

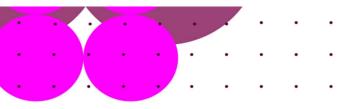


Skip Rate Methodology & Implementation guide

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Version Control

Version	Amendments	Date
1.0	First Publication	16 th December 2024
2.0	Dataset Updates	16 th May 2025





Introduction

As part of NESO's commitment to transparency and addressing the issue of skip rates, we aim to provide greater clarity. To support this, NESO asked LCP Delta to review and create a new method for defining and measuring skip rates. NESO's Skip Rate Dataset is based on LCP Delta's suggested method, with additional exclusions for units that are behind system constraints and could not have been instructed.

This document explains the full methodology of the <u>data published</u> from 16 December 2024. As we receive feedback from ENCC and the industry, the method will be updated to better reflect ENCC Operations and address the questions which are received. This document assumes you understand physical & dynamic parameters and how the Balancing Mechanism (BM) operates.

A tool has been created which follows the steps outlined in this document. The tool analyses data from the previous day, and the results will be published on the data portal day +1.

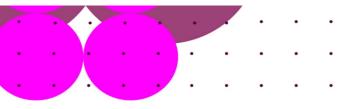
The data can be accessed on the data portal <u>here</u> and any queries on this data set should be directed to <u>box.NC.customer@nationalenergyso.com</u>

How are skips assessed

The method aims to assess skips by considering the volume of accepted actions for each 5-minute period which we will refer to as **imbalance requirement**. Bids and offers are treated independently. The method compares any accepted actions to all the options that were available based on their price, from most economically attractive to least economically attractive. We refer to the list of all available options as the **feasible merit stack**.

As actions can be taken for reasons other than just price, this method applies 5 stages of exclusions. The intention of these exclusions is to progressively remove units that were not feasibly available to ENCC balancing engineers in real time. Stage 0 is the starting point and considers BM units based on price alone. Each subsequent stage removes units that may not have been accessible to balancing engineers in real time. The exclusions are applied sequentially, i.e. units that are excluded at stage 1 will remain excluded in all later stages.







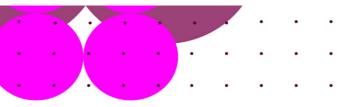
To calculate the skip rate, the method considers how much offer and bid volume was accepted and calculates the cheapest way this volume could have been dispatched. This final list of units is referred to as the **Volume Adjusted In-Merit Stack**.

There are two skip rates being calculated (All BM and Post System Action (PSA)) each with different **Volume Adjusted In-Merit Stacks**:

- Each time you move through the stages for All BM the accepted volume considered is equal to the **imbalance requirement**.
- As feasible volume is excluded, other units are considered in their place.
- For PSA the **imbalance requirement** may reduce relative to All BM at stage 2 and again at stage 3 when any constraint system tagged acceptances are removed.
- In both calculations, the skipped volume remains the same.
- System Tagged Units are treated as follows:
 - Any actions taken for system reasons are removed from the acceptance stack in both examples.
 - Then for All BM, the system flagged accepted actions are incorporated back into the Volume Adjusted In-Merit Stack. It is assumed that these actions had to be taken for system reasons so cannot cause a skip. These are maintained in the stack for all following stages.
 - For PSA these actions remain excluded from both the Acceptance Stack and the Volume Adjusted In-Merit Stack.

The exclusions at each stage are:

Stage 1	At stage I we remove accepted and feasible wind offers
Stage 2	At stage 2 we remove feasible volume from very long notice units where they are inaccessible to balancing engineers in real time. We also remove units behind active constraints where the BOA direction would worsen the constraint (e.g. offers on Peterhead behind SCOTEX). We consider all constraint flows and limits on the system and 'artificially' system tag acceptances that are deemed to have been sent for system
	reasons.
Stage 3	There may be units that are not 'Artificially' System tagged from stage 2 but
	are system tagged in the Elexon Bid Offer Accept Level Facts table.





	These units are treated the same way as the 'Artificially' system tagged units at stage 2.
Stage 4	At stage 4 we remove the actions that would cause an unwind of an action already taken (e.g. Offers on a unit that has already accepted Bids).
Stage 5	At stage 5 we remove feasible volume from long notice units where they are inaccessible to balancing engineers in real time. In addition, we remove infeasible pumped storage actions that go from a positive value through zero to a negative or vice versa (e.g. +300MW to -300MW on DINO). This is done because these units need to remain at 0 for some time before switching between import and export.

Data Sources

To ensure replicability of this analysis it was decided that the primary source of data would be Elexon's BMRS API. The data used is as follows:

- SEL, SIL, MZT, MNZT, NDZ from <u>APIs: Details API Developer Portal</u>
- PN, MIL, MEL from <u>APIs: Details API Developer Portal</u>
- BOD from <u>APIs: Details API Developer Portal</u>
- BOALF from <u>APIs: Details API Developer Portal</u>
- Fuel Type is determined by internal data sources supplemented with Elexon Fuel Types where required
- Constraint flows, limits, and units that sit behind each constraint. This is not published.

Definitions

Acceptance Stack	This stack contains the units that were issued BOAs and serves to
	assess the volume instructed within a specified 5-minute interval.
	This is used alongside the Feasible Merit Stack to evaluate the
	proportion of this volume that was in merit.
Feasible Merit Stack	This is the comprehensive list of all the units that could have been
	instructed. The feasible volume that accepted units could have
	delivered is included in the Feasible Merit Stack.

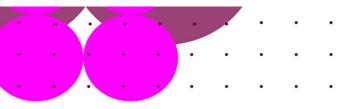






Imbalance Requirement	This pertains to the total volume of bids or offers accepted within a specific 5-minute period after all exclusions have been made for a	
	given stage.	
Volume Adjusted Merit	This denotes the final list of units representing the most cost-	
Stack	effective means to meet the imbalance requirement. The portion of	
	the volume from this stack that was accepted is deemed to be	
	'accepted in merit', while the volume not accepted from this stack is	
	referred to as 'skipped' volume.	
Import Constraint	This refers to the limitation on the amount of volume that can be	
	imported into a specific boundary.	
Export Constraint	This refers to the limitation on the amount of volume that can be	
	exported out of a specific boundary.	
Constraint Limit	This is a restriction required to control flow in and out of the	
	boundary to ensure the safety and reliability of the system.	
	To ensure a margin of safety, we apply a reduction factor to the	
	original constraint limit as below:	
	0.95 * Limit (applicable to positive export constraint limits and	
	negative import constraint limits)	
	 1.05 * Limit (applicable to positive import constraint limits or 	
	negative export constraint limits)	
Adjusted Flow or PN of a	This metric retroactively analyses the impact that BOAs have had on	
constraint	a constraint. It represents the transfer that would have occurred if	
	NESO had not issued BOAs for the constraint.	
Unwind	Feasible volume from a negative pair ID on a unit which has	
	been sent an offer volume from a positive pair ID in a given 5-	
	minute period	
	Feasible volume from a positive pair ID on a unit which has	
	been sent a bid volume from a negative pair ID in a given 5-	
	minute period	
	Where a BOA has been sent, we will never consider the option	
	of bringing the BOA back to its PN by instructing it through the	
	bid price of a positive pair id or an offer price of a negative	
	pair id.	
	Unwinds should be treated the same as any other feasible volume	
	for stages 0 – 3 inclusive.	
	Unwinds are also considered when calculating which units can fill	
	available head room / foot room for a constraint in stages 2 & 3.	







	Accepted unwinds can be considered accepted in-merit at all	
	stages	
Skipped Volume	This refers to the amount of offer or bid volume in MWh that is	
	deemed available to balancing engineers and in-cost merit but not	
	accepted during the dispatch process.	
Long Notice	MZT >= 31mins MNZT >= 31mins NDZ >= 31mins	
Very Long Notice	MZT > 12hours MNZT > 12hours NDZ >= 89mins	
Skip Rate - All BM	This metric refers to the proportion of bid or offer volume in-cost	
	merit and not accepted to the total amount of accepted volume for	
	a given 5-minute period.	
	This is calculated as:	
	Total Skipped Volume, MWh	
	$\frac{11}{Total\ Imbalance\ Requirement, MWh} imes 100\%$	
Skip Rate - Post System	This metric refers to the proportion of bid or offer volume in-cost	
Actions	merit and not accepted to the total amount of accepted energy	
	volume for a given 5-minute period.	
	This is calculated as:	
	Total Skipped Volume, MWh 100%	
	Total Imbalance Requirement, $MWh - System Tagged Volume, MWh$	

Preparation of Data

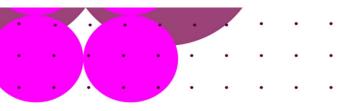
Before applying exclusions and calculating the Volume Adjusted In-Merit Stack, the Acceptance Stack and Feasible Merit Stack, the input data is prepared. Based off the values at the start and end of every minute, the following is calculated for each 5-minute period:

- Average PN, SEL, SIL, MNZT, MZT and NDZ
- Maximum MEL
- Minimum MIL
- Feasible Volume that can be delivered (these values change through the exclusion stages to ensure feasibility)

The list of all units, their prices, and their feasible volumes form the Feasible Merit Stack.

We interpolate the **Bid Offer Accept Level Facts table** and **PN** data from Elexon to determine the values for this data at the start and end of each minute. We compare the unit's BOA Level







with its PN to calculate how much volume was accepted from each BM Unit. We use Bid Offer Data to work out which Bid Offer Pair ID is associated with Accepted Volume. This provides us with the corresponding price of the bid offer acceptance. The units that have been accepted form the Acceptance Stack.

For a given 5-minute period, the Imbalance Requirement for offers is defined as the total Volume of offers that were instructed, in MWh. The Imbalance Requirement for bids is defined as the total Volume of bids that were instructed, in MWh.

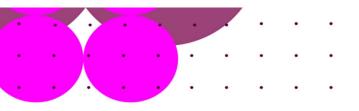
Creating the Volume Adjusted In-Merit Stack

At every stage, the Feasible Merit Stack and Volume Adjusted In-Merit Stacks are created after excluding units based on the stage's exclusion criteria. The exclusions are applied sequentially, i.e. units that are excluded at stage 1 will remain excluded in all later stages.

For each 5-minute period, we order the Feasible Merit Stack from most economically attractive to least economically attractive. Feasible volume from units up to and including the imbalance requirement are considered, with more expensive units excluded. This forms the Volume Adjusted Merit Stack. A tie-breaker rule is applied if there are multiple units at the same price – this is explained later. This works as follows:

- 1. Volume Adjusted Merit Stack
 - a. Offer
 - i. Define the imbalance requirement as the sum of all offer volume (MWh) for a given 5-minute period.
 - ii. Order the Feasible Merit Stack by price ascending.
 - iii. Calculate the cumulative volume delivered by BMUs for each row by summing feasible volume for all units up to and including the current unit. This reflects the total volume available at or cheaper than the current row's price level.
 - iv. Match the cumulative volume to the stack at the point where the marginal unit meets the imbalance requirement. The price at this point is the marginal price.
 - b. Bid







Note: This unit

had a lower price than the most expensive

accepted unit, but was <u>not</u> needed

Public

- i. Define the imbalance requirement as the sum of all bid volume (MWh) for a given 5-minute period.
- ii. Order the Feasible Merit Stack by price descending.
- iii. Calculate the cumulative volume delivered by BMUs for each row by summing feasible volume for all units up to and including the current unit. This reflects the total volume available at or cheaper than the current row's price level.
- iv. Match the cumulative volume to the stack at the point where the marginal unit meets the imbalance requirement. The price at this point is the marginal price.

The above process is performed for each stage of exclusions. The image below shows a simple visual example of this.

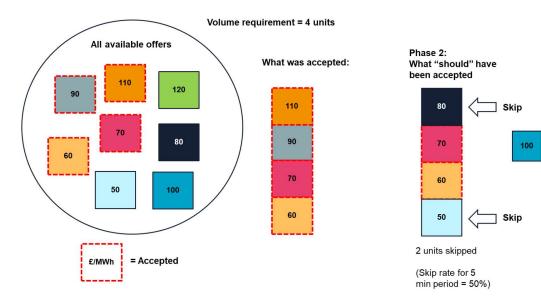


Figure 1 - example of Volume Adjusted In-Merit Stack

Exclusions Methodology

1. Stage 0







i. Input data

- To create the input data, we consider all units that received Bid
 Offer Acceptances and all units that could have received Bid
 Offer Acceptances. For each 5-minute period we consider the
 unit's average PN, SEL, SIL, NDZ, MNZT, MZT, and their minimum
 MIL, and their maximum MEL.
- At stage 0, in LCP Delta's method the 'feasible volume' a unit can deliver does not consider whether the final position of the unit is 'stable' (does not leave the unit between 0 and SIL or 0 and SEL).
 This is corrected at stage 2.

2. Stage 1:

a. Removes Offers on Wind Units

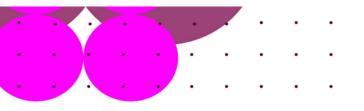
i. Methodology:

- Remove Wind Offer volume from acceptances, including unwinds (i.e. across all bid-offer pairs).
- Remove wind offer volume (positive bid-offer pair IDs and potential bid unwinds) from merit stack.

3. Stage 2:

- a. Constraints exclusions
 - i. For all constraints, calculate the adjusted flow (PN) = Transfer (Net impact of BOAs) from accepted units. All bids and offers from units behind each constraint are considered.
 - ii. Constraints are considered active when they are within a 5% tolerance of the limit. For export constraints are considered active where the PN > limit * 0.95. Where this occurs, we artificially system tag the cheapest accepted bids that were required to take the constraint from PN to limit * 0.95. The full volume from the marginal unit is considered. To do this:
 - Sort accepted bids price descending.
 - Accepted Bid Volume up to and including a cumulative impact of adjusted flow limit * 0.95 will be artificially system tagged.
 The accepted volume from these units is forced into the Volume Adjusted Merit stack in the All BM method. It is not



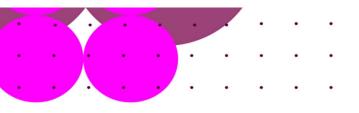




considered in the Acceptance Stack or Volume Adjusted In-Merit Stack in the PSA method.

- Accepted Bid Volume that would not have been needed to take adjusted flow below limit * 0.95 will be artificially energy tagged.
- Remove feasible offer volumes from the merit stack for units behind the constraint.
- iii. For export constraint with headroom (where adjusted flow< limit * 0.95):
 - For units behind the constraint, sort offer volumes (from accepted and merit stack combined) by offer price ascending.
 - Keep offer volume from merit stack that takes the adjusted flow up to limit * 0.95.
 - Exclude feasible offer volume that will result in a flow that exceeds limit * 0.95.
- iv. Import constraints are considered active where the PN < limit * 0.95 for negative limits or where PN < limit * 1.05 for positive limits. Where this occurs, we artificially system tag the cheapest accepted offers that were required to take the constraint from PN to limit * 0.95. The full volume from the marginal unit is considered. To do this:
 - Sort accepted offers price ascending.
 - Accepted offer volume up to and including a cumulative impact of (limit * 0.95 for -ve limit OR limit * 1.05 for +ve limit) - adjusted flow will be artificially system tagged. The accepted volume from these units is forced into the Volume Adjusted Merit stack in the All BM method. It is not considered in the Acceptance Stack or Volume Adjusted In-Merit Stack in the PSA method.
 - Accepted offer Volume that would not have been needed to take adjusted flow above limit * 0.95 for -ve limit OR limit * 1.05 for +ve limit will be artificially energy tagged.
 - Remove feasible bid volumes behind the constraints as accepting them will violate the limit.
- v. For import constraint with foot room (where adjusted flow > limit * 0.95 for -ve limit OR adjusted flow > limit * 1.05 for +ve limit):





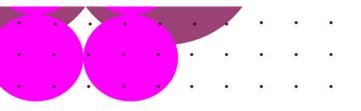


- For units behind the constraint, sort accepted + potential bid volumes in bid price descending.
- Include accepted and potential bid volume from merit order up to limit * 0.95.
- Exclude feasible bid volume that will result in a flow that exceeds limit * 0.95.
- b. Remove volume infeasible or inaccessible to Balancing Engineers in real time
 - i. If a unit is between 0 and SEL or 0 and SIL due to PN or a BOA:
 - Where a unit is ramping from a BOA between 0 & SEL or 0 and SIL, the BOA volume delivered in the 5-minute period is considered.
 It is assumed the unit could not have delivered any further bid or offer volume on top of this BOA.
 - If the PN is between 0 and SEL or 0 and SIL, it is assumed that the unit could not have delivered bid or offer volume
 - ii. Applied to Feasible Merit Stack for units that have not been accepted (instructed units are not considered for this exclusion)
 - MNZT > 12 hours & PN or BOA == 0 all feasible volume removed
 - MZT >12 hours & PN or BOA == 0 all feasible volume removed
 - NDZ >= 89 minutes & PN or BOA == 0 all feasible volume removed
- 4. Stage 3: Treatment of System Tagged Units
 - a. For the All BM Skip rate where volumes in the accepted stack have been taken for system reasons, they are forced into the Volume Adjusted Merit stack. For units in the accepted stack:
 - i. Where an accepted unit has an Elexon System Flagged == True, the accepted volume from this unit will be forced into the Volume Adjusted Merit stack. Artificially System Tagged Actions from stage 2 continue to be forced into the Volume Adjusted Merit stack.

Frequency Response Actions

 The LCP Delta methodology removes units that are frequency tagged based on the Potential Alternative Actions dataset. The

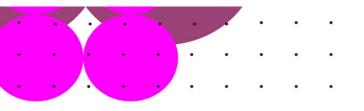






current implementation does not currently exclude these units as the information from this dataset is not available in real time. Future versions of the tool may take this into consideration.

- 5. Stage 4: Remove Unwinds from the Feasible Merit Stack
 - Remove unwinds as defined at the top of this document from the Feasible Merit Stack.
 - b. Volume from BOAs that unwinds a previous BOA are **not excluded** from the acceptance stack
- 6. Stage 5: Removes volumes that could not be accessed by the Balancing team in real time.
 - a. Applied to units that haven't been accepted, remove volumes from the Feasible Merit Stack
 - i. Where MNZT >= 31 mins & PN or BOA == 0 the unit is assumed to have no feasible volume
 - ii. Where MZT >= 31 mins & PN or BOA == 0 the unit is assumed to have no feasible volume
 - iii. Where NDZ >= 31 minutes & PN or BOA == 0 the unit is assumed to have no feasible volume
 - b. Additional Consideration:
 - i. Applied to units that have been accepted in the accepted stack
 - For either MNZT >= 31, MZT >= 31 mins or NDZ >= 31mins with PN =
 - For offers, exclude accepted volume 0 to SEL from both accepted and merit stack
 - For bids, exclude accepted volume 0 to SIL from both accepted and merit stack
 - If the unit is between SEL and MEL, it must stay between SEL and
 MFI
 - If the unit is between SIL and MIL, it must stay between SIL and MIL
 - ii. Pumped Storage / Hydro units
 - If a hydro or pumped storage unit is importing, it cannot be instructed to export without first returning to 0. If a hydro or





pumped storage unit is exporting, it cannot be instructed to import without first returning to 0.

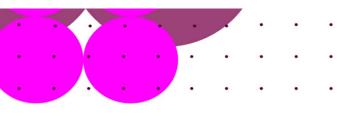
For marginal units when creating the Volume Adjusted Merit Stack:

- For units at the marginal price, the remaining imbalance requirement is distributed as in-merit volume
- Accepted volume from marginal units is considered in-merit before non-accepted volume
- This serves two purposes:
 - Ensures that assignment of margin volume correctly reflects the volume that is actually taken
 - This is required to ensure that the correct amount of skipped volume shows in the Volume Adjusted In-Merit Stacks

Skip Rate – Exclusion Reasons Implementation

This dataset shows the units that have been excluded at each stage of the analysis and why. It works as follows:

- If the unit would have been in merit at a given stage but some of its volume was excluded, it takes all applicable exclusion reasons and lists them along with the total volume excluded at the stage
- The dataset shows both accepted and feasible volume that have been excluded
- Feasible volume behind constraints is recalculated at every stage to ensure each
 unit's feasible volume is representative of the stage's exclusions. Because of this,
 units may be excluded from one stage but not excluded from the following stage.
 For simplicity, the first time a unit is excluded with reason 'behind constraint', an
 associated row will show in the Exclusion Reasons dataset. There will be no further
 records for this unit, even if it is excluded for another reason at a later stage. For
 example:
 - At stage 2, Units 1, 2, and 3 are all behind a constraint with headroom. Units
 1 & 2 are able to fill the headroom, but unit 3 would have caused a constraint





- issue so unit 3 is excluded. This is recorded in the Exclusion Reasons Dataset as excluded due to being behind a constraint.
- At stage 4, unit 1 is excluded as it would have unwound an acceptance. Now, units 2 & 3 are able to fill the headroom and unit 3 is no longer excluded.

Change Log

This section provides a detailed record of all modifications made to the document and data, outlining changes in methodology, updates to data sources, and revisions to analysis results. Each entry includes the date of the change, a brief description of the update, and the rationale behind it to ensure transparency and traceability of the skip rate tool's evolution. This log serves as a comprehensive reference for readers to understand the progression and refinement of the data over time.

V1.1 - 01/02/2025

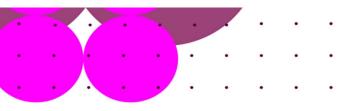
NESO began publishing 'Skip Rate – Exclusion Reasons' Dataset. This provides visibility of which units have been excluded at each stage and the reason they have been excluded. See section "Skip Rate – Exclusion Reasons Implementation" for more information.

V2 - 16/05/2025

NESO 'aligned' all datasets. Previously, in a given period, it may have appeared that there were discrepancies in skipped volume between the "Skip Rate – Summary" Dataset and the "Skip Rate – All Balancing Mechanism" or "Skip Rate – Post System Action" Datasets.

These discrepancies were caused by with the way in which the Volume Adjusted In-Merit Stack and the summary dataset are calculated:

 Accepted volumes are calculated and exclusions are applied to calculate the imbalance requirement





- We look down the feasible merit stack (independent of accepted volumes) to find the marginal price at which this volume could have been delivered
- We assign in-merit volume to the units in the feasible merit stack, and skipped volume based on how much volume was accepted for these units
- We work out skipped volume for the Summary Dataset = imbalance requirement volume accepted at or below the marginal price (capped by volume required at marginal price)
- We 'over-assigned' skipped volume in the Volume Adjusted In-Merit Stack because:
 - Treatment of marginal units means we sometimes gave them skipped volume when volume was accepted at the marginal price
 - Sometimes we saw accepted volume > feasible volume due to assumptions made when calculating feasible volume

NESO has made the following changes to correct this:

- 1. Cap accepted volume at MIL / MEL this better reflects the volume that the unit delivered in practice.
- 2. Where a unit has been accepted for volume > feasible volume, we increase the feasible volume of the unit to match the accepted volume. Given the unit delivered the volume, it is assumed the unit had at least that much volume available.
- 3. Amend treatment of marginal units where units have been accepted at the marginal price, accepted volume is now assigned in-merit volume before non-accepted volume. This ensures that assignment of margin volume correctly reflects the volume that is actually taken and is required to ensure full alignment between all of the datasets.

This has had some impact on the skip rate numbers. We see (approximately):

- A 3% increase in offer skipped volume
- A 1 % increase in bid skipped volume

This can be explained by the following:

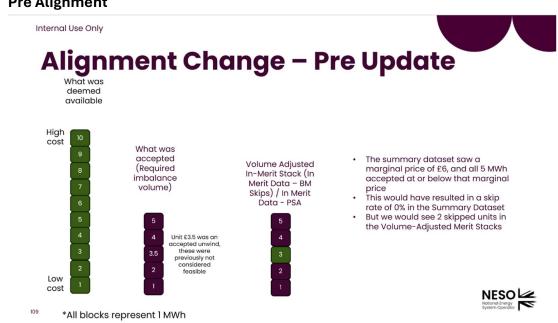
• The changes made (described above) often increase the feasible volume deliverable by each unit, and slightly reduce the imbalance requirement.





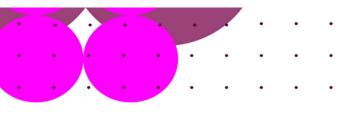
- This means that often the imbalance requirement can be met with fewer units, meaning a cheaper marginal price.
- Compared to before the changes, this means that less volume was accepted inmerit, hence we see more skipped volume.
- See below for an example:

Pre Alignment



Post Alignment

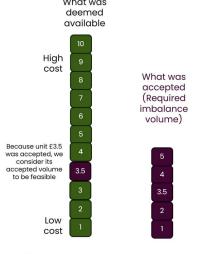






Internal Use Only

Alignment Change – Post Update



Volume Adjusted In-Merit Stack (In Merit Data – BM Skips) / In Merit Data – PSA



- The summary dataset now sees a marginal price of £4, with 4 MWh accepted at or below that marginal price
- price
 This would have resulted in a skip rate of 20% in the Summary Dataset
- This would be consistent now with the Volume Adjusted In-Merit Stacks



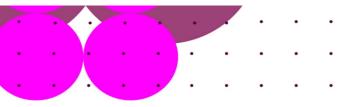
*All blocks represent 1 MWh

Frequently Asked Questions

Question	Answer
Is the methodology a price based	The methodology assesses each five minutes
or cost-based assessment?	independently based on price and is not therefore
	based on cost over a period of combined five minutes.
Why is there bid and offer skip	The methodology independently assesses bid and
volume for the same unit?	offers.
Why are you not publishing more	We are currently progressing this conversation with
detail i.e. data behind the system	industry with an intent to publish more detail where we
constraint methodology	can. To do this we need to be sure a full assessment of
	the associated impacts of doing this has been
	completed and signed off by all stakeholders.
How do you treat deemed	We use the bid offer price data and do not calculate
volumes?	any additional volume above the 5 bid and 5 offer
	volume tranches. Effectively deemed bids and offers
	are excluded.









I have a query about the	Please direct queries to
methodology or published data -	box.nc.customer@nationalenergyso.com
where can I direct my query?	
Is there any output data which	We have taken an approach to include disaggregated
you are not intending to publish?	data to thirty minutes to allow our customers and the
	industry to challenge the datasets as provided.
	Therefore, the approach taken is in full transparency.
What will NESO be doing with the	NESO will be using the data being captured as part of
data which is being published?	an ongoing exercise in understanding the capabilities
	which need to be incorporated within the NESO to
	continue to drive down skip rates.
I am a new Balancing Mechanism	The basis for most of the data will come from ELEXON
Unit; will data be	and therefore any new BM unit will be incorporated as
reported/included for my BM	standard.
unit?	

Limitations of methodology have been set out by LCP Delta in their report:

- No ramp rate consideration
- State of charge for batteries is not considered
- Ancillary services are not included
- Pumped storage in "spin pump" and "spin gen" modes

In addition, there are further limitations to this methodology

- No notice to offer/ notice to bid consideration
- If a unit is ramping in a 5 min period as per PN, is BOAd to above SEL, feasible volume is considered to be 0
- Wind offers not considered for constraint exclusions although this should not happen frequently
- The unit which is marginal for artificially system tagged units reasons is fully attributed to a system action even where their full acceptance volume was not required.