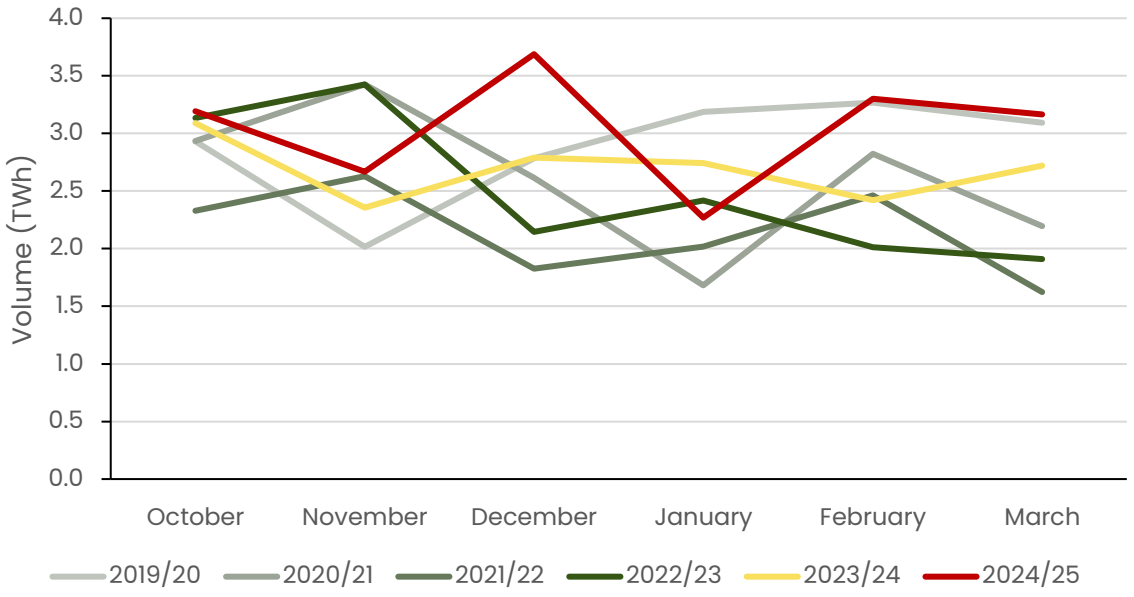
Balancing Cost Overview

Monthly Balancing Costs



Monthly Absolute Balancing Volumes



Overall, monthly balancing costs across winter 2024/25 were on average 19% higher compared with winter 2023/24. A similar trend is observed with the monthly absolute balancing volumes, which were on average 14% higher compared with the previous year. The increase in balancing volumes was linked to an increase in thermal constraints which were impacted by planned network outages in Scotland that are facilitating work to enhance the transfer capacity of key boundaries in this region.

December was the highest cost month of the winter period with a total cost of £326m. This was due to particularly high constraint volumes due to high wind outturn, particularly in northern and western Scotland, coinciding with planned outages in this region. January was the lowest cost and volume month. Although volumes fell year-on-year in January costs were slightly higher compared to last year due to high spend on reserve in this month to manage tight margins.

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Cost bracket comparisons

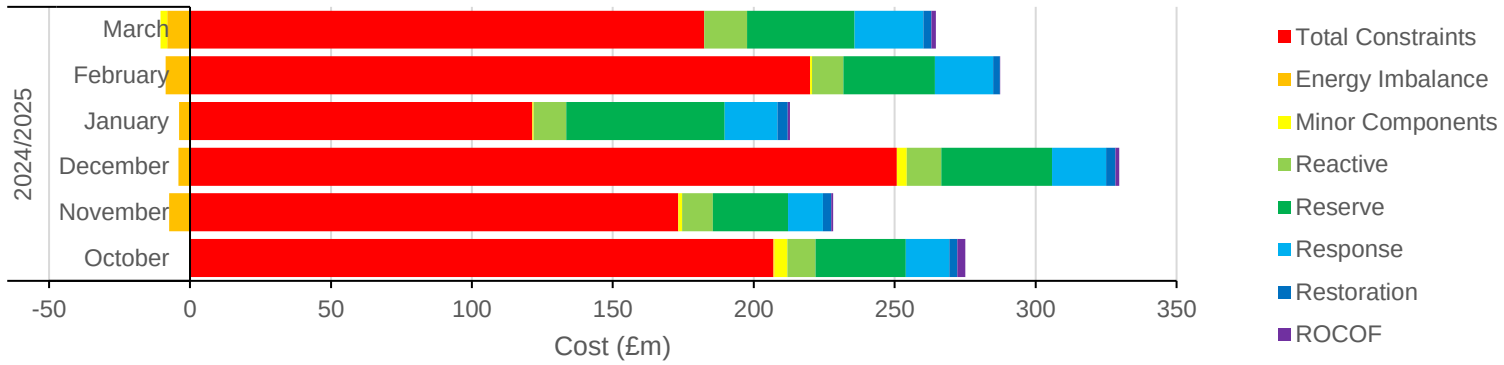
Constraint costs in winter 2024/25 have increased by 45% compared to winter last year, due to high wind outturn and network constraints in Scotland.

Non-constraint costs in winter 2024/25 have decreased by 28% compared to winter last year, with the continued development of balancing services helping to lower prices across many cost components.

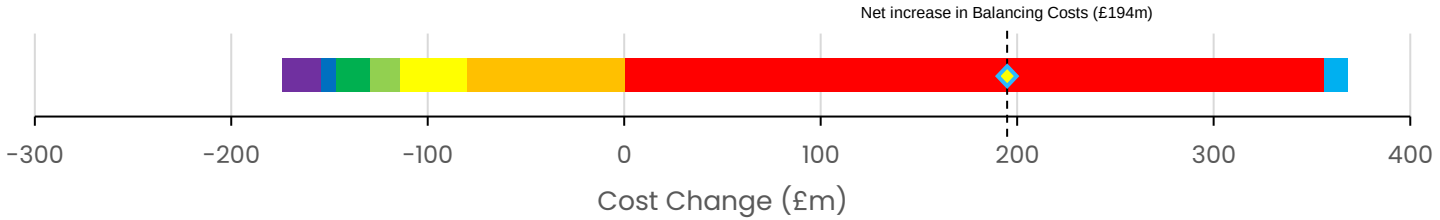
Key trends W23/24 to W24/25:

Constraint costs	Non-constraint costs
↑ 45%	↓ 28%

Actual Cost Breakdown - Winter 2024/25



Total cost change - Winter last year



Total balancing costs for the winter of 2024/25 decreased across most of the non-constraint categories. The Energy Imbalance and Minor Components categories saw decreases compared to the same month last year in every month over the winter period, leading to more sizable cost reductions.

However, while there was an increase in response costs compared to last winter, the major increase in balancing costs came from a substantial rise in constraint costs. This was largely down to high wind curtailment and managing thermal constraints in Scotland, due to planned outages to improve network capacity at key boundaries.

December had the highest total constraint costs of any month during the winter 2024/25 period. The main drivers behind this were high wind outturn in both England & Wales and Scotland due to windy weather and Storm Darragh, along with network constraints.

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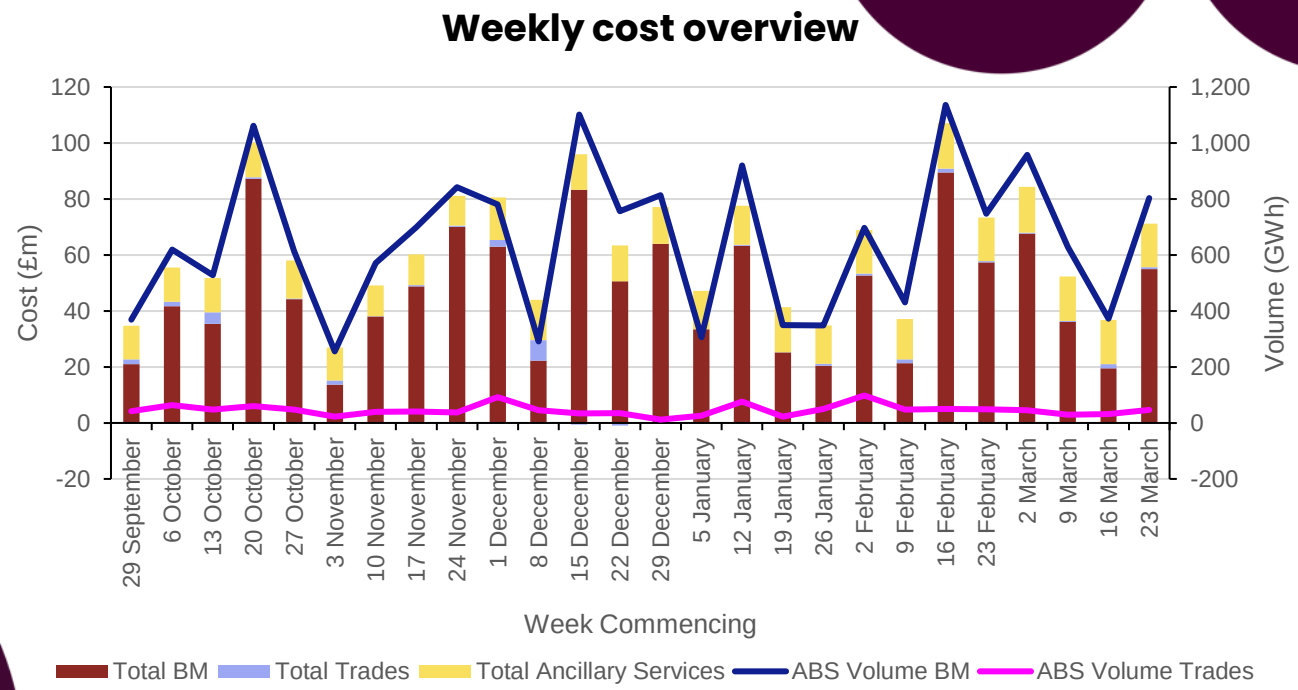
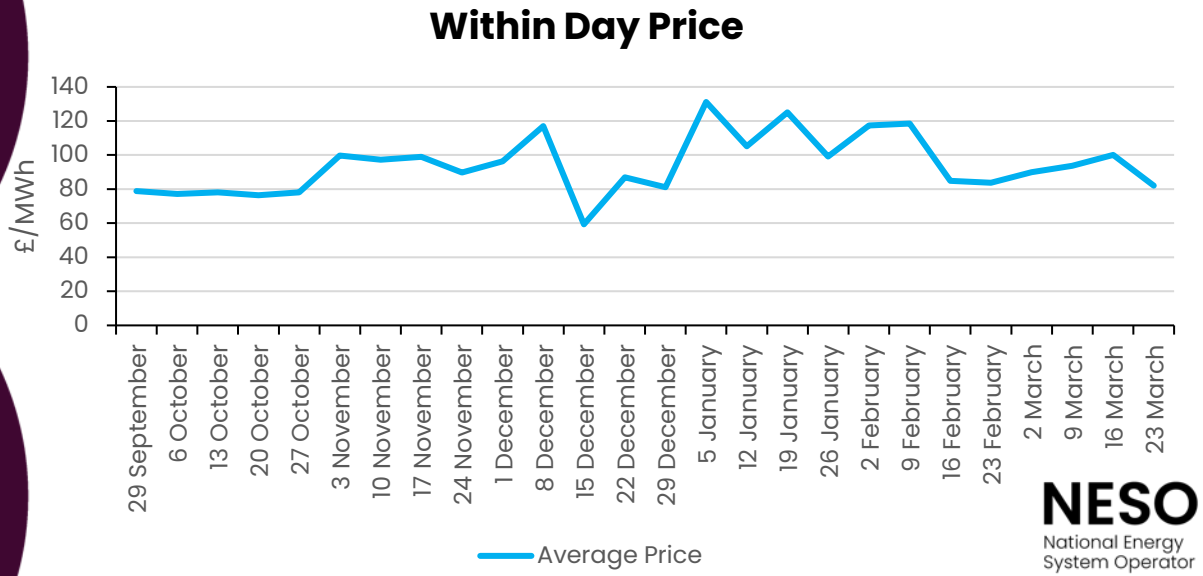
Weekly Balancing Costs

High cost weeks were seen across the winter period, with higher costs often linked to higher absolute volume of actions.

- The highest weekly balancing costs were observed on the w/c 16th February, which corresponds with the highest absolute volume of BM & Trades accepted.
- This was down to high wind outturn both in England & Wales and Scotland, leading to the largest weekly volume of wind curtailment over the winter period.
- Outside of this, high cost weeks were seen in October, November, December and March. These high cost weeks correlate to high volumes of wind curtailment, and in most cases a reduction in weekly average Within Day Price.

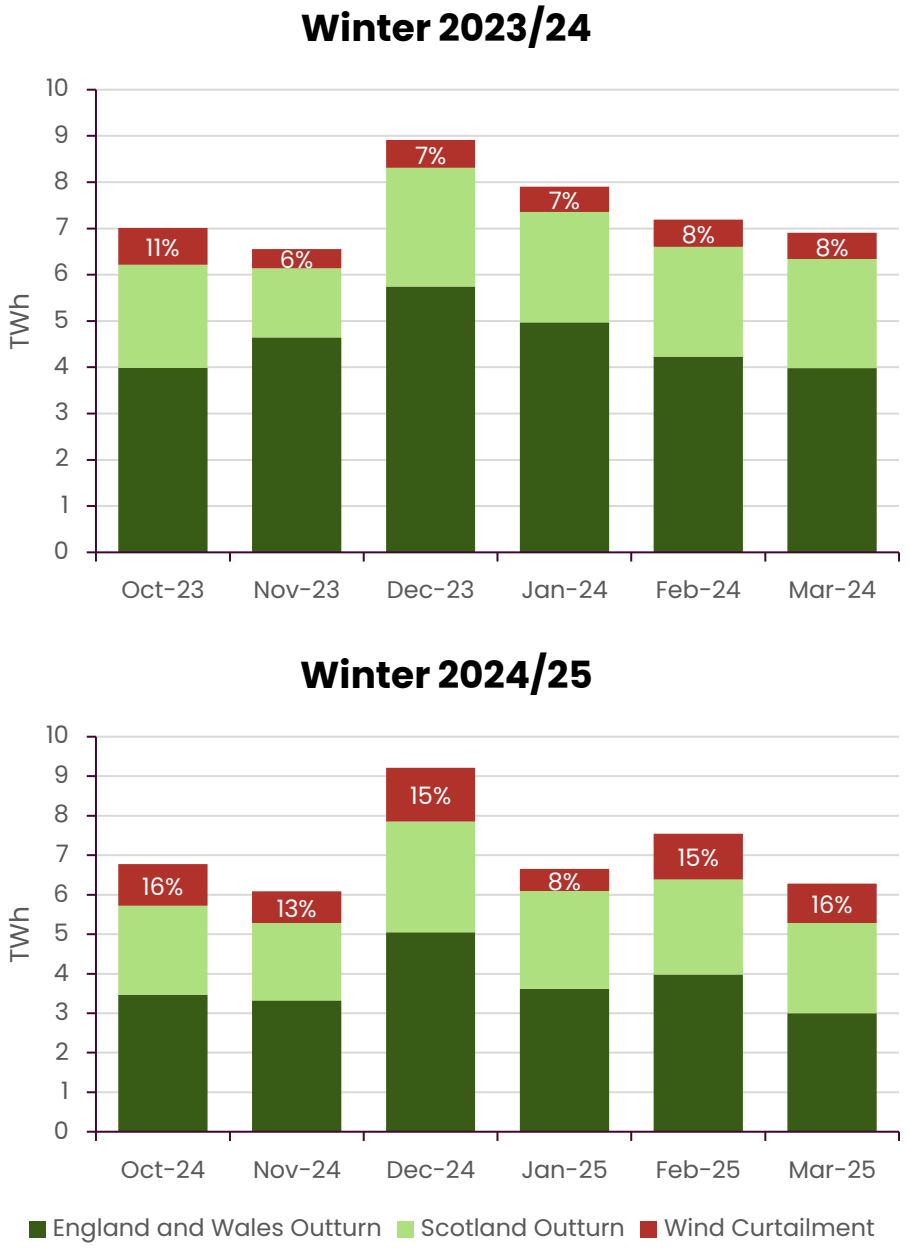


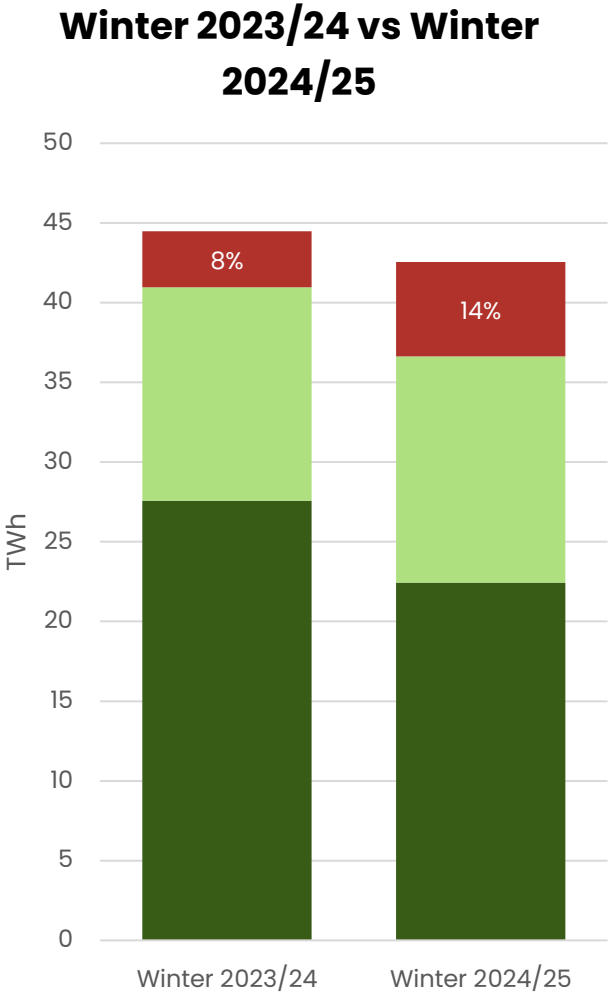


Wind outturn & curtailment

In winter 2024/25, wind curtailment volumes increased to 14% of hypothetical wind outturn (wind outturn if no curtailment had taken place). Wind curtailment volumes were exacerbated by increased congestion on the system driven in part by planned outages in Scotland which have reduced constraint limits across key boundaries, causing us to take a greater volume of bid actions on wind generators. These outages are facilitating work to enhance the transfer capacity of the network in this region which is expected to reduce wind curtailment over the long-term.

Operational wind outturn and wind curtailment volume – Winter 2023/24 vs Winter 2024/25





Note: Percentages represent % of hypothetical total wind outturn that was curtailed

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Market Dynamics

Key messages:

- Average demand in winter 2024/25 was ~3% higher than winter 2023/24.
- The average balancing mechanism offer acceptance price has increased compared to winter 2023/24.
- Across winter 2024/25 there was a reduction in wind generation and coal generation. This was broadly displaced by energy provided by gas.

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Transmission System Average Demand

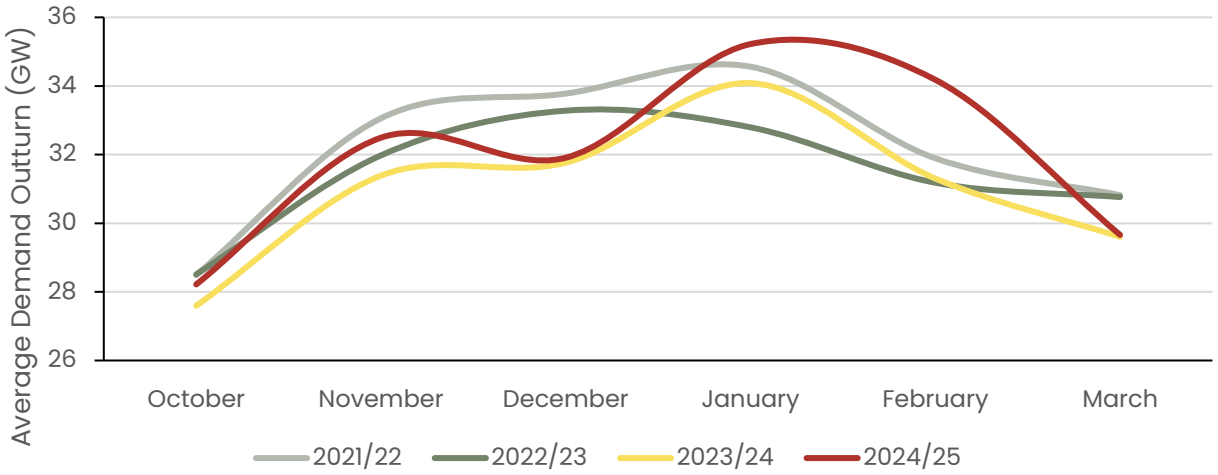
Average demand across winter 2024/25 was ~3% higher than winter 2023/24.

Average transmission system demand was higher in across all months in winter 2024/25 compared to winter 2023/24. Higher demand was particularly prominent across January and February which coincided with colder temperature conditions driving up demand for heating. The month with the highest electricity demand was January, which saw particularly low temperatures early in the month acting to push up demand and contribute to tight margins. We subsequently took actions to increase available generation on these days (further details on how we managed 8th January margins can be found here).

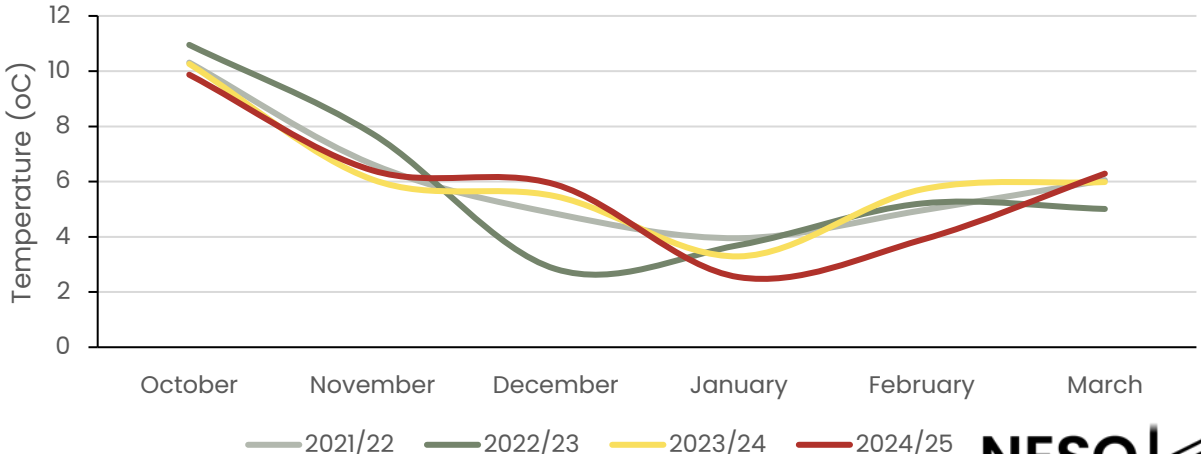
Key highlights for winter 2024/25:

- January was the month with the highest average electricity demand at 35.2GW.
- February saw the greatest year-on-year increase in demand, up 9.2%, coinciding with a 1.8°C decrease in average air temperature.
- Winter 2024/25 saw slightly colder weather conditions than last year with an average air temperature of 5.8°C, down 0.3°C compared to winter 2023/24.

Average Tranmission System Demand Out-turn



Average GB Air Temperature



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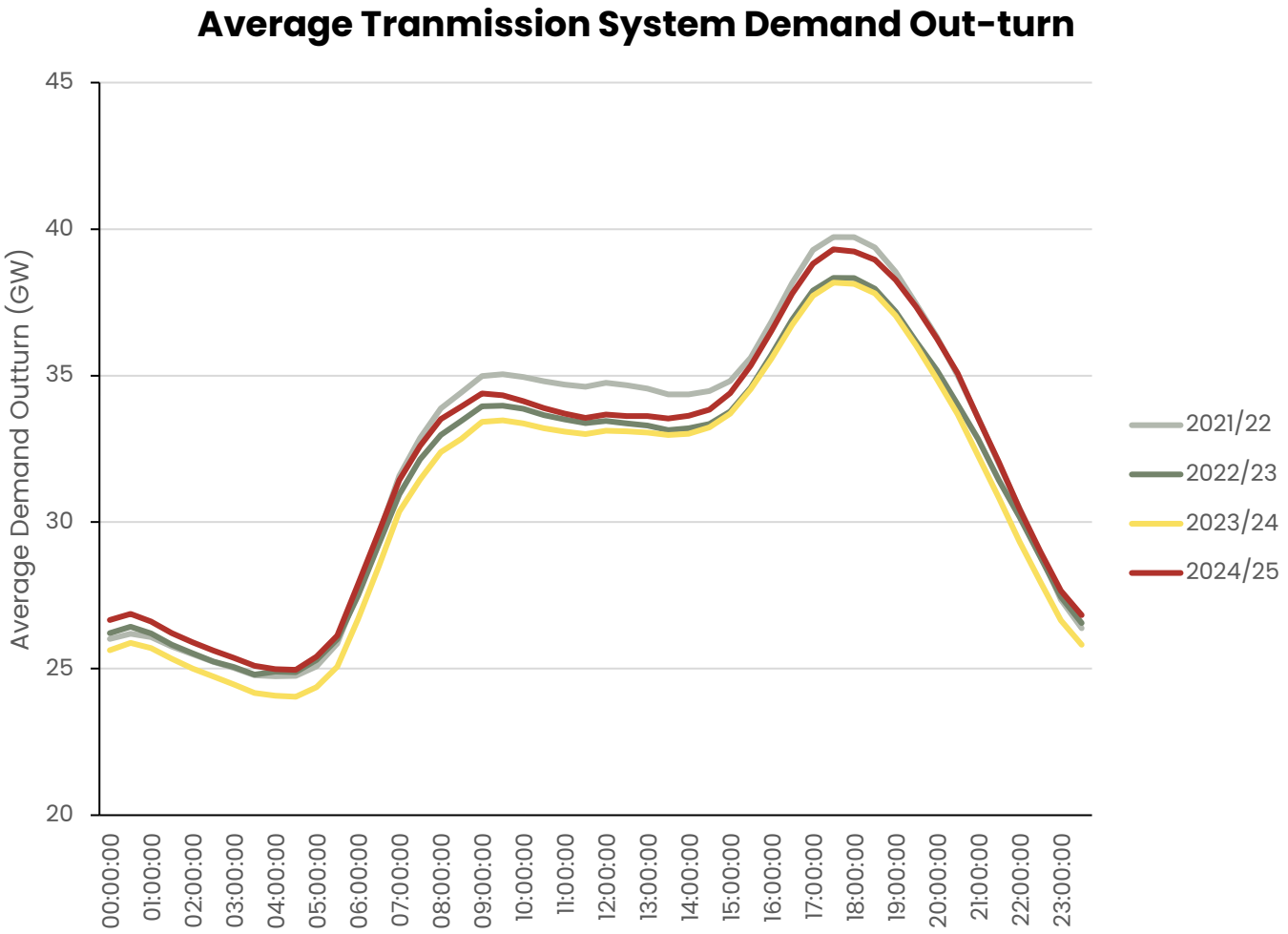
Transmission System Average Demand Hourly Profile

The hourly demand profile for winter 2024/25 shows an increase in demand across all periods of the day.

Average hourly demand across winter 2024/25 is higher across all settlement periods compared to last winter. Higher demand is particularly notable across the morning and evening peaks and overnight.

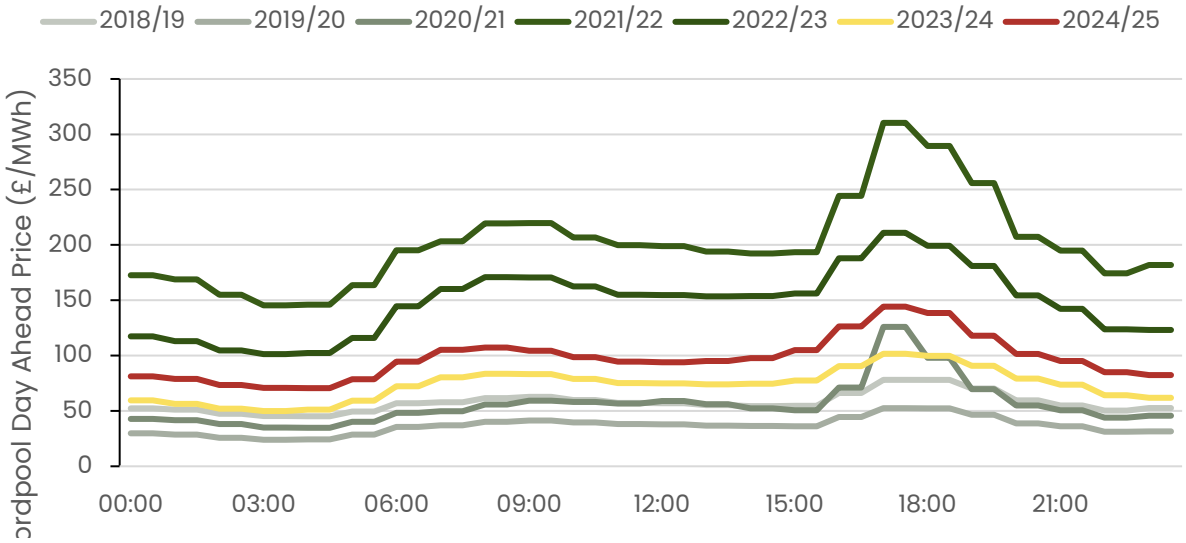
Key highlights for winter 2024/25:

- Demand up ~3% over evening and morning peaks and ~4% overnight.
- Historically high transmission system demand during the overnight period
- Similar profile of time of consumption to previous winters



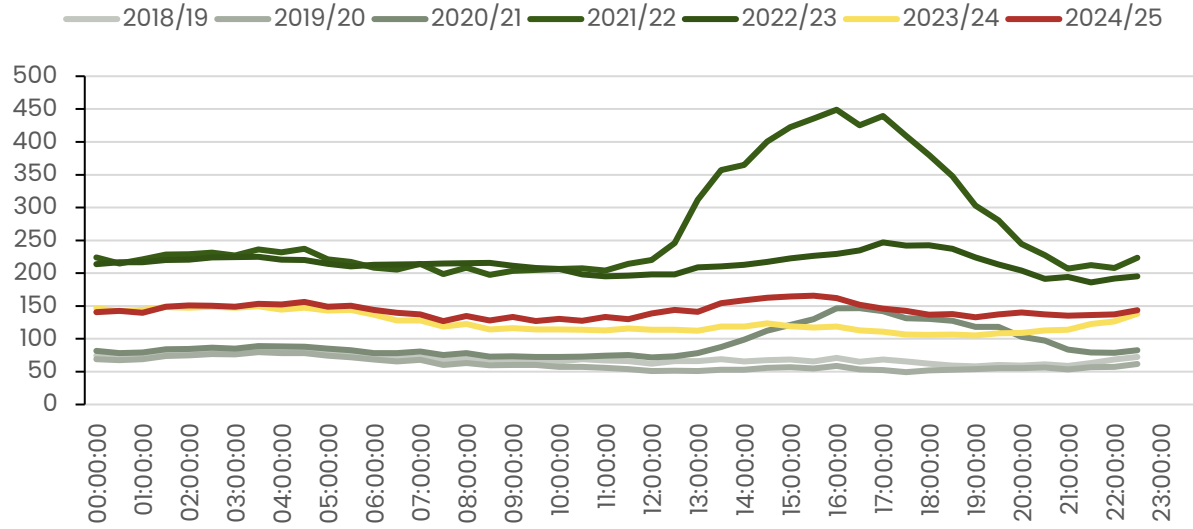
Day-Ahead Market and Balancing Mechanism Prices

Average Day Ahead Wholesale Market Price



- Year-on-year, Nordpool day-ahead market prices have increased by 33% but remain 52% lower compared to the global energy price spike in 2022
- The evening peak (4-7pm) and early morning (1-4am) saw the largest year-on-year increases in day-ahead prices, rising 4.0% and 4.1% respectively on average.
- Overall trends were similar to winter 2023/24 but with slightly amplified morning and evening peaks.

Volume Weighted Average Offer Price



- The average balancing mechanism offer acceptance price has increased compared to winter 2023/24.
- Higher market prices have supported this increase year-on-year.
- The largest increase in offer prices was observed across the afternoon and evening periods.

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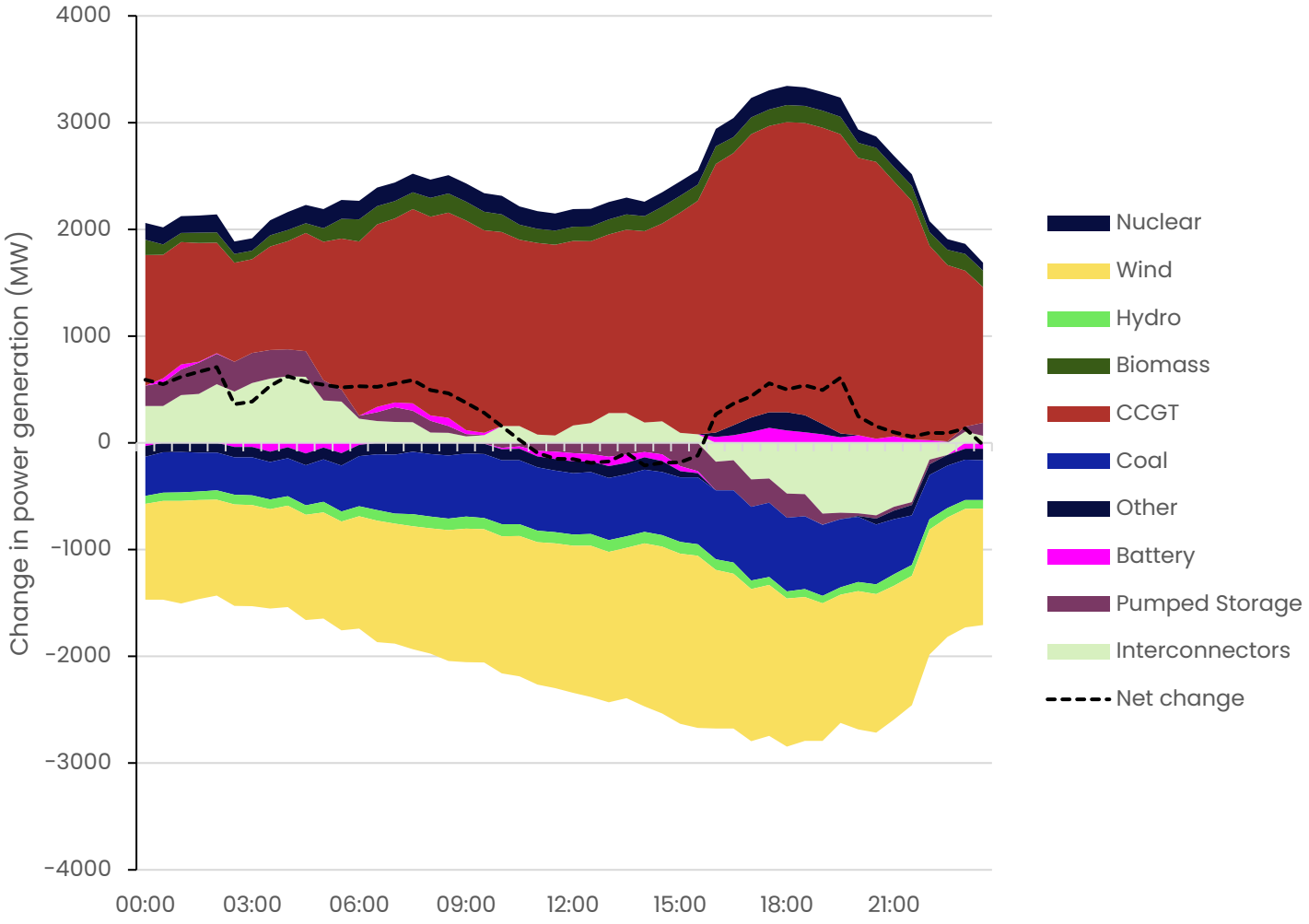
Power Generation Change by Fuel Type

Change in Power Delivered By Fuel Type (Winter 2023/24 vs Winter 2024/25)



Across winter 2024/25 there was a reduction in wind generation and coal generation. This was broadly displaced by energy provided by gas.

The reduction in wind generation was linked to lower year-on-year output, which was linked to both lower hypothetical output (wind outturn if no curtailment had taken place) and higher curtailment volumes over this period.

This year GB saw an end to 142 years of coal powered generation as Ratcliffe-on-Soar stopped generating on 30th September 2024. With no coal on the power system over the winter 2024/25 period, these volumes have consequently fallen year-on-year.

There was an increase in interconnector volumes during the overnight and morning periods but a decrease across the evening peak. Greenlink interconnector became operational January 2025, contributing to increased interconnector flow over the second half of the winter period.

Storage saw an overall increase in utilisation over the morning and evening peaks, however given their requirement to cycle this increased utilisation also shows an increase in periods charging during off peak hours.

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Balancing Actions

Key messages:

- The total cost of bids has decreased in winter 2024/25, despite an increase in bid volumes, due to a reduction in bid prices. While the total cost of offers has increased in winter 2024/25 in line with an increase in volume and wholesale prices.
- Total constraint costs across winter 2024/25 were 41% higher compared to winter 2023/24. This was due to a significant increase in constraint volumes, up 40% between the two periods. The main driver of this increase in volumes was thermal constraints which were impacted by planned network outages in Scotland that are facilitating work to enhance the transfer capacity of key boundaries in this region.
- Clearing prices for our Dynamic Services increased across the second half of the winter 2024/25 period are linked to a rise in wholesale prices and demand for frequency response.

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Bid costs and volumes

The total cost of bids has decreased in winter 2024/25, despite an increase in bid volumes, due to a reduction in bid prices.

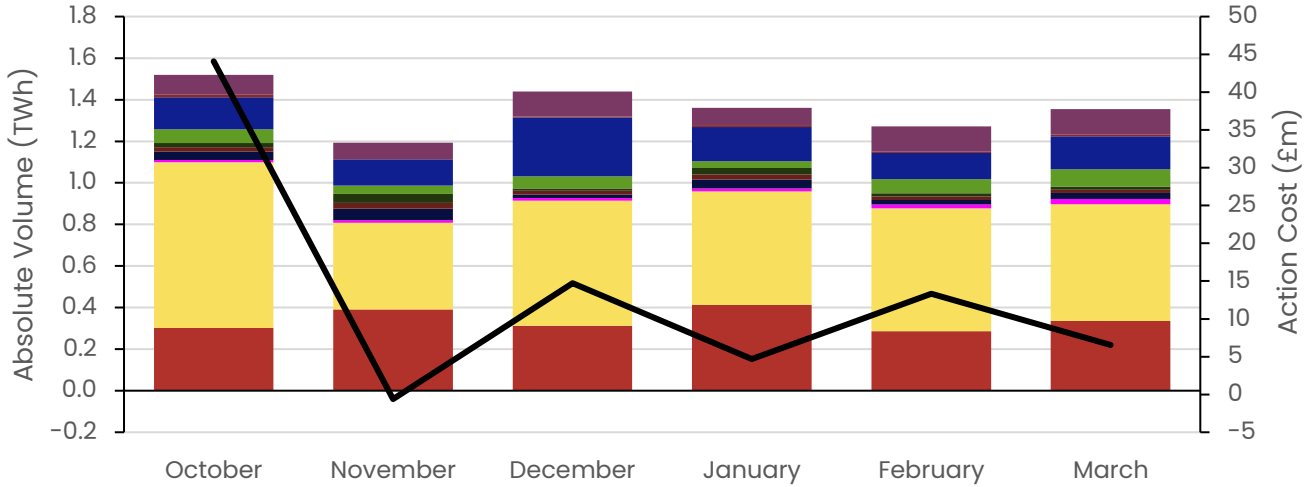
The total cost of bids across winter 2024/25 was £38.7m. This is a decrease of 53% compared to winter 2023/24. Total bid volume was 9.4TWh, an increase of 16% compared to the previous winter.

There was an increase in the total volume of bids accepted for wind between the two periods, up 69% year-on-year. This was due to network outages in Scotland, which reduced constraint limits across key boundaries and contributed to higher volumes of wind bids across the winter period. However, the volume weighted average price for wind fell by 46% year-on-year. The total cost of bids accepted for wind subsequently fell by 9% compared to the previous winter, totalling £202.1m. Lower bid prices from other fuel types also contributed to a decrease in the total bid costs across winter 2024/25. Although total bid costs fell, higher bid volumes have contributed to an increase in offer actions/costs for replacement energy – see next page.

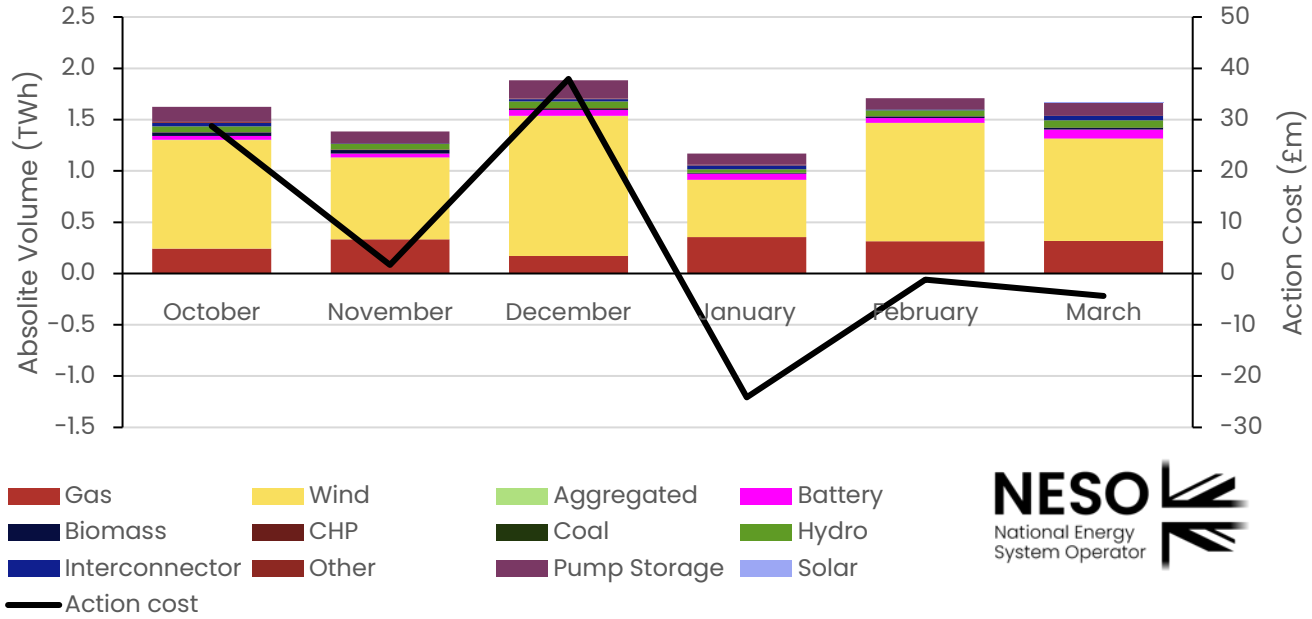
Key highlights for winter 2024/25:

- Hypothetical wind outturn decreased 4.3% between winter 2024/25, with reduced constraint limits being the main driver of higher curtailment volumes.
- The volume of bids accepted for battery units increased by 166% year-on-year (totalling 320GWh in winter 2024/25). The launch of the Open Balancing Platform In December 2023 is supporting greater utilisation of battery units in the BM.

Bid cost and volume - Winter 2023/24



Bid cost and volume - Winter 2024/25



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Offer costs and volumes

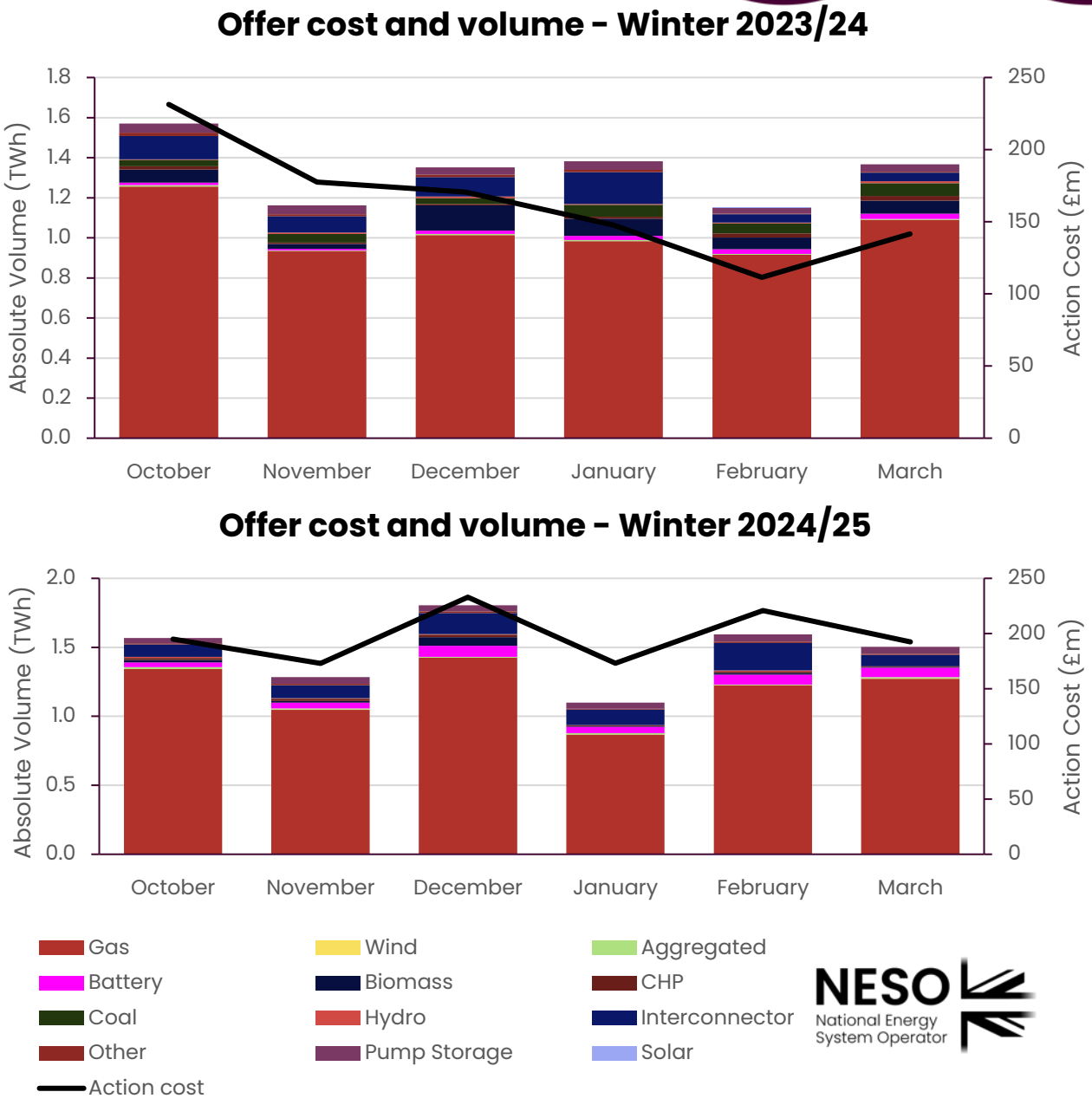
The total cost of offers has increased in winter 2024/25 in line with an increase in volume and wholesale prices.

The total cost of offers accepted across winter 2024/25 was £1.2bn. This is an increase of 21% compared to winter 2023/24. This increase follows an 11% rise in the volume of offers accepted. A 33% increase in wholesale prices between the two periods also contributed to higher offer prices.

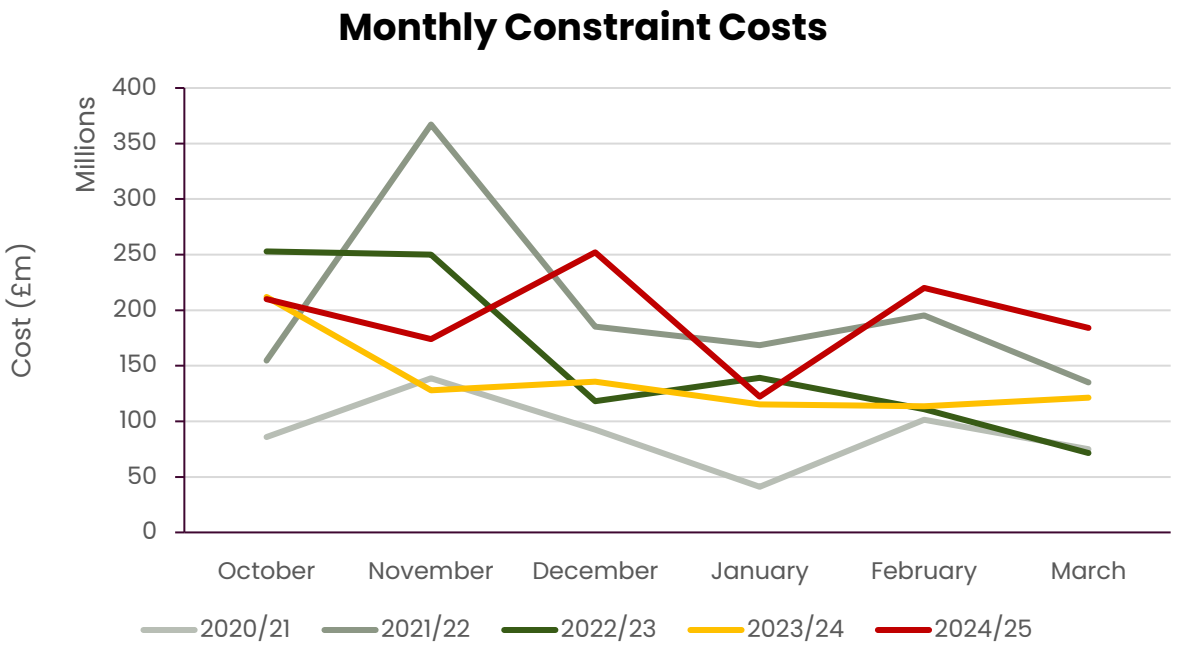
The generation mix of offers is similar across both winter periods with gas offers continuing to dominate. However, the volume of battery offers has increased by 147% year-on-year, following the launch of OBP which is supporting greater utilisation of batteries in the BM.

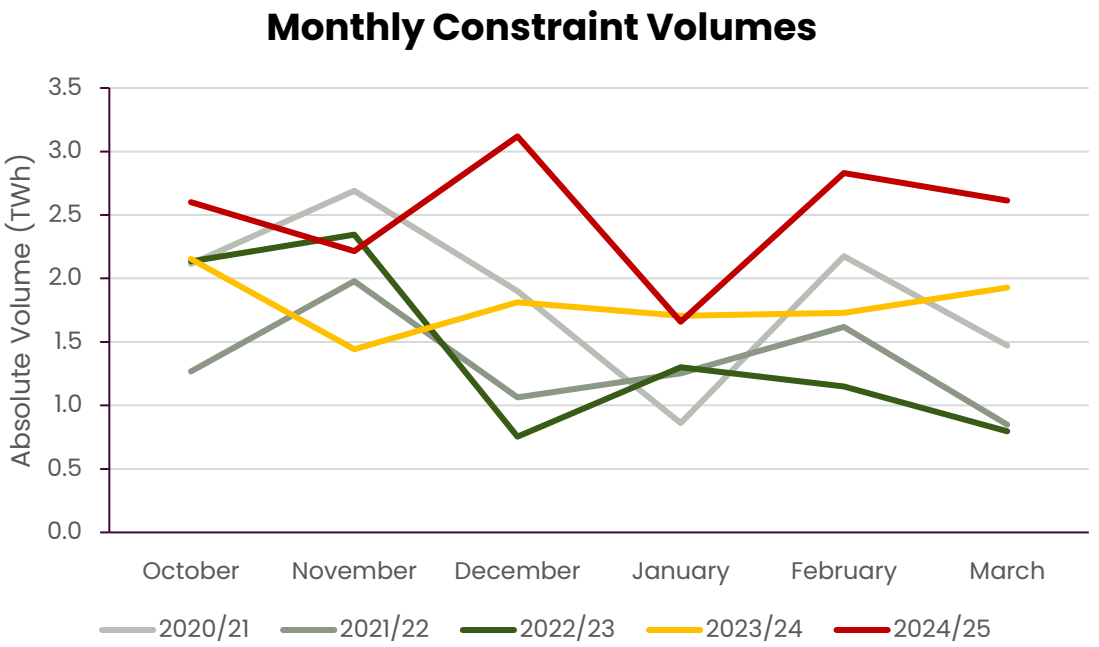
Key highlights for winter 2024/25:

- December was the highest month for offer costs and volumes totalling £233m and 1.8TWh respectively.
- Similar to previous years, gas dominated offer costs and volumes at £959m and 7.2TWh respectively across the winter period.
- Offer costs and volumes for battery units increased significantly compared to winter 2023/24, with a total offer cost of £4.3m and volume of 344GWh.



Constraint Costs





Total constraint costs across winter 2024/25 were 41% higher compared to winter 2023/24. This was due to a significant increase in constraint volumes, up 40% between the two periods. The main driver of this increase in volumes was thermal constraints which were impacted by planned network outages in Scotland that are facilitating work to enhance the transfer capacity of key boundaries in this region. This work is expected to provide significant cost benefits over the long-term but is contributing to higher thermal constraint costs in the short-term.

The highest constraint costs and volumes were observed in December which saw high wind outturn, particularly in northern and western Scotland which impacted constraint costs across the Scottish boundaries. In contrast, January saw the lowest constraint costs and volumes. This month was characterised by a reduction in network outages which alleviated Scottish constraint in comparison to other months across the winter period.

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Constraint Cost Breakdown

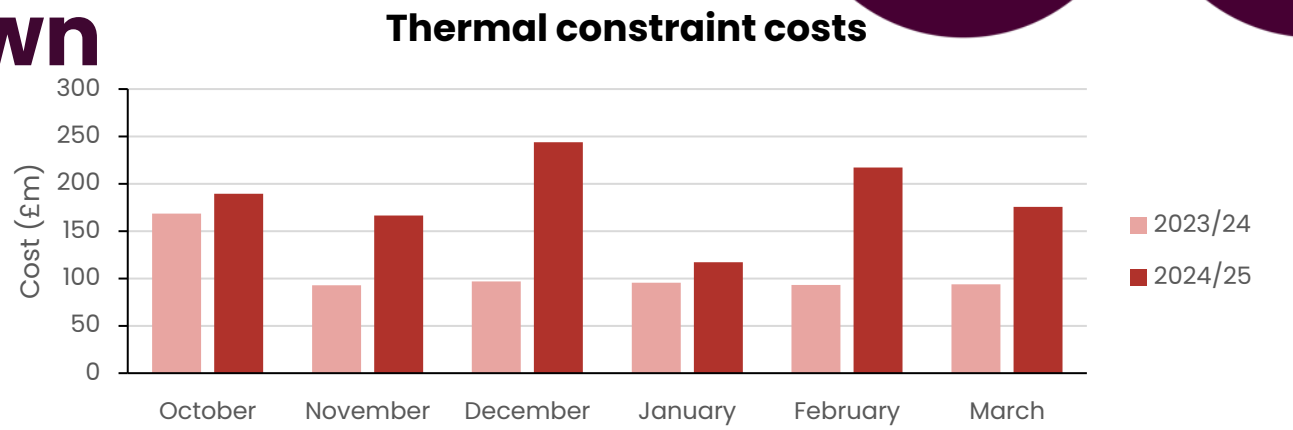
Cost trends W23/24 to W24/25:

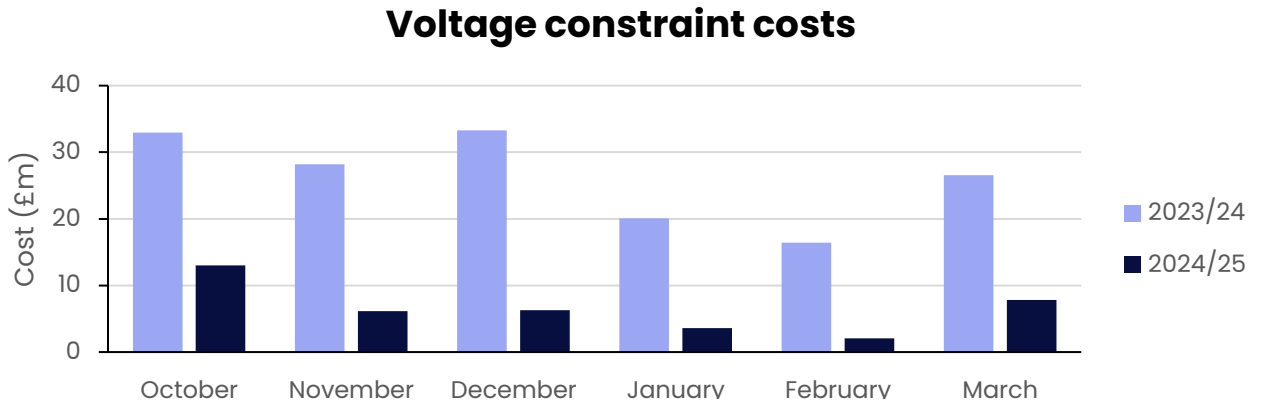
Thermal	Voltage	Stability
↑ 73%	↓ 75%	↓ 68%

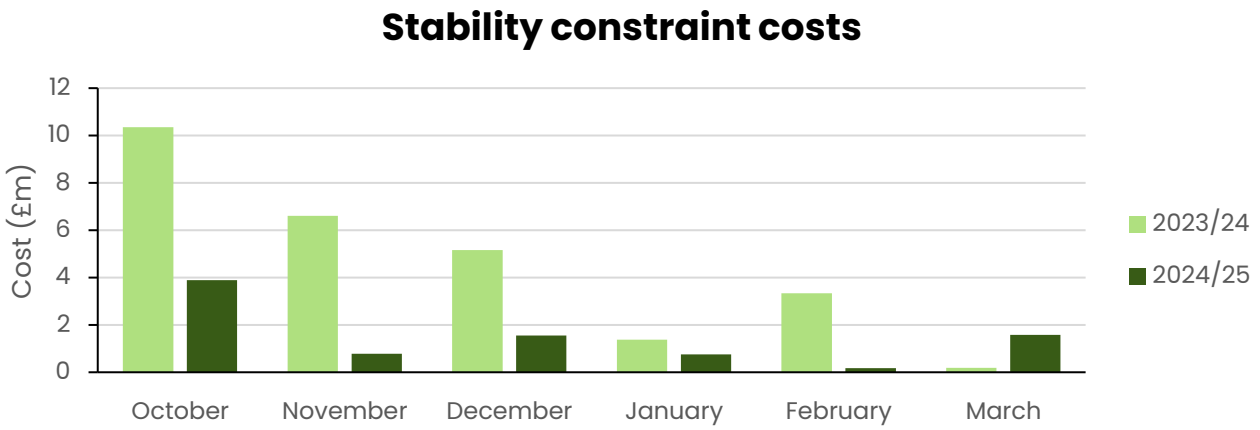
Thermal constraints were higher across all months of the winter 2024/25 period compared to winter 2023/24. This is due to planned outages on the Scottish boundaries to facilitate multi-stage reinforcement works.

Voltage synchronisation costs across winter 2024/25 have reduced significantly compared to the previous year. Lower costs have been supported by reduced volumes for voltage control. Additionally, NESO's Voltage Network Services (NS) alongside the commissioning of Greenlink interconnector in January 2025 are providing access to an additional reactive capacity, which is supporting lower voltage costs.

Stability constraint costs also saw a significant reduction compared to the winter 2023/24 period. Stability costs are benefiting from reductions to our inertia requirements in 2024. Phase 1 and 2 of our Stability Network Procurement Service have also been supporting lower costs for stability constraints across 2024/25.







Ancillary Service Prices

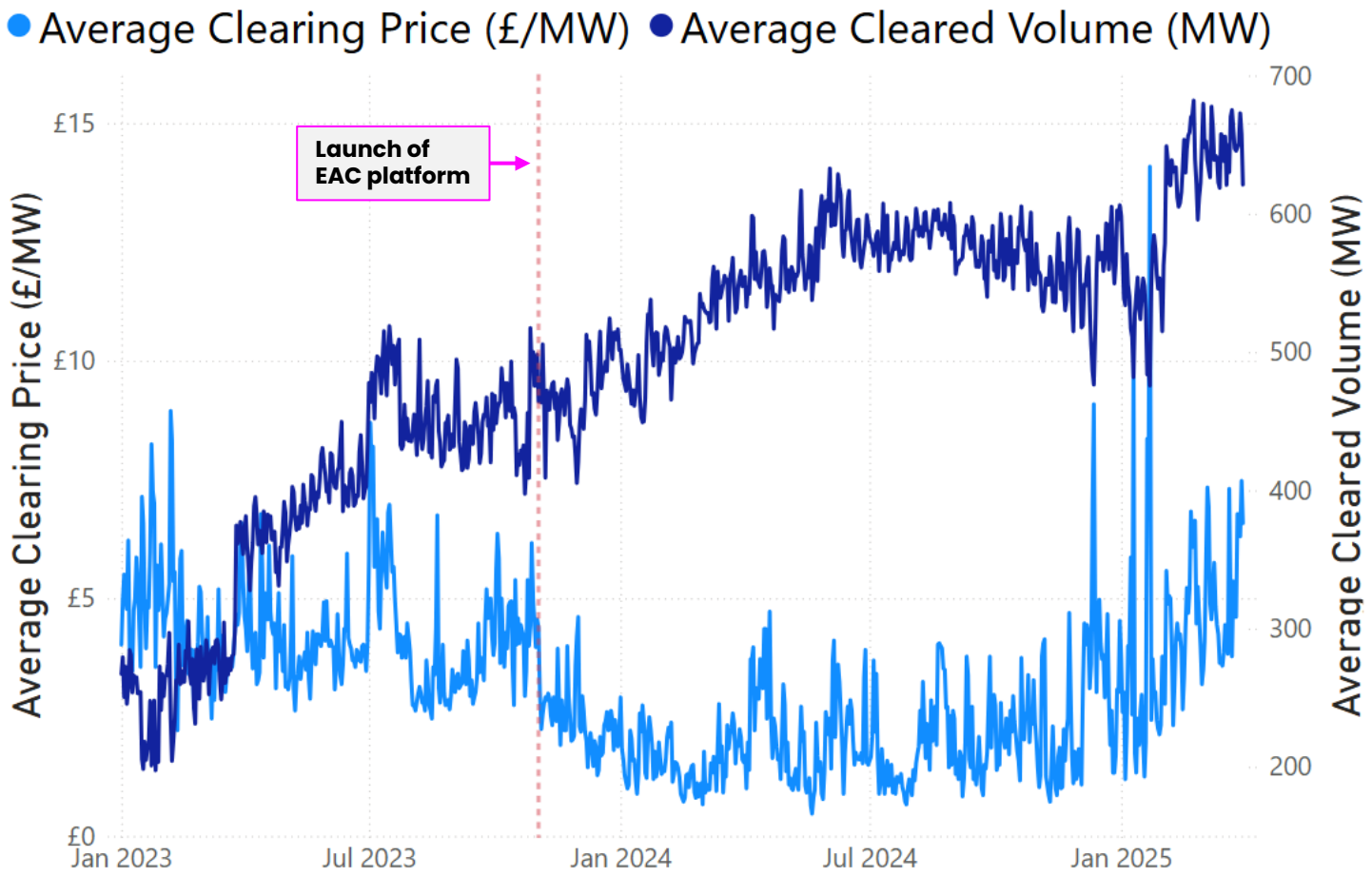
Our Dynamic Services for response, Dynamic Containment (DC), Dynamic Moderation (DM) and Dynamic Regulation (DR) have seen significant benefits since the launch of the Enduring Auction Capability (EAC) platforming November 2023 which offered enhanced functionality such as splitting, co-optimisation and negative pricing leading to greater efficiency and reduced prices.

Although clearing prices have reduced since this implementation, higher prices across the second half of the winter 2024/25 period are linked to a rise in wholesale prices and demand for frequency response.

Key trends W23/24 to W24/25:

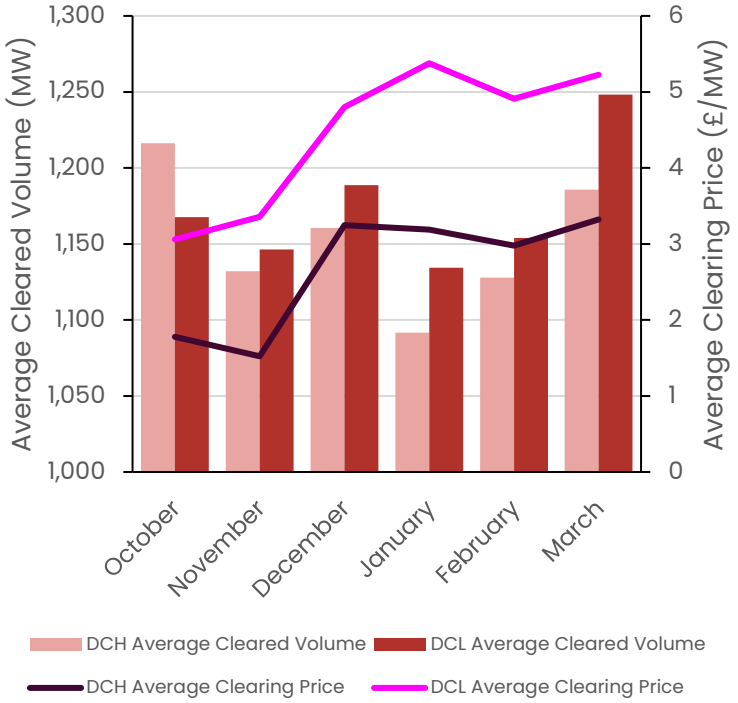
Clearing Prices	Volume
↑ 19%	↑ 46%

Average clearing price and average cleared volume for Dynamic Services (January 2023 – March 2025)

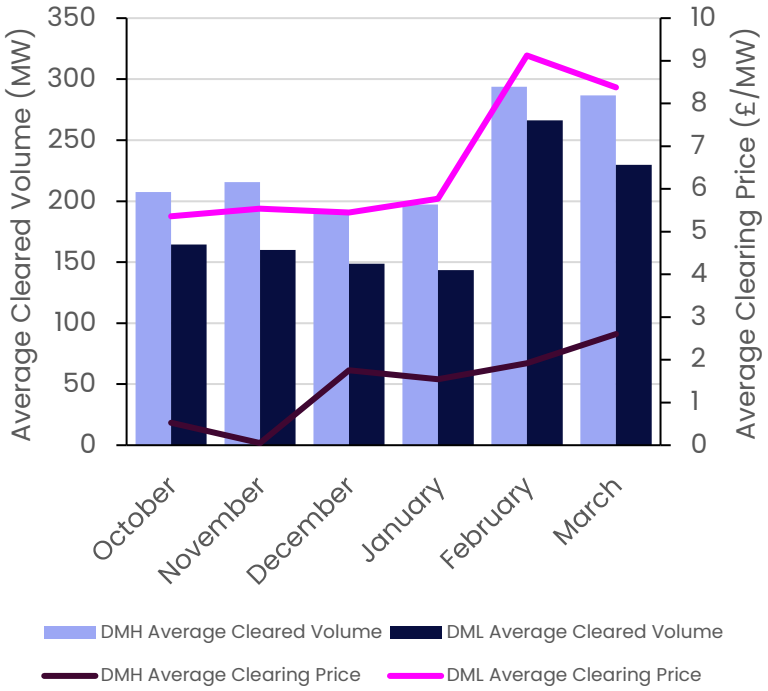


Ancillary Service Prices

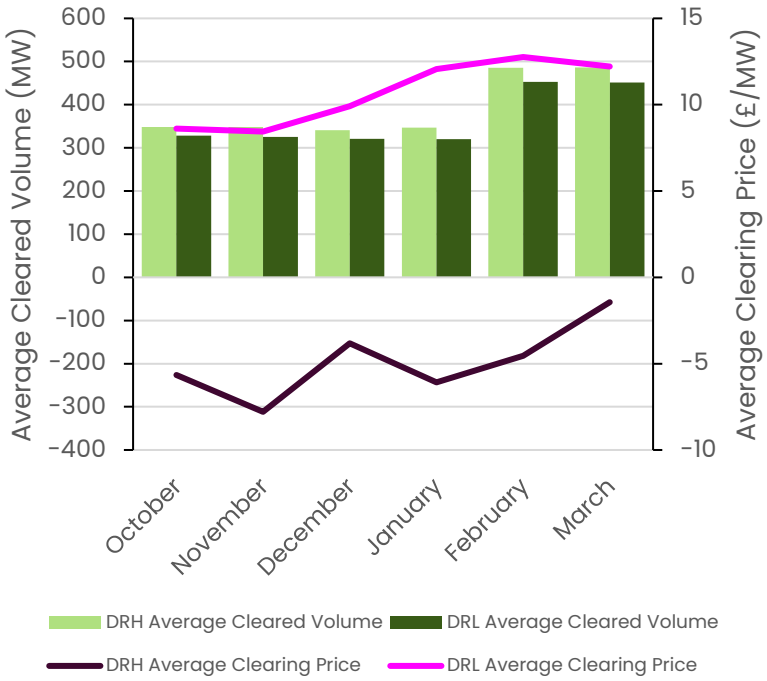
Dynamic Containment



Dynamic Moderation



Dynamic Regulation



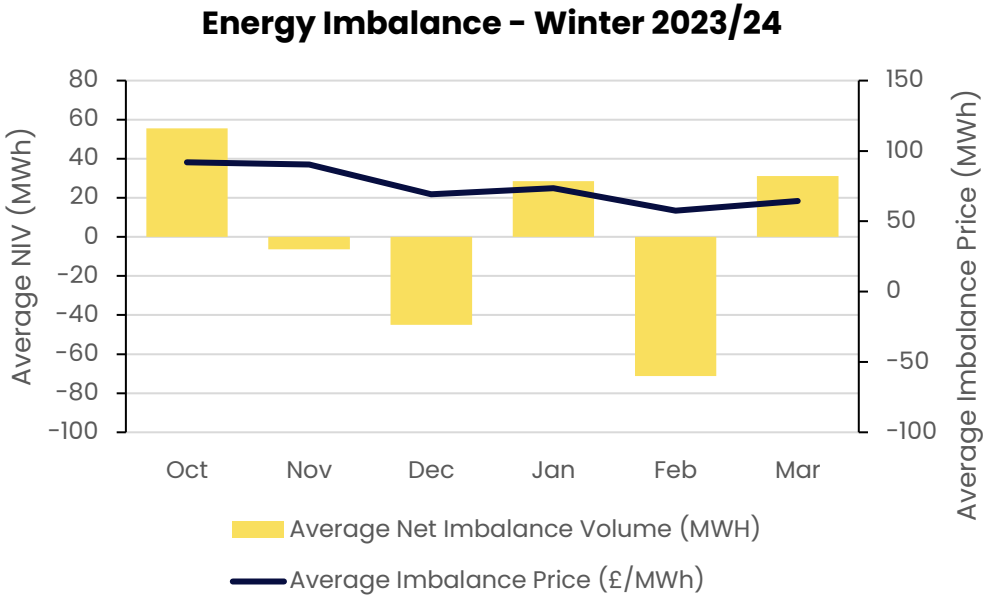
Average clearing prices for Dynamic Services increased in winter 2024/25 compared to winter 2023/24. Frequency response prices are linked to wholesale prices and spreads and consequently rose in line with these. An increase in system requirements between the two winter periods also increased the need for Dynamic Services which acted to push prices up compared to last year.

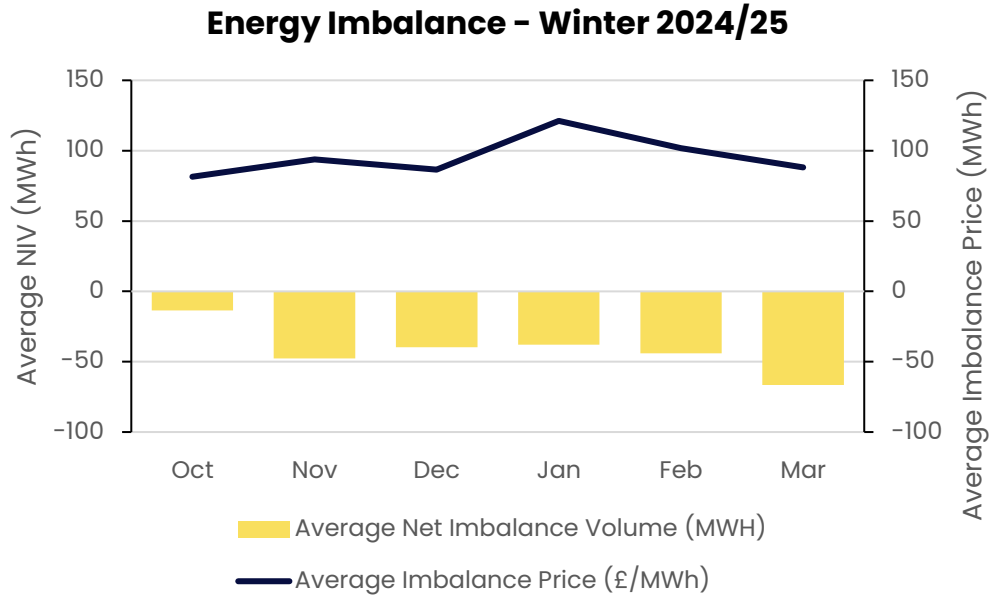
Imbalance Price

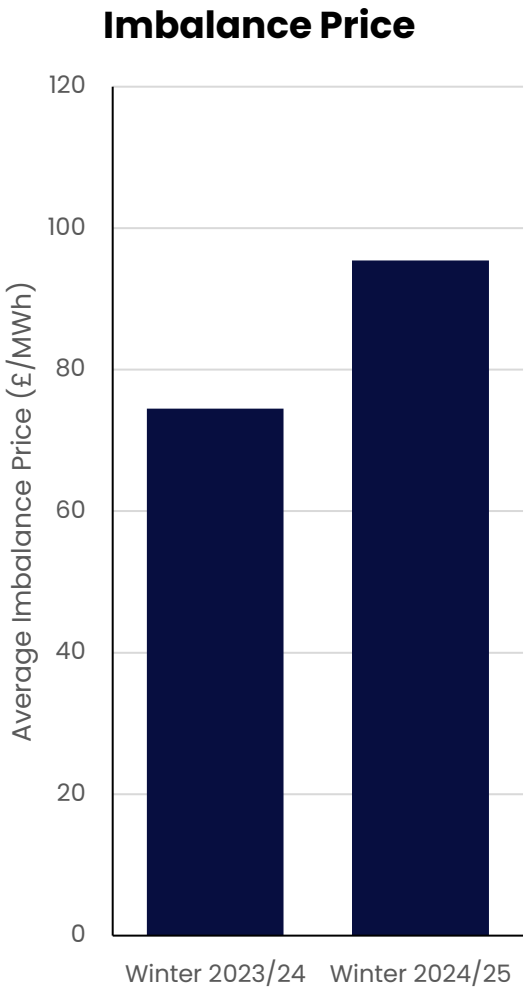
The average imbalance price has risen in winter 2023/24 (£95/MWh), compared to winter 2023/24 (£74/MWh).

The market was mainly long throughout the winter except for morning and evening peaks.

The monthly average Net Imbalance Volume (NIV) was lowest in March, and both the lowest and highest daily average NIV occurred during the month, on 29 March at -1.9GWh and 6 March at 1.4GWh, respectively.







Market Developments

Key messages:

- DFS was transitioned from an enhanced action service to an in-merit based margin tool from 27 November 2024.
- The Greenlink Interconnector became fully operational on 30 January 2025. In addition to providing access to additional energy imports/exports, Greenlink is supporting voltage management.
- The first auction for Quick Reserve took place on 3 December 2024.

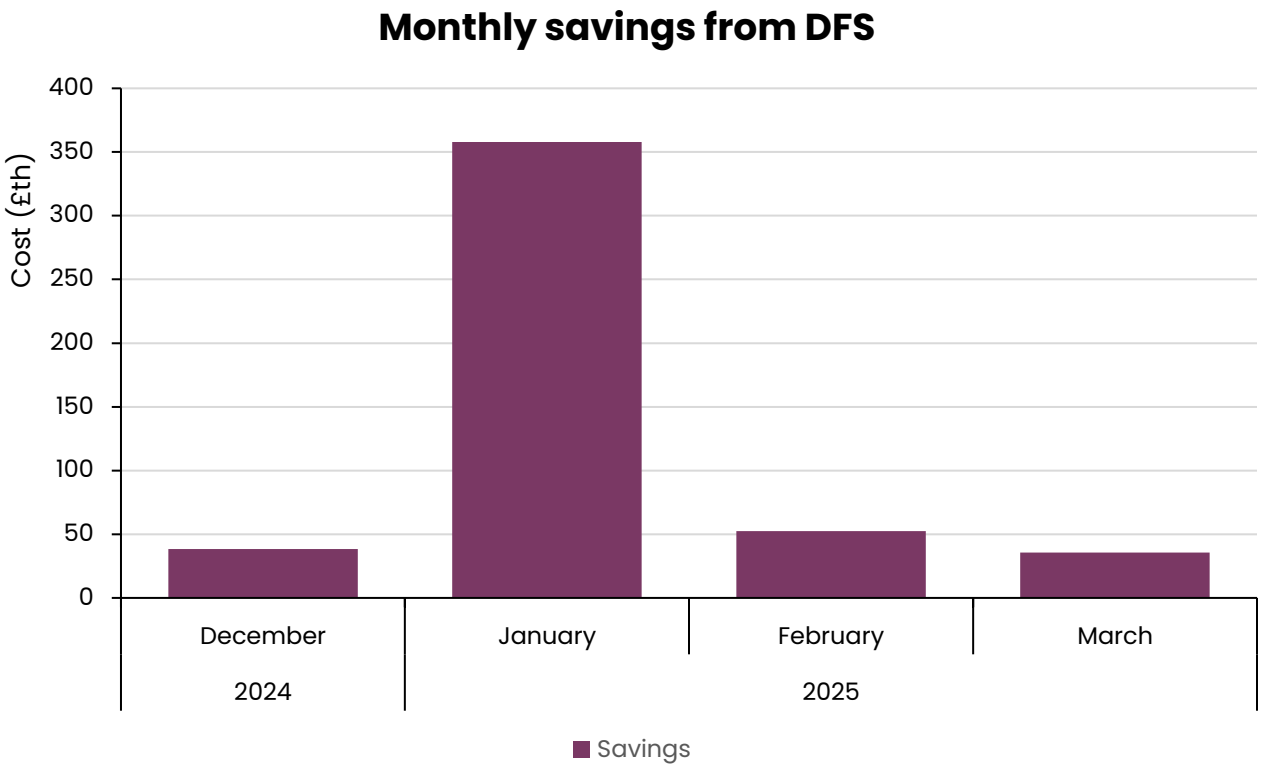
Demand Flexibility Service (DFS)

The Demand Flexibility Service (DFS) helps households and businesses participate in the electricity market by providing incentives, through suppliers and aggregators, for reducing or shifting demand.

DFS was introduced during the winter of 2022/2023 as part of the winter contingency toolkit. In 2024, DFS was transitioned from an enhanced action service to an in-merit based margin tool and the service went live on 27 November 2024.

Since initial trials, the cost of accessing volume through DFS has reduced significantly and often provides a cheaper alternative to equivalent actions in the BM. DFS has been utilised consistently over winter 2024/25 and has contributed to ~£485k savings over this period.

The day where DFS provided the greatest savings was the 8th January, where due to tight margins DFS was able to provide a saving of £285k.



Greenlink Interconnector

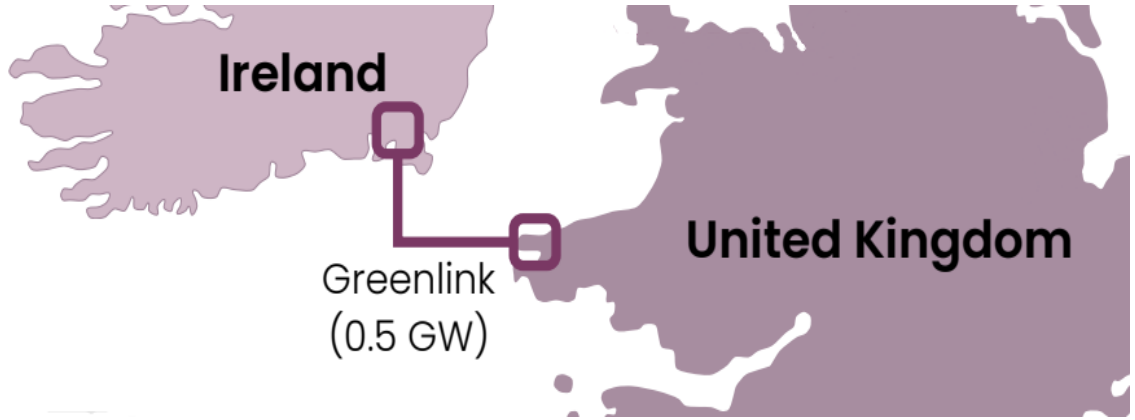
The Greenlink Interconnector became fully operational on 30 January 2025. Greenlink is the third interconnector between Ireland and GB, connecting substations in County Wexford, Ireland and Pembrokeshire, Wales via a subsea cable. In addition to providing access to additional energy imports/exports, Greenlink is supporting voltage management.

Voltage spending is highly locational by nature. Roughly 62% of the 2024 system spending is allocated to the South-West (South-West England and South Wales). This has been characterised by high spending towards a limited set of thermal power stations (CCGTs) that are required to be instructed (synchronised) on a regular basis during overnight periods to maintain voltage under SQSS limits.

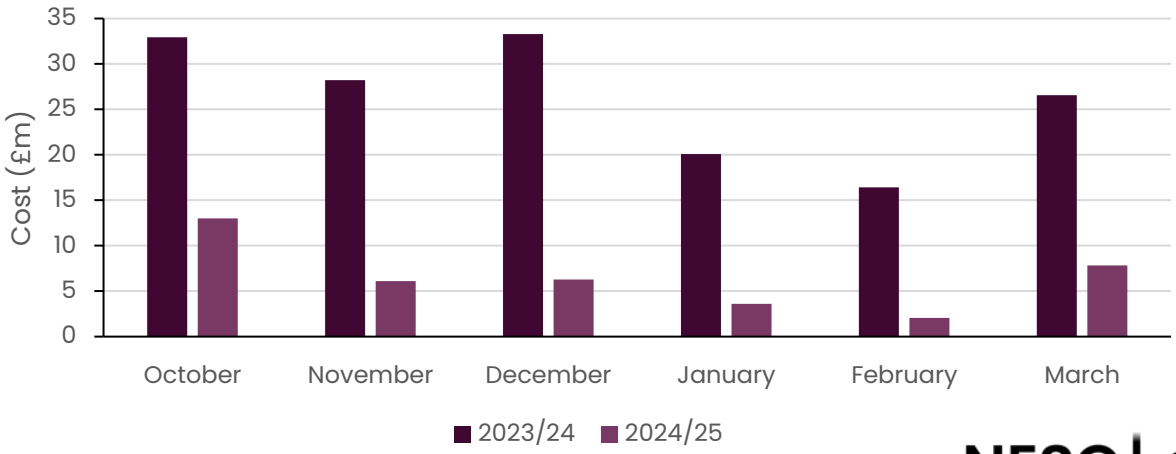
Since becoming operational Greenlink has allowed access to additional reactive capacity in South Wales and South-West England, allowing NESO to reduce its dependence on CCGTs instructed for voltage, which represent considerable savings in balancing costs compared to the previous year.

NESO's Voltage Network Services (NS) are also helping to reduce voltage synchronisation costs and have delivered ~£22m savings over the Winter 2024/25 period.

Greenlink Interconnector



Voltage Synchronisation Costs (Winter 2023/24 vs 2024/25)



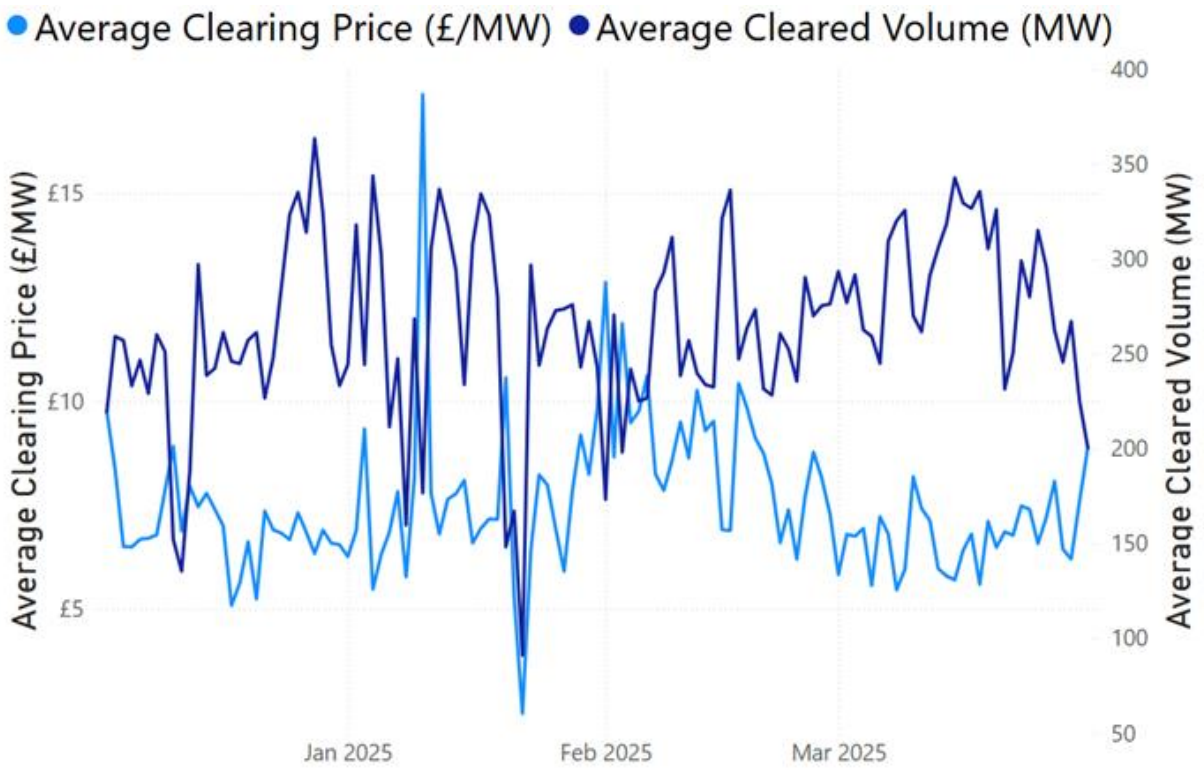
Quick Reserve

Clearing prices for Quick Reserve average ~£7.5/MWh across the first 4-months of the service, while average cleared volume was ~264MW

Quick Reserve (QR) is a new reserve service, procured at the day-ahead stage through an auction in the afternoon. The service is aimed primarily for reacting to pre-fault disturbances to restore the energy imbalance quickly and return the frequency close to 50.0 Hz. The first auction took place on 3 December 2024.

We are now developing the proposed service and procurement design for the enduring (Phase 2) Quick Reserve service, incorporating both BM (Balancing Mechanism) and non-BM (non-Balancing Mechanism) market participants, with the service design currently undergoing consultation.

Average clearing price and average cleared volume for Quick Reserve (December 2024 – March 2025)



Case Studies

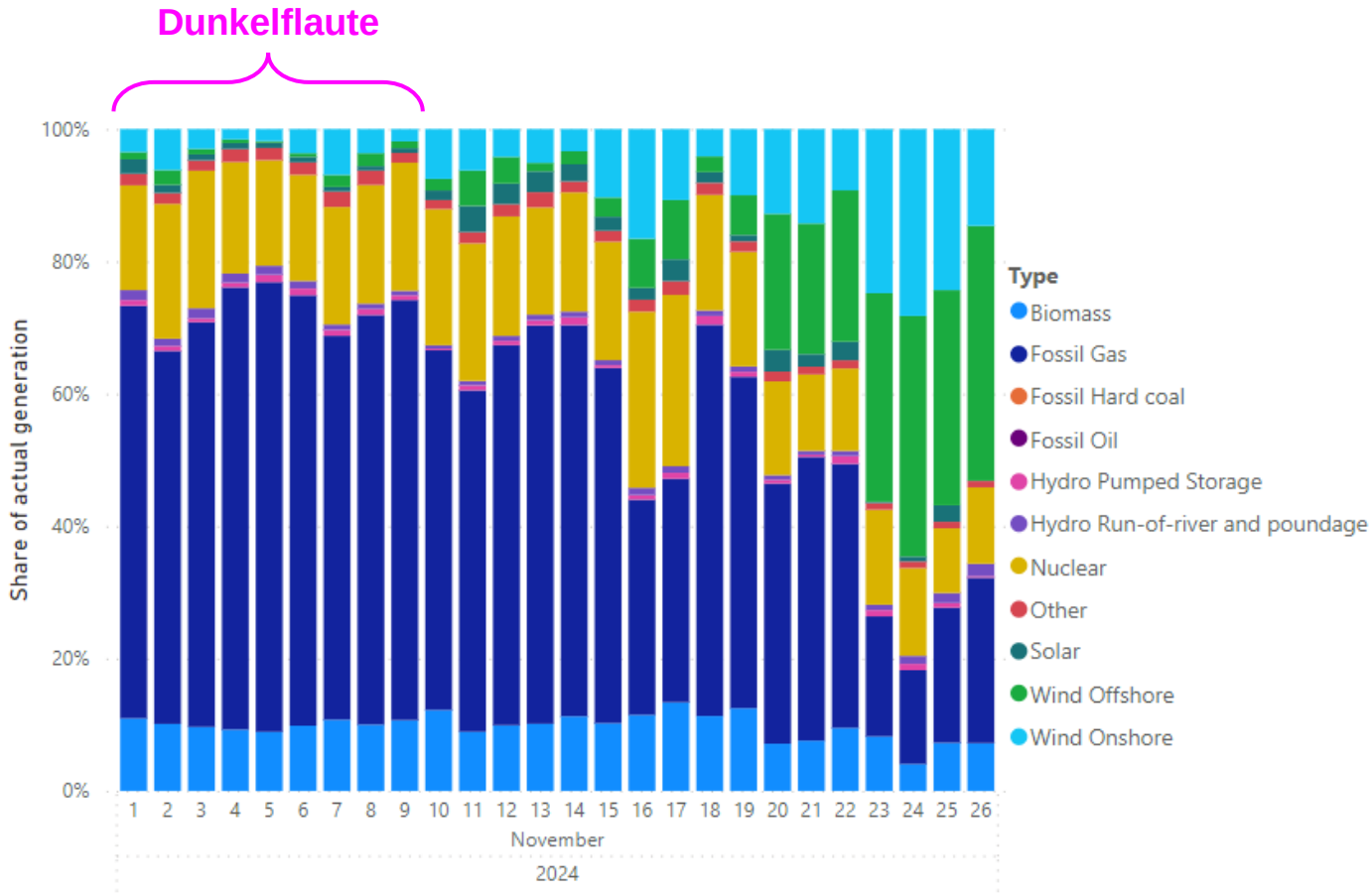
Key messages:

- There was particularly low wind and solar generation between 1st and 9th of November 2024, known as a Dunkelflaute period.
- We find that Dunkelflaute periods generally exhibit a minimal balancing cost impact on the system.
- However, there are instances where the costs during Dunkelfalute periods have escalated significantly, often when these conditions coincide with tight margin periods.

Dunkelflaute

Periods of minimal wind and solar outturn

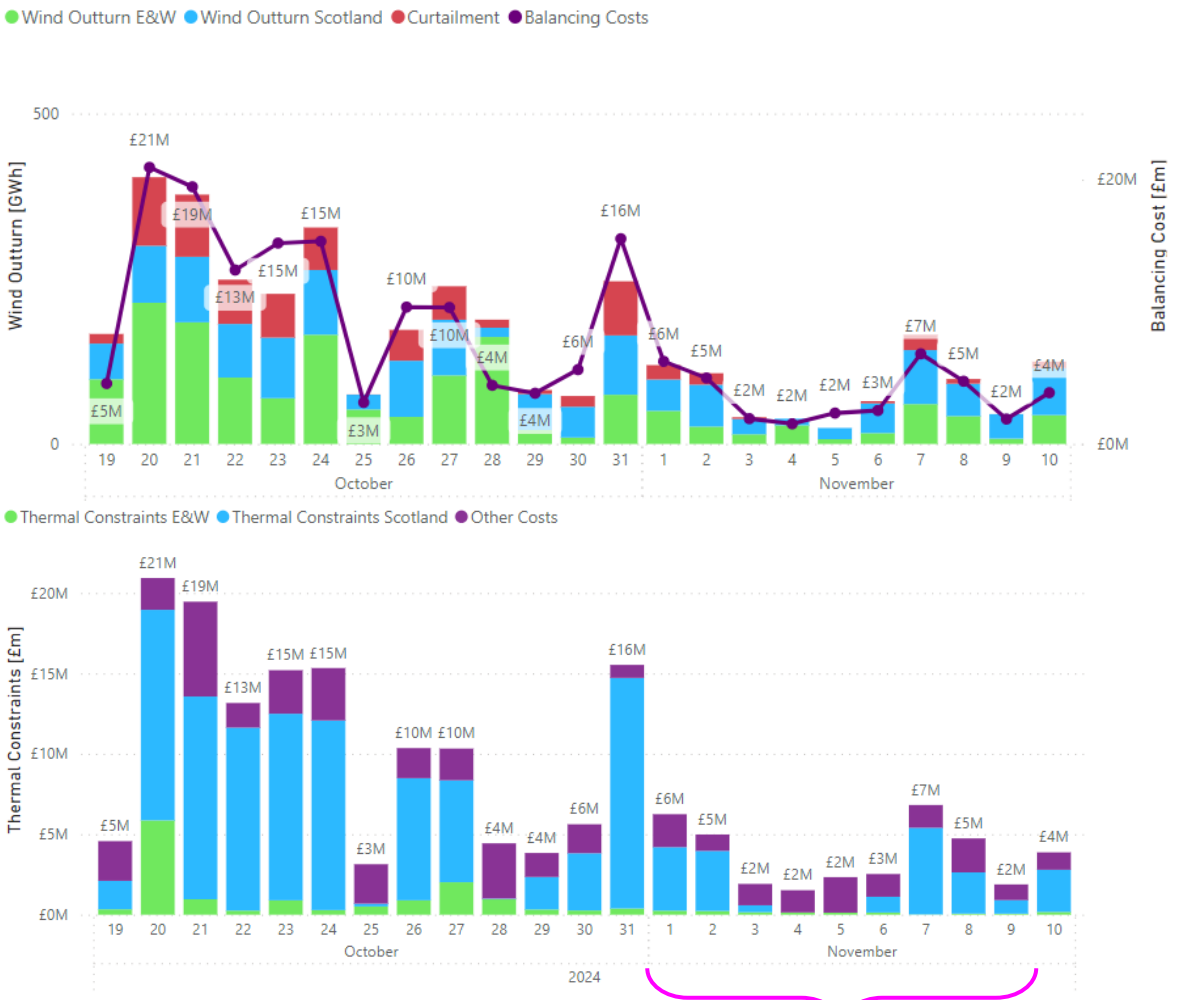
- There was a particularly low wind (offshore & onshore) and solar generation between 1st and 9th of November 2024, known as a Dunkelflaute period.
- Across the daily averages, onshore wind generation in the fuel mix (excluding exports and imports) was consistently below 6.93%, while offshore wind and solar accounted for a maximum of 2.25% and 2.17%, respectively.
- The lowest share of wind/solar generation occurred on the 5th, when offshore and onshore wind, along with solar, combined to account for only 2.85% of the total mix.
- For comparison, in October solar and offshore & onshore wind accounted for roughly 21% of the generation mix on average.
- During this period, there is a higher dependency on gas-fired generation compared to the rest of the month.
- Wind generation eventually ramped up since Nov 20th, mainly driven by weather conditions derived from Strom Bert.



Dunkelflaute

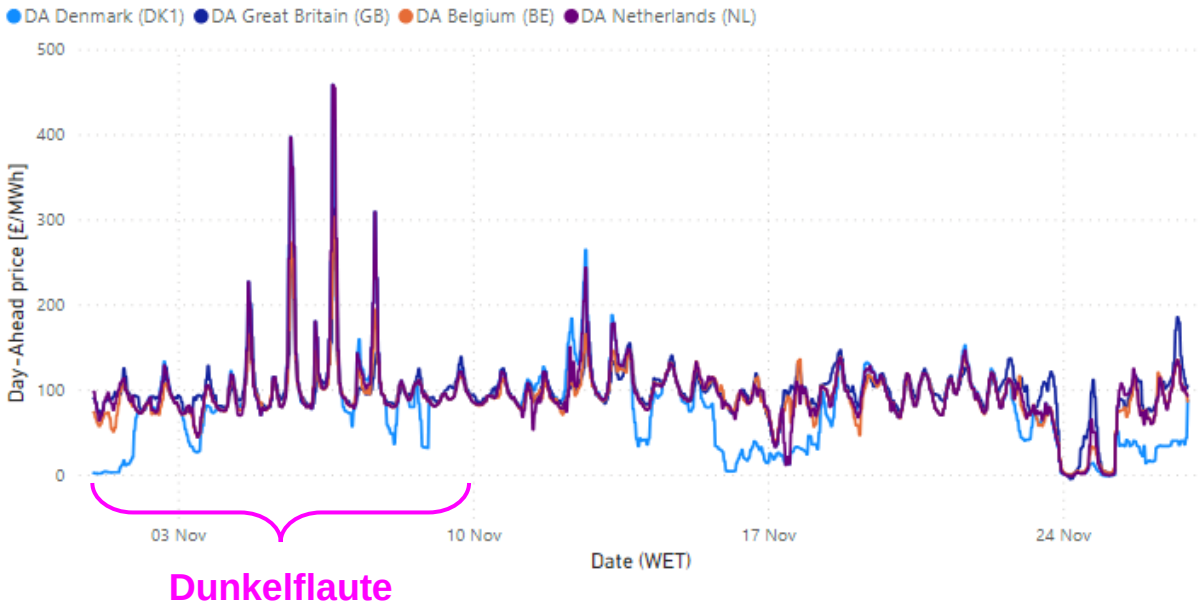
Dunkelflaute periods generally exhibit a minimal balancing cost impact on the system…

- There is a strong correlation between balancing costs and wind curtailment. The system usually spends more on windy days when curtailment is needed to manage congestion across boundaries, mainly B4 and B5.
- Most of the cost is usually driven by thermal constraints and it is exacerbated by outages that limit the transfer capacity of the boundaries. There was **zero spending on Scottish constraints on the 4th and the 5th of Nov.**
- During the dunkelflaute period, balancing costs remained relatively "low". Spending between the 1st and 9th was on average £3.6m/day, and curtailment averaged 8 GWh/day.
- For comparison, the most expensive day in October corresponded to the 20th, accounting for roughly £21m in total balancing costs and 104 GWh in curtailment volumes.

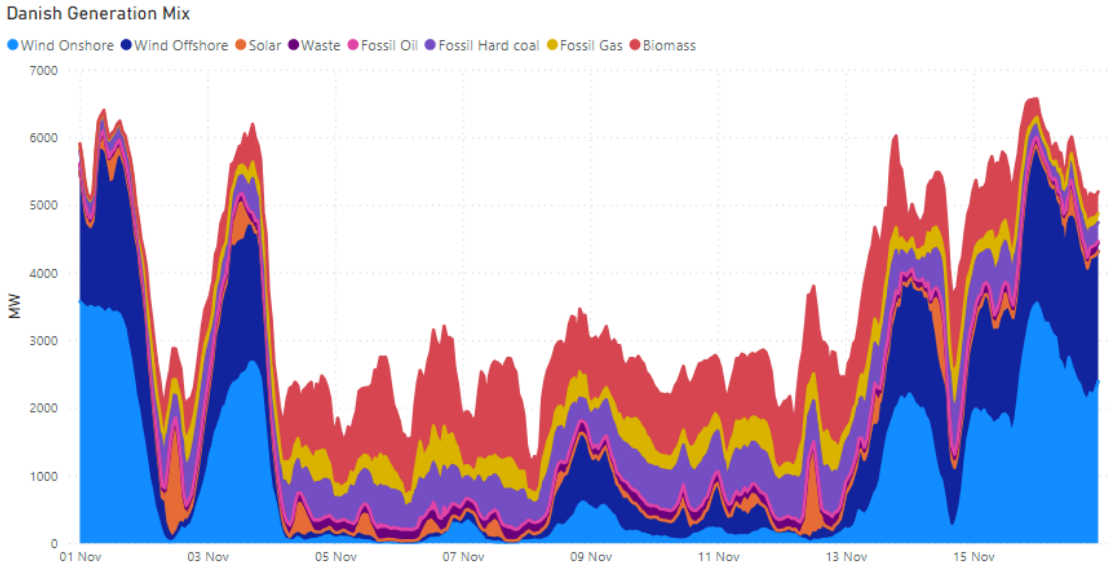


Dunkelflaute

Dunkelflaute periods often result in lower balancing costs in Great Britain, but they come at the expense of higher wholesale prices.



- Low wind and solar outturn have significant impact in wholesale prices. Over the dunkelflaute, prices peak up to £312/MWh in Great Britain, £458/MWh in Denmark, £458/MWh in the Netherlands and £302/MWh in Belgium.



- Denmark also experienced the Dunkelflaute period, presumably with a greater impact due to a higher share of wind in the total generation mix. This differs from Great Britain, where gas-fired power stations have a greater share in the fuel-mix of the system.

NESO
National Energy System Operator

If you have any questions or queries relating to Balancing Costs, please reach out to box.nc.customer@neso.energy

For further information on NESO publications please visit: neso.energy.com