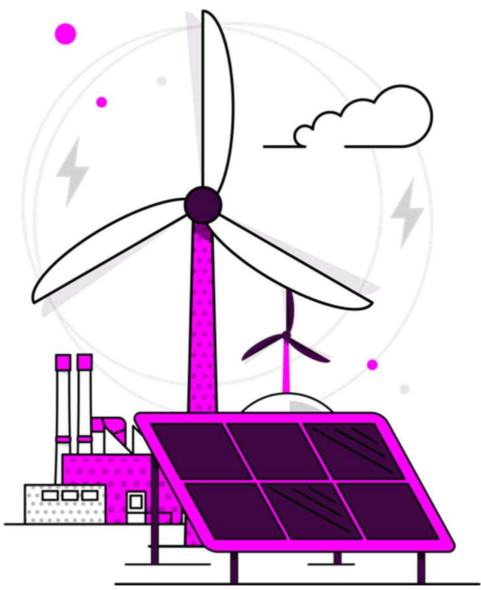
November 2025

Article 13 – Clean Energy Package (CEP) Redispatching

Annual Report - 2024

NESO
National Energy System Operator

Contents



1. Introduction

Article 13 of the Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity[1] outlines principles for redispatching. Most of the article has been retained in GB regulation via the Electricity and Gas (Internal Markets and Network Codes) (Amendment etc.) (EU Exit) Regulations 2020 (The Recast Electricity Regulation amended by SI 2020/1006[2]).

As per Article 2 of the regulation – Definitions – 'redispatching' means a measure, including curtailment, that is activated by one or more transmission system operators by altering the generation, load pattern, or both, in order to change physical flows in the electricity system and relieve a physical congestion or otherwise ensure system security.
Balancing actions for energy purposes are not in scope of the Redispatching term. Redispatching in this context is used for system reasons.

This report details the then Electricity System Operator's (ESO) (Now National Energy System Operator [NESO] as of 1st October 2024) level of the compliance for redispatching in Great Britain for 2024 as agreed with Ofgem, based on the Clean Energy Package Article 13 (4) and (5). Along with impact factors throughout 2024 and NESO initiatives to reduce redispatching.

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32019R0943&from=EN
[2] https://www.legislation.gov.uk/uksi/2020/1006/schedule/4/paragraph/13/made

2. Reporting Requirements

The reporting requirements on NESO are outlined in this section. Further information on our compliance with these requirements can be found in section 3, 4 and 5.

Article 13 Paragraph (4) - The transmission system operators and distribution system operators shall report at least annually to the regulatory authority, on:

(a) the level of development and effectiveness of market-based redispatching mechanisms for power generating, energy storage and demand response facilities;

(b) the reasons, volumes in MWh and type of generation source subject to redispatching;

(c) the measures taken to reduce the need for the downward redispatching of generating installations using renewable energy sources or high-efficiency cogeneration in the future including investments in digitalisation of the grid infrastructure and in services that increase flexibility.

Article 13 Paragraph (5) - Subject to requirements relating to the maintenance of the reliability and safety of the grid, based on transparent and non-discriminatory criteria established by the regulatory authority, transmission system operators and distribution system operators shall:

(a) guarantee the capability of transmission networks and distribution networks to transmit electricity produced from renewable energy sources or high-efficiency cogeneration[3] with minimum possible redispatching, which shall not prevent network planning from taking into account limited redispatching where the transmission system operator or distribution system operator is able to demonstrate in a transparent way that doing so is more economically efficient and does not exceed 5% of the annual generated electricity in installations which use renewable energy sources and which are directly connected to their respective grid, unless otherwise provided by the regulatory authority in which electricity from power-

[3] NESO interpret high-efficiency cogeneration to include CHP facilities

generating facilities using renewable energy sources or high-efficiency cogeneration represents more than 50 % of the annual gross final consumption of electricity;

(b) take appropriate grid-related and market-related operational measures in order to minimise the downward redispatching of electricity produced from renewable energy sources or from high-efficiency cogeneration;

(c) ensure that their networks are sufficiently flexible so that they are able to manage them.

For the purposes of this report, renewable energy sources or renewable energy means energy from renewable non-fossil fuel sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, landfill gas, sewage treatment plant gas, and biogas.

3. Great Britain Generation Redispatching

2024 Summary

NESO faced extensive constraints throughout 2024 which has contributed to higher levels of redispatch. This is due to various reasons such as:

- Unseasonable weather conditions for the time of year, for example high winds seen in various months compared to historical trends such as March, April, June and August. With some of these high winds being seen behind highly constrained boundaries.
- Competing pressures between bringing new renewable generators online against network build to support this increased capacity. Given some of these renewable generators are behind highly constrained boundaries, we ultimately have to bid them off to operate the system securely which increases the need for redispatching.
- Unplanned outages causing delays to planned network reinforcement works. Planned outages around the B4/5 boundary have been underway to allow this boundary to be reinforced and open more capacity. However, there were delays to maintenance which resulted in further constraints over that boundary.

Combining all the above challenges, NESO saw 31.56% renewable generation and 8.54% renewables being redispatched to meet our obligation to operate the system securely.

2024 Data & Analysis

Table 1 below shows the overall reported figures for January to December 2024. There are three reported values based on slightly different fuel types, with one including CHP and Biomass which is included for consistency with previous reports[4].

[4] Previous reports used the EU definition of renewables which specifically included Biomass and CHP as High Efficiency Carbon. 2021 and onwards used the adjusted EU definition which does not specify Biomass.

To only consider Non-pumped Storage Hydro (NPSHYD), Solar and Wind fuel types as renewable, 31.56% of Great Britain's energy requirement was met by renewable generation[5]. 8.52% of downwards redispatching was required to maintain system security throughout 2024.

Table 2 also shows the reportable figures if we consider the previously mentioned renewable sources along with Biomass as a non-fossil fuel source where we see our percentage of renewable generation at 37.45% and redispatch is at 7.18%.

Table 3 further develops on Table 2 by adding in CHP as High Efficiency Co-generation (HEC) and we see an increase in the volume of renewables to 39.04% and the downwards redispatching is reduced to 6.89%.

Item	Value
Total Generation Output	317.81 TWh
Renewable Generation	100.29 TWh
Percentage of Renewable Generation	31.56%
Renewable Volume Redispatched	8.54 TWh
Percentage of Renewables Redispatched	8.52%

Table 1: Article 13 Figures utilising NPSHYD, Solar and Wind as renewable fuel types

Item	Value
Total Generation Output	317.81 TWh
Renewable Generation	119.01 TWh
Percentage of Renewable Generation	37.45%
Renewable Volume Redispatched	8.54 TWh
Percentage of Renewables Redispatched	7.18%

Table 2: Article 13 Figures utilising NPSHYD, Solar, Wind and Biomass as renewable fuel types

Item	Value
Total Generation Output	317.81 TWh
Renewable Generation	124.08 TWh
Percentage of Renewable Generation	39.04%
Renewable Volume Redispatched	8.55 TWh
Percentage of Renewables Redispatched	6.89%

Table 3: Article 13 Figures utilising NPSHYD, Solar, Wind, CHP and Biomass as renewable fuel types

[5] Generation is determined from BMU export volume and Interconnector Import along with our best modelling of embedded wind and solar.

Fuel Type	ROCOF	THERMAL	VOLTAGE CONTROL	Total
BIOMASS	0	0.0042	0.0001	0.0043
CHP	0	0.0066	0	0.0066
NPSHYD	0.0001	0.4880	0	0.4881
WIND	0.0028	8.0462	0.0005	8.0495
Total	0.0029	8.5450	0.0006	8.5485

Table 4: Volume (TWh) of redispatching by fuel type and constraint reason

It is clear from Table 4 that wind was the significant fuel type to impact the redispatched volume with 8.05TWh out of the total 8.55TWh (94%). The majority of this redispatched wind was because of thermal constraints on the system (99.9%) along with thermal constraints being the outstanding reason for any fuel type being redispatched.

We can also determine that 98% of total redispatched volumes were in Scotland (Figure 1) with 98% of the redispatched wind being in Scotland as well (Figure 2).

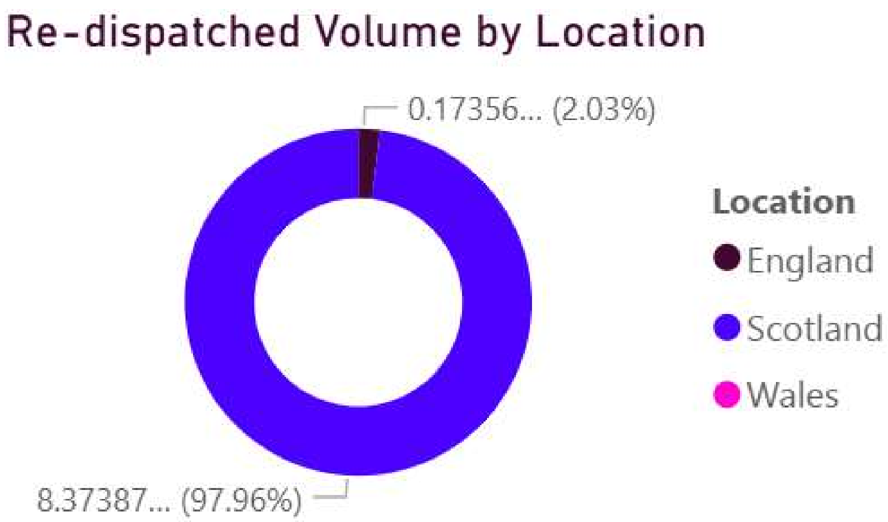


Figure 1: Redispatched volume for all fuel types by geographical location

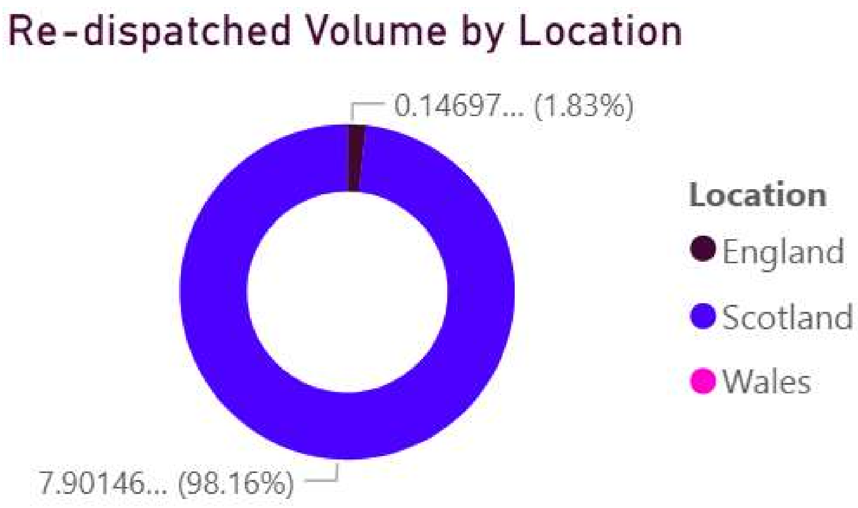


Figure 2: Redispatched wind volume by geographical location

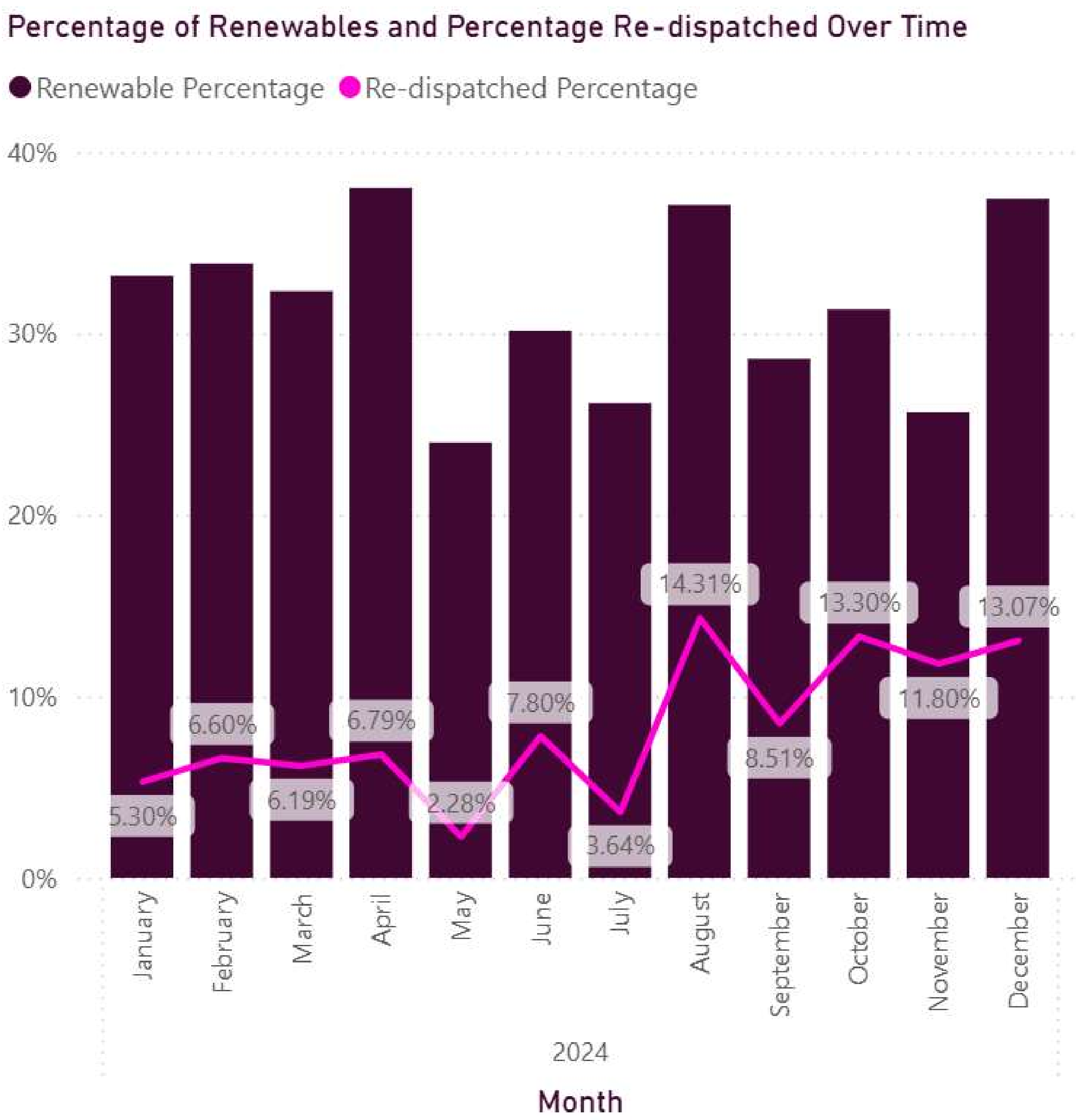


Figure 3: Renewable percentage and redispatched percentage by month for 2024 utilising NPSHYD, Solar and Wind

It is clear to see from Figure 3 above there were certain months where the redispatching was higher than others. Months such as August, October, November and December, which saw more than 10% of renewable volumes redispatched.

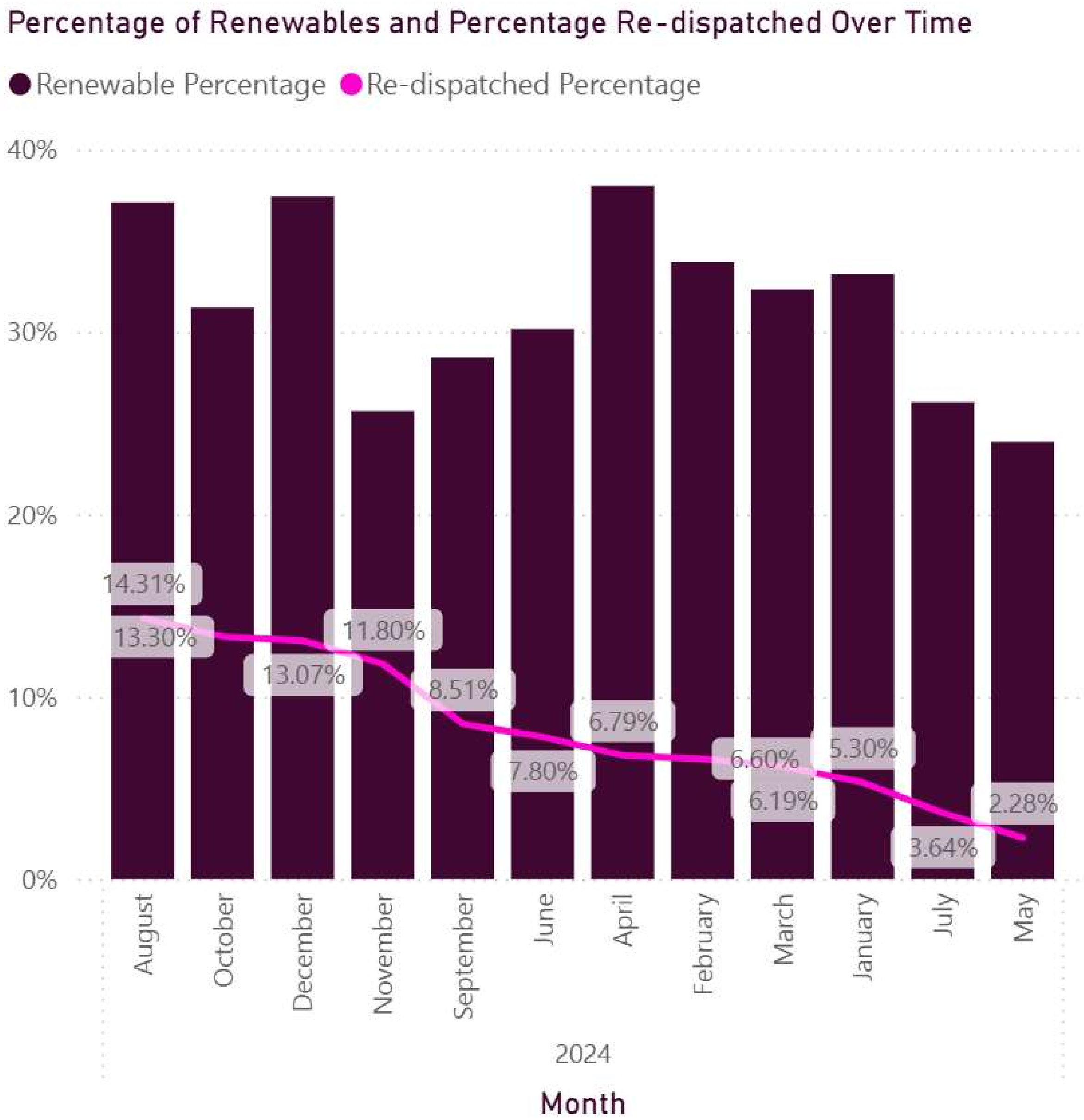


Figure 4:Renewable percentage and redispatched percentage by month for 2024 utilising NPSHYD, Solar and Wind ordered by Redispatched percentage descending

Figure 4 illustrates that there is little to no correlation between months with high renewable generation and high redispatching, for example we can see months such as November with the second lowest renewable generation and the fourth highest redispatched percentage.

August 2024

In August 2024, high wind conditions in Scotland, produced abnormally high hypothetical wind generation throughout the month for this time of year. This increase was around 50% higher than compared to the previous 5-year average

In the following analysis, we have compared August 2024 against the average conditions for the previous 5-years to assess the impact this had on 2024. We took a few assumptions:

- Hypothetical[6] wind outturn is the sum of the actual wind outturn and curtailed volumes.
- Scotland is in isolation here as hypothetical wind outturn for England and Wales was below the 5-year average.
- Analysis has not been normalised for installed wind capacity in Scotland.

The below graph provides an overview of August 2024 wind generation with 2,002 GWh of wind outturn and a hypothetical 3,184 GWh meaning NESO curtailed 1,181 GWh. If we saw wind levels comparable to the 5-year average in hypothetical wind conditions, wind curtailment would have been significantly lower as is shown below. This would have resulted in the same 2,002 GWh outturn volume, but a significantly lower hypothetical wind generation due to the 5-year average being lower at 2,069GWh and only resulting in 67GWh of wind curtailment had we had more typical conditions.

[6] Hypothetical wind is the potential outturn that could have happened at the time, this includes actual wind generation the volumes that NESO curtailed from Wind registered BMUs.

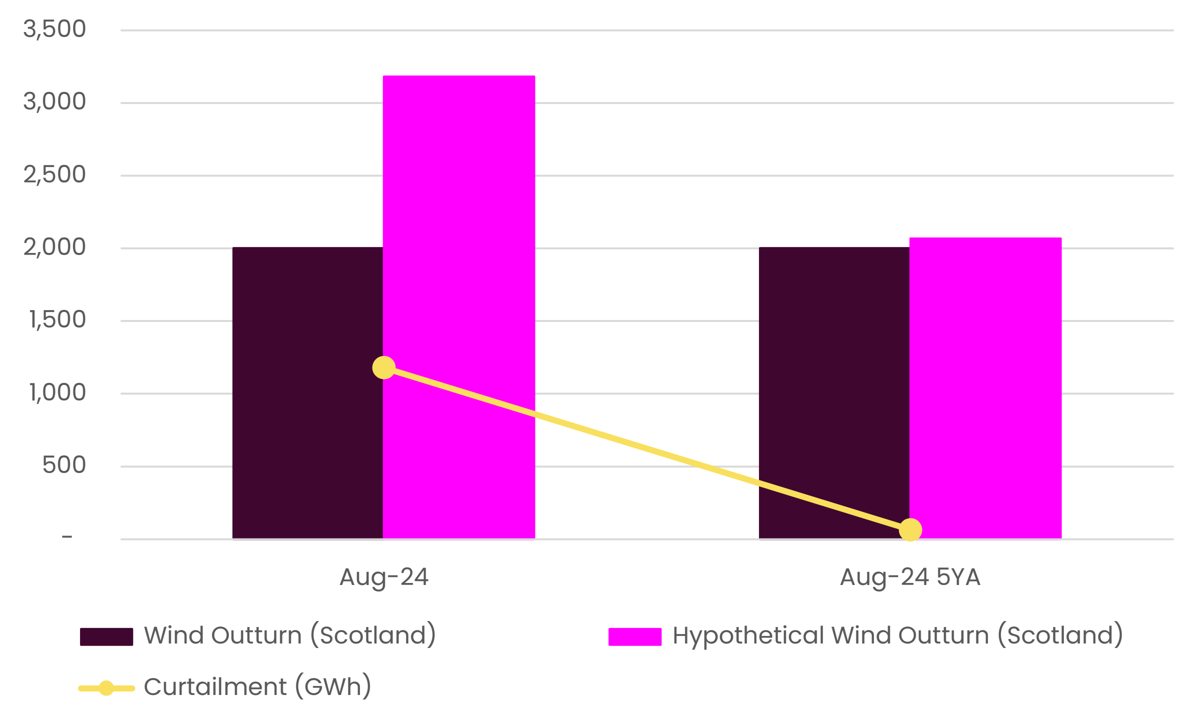


Figure 5: Wind outturn, Hypothetical Outturn and Wind Curtailment for August 2024 and the 5 Year Average prior to August 2024.

This shows Scotland was 1115GWh higher in hypothetical wind outturn compared to what the past 5-year average suggests. This is about 94% of the volume NESO curtailed due to constraints.

Therefore, our analysis suggests had we not seen these unfavourable weather conditions we would have curtailed 1,115 GWh less than we did which would have resulted in us seeing a reduction in renewables redispatched to 7.4% (from 8.52% in Table 1) due to the reduction in volume we were required to redispatch.

October 2024

October was a month where NESO saw some reinforcement works on the B4/B5 boundary pushed back further than expected due to an unplanned outage extension on one of the major 275kV circuits. As a consequence, there was an unplanned outage which resulted in two single circuit outages taken over the boundary which reduced the constraint limit.

This unexpected extension, of a required network improvement, meant NESO had to take considerably more actions across that boundary even though hypothetical wind was below the last 5 years of seasonal averages. In the following piece of analysis, we compare what typical flows over this boundary in the previous 5 years to 2024, against what we had to reduce the boundary to in 2024 with the following assumptions made:

- The proportion of Wind curtailment is directly linked to boundary flow and no other fuels affected this ratio.
- No other outages would have affected 2024.
- Scotland figures are taken in isolation.

Typically, NESO has curtailed between 7% and 17% of wind in October over the period 2019-2023. In 2024 this figure jumped to 46% due to the outage works.

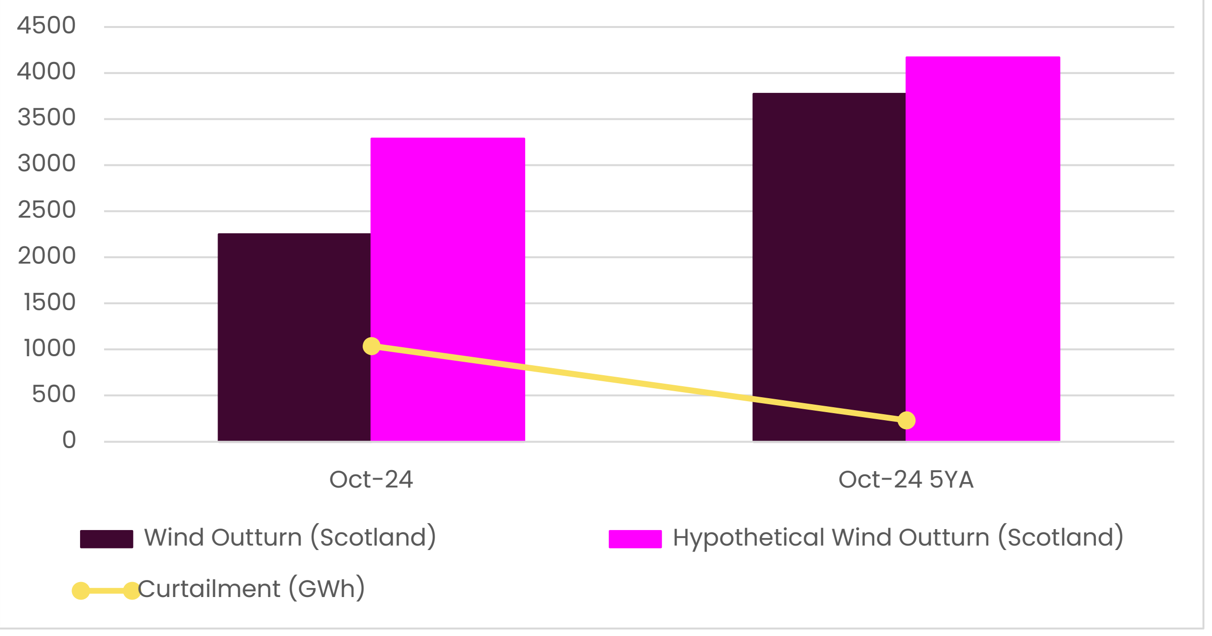


Figure 6: Wind outturn, Hypothetical Wind Outturn and Wind curtailment for October 2024 and the 5 Year Average leading up

What is clear to see from the above graph is that NESO under typical conditions on the network would have been able to better handle the volume of hypothetical wind generation on the B4/B5 boundary. Had this outage occurred at a time where this wasn't impacted, we could have reduced wind curtailment from 1,038 GWh to 231GWh which is more typical based on historical trends.

Our analysis suggests that had we had more typical curtailment around October 2024 with the reinforcement works not being delayed we could have seen our renewable redispatch figure reduced to 7.65% (from 8.52% in Table 1) due to us curtailing less and having more wind generation.

August and October Combined Impact

There has been two specific months mentioned above in isolation to show the actions NESO had to take throughout 2024 significantly impacted renewable redispatch. Increasing the total redispatch figure by around 1% in each case. If both of those months had seen conditions more in line with their 5-year trends we could have seen a final renewable redispatch figure around 6.55%.

4. Initiatives to Reduce Redispatching

Short Term

Due to long lead times for network reinforcement and market reform currently under review by the government's Review of Electricity Market Arrangements (REMA) Thermal Constraints are currently being managed through short-term reforms.

Constraint Collaboration Project

In 2024, NESO asked the industry for ideas about how to reduce constraint volumes, actions and associated costs with the intention to be implemented alongside current solutions. The solutions should be feasible and within NESO's scope, quick to be introduced within 5 years and effective.

The ideas fell into two categories: Constraints Management Markets (CMM) and Increasing boundary flows.

Demand for constraints

Demand for constraints is an idea proposed that focuses on increasing demand around constrained regions/boundaries instead of looking to reduce and relocate generation to facilitate the constraint.

Two contract types for this have been assessed in the Cost Benefit Analysis (CBA) scope; A fixed utilisation tariff (£/MWh for excess electricity consumed) paid from demand facilities to NESO, and a variable utilisation tariff based on a set discount from spot price, paid from demand provider to NESO. We've found that both would provide a benefit but a 50:50 split of Flex and baseload offering being a chosen method to utilise for modelling. Various cases were modelled with different boundaries selected which resulted in an identified benefit for this service being offered.

NESO is anticipating this service to provide an improvement to the volume of redispatching through it improving boundary constraints between 10% and 25% of forecasted constraint volumes across B0-1 boundary. This figure is still subject to the following factors:

- Timely allocation of funding support.
- How competitive the contract is compared to other markets.
- Availability of off taker/wider infrastructure for the demand and the alignment of the constraint periods with their individual operational profiles.
- The ability to secure land, permitting and consenting within the designated boundary in a timely manner to meet the requirements of the contract.
- Availability of grid connections and the associated reinforcement costs.

Extended Intertrip Service

As part of the Constraint Collaboration Project, NESO is looking to expand the current two Constraint Management Intertrip Services (CMIS) in operation, one supporting the B6 boundary and one the EC5 (explained in more detail in section “Constraint Management Intertrip Service”). These have been successful in reducing boundary flows, leading to support for further developing and extending these services to other highly constrained boundaries.

We expect that further intertrip services would similarly benefit boundary flow volumes and there is support for further developing and extending these services to other highly constrained boundaries. NESO are currently progressing the development of intertrip schemes and continuing to investigate technical options relating to intertrip as part of this expansion. This includes:

- **CMIS EC5-Enduring:** An enduring commercial Constraint Management Intertrip Service for the EC5 boundary region. This service is expected to go live in July 2026 and will replace the current Interim EC5 service. Tender Outcome letters have now been sent to all bidding parties, and NESO will be publishing these results via the NESO website
- **CMIS Scotland (multiple boundary areas):** NESO is continuing to work with both Scottish TOs on options and potential solutions for a Constraint Management Intertrip Service for the B2 & B4 boundaries in Scotland. The current target date for these solutions and services

to be in place for these boundaries is mid-2027. We expect to publish more information about this to the market in the second half of 2025.

- **CMIS B6:** NGET are working to extend the current B6 scheme to include circuits in North England that can be managed by generators in Scotland. This work is expected to complete mid-late 2026.

Boundary Flow Smoothing

Transmission network boundary transfer capacities are the safe limits for how much power can flow over a boundary. The ENCC has to keep the flow below the limit by taking actions to reduce the flow. This often means bidding off wind and accepting offers on replacement gas generation. Ideally the flow should be reduced to just below the limit.

Power flows over constrained boundaries are often very variable, because of rapid changes in supply and demand on both sides of the boundary (e.g. due to wind gusts). This variability can make it harder to keep the constrained flow to just below the limit, therefore when variability is high, ENCC may choose to reduce the flow a bit further below the limit, creating a buffer or headroom, to reduce the risk of the variability in the flow causing the limit to be exceeded. If the fluctuation in the boundary flow could be reduced, it may allow the ENCC to lower the headroom, enabling more renewable power to cross the boundary and thus reducing costs.

A flexibility service provider (FSP), located near a constrained boundary, could receive a high-resolution, low-latency data feed of the flow over the boundary. The FSP could adjust its supply or demand to counteract the flow variability. The FSP would provide the service whenever instructed, typically when the boundary is constrained and, the FSP may respond to a signal by increasing or decreasing its output to oppose the flow, reducing its variability.

NESO is currently investigating the benefits of boundary flow smoothing in collaboration with Frazer-Nash consulting. The project will last approximately 6 months, from April to October 2025.

Constraint Management Intertrip Service

The current Constraint Management Intertrip Service (CMIS) looks for ways to reduce the impact of constraints at various locations on the electricity system. Intertrip schemes enable the ENCC to facilitate more power to flow on the existing transmission infrastructure pre-fault, thus reducing the amount of generation being curtailed when the expected flow exceeds the current capability of the circuits. At present two intertrip services have been implemented and are helping to manage network congestion at the B6 and EC5 boundaries. The B6 Intertrip service has helped to effectively manage a further 223.5GWh of volume around the B6 boundary since 2022 to 2025 with 36.5GWh being within 2024. Whilst EC5 has shown 10.5GWh since it's deployment in 2024.

There are limitations to any intertrip service in place which can hinder the benefits we see from them, namely they have a maximum amount of congestion they can help to relieve before they exceed the largest loss on that boundary and can't support further.

In 2024, the main region of constraints in Scotland has moved north of the B6 boundary to the B4/B5 boundaries due to planned long-term outages. This has limited the effectiveness of the B6 Intertrip Service over this period. The current B6 Intertrip service saw between 0.05% and 0.1% of the B6 Boundary flow reduced by the CMIS in its first 2 years (2022 and 2023). The B6 CMIS impacted around 0.02% of boundary flow volume in 2024.

The Constraint Collaboration Project is considering options for enhancing the current intertrip service by securing the boundaries with more assets and intertrip connections to support constraint management through varying system conditions.

Local Constraint Market (LCM)

LCM was launched in December 2023 and has continued developing and improving since then to try and find the optimal structure of the market. We are trialling a Local Constraint Market to access new sources of flexibility to help manage one the B6 Boundary. We have committed as

part of the NESO 5-point plan to deliver a Local Constraint Market to help tackle the rising constraint costs at the B6 boundary.
However, there are limitations in the volume procured due to the prices available currently through this service compared to the Balancing Mechanism. Consequently, its contribution to reducing redispatch volumes is currently small at the position it is in currently.

Outage Optimisation

Development of the transmission system over the coming years will require an increase in outages to enable access to the network. In the long-term, network upgrades will help to lower thermal constraints and redispatch of renewable generation by increasing network capacity and supporting energy flows from newly connected generators, however, in the short-term, outages are expected to contribute to higher redispatch volumes.

NESO review all planned outage requests to optimise the constraints they inflict on the network. Key aims of this are preventing significant boundary constraints from happening at the same time which increases balancing costs.

Regional Development Programs (RDPs)

RDPs are designed to address areas of the network challenged by large volumes of Distributed Energy Resources (DER). They aim to improve transmission and distribution system coordination to unlock network capacity, reduce constraints and open new revenue streams for market participants. Several RDPs are under development and at varying stages of progression. This includes Megawatt Dispatch (MWD), an RDP analysing what requirements and capabilities are needed in the south-west of England to manage power flows from high levels of renewable solar and wind energy at the least cost to consumers. MWD is now active in the Southwest and Southeast of England.

Auto Switching Software

Auto switching software can be used to increase pre-fault flows on the network by allowing control engineers to use automated circuit switching.

NESO is currently undertaking a trial of this software, and following successful completion, further schemes are to be considered.

Long Term

Long Term Market Reform

Over the long-term renewable redispatching is heavily tied to thermal constraints on the grid, these constraints will be largely determined by the balance between new generation connections, pushing these up, and the development of new network, bringing them back down. Market reforms will also be significant over the long-term and as they have the potential to influence the locational and operational signals sent to generators which will have knock-on consequences for the volume and cost of actions we need to take to manage constraints. There is currently a high level of uncertainty regarding final decisions impacting long-term market reforms, and we expect the next few years to be highly influential for determining the long-term outlook for redispatch volumes. Key workstreams we are tracking that are expected to have a high level of influence on thermal constraints include network delivery timelines, connections reform, REMA, and policy for new generation.

REMA

Reform to national pricing

The reformed national pricing package reflects the 10 July 2025 decision by the Secretary of State for Energy Security and Net Zero to retain a single, national wholesale market price for Great Britain. It contains measures related to the efficient siting of new assets alongside measures to improve operational efficiency.

Under RNP, more efficient siting of new assets will be pursued via NESO's Strategic Spatial Energy Plan (SSEP) and its associated levers such as connections reform, planning reforms, transmission and connection charging, and, potentially, government-backed contracts, among others. Via better alignment between generation and transmission investment, transmission 'bottlenecks' can be avoided such that the need for redispatch actions will be lower than they might have been otherwise. The first SSEP will be published in Q4 2026.

The package also seeks improvements to the balancing and settlement arrangements to incentivise greater self-balancing by market participants ahead of gate closure, greater visibility for NESO for redispatch decision-making, and greater volumes of flexible capacity available for redispatch. These initiatives are expected to provide for more efficient redispatch by NESO. The balancing reforms are still subject to additional policy development and industry consultation but assuming they are progressed to implementation, they could be in place by 2030.

Connections Reform

The Connections Reform project forms part of NESO's long-term vision for change to the connections process. In 2024, we set out our proposed way forward for connections reform (referred to as TMO4+), that will seek to align the connections process with strategic energy and network plans.

Connections Reform will look to speed up grid connections which will support faster decarbonisation of the energy system and is expected to contribute to cheaper electricity generation. The acceleration of generation connections is also likely to add to network congestion and increase redispatch volumes. However, the proposed options will provide connection offers based on a co-ordinated network design which is expected to support more efficient us of the network compared to the status quo. In April 2025, Ofgem published its Final Decision to approve the TMO4+ Connections Reform Proposals.

In November 2024, Ofgem additionally published a consultation on proposed changes to the regulatory framework around electricity grid connections, as part of its connections end-to-end review.

5. Future Outlook

Looking ahead to 2025 so far, NESO has continued to be faced with ongoing outages alongside some unfavourable weather conditions in constrained regions which has meant a large number of actions to maintain system security by managing these thermal constraints. There are more generators being built prior to network reinforcement and build which means we inevitably need to bid these generators down for thermal constraints until the network is reinforced. This is a decision NESO do not control but have highlighted recommendations around network build which could result in savings in thermal constraint costs in 2030 of ~£4 billion mostly by bringing forward some reinforcements in East Anglia and the Southeast to support delivery of projects in the North Sea.

As we are seeing TOs building network in the north, NESO are beginning to see the south-east as the next constrained area with interconnectors being more focused here. Interconnector exports are expected to grow out to 2030, and with a higher concentration of generators in the north, this is expected to increase the north-south flows across the network and amplify thermal constraints.