LCPDelta

BM Skip Rates Phase 2 Report

Report prepared for NESO

Executive Summary

Background

In September 2023, the National Grid Electricity System Operator (ESO) engaged LCP Delta to support work to address market participants' concerns around the level of "skipping" perceived to occur in the Balancing Mechanism (BM).

A "skip" occurs when balancing actions are taken seemingly uneconomically (out of price order). ESO published dispatch transparency data shows that some of these actions occur to meet other system needs, however many are unexplained.

This report is the outcome of work undertaken by LCP Delta, including:

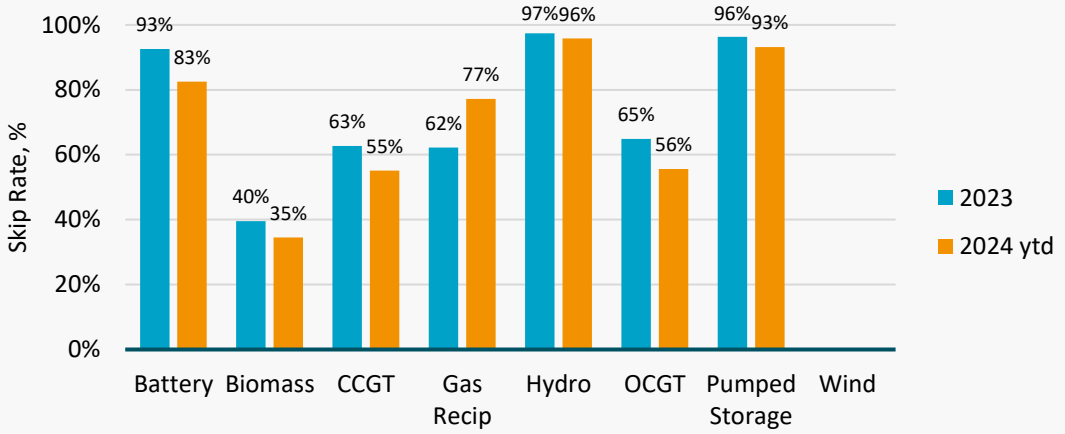
- Industry engagement and workshops to provide ESO with direct feedback and to inform LCP Delta analysis;
- Establishing an appropriate common methodology to calculate "skip rates" in the BM; and
- Calculating and presenting the skip rates observed over recent history.

This review followed on from the Electricity Storage Network's (ESN) open letter to the ESO highlighting concerns on the average skip rates of 80% for large scale batteries operating in the BM between November 2022 and May 2023.

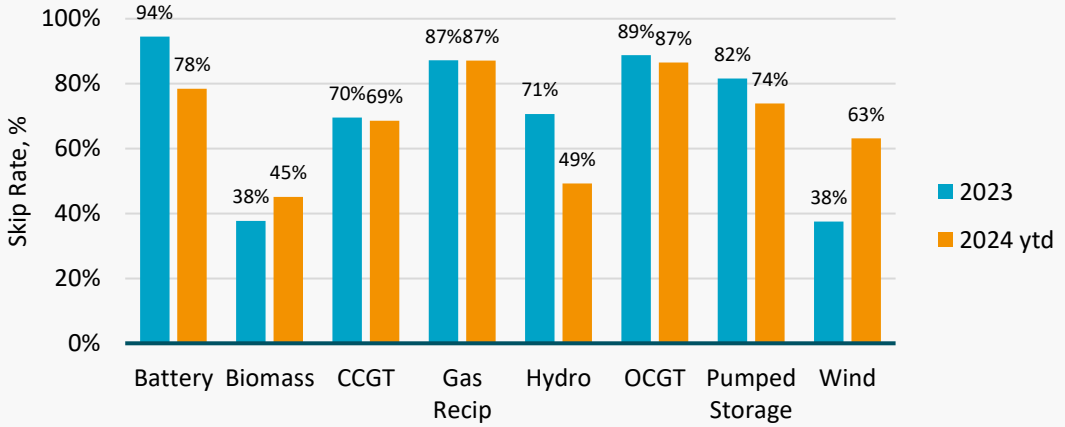
In our review we have found the average skip rate for Battery Storage offers was 93% across 2023, reducing to 83% across 2024 (analysis carried out between 1st January to 31st July 2024). Similarly for Battery Storage bids the average skip rate was 94% in 2023 and 78% for 2024 (ytd*).

This is based upon an evolution of the skip rate methodology presented in October 2023 (referred to in this report as the "Phase 1" approach).

Offer Skip Rate by technology (Phase 2 approach, Stage 3)



Bid Skip Rate by technology (Phase 2 approach, Stage 3)



***ytd = 31st July 2024 throughout the report**

Executive Summary

An evolving methodology

In October 2023, LCP Delta presented findings from Phase 1 of this work to industry and outlined a methodology for calculating the "Unexplained Skip Rate", this approach was in line with analysis undertaken by the industry. This was to quantify the number of instances in which, compared to the maximum accepted offer price or minimum accepted bid price, more economic actions were available (excluding any actions that had been system tagged).

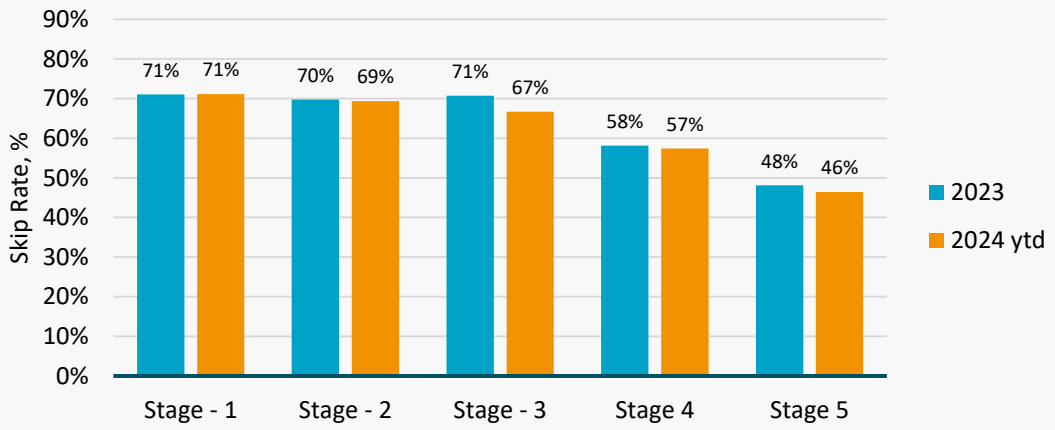
In this report **an evolution of this methodology has been utilised** (our "Phase 2" approach). These changes widen the pool of actions considered whilst reflecting that not all actions which are in-merit in comparison to the maximum accepted offer price/minimum accepted bid price could be utilised. The key changes from Phase 1 are:

- The granularity of the analysis has been increased from a 30-minutely settlement period basis to 5-minutely blocks;
- All bid-off pairs submitted are incorporated (not just the first, lowest-cost pair); and
- Merit order stacks are calculated for each 5-minute block, with the skip rate being calculated as the ratio of volume in-merit but not utilised to the overall balancing requirement for that time-period.

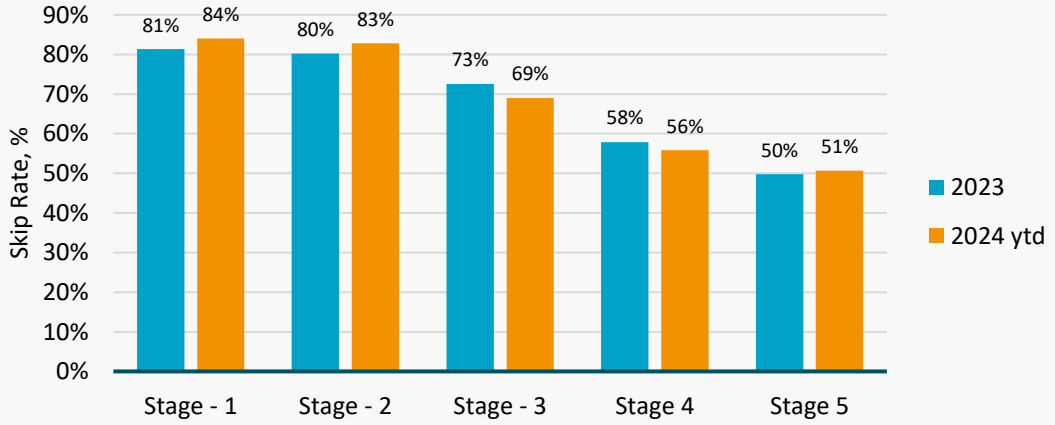
The final change is significant – in Phase 1 it was assumed that in-merit actions include anything with a more economically attractive price. In Phase 2, LCP Delta builds an in-merit stack of the cheapest available actions to meet the energy requirement for each 5-minute period. We compare this to the ESO's actual dispatched stack, and the skip rate is the proportion of the calculated in-merit stack that was not dispatched by the ESO. To provide transparency, LCP Delta report results for Phase 2 and using the Phase 1 approach for defining in-merit actions (akin to industry reporting).

Skip rates for Phase 2 are presented in **five stages** building up initially from looking at all actions on the system (stage 1), through to excluding system and frequency tagged actions (stage 3 – and most reflective of industry reporting) to only considering actions dispatchable at short notice by the Electricity National Control Centre (ENCC) (stage 5).

Offer Skip Rate (All Technologies, Phase 2 approach)



Bid Skip Rate (All Technologies , Phase 2 approach)



Note that the analysis has a number of limitations, including the treatment of 5-minute periods as independent. These limitations are outlined on page 42.

Contents

Introduction and background

Project background

In September 2023, the ESO engaged LCP Delta to review and report on market participant concerns around the perceived issue of “skipping” in the Balancing Mechanism (BM).

The work undertaken by LCP Delta included:

- Engaging with market participants and key stakeholders to understand the issue of inefficient dispatch in the BM, provide ESO with feedback and inform LCP Delta analysis;
- Establishing an appropriate common methodology to calculate “skip rates” in the BM; and
- Calculating and presenting the skip rates observed over recent history.

This work was limited to the current BM design, and as such wider future market design considerations are out of scope. These will be considered outside of this project, through the ESO’s long-term market reform projects, and its involvement in the UK Government's Review of Electricity Market Arrangements.

In October 2023, LCP Delta presented to industry an interim project report, including a proposed methodology for calculating the “Unexplained Skip Rate”.

Following further engagement with industry and stakeholders, and through further understanding of the issue and concerns, this “Phase 2” report builds on the interim “Phase 1” report.

A new “Phase 2” methodology for the calculation of skip rates was established, building on and refining the Phase 1 methodology. This methodology was presented to industry in November 2024.

This “Phase 2” report includes:

- **An updated methodology** for the calculation of skip rates updated to use a 5-minute granularity and consider the energy requirement by creating an in-merit stack, along with other refinements.
- **“Skip rate” results** based on the updated methodology.
- A review of the ESO’s dispatch transparency methodology and BM action reason codes.

What is a “skip”?

Background

A skip as being created when a non-economic dispatch decision is made.

If the NESO Control Room sends an instruction via BOA (Bid Offer Acceptance) which is at a higher price than an alternative action that could have been taken, then NESO will have created a skip (i.e. the alternative action is skipped).

Some skips are unavoidable and are due to asset dynamics and limitations on the transmission system. Other operational actions, which optimise the lowest operational cost per day, may also introduce skips.

Those skips that are avoidable, including those that can be minimised through NESO improvements (system improvements, process improvements or market design) should be kept to a minimum.

The “skip rate” refers to the frequency at which certain actions or assets are bypassed or "skipped" during operational decisions. A “skip rate” can have different definitions depending on the specific interests of the party calculating it.

Skip rates help measure the efficiency and decision-making processes in operations, highlighting areas where improvements can be made to optimise performance and transparency.

How a "skip rate" is defined

Background

At a high level, NESO has defined two types of skip rate:

1. All BM Skip Rate – calculated based on all BM volumes
2. Post System Actions Skip Rate – calculated based on BM volumes to manage energy imbalance

1. All BM Skip Rate:

"All BM Skip Rate is a measurement of out of cost merit actions (which cannot be attributed to NESO's requirement to maintain operational security or respect individual dynamic physical parameters) taken by NESO against the total volume of actions available."

The comparison between the price per MWh for the BMU instructed by the ESO Control Room via a Bid Offer Acceptance (BOA), against the other available BMUs with lower prices per MWh that were not instructed.

Calculation:

$$\frac{\text{Volume of units in merit not taken}}{\text{Total volume of accepted units, including system actions}}$$

2. Post System Actions Skip Rate:

"Post System Actions Skip Rate is a measurement of out of cost merit actions taken by NESO against all actions which cannot be attributed to NESO's requirement to maintain operational security or respect individual dynamic physical parameters."

To determine a Post System Actions Skip Rate, a number of exclusions must be applied to the basic stack of actions available versus the actual actions taken in a settlement period.

This is because NESO must make decisions to guarantee system security. Exclusions include; actions taken to manage a constraint, actions to manage voltage to within SQSS standards, and actions to ensure frequency response options remain available. Other significant exclusions are required where a generator, which is essential for security, has a high minimum zero time, minimum non-zero time or notice to deviate from zero.

Calculation:

$$\frac{\text{Volume of units in merit not taken}}{\text{Total volume of units accepted to manage energy imbalance}}$$

This report, and LCP Delta's analysis, focuses on "Post System Actions Skip Rates". From stage 3 onwards, "skip rates" in this report are consistent with this definition.

The Balancing Mechanism

What is the Balancing Mechanism?

The Balancing Mechanism (BM) is ESO's primary tool for balancing supply and demand. It allows the ESO to dispatch assets ahead of and in real-time. Most actions are taken post gate closure, with some asset repositioning taking place for a specific time taken slightly ahead of time – this would be known as "BM timeframes".

Anything that is taken outside of these BM timeframes are usually taken to make an asset available to the ENCC in the future that otherwise wouldn't have been (for example, in the past a coal asset), or through BSAD/Schedule 7A trades. These actions are out of scope for this project.

The BM generally becomes active post-gate closure, one hour ahead of delivery when all BMUs with their Final Physical Notification (FPN) flag set to true are required to provide the ESO with their FPNs. At this point all positions of assets are final with no further trading or self-dispatch optimisation available for that given period.

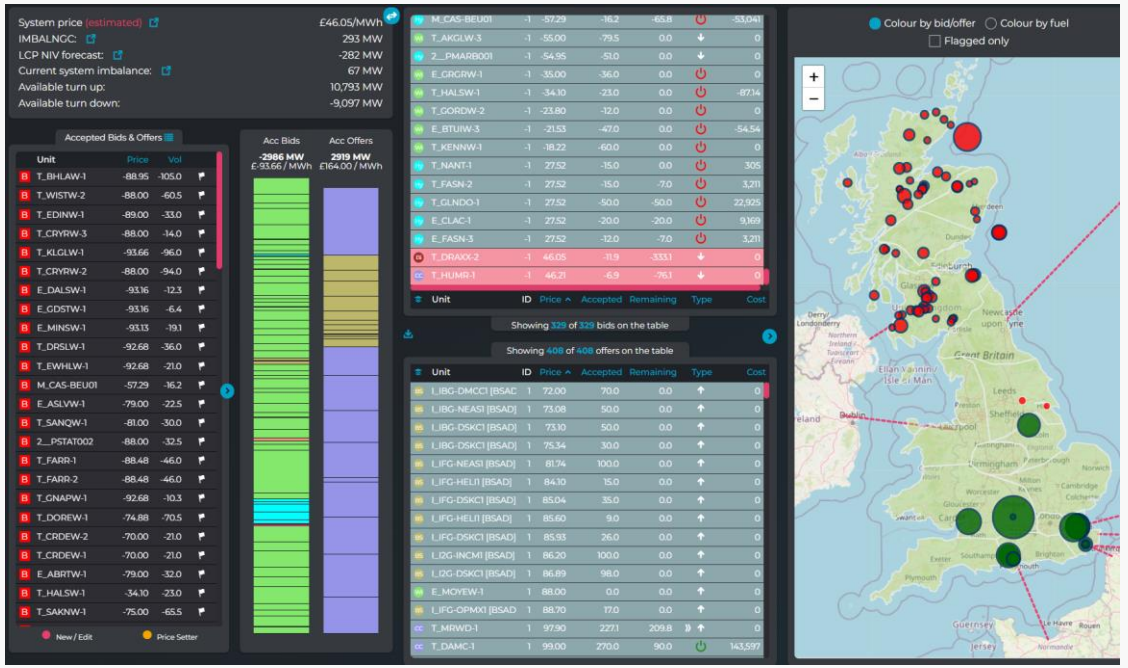
Alongside FPNs, dynamic data is also submitted through Bid-Offer Data (BOD). Together these provide the ESO with a full understanding of a unit's sold position in the market, as well as its technical requirements and limitations to have that position changed by the ESO through the BM. Any changes to a unit's position carries a cost with it.

To provide the ESO with an understanding of cost to change a BMU's position, the BMU operator submits Bid-Offer pairs for each settlement period (up to 5 pairs). Each pair consists of the prices that the BMU is willing to incrementally increase (offer) or decrease (bid) their power output (or consumption) for a certain tranche of volume.

The BM solves a multitude of energy and system needs – purchasing a number of services from suppliers that do not necessarily know what they are supplying ahead of time – and preventing the effective pricing of a particular service. This makes the BM an imperfect market.

If the BM were a simple energy market with infinitely flexible units, Bids and Offers could be simply accepted in merit order – taking the most cost-effective action first.

BM Dashboard, Enact – LCP Delta's power market analytics platform



Market Background

Decarbonisation is rapidly presenting a power sector with vastly different characteristics

The BM was implemented as part of the New Electricity Trading Arrangements (NETA) in 2001. At that time, the GB power system was dominated by large centralised assets such as coal, nuclear and gas power generation.

Over the past decade the GB electricity system has undergone significant change. The ongoing drive towards a decarbonised power system has resulted in a significant decline in coal generation (with the final coal fire power station due to close in GB by October 2024), which has been replaced by increasing levels of renewable generation in the supply stack.

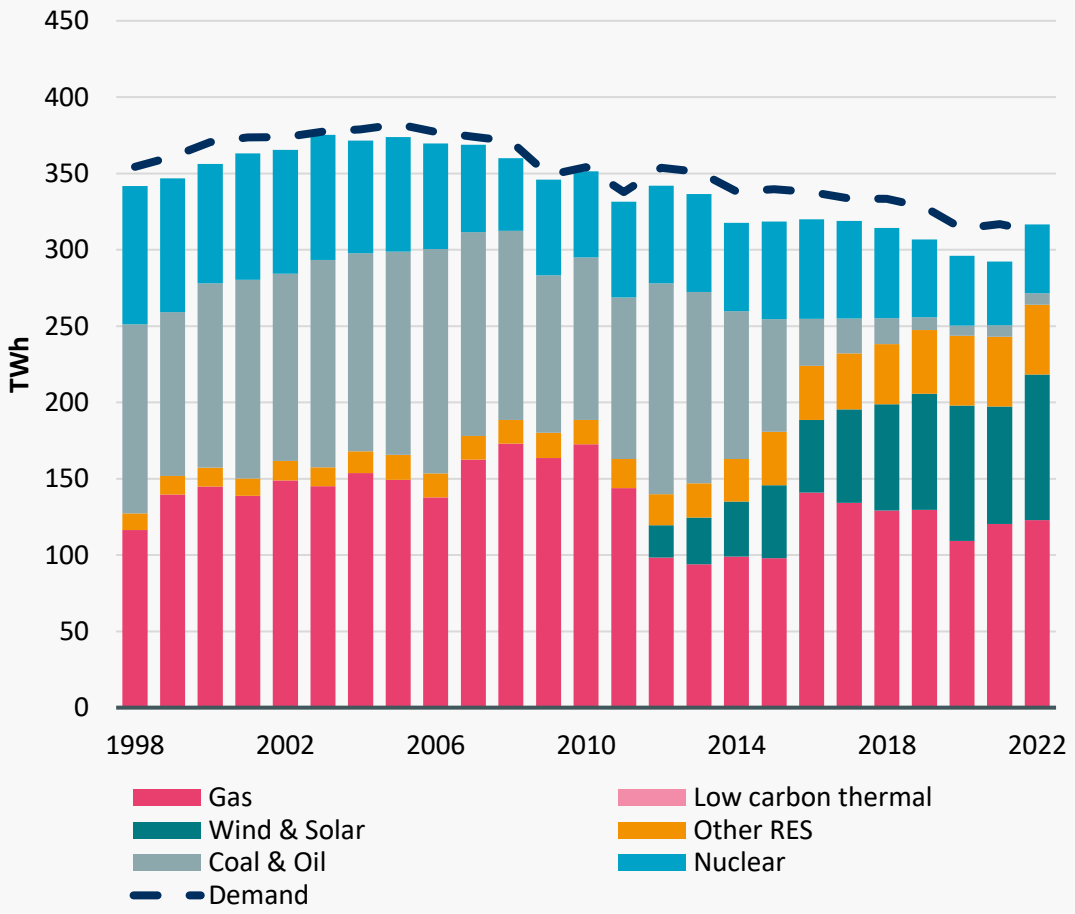
The catalyst for this change was the UK's Electricity Market Reform (EMR), which looked to solve the 'energy trilemma' in the electricity market by bringing forward:

1. **The Capacity Market (CM)** to ensure there is enough electricity generation capacity to meet demand. This addresses concerns about energy security by reducing the risk of supply shortages during peak demand periods.

2. **The Contracts for Difference (CfD)** to provide stable and predictable revenue for low-carbon electricity generators. This helps in attracting private investment into low-carbon technologies.

3. **The Carbon Price Floor (CPF) and Emission Performance Standard** to incentivise low-carbon electricity generation, with the CPF putting an additional price on carbon emissions over and above the Emission Trading Scheme (ETS).

GB Generation Outturn



The growth of smaller assets in GB

The market is presenting a more decentralised system mix that the ESO must harness for consumer benefit

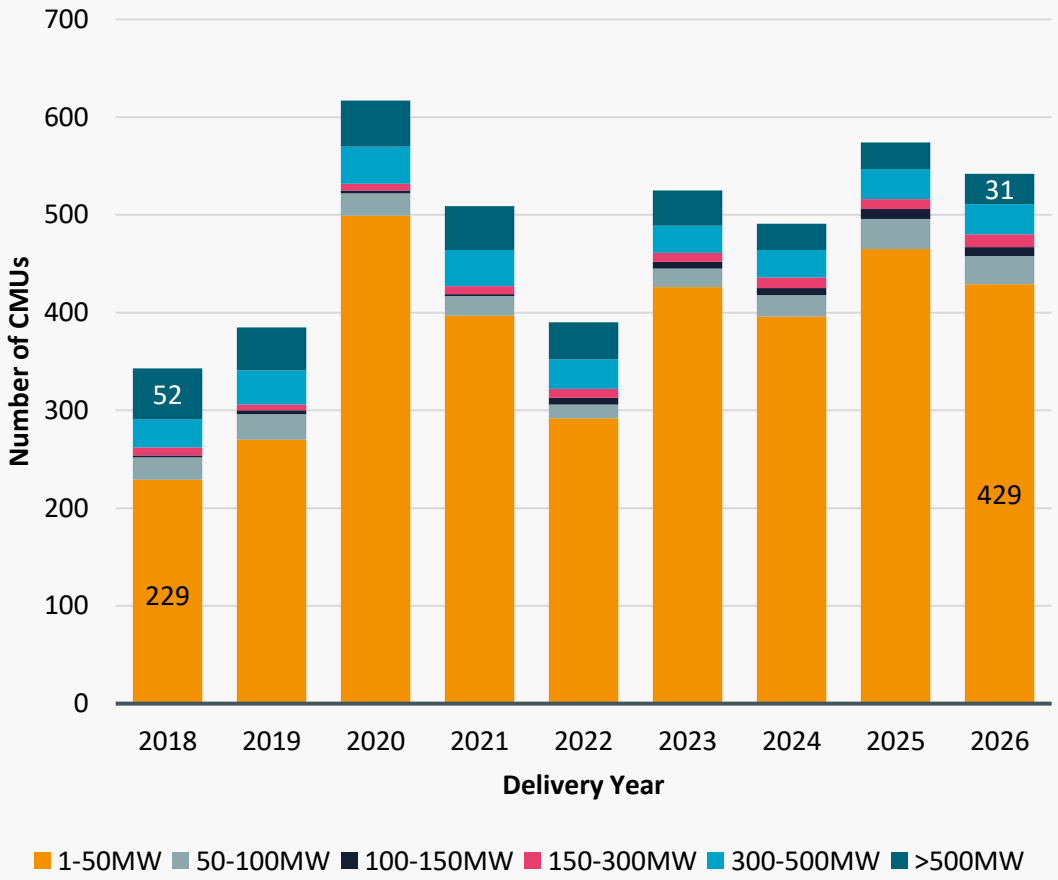
The EMR package generally expected to phase out coal generation, making way for increasing levels of intermittent renewable generation and large-scale Combined Cycle Gas Turbines (CCGTs). From this policy direction, the GB power system was expected to generally remain a “centralised system”, consisting of fewer, large high efficiency generators.

However, due to various factors and sector drivers, there has also been an increase in the number of smaller, decentralised, flexible generators. This is demonstrated through the CM results, as seen on in the figure to the right that shows an increase in the number of successful T-4 CMUs with an installed capacity of less than 50MW, and a decrease in those larger than 500MW.

This change of prevailing unit size ratio of the GB power system demonstrates how the ESO must adapt to manage the electricity system with the tools that the sector is presenting to it. Historically, the ESO’s systems and processes have been centred around dispatching fewer, larger generators..

The ESO must ensure that its systems and processes are efficiently enabling the scheduling and dispatch of a decentralised system

Number of accepted Capacity Market Units (CMUs) by installed capacity



The Balancing Mechanism

The importance of better utilising smaller BMUs

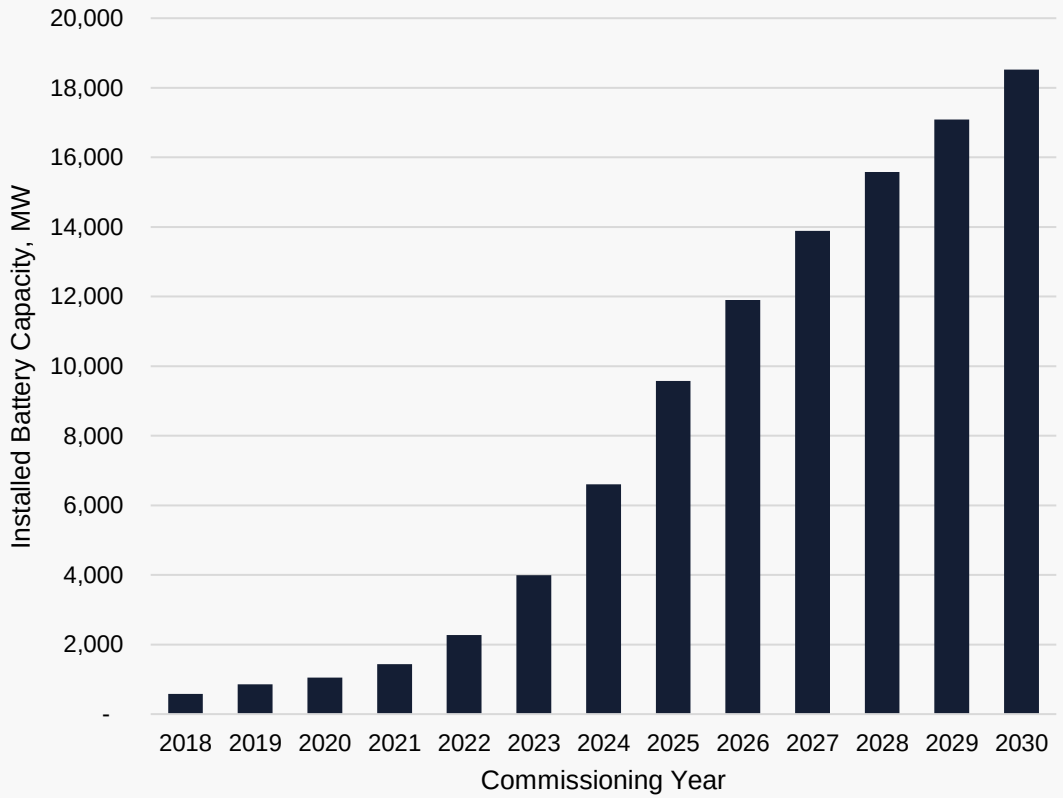
The ESO has recognised that its BM processes and systems are not well suited to efficiently utilising many smaller BMUs in place of single larger ones. Since early 2023, the ESO has rolled out various improvements to the ENCC to enhance dispatch of smaller BMUs and Battery Energy Storage Systems (BESS) in the BM.

Whereas CCGTs and OCGTs can provide significant flexibility, they are only flexible when synchronised to the electricity system and operating between their Stable Export Limit (SEL) and its Maximum Export Limit (MEL). Gas reciprocating engines and BESS however are flexible from a dormant state. They can quickly respond (sub 1-minute, or for batteries within seconds) to deviations in frequency and reserve requirements. This makes their potential value to the ESO particularly high for system balancing and management.

As these assets are highly valuable to the balancing of a power system, programmes of work such as the Open Balancing Platform (OBP), launched in December 2023, are important to ensuring that the assets are utilised as efficiently as possible. This initial stage made the processing of bulk dispatch of Battery Storage and small Balancing Mechanism Units (BMUs) easier, enabling greater dispatch efficiency.

Many have noted increases in small and BESS BMUs over the course of OBP roll-out, however it has also coincided with the growth of these asset classes. Our analysis looks at how extensive “skip rates” in the BM are, and any observed improvements since the launch of OBP.

Front of Meter Battery Capacity forecast (Source: LCP Delta StoreTrack)



Phase 1 Methodology

Phase 1: Methodology

30-minute granularity, compare to most expensive action

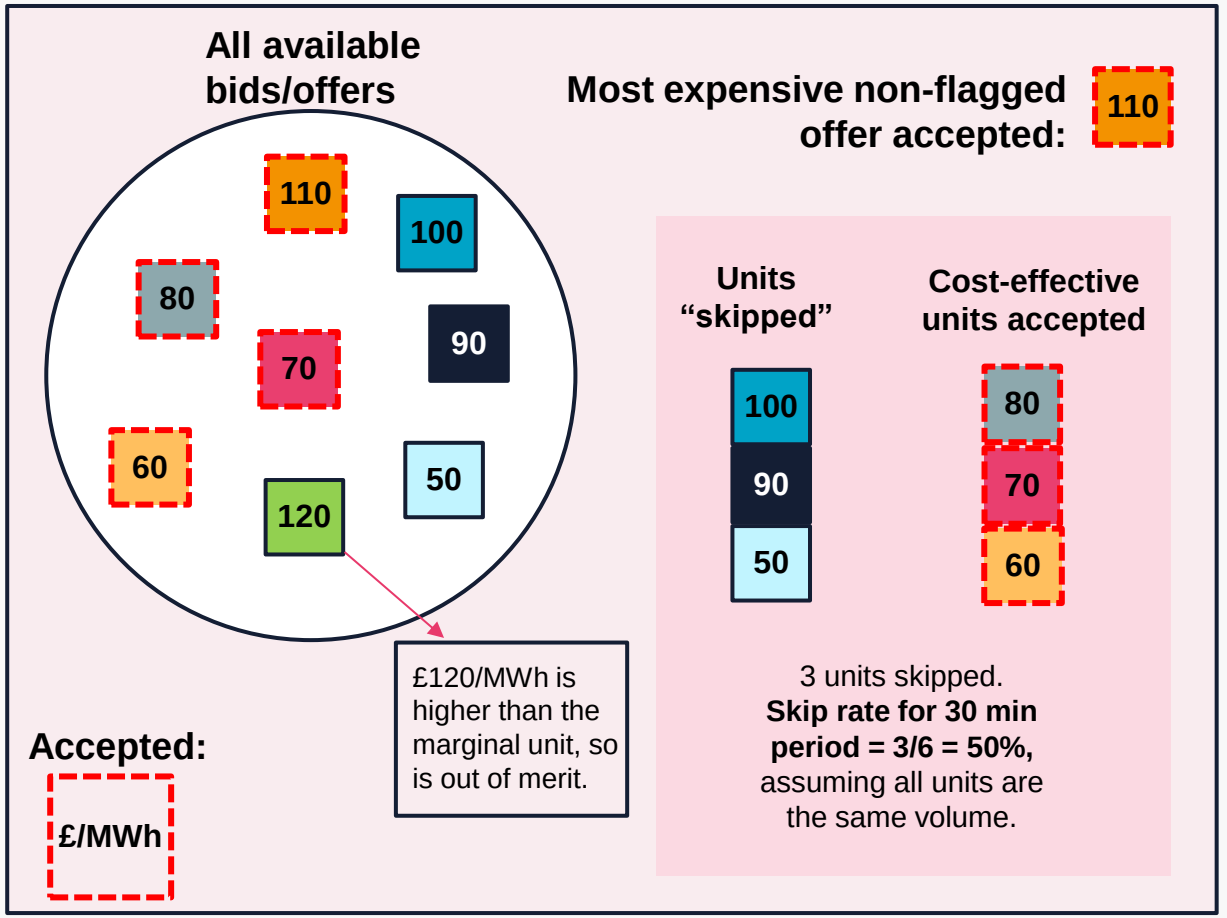
LCP Delta's "Phase 1" methodology is similar to that of existing analysis that has been adopted by analysts and operators. This approach was presented to industry in October 2023.

This methodology works by comparing all other viable actions with the most expensive action taken over the course of a 30-minute settlement period. If an action was not accepted in a settlement period but was cheaper than the marginal action in that period, this would be classified as a skipped action.

The diagram to the right illustrates how the phase 1 methodology works. In the circle, there are a number of available bids/offers with the number assigned to each action being the offer price (in the examples, we assume the volume of each action is 1MWh for ease). The offers that were accepted by the ESO are indicated by a dashed red outline.

In this example, the most expensive action taken (the marginal action) was £110/MWh. There were three skipped actions that were seemingly cheaper than this £110/MWh action – a £100/MWh, a £90/MWh, and a £50/MWh action. A bid/offer is strictly only in-merit if it is cheaper than the marginal accepted unit. The skip calculation is made on a volume basis – i.e. out of the 6 actions that were cheaper than the most expensive action ("in-merit"), 3 were not accepted. The simplified skip rate calculation in this scenario is:

$$Skip\ Rate = \frac{Total\ volume\ of\ skipped\ in\ merit\ bids/offers}{Total\ volume\ of\ in\ merit\ bids/offers}$$



Phase 1: Methodology

Exclusions based on suitability of actions within merit

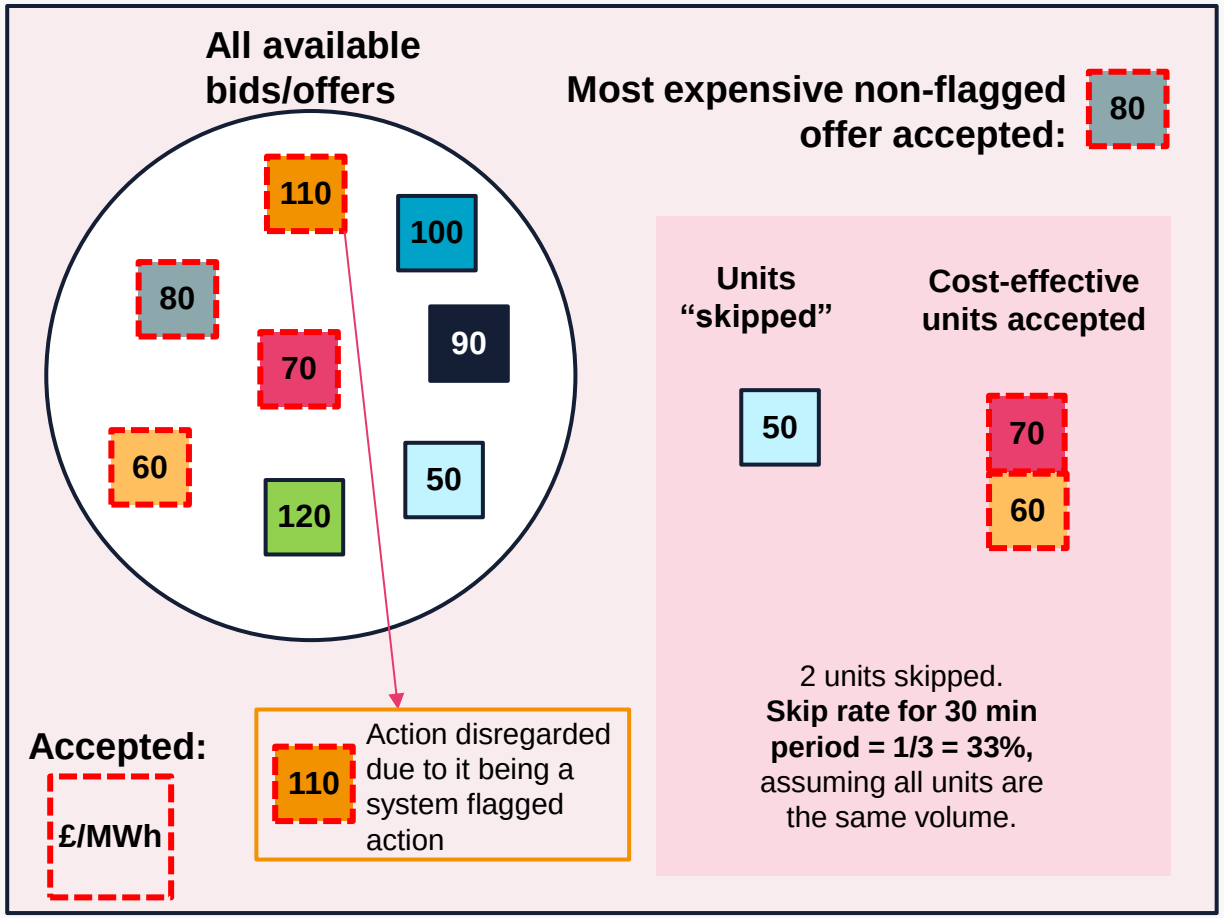
The previous example assumed that all actions were equal and feasible. This would mean that all of the skipped actions could have met the requirement that the ESO was looking to satisfy and there was no discernible reason as to why the cheaper "skipped" actions were not taken in favour of more expensive actions.

However, we exclude from the calculation any units that were accepted but were either system flagged or frequency tagged.

Reasons as to why an action might be system flagged include:

- System need;
- Geometry limitation;
- Loss risk;
- Unit commitment;
- Response;
- Merit;
- Frequency of flexibility needs; and
- Incomplete.

The example to the right shows how the skip rate decreases from 50% to 33% due to the £110/MWh action being system flagged and therefore excluded from the calculation.



Phase 1: Methodology

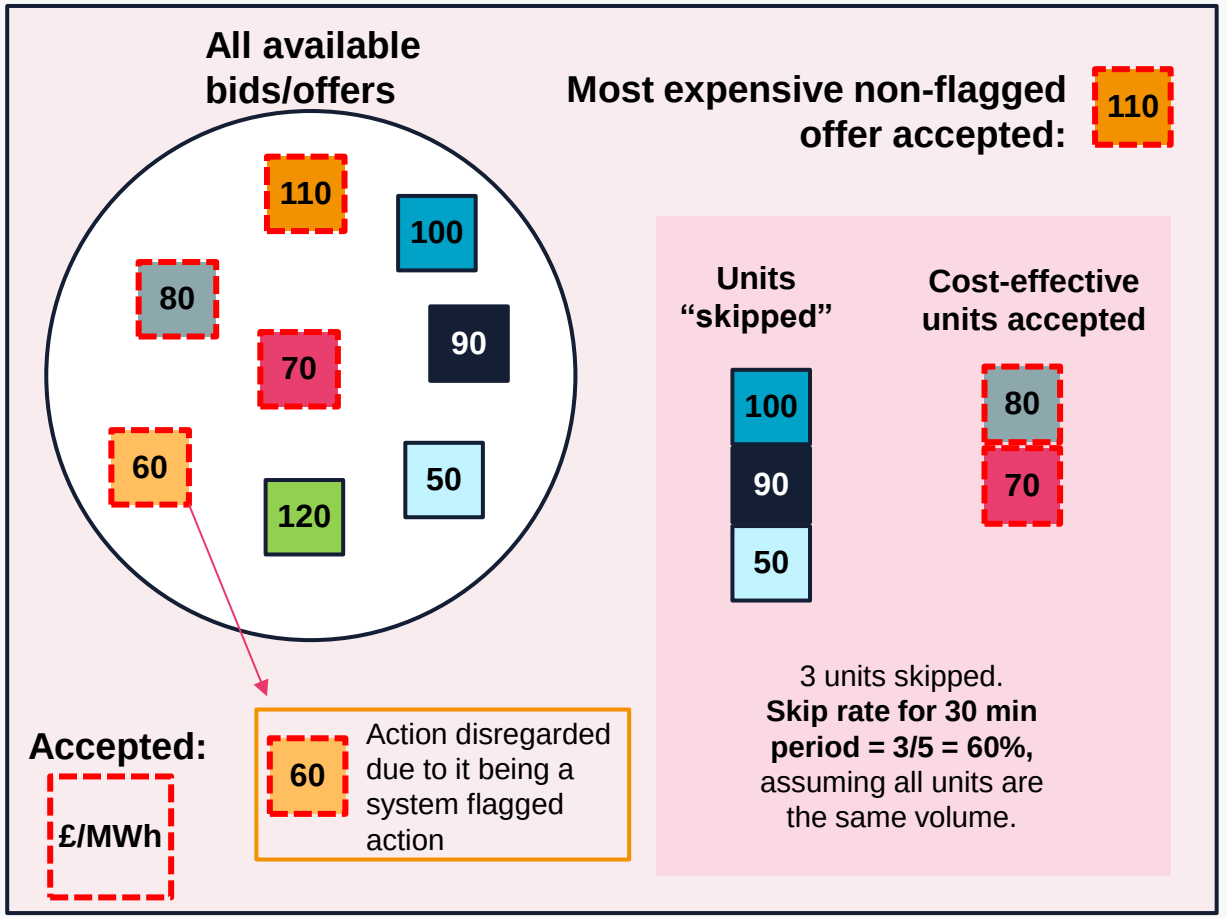
Exclusions based on suitability of actions within merit

Exclusions can also increase the skip rate.

For example, if the was the £60/MWh offer was system flagged and excluded (rather than the £110/MWh offer), then the £110/MWh offer would remain as the most expensive accepted action.

3 offers would still be skipped, but only 2 cost-effective units were accepted for energy reasons (excluding the marginal unit), reasons so the skip rate would increase to 60%.

The example to the right shows how the skip rate increases to 60% due to the £60/MWh dispatched action being system flagged and therefore excluded from the calculation.



Phase 2 Methodology

Phase 2: Updated Methodology

Constructing a merit stack for each 5-minute period in price order

In late 2023, LCP Delta delivered and presented initial analysis to ESO based on the phase 1 methodology. Through further engagement, it was identified that the methodology could be enhanced to capture BM dispatch decisions in greater detail and improve the usability of the analysis across the industry and within ESO.

Our phase 1 methodology is similar to existing industry analyses, considering the units that were not dispatched despite being cheaper than the most expensive unit dispatched (the marginal unit) to be "skipped". However, it does not account for the actual energy need within the BM.

In phase 2, we assess ESO's dispatch decisions against the BM energy volume requirement. We construct a stack of bids/offers in price order, up to the point where the requirement is satisfied. This allows for a comparison between the most cost-effective bids/offers available to ESO to satisfy the requirement, and what was actually accepted. Any bid/offers that appear in the "in-merit" stack, but were not actually accepted, are considered to have been "skipped".

We have also increased the granularity of the data analysis, moving from a 30-minute to a 5-minute observation period. This prevents short-duration assets from being averaged over a longer period. We also consider all bid/offer pairs submitted, ensuring completeness.

Under the phase 1 methodology if 500MW of accepted actions and 750MW of unaccepted actions were cheaper than the most expensive unit accepted, the skip rate would be 750/(750+500) = 60%. Under the phase 2 methodology a merit stack is constructed in price order to satisfy the 500MW requirement. If this stack contained 250MW of accepted bids/actions and 250MW of skipped volume the skip rate would be 50%.

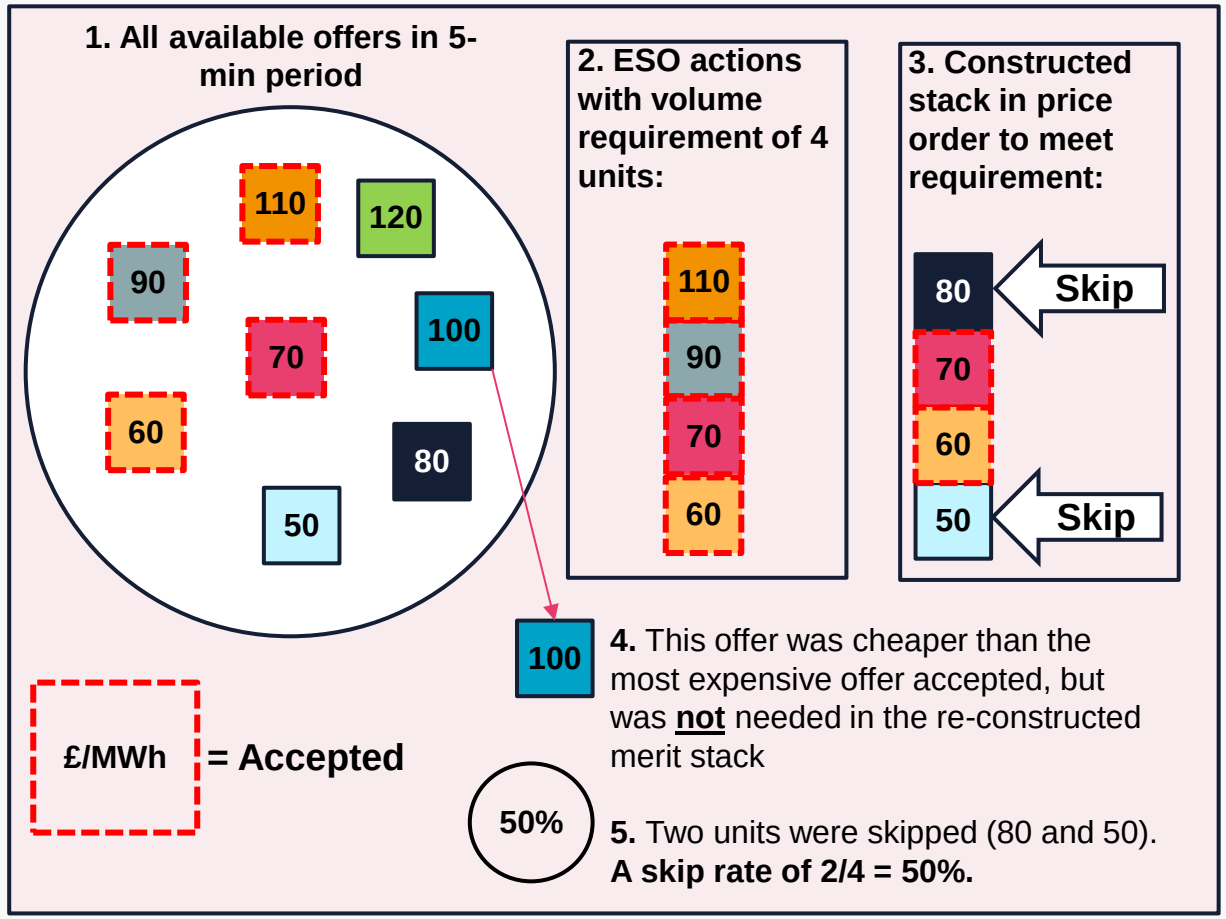
Key phase 2 updates	
5-minute granularity	Analysing over a shorter observation period minimises erroneous results from averaging shorter actions over a full 30-mins.
Considering all bid-offer pairs separately	The ESO considers all BOD price bands separately. In phase 2, we consider all price band pairs rather than just the initial price band.
Consider the BM energy requirement	Determine the energy requirement in each 5-minute period, based on the total bids/offers accepted.
Determine the most cost-effective combination of bid/offers	Across 5-min observation periods construct a stack of available bids/offers in price order to satisfy the requirement in that period. This is then compared to the ESO's actual acceptances.

Phase 2: Updated Methodology

Constructing a merit stack for each 5-minute period in price order

The figure on this page provides an illustrative example of the analysis that we carry out for every 5-minute period.

1. All available bids/offers in a 5-min period	In this 5-min period there are 8 offers available to the ESO, with their prices shown in £/MWh. In this example, we assume that they are equal volume.
2. ESO acceptances used to determine volume requirement	Using the offers accepted we construct the actual stack dispatched and use this to calculate the BM energy requirement. In this example, the requirement is for a volume of 4 units.
3. Construct an "in-merit" stack to meet the requirement	We then construct a new stack in price order to determine the most cost-effective way to meet the requirement. In this example, that is the 50, 60, 70, and 80 £/MWh offers.
4. Unrequired bid/offer	In this example, when reconstructing the stack we find that the accepted 90 and 110 £/MWh and the unaccepted £100/MWh actions are not needed to meet the requirement and not included in the skip rate calculation.
5. Determine units skipped and skip rate	From the constructed merit stack, the 80 and 50 £/MWh actions were not dispatched by the ESO, but should have been – i.e. were "skipped". Therefore, there is a 50% skip rate in this scenario.

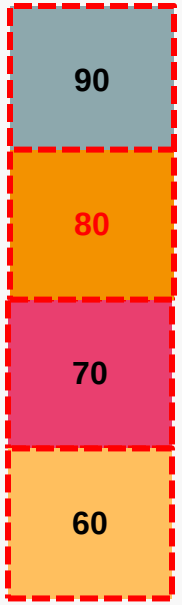


Phase 2: Tie breaking rules

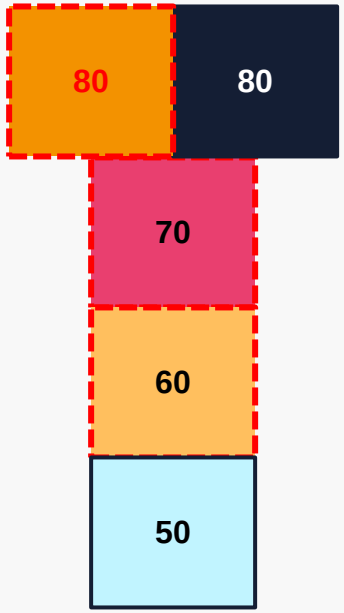
What happens when a potential skip and an acceptance have the same price?

In this example both a potential skip and acceptance have a price of £80/MWh

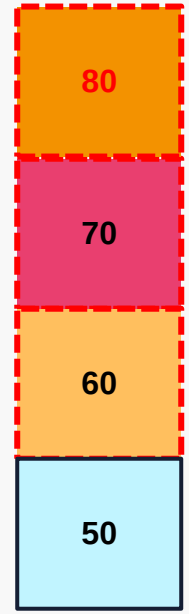
What was accepted:



Phase 2: What "could" have been accepted



Phase 2: What "should" have been accepted



£/MWh = Accepted

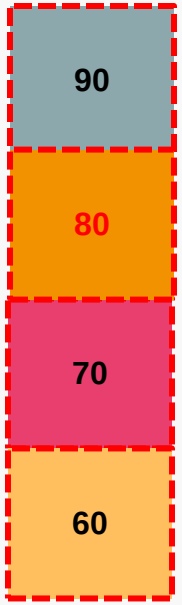
Tie-break rule: If an acceptance and a skip have the same price **the acceptance will always be prioritised, this minimises the skip rate.**

Phase 2: Tie breaking rules

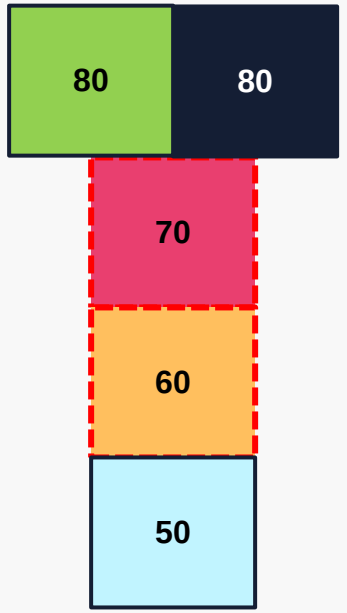
What happens when two potential skips have the same price?

In this example two potential skips (assumed to be from differing technologies) are price at £80/MWh.

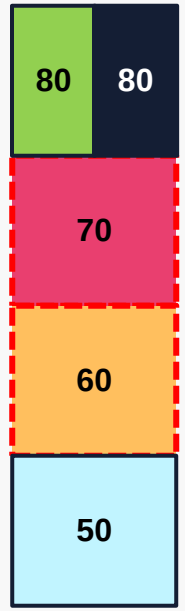
What was accepted:



Phase 2: What "could" have been accepted



Phase 2: What "should" have been accepted



£/MWh = Accepted

Tie-break rule: If two potential skips are on the margin their skip volume is assigned on a volume weighted basis **to prevent bias in favour of one asset (and technology)**

Phase 2 exclusion rules: step-by-step application

Exclusion Rules

Volumes are excluded for the following reasons

Stage	Exclusion	Application	Reason
1	**Wind Offer**	Offers from wind assets are excluded	
	Balancing Services Adjustment Data (BSAD)	Actions in BSAD dataset are excluded	Actions occur outside of the Balancing Mechanism
	Winter Coal Contingency Contracts	Volumes from coal assets which received winter coal contingency contracts are excluded	These volumes are priced at £0/MWh in the BM and bias the skip rate results
2	**Minimum Zero Time (MZT)**	Greater than or equal to 12 hours	Unit is not accessible by the ENCC within BM timescales
	Minimum Non-Zero Time (MNZT)	Greater than or equal to 12 hours	
	Notice to Deviate from Zero (NDZ)	Greater than or equal to 90 minutes (unless already running or has warming contract)	
	Stable Export Limit (SEL) / Stable Import Limit (SIL)	Excluded if action results in final position breaching SEL/SIL (units can go to 0MW)	Results in infeasible volume because of a unit entering an unstable position

Exclusion Rules

Volumes are excluded for the following reasons

Stage	Exclusion	Application	Reason
3	**System Flagged**	If an asset has an Acceptance which is system flagged the Acceptance (and any acceptances for lower bid-offer pairs) are excluded	Accepted action was required for locational balancing and / or system security
	Frequency Response	If an asset has an Acceptance which is Frequency flagged the Acceptance is excluded	Accepted action was required for frequency control
4	**Unwinds**	BOAs to reverse out (unwind) a previously accepted action are excluded	This action only becomes available if the opposing bid or offer action is accepted
5	**Minimum Zero Time (MZT)**	Exclude actions that would desync a unit with an MZT of greater than or equal to 31 mins	Only volumes available to the balancing team in the ENCC are included
	Minimum Non-Zero Time (MNZT)	Exclude actions that would sync a unit with an MNZT of greater than or equal to 31 mins	
	Notice to Deviate from Zero (NDZ)	Exclude actions that would sync a unit with an NDZ of greater than or equal to 31 mins	
	SEL to MEL range / SIL to MIL range	Remain between SEL and MEL or SIL and MIL (unless MZT is less than 31mins and unit is running)	

Step-by-step guide

Stage 1

Remove volumes that are procured outside of the balancing mechanism

BSADs:

The prices and volumes of balancing services procured outside of the Balancing Mechanism are shown in the Balancing Services Adjustment Data (BSAD).

Because these volumes have been procured outside of the Balancing Mechanism they are excluded from this analysis.

Wind Offers:

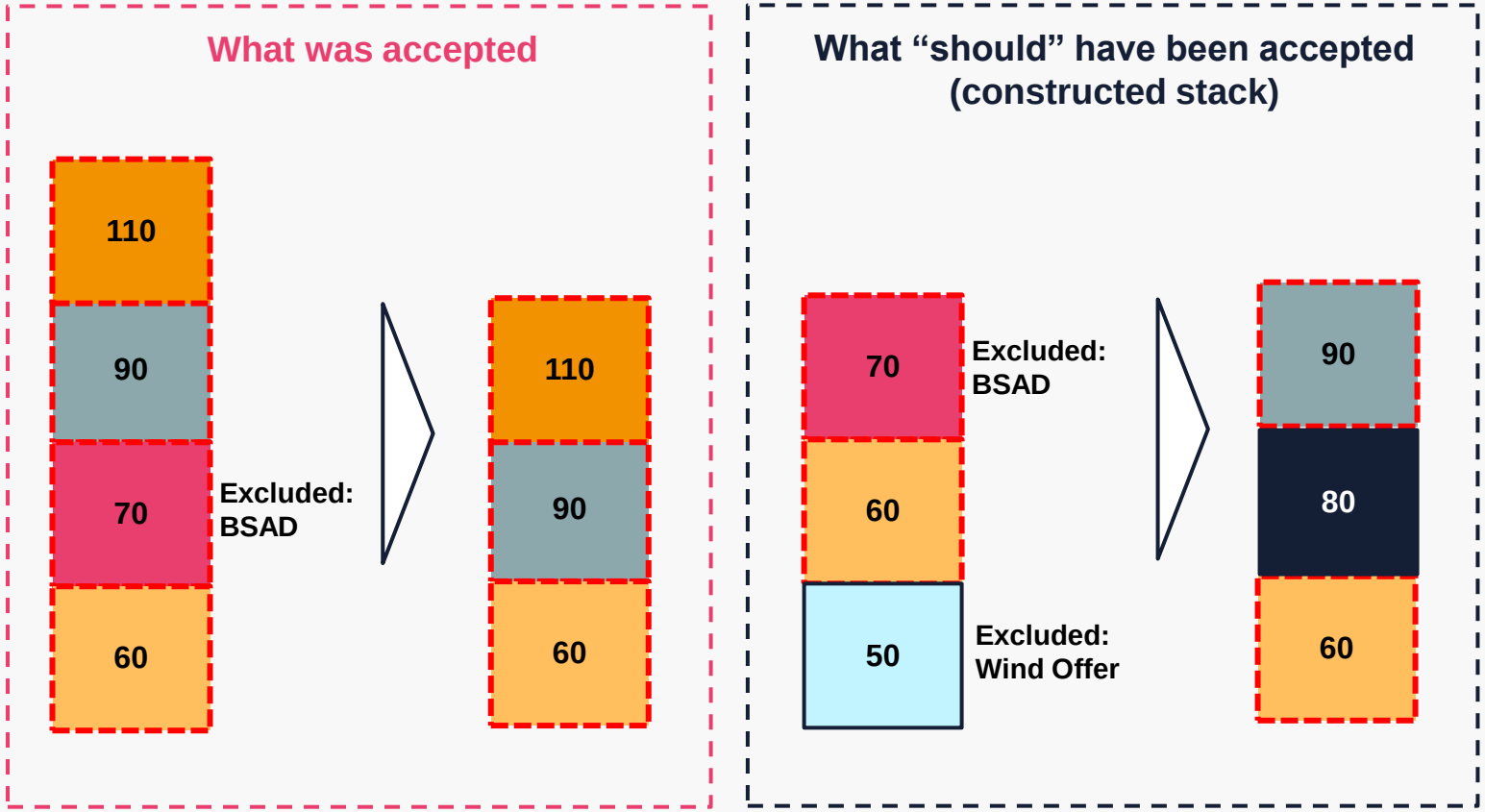
Wind technology is dependent on weather conditions. To enable an offer on a wind unit, the weather would need to change.

Winter Coal Contingency Contracts:

Coal contingency contracts were put in place between 1st October 2022 and 31st March 2023 for five coal units (T_RATS_1, T_DRAXX-5, T_DRAXX-6, T_WBUPS-1 and T_WBUPS-2).

These units received payments for remaining available across the winter period but were not available to the market and would be dispatched if required by the ESO through the Balancing Mechanism or a trade priced at £0/MWh.

This low price in the BM would distort the skip rate analysis and so these volumes are excluded.



Step-by-step guide

Stage 2

Remove volumes that are infeasible or that cannot be accessed within balancing mechanism timescales

MNZT / MZT:

Volumes from units which have a Minimum Non-Zero Time (MNZT) or Minimum Zero Time (MZT) of greater than or equal to 12 hours are excluded.

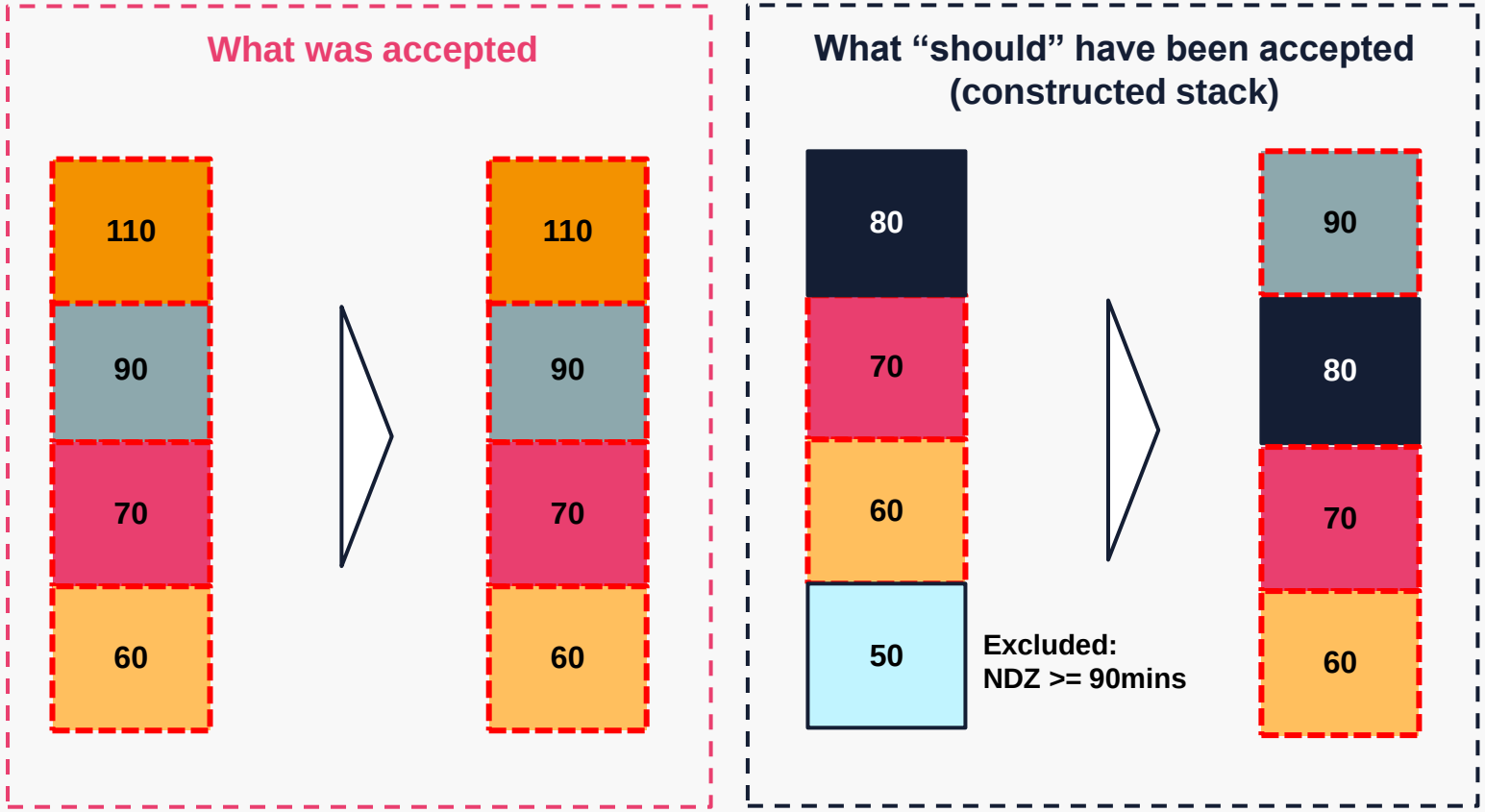
NDZ:

Volumes from units which have a Notice to Deviate from Zero (NDZ) of greater than or equal to 90 minutes and have a post BOA output of 0MW at the end of the previous 5-minute period are excluded.

This excludes volumes that could not be access by the ENCC within Balancing Mechanism timescales (gate closure of 60 mins from the end of the current settlement period means the earliest an instruction can be sent is 89 minutes prior to delivery).

SEL / SIL:

Where accepting a potential bid or offer volume would place a unit between zero and SEL or zero and SIL potential skip volumes are capped to SEL or SIL respectively. Note that units can be instructed to zero and these volumes are included.



Step-by-step guide

Stage 3

Remove volumes that were not taken for Energy balancing only

System Flagged:

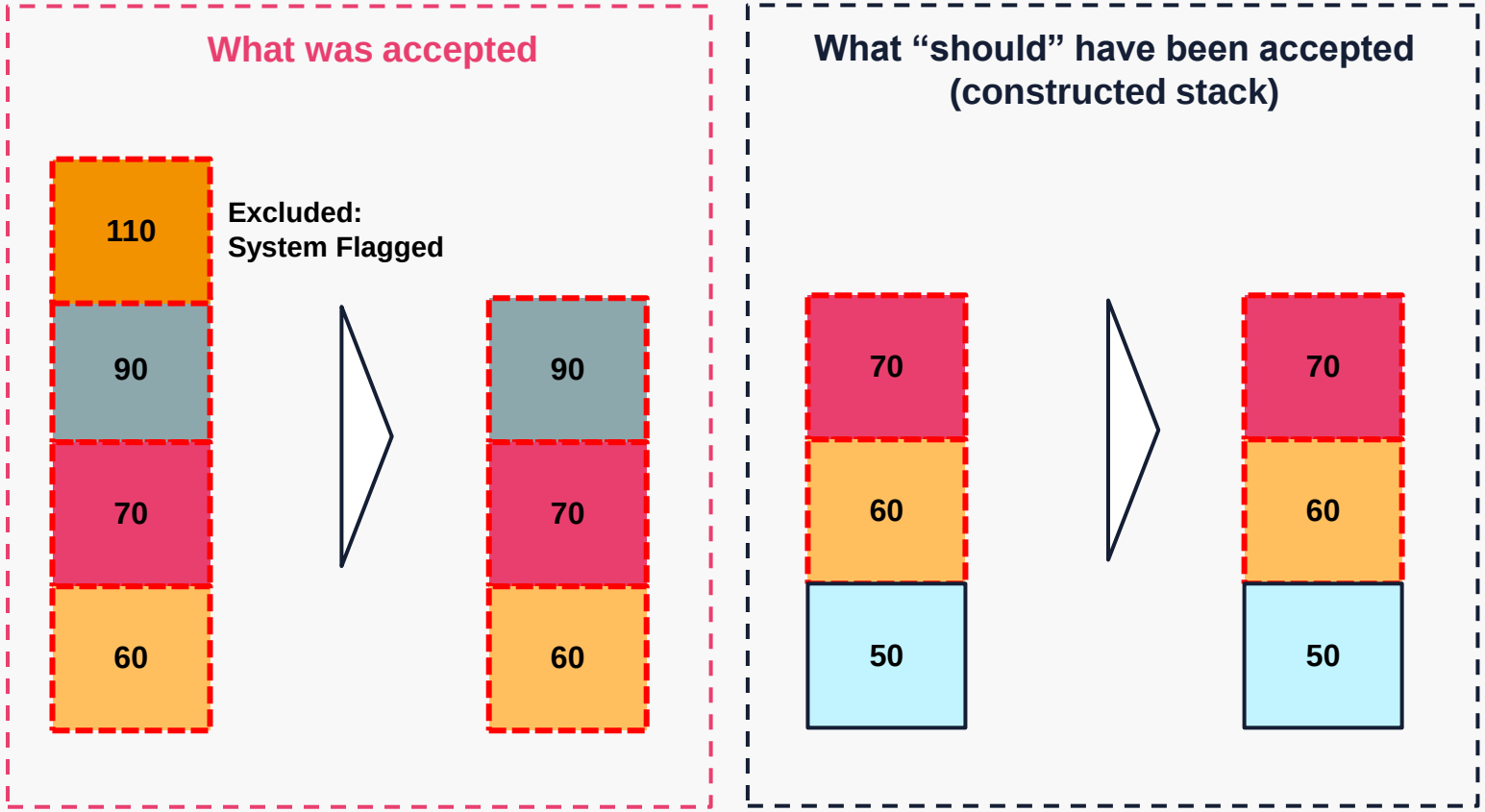
Acceptances which have been flagged as being taken for System balancing reasons are excluded. These actions are taken to alleviate transmission constraints in specific regions (so only a subset of assets located in that region can be utilised) and / or for system security.

This analysis focusses on the Energy balancing requirement that can be met by all assets.

Note: When applying this exclusion any acceptance which is system flagged is excluded. In addition, if a higher bid-offer pair is flagged but the lower pair remains unflagged the lower pair is also assumed to be flagged and is excluded.

Frequency Response:

Acceptances which have been flagged as being taken for Frequency Response in the Dispatch Transparency Data published by ESO are excluded.



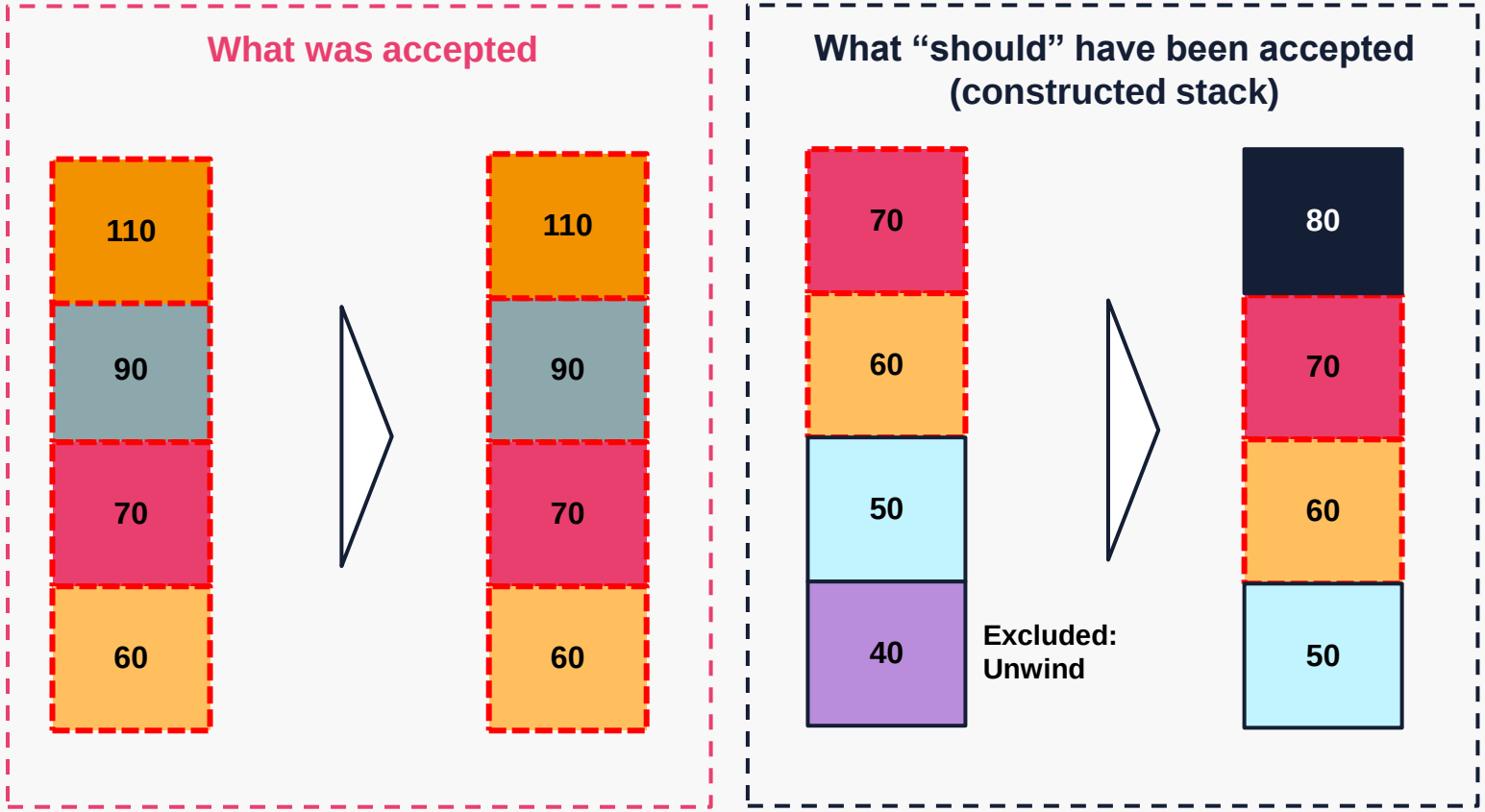
Step-by-step guide

Stage 4

Remove volumes that are not contingent on an opposing bid or offer action to be accepted.

Unwinds:

Unaccepted actions to unwind previously accepted bids or offers are excluded. These actions only become available upon the acceptance of a bid or offer in the opposing direction, otherwise they do not appear in the list of available bids and offers to ESO.



Step-by-step guide

Stage 5

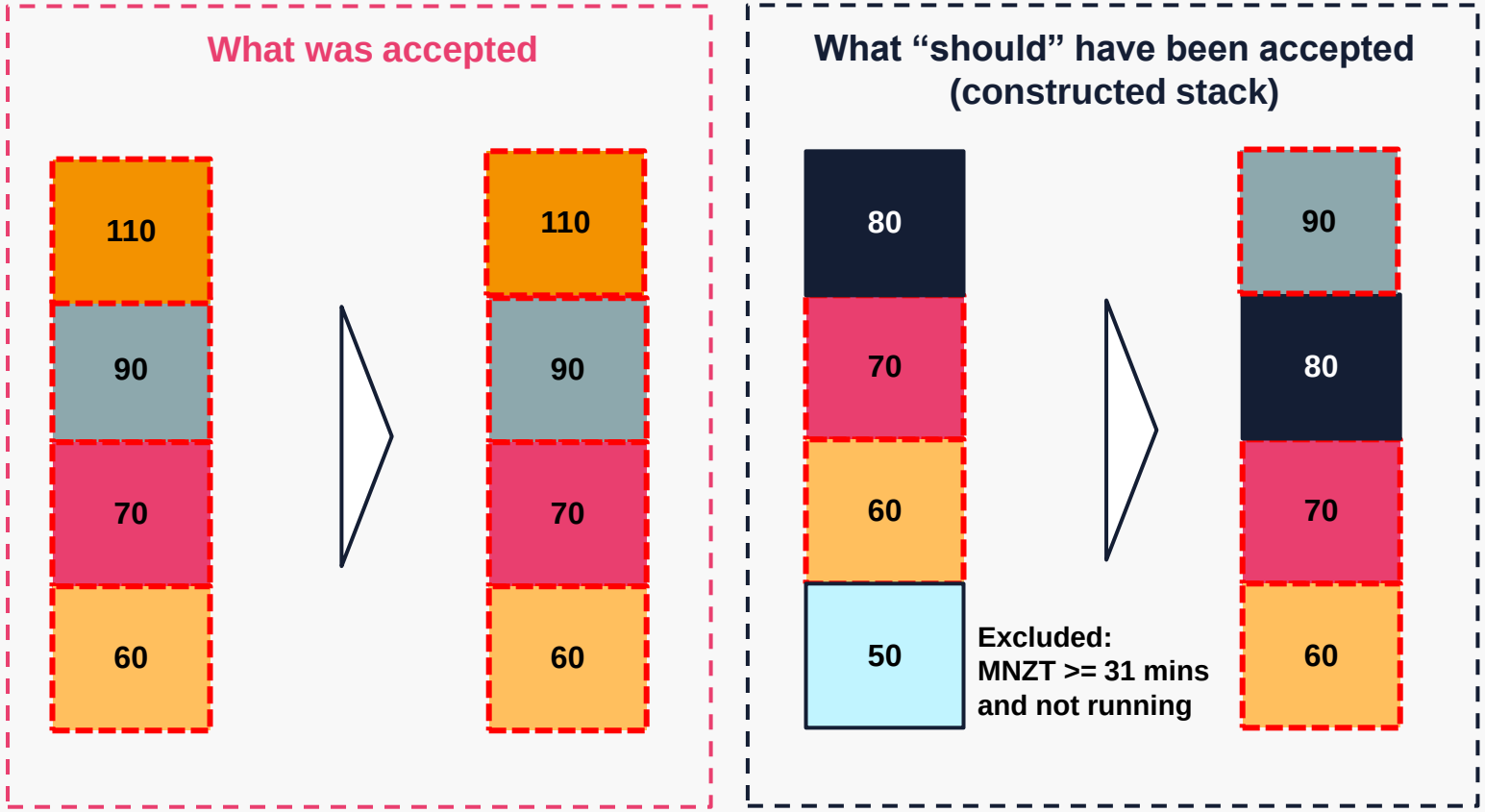
Remove volumes that could not be accessed by the Balancing team in the Control Room.

MZT / MNZT / NDZ:

- Exclude actions that would sync a unit with an MNZT or NDZ of greater than or equal to 31 minutes.
- Exclude actions that would desync a unit with an MZT of greater than or equal to 31 minutes.

Desync:

Exclude actions that would delay the desync of a unit with MZT or MNZT of greater than or equal to 31 mins.



Results

Results

Introduction

Overview:

In this section we present the results of the skip rates analysis. This analysis seeks to quantify the efficiency of dispatch decisions undertaken by ESO in the Balancing Mechanism across the observation period. It identifies the overall “skip rate” based on the proportion of in-merit actions that were not accepted.

In addition, we also calculate technology-specific skip rates as part of the results package in this report.

Time Period:

Skip rates have been analysed for the period between 1st January 2023 to 31st July 2024. We present results for 2023 and for 2024 until 31st July, with the division roughly aligning with the introduction of OBP (late December 2023 / early January 2024).

Granularity and averaging:

In-merit volumes and skip rate volumes are determined at 5-minute granularity. Skip rates reported at the annual (or monthly) level are the “volume-weighted” average of these 5-minute skip rates (based on the volume requirement in each period). This ensures that the calculation is not distorted by periods with very small volumes.

Technologies:

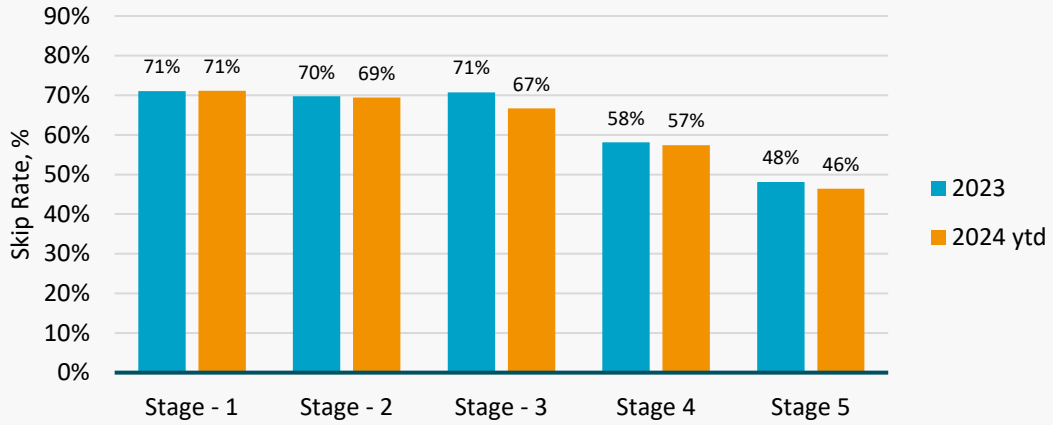
All technologies which participate in the balancing mechanism are considered in this analysis.

Note: BOA data for nuclear plant was also retrieved but as these units do not actively participate in the balancing mechanism (and have a skip rate of zero) results for these units are not presented.

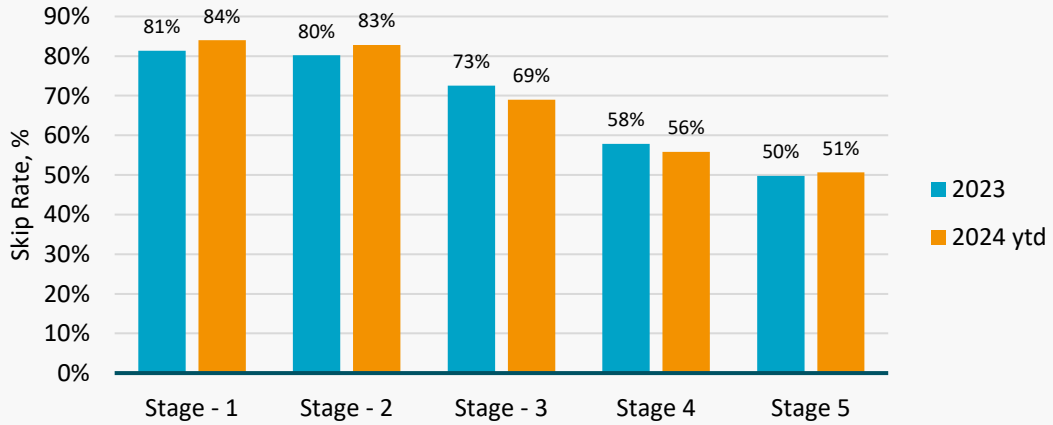
Results

Skip Rate – Phase 2

Offer Skip Rate (All Technologies)



Bid Skip Rate (All Technologies)



2024 ytd = 1st January 2024 to 31st July 2024

In line with the exclusion process, applicable volumes are excluded across the 5-stage process (detailed here). The all-technology results are detailed to the left.

When calculating skip rates some volumes are excluded as they were either taken for system balancing reasons or were not accessible to the control room. To gauge the impact of these exclusions the results of applying each in turn prior to the calculation of the final skip rate are shown.

- **Stage – 1:** Remove volumes that are procured outside of the balancing mechanism.
- **Stage – 2:** Remove volumes that are infeasible or that cannot be accessed within balancing mechanism timescales.
- **Stage – 3:** Remove volumes that were not taken for Energy balancing only.
- **Stage – 4:** Remove unwind actions
- **Stage – 5 :** Remove volumes that could not be accessed by the balancing team in the Control Room.

Offers:

- Skip Rates have reduced by 4% (stage 3) between 2023 and 2024 (to 31st July).
- Impact of exclusions reduces skip rates by 23% in 2023 and 25% in 2024 (to 31st July).

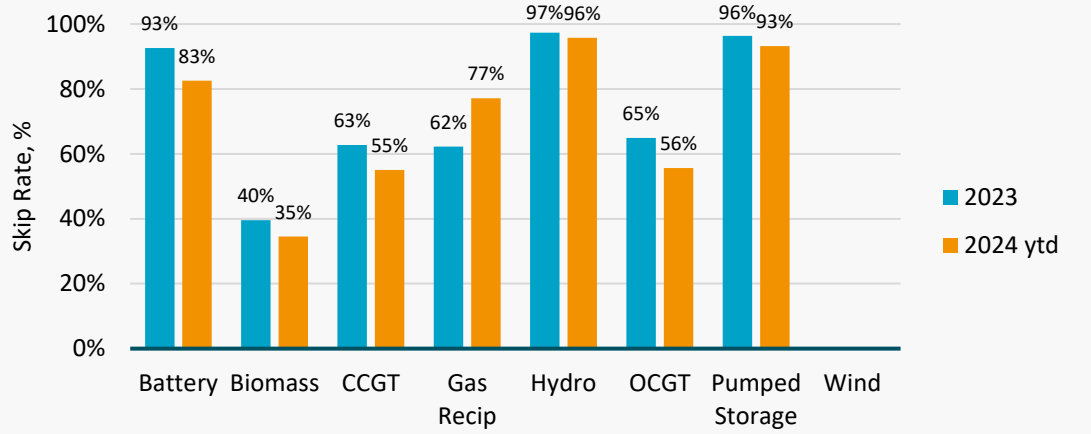
Bids:

- Skip Rates have reduced by 4% (stage 3) between 2023 and 2024 (to 31st July).
- Impact of exclusions reduces skip rates by 31% in 2023 and 33% in 2024 (to 31st July).

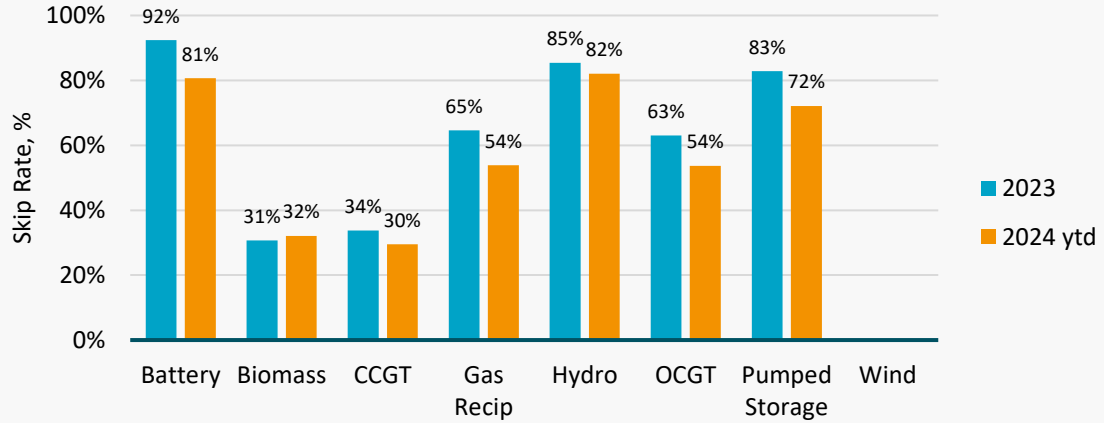
Results

Skip Rate – Phase 2 (proportion of technology participating in BM affected)

Offer Skip Rate by technology (stage 3)



Offer Skip Rate by technology (stage 5)



2024 ytd = 1st January 2024 to 31st July 2024

The offer skip rates experienced by each technology class are shown on the left.

These are calculated by determining the percentage (%) of unaccepted in-merit volume against the total amount of in-merit volume in each 5-minute period for each technology.

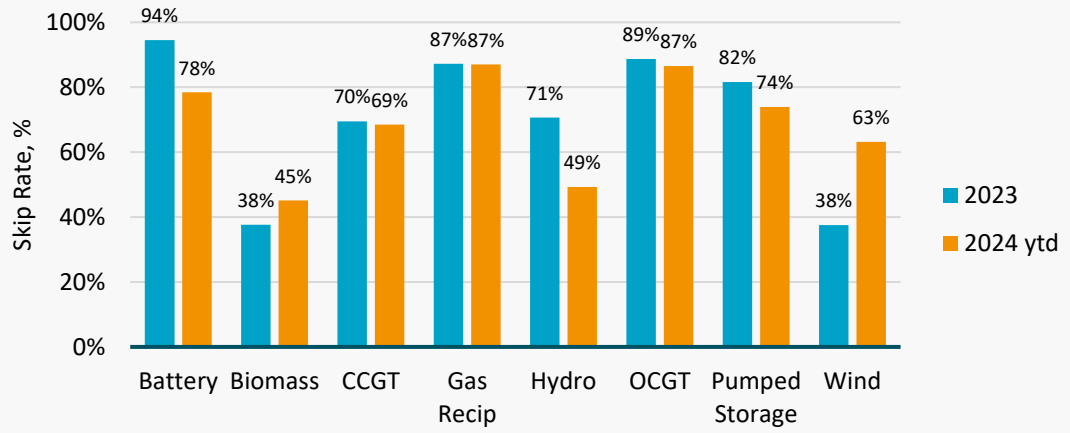
- **Battery Storage skip rates have fallen by 10% at stage 3 and 11% by stage 5** between 2023 and 2024 (to 31st July) following the introduction of OBP.
  - Gas Recips conversely have seen an increase in overall skip rates in comparison to 2023 of 15% at stage 3 and a 11% decrease at stage 5.
  - **CCGT units have also experienced a fall in skip rates of 8% at stage 3 and 4% by stage 5.**

- Battery Storage, Hydro and Pumped Storage technology classes experience the highest levels of skips.
  - Pumped Storage units provide other ancillary services (for example Spin Gen for reserve and response) which are not taken into account in the current methodology and may be a contributing factor to the higher level of skips.
  - There is no information available on whether units are in Spin Pump mode or in Spin Gen mode, which would dictate if they are able to be bid-down or offered-up from a zero position.

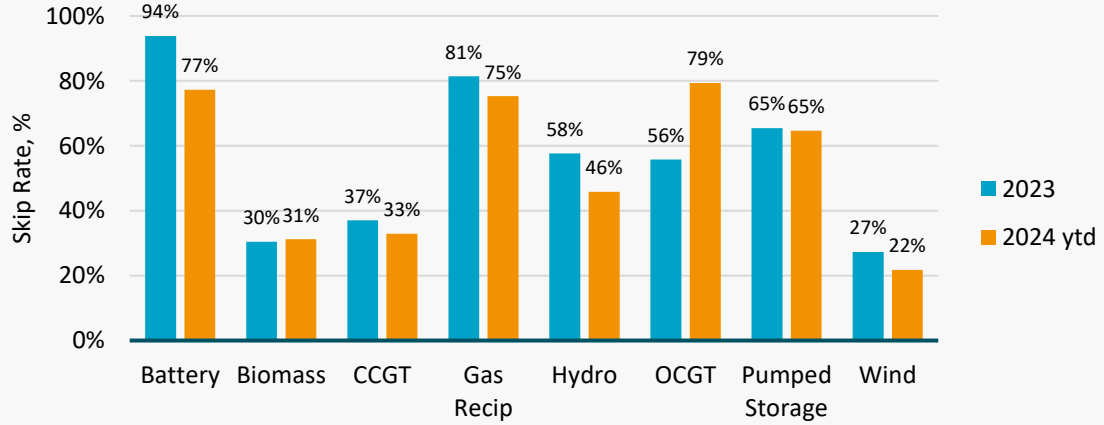
Results

Skip Rate – Phase 2 (proportion of technology participating in BM affected)

Bid Skip Rate by technology (stage 3)



Bid Skip Rate by technology (stage 5)



2024 ytd = 1st January 2024 to 31st July 2024

The bid skip rates experienced by each technology class are shown on the left.

These are calculated by determining the percentage (%) of unaccepted in-merit volume against the total amount of in-merit volume in each 5-minute period for each technology.

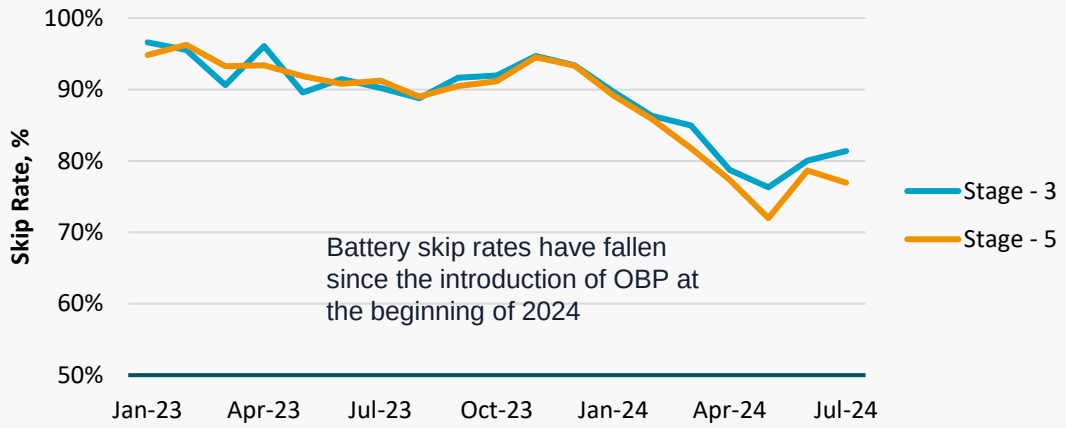
- **Battery Storage skip rates have fallen by 16% at stage 3 and 17% at stage 5** between 2023 and 2024 (to 31st July) following the introduction of OBP.
  - **CCGT units have also experienced a fall in skip rates of 1% at stage 3 and 4% by stage 5.**

- Battery Storage, Gas Recips, OCGTs, and Pumped Storage technology classes experience the highest levels of skips.
  - Pumped Storage units provide other ancillary services (for example Spin Gen for reserve and response) which are not taken into account in the current methodology and may be a contributing factor to the higher level of skips.
  - There is no information available on whether units are in Spin Pump mode or in Spin Gen mode, which would dictate if they are able to be bid-down or offered-up from a zero position.

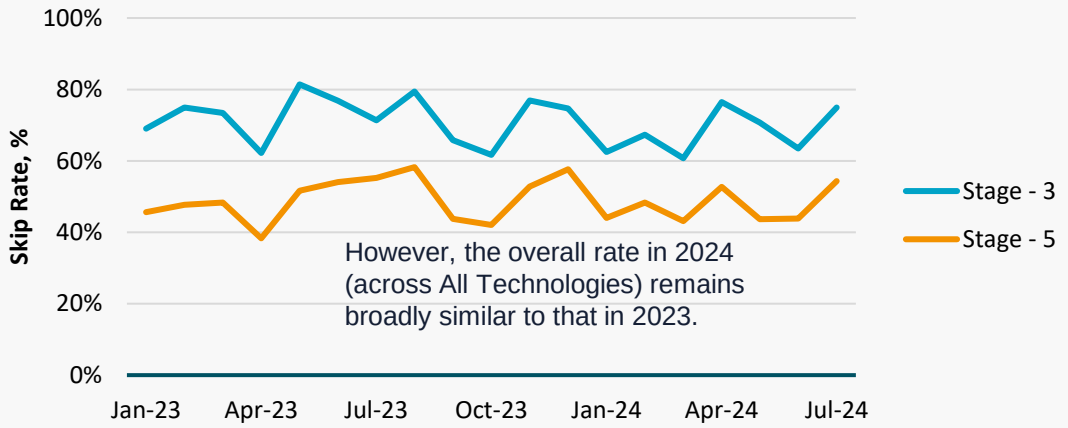
Results

Skip Rate – Phase 2 by month

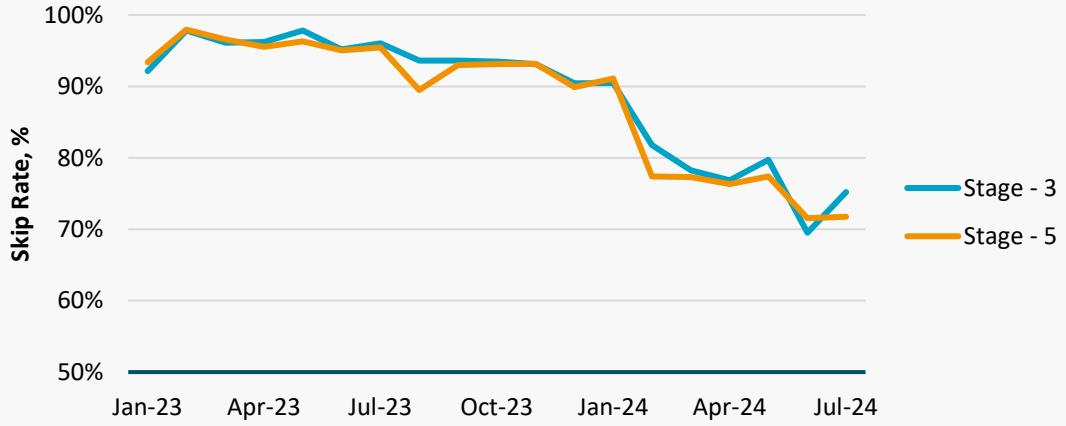
Battery Storage Offer Skip Rate



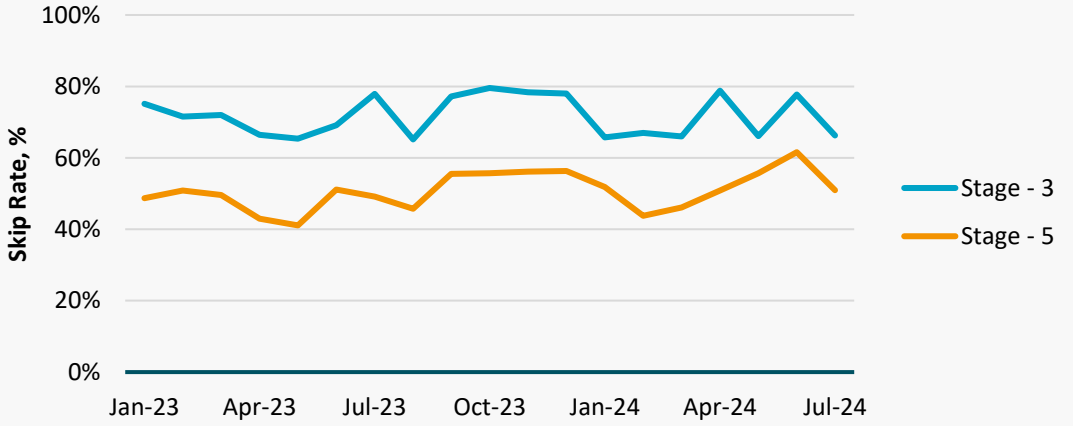
Offer Skip Rate (All Technologies)



Battery Storage Bid Skip Rate



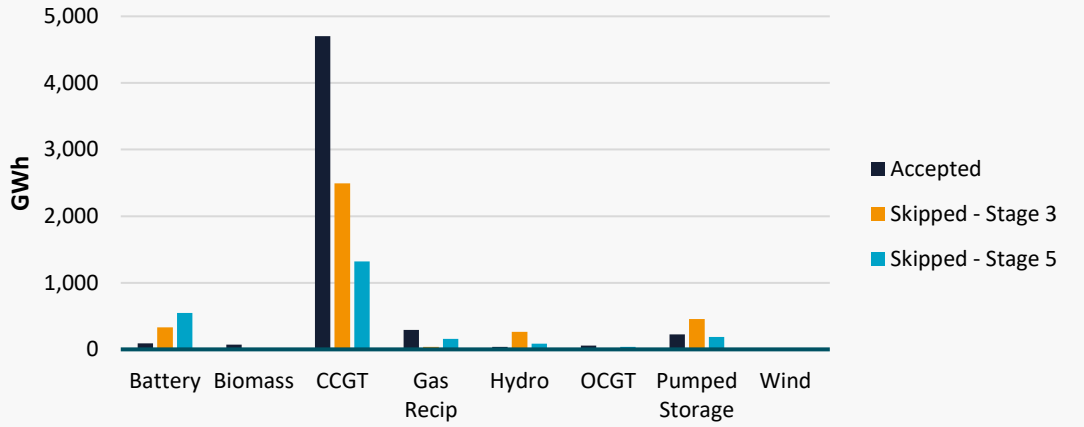
Bid Skip Rate (All Technologies)



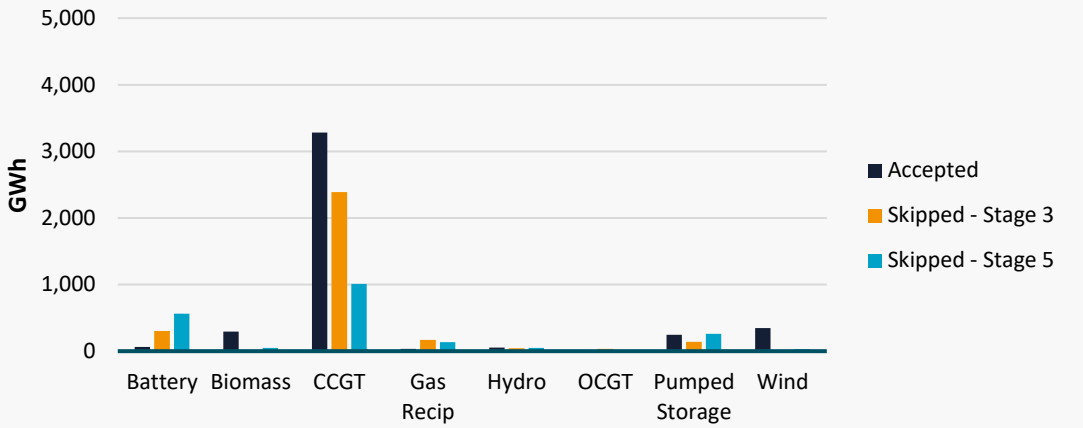
Results

Skip Rate – Phase 2 (volumes by technology)

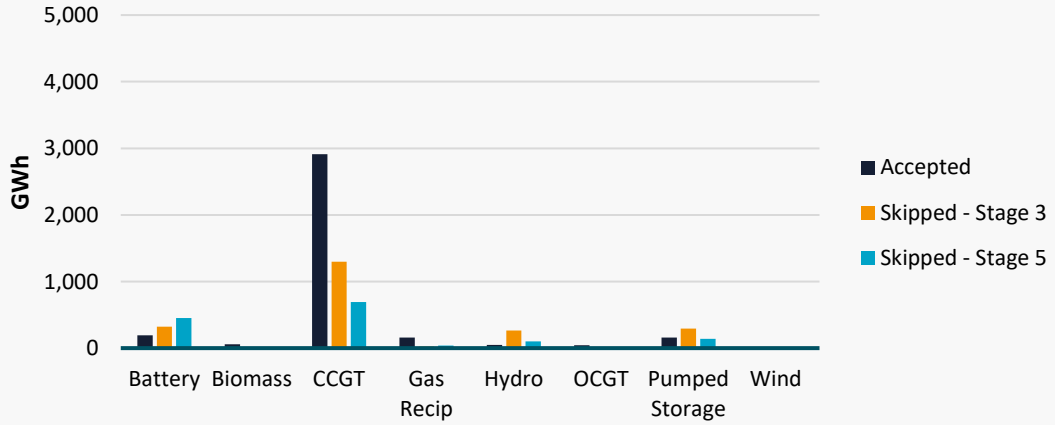
Offer Skip and Acceptance volumes - 2023



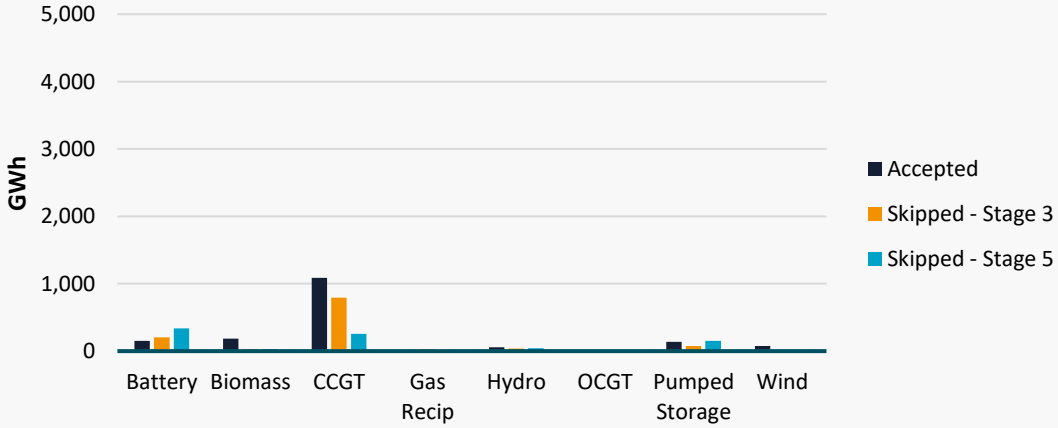
Bid Skip and Acceptance volumes - 2023



Offer Skip and Acceptance volumes – 2024 (ytd)



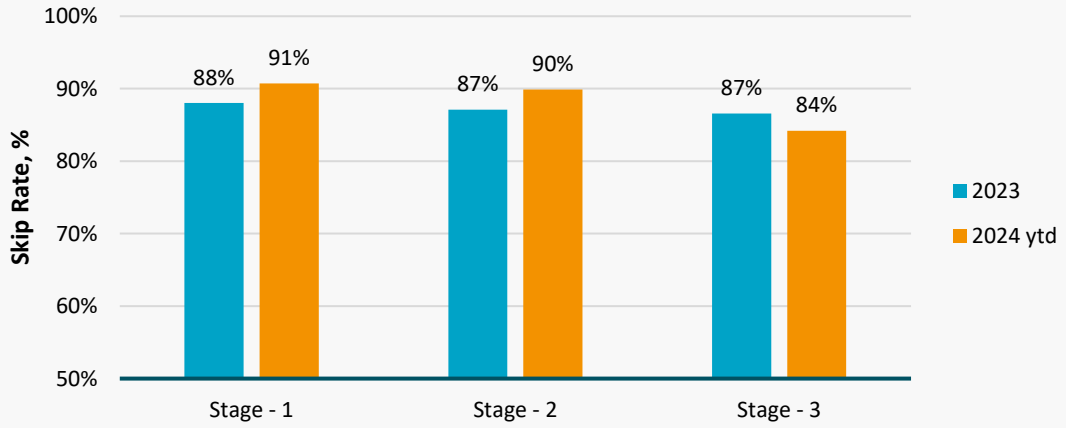
Bid Skip and Acceptance volumes – 2024 (ytd)



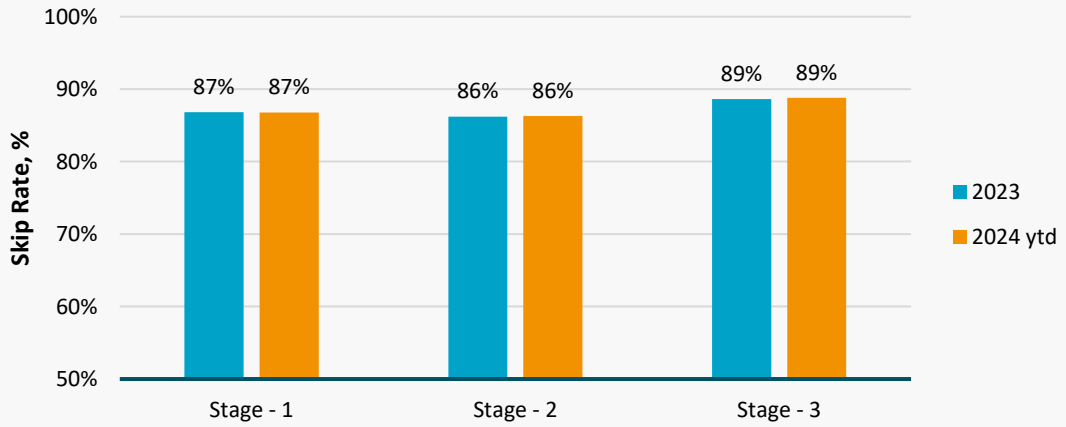
Results – impact of using an in-merit stack

Skip Rate – Phase 1 approach to defining in-merit actions (comparing to most expensive action)

Offer Skip Rate (All Technologies) – using Phase 1 in-merit approach



Bid Skip Rate (All Technologies) – using Phase 1 in-merit approach



The Phase 1 approach calculates the total volume of in-merit actions by **comparing to the marginal bid or offer price**. Here, we present results using this approach to in –merit actions, but otherwise keeping the approach the same as in Phase 2 (i.e. using 5-minute granularity and the same exclusions as in stage 3 of Phase 2).

The skip rate is then defined as the proportion of these "in-merit" actions that were not utilised as a proportion of the total in-merit volume in each period.

The overall skip rate across all technologies is:

- Offers: 87% in 2023, 84% for 2024 (ytd)
- Bids: 89% in 2023, 89% for 2024 (ytd)

Exclusions applied:

- Equivalent to stage 3 of Phase 2 analysis
- Accepted actions which are either system flagged or denoted as being utilised for Frequency Response in the Dispatch Transparency dataset published by ESO are excluded.
- Wind Offers, BSADs and volumes from units with Winter Coal Contingency contracts are also excluded.

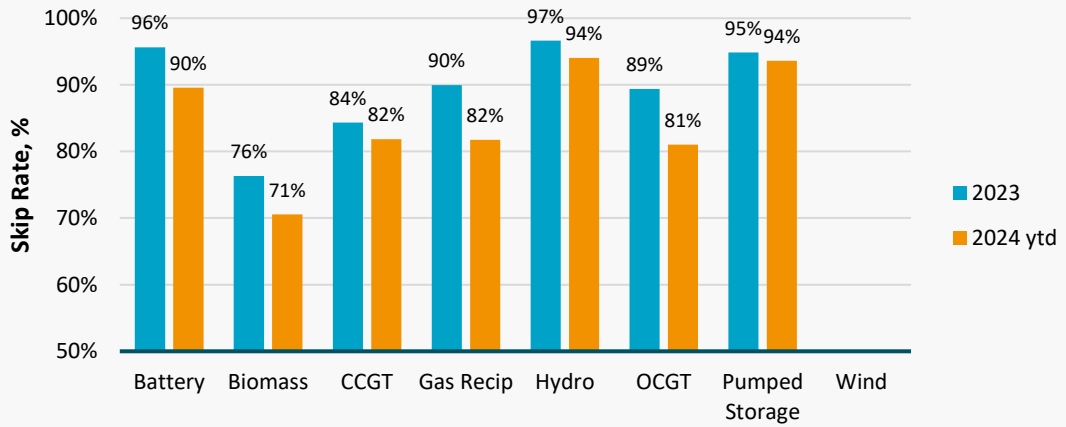
Limitations of this approach:

- The actual volume requirement to balance this period may be much less than the volume which appears to be "skipped" versus the marginal bid/offer price. Some volumes that are classified as being "skipped" may have never been required.

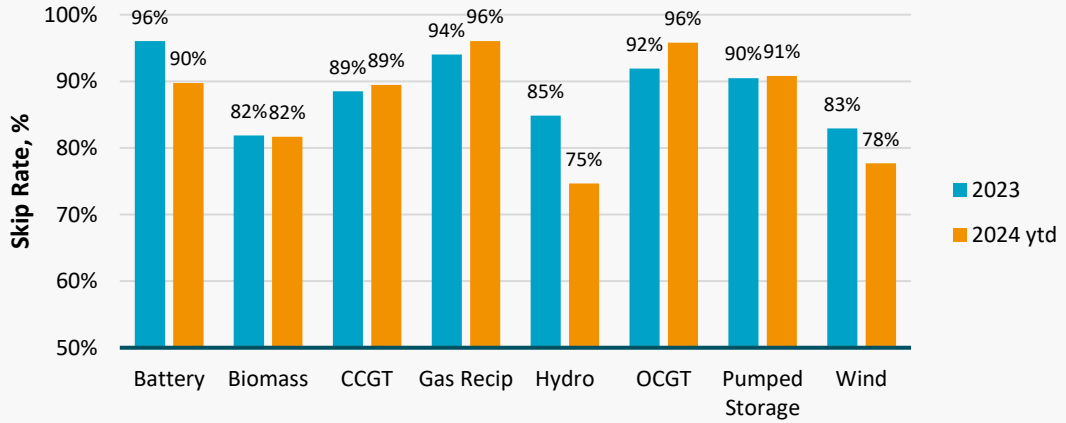
Results – impact of using an in-merit stack

Skip Rate – Phase 1 approach to defining in-merit actions (comparing to most expensive action)

Offer Skip Rate by technology (stage 3) – using Phase 1 in-merit approach



Bid Skip Rate by technology (stage 3) – using Phase 1 in-merit approach



The skip rates experienced by each technology class are shown on the left.

These are calculated by determining the percentage (%) of unaccepted volume (which was more economic than the most expensive accepted action) against the total amount available volume for each technology.

In general, versus the Phase 2 approach **technology skip rates are higher because the actual balancing volume requirement is no longer taken into account**. Any unaccepted volume which appears to be in-merit versus the most expensive action counts as being “skipped”.

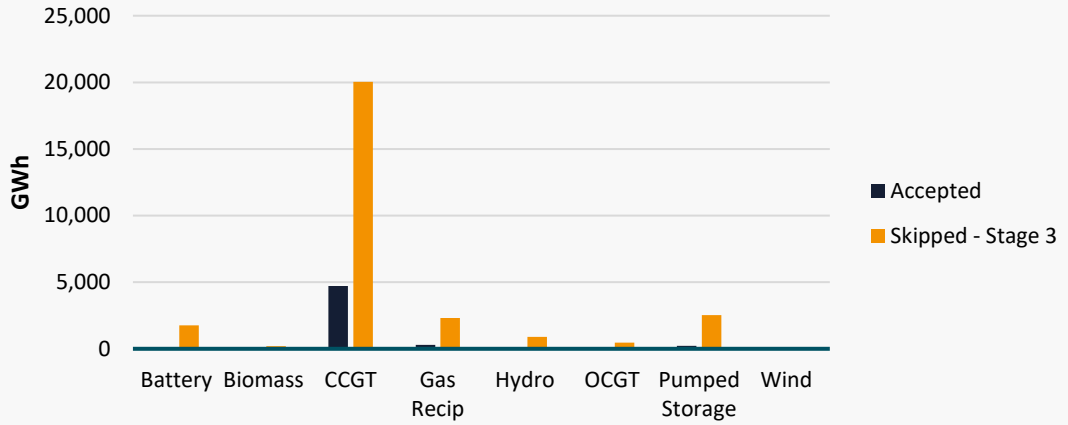
As in Phase 2, Battery Storage, Hydro and Pumped Storage have the highest Offer Skip Rates, and these technologies are Battery Storage, Gas Recips, OCGTs and Pumped Storage have the highest Bid Skip Rates.

However, using the Phase 1 approach to defining in-merit actions increases the skip rates for technologies such as CCGT and Biomass significantly, meaning there is less variation across technologies compared to Phase 2.

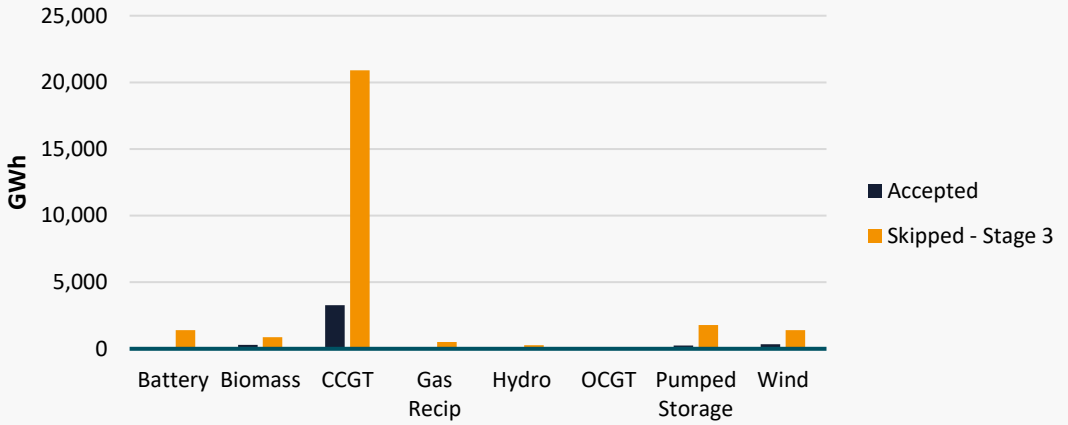
Results – impact of using an in-merit stack

Skip Rate – Phase 1 approach to defining in-merit actions (comparing to most expensive action)

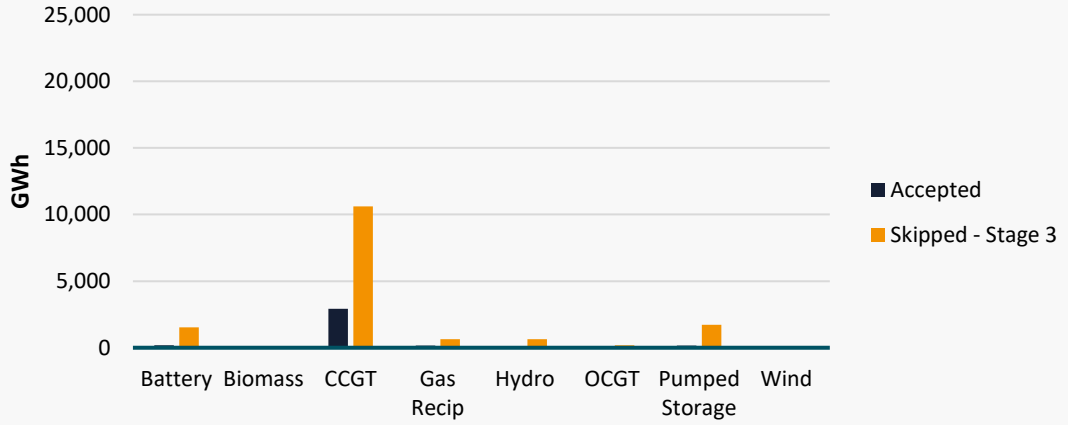
Offer – Skip & Acceptance volumes - 2023



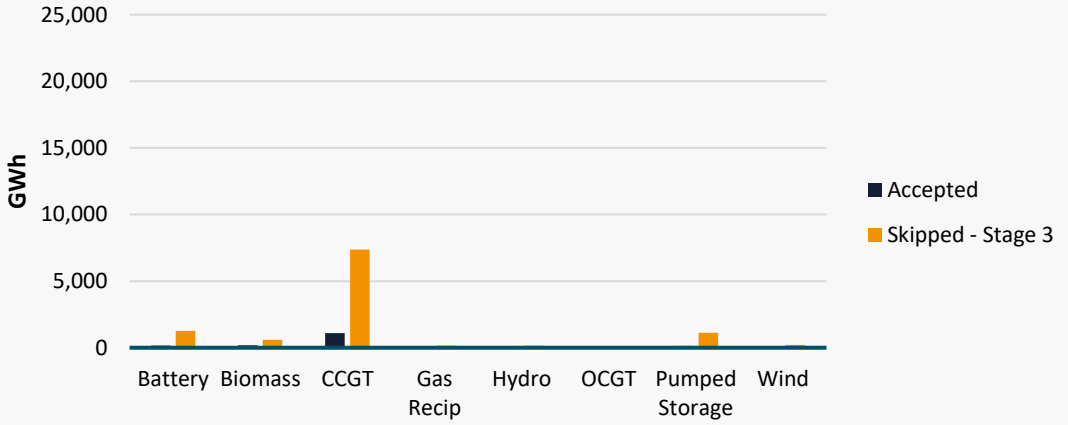
Bid – Skip & Acceptance volumes - 2023



Offer – Skip & Acceptance volumes – 2024 (ytd)



Bid – Skip & Acceptance volumes – 2024 (ytd)



Conclusion

Conclusion

A “skip” occurs when balancing actions are taken seemingly uneconomically (out of price order). The ESO has recognised recently that its BM processes and systems are not well suited to efficiently utilising many smaller BMUs and have resulted in assets being skipped.

This report has put forward a methodology for assessing the level of “skipping” to improve transparency. Using this methodology, the average skip rate for Battery Storage offers was 93% across 2023, reducing to 83% across 2024 (analysis carried out between 1st January to 31st July 2024). Similarly, for Battery Storage bids the average skip rate was 94% in 2023 and 78% for 2024 (ytd).

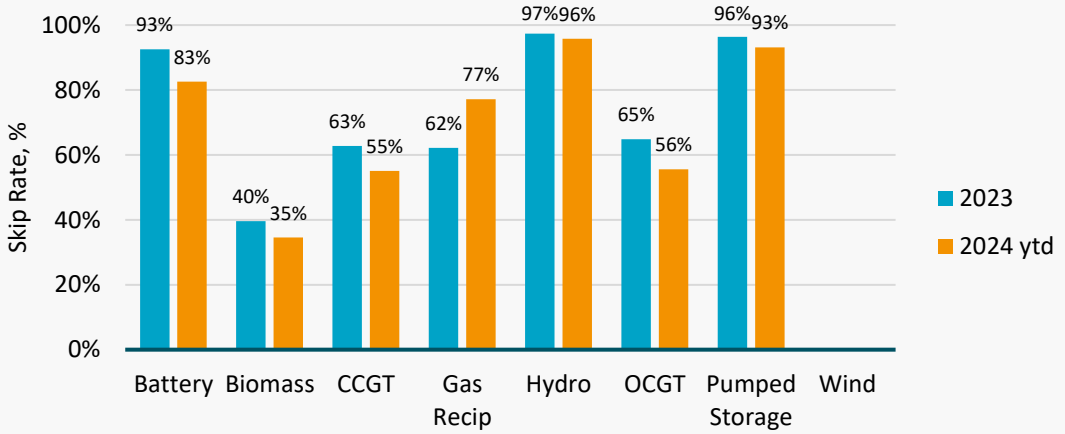
In developing the report, LCP Delta have evolved the methodology beyond what is typically used in industry (more akin to our Phase 1 analysis). Our Phase 1 methodology does not account for the actual energy need within the BM, whereas, in Phase 2, we assess ESO’s dispatch decisions against the BM energy volume requirement.

Since early 2023, the ESO has rolled out various improvements to enhance dispatch of smaller BMUs and Battery Storage in the BM, and in December 2023, ESO launched the Open Balancing Platform (OBP) that made the processing of bulk dispatch of small BMUs and Battery Storage easier, enabling greater dispatch efficiency.

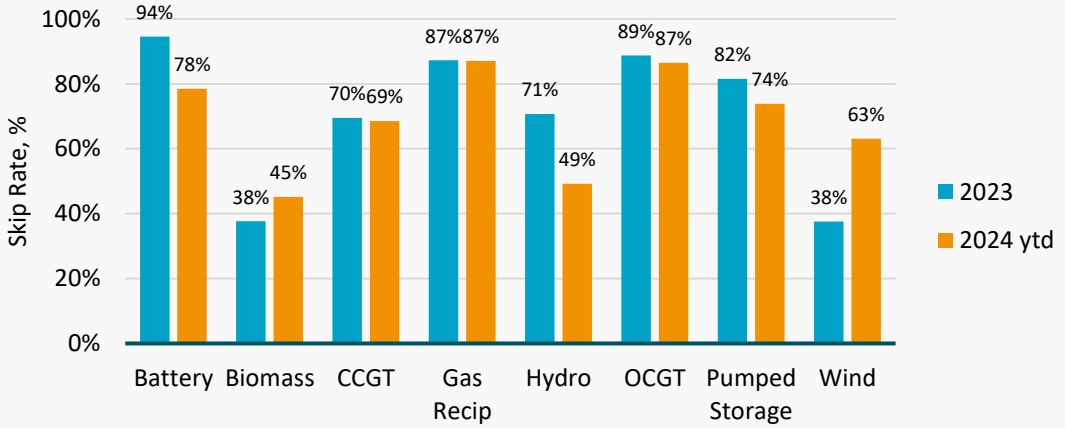
It is difficult to isolate the impact of OBP, and not the purpose of the report, but early evidence is that Battery Storage skip rates have fallen following the introduction of OBP.

Finally, we outline on the next slide some of the limitations of the analysis.

Offer Skip Rate by technology (Phase 2 approach, Stage 3)



Bid Skip Rate by technology (Phase 2 approach, Stage 3)



Limitations of this analysis

Run-up/down Rates:

Feasible volumes are not constrained by run-up and run-down rates.

State of Charge:

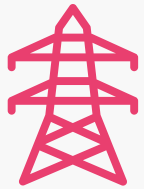
Each 5-minute period is assumed to be independent and the state of charge of storage assets is not tracked.

Tracking state of charge would introduce additional complexity to the analysis (would need to decide in which periods it is optimal to dispatch these assets) and in turn introduce additional assumptions around cycling limits, round-trip efficiency and state of health.

Each 5-minute period is assessed independently of any preceding and successive period. This will limit the exposure of efficiencies that the ENCC could have accessed by dispatching assets across multiple 5-minute periods.

Data Availability:

Dispatch Transparency data is incomplete, this data is used to retrieve which units were utilised for Frequency Response.



Thermal Constraints:

Accounting for thermal constraints (beyond the exclusion of system tagged actions) would introduce additional complexity to the calculation of the skip rate metric making it less transparent and difficult to reproduce.

It would entail the calculation of locational merit stacks to ensure actions taken behind thermal constraints were efficient.

Ancillary Services:

Assets held back by ESO in readiness to provide other ancillary services (Reserve, Response) are not excluded.

Pumped Storage:

Data is not available to show when pumped storage units are in ‘Spin Pump’ or ‘Spin Gen’ modes which would impact the feasibility of providing balancing actions.

Appendix: Stakeholder Feedback

Write up of LCP Delta stakeholder engagement activities which took place over a 6-week period in autumn 2023 to gather evidence from key industry participants.

Gathering stakeholder feedback on "skip rates"

LCP Delta conducted a series of stakeholder engagement activities which took place over a 6-week period in autumn 2023 to gather evidence from key industry participants. These activities comprised of 10 one-hour interviews and an industry workshop. Across both forms, careful consideration was made to ensure that a broad range of views were captured and there was sufficient representation from different industry actors.

Overview of research methods

Interviews

10 industry stakeholders were interviewed during this project. To ensure equal representation, these stakeholders were specifically identified by LCP Delta and ESO and categorised into one of the following groups:

- General traders (4 participants)
- Flexible asset operators and aggregators (3 participants)
- Investors (3 participants)

Each interview comprised of 10 questions which were divided across three broad sections:

- Experience and perception of uneconomic dispatch in the BM
- Use of the BM Transparency dataset
- Addressing uneconomic dispatch in the BM

Workshop

LCP Delta facilitated a workshop on 16 November 2023 at the ESO's 'Enhancing Energy Storage in the Balancing Mechanism' event in London. This provided an opportunity for a wider group of industry stakeholders to contribute to this work and validate the emerging findings from the previously completed interviews. The workshop specifically focused on gathering stakeholders' opinions around the BM Transparency dataset and solutions to addressing uneconomic dispatch. Stakeholders were also provided an opportunity to provide feedback on the methodology that has been developed to measure levels of uneconomic dispatch.

During this workshop ~90 attendees participated in discussions as part of working groups. LCP Delta acted as an independent facilitator and recorded any feedback given.

Presentation of stakeholder findings

All stakeholder comments collected in this research have been presented anonymously by stakeholder group in this report. This was outlined to participants to encourage their engagement and honest feedback. ESO representatives were also present in the workshop hall during the workshop.

Stakeholder feedback event – October 2023

Enhancing Energy Storage in the BM Event

On 16 October 2023, LCP Delta presented an initial report to industry at the ESO's "Enhancing Energy Storage in the BM" event. This event acted as an opportunity to present LCP Delta's initial findings, project methodology and assumptions.

Our involvement in this event was divided into two session:

1. A morning session where we introduced the project and our emerging findings, providing context for the day.
2. An afternoon of stakeholder engagement in breakout sessions.

We used this event to allow for wider feedback on the project and receive views on the issue of inefficient dispatch, including:

- A definition of "skip rates";
- Tested and agreed on a methodology for calculating "skip rates".

Stakeholder feedback findings

Experience and perception of uneconomic dispatch in the BM

In this opening section we asked stakeholders several questions related to their experience and perceptions of uneconomic dispatch in the BM. Specifically, we asked the extent to which their assets and company had been affected and the impact this could have on further investment.

All stakeholders interviewed were aware of the terms ‘explained skip’ and ‘unexplained skip’. When asked to define these terms, there was broad alignment across stakeholders in how they were described. Several stakeholders mentioned they have previously engaged with ESO on this topic and shared portfolio or asset level analysis. However, no new analysis was put forward as part of this process to support this review.

Stakeholders experience of skip rates

There is a consensus between battery storage operators and investors that uneconomical dispatches have significantly affected their operations, especially over the last two years when rates have been particularly high. General traders highlighted that uneconomic dispatch is not specific to battery assets and that they have also experienced skip rates, but not to the same extent as the other groups. Some stakeholders have responded to these market conditions by pivoting their operations away from the BM and into other markets that they have greater confidence in.

Stakeholders’ opinions on ENCC limitations

Stakeholders recognise that ENCC engineers face significant constraints due to manual processes and a lack of automation, hindering optimal system operation. Outdated IT systems designed two decades ago contribute to this challenge, failing to keep pace with the evolving electricity system.

ENCC engineers are observed to adopt varying approaches or 'habits' in system operation, influenced by factors such as experience, knowledge, and attitude. A bias towards prioritising larger assets over smaller, distributed ones is noted, driven by operational constraints favouring the dispatch of more straightforward, larger assets. Some stakeholders argue that current rules, like the 15-minute duration limitation*, unfairly penalize smaller assets, creating a perceived bias based on asset size.

Communication with ENCC engineers is deemed crucial for desired outcomes, with inconsistencies in approach causing frustration among stakeholders. Further clarification is sought on engaging with Dispatch Datasets, Account Managers, and Dedicated teams.

Concerns also arise regarding the ENCC structure particularly the division of dispatch tasks between geographical North and South desks by ESO

*The 15-minute duration limitation (the “15-minute rule”) has since been extended to 30-minutes

Stakeholder feedback findings

Experience and perception of uneconomic dispatch in the BM

Stakeholders' expectations of dispatch rates in the Balancing Mechanism when at project development and investment stage

Investors believe that uneconomic dispatch rates have been "a country mile" higher than projected at the project development stage. In the opinion of one stakeholder within a group, the BM has materially underperformed their expectations and made it very difficult for their assets to compete with other technologies which is undermining the merchant power revenue models of batteries in the UK. This view is generally held by battery operators as well, with one stakeholder highlighting that their battery asset has been sitting idle for up to two-years. Due to the lack of relevance to the general traders sub-group, these stakeholders did not address this section.

Stakeholders' opinions of further investing in the GB electricity sector

Some stakeholders highlighted the impact that uneconomic dispatch is having on participation in the BM and stressed that the expectation of uneconomic dispatch alters pricing and that there are potentially increased volumes being offered in the ancillary service market, reducing the BMs Maximum Deliverable Offer/Maximum Deliverable Bid.

Stakeholders explained how they are now incorporating higher levels of skip rates in their modelling forecasts and revenue streams. Some Battery Storage Operators stated that this has caused them to hold back investment in the GB electricity market and that without any certainty or clarity as to when skip rates will be addressed, this will significantly risk future investment.

In some cases, stakeholders have avoided investment into all commercial and domestic projects with many of these stakeholders' clients looking towards markets in the USA and the EU (noting strong market signals from the Inflation Reduction Act and European Market Design).

Other stakeholders still intend to invest given the outcome from the 2020 'Reserve from storage' trial by National Grid, which demonstrated the capabilities and competitiveness of battery assets. Following this, stakeholders expected a change in the system to allow batteries take a greater role in the BM. However, there are concerns that the legacy of this trial has disappeared, and consequently, skips remain an issue.

Stakeholder feedback findings

The BM Transparency Dataset

Introduction to Dispatch Transparency

The Dispatch Transparency dataset is a data portal that provides information on the actions taken by ESO to balance the electricity system. The dataset includes the publication of actions taken in the BM, within which all actions are assigned a 'reason code', providing additional insight on why alternative actions may not have been a suitable option. A dispatch methodology document is also published which provides additional detail on the process for categorising actions, assigning reason codes and publishing the dataset.

ESO was particularly interested in what a common co-created dataset between market participants and ESO could look like. In this section, we gathered feedback from stakeholders on their experience of using the dataset. Specifically, we gathered evidence on how stakeholders engaged with the dataset, how they were using it, how useful they found it and how they believed it could be improved.

Stakeholders' engagement with the ESOs Balancing Mechanism Transparency Dataset

Awareness of the dataset is widespread, with all stakeholders having some knowledge of its existence and purpose. As expected, use of the dataset and detailed knowledge of its exact contents varied across stakeholder groups.

The dataset is most commonly used by stakeholders to review decisions that have been made in the BM and to better understand why actions have been taken, particularly in the case where assets have been used out of merit. In some cases, stakeholders said they would use data provided by the dataset in conjunction with their own economic models to provide deeper analysis. However, many stakeholders highlighted issues with data quality which affects how they can use the data and, in some cases, prevents deeper analysis (e.g. through combining with other datasets). This includes instances of incomplete data (e.g. BMU IDs) and data inconsistencies (e.g. inconsistent spelling).

Some stakeholders had more fundamental concerns with ESO conducting this process. In particular, they questioned the legitimacy of ESO assessing the quality of the actions it had taken given the lack of impartiality inherent in an organisation assessing its own actions. Furthermore, stakeholders highlighted a perception that the manual process associated with this exercise, which delays the publication of data further affects its credibility.

Stakeholder feedback findings

The BM Transparency Dataset

Stakeholders' opinions on the current 'reason codes'

There is widespread concern across industry stakeholders around the reason codes that are used to explain skip rates. Many stakeholders hold the opinion that, in their current form, the reason codes are insufficient to explain clearly why uneconomic actions by ESO have been taken.

The overriding concern is that in many situations, the reason code does not accurately reflect the root cause of the issue that has led to skips. The majority of skips have been tagged as 'zonal management' or 'frequency' which stakeholders believe do not provide any transparency or explanation of the true reason the skip happened. In many situations, stakeholders believe skips are caused by system deficiencies such as the IT systems. However, these reasons are not coded or applied to any skipped actions.

IT upgrades and greater automation – All stakeholders that have been engaged throughout this process stressed the need for IT upgrades and greater automation. It was felt that this would enhance data quality (by reducing the level of human input), speed up the publication process and enhance the reputation of the dataset.

Greater transparency on reason code tagging process - Although the ESO provide the methodology of how they work through dispatching assets, stakeholders would welcome work to be done to map out the reason code tagging processes, and for this to be included alongside the dataset on the portal.

Greater detail on existing reason codes and additional reason codes – More detail on the reason codes is necessary so that stakeholders can better understand why actions have been taken. Stakeholders would also like the economic rationale to be communicated when skips are taken and would welcome a more open and detailed discussion on specific actions that have been taken during the Operational Transparency Forum.

More timely publication – Stakeholders highlighted the benefits of ESO publishing the dataset closer to real time. This would improve the credibility of the dataset. During the industry workshop some stakeholders outlined that all BM data should be shared in real time and made easily accessible to market participants. It was suggested that the data should be reviewed and further analysed ESO in reconciliation runs to understand the key reasons behind skips.

Additional data points – Stakeholders highlighted the benefits of providing additional data outputs. This included: providing system operating plans and publishing the BESS fleet as a fuel type (which would enable market players to better map assets by zonal constraints). One stakeholder also suggested expanding the existing data categories. This includes more detailed sub-categorisation of the following data categories: All BOAs/Loss Risk (e.g., capacity), All BOAs/response and alternative actions/frequency. Further suggestions include more explanation of the alternative actions/no reason category/providing locational datapoints.

Stakeholder feedback findings

Addressing Uneconomic Dispatch in the BM

Introduction to addressing uneconomic dispatch in the BM

In the final section we sought feedback from industry stakeholders on the progress ESO has made on addressing skip rates, including their expectations on upcoming system changes (such as the introduction of the OBP and additional code modifications). Stakeholders were also provided with the opportunity to suggest additional technical or non-technical solutions.

Progress to date

All stakeholders were supportive of the upcoming system changes which they are expecting will have a positive impact on the level of skip rates. Most stakeholders singled out the impact upgraded IT systems and increased automation should have on reducing the operational burden on the ENCC and improving the handling of small BMUs. Stakeholders are also encouraged by upcoming code modifications (such as the 15-minute rule and bulk dispatch) and some also praised ESO for the transparency they have shown in communicating these system changes to industry.

All stakeholders have acknowledged that progress has been made over the past few years and understand the complexity and scale of the challenge. However, despite extensive collaboration with industry participants almost all stakeholders expressed that the pace of change has been too slow. One stakeholder stressed the impact delayed implementation is having on carbon emissions and market prices.

Stakeholders' express concerns about a significant risk of delays and overspending in the delivery of system changes, citing a lack of confidence in ESO's ability to meet deadlines due to perceived slow and bureaucratic processes. Doubts arise regarding ESO's suitability for handling IT software or system changes, with past delays and budget overruns on the EBS system serving as an example.

Uncertainty prevails among stakeholders regarding the anticipated impact of upcoming system changes on skip rates. Transparency issues surrounding ESO's tools and processes make it challenging for stakeholders to gauge whether the changes will effectively address levels of skip rates. Some express scepticism based on disappointing outcomes from past system changes, like the introduction of the DER desk. Questions also arise about the upgraded IT system's capabilities to handle the required data volume efficiently.

Frustration is voiced over the extended timeline, until 2026, for the system-wide integration of the OBP. Stakeholders emphasize the need for a detailed implementation plan, including a timeline for all OBP elements and a comprehensive impact assessment highlighting which types of skips are expected to be resolved. This, they argue, would enhance industry confidence in the delivery timeline and provide clarity on anticipated impacts.

Stakeholder feedback findings

Addressing Uneconomic Dispatch in the BM

Further solutions

Several changes were suggested by stakeholders which they believed would help improve dispatch efficiency in addition to those already planned by ESO (e.g. OBP). This included changes that could be implemented to address issues in the short-term (i.e. before transition to OBP) and longer-term solutions. Below is a summary of the three main suggestions that were put forward:

- **Greater education and introductory trials to improve understanding of the capabilities of small BMUs and build trust in their performance -** Several stakeholders highlighted that technical system changes introduced via the OBP may not be sufficient to deliver optimal dispatch. In addition to these changes, stakeholders believe a shift in perspective is required to ensure that ENCC operating behaviours / habits evolve alongside a changing system. Several stakeholders suggested that the re-introduction of trials (such as Reserve from Storage) could be used to demonstrate the capabilities of small BMUs. One stakeholder suggested site visits could be used to develop knowledge of how small BMUs operate and establish stronger relationships between ESO and flexibility providers. Both of these interventions would help ENCC operators develop a deeper understanding of how small BMUs operate.

- **Greater role for the regulator to improve accountability –** Several stakeholders highlighted the role a regulator could play in monitoring outcomes to ensure a certain level of operation performance is maintained. Stakeholders view this as a practical solution as, through digitalisation, there is more transparency of actions that have been taken by ESO, which allows for greater monitoring.

- **Improved operational transparency to enable industry to support ESO** – Some stakeholders encourage ESO to be more should be more explicit in how they explain and demonstrate the tools they use in the ENCC and their limitations. This would provide stakeholders with more insight into what how they can adapt how they can position their assets to better suit the needs of the ENCC in the BM. This would also allow stakeholders to better understand the impact they can likely expect to see from the system changes

Appendix: ESO Dispatch Transparency Methodology

Dispatch Transparency Methodology

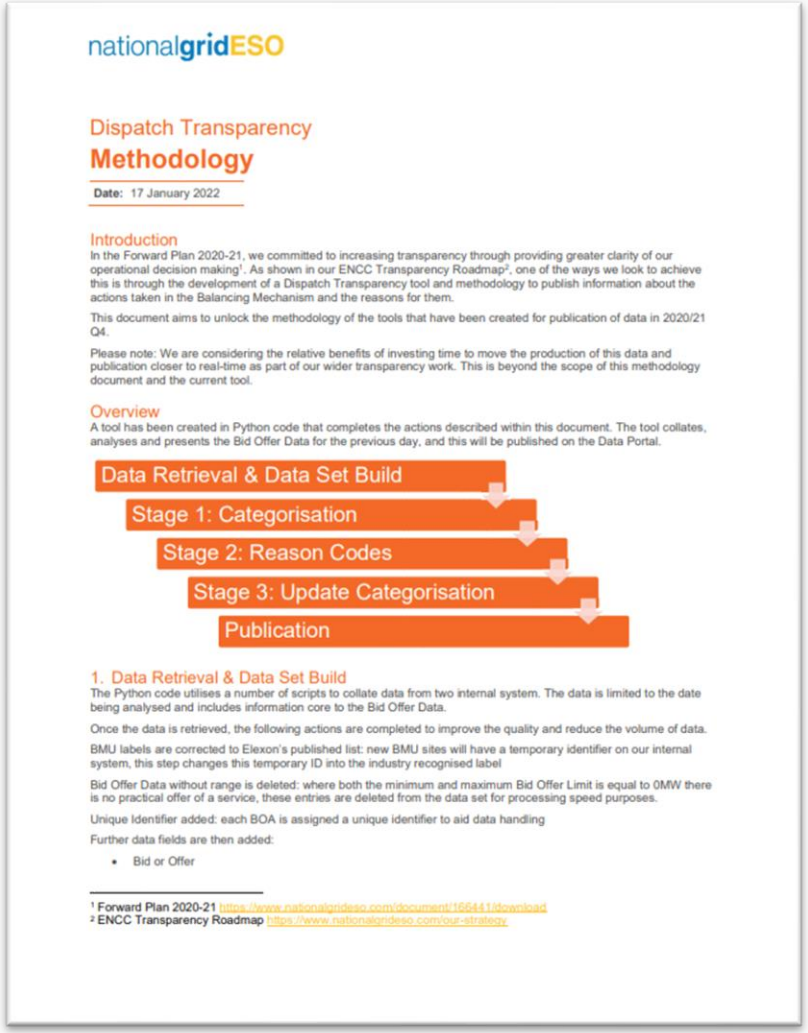
The Dispatch Transparency Methodology came about from the ESO's 2020-21 Forward Plan, as submitted to Ofgem and the ESO's performance panel to have its performance measured against for that year. In this Forward Plan, the ESO outlined its ambitions and delivery strategy to provide greater clarity of its operational decision making.

The **Dispatch Transparency Methodology** was implemented to enable this clarity of operational decision making in the ENCC. The ESO's ambition was to maximise market participants real-time decision-making, which would ultimately improve dispatch efficiency and be realised in consumer benefit.

In the current methodology, Bid-Offer pairs are classified into system flagged, in-merit and alternative actions not taken. Five reason codes for alternative actions are then assigned to the alternative (Frequency, Flexibility, Incomplete, Zonal Management, No Reason). These codes provide explanations for actions based on these factors.

Through stakeholder feedback and replicating the ESO's decisions, we have found that these reason codes lack the suitable transparency and detail. This makes it difficult for BMUs to understand why they were rejected. A particular recommendation is for the ESO to introduce a clear constraint reason code.

We further propose that the ESO should provide more detailed information to distinguish between system requirements constraints and ENCC IT and system limitations, providing clarity to BMUs. This information should be co-created with industry.



nationalgridESO

Dispatch Transparency

Methodology

Date: 17 January 2022

Introduction

In the Forward Plan 2020-21, we committed to increasing transparency through providing greater clarity of our operational decision making[1]. As shown in our ENCC Transparency Roadmap[2], one of the ways we look to achieve this is through the development of a Dispatch Transparency tool and methodology to publish information about the actions taken in the Balancing Mechanism and the reasons for them.

This document aims to unlock the methodology of the tools that have been created for publication of data in 2020/21 Q4.

Please note: We are considering the relative benefits of investing time to move the production of this data and publication closer to real-time as part of our wider transparency work. This is beyond the scope of this methodology document and the current tool.

Overview

A tool has been created in Python code that completes the actions described within this document. The tool collates, analyses and presents the Bid Offer Data for the previous day, and this will be published on the Data Portal.

Data Retrieval & Data Set Build

Stage 1: Categorisation

Stage 2: Reason Codes

Stage 3: Update Categorisation

Publication

1. Data Retrieval & Data Set Build

The Python code utilises a number of scripts to collate data from two internal system. The data is limited to the date being analysed and includes information core to the Bid Offer Data.

Once the data is retrieved, the following actions are completed to improve the quality and reduce the volume of data.

BMU labels are corrected to Elexon's published list: new BMU sites will have a temporary identifier on our internal system, this step changes this temporary ID into the industry recognised label

Bid Offer Data without range is deleted: where both the minimum and maximum Bid Offer Limit is equal to 0MW there is no practical offer of a service, these entries are deleted from the data set for processing speed purposes.

Unique Identifier added: each BOA is assigned a unique identifier to aid data handling

Further data fields are then added:

- Bid or Offer

[1] Forward Plan 2020-21 https://www.nationalgrideso.com/document/166441/download
[2] ENCC Transparency Roadmap https://www.nationalgrideso.com/our-strategy

Dispatch Transparency Methodology

An overview of the stages of data sorting and publication

Stage 1: Categorisation

ESO developed a Python tool to gather, clean, and classify Bid-Offer data. Cleaning enhances data quality and reduces volume. The bid-offer pairs are categorised as system-flagged actions, in-merit energy actions, or alternative actions. The breakdown includes:

- **System-flagged action**;
- **System** – satisfy thermal, voltage, Rate of Change of Frequency (RoCoF), inertia or stability limits on the system;
- **Geometry** – when previous actions taken may lead to an unacceptable shape for a BMU to follow or for frequency management;
- **Loss risk** –needed to keep potential loss groups of generation within limits;
- **Unit commitment** – previous actions that need to be continued due to minimum non-zero time and/or minimum zero time;
- **Response** - dispatching a unit for frequency response, positioning a unit with this capability, or bidding down/off to make space for an asset with frequency response capability.
- **In-merit action** – actions that don't fall in any of the above categories, and don't have a cheaper price alternative BOD; and
- **Alternative Actions Not Taken.**

Stage 2: Applying Reason Code to Alternative Actions Not Taken

In stage 2, reasons for out-of-merit actions are given, contingent on the BMU not receiving a BOA in the same period or failing to meet physical requirements. The remaining actions are then compared to the Bid/Offer Stack for the settlement period with the highest BOA net volume proportion.

Alternative BODs with a lower average price are assigned based on suitability after evaluating them to replace the BOA. Excluded actions are:

- Volume that would oppose system actions in the same GSP group;
- Alternative BODs that have received a BOA;
- Alternative BODs that have already been marked as an alternative BMU in the same settlement period and;
- BOD with insufficient performance in speed, minimum change, commitment, and less than 1MW.

Stage 3: Update of Categorisation of Actions Taken to Reflect Stage 2 Output

The final stage is to take the results from Stage 2 and apply them to the Stage 1 output to create a trend chart. This will create a stack of categories for each day and split the ‘Actions to be assessed in Stage 2’ into:

- Investigated BOAs reason outstanding; and
- Investigated BOAs with reason.

Reason Codes

Five reason codes are provided for remaining Alternative Actions Not Taken:

- Frequency
- Flexibility
- Incomplete
- Zonal management
- No Reason.

The list is not exhaustive but does represent the best data available to the ESO.

'Frequency' related actions are often taken in a time-pressured environment, and some actions must be taken on fast-acting units to meet system requirements. If an action takes less than 5 minutes to get to the target level, remains at that target level for less than 5 minutes, and the absolute change is greater than 30 MW the action is marked as a 'Frequency' response.

A **'Flexibility'** code will be used during a period of uncertainty and generation variability. Units that offer faster Run Up Rate (RUR) and Run Down Rate (RDR), or units that have slower RUR and RDR but can provide a base volume of MWs are often preferred during these periods. Which units are chosen is dependent on short-term positive and negative margins, the availability of short-notice plants, the variability of generation and the level of certainty behind forecasts.

The **'Incomplete'** reason group is used where alternative actions would be unable to solely meet the requirement volume. In circumstances where all additional units are assumed to have been taken, and the original unit is below it's stable limit then the subcategory 'BOA unit below SEL' will be used in addition to the incomplete reason code

If the desk allocation of the Alternative BOD is different to the BOA desk allocation, then it will be marked with the reason code **'Zonal Management'**. The dispatch of units is split across several roles and user interfaces, which has the advantage of enhanced efficiency and system control. However, this can lead to higher-priced BOA selections being made for zonal optimisations rather than national optimisations. 'Zonal Management' issues are particularly exposed to the architecture and design of ENCC processes, as well as time constraints of dispatch engineers.

The remaining BOAs with alternative BODs are presented as **'No Reason'** Codes. Other valid reasons, such as i) not taking an action to avoid activating or exacerbating constraints, and ii) taking action to avoid eroding headroom or footroom. These reasons, however, are not currently communicated explicitly.

Reason Codes

Are current reason codes suitable?

Current reason codes provide little detail and transparency as to why a unit was not dispatched. Given the broad nature of the skip rate definitions, a reason code does not tell the BMU operator whether their asset was skipped due to the nature of their asset or because of ENCC constraints. This lack of accountability can make it difficult for BM participants to price their assets and trade their asset more efficiently.

The 'Zonal Management' reason code is a good example of where ambiguity in the reason code can be detrimental to BMUs. A 'Zonal Management' code can be allocated for genuine zonal/national optimisation reasons, but the same code is also given when the desk allocation is different due to communication limitations between national and zonal dispatchers. Currently, BMUs have no way of determining which factor affected their assets.

How could reason codes be improved?

More information needs to be provided to BMUs to highlight whether the constraining factor was a system requirement constraint or a ENCC limitation. This will help BMUs to understand if their asset was skipped due to it not meeting a system requirement (genuine technology-specific reason) or whether the ENCC could not dispatch their asset efficiently. This could be provided by a subfactor being added to the original factor, and the inclusion of a “Constrained” reason code.

Units marked with 'Flexibility' codes can be given to two very different types of units. A further subcode distinguishing the two actions should be considered. Furthermore, the decision to deploy faster or slower units is dependent on a range of factors, such as short-term positive and negative margins, the availability of short-notice units, the variability of generation and the certainty behind forecasts. Explaining which factor was dominant in decision-making would provide data to BMUs on where flexibility challenges are originating.

'Zonal Management' codes are particularly exposed to inefficiencies between zonal and national dispatch, but they do occur for enhanced frequency and system control. Further granularity as to whether zonal or national optimisation was prioritised, and whether ENCC inefficiencies contributed to this disparity would be useful.

ESO has also aimed to minimise 'No Reason' codes. Additional codes should be provided to further detail why an asset was not selected as current decisions lack transparency, especially when decisions directly relate to the capability of a BMU asset.

Appendix: Data sources review

Data Sources Review

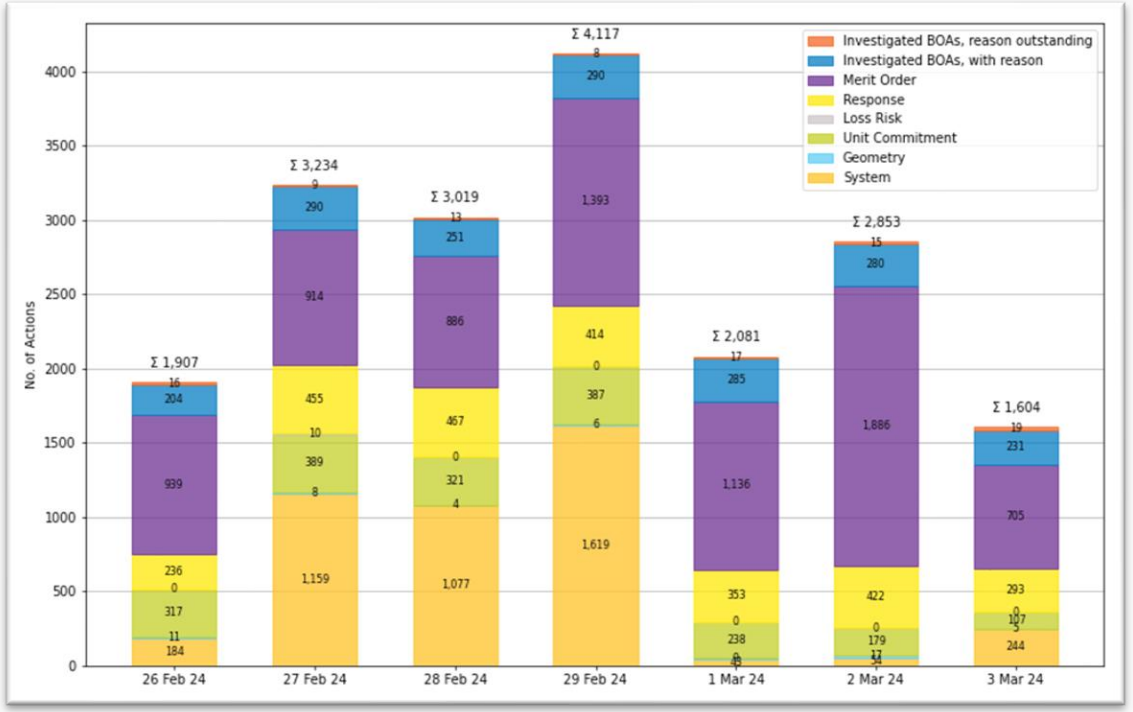
Throughout our analysis, we utilised a number of external and internal datasets to quantify the Out of Price Merit dispatch rate. A key objective of ours when establishing this work is to ensure that it is easily replicable by all market participants to ensure that it facilitates efficient market outcomes. However, we have observed a number of issues and concerns when using the public data sources provided by the ESO and BMRS.

A key data source that we used was the Dispatch Transparency datasets. We found a number of issues with this such as missing data, quality concerns, and difficulties connecting All BOAs with Potential Alternative Actions. This fundamentally made establishing a comprehensive analysis challenging.

We utilised Elexon's BMRS datasets to map across dynamic data (such as unit availability), which lacked technology type-specific information. This meant that we had to revert to using our own LCP Delta Enact data platform for much of this requirement. This is an important barrier that would prevent particularly smaller market participants from replicating this analysis.

We encourage the ESO to review its Dispatch Transparency data urgently. In order to provide a sufficient level of transparency and understanding, ESO should ensure that it is of high quality and complete.

ESO: Breakdown of BOA instructions 26th Feb 2024 – 3rd Mar 2024



Data Sources Review

BMRS

The Balancing Mechanism Reporting Service (BMRS) is provided by Elexon and includes a series of detailed, real-time datasets that are necessary to understand the true availability of units in the Balancing Mechanism. These datasets were accessed through LCP's Enact platform in order to streamline the process and incorporate additional information.

The following datasets were used from BMRS:

- Final Physical Notification (FPN) – physical data on the intended position of each unit at gate closure.
- Bid Offer Data (BOD) – a list of all potential bids and offers in the Balancing Mechanism, or options to move away from the FPN of each participating unit.
- Dynamic Data – Maximum Export Limit (MEL), Minimum Import Limit (MIL), Stable Export Limit (SEL), Stable Import Limit (SIL), Minimum Zero Time (MZT), Minimum Non-Zero Time (MNZT), Notice to Deviate from Zero (NDZ). At any given point in time, units have certain characteristics that limit their ability to respond to instructions from the ENCC. For example, a fully charged battery will not be able to import any more power and its MIL will be set to zero.
- Detailed System Price – the price of each action in a given settlement period. This information helps determine whether a BOD would have gone against the overall direction of the system.

Identifying technology type-specific differences in dispatch decisions is a key aim of the quantitative analysis. However, the BMRS datasets do not include this information, so we used our LCP Enact platform to source the unit technology type. This information has been obtained through our own market research.

Data Sources Review

ESO

ESO published the dispatch decisions taken by the ENCC on their own data portal. The so-called Dispatch Transparency data is a very large collection of data with a high degree of complexity. It includes two datasets, which we have assessed over the course of this project and identified some issues.

The All BOAs (Bid-Offer Acceptance) dataset includes a list of all actions that were taken by the control centre, including the reason why they were taken. Many of the actions taken are due to being in-merit, but Acceptance Categories also include reasons that are about satisfying system needs (e.g. Response, where a unit was chosen so that it can provide response services). Some actions do not have an explanation and these are addressed in the Alternative Actions dataset.

The All BOAs dataset is very large, it includes records of over 1.3 million bid-offer acceptances, dating back to March 2021. At the same time, it also features considerable volumes of missing data. The published version of the dataset is missing about 10% of the sample year used for this analysis, making it difficult for individuals to make use of it. ESO was able to provide LCP Delta with most of this missing data but it is still missing 3 whole days. In addition to the entire missing days, there is a considerable number of individual settlement periods for which data is unavailable.

Some data quality issues were also identified with the All BOAs dataset. We found multiple instances where the values ‘time to target’ / ‘notice time’ are negative, which is not possible. In addition, we identified about 60,000 instances where the ‘Accepted BMU’ is blank.

The Potential Alternative Actions dataset includes a list of all actions that were not taken but have no corresponding Acceptance Category in the All BOAs dataset. Essentially, this dataset is intended to show that when actions taken in the All BOAs dataset do not have an Acceptance Category, the potential alternatives would not have been viable. It includes a series of reason codes, including ‘Incomplete’ when not enough information was available to safely dispatch a unit, and ‘Zonal Management’ when a lower cost option was available in a different zone but this was not taken due to operational limits in the control centre.

Similarly to the All BOAs dataset, we identified some issues with the Potential Alternative Actions dataset. There are an overall 89 missing days in the published dataset, as well as 101 days that appear to be incomplete (containing data for fewer than 10 settlement periods). ESO was able to supply LCP Delta with some of this missing data as part of this project, but not all, limiting the conclusions that can be taken. Explanation is missing for a large portion of the alternative actions for each acceptance, implying that the dataset is not comprehensive enough. Finally, there is no easy way to connect the All BOAs dataset with the Potential Alternative Actions dataset, requiring additional analytical steps and resources. Introducing a BOA reference would be helpful to address this issue.

The BMRS datasets and the Dispatch Transparency datasets use different identifiers for each unit (NGC ID and BMU ID), introducing a mapping problem between the two datasets. While mapping is available on the Elexon portal, this is incomplete, making independent analysis of dispatch decisions more complicated. For this analysis, ESO provided LCP Delta with a more complete mapping between the two sets of identifiers.

Data Sources Review

Data sources utilised in this analysis

To calculate skip rates the following data sources have been used:

BMRS:

BMRS API's used to pull back the following data:

- MEL / MIL and SEL / SIL
- FPN
- BOALFs Data
- System Flags
- MNZT, MZT & NDZ
- Bid-Offer data

https://www.bmreports.com/

Dispatch Transparency Data:

- Dispatch transparency (alternative actions) dataset

https://data.nationalgrideso.com/balancing/dispatch-transparency

Note: An additional file was provided by ESO containing additional alternative actions data to fill in periods which were missing from the dataset published on the data portal.

SONAR:

- SONAR website (used to download warming instructions)

https://extranet.nationalgrid.com/sonar

Note: No warming instructions were applicable to the 12-month period analysed as they were all cancelled prior

Elexon:

- Registered BM Units dataset (used for GSP region and fuel type of each unit)

https://www.elexonportal.co.uk/article/view/247?cachebust=1avm6vycvc

BM/NGC ID Mapping:

- Mapping between NGC and BMU ID's provided by ESO (used to merge alternate actions data with BMRS data pull)

Contact us

Sam Hollister
Head of Economics, Policy & Investment
+44 (0)20 7432 3780
sam.hollister@lcp.uk.com

Chris Matson
Partner
+44 (0)20 7432 0674
chris.matson@lcp.uk.com

Matthew Deitz
Senior Consultant
+44 (0)20 7432 0625
matthew.deitz@lcp.uk.com

Gurpal Ruprai
Senior Consultant
+44 (0)20 3824 7425
gurpal.ruprai@lcp.uk.com

About LCP Delta

LCP Delta is a trading name of Delta Energy & Environment Limited and Lane Clark & Peacock LLP. References in this document to LCP Delta may mean Delta Energy & Environment Limited, or Lane Clark & Peacock LLP, or both, as the context shall require.

Delta Energy & Environment Limited is a company registered in Scotland with registered number SC259964 and with its registered office at Argyle House, Lady Lawson Street, Edinburgh, EH3 9DR, UK.

Lane Clark & Peacock LLP is a limited liability partnership registered in England and Wales with registered number OC301436. All partners are members of Lane Clark & Peacock LLP. A list of members' names is available for inspection at 95 Wigmore Street, London, W1U 1DQ, the firm's principal place of business and registered office. Lane Clark & Peacock LLP is authorised and regulated by the Financial Conduct Authority and is licensed by the Institute and Faculty of Actuaries for a range of investment business activities.

LCP and LCP Delta are registered trademarks in the UK and in the EU. Locations in Cambridge, Edinburgh, London, Paris, Winchester and Ireland.

Disclaimer and use of our work

This work has been produced by LCP Delta under the terms of our written agreement with National Grid Electricity System Operator (Client) for the Client's sole use and benefit, subject to agreed confidentiality provisions, and for no other purpose. To the greatest extent permitted by law, unless otherwise expressly agreed by us in writing, LCP Delta accepts no duty of care and/or liability to any third party for any use of, and/or reliance upon, our work. This document contains confidential and commercially sensitive information. Should any requests for disclosure of information contained in this document be received, LCP Delta request that we be notified in writing of the details of such request and that we be consulted and our comments taken into account before any action is taken.

Where this report contains projections, these are based on assumptions that are subject to uncertainties and contingencies. Because of the subjective judgements and inherent uncertainties of projections, and because events frequently do not occur as expected, there can be no assurance that the projections contained in this report will be realised and actual events may be difference from projected results. The projections supplied are not to be regarded as firm predictions of the future, but rather as illustrations of what might happen. Parties are advised to base their actions on an awareness of the range of such projections, and to note that the range necessarily broadens in the latter years of the projections.