Public

February 2025

Guidance Note – Good Industry Practice.

In relation to FPN Accuracy (Grid Code **BC 1.4.2(a)**).

NESO
National Energy System Operator

1. Foreword

National Energy System Operator (NESO) has a licence obligation (C1.5(c)) to monitor balancing services markets. This Guidance Note is prepared to provide Balancing Mechanism Units (BMUs) and other market participants with a clear understanding of how NESO monitors 'Good Industry Practice' in accordance with the Grid Code **BC 1.4.2(a)**. The purpose is to ensure transparency and provide guidance on how NESO interprets these requirements. Wind BMUs on average exhibit greater inaccuracy of Final Physical Notifications (FPNs) than other fuel types and should take particular note of this Guidance Note. However, the monitoring process outlined in this document will also consider the accuracy of FPNs from all BMU fuel types.

This Guidance Note is also prepared for the assistance of prospective Generators that intend to connect directly to the National Electricity Transmission System and Embedded Power Stations that also wish to register as BMUs. In the event of dispute, the Grid Code and Bilateral Agreement documents will take precedence over these notes.

Definitions for the terminology used in this document can also be found in the Grid Code.

Following the release of the Guidance Note issued in August 2024, a three-month education period commenced, during which NESO engaged with a large number of market participants through one-to-one calls and received some additional feedback highlighting the need for the Guidance Note to provide some further clarity. This document represents the updates made following the targeted consultation between 02nd December 2024 – 10th January 2025. The consultation document that has formed these changes can be found on the NESO Balancing Costs webpage, or directly through the following link: FPN Good Industry Practice Consultation - December 2024.

Since the initial release of the Guidance Note in August 2024, NESO has observed significant improvements in wind PN accuracy. The dedication to improving PN accuracy, engaging with NESO, and maintaining open communication has been greatly appreciated. NESO would also like to extend our gratitude to the operators who have shared insights into their forecasting models with the industry, fostering a collaborative approach to sharing best practices. Thank you for your continued support and commitment.

For the avoidance of doubt, this Guidance Note issued on 10th February 2025 replaces all versions released before this date.

NESO's Market Monitoring team will be happy to provide clarification and assistance required in relation to these notes and on Grid Code compliance issues.

NESO welcomes additional feedback, and this can be directed to the NESO Market Monitoring Team at:

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Change management.

Change Control	*Changed by*	*Release date*
Version 1 of Guidance Note released *Consultation concluded on 26th June 2024.*	*NESO Market Monitoring Team*	*09/08/2024*
Version 2 of Guidance Note released. *Changes made following the consultation period between 2nd December 2024 – 10th January 2025. Changes include an introduction of principles that can be used in preparing PNs and the explanation of each principle in practice, expansion of NESOs description to extenuating circumstances, change to the threshold measures at a set level for both onshore and offshore wind and an appendix detailing some of NESOs decisions.*	*NESO Market Monitoring Team*	*10/02/2025*

1. Contents

3. Introduction & Requirements.

Grid Code **BC 1.4.2(a)** and **BC 2.5.1** outline the standard to which Final Physical Notifications (FPNs) should be prepared in accordance with Good Industry Practice. FPNs are an important parameter in the Balancing Mechanism, as the FPN should provide a true and accurate reflection of the power (MW) import or export of a Balancing Mechanism Unit (BMU) for a particular half hour. This is vitally important for balancing as it gauges the difference between the contracted position struck between Generators and Suppliers and outlines to NESO the BMU's intended schedule for export/import. The more accurate an FPN can be, the more accurate the indication of intended BMU export/import schedule, which, in turn will reduce errors and enable much more accurate procurement of bids and offers by NESO in the balancing mechanism, therefore keeping balancing costs down. Furthermore, Bid-Offer-Acceptance payments are based on deviations away from FPNs. Therefore, accurate FPNs will result in a reduction in Balancing Costs through accurate payments.

NESO have identified significant inaccuracies in the provision of FPNs, which is leading to excess Balancing Costs being incurred and unnecessary operational risk in the balancing of Great Britain's electricity system. This Guidance Note outlines the accuracy to which NESO believe FPNs should be prepared. The need for BM participants to submit accurate FPNs has also been highlighted by the regulator, Ofgem, on a number of occasions.[1]

The level of accuracy in FPN submissions is stipulated in Grid Code **BC 1.4.2(a)**:

> *…**Physical Notifications** shall be prepared in accordance with **Good Industry Practice**.*

and in **BC 2.5.1** as

> *Each BM Participant must, applying Good Industry Practice, ensure that each of its BM Units follows the Physical Notification in respect of that BM Unit…*

Good Industry Practice is a defined term in the Grid Code as the following:

> ***Good Industry Practice**: The exercise of that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected from a skilled and experienced operator engaged in the same type of undertaking under the same or similar circumstances.*

This document serves to establish clear guidelines on the performance measures NESO will use to consider whether 'Good Industry Practice' is being followed in relation to BC1.4.1(a) and BC2.5.1. While the term 'Good Industry Practice' allows for interpretation, it strongly emphasises the significance of skilled and experienced operators operating under comparable circumstances. This term is intended to enforce a high standard for operators in terms of their information submission and behaviour.

It is important to note that **this Guidance Note focuses on establishing thresholds and principles for the preparation of a Physical Notification that NESO considers to be within the bounds of Good Industry Practice for wind BMUs**. This is because Wind BMUs have been identified to be significantly more inaccurate than other fuel types and are causing more operational risks and excess Balancing Costs due to this inaccuracy and the prevalence of the requirement to curtail this particular fuel type. NESO will continue to monitor the accuracy of other fuel types and will raise inaccuracy issues where necessary. Should other fuel types exhibit a similar level of inaccuracy and risk to operations, then NESO will follow a similar process to establish its view of Good Industry Practice for those units.

For the avoidance of doubt, it is expected that operators of all fuel sources should ensure their FPN submissions meet the requirements of Good Industry Practice as defined in Grid Code and that while present levels of inaccuracy in other fuel resources do not lead to a need to establish thresholds within this Guidance

[1] See for example: https://www.ofgem.gov.uk/sites/default/files/2021-06/Open%20letter%20on%20dynamic%20parameters%20and%20other%20information%20submitted%20by%20generators%20in%20the%20Balancing%20Mechanism_0.pdf and https://www.ofgem.gov.uk/sites/default/files/docs/2016/12/scarcity_pricing_and_conduct_in_the_wholesale_energy_market.pdf

Note, the improvement processes outlined within this Guidance Note could be applied to an operator of any fuel source.

4. Objective.

NESO has established two threshold measurements that will be used, amongst other considerations, to assess its view of 'Good Industry Practice'. It is important to note that these thresholds do not encompass all possible interpretations of what may be regarded as 'Good Industry Practice' and that the process outlined is intended to be collaborative and open in explaining how NESO will approach its existing licence obligations to report potential breaches of the Grid Code to the regulator

This Guidance Note provides the following with regards to Good Industry Practice:

- How NESO will continue to monitor the level of accuracy of FPNs;
- Principles that might be employed by an operator demonstrating Good Practices;
- How BMUs can work with NESO to improve FPN accuracy and raise any specific concerns with meeting these thresholds; and
- The enduring escalation and monitoring process and timelines

Throughout the monitoring process, NESO will establish through engagement with responsible parties of units not meeting thresholds if there are any site-specific reasons that thresholds may be unachievable for a BMU or a group of BMUs. If, throughout the monitoring process it has been identified that there are extenuating circumstances leading to these thresholds not being met, NESO will factor this into its decision to raise the inaccuracy to Ofgem. Similarly, demonstrating through engagement application of principles to ensure a high standard in the preparation of PNs such as those outlined in this Guidance Note will be considered in any decision to raise the inaccuracy to Ofgem.

5. Measuring Good Industry Practice in Relation to FPN Accuracy.

This Guidance Note explicitly defines the level of accuracy that NESO will use to monitor whether in its view wind BMUs are operating with the bounds of Good Industry Practice for submitting Final Physical Notifications (FPNs). It will also allow NESO to monitor, in a transparent manner, which units are improving the accuracy of their FPN submissions. We will work collaboratively with market participants to improve their level of accuracy and in cases where thresholds are not met, we will continue to engage with market participants. Finally, if necessary, we will notify Ofgem should we have outstanding concerns that Good Industry Practice is not being followed.

NESO is therefore providing guidance in relation to two measures that it will use to assess its view of Good Industry Practice regarding FPN accuracy, which are the following:

A) The net error between FPN and Actual Metered Output of a BMU should be **between 3% and -3% for each month** as a function of their available capacity; and

B) The sum of absolute error between FPNs and Actual Metered Output relative to total generation across a month should **be below 9.4%** as a function of their available capacity.

Measures provided for net errors are required to ensure that providers are correctly compensated for any bid offer acceptance volume as calculated from the Final Physical Notification. Measures provided for absolute errors are required to minimise operational risk by increasing the certainty on output.

All the measures described in this Guidance Note relate to the Final Physical Notification. It is important that Pre-gate Closure Physical Notifications should also reflect a unit's best expectation of output, but it is recognised that both commercial and weather factors lead to changes in output that make it inappropriate to stipulate a percentage accuracy relative to delivered volume.

The net and absolute error thresholds that NESO considers should be **regularly met** by a unit meeting Good Industry Practice are derived using historic performance data from 2023 datasets. "Regularly met" means that NESO would not intend to apply strict scrutiny to an isolated month where thresholds are not achieved. A

measure of what is achievable consistently is used by identifying the worst months performance data for each wind BMU in each measure, ranking this data and then selecting the 10% of best performing onshore wind BMUs from this dataset. This threshold is also aligned with the median performance across all wind BMUs. Further description on how these have been established and why they are considered appropriate can be found in section 10.Appendix of this document. **The Net and Absolute error thresholds outlined below apply to both onshore and offshore wind.**

Performance of the Top %	Net % Threshold	Absolute % Threshold
25%	±4.84%	10.71%
20%	±4.03%	10.47%
10%	±3.03%	9.38%
5%	±2.08%	8.72%
NESO view of Good Industry Practice Threshold	±3%	9.4%

6. Methodology

In establishing how NESO interprets Good Industry Practice we have identified two measures as relevant to carrying out this assessment:

1. Net error which is a representation of any directional offset in the errors leading to persistent under or over statement of the expected output of the unit based on submitted data.
2. Absolute error which is a representation of the cumulative errors over time.

A high standard of performance against both metrics is required to minimise costs associated with uncertainty and to ensure fair settlement of bid offer acceptances, which are paid based on calculations from the physical notification and therefore affected by any directional error bias.

In line with received feedback, the methodology has been adapted to one based on the available capacity of the unit rather than the delivered output of the unit as the denominator. This results in a methodology as follows for the calculation of error:

Threshold 1 – Net % Error

$$NET\_PERC\_ERROR(u,m) = \frac{NET\_ERROR(u,m)}{\sum_{s \in S(m)} CAP(u,s)}$$

$$NET\_ERROR(u,m) = \sum_{s \in S(m)} FPN(u,s) - AMO(u,s)$$

In each settlement period the expected energy delivered minus the metered output is calculated. This parameter is then summed across the duration of a month to provide a monthly net energy error. Directionality is maintained so positive errors offset negative errors and the monthly value is a cumulative value across the monthly sample period. To turn this into a percentage, the sum of each settlement period capacity is used as the denominator, where capacity is assumed as the minimum of the average Maximum Export Limit declared in any period or the registered capacity of the unit.

Threshold 2 – Absolute % Error

$$ABS\_PERC\_ERROR(u,m) = \frac{ABS\_ERROR(u,m)}{\sum_{s \in S(m)} CAP(u,s)}$$

$$ABS\_ERROR(u,m) = \sum_{s \in S(m)} |FPN(u,s) - AMO(u,s)|$$

In each settlement period the expected energy delivered minus the metered output is calculated and the absolute value is calculated. This parameter is then summed across the duration of a month to provide a monthly absolute energy error. Directionality is lost so positive errors and negative errors in each settlement period are cumulative across the monthly sample period. To turn this into a percentage, the sum of each settlement period capacity is used as the denominator where capacity is assumed as the minimum of the average Maximum Export Limit declared in any period or the registered capacity of the unit.

Variable	Units	Description
NET_PERC_ERROR(u,m)	%	The net percentage error measurement.
ABS_PERC_ERROR(u,m)	%	The absolute percentage error measurement.
AMO(u,s)	MWh	The actual metered output according to settlement metering.
CAP(u,s)	MWh	Minimum of the MEL or the capacity of the unit in each settlement period.
FPN(u,s)	MWh	The expected metered output according to Physical Notifications. *(Periods affected by a Bid/Offer acceptance or an unavailability as indicated by a Maximum Export Limit below the Physical Notification adjusts this Expected Output parameter according to wider Grid Code).*
NET_ERROR(u,m)	MWh	The net error MWh of error between FPN and AMO.
ABS_ ERROR(u,m)	MWh	The absolute MWh of error between FPN and AMO.
u	BMU_ID	Balancing Mechanism Unit.
m	Month	The month in which the NET_PERC_ERROR and ABS_AVG_ERROR is being calculated for.
s	Settlement Period	Settlement Periods.
S(m)	{}	Number of Settlement Periods in month m.

Table 1: Variables and their descriptions for calculating the Accuracy Thresholds.

All figures are collected using Elexon data to ensure complete transparency and repeatability of approach. Periodically the datasets used in analysis will be updated and published on the NESO balancing costs page.

At the start of the Monitoring Procedure, and monthly there-after NESO will publish each Wind BMU with their NET_PERC_ERROR(u,m) and ABS_PERC_ERROR(u,m) values for the last 6-months, to make transparent NESO's accuracy calculations.

7. Principles for preparation of a Physical notification

Alongside these thresholds, NESO is introducing a set of non-exhaustive principles that can be applied to preparing accurate FPN data. These principles have been developed based on discussions with wind market participants that own or operate onshore and/or offshore units that demonstrate high levels of PN accuracy according to NESO's benchmarking analysis, NESO's balancing engineers and based on industry feedback received during the FPN Good Industry Practice Consultation December 2024.

Where a unit cannot meet thresholds and cannot demonstrate extenuating circumstances, NESO may consider the following non-exhaustive principles in its view of whether Good Industry Practice is being followed by wind generators in the preparation of PNs:

- **Wind forecasts and models used for the preparation of Final Physical Notifications are updated regularly and are reflective of the best data available for that BM Unit.**

  For wind BMUs we would expect to see that the best available wind data and models are used in the preparation of Physical Notifications. In cases where integrated trading and data submission exist, the principles would be that all models used for creating an expectation of output for the purpose of energy trading should be the same as for PN submission in all timescales until gate closure. For cases where these are separated functions, we would expect that data used is the most recent available within modelling and gate closure constraints and typically using wind forecast data that is no more than an hour before gate closure (2 hours before delivery). In all cases if it can be demonstrated that more frequent and recent data does not lead to improvements in PN accuracy by the operator or responsible party for PN submission this analysis would also be considered as meeting the principle of best data available.

- **Whenever the expected output of the unit changes due to updated forecast data or new model outputs, this is reflected in the Physical Notification.**

  Pre gate closure PNs should be resubmitted on any change greater than 1MW in the wind generators best expectation of a unit's output. For the avoidance of doubt, details regarding best practices for use of Electronic Data Transfer (EDT) and Electronic Data Log (EDL) are shared in wider NESO guidance. However, for ease of reference current best practices for use of these systems is documented in section 10.Appendix.

- **The model should not lead to a Physical Notification which is consistently higher or lower than outputs.**

  This principle is in line with the measure of net error, it is possible that corrections are needed in datasets themselves to increase or decrease the outputs for a weather model, but the output should not lead to a result that consistently over or under estimates generation outputs of a unit.

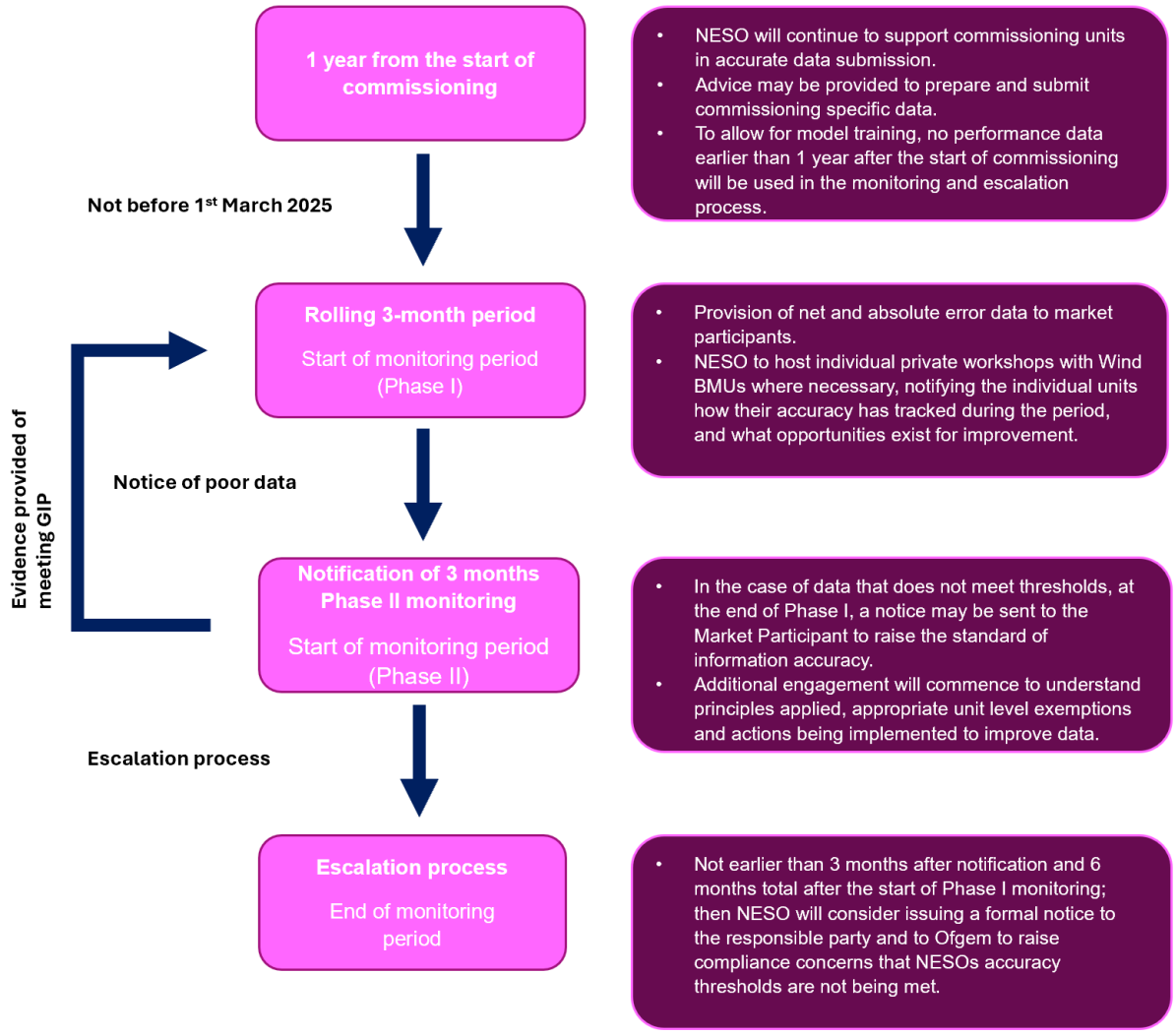
- **The model used for preparing a Physical Notification is reviewed regularly.**

  Models for the preparation of a PN should be reviewed regularly with approximately once yearly considered appropriate, and where services are provided by a 3rd party, the responsible party should review performance of this provider.

The monitoring process outlined below aims to foster collaboration and assist Balancing Mechanism Units (BMUs) in reaching the thresholds set out in this Guidance Note where these thresholds are not met. It is important to note that these thresholds do not encompass every aspect of what may be considered Good Industry Practice.

NESO recognises that the monitoring process may uncover extenuating circumstances for certain wind farms that prevent them from meeting the defined accuracy thresholds, regardless of whether the principles for the preparation of PNs outlined above are being followed. This understanding will be achieved through a collaborative process, involving close engagement with these wind farms to gain insights into the unique characteristics of their site(s). NESO will consider these circumstances when determining whether to report any inaccuracies to Ofgem.

8. Monitoring Timelines and Procedures



The Monitoring Procedure is a six-month monitoring period for all wind BMU's with workshops and a gradual escalation of severity raised from continued inaccuracy. The monitoring period will begin on 1st March 2025. For commissioning units, the monitoring period will start either one full calendar year from the beginning of commissioning or on 1st March 2025, whichever is later.

At the 3-month mark, a **notice** will be given to units that are not regularly meeting NESOs accuracy thresholds that NESO is intending to raise concerns to Ofgem that in NESO's view, Good Industry Practice has not been followed should this continue. Should the inaccuracy continue for another 3-months (6-months monitoring in total) without evidence of extenuating circumstances or application of the appropriate principles for the

effective preparation of PNs, then NESO will consider issuing a **formal notice** to the responsible party and to Ofgem that the expected level of accuracy set out in this Guidance Note has not been followed for each BMU not meeting these thresholds.

Where a unit meets NESOs view of Good Industry Practice as set out in this document in the first 3 months, at least 3 months additional data would be needed to consider escalation into phase II monitoring to account for wind variability. If a unit enters phase II monitoring but demonstrates NESOs view of Good Industry Practice within the following 3 months, it will enter Phase I monitoring with a further 3 months before a notice could be re-issued by NESO.

The process outlined is intended to be collaborative and we endeavour to work with BMUs to improve their FPN accuracy throughout. Escalation to the regulator is a means of last resort where units cannot show meeting of NESOs accuracy thresholds, employing of principles for the effective preparation of a PN or extenuating circumstances; All escalation to the regulator is as part of existing NESO licence obligations.

Across the process, we will make reasonable allowances for exceptional circumstances and specific process or system reasons that thresholds may not be met. If an exceptional circumstance is identified during a performance month, it will be excluded from the performance monitoring for that month or months.

When achieving the thresholds defined within the Guidance Note**, it is not the expectation of NESO that the thresholds can or will be achieved every month** of the calendar year. With the variability wind naturally presents, NESO understands that there may be occasional months where the thresholds are not achieved. It would not be the intention of NESO to apply strict scrutiny to a singular month where thresholds are not achieved.

Where improvements or plans for improvements are indicated to NESO as part of the ongoing workshops this will be considered and if appropriate also relayed to Ofgem in any escalation process or used as a mitigating reason not to escalate.

NESO acknowledge that BMUs under construction, commissioning BMUs and newly commissioned BMUs are likely to exhibit more inaccurate PNs due to the lack of history available to train models. Therefore, BMUs that fall into these categories will be subject to the Guidance Note requirements after one full calendar year from the start of commissioning, allowing time to gather adequate operational history for forecasting models.

9. Feedback & Correspondence

NESO will provide updates and initial notifications regarding workshops and the Monitoring Procedure at the Operational Transparency Forum and via NESO's Balancing Cost website. Private correspondence on Wind BMU performance of FPNs will be made via email and Microsoft Teams conference calls to individual BMUs.

Should any parties wish to provide feedback on the outlined thresholds and Monitoring Procedure in this Guidance Note, we ask that it is submitted via email to MarketReporting@nationalenergyso.com

At any point in time, if an operator, irrespective of meeting thresholds, would like to hold a workshop on data quality please contact NESO via MarketReporting@nationalenergyso.com

10. Appendix

This appendix provides additional clarifications required throughout the FPN Good Industry Practice Consultation held in December 2024. These clarifications aim to address specific queries and enhance transparency, providing clear, detailed explanations that support the core principles outlined in the Guidance Note.

Best Practices for submission of data via EDT and EDL

The following principles outline how a unit should practically consider meeting the requirements of submitting best expectation of generation output at all times in pre gate closure data without excessive volumes of data being produced and shared.

- For the avoidance of doubt, resubmission of the same data is not advantageous and there is no requirement for submitting updated data on a schedule where no change exists.
- Data more than 4 hours ahead of delivery would ideally not be updated more than hourly unless there is a significant change in expected outputs
- Data between 4 hours ahead of delivery and gate closure should not be updated more than once every 15 minutes to preserve effective operations of Electronic Data Transfer (EDT) systems.
- Electronic Dispatch Log (EDL) data, which can be used for submission of Maximum Export Limit data in real time should be used to profile for technical unavailability (inclusive of wind cut out periods) and declared only upon change, data submission on no change or at granularities lower than for 1 minute are not possible to be used within control system timescales and therefore should be avoided.

Thresholds in the Guidance Note

Some feedback received throughout the consultation periods focuses on the use of the top 10 percentile of performers in determining the thresholds. NESO would like to outline the rationale behind this figure. We are aware that this same measure may not be appropriate when considering Good Industry Practice across other Grid Code issues and that this represents a high-performance measure, in all guidance notes consideration will be given to the balance between what is achievable and what is needed for operating a safe, secure and economic power system.

Firstly, analysing the 2023 data, it can be observed that the median net error (2.61%) and the median absolute error (9.18%) are both lower than the accuracy thresholds set by NESO. This ensures that published thresholds are aligned with the central tendency of the error distribution within the sample **before any implemented improvements**.

Use of the worst months data in assessing performance ensures that this was possible to achieve across varied weather conditions and seasonality, this compares with use of a median in the dataset that may not capture this variability.

Secondly, we've observed significant improvement in the monthly net and absolute errors amongst wind market participants. The mean net error has dropped by approximately 2 percentage points between 2023 and 2024, whereas the mean absolute error has dropped by approximately 3 percentage points. On examining this data, we see that it remains skewed by units holding very high error percentages but that units that previously exhibited some of the highest errors also had some of the most significant improvements; now regularly meeting established thresholds.

Upon examining the median monthly performance of individual BMUs, it was found that approximately 107 BMUs met the net error threshold in 2023 and 128 BMUs met the net error threshold in 2024. Among the units that achieved the thresholds in 2023, approximately 51% were offshore wind farms, while 49% were onshore wind farms. In 2024, among the BMUs that achieved the thresholds, 51% were onshore, whereas 49% were offshore. Figures 2 and 3 present a comparison of the median monthly net errors between 2023 and 2024,

classified by BMU. Units that exhibited high net errors in 2023 have significantly improved their performance in 2024, mitigating the worst periods of performance. However, there are some outliers, where BMUs have shown a decline in median performance between the two years.

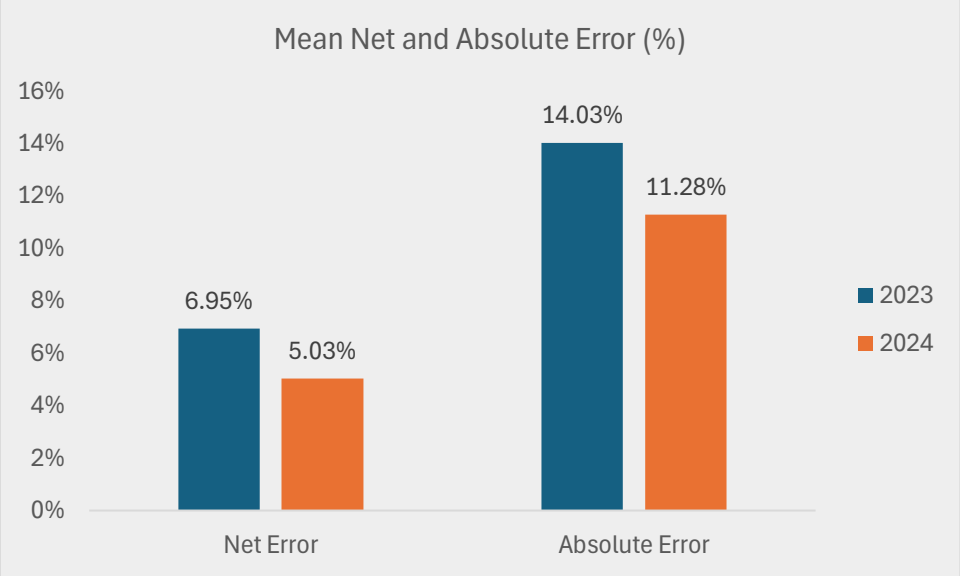


Figure 1: Mean net and absolute errors, 2023 vs 2024.

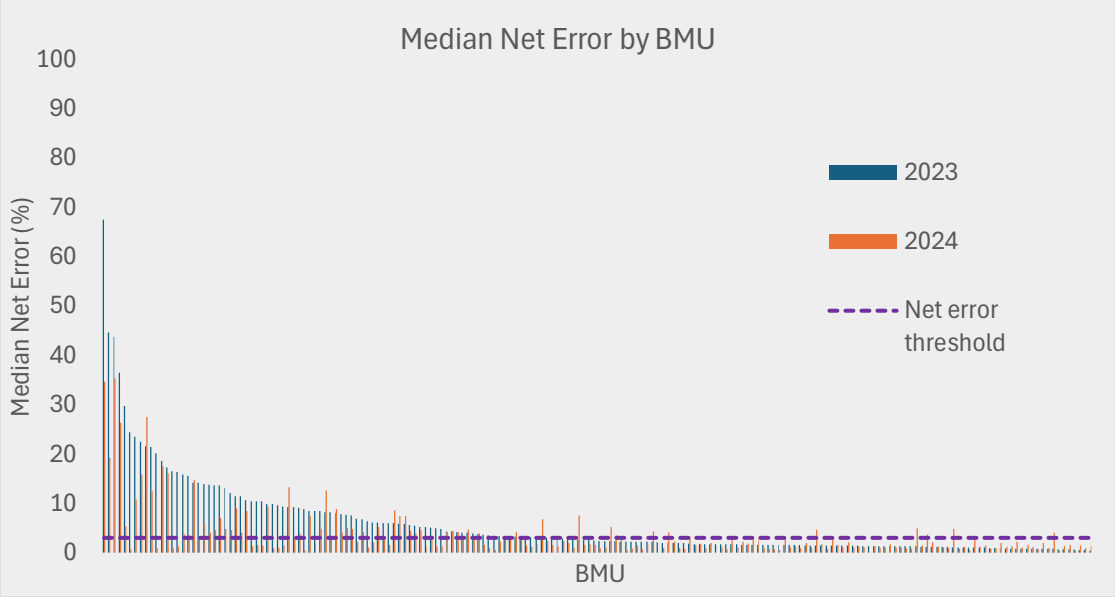


Figure 2: Illustration of median net error by BMU between 2023 (blue) and 2024 (orange), in 2023 order.

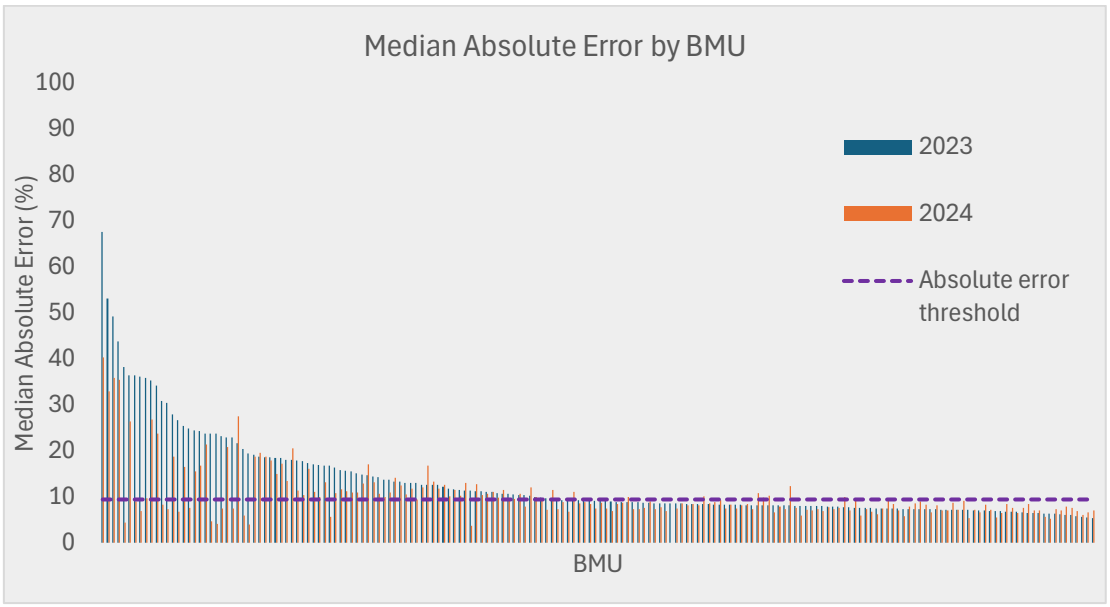


Figure 3: Illustration of median absolute error by BMU between 2023 (blue) and 2024 (orange), in 2023 order.

Additionally, use of onshore units to set the requirement was implemented in response to feedback received in addition to further data analysis and broad agreement from the consultation process for implementation. While there is a relatively even distribution of performance across onshore and offshore assets, in the top 10% without stratification onshore wind units were underrepresented. Similarly, while this may indicate potential for offshore units to deliver more accurate physical notifications it was not deemed reasonable to increase thresholds for this unit type.

In conclusion, the adoption of the consistent performance of the top 10 percentile of performers as a benchmark for setting thresholds is a robust approach that ensures high standards and continuous improvement within the industry. The improvement in the performance of BMUs between 2023 and 2024 further supports the use of these thresholds, demonstrating their effectiveness in driving better outcomes. By aligning with accuracy thresholds based on 2023 onshore wind farm data, and recognising the substantial performance enhancements observed, NESO is committed to fostering an environment where both offshore and onshore wind farms can achieve FPN accuracy.