ESO RIIO2 Business Plan 2 (2023-25)

May 2023 Incentives Report

23 June 2023

Contents

Introduction

As part of the RIIO-2 price control, we submitted a second Business Plan to Ofgem in August 2022. It sets out our proposed activities, deliverables, and investments for years three and four of RIIO-2 (2023-2025) as we respond to the rapidly changing external environment.

The ESO's Delivery Schedule sets out in more detail what the ESO will deliver, along with associated milestones and outputs, for the "Business Plan 2" period.

Ofgem, as part of its Final Determinations for the RIIO-2 price control, set out that the ESO would be subject to an evaluative incentive framework, assessing our performance in delivering the Business Plan.

The updated ESO Reporting and Incentives (ESORI) guidance sets out the process and criteria for assessing the performance of the ESO, and the reporting requirements which form part of the incentive scheme for the BP2 period. Every month, we report on a set of monthly performance measures; Performance Metrics (which have benchmarks) and Regularly Reported Evidence items (which do not have benchmarks). This report is published on the 17th working day of each month, covering the preceding month.

Every quarter, we report on a larger set of performance measures, and also provide an update on our progress against our Delivery Schedule in the RIIO-2 deliverables tracker. Our six-month and eighteen-month reports will broadly be similar to our usual quarterly report.

Our mid-scheme and end of scheme reports will be more detailed, covering all of the criteria used to assess our performance.

Please see our website for more information.

Summary of Notable Events

In May we have successfully delivered the following notable events and publications. We provide further detail on each of these under the role sections:

- For the Coronation of King Charles III and Queen Camilla we created a bespoke planning team with SMEs from across ESO teams, including the duty control room team on the day of the coronation. The duty control room team successfully maintained the second-by-second system frequency within normal limits throughout the event, 49.8 - 50.2 Hertz, and there were no instances to threaten transmission system security. Thus, we were able to successfully play our part during this historic and joyous Royal occasion.
- We hosted two balancing services drop-in events, one in Edinburgh on 18 May and one in London on 24 May. The discussion went beyond balancing services and brought together specialists from different project areas. We discussed current market conditions and our plans for the future of the markets and attendees provided valuable insight.
- Data release in May shows 1.6 million households and business took part in our Demand Flexibility Service (DFS) saving over 3,300MWh of electricity across peak demand times. This would be enough to power nearly 10 million homes across Great Britain.
- In May, we published our Megawatt (MW) Dispatch service details including visibility and control requirements. This paper provides an overview of the MW Dispatch functionality as developed with National Grid Electricity Distribution (NGED) and UK Power Networks (UKPN). Our new Megawatt (MW) Dispatch Service allows us to manage the output of distributed energy resources (DER) in real time. The service is currently under development and is due to go live in the South of England later this year. The service will allow the ESO Control Room teams to request that generators embedded in the Distribution network reduce their generation output down to zero at times of particular network congestion and where we have constraints on the flow of electricity on the network. This service will mean lower bills for customers as it gives us more dispatch options to secure the system.
- At a connections seminar in Glasgow, held on 16 May, we announced the next stage of our five-point plan to speed up the connection processes, enabling energy storage projects to the connect to the grid more quickly through a non-firm connections agreement, potentially speeding up connections for up to 95GW of energy storage projects in the pipeline.

Summary of Metrics and RREs

This table summarises our Metrics and Regularly Reported Evidence (RRE) performance for May 2023.

Metric/RRE		Performance	Status
Metric 1A	**Balancing Costs**	£132m vs benchmark of £157m	● (Exceeding expectations)
Metric 1B	**Demand Forecasting**	Forecasting error of 524MW vs indicative benchmark of 606MW	● (Exceeding expectations)
Metric 1C	**Wind Generation Forecasting**	Forecasting error of 4.08% vs indicative benchmark of 3.95%	● (Meeting expectations)
Metric 1D	**Short Notice Changes to Planned Outages**	2.6 delays or cancellations per 1000 outages due to an ESO process failure (vs benchmark of 1 to 2.5).	● (Below expectations)
RRE 1E	**Transparency of Operational Decision Making**	90.9% of actions taken in merit order	N/A
RRE 1G	**Carbon intensity of ESO actions**	1.9gCO_2/kWh of actions taken by the ESO	N/A
RRE 1I	**Security of Supply**	0 instances where frequency was more than ±0.3Hz away from 50Hz for more than 60 seconds. 0 voltage excursions	N/A
RRE 1J	**CNI Outages**	0 planned and 0 unplanned system outages	N/A
RRE 2E	**Accuracy of Forecasts for Charge Setting**	Month ahead BSUoS forecasting accuracy (absolute percentage error) of 68.4%	N/A

Below expectations ● **Meeting expectations** ● **Exceeding expectations** ●

We welcome feedback on our performance reporting to box.soincentives.electricity@nationalgrideso.com

Gareth Davies
ESO Regulation Senior Manager

Role 1 (Control Centre operations)

ESO

Metric 1A Balancing cost management

This metric measures the ESO's outturn balancing costs (including Electricity System Restoration costs) against a balancing cost benchmark.

A new benchmark has been introduced for BP2. Analysis has shown that the two most significant measurable external drivers of balancing costs are wholesale price and outturn wind generation. The new benchmark has been derived using the historical relationships between those two drivers and balancing costs:

1. Benchmark has been created using monthly data from the preceding 3 years.

2. A straight-line relationship has been established between historic constraint costs, outturn wind generation and the historic wholesale day ahead price of electricity.

3. A straight-line relationship established between historic non-constraint costs and the historic wholesale day ahead price of electricity.

4. Ex-post actual data inputted into the equation created by the historic relationships to create the monthly benchmarks.

The formulas used are as follows (with Day Ahead Baseload being the measure of wholesale price):

Non-constraint costs = 54.48 + (Day Ahead baseload x 0.52)
Constraint costs = -32.66 + (Day Ahead baseload x 0.34) + (Outturn wind x 25.72)

ESO Operational Transparency Forum: The ESO hosts a weekly forum that provides additional transparency on operational actions taken in previous weeks. It also gives industry the opportunity to ask questions to our National Control panel. Details of how to sign up and recordings of previous meetings are available here.

May 2023 performance

Figure 1: 2023-24 Monthly balancing cost outturn versus benchmark

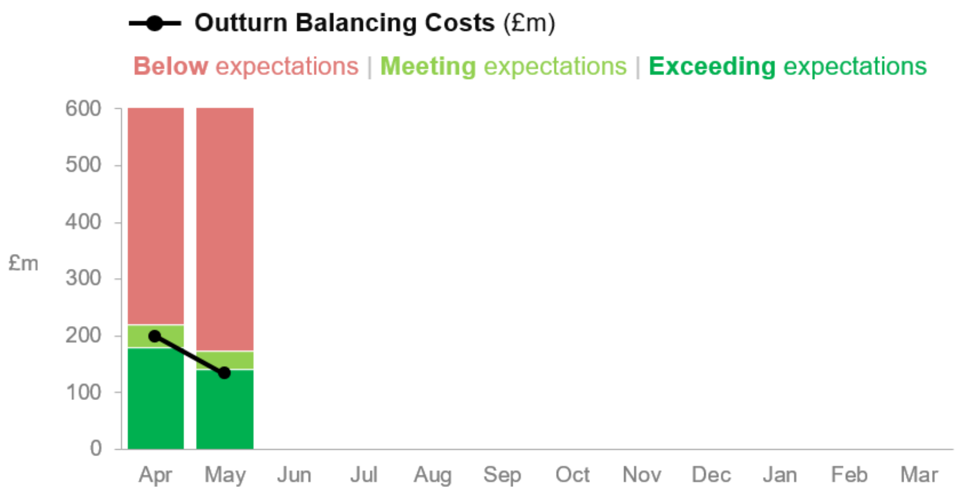


Table 1: 2023-24 Monthly balancing cost benchmark and outturn

All costs in £m	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	YTD
Outturn wind (TWh)	3.4	2.6											5.97
Average Day Ahead Baseload (£/MWh)	105	81											186
Benchmark	200	157											357
Outturn balancing costs (excluding Winter Contingency)[1]	**198**	**132**											**331**
Status	●	●											●

Previous months' outturn balancing costs are updated every month with reconciled values. Figures are rounded to the nearest whole number, except outturn wind which is rounded to one decimal place.

Performance benchmarks:

- **Exceeding expectations:** 10% lower than the annual balancing cost benchmark
- **Meeting expectations:** within ±10% of the annual balancing cost benchmark
- **Below expectations:** 10% higher than the annual balancing cost benchmark

Supporting information

Ongoing data issue:

As stated in previous reports, due to a data issue over the previous months, the Minor Components line in Non-Constraint Costs is capturing some costs which should be attributed to different categories. It has been identified that a significant portion of these costs should be allocated to the Operating Reserve Category (not limited to). Although the categorisation of costs is not correct, we are confident that the total costs are correct in all months.

We continue to investigate and will advise when we have a resolution.

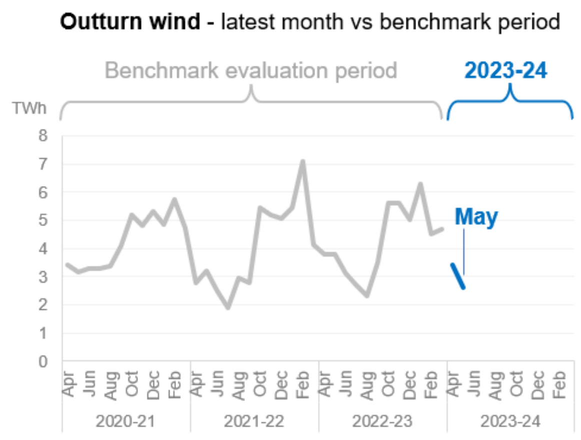
This month's benchmark

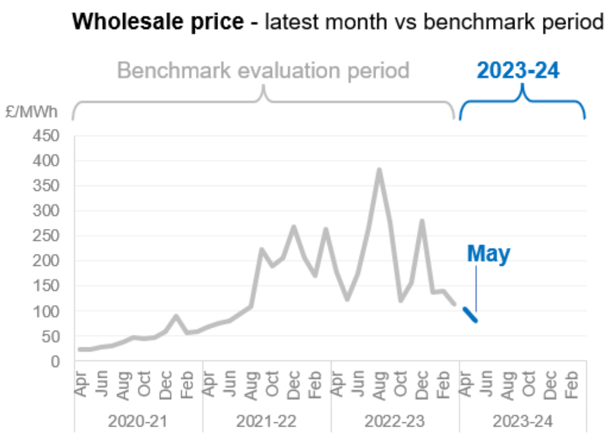
The benchmark of **£157m** for May reflects:

- a relatively low average **outturn wind** figure compared to the benchmark evaluation period (the last three years). Wind is seasonal and the figure for this month is broadly in line with the same month in the last three years, although this month's is slightly lower.
- a relatively low average monthly **wholesale price** (Day Ahead Baseload) compared to the benchmark evaluation period (the last three years)

Note that of the two factors, wholesale price always has the biggest impact on the benchmark, as it is used to calculate both the constraint and non-constraint costs parts. Outturn wind is only used for constraint costs.

[1] Winter Contingency costs are excluded from the outturn balancing costs for comparison to the benchmark as agreed with Ofgem. However in the rest of this section we continue to include those costs for transparency and analysis purposes.





May performance

May's total balancing costs were £132m which is £25m below the benchmark of £157, and therefore exceeding expectations. As explained above, this month the average wholesale price and outturn wind were both lower than in April, meaning a lower benchmark. Therefore, all other things being equal, we would expect actuals to fall broadly in line with this, and that's what we have seen with total balancing costs dropping from £198m to £132.

Now that the benchmark methodology has been confirmed, we have also updated the status for last month, which was meeting expectations, with actuals within 10% of the benchmark.

Breakdown of costs vs previous month

Balancing Costs variance (£m): May 2023 vs April 2023

		(a) Apr-23	(b) May-23	(b) - (a) Variance	decrease ◄► increase Variance chart
Non-Constraint Costs	Energy Imbalance	1.9	-4.0	(5.9)	
	Operating Reserve	17.0	17.0	(0.1)	
	STOR	2.5	3.0	0.4	
	Negative Reserve	1.0	0.1	(0.9)	
	Fast Reserve	14.5	12.5	(2.0)	
	Response	21.0	17.7	(3.3)	
	Other Reserve	1.9	1.5	(0.4)	
	Reactive	18.7	19.4	0.7	
	Restoration	2.9	2.7	(0.2)	
	Winter Contingency	0.0	0.0	0.0	
	Minor Components	3.8	7.3	3.5	
Constraint Costs	Constraints - E&W	60.1	33.6	(26.5)	
	Constraints - Cheviot	0.0	0.0	0.0	
	Constraints - Scotland	15.1	8.2	(6.9)	
	Constraints - Ancillary	3.1	1.1	(1.9)	
	ROCOF	3.3	2.9	(0.4)	
	Constraints Sterilised HR	31.6	9.4	(22.2)	
Totals	Non-Constraint Costs - TOTAL	85.2	77.0	(8.3)	
	Constraint Costs - TOTAL	113.2	55.3	(57.9)	
	Total Balancing Costs	**198.4**	**132.3**	**(66.1)**	

As shown in the total rows from the table above, the non-constraint costs fell by over £8m, while the constraint cost fell by £58m compared with April 2023.

Constraint costs: The main driver of the variances compared to last month are detailed below:

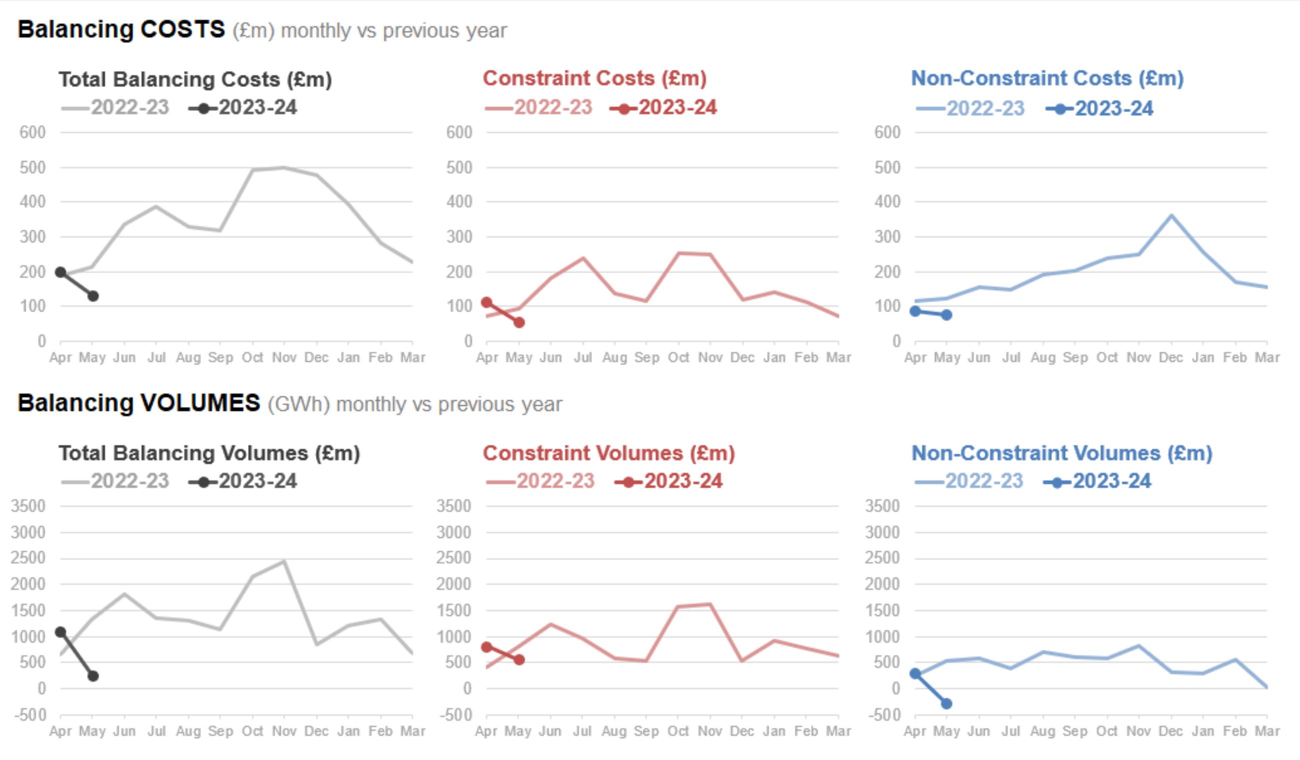
- **Constraint-England & Wales**: £26.5m decrease, due to significant lower volume of actions
- **Constraint-Scotland**: £6.9m decrease, due to lower volume of actions.

- **Constraints Sterilised Headroom**: £22.2m decrease. Cost decrease is in line with the decreasing of constraint actions because less headroom had to be replaced on the system outside the constraint through BM actions.

Non-constraint costs: The main drivers of the biggest variances this month are detailed below:

- **Energy Imbalance**: £5.9m decrease. Lower volume of actions needed to balance the system.
- **Minor Components**: £3.5m increase, due to higher volume of actions.

Constraint vs non-constraint costs and volumes



Please note that a portion of the **Minor Components** spent contributing to non-constraint cost and volume is Operating Reserve cost (but not limited to) and volume. The narrative below discusses the broad themes of spend. The figures will be revised once the data issue is resolved.

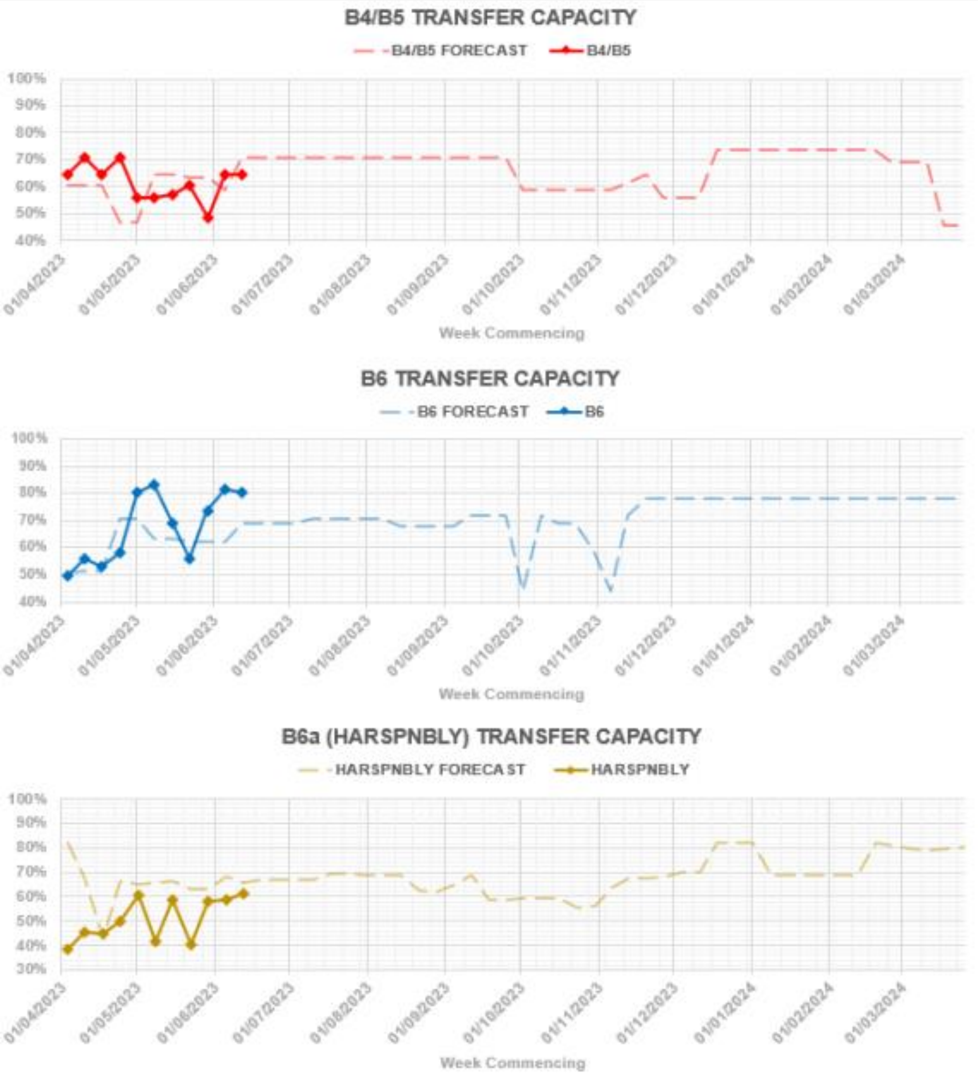
Constraint costs

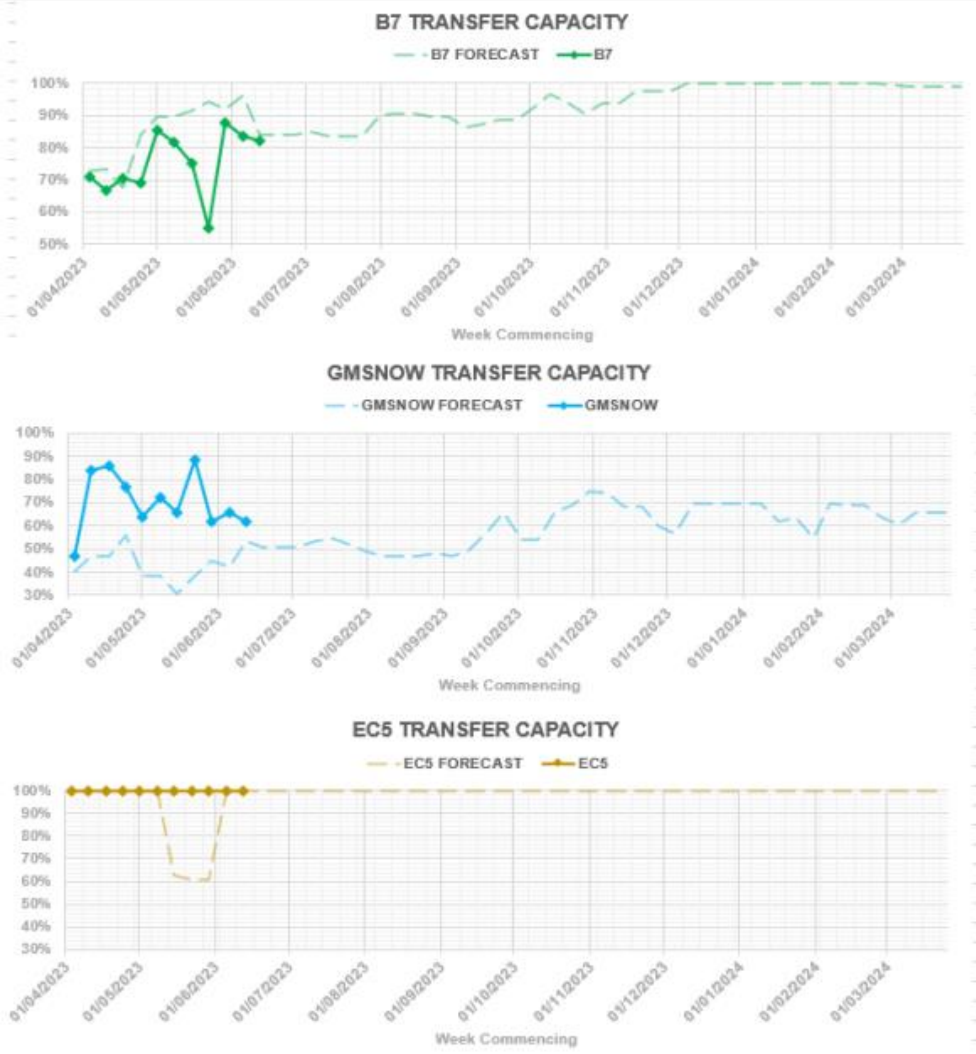
Compared with the same month of the previous year:	Constraint costs were **£37m lower** than in May 2022 due to: • Lower volume of actions • Lower average wholesale prices.
Compared with last month:	Constraint costs were **£58m lower** than in April 2023 due to: • Lower volume of actions. • Lower average wholesale prices.

Non-constraint costs

Compared with the same month of the previous year:	Non-constraint costs were **£44m lower** than in May 2022 mainly because significant lower volume of actions.
Compared with last month:	Non-constraint costs were **£8m lower** than in April 2023 due to: • Lower average wholesale prices. • Lower volume of actions

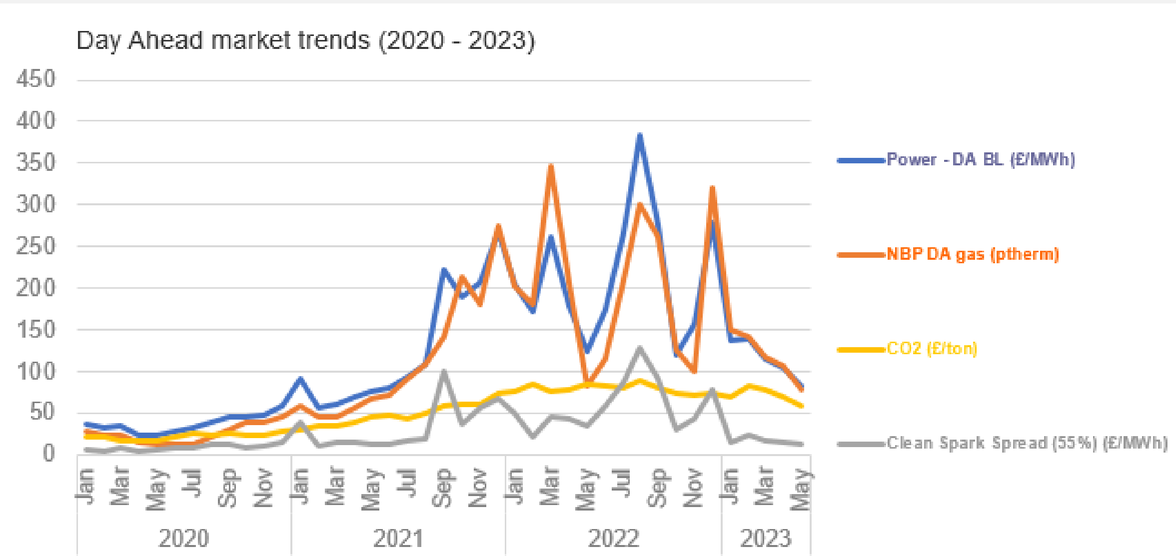
Network availability 2023-24





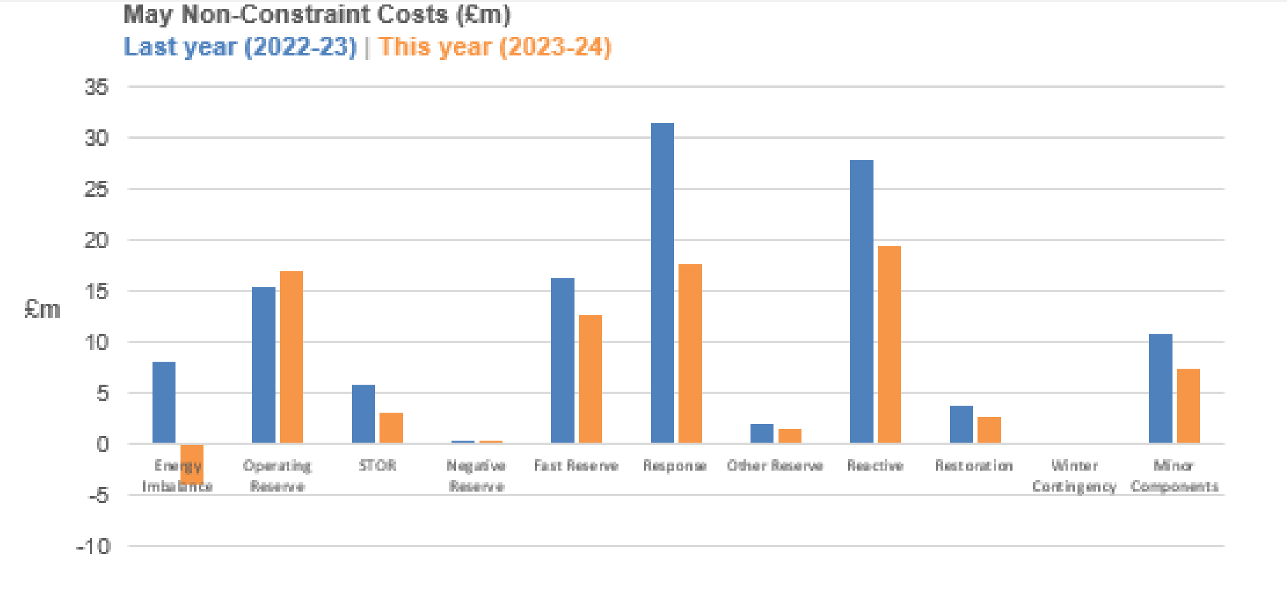
Please note that transfer capacity is discussed in more detail at each week's Operational Transparency Forum. Details of how to sign up, and recordings of previous meetings are available here.

Changes in energy balancing costs



DA BL: Day Ahead Baseload **NBP DA:** National Balancing Point Day Ahead

Power day ahead prices, day ahead Gas prices, Clean Spark Spread and Carbon prices decreased from last month and remain lower compared to the previous year.



Comparing the non-constraint costs of May 2023 with those of May 2022, all the categories showed a decrease or a small deviation from the previous period due to lower volume of actions it took to balance the system and the drop in average wholesale prices.

We do not cover the variation in Minor Components here as it is driven by the data issue referenced earlier.

Drivers for unexpected cost increases/decreases

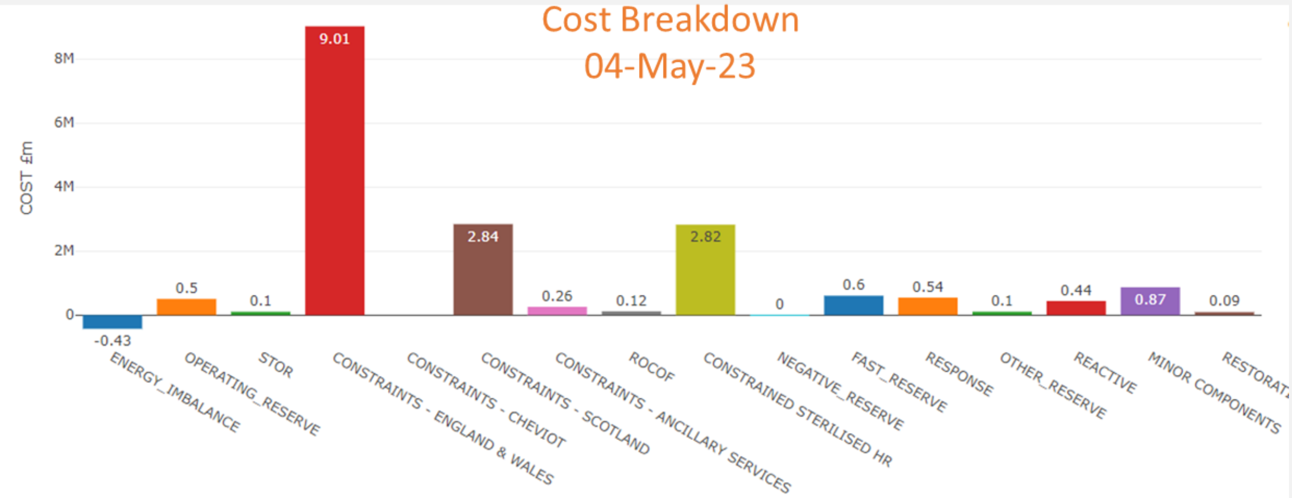
Margin prices (the amount paid for one MWh) have increased compared to April 2023 and the corresponding period of the previous year.

Daily Costs Trends

As discussed above, May's balancing costs were £66m lower than the previous month due to lower volume of actions and lower average of wholesale prices.

At the date of publication, we have recorded 2 days with a spend of more than £10m:

- On Thursday 04 May when costs were around £17m, the major cost component was driven by the constraints due to high wind speed resulting in more BM actions required to curtail generation in order to manage thermal constraints.



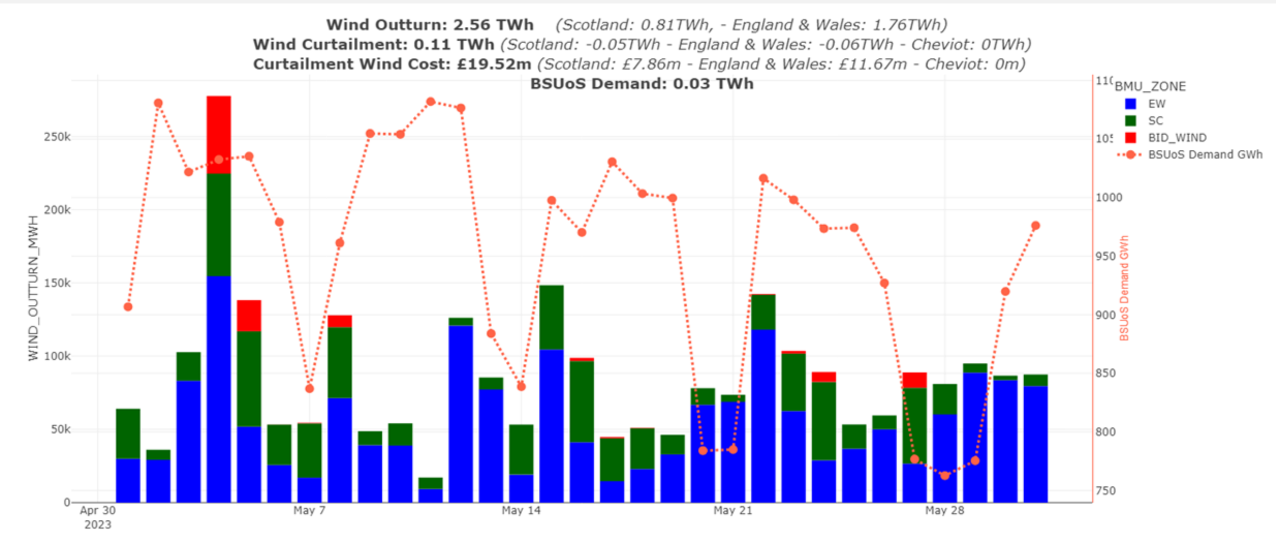
There was a similar picture for the second highest cost day, namely 29 May, with thermal constraints being the main drivers behind costs.

The minimum cost of £1.7m was observed on 3 May, which was a sunny day, with up to 8.6GW PV output. Wind was low during the early morning but picked up throughout the day. No constraints were active. Demand out turned lower than expected (probably due to high solar output) even with the wind 700MW below forecast. The continental interconnectors reduced flow by up to 600MW.

On the other hand, 4 May was a high wind day with 15GW of wind increased to 19GW and also high PV output. Constraint issues were experienced with some pre-fault flows greater than 84%. Interconnector flow changes occurred at the hourly gates. Austrian Power Grid declared Alert state on the ENTSOe Awareness System (EAS) with a reason code of 'N-1 Violation'. TenneT Germany & TenneT NL declared Alert state, both due to 'Loss of Tools'. The Hungarian TSO (MAVIR) declared Alert state with a reason code of 'Critical Event'. The volume of wind bids was reduced overnight as the Western HVDC link increased transfer and the overall wind generation decreased.

The average daily spent for the month was 4.3m, a £2.3m decrease from the previous month.

Daily Wind Outturn – Wind Curtailment and BSUoS Demand



High-cost days and balancing cost trends are discussed every week at the Operational Transparency Forum to give ongoing visibility of the operability challenges and the associated ESO control room action

Metric 1B Demand forecasting accuracy

This metric measures the average absolute MW error between day-ahead forecast demand (taken from Balancing Mechanism Report Service (BMRS19) as the National Demand Forecast published between 09:00 and 10:00) and outturn demand (taken from BMRS as the Initial National Demand Outturn) for each half hour period. The benchmarks are drawn from analysis of historical errors for the five years preceding the performance year.

A 5% improvement in historical 5-year average performance is expected, whilst coming within ±5% of that value is required to meet expectations.

In settlement periods where Optional Downward Flexibility Management (ODFM) and/or Demand Flexibility Service (DFS) are instructed by the ESO, this will be retrospectively accounted for in the data used to calculate performance. The ESO shall publish the volume of instructed ODFM to enable this to be done.

Performance will be assessed against an annual benchmark, but monthly benchmarks are also provided as a guide. The ESO will report against these each month to provide transparency of its performance through the year.

May 2023 performance

Indicative benchmark figures for 2023-24: Please note that the benchmark figures used below are indicative only. We have calculated these in line with the method specified by Ofgem, but we have not yet received the confirmed figures from Ofgem. We will update the April and May performance in subsequent reports once the benchmark has been finalised.

Figure 2: 2023-24 Monthly mean absolute MW error vs Indicative Benchmark

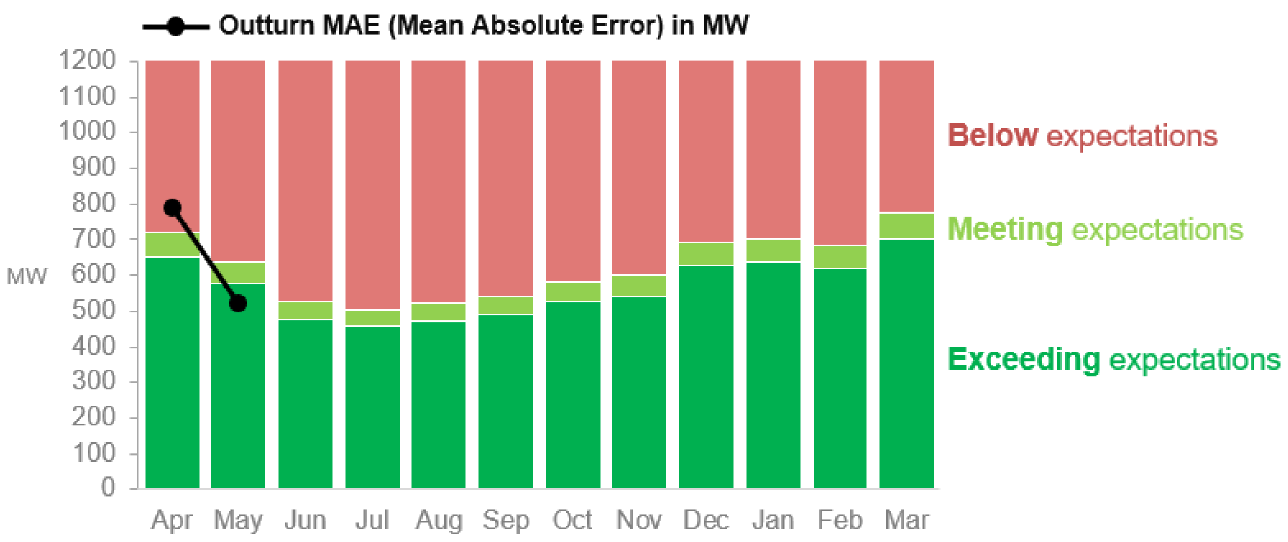


Table 2: 2023-24 Monthly mean absolute MW error vs Indicative Benchmark

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Indicative benchmark (MW)	687	606	503	481	497	516	554	571	659	669	651	738
Absolute error (MW)	**791**	**524**										
Status	● (red)	● (green)										

Performance benchmarks:

- **Exceeding expectations:** >5% lower than 95% of average value for previous 5 years
- **Meeting expectations:** ±5% window around 95% of average value for previous 5 years
- **Below expectations:** >5% higher than 95% of average value for previous 5 years

Supporting information

In May 2023, the mean absolute error (MAE) of our day ahead demand forecast was 524 MW compared to the indicative performance target of 606 MW, and therefore exceeded expectations.

The weather in May was dominated by high-pressure systems, which generally work to suppress strong and gusty winds. The relative omission of these variable conditions made for higher accuracy in May compared to April, and previous 5 years' worth of May data.

May is often challenging, with the added uncertainty of two (minimum) Bank Holidays and half-term School Holidays. This year was further problematic with the Kings Coronation and additional Bank Holiday. The daily error on the Coronation day (Sat 6) was 664 MW – slightly higher than the monthly target, but quite accurate for such a large event day without modern precedent, and with weather conditions worsening overnight.

In general, spring / early summer is when PV outturn is highest – and with this high PV generation comes the risk of high solar errors, particularly due to cloud cover appearing/burning off in short timescales. For the small number of days with relatively higher demand error, the main contributor was solar forecast error. One of these challenging days (29 May) with larger solar error also overlapped with the spring bank holiday.

The distribution of settlement periods by error size is summarised in the table below:

Error greater than	Number of SPs	% out of the SPs in the month (1488)
1000 MW	207	14%
1500 MW	64	4%
2000 MW	21	1%

The days with largest MAE were May 29, 20 and 18.

Missed / late publications

There were 0 occasions of missed or late publications in May.

Triads

Triads only take place between November and February, and therefore did not impact on forecasting performance during May.

Metric 1C Wind forecasting accuracy

This metric measures the average absolute percentage error (APE) between day-ahead forecast (between 09:00 and 10:00, as published on ESO Data Portal here) and outturn wind generation (settlement metering as calculated by Elexon) for each half hour period as a percentage of capacity for BM wind units only. The data will only be taken for sites that did not have a bid-offer acceptance (BOA) during the relevant settlement period.

The ESO will publish this data on its Data Portal for transparency purposes. The benchmarks are drawn from analysis of historical errors of the five years preceding the performance year. 5% improvement in performance expected on the 5-year historical average, with range of ±5% used to set benchmark for meeting expectations.

May 2023 performance

Indicative benchmark figures for 2023-24: Please note that the benchmark figures used below are indicative only. We have calculated these in line with the method specified by Ofgem, but we have not yet received the confirmed figures from Ofgem. We will update the April and May performance in subsequent reports once the benchmark has been finalised.

Figure 3: 2023-24 BMU Wind Generation Forecast APE vs Indicative Benchmark

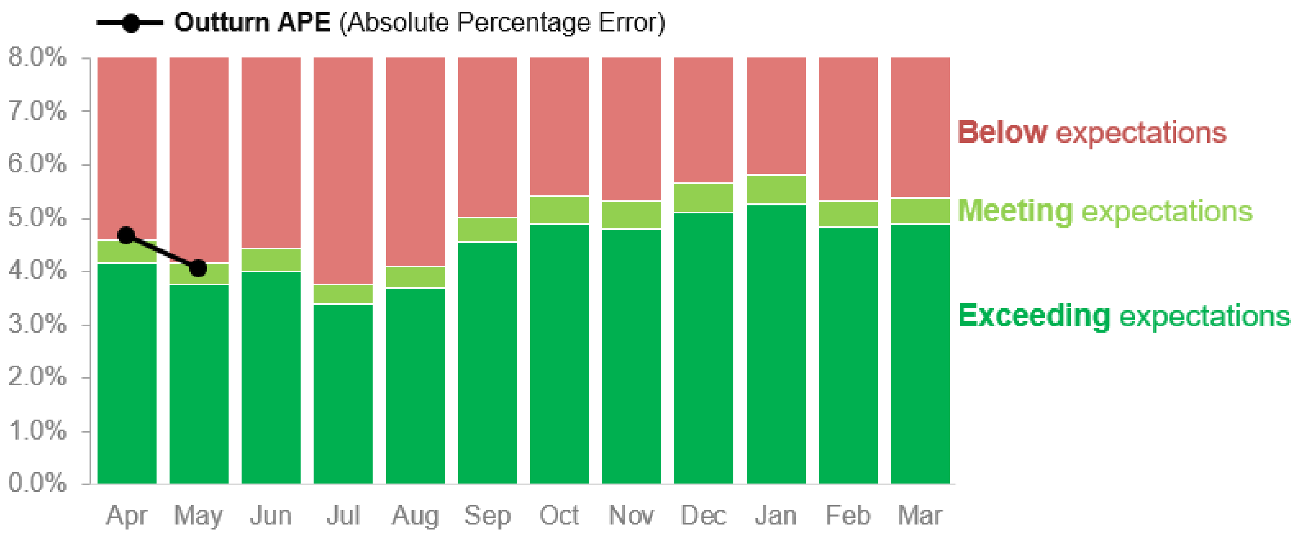


Table 3: 2023-24 BMU Wind Generation Forecast APE vs Indicative Benchmarks

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Indicative benchmark (%)	4.38	3.95	4.21	3.57	3.89	4.79	5.15	5.06	5.38	5.53	5.08	5.14
APE (%)	**4.69**	**4.08**										
Status	🔴	🟢										

Performance benchmarks:

- **Exceeding expectations:** < 5% lower than 95% of average value for previous 5 years
- **Meeting expectations:** ±5% window around 95% of average value for previous 5 years
- **Below expectations:** > 5% higher than 95% of average value for previous 5 years.

Supporting information

In May the wind power forecast accuracy achieved was 4.08% which is within +/-5% of the benchmark of 3.95% and therefore met expectations.

Generally, the weather was stable and settled during the month of May. A short-wave trough (short period of large wind suppression) passed through on 5/6 May, resulting in significant (~3GW) forecast errors. Similar days of chaotic weather activity on 8 May and 15 May, again resulted in comparably-sized forecast errors: with the peak error exceeding 20% (~3.6GW) briefly on 15 May.

For a large portion of May the wind direction was from the North/North-East. Our wind farm models are currently not tuned for wind direction variances and so we would normally expect this to cause a reduction in wind power forecast accuracy; particularly for onshore windfarms.

Negative prices

Wind farms with CFD contractual arrangements switch off for commercial reasons while prices are negative for 6 hours or more. In May there were no occasions when the electricity price went negative. The electricity price used for this analysis is the Intermittent Market Reference Price. Market Price Data can be downloaded from here. https://www.emrsettlement.co.uk/settlement-data/settlement-data-roles/

Withdrawal of wind units

According to operational data there is no indication that any wind units withdrew their capacity in the month of May.

Missed / late publications

In May there were no occasions of late or missing publications of the forecast.

Metric 1D Short Notice Changes to Planned Outages

This metric measures the number of short notice outages delayed by > 1 hour or cancelled, per 1000 outages, due to ESO process failure.

May 2023 performance

Figure 4: 2023/24 Number of outages delayed by > 1 hour, or cancelled, per 1000 outages

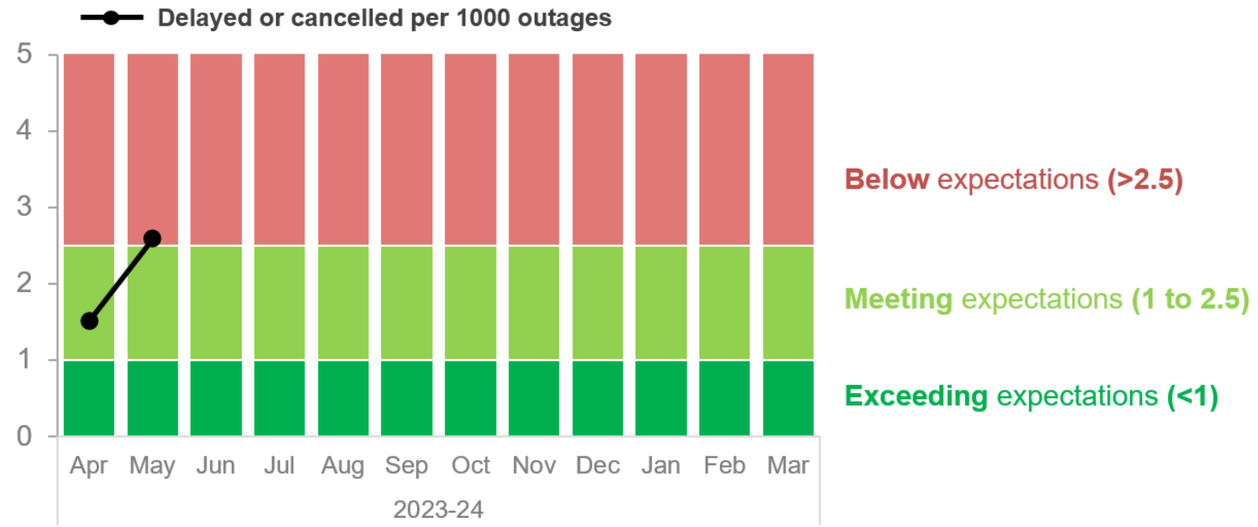


Table 4: Number of outages delayed by > 1 hour, or cancelled, per 1000 outages

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	YTD
Number of outages	664	772											1436
Outages delayed/cancelled due to ESO process failure	1	2											3
Number of outages delayed or cancelled per 1000 outages	1.5	2.6											2.1
Status	●	●											●

Performance benchmarks:

- **Exceeding expectations:** Fewer than 1 outage delayed or cancelled per 1000 outages
- **Meeting expectations:** 1-2.5 outages delayed or cancelled per 1000 outages
- **Below expectations:** More than 2.5 outages delayed or cancelled per 1000 outages

Supporting information

In May, we successfully released 772 outages and there were two delays or cancellations that occurred due to an ESO process failure. The number of stoppages or delays per 1000 outages is 2.59, which is outside benchmark range of less than 2.5 delays or cancellations per 1000 outages and therefore below expectations. The events can be summarized below:

The first delay occurred on an outage where there was a clash between two outages that could not occur simultaneously. There was an on-going busbar outage at a 400kV substation that could not proceed with taking out a particular 400kV circuit due to the impact it would have on a transmission connected generator for a specific fault. This clash of outages was not identified within planning timescales due to human error, and when it reached the control room the outage was postponed until the busbar outage had returned. An Operational Learning Note is being written to capture preventative actions.

The second delay occurred where there was a request to take a major outage on a 400kV circuit that has a big influence on the Main Interconnected System (MIS) power flows and the ability to secure a large demand group. The unavailability of several synchronous generators that were on outage provided further challenges to secure the import constraint by impacting on the use of an HVDC link . This HVDC link was seen as one of the solutions to manage the challenging outage. Due to the complexity of the outage, it required many different scenarios to be assessed to ensure all voltage challenges could be mitigated. As the Emergency Return to Service (ERTS) was high at 12 days, the outage was passed back to planning to conduct further studies and re-assure the control room that all scenarios were securable and mitigations were identified. An Operational Learning Note (OLN) is being written to capture the sequence of events and identify preventative actions.

RRE 1E Transparency of operational decision making

This Regularly Reported Evidence (RRE) shows the percentage of balancing actions taken outside of the merit order in the Balancing Mechanism each month.

We publish the Dispatch Transparency dataset on our Data Portal every week on a Wednesday. This dataset details all the actions taken in the Balancing Mechanism (BM) for the previous week (Monday to Sunday). Categories and reason groups are allocated to each action to provide additional insight into why actions have been taken and ultimately derive the percentage of balancing actions taken outside of merit order in the BM.

Categories are applied to all actions where these are taken in economic order (also called merit order or Merit) or an electrical parameter drives that requirement. Reason groups are identified for any remaining actions where applicable. Additional information on these categories and reason groups can be found on our Data Portal in the Dispatch Transparency Methodology.

Categories include: System, Geometry, Loss Risk, Unit Commitment, Response, Merit

Reason groups include: Frequency, Flexibility, Incomplete, Zonal Management

The aim of this evidence is to highlight the efficient dispatch currently taking place within the BM while providing significant insight as to why actions are taken in the BM. Understanding the reasons behind actions being taken out of pure economic order allows us to focus our development and improvement work to ensure we are always making the best decisions and communicating this effectively to our customers and stakeholders.

We have been publishing the Dispatch Transparency dataset since March 2021, and it has sparked many conversations amongst market participants. As we continue to publish this dataset for BP2 we will also be providing additional narrative to help build trust by explaining:

- actions we are taking to increase understanding of the ESO's operational decision making
- insight into the reasons why actions are taken outside of merit order in the Balancing Mechanism
- activity planned and taken by the ESO to address and reduce the need for actions to be taken out of merit order.

May 2023 performance

Figure 5: 2023-24 Percentage of balancing actions taken in merit order in the BM

Table 5: Percentage of balancing actions taken outside of merit order in the BM

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Percentage of actions taken in merit order, or out of merit order due to electrical parameter (category applied)	94.1%	90.9%										
Percentage of actions that have reason groups allocated (category applied, or reason group applied)	99.7%	99.6%										
Percentage of actions with no category applied or reason group identified	0.3%	0.4%										

Supporting information

May performance

This month 90.9% of actions were taken in merit order or taken out of merit order due to an electrical parameter. For the remaining actions, where possible, we allocate actions to reason groups for the purposes of our analysis. During May 2023, there were 38562 BOAs (Bid Offer Acceptances) and of these, only 155 remain with no category or reason group identified, which is 0.4% of the total.

Dispatch Transparency Event

In May we continued preparations for the online Dispatch Transparency event to take place on 2 June. By the end of May over 350 people had signed up to participate in the event which confirms our stakeholders interest in learning more about the topic.

Details of the planned content were shared in the April report, at the Operational Transparency Forum, and to additional stakeholders who had previously expressed an interest.

When signing up, we asked participants to tell us what they hope to get out of the event.

The webinar recordings and slides will be shared alongside the Q&A document on our Operational Transparency Forum webpage. Next month we will report on the event itself including insights from the participants' feedback.

Plans to enhance commentary in future reports

During June we will also engage with Ofgem to ensure we understand the expectations for providing the following in our commentary:

- Insight into the reasons why actions are taken outside of merit order in the Balancing Mechanism
- Activity planned and taken by the ESO to address and reduce the need for actions to be taken out of merit order.

RRE 1G Carbon intensity of ESO actions

This Regularly Reported Evidence (RRE) measures the difference between the carbon intensity of the combined Final Physical Notification (FPN) of machines in the Balancing Mechanism (BM) and the equivalent profile with balancing actions applied.

This takes account of both transmission and distribution connected generation and each fuel type has a Carbon Intensity in gCO2/kWh associated with it. For full details of the methodology please refer to the Carbon Intensity Balancing Actions Methodology document. The monthly data can also be accessed on the Data Portal here. Note that the generation mix measured by RRE 1F and RRE 1G differs.

It is often the case that balancing actions taken by the ESO for operability reasons increase the carbon intensity of the generation mix. More information about the ESO's operability challenges is provided in the Operability Strategy Report.

May 2023 performance

Figure 6: 2023-24 Average monthly gCO2/kWh of actions taken by the ESO (vs 2022-23)

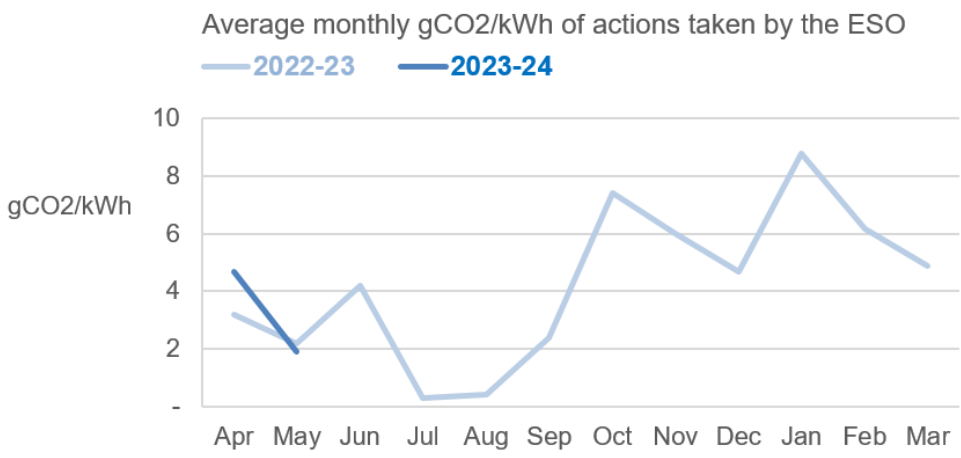


Table 6: Average monthly gCO2/kWh of actions taken by the ESO

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Carbon intensity (gCO2/kWh)	4.7	1.9										

Supporting information

In May 2023, the average carbon intensity of balancing actions was 1.9 gCO2/kWh. This is 0.3g lower than May 2022.

Across the month, our actions reduced the carbon intensity in 60% of settlement periods. The greatest impact of our actions on carbon intensity was seen on 4 May and across the spring bank holiday weekend (27-29 May). High winds on 4 May coupled with interconnector imports required wind output to be constrained. Gas-fired generation was required to support voltage and inertia requirements.

Across the 27-29 May, low demands and high volumes of solar generation and interconnector imports led to the market carbon intensity being <50g CO2/kWh. This scenario required the ESO to synchronise gas fired generation to support voltage and inertia requirements and ensure enough available generating margin.

To show the impact of those three days alone, excluding them month's figures would leave the average carbon intensity of balancing actions at -1.0 gCO2/kWh.

RRE 1I Security of Supply

This Regularly Reported Evidence (RRE) shows when the frequency of the electricity transmission system deviates more than ± 0.3Hz away from 50 Hz for more than 60 seconds, and where voltages are outside statutory limits. On a monthly basis we report instances where:

- The frequency is more than ± 0.3Hz away from 50 Hz for more than 60 seconds
- The frequency was 0.3Hz - 0.5Hz away from 50Hz for more than 60 seconds.
- There is a voltage excursion outside statutory limits. For nominal voltages of 132kV and above, a voltage excursion is defined as the voltage being more than 10% away from the nominal voltage for more than 15 minutes, although a stricter limit of 5% is applied for where voltages exceed 400kV.

For context, the **Frequency Risk and Control Report** defines the appropriate balance between cost and risk, and sets out tabulated risks of frequency deviation as below, where 'f' represents frequency:

Deviation (Hz)	Duration	Likelihood
f > 50.5	Any	1-in-1100 years
49.2 ≤ f < 49.5	up to 60 seconds	2 times per year
48.8 < f < 49.2	Any	1-in-22 years
47.75 < f ≤ 48.8	Any	1-in-270 years

At the end of the year, we will report on frequency deviations with respect to the above limits and communicate any plans for future changes to the methodology.

May 2023 performance

Table 7: Frequency and voltage excursions (2023-24)

	2023-24											
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Frequency excursions (more than 0.5 Hz away from 50 Hz for over 60 seconds)	0	0										
Instances where frequency was 0.3 – 0.5 Hz away from 50Hz for over 60 seconds	0	0										
Voltage Excursions defined as per Transmission Performance Report[2]	0	0										

Supporting information

There were no reportable voltage or frequency excursions in May.

[2] https://www.nationalgrideso.com/research-publications/transmission-performance-reports

RRE 1J CNI Outages

This Regularly Reported Evidence (RRE) shows the number and length of planned and unplanned outages to Critical National Infrastructure (CNI) IT systems.

The term 'outage' is defined as the total loss of a system, which means the entire operational system is unavailable to all internal and external users.

May 2023 performance

Table 8: 2023-24 Unplanned CNI System Outages (Number and length of each outage)

	2023-24											
Unplanned	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Balancing Mechanism (BM)	0	0										
Integrated Energy Management System (IEMS)	0	0										

Table 9: 2023-24 Planned CNI System Outages (Number and length of each outage)

	2023-24											
Planned	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Balancing Mechanism (BM)	0	0										
Integrated Energy Management System (IEMS)	0	0										

Supporting information

There were no outages, either planned or unplanned, during May 2023.

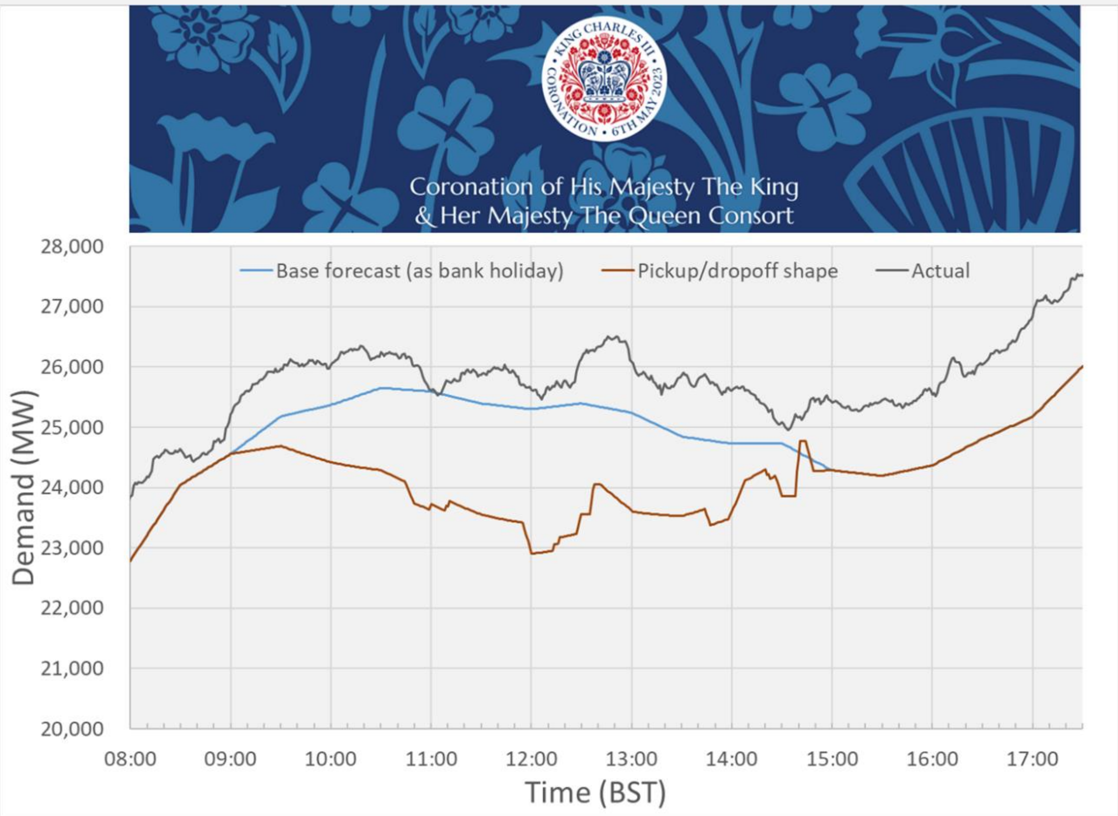
Notable events during May 2023

Managing the system through the Coronation

The Coronation of King Charles III and Queen Camilla took place on 6th May 2023. In preparation for this we created a bespoke planning team with SMEs from across ESO teams, including the duty control room team on the day of the coronation. We put in place daily 'stand-up' calls to coordinate our planning activities including energy and weather forecasting, frequency response and reserve holdings, treatment of interconnectors, plant scheduling requirements, resourcing and transmission network planning. Using the coronation event timings, supplied to us by DESNZ, and our experience of managing Royal events including the Queen's Funeral, we were able to create a demand forecast curve to upload to our Balancing Mechanism systems. We collaborated with National Grid Electricity Transmission (NGET) to ensure the integrity of the transmission system in London was as strong as possible leading up to the coronation, resulting in NGET restoring to service two key transmission circuits and three key supergrid transformers feeding central London.

The duty control room team on 6 May implemented the operational plan, putting in place defensive measures including scheduling and dispatching additional Frequency Response and Reserve such as pumped storage plant, trading on one of the interconnectors (IFA2) to provide upward and downward margin and arranging with the French Transmission System Operator (TSO) to be able to take emergency actions on interconnectors if required.

The underlying demand profile out-turned much higher than forecast (1.5 – 2.5GW) due to the inclement weather. Throughout the duration of the coronation, between 10:20 and 14:45, the impact on national demand was significant, including several reductions and increases in the range 200 – 650MW. These broadly followed the forecast demand curve being used but the 11:00 demand increase after the arrival of the King at Westminster Abbey was not expected. The duty control room team successfully maintained the second-by-second system frequency within normal limits throughout the event, 49.8 - 50.2 Hertz, and there were no instances to threaten transmission system security. Thus, we were able to successfully play our part in this historic occasion.



Role 2 (Market developments and transactions)

ESO

RRE 2E Accuracy of Forecasts for Charge Setting – BSUoS

This Regularly Reported Evidence (RRE) shows the accuracy of Balancing Services Use of System (BSUoS) forecasts, used to set industry charges, against the actual outturn charges.

May 2023 performance

Figure 7: 2023-24 Monthly BSUoS forecasting performance (Absolute Percentage Error)

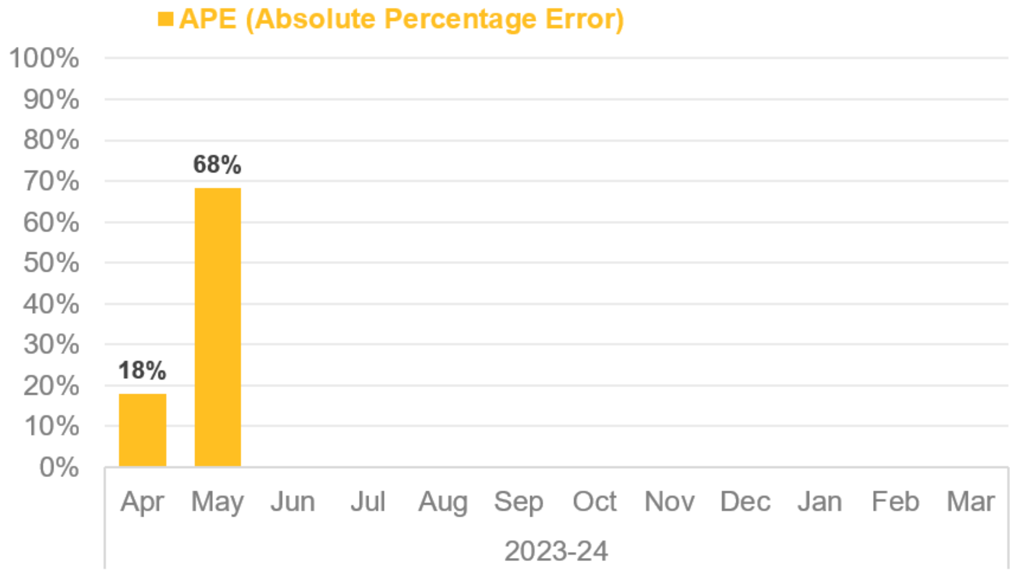


Table 10: Month ahead forecast vs. outturn BSUoS (£/MWh) Performance[3] - one-year view

	Apr[4]	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Actual	10.8	8.2										
Month-ahead forecast	12.7	13.8										
APE (Absolute Percentage Error)[5]	**18.0**	**68.4**										

Supporting information

Context

The BSUoS charge (£/MWh) is now based upon a fixed tariff that was published in January 2023. Daily balancing costs (and other costs that ultimately make up the costs recovered through the BSUoS charge) were forecast for the year ahead and two 6-month tariffs were set to cover the 2023/24 charging year. We continue to forecast balancing costs monthly and measure our performance against this forecast as it remains an important metric to support the fixed tariff methodology, by being the main component of the fixed BSUoS tariff. The BSUoS cost forecast (costs rather than what is charged against the fixed tariff) is probabilistic and therefore produces percentile values. The published forecast for each month is based on the central value of the BSUoS cost forecast (50th percentile). If the outturn BSUoS costs are below the

[4] The month-ahead forecast and APE for April have been revised as a data error has been corrected. Month ahead forecast revised from £13.4/MWh to £12.7/MWh and APE revised from 24.0% to 18.0%.
[5] Monthly APE% figures may change with updated settlements data at the end of each month. Therefore, subsequent settlement runs may impact the end of year outturn.

50th percentile of the cost forecast, then the actual costs for that month would be lower than the forecast predicted, provided the actual volume is at or above the estimate (and vice versa).

May Performance:

Absolute Percentage Error (APE) increased from 18% in April 2023 to 68% in May 2023, mainly due to May outturn costs being lower than forecast, as detailed below.

Costs:

May outturn costs were below the 5th percentile of the forecast produced at the beginning of April.

This is firstly due to the wholesale electricity prices being 31% lower in outturn (£80/MWh) than the forward market prices available at the beginning of April (£115/MWh).

Secondly, the proportion of demand met by renewable generation was lower in outturn (19%) than the forecast at the beginning of April (28%). The proportion of demand met by renewables is a main driver in BSUoS costs, as a high proportion of renewables tends to driver higher constraint costs.

Forecast for May made at the start of April: £243 million.

Outturn costs for May: £131 million.

Volumes:

May actual volume was broadly in line with the forecast.

Forecast BSUoS volume (made at the start of April): 21.4 TWh

May actual BSUoS volume: 20.5TWh

Notable events during May 2023

Balancing Services Roadshows

Building on the success of the 2022 Response Reform roadshows we hosted two drop-in events again this year, one in Edinburgh on 18 May and one in London on 24 May. Recognising the close interaction of our projects across Balancing Services we expanded the scope of discussion and brought together specialists from the following project areas:

- Response
- Reserve
- Balancing Reserve
- Single Markets Platform
- Enduring Auction Capability
- Markets Roadmap

We had a great turn out at both events with attendance from market participants, asset owners, investment groups, market analysts, academic researchers, and many others. We discussed current market conditions and our plans for the future of the markets. Attendees provided valuable insight on their areas of interest and suggestions for future market reform. Each project team will incorporate feedback received.

DFS delivers electricity to power 10 million homes

Following verification of market data we can now confirm that the Demand Flexibility Service, put in place by the ESO across the 2022/2023 winter, saved over 3,300MWh of electricity as consumers and businesses did their part to reduce demand at key times. In total, this was enough to power nearly 10 million homes across Great Britain, for a single hour.

1.6million households and businesses participated in the Demand Flexibility Service, delivering demand reduction across 22 events over the winter. Southern England, East of England and East Midlands led the way by each saving over 370MWh across the 22 events. Welsh consumers and businesses delivered an estimated electricity reduction of over 348MWh across the winter, enough to power over 1 million households, roughly 80% of Wales' 1.3 million homes, for a single hour.

The 22 sessions covered both live events to balance Great Britain's electricity network and monthly test events to deliver savings for consumers. This has demonstrated interest and enthusiasm for consumer flexibility on a scale not previously seen in the UK. Across this winter consumers and small and medium sized businesses worked with the ESO, 31 suppliers and aggregators, to deliver new levels of demand flexibility, unseen on Great Britain's electricity network until now.

Role 3
(System insight, planning and network development)

ESO

Metrics and RREs: Please note there are no metrics or monthly RREs for Role 3

Notable events during May 2023

New Megawatt (MW) Dispatch Service

In May, we published our Megawatt (MW) Dispatch service details including visibility and control requirements. This paper provides an overview of the MW Dispatch functionality as developed with National Grid Electricity Distribution (NGED) and UK Power Networks (UKPN). The MW Dispatch project is delivering a whole electricity system operational solution which enables a coordinated approach to managing transmission network constraints between ESO and each partner Distribution Network Operators (DNO). We plan to go live September time for our first DNO and then late this year/early next year with the second.

ESO's Mega Watt Dispatch service is currently under development and is due to go live in the South of England later this year. The Mega Watt Dispatch service will mean lower bills for customers as it gives us more dispatch options to secure the system.

The service is being developed in conjunction with 2 of our Distribution Network Operator (DNO) partners, National Grid Electricity Distribution (NGED) in the south-west of England and UK Power Networks (UKPN) along the south coast. The service is anticipated to go live in the NGED area in September this year and in the UKPN area in late 2023 / early 2024.

The service will allow the ESO Control Room teams to request that generators embedded in the Distribution network reduce their generation output down to zero at times of particular network congestion and where we have constraints on the flow of electricity on the network. Generators that are requested to reduce their output to zero will be paid for the time that they are curtailed and are able to amend their curtailment price each day should they wish to reflect market trends and conditions.

The curtailment requests will be issued by ESO and will be passed to the generators via the DNO Network Management and Control Equipment. Each curtailment request will be open ended, ceasing when the ESO Control Room Engineer makes the decision to issue a cease instruction which again is issued via the DNO to the generator.

New energy storage policy to speed up 95GW in connections queue

We held a Connections Seminar in Glasgow on 16 May for our existing and prospective customers to come and engage with the Connections Team and for the ESO to ensure important internal and external topics are shared with the industry.

Over 100 industry delegates were able to join us and it was great to reconnect in person and discuss everyone's thoughts on everything happening across connections. During the seminar we announced the next stage of our five-point plan to speed up the connection processes, enabling energy storage projects to the connect to the grid more quickly through a non-firm connections agreement. Potentially speeding up connections for up to 95GW of energy storage projects in the pipeline.

We remain committed to addressing issues with the connections process via the actions outlined in our five-point plan and Connections Reform project, where we will continue to engage with stakeholders.

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