Winter Balancing Costs Review

ESO

Foreword

Welcome

At ESO our core objectives are to minimise consumer costs whilst providing a secure electricity system and enabling the energy transition. This report has been commissioned to explore drivers of balancing market costs over the winter period and identify any improvement actions available.

Following on from the Balancing Market Review conducted last winter, LCP have undertaken similar analysis working with ESO between November 2022 and March 2023. This report provides a data driven and independent review of the direct costs of balancing mechanism (BM) and trade actions taken by ESO to manage overall system operability, this allows for direct comparisions between various wholesale energy products but does not provide a review of ancillary service markets.

Winter 2022 has seen the costs of BM and trade actions fall by 20%[1] from their peak last winter with this change driven by lower average prices than winter 2021. However, this still marks a very significant increase compared with previous years, driven by persistently high wholesale gas prices which only began to fall towards the end of winter but remain at historically high levels.

A key positive finding of this report is that the pricing behaviour identified in the Winter 2021 Balancing Market Review of units using their inflexibility to achieve very high market prices has significantly reduced with consumer costs from this specific commercial strategy reducing by £199 million between winters.

However, despite reductions in these costs, overall action volumes increased 12%. Key drivers for this increase were actions to manage system inertia and footroom requirements. Ongoing work stemming from the frequency risk and control report is expected to offset £1.8bn of these actions across 2023/2024.

In addition, volumes of actions taken to manage margin also increased between winters. This is a key focus area for ESO with new reserve services being introduced to support this requirement more efficiently.

At ESO we will continue to share these learnings across the business and the wider industry as we continue to seek improvements to minimise the consumer impact of balancing actions. With this in mind, following publication of this report we are engaging with all parties via an open workshop to provide qualitative insights to this data driven report and will include the outcomes of this in a follow up publication.

Claire Thorpe-Morris

Senior Market Monitoring Manager

[1]Ancillary service markets across this same period represent a further £698M but are excluded from this review.

Key Findings

Total Costs

BM Costs in Winter 2022/23 are down from the previous winter but still remain historically high.

The total cost of Bids, Offers and trades accepted through the Balancing Markets (BM) for Winter 22/23 was £1,235M, down 20% from the peak of £1,546M in Winter 21/22. This does not include ancillary service markets which were out of scope for this analysis to allow analogous comparison between wholesale energy markets.

BM costs in Winter 2021/22 and 2022/23 have been historically high due to:

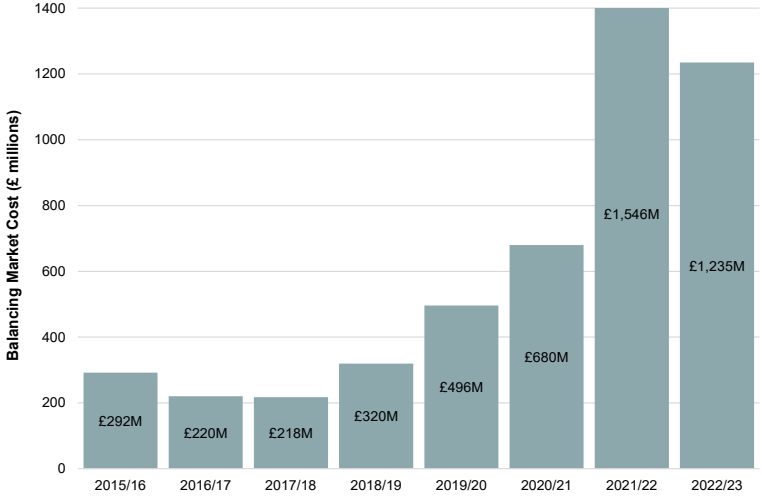
- High gas prices, increasing the operating costs for gas generators and reducing competitive pressures on other fuel sources
- High costs associated with maintaining required reserve
- Very high and very low wind output scenarios

When tighter system margins occur this means that scarcity pricing can dominate the overall action costs, this winter £310M of BM acceptance costs were due to maintaining sufficient reserve.

High gas prices increase the costs for gas generators to operate, and this pushes up the costs of their electricity generated. This winter £756M in BM and trade acceptance costs has been from units which use gas to generate electricity.

Increased wind output can lead to thermal congestion and therefore the requirement to reduce the wind output and replace that energy in areas not affected by the constraint limits. Direct payments to wind to manage thermal congestion were £71M this winter with a further £110M in costs to replace the energy deficit created by these actions.

Total BM & Trade Cost by Winter



This graphic represents the total costs of bid offer acceptances and Balancing Service Adjustment Data excluding ancillary service costs.

Key Findings

Market Prices

Winter 22/23's historically high BM costs have been driven by changes in market prices, rather than changes in energy volumes.

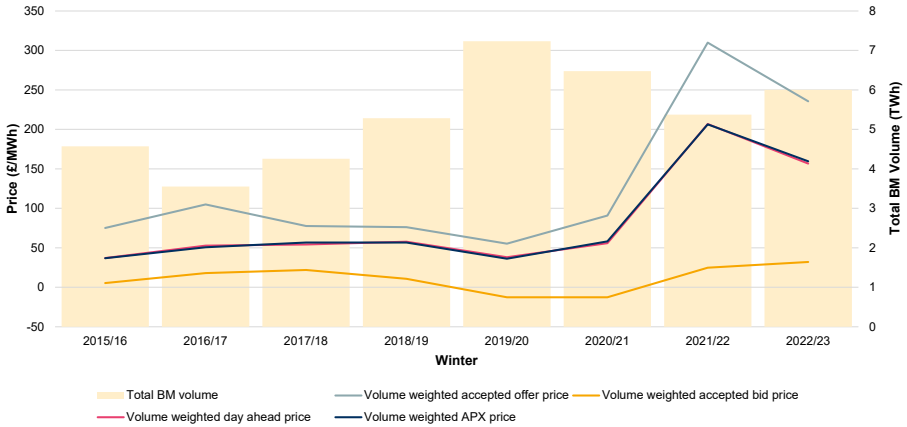
Compared to last winter, wholesale prices have reduced:

- The BM volume weighted average accepted offer price has reduced by **24%**
- The intra-day market price has reduced by **22%**
- The day-ahead market price has reduced by **24%**
- The intra-day gas price has reduced **29%**

Whilst these prices are lower than last year, they are historically very high:

- The BM volume weighted average accepted offer price has increased by **159%** compared to winter 2020/21
- The intra-day market price has increased by **175%** compared to winter 2020/21
- The day-ahead market price has increase by **181%** compared to winter 2020/21
- The intra-day gas price has increased **249%** compared to winter 2020/21

Market Prices and Volumes by Winter



Compared to last winter, BM actions have increased:

- The volume of actions was 6TWh, an increase of **12%.**

Key influencers of these changes in volumes when comparing with the previous winter were:

- An increase of **57%** in actions to manage import constraints & inertia
- An increase of **38%** in actions to manage reserve requirements
- An increase of **188%** in actions to manage footroom requirements
- A decrease of **22%** in actions to manage export constraints.

Gas Prices

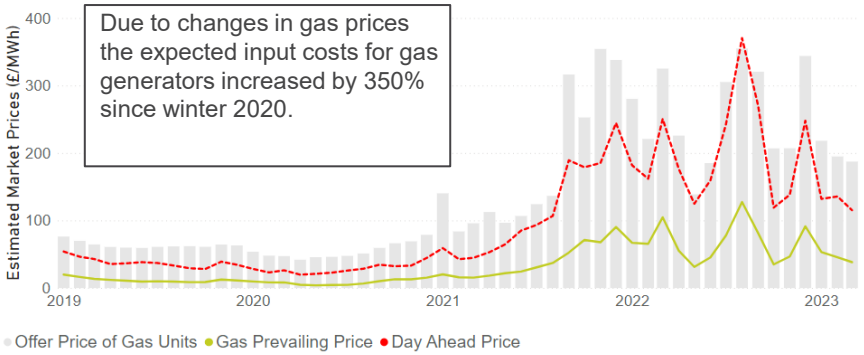
Gas prices are a key indicator of BM costs due to their impact on the short run marginal cost of CCGTs, on average this decreased by 29% between winters.

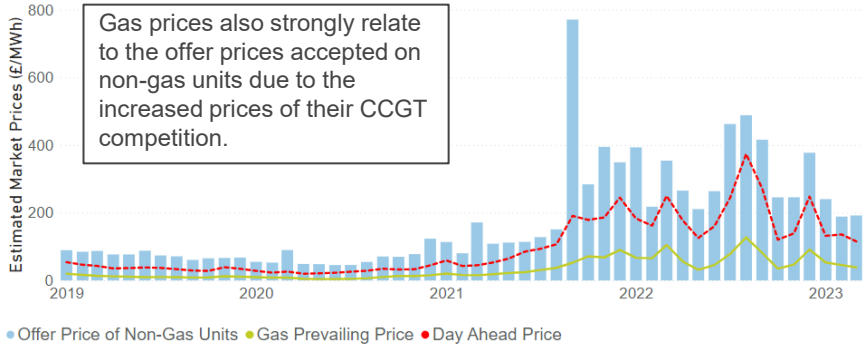
Gas prices are a key driver behind the increase in BM costs since winter 2020/21. Gas prices feed directly into the prices of conventional units offers and bids into the BM to turn up and turn down. When the gas price is higher, costs are higher for gas units to produce more generation, and these costs are passed onto the ESO via increased offer prices.

The average estimated Short Run Marginal Cost (SRMC) for a CCGT unit this winter was £164/MWh, down from the peak last winter of £231/MWh.

The average volume weighted average offer price on days with the top 10% of estimated CCGT SRMC was £682/MWh, 60% higher than the average offer price this winter of £423/MWh.

Days with higher gas prices were not found to correspond with periods of electricity scarcity this winter and thus the days with the highest gas spot market price did not strongly relate to the days with the highest gas prices. However, over extended periods there is a very strong relationship between offer prices and gas prevailing prices.





Cost Drivers

System Margin

There was a £199M decrease in costs resulting from the delay de-sync strategy between winters.

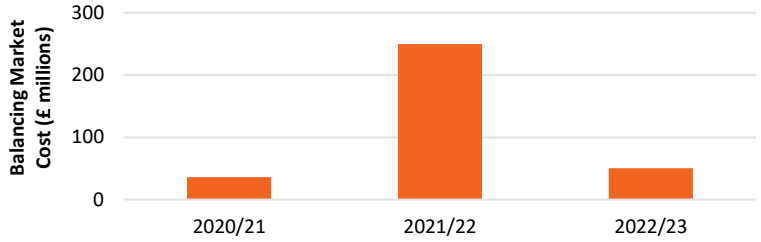
Winter 2021/22 had significant costs associated with units employing the 'delay desync' strategy, this was identified and discussed in the Balancing Market Review work conducted last winter.

This strategy is enacted by inflexible units with long minimum zero times (MZT) on days when the forecast de-rated margin at midday for the evening peak is very low. Units submit a positive PN in the run up to midday and then drop their PN to zero in the run up to the peak of the day, often increasing their offer price at the point they drop their PN.

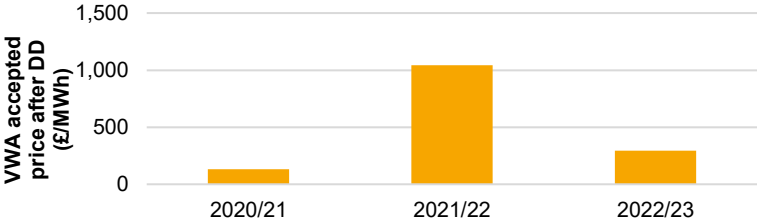
This significant decrease in costs is due to significantly lower market prices when these conditions occur. However, the volumes of energy needed to secure against this behaiour have not changed significantly. The change in commercial strategy is thought to be driven by the removal of coal units which were due to decommission from the BM and the ongoing consultations from OFGEM suggesting this behaviours may be restricted in the future.

Work is ongoing to further develop the balancing reserve product that should procure this requirement and reduce the required BM volumes, whilst the OFGEM inflexible offer licence condition consultation may prohibit very high prices when this behaviour occurs.

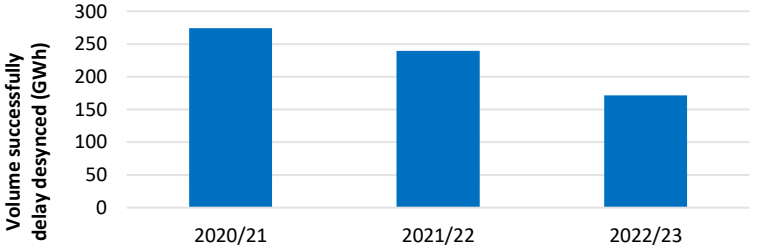
BM Cost Impact from 'Delay De-Sync'



BM Accepted Prices from 'Delay De-Sync'



BM Accepted Volumes from 'Delay De-Sync'



Wind and Demand

Residual load is a measure of the requirement for conventional generation on the system. It is calculated as the national demand[1] minus Wind and Nuclear generation. Both high and low residual load requirements lead to higher balancing costs.

High Wind Generation

As wind increases the residual load decreases. High wind generation reduces forward market prices and therefore reduces the likelihood of synchronous resource self dispatch, resulting in inertia and voltage requirements alongside increasing the probability of thermal constraint management actions due to the installed location. This winter, days with the highest 5% of wind output were nearly 2x more expensive than the average day this winter.

Low Wind Generation

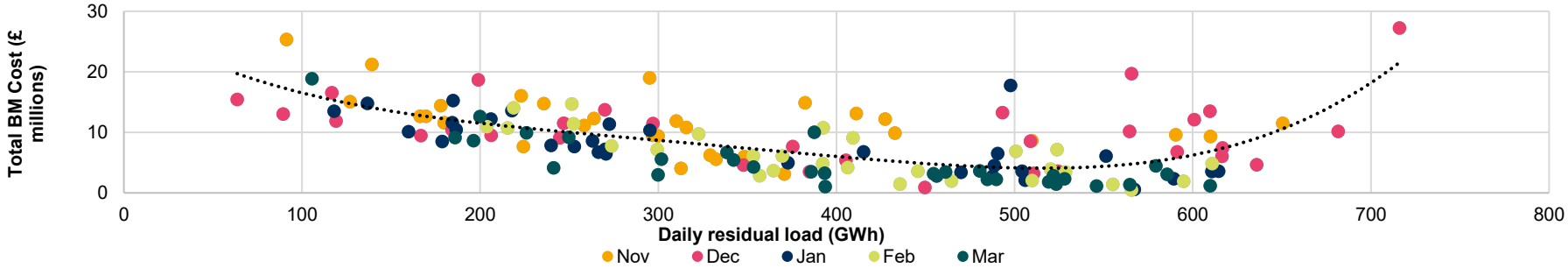
As wind levels decrease the residual load increases. This results in a greater proportion of demand needing to be met with conventional synchronous machines allowing for scarcity pricing to be achieved in balancing markets.

The highest cost day of winter 22/23 was in the lowest 5% of wind output days at £27.2M, as scarcity pricing and margin requirements led to significant costs to ensure security of supply.

Demand

As demand increases the residual load increases. Like wind, both high and low demand senarios lead to increased costs as either scarcity pricing can increase the transaction costs or larger levels of intervention are needed to manage system inertia and voltage.

The costs of days with the highest 5% of demand were 67% higher than average, whilst days with the lowest 5% of demand were 30% higher.



[1] Balancing & Settlement Codes definition for National Demand

ESO Actions

Enhanced Actions

Market Notices

An Electricity Margin Notice (EMN) was triggered on 7th March and two coal contingency units were synchronised. However, costs on 7th March were only £4.4million with accepted BM prices remaining similar to previous days.

On days with Capactiy Market Notices (CMNs), the same pattern of low BM costs and limited change in prices, suggests these notices don't drive BM costs.

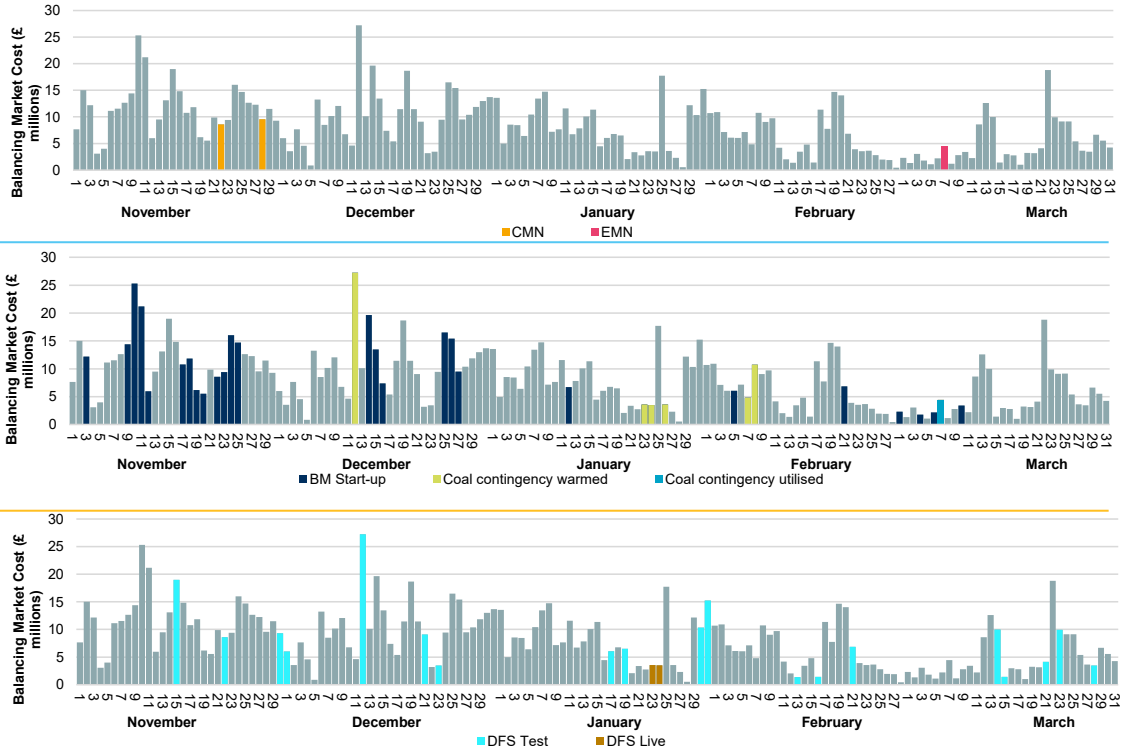
Coal

The control room instructs inflexible units to warm to make them available in BM timescales, this includes both commercial and contingency coal units. On the 7th March coal contingency units were synchronised, however the total cost was only £4.4million. This action lead to very high offer prices being submitted but these actions were not required based on out-turn conditions. However, BM startup instructions do show some relation to BM out-turn costs.

DFS

The Demand Flexibility Service (DFS) was introduced this winter to engage demand side participation in resolving anticipated margin requirements. DFS tests correspond to both some of the highest and lowest cost days. However, the live events on 23rd and 24th January do not correspond to higher cost days with both days costing under £4million (excluding direct DFS ancillary service costs).

There is no strong link between enhanced actions and wider BM costs or accepted BM prices this winter[1]



[1] This does not include the costs of the Demand Flexibility Service activation or coal contingency contracts themselves.

ESO actions

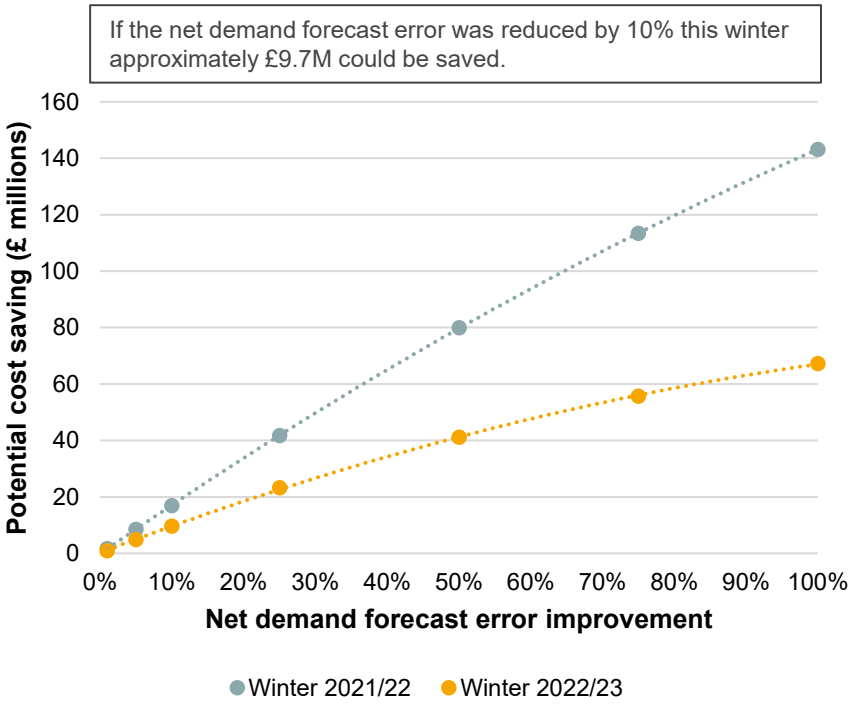
Demand and Wind Forecasting

Demand and wind forecasting are key areas of focus for ESO with significant work ongoing to reduce forecasting errors. It is not possible to achieve perfect forecasting accuracy but this report demonstrates that small improvements can avoid significant costs.

The Net demand forecast is the national demand forecast net of the transmission wind generation forecast, this is a measure of the combined wind and demand forecasting accuracy.

In Winter 22/23, the net demand forecast was on average in 240MW higher than the outturn. Furthermore, in the top 5% of net demand periods, net demand was over forecast by 370MW suggesting a small bias towards over-forecasting requirements on days when the margin is lowest.

The cost savings chart assumes the most expensive delayed on units aren't used, up to the capacity of the net demand error, and sums up their total costs. Derriving a full counterfactual is not possible and thus these are only representative figures but they demonstrate the value of continuing to invest in forecasting improvements.



Conclusion

Conclusion

The full report is a data driven review considering overall cost and some key metrics which drive balancing costs. This work will be used to inform our balancing costs strategy and share observations with the wider market as the energy industry works together to minimise consumer costs and deliver a net zero future.

Winter 22/23 has been the second most expensive winter for balancing market costs, at a total of £1.2bn in spend directly on bid offer acceptance and trading actions. Whilst positive trends have been identified in wholesale market prices as gas prices reduced towards the end of winter, these remain at historic high levels and thus increase the consumer impact of balancing costs.

Whilst ESO has very limited influence over market prices, the pay as bid structure of BM and trades means the lower the volume of actions taken, the lower the average prices of these transactions. Therefore, ancillary services or market structures that enable the market to self balance for these requirements at lower market prices observed in day ahead and intraday markets have potential to add significant consumer value and are being explored through the Review of Wholesale Energy Market Arrangements (REMA).

Gas prices are another item which ESO has very limited influence over but diversifying operational requirements away from conventional synchronous machines improves competition and reduces the direct link between gas prices and balancing market costs.

A very welcome positive conclusion of this report is market wide actions taken to limit offer prices when following the 'delayed de-sync' strategy. This was identified as an 'immoderate' behaviour by the balancing market review report 2021 and Ofgem's response to this. A reduction of 80% in costs from this specific commercial strategy shows the impact of data transparency and the value of work undertaken by ESO and Ofgem since this publication.

Significant work is ongoing to enable operability as synchonous machines are displaced with zero carbon resources. Therefore, the link between residual load and volumes of required actions should weaken as we move towards zero carbon operability capabilities.

Considering ESO actions, the enhanced actions used this winter were shown to have limited relationship with market prices and total BM costs. This finding will be considered in any future replacement products. Furthermore, the observation that incremental improvements in forecasting accuracy have significant potential to reduce consumer costs is a positive finding as ongoing work continues to refine methodologies and account for the greater weather driven uncertainties in the generation mix.

Looking Ahead…

Balancing Costs Strategy

The ESO balancing costs strategy is expecting to deliver over £12bn in consumer savings by 2026[1]. The learnings from this report will feed into this strategy, providing market insight as we work to deliver net zero operability at the lowest consumer cost.

The ESO balancing costs strategy focuses on 4 key areas of development.

Network Planning and Optimisation
Commercial mechanisms
Control Room Actions
Innovation & Technology

[1]Based on the central assumptions within BP2, subject to changes based on wholesale prices.

The ESO has a key role to play in tackling climate change by transitioning GB's electricity system to net zero. We already operate the fastest decarbonising electricity system in the world, with an ambition for zero carbon operation by 2025. And by 2035, we want to run 100% clean, green energy, all the time."

A net zero future | ESO (nationalgrideso.com)

Balancing Costs Strategy

Balancing Strategy	Key planned initiatives & improvements	Learnings from the winter balancing costs review
Network Planning and Optimisation	By 2026 it is currently estimated that these initiatives will lead to £8.8bn[1] in consumer savings. Core initiatives include: the Five-point plan to manage thermal constraints, Network Services Pathfinder Projects and Outage Optimisation.	The volume of export constraint actions was down this winter compared with previous winters as some improvement works begin to deliver. However, the residual load analysis demonstrates that reducing the peak volume of actions can have the most significant cost impact as days with very high thermal congestion driven by high winds become exponentially more expensive.
Commercial mechanisms	By 2026 it is currently estimated that these initiatives will lead to £1.1bn[1] in consumer savings. Core initiatives include: Future ancillary services, Local constraint markets and balancing reserve.	This report demonstrates that the volumes of BM actions taken to manage reserve increased compared to last winter but that the delay-desync commercial strategy was not as frequently associated with very high BM prices. However, the volumes of this behaviour remained consistent, demonstrating the continued need for a reserve product to explicitly procure against this operational requirement.
Control Room Actions	By 2026 it is currently estimated that these initiatives will lead to £867M[1] in consumer savings. Core initiatives include: Trading Activities, Constraint Optimisation and Inertia monitoring and forecasting.	This report demonstrates the potential that incremental increases in forecasting accuracy can lead to significant cost savings by avoiding some of the most expensive actions taken. This suggests continued investment into demand and wind forecasting would add consumer value.
Innovation & Technology	By 2026 it is currently estimated that these initiatives will lead to £1.5bn[1] in consumer savings. Core initiatives include FRCR, SO:TO optimisation and the Balancing Programme.	Since the introduction of Frequency Risk and Control Report (FRCR) BM actions have not been taken to curtail the largest loss for stability. However, volumes and costs of actions associated with increasing inertia have continued to increase, part of the 2025 carbon free operability work considers how to reduce this inertia requirement alongside initiatives such as pathfinders which will deliver inertia without synchronising conventional machines.

[1]Based on the central assumptions within BP2, subject to changes based on wholesale prices.

Disclaimer

This report is based upon the full Balancing market winter review report 2022/2023 as supplied by LCP. Graphics and analysis from these reports is re-used and presented to align with wider ESO activities to manage balancing costs and provide a high level overview of this detailed report.