Public

Workgroup Report

GC0166: Introducing new Balancing Mechanism Parameters for Limited Duration Assets

Overview: This modification seeks to introduce new parameters that will allow the better use of Electricity Storage Modules within the Balancing Mechanism, with all Balancing Mechanism Units (BM Units) required to submit the new parameters.

Modification process & timetable

1. **Proposal Form**
   29 November 2023
2. **Workgroup Consultation**
   18 November 2024 – 09 December 2024
3. **Workgroup Report**
   23 April 2025
4. **Code Administrator Consultation**
   06 May 2025 – 06 June 2025
5. **Draft Modification Report**
   18 June 2025
6. **Final Modification Report**
   08 July 2025
7. **Implementation**
   10 Business Days after Authority Decision

Have 10 minutes? Read our Executive summary
Have 90 minutes? Read the full Workgroup Report
Have 180 minutes? Read the full Workgroup Report and Annexes.

Status summary: The Workgroup have finalised the proposer's solution. They are now seeking approval from the Panel that the Workgroup have met their Terms of Reference and can proceed to Code Administrator Consultation.

This modification is expected to have a:
Medium impact on Generators, Aggregators, Storage Users (All Balancing Mechanism Units)

Modification drivers: Efficiency, New Technologies, System Operability, System Planning, System Security, Transparency

Governance route	Standard Governance modification which has been assessed by a Workgroup	
Who can I talk to about the change?	**Proposer:** Stephen Baker, NESO stephen.baker@nationalenergyso.com 07929 724347	**Code Administrator Chair**: Claire Goult claire.goult@nationalenergyso.com 07938 737807

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Executive Summary

This modification seeks to introduce new parameters that will allow the better use of Electricity Storage Modules within the Balancing Mechanism (BM), with all Balancing Mechanism Units (BM Units) required to submit the new parameters.

What is the issue?

A large number of Electricity Storage Modules are currently operating in the Balancing Mechanism. These devices can only import or export until their limited storage capacity is either fully charged or fully depleted. Although there are two parameters already defined in the Grid Code and the Balancing and Settlement Code (BSC) (Max Delivery Period and Max Delivery Volume), these do not cater for bi-directional modules. Although the current issues have been brought into focus by batteries, this modification is intended to include all Electricity Storage Modules.

What is the solution and when will it come into effect?

Proposer's solution: The introduction of new parameters, Maximum Delivery Offer (MDO) and Maximum Delivery Bid (MDB), that will be defined in the Balancing Code (BC) section of the Grid Code.
As well as introducing additional defined terms into the Glossary and Definitions to enable the new parameters, MDO, MDB and Future State of Energy (FSoE). There will also be changes required to the Data Validation, Consistency and Defaulting Rules.
Implementation date: Q2 2025 (July – September 2025)

What is the impact if this change is made?

All BM Units must provide new information. The solution is intended to optimise the use of diverse assets by NESO. Electricity Storage Modules will be required to provide more information to facilitate this.
Workgroup conclusions: The Workgroup concluded unanimously 12 to 13 that the Original better facilitated the Applicable Objectives than the Baseline. One Workgroup member abstained from voting

Interactions

NESO will be proposing a modification to the BSC to enable the publication of these Data items via Balancing Mechanism Reporting Agent, i.e. Elexon's Insights Solution[1] .
As the modification seeks to alter Balancing Code 1 (BC1) there are Electricity Balancing Regulation (EBR) Article 18 T&Cs implications, which will be consulted against.

[1] Formally Balancing Mechanism Reporting Service (BMRS).

What is the issue?

A large number of Electricity Storage Modules are currently operating in the Balancing Mechanism. These devices can only import or export until their limited storage capacity is either fully charged or fully depleted. Although there are two parameters already defined in the Grid Code and BSC (Max Delivery Period and Max Delivery Volume), these do not cater for bi-directional modules. Although the current issues have been brought into focus by batteries, this modification is intended to include all Electricity Storage Modules in the Balancing Mechanism (BM) and the data submission requirements will apply to all generators active in the BM.

To get around this NESO use Maximum Import Limits (MIL) and Maximum Export Limits (MEL) and the "30-minute" rule (previously "15-minute" rule) which limits how NESO uses these assets and does not allow NESO to plan in longer timescales. The proposed solution works to supersede this.

To use stored energy in an optimal way to balance the National Electricity Transmission System (NETS) it requires an increased economic dispatch of Electricity Storage Modules, and to allow for improved operational planning allowing NESO to factor in these modules for longer term planning (up to 24 hours ahead).

After extensive discussion with industry, NESO is proposing via this modification to introduce new parameters that will allow the better use of Electricity Storage Modules. Please note, although the current issues have been brought into focus by batteries, this modification is intended to include all Electricity Storage Modules.

GC0166 seeks to address the growing problem presented increasingly as the energy mix becomes ever more diverse.

Why change?

Increased economic dispatch of Electricity Storage Modules. Improved operational planning allowing NESO to factor in these modules for longer term planning (up to 24 hours ahead).

What is the solution?

Proposer's solution

The Proposer intends this modification to cover any Electricity Storage Modules (including short duration assets, not just batteries) within the Balancing Mechanism (BM), with all BM Units required to submit the new parameters (if active in the BM).

There will be an implementation period informed by the Open Balancing Platform (OBP), and NESO will require a period to implement the changes post approval.

The introduction of new parameters, Maximum Delivery Offer (MDO), Maximum Delivery Bid (MDB) and Future State of Energy (FSoE), that will be defined in the Balancing Code section of the Grid Code.

If a BM Unit can deliver the full volume of energy in a Bid Offer Acceptance, in the BM Window, as defined by the run up/run down rates, Stable Import Limit (SIL)/Stable Export Limit (SEL) and MEL/MIL they can declare a default value for MDO or MDB. If they cannot, they must inform NESO of the energy limitation by submitting a value of MDO or MDB that reflects this limitation.

As well as introducing additional defined terms into the Glossary and Definitions to enable the new parameters, MDO, and MDB and Future State of Energy (FSoE) there will also be changes to the Data Validation, Consistency and Defaulting Rules.

There is also a requirement for Energy Storage Modules to provide a planning model which is more asset specific.

The Proposer considers that the solution as specified meets the original goals of the modification proposal in terms of allowing NESO to increase the economic dispatch of electricity storage devices and improved operational planning to allow NESO to factor these units for longer term planning.

See **Annex 03** for full draft legal text.

Workgroup considerations

The Workgroup convened with a range of Industry experts covering a variety of asset types and met 13 times to discuss the identified issue within the scope of the defect, develop potential solutions, and evaluate the proposal in relation to the Applicable Code Objectives. Previously, in August 2023 a presentation on the concept of Parameters for Storage Assets had been presented at GCDF. The OBP consulted with Industry about the

intention of the new Dynamic Parameters before GC0166 commenced and has continued to do so since.

The Workgroup held their Workgroup Consultation between 18 November 2024 – 09 December 2024 and received 14 non-confidential responses and 0 confidential responses. The full responses and a summary of the responses can be found **Annex 07**.

During the development of GC0166 solution, NESO Subject Matter Experts (SMEs) have liaised with relevant Industry parties throughout, both inside and outside of the Workgroup meetings, to address specific concerns expressed by individuals.

Consideration of the Proposer's solution

The Proposer confirmed that they intend that the solution for MDO and MDB will be technology neutral. However, there was concern from several Workgroup members that BM Units should not be subject to MDO and MDB when they can fully deliver in the BM Window. Several Workgroup members had concerns around the application of the modification on pumped storage.

The Proposer still intends that this is a parameter which should be submitted by all technology types.

Some Workgroup members expressed concern that the use of the defined term "Electricity Storage Module" exempts Pumped Storage from the additional requirement to provide asset specific planning model but would leave in scope similar Long Duration Energy Storage asset classes such as Compressed Air Energy Storage or Long Duration Lithium Ion Battery.

The asset types that are not limited can record a large value at registration so that NESO will know that any Bid Offer Acceptance (BOA) is not curtailed by a lack of energy. If this modification is approved, for existing BM Units NESO will insert a value.

These values will be defaulted each day so that the BM Unit does not have to redeclare. The suggested default value for MDO is +9999MWh and for MDB it is -9999MWh.

Several Workgroup members wanted there to be a stronger definition around what falls under limited/ unlimited, whereas the Proposer was comfortable that this was not required due to the other parameters in the Grid Code. The Workgroup members who disagreed with the Proposer have not yet raised an alternative solution.

Workgroup discussed multiple scenarios involving BM Units, energy sources and hybrid units. NESO SME after modelling each component individually to ensure the proposal

works effectively confirmed that NESO do treat multiple BM Units with a single source of energy as individual units.

BSC Interaction

For the solution to work there is a requirement to move the short-term asset data onto the Elexon Insight platform. The Workgroup agreed with the approach suggested by the Proposer that the BSC change won't be developed until the Final Modification Report is submitted to the Authority, but meanwhile NESO have engaged with Elexon Business & IT representatives to discuss the changes and establish the best way forward given the desire from the industry to progress this capability.

Commercial Versus Technical Dynamic Parameters Discussion

The Workgroup had extensive discussion without reaching a consensus whether the proposed dynamic parameters; MDO and MDB, should be considered technical (i.e., what a plant is physically capable of delivering) or commercial (what the provider has elected to deliver). This discussion was centred around the Ofgem Open Letter published in September 2020, which explained that Dynamic Parameters should not be used for commercial purposes.

An Authority Representative confirmed that there were no immediate concerns with classing MDO/MDB as dynamic parameters from an enforcement/ compliance perspective. And that the definition still reads as the amount of energy that can technically be delivered excluding the volume of energy required to satisfy to any other Ancillary Service commitments, rather than the amount that the party would like to deliver. Therefore, this is broadly consistent with other dynamic data in terms of the focus on technical rather than commercial data.

As the definition explicitly states that the information should be submitted net any energy required for Ancillary Service contracts, it would mean that it would be difficult for a party to argue that that similar contractual considerations should be accounted for when submitting other dynamic data.

However, there was some contention around the fact that these parameters can be redeclared inside the BM Window based on proposed changes to the Physical Notification after the BM Window.

It was recognised in the Workgroup that stopping a redeclaration inside the BM Window meant an Electricity Storage Module could not trade as normal and at the same time obey its Final Physical Notifications (FPN) (**Annex 04**). For NESO having an accurate FPN is vital.

Allowing MDO and MDB to be redeclared inside the BM Window means that NESO will not have certainty during this period.

Workgroup discussed the distinction between technical and commercial parameters, with concerns raised about the potential for unintended consequences. NESO further consulted with market monitoring and compliance teams and provided responses.

Worked Example models were extended to demonstrate Period 4 and include on responsibilities and permitted actions. For BM Units of long duration, a default value facility was provided. The FSoE model will be applied across all Electricity Storage Modules. The Optimiser will be run frequently covering the entire period a Physical Notification (PN) is available for to establish the volume of Electricity Storage Modules that will be deployed across the entire system vs non- Electricity Storage Module commitments and only becomes final once BOAs are issued within the BM window. With 27GW of Electricity Storage Module capacity possible by 2030 NESO clearly require a FSoE model.

MDO/MDB versus an asset-based model

During the initial Workgroup meetings Workgroup Members discussed whether NESO should use an asset-based model to predict the energy left in a BM Unit before and after NESO issues a BOA.

In this context an "asset-based model" means a representation of the components making up the BM Unit and a model of the behaviour of these components as energy is taken from, and inserted into, the BM Unit.

Annex 05 was provided by a Workgroup member for the purposes of a sub-group addressing Action 15 and shows a Dispatch Planning Tool for illustrative purposes.

Most of the Workgroup and NESO agreed that inside the BM Window the owners of BM Units should provide NESO with an explicit statement of the available energy for an offer or a bid. NESO should not try to derive these, or NESO is effectively making decisions that could affect the BM Units commercial position.

However, NESO also must make constant forecasts of future margins and provide this information to the market so that the market can respond.

NESO agreed that an asset-based model was the best approach for this.

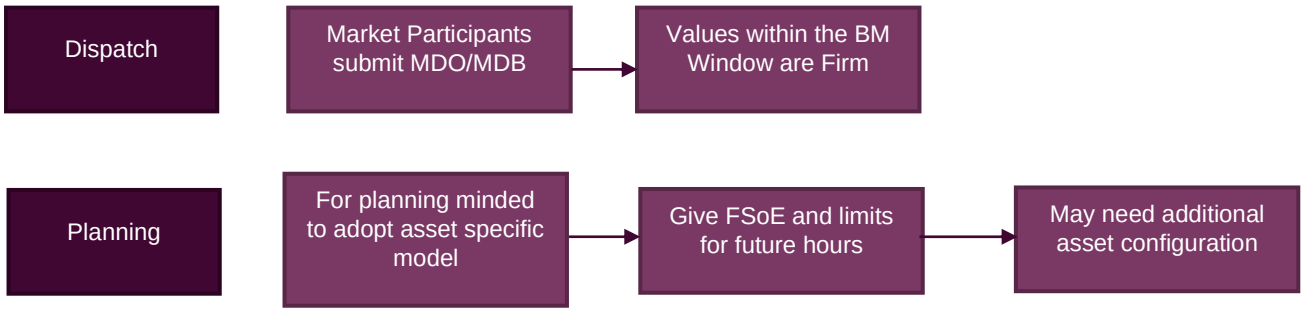
This model can be used by NESO to forecast the availability of BM Units in the future and to perform "what-if" analysis if NESO were to issue a BOA to these assets. In these

timescales NESO is not making any commercial decisions and so using an approximate model is considered sufficient.

NESO also gets another important piece of information about Electricity Storage Modules – the State of Energy is a metered value returned to NESO via Supervisory Control and Data Acquisition (SCADA) measurements. This is a measurement of the current situation, but it does not forecast future behaviour.

Overarching Battery Model

The Workgroup discussed the proposed approach that the battery assets model would follow, with the Proposer acknowledging that there will be some asset-specific variation.



Dispatch: Flow for Maximum Delivery Offer (MDO) and Maximum Delivery Bid (MDB)

The Proposer explained how for new BM Units a value will be provided by the BM Unit during the registration process, where for existing BM Units a default value can be inserted (+9999/ -9999) by NESO into their IT systems for each BM Unit.

The new parameters will follow the usual defaulting rules. BM Units will submit indicative values for the next Settlement Day before 11:00 at Day Ahead. If a BM Unit has not submitted these values the previous day's values will be copied and defaulted at 11:00 Day Ahead (the details of how this works now are in the Data Validation, Consistency and Defaulting Rules).

As we approach each Gate Closure BM Units will update MDO/MDB as they trade their positions. After Gate Closure the values of MDO/MDB within the BM Window can only be updated in response to one of the following circumstances:

- A technical fault;
- If NESO issues a BOA;
- If a frequency event occurs so that the BM Unit depletes all energy it had reserved for an Ancillary Service; and/or
- If it has a non-zero PN after the BM Window changes.

The Workgroup queried whether there is a difference between the treatment of duration limited versus energy limited and if this would lead to needing a threshold to be established. The Proposer confirmed that as BOAs that are longer than 89 minutes (the length of the BM Window) any BM Unit that can sustain a BOA for longer than the length of the BM Window, at their MIL or MEL, is not considered limited for NESO purposes.

Planning: Future State of Energy (FSoE) and Flow for Asset Specific Models

The Workgroup queried whether the definition should be 'Charge' or 'Energy,' the Proposer confirmed that as the reference is to energy, and the definition relates to modules (MWh) then "Future State of Energy (FSoE)" is the better term.

The Proposer explained how for each BM Unit, to avoid differentiating between current and future technologies, NESO will agree a model. Different BM Units may have different models depending on what they want to share and the level of accuracy.

A very simple model may just have export and import efficiencies. A more complex model may have additional parameters (temperature effects etc). NESO will take guidance from the BM Unit owner on what is a fair representation, but their assumption is that the model shown below is sufficient in most cases:

- For new BM Units the model and its parameters are agreed at registration;
- For existing BM Units a model will be agreed after the modification has been approved by the Regulator;
- The model parameters are not expected to change at any great frequency – they will only change if there is some change to the asset;

Workgroup members requested further clarification on the asset-based model; the Proposer confirmed the intent of the solution for the following four areas:

How should model parameters be sent to NESO and covering what time horizon?

The aim of an asset-based model is to allow NESO to plan in future timescales.

- The period covered is the time for which NESO has interim data.
- At 11:00, Market Participants are expected to submit this interim data for the following schedule day. If they do not do this, then data is defaulted.
- So, at 11:00, NESO has interim data to end of the next schedule day.
- NESO will use this data to plan ahead for 33 hours.

- To make it easier for BM Unit owner NESO will derive limits for Ancillary Services from auction data available to NESO. NESO will get this data after each auction and calculate the level of charge needed for the Ancillary Service from the awarded contract.
- This means the model parameters will change infrequently and will be derived at the time of BM Unit registration.

How would co-located assets be treated (that is, assets with different technology types making up a single BM Unit)?

To perform the required "what-if" analysis NESO requires a model that allows it to simulate the effect of issuing Bid-Offer Acceptances while staying within the FSoE of the BM Unit. This model must also show how the FSoE changes after the BM Unit follows a PN.

There are many ways to collate assets to form a BM Unit. The required model will be agreed after bilateral discussion.

The main characteristic of this model is accuracy – it is expected that the model will be able to predict FSoE at an accuracy of less than 10% up to four hours into the future and an accuracy of less than 20% between 4 to 33 hours.

The model will be reset (due to any drift in calculating the state of energy) by comparing data to the measured FSoE that NESO receives via SCADA measurement.

What MIL/MEL should be declared by these co-located assets? The Proposer explained that MIL/MEL is outside the scope of this Grid Code modification but suggested this query would be passed onto the relevant task force. The Proposer confirmed that co-located assets would be addressed outside of this current modification, with the focus of GC0166 being on the primary objectives of this Workgroup without encompassing co-location complexities.

Was NESO interested in the internal energy of the asset or at a Connection Point? The model should allow NESO to model BOAs and PNs at the point where these are measured as defined in the BSC (normally settlement metering).

Workgroup discussed the need for clarity in definitions and defaulting rules in the legal text, suggesting the use of "Energy Constrained BM Unit" instead of "limited" or "unlimited" storage to provide better clarity.

Workgroup members emphasised the need for clarity on the parameters for the **Future State of Energy** model, specifically the import and export efficiency, state of energy, maximum limits, daily cycle limit and how often the parameters should be updated, and

whether they should be considered static or dynamic. It was agreed that more detail would be needed to clarify the parameters, and the intention is to refine them over time once MDO and MDB are in place. Initially, the model would use static parameters, but it would become more granular in the future. NESO emphasised that the current focus was on getting the basic model in place and then further refining it. Agreed that detail would be included in the Workgroup Report to provide clear guidance on the expectations for parameter updates.

Time resolution for MDO/ MDB parameters and number of submissions

NESO SME clarified the desire for the MDO/MDB parameter to be a time varying parameter which considers Ancillary Service contracts, and NESO SME shared that NESO treat Physical Notifications (PNs) as sacrosanct and therefore should not be changed.

A Workgroup member raised concerns around using time resolution parameters and suggested one variation per settlement period seemed to be the correct trade off.

It was agreed that minute resolution was preferred, however there were queries on the maximum number of submissions that NESO IT systems could handle.

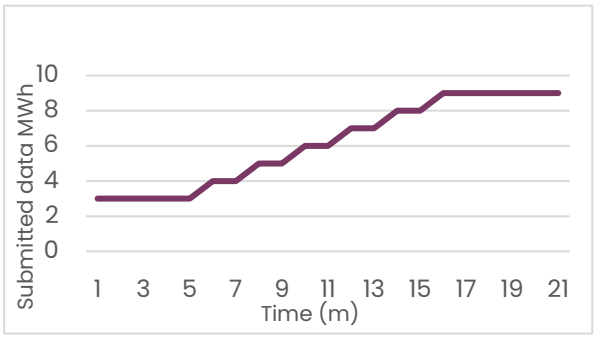
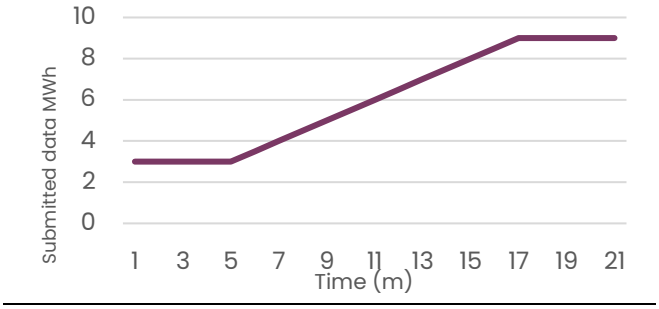
At the time of writing NESO is transitioning its IT services to a new platform. The new MDO and MDB parameters may be implemented in either the older or new platform depending on the time when approval is given.

If we consider MEL submission from batteries the current system experiences a peak in submissions immediately before Gate Closure.

On average this peak is 1100 submissions in the five-minute period before Gate Closure from a total of 135 batteries. So, the maximum number of submissions NESO would expect per BM Unit in the five-minute period for MDO is 8. With a similar number for MDB.

The new IT platform can handle more than this however the Proposer believed 8 to be a reasonable limit overall.

With one minute granularity a BM Unit could submit a different MDO or MDB for every minute. Instead, NESO expects BM Units to use the “to” and “from” fields to reduce this.

One minute granularity	Using 'to' and 'from' Fields
	

NESO provided an overview of the MDO/MDB submissions-only worked example (**Annex 08**).

1. Calculate MDO/MDB for the entire data range a PN has been submitted. Data submitted in 1 min granularity. Indicating the Offer and Bid Volume, in MWh that can be delivered if a BOA were to be sent starting at that minute. A BOA can start at any minute within the BM Window and always ends at the BM Gate.

2. The MDO/MDB volume must be calculated so that the entire CCL (Capped Committed Level in BETTA Despatch Instruction Guide) can be met within the BM window and the first settlement period after the BM Window. CCL is the Capped Committed Level after a PN is adjusted by BOA.

3. Energy volumes required for ancillary service delivery must be taken in account when calculating MDO/MDB.

4. A BOA can be sent a second before the BM Gate moves and locks in the next settlement period. As such MDO/MDB must take account of the settlement period after the BM Window. It will not be acceptable for the declared PN not to be followed or for the declared PN to be capped by MEL and MIL once within the BM Window due to the state of energy being altered by a BOA that was accepted when the BOA did not exceed MDO/MDB.

5. MDO/MDB can be resubmitted within the BM Window: after a BOA is accepted or a PN Change in the first settlement period after the BM Window. The BM Unit no longer being able to achieve the previously stated value as a result of an unavoidable event. Examples of such an event include (but are not limited to) plant breakdowns, or events requiring a variation on safety grounds (relating to personnel or plant). Or The BM Unit

fully utilising the energy reserved (or storage capacity for energy which was reserved) for delivery of System Ancillary Services or Commercial Ancillary Services.

6. MDO/MDB must be submitted for the same duration a PN is submitted. MDO/MDB will default at 11:00 each day.

The GC0166 Worked Example Spreadsheet included in **Annex 08** shows a data submission example for:

1. No BOA and Zero PN
2. PN Submitted in Settlement Period 4
3. BOA accepted in Settlement period 1
4. Second BOA accepted in Settlement Period 1
5. Third BOA accepted in Settlement Period 2
6. PN changed in Settlement Period 4 to release volume within BM window.

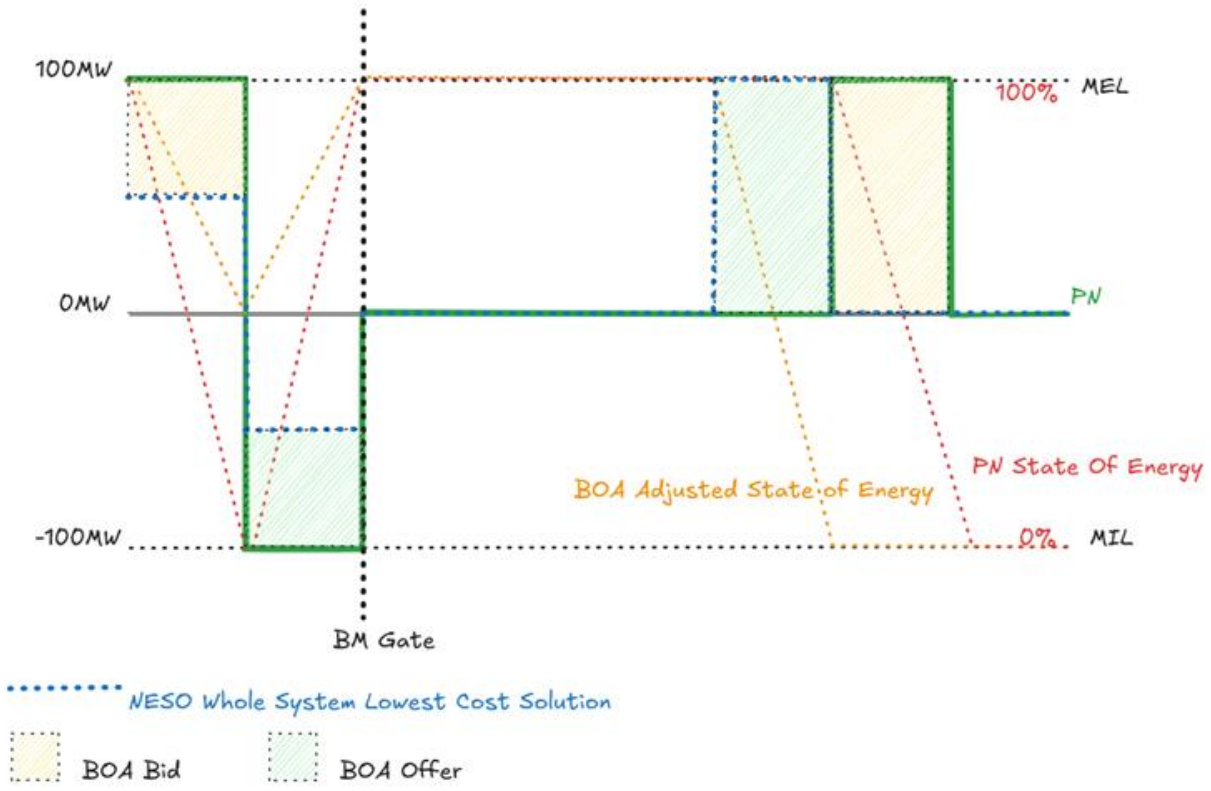
The NESO SME clarified that the data submission should cover the entire period, from 11:00 of the defaulting day plus D+2 5:00, to ensure the data is applicable for the whole duration. Workgroup members noted that "Capped Committed Level" (CCL) was not a defined term in the Grid Code and agreed the Grid Code defined term "**Committed Level**" (CL) should be used to instead to ensure clarity in the legal text.

Future State of Energy Model (Annex 08)

1. Submit the parameters required by FSoE model via Single Markets Platform.
    a) Import and Export Efficiency
    b) State of Energy (SoE) Maximum and Minimum Limit
    c) Daily Cycle Limit
2. Submit real time SoE through SCADA (Integrated Energy Management System - IEMS)

NESO will use the FSoE model to optimise the Limited Duration Asset (LDA) within and beyond the BM Window.

As the FSoE Model will not be 100% accurate, the MDO/MDB submissions will be used to correct the model within the BM Window to ensure BOA instructions delivered by LDA.



The FSoE model will keep a BM Unit within the declared Max/Min State of Energy Limits

In this example the unit has a 100MW PN depleting the state of energy completely within the first half of the BM Window. Indicated by the PN State of Energy.

100MW PN in the second half of the BM Window leaving the unit with a full State of Energy at the end of the BM Window.

A 100MW PN several hours outside the BM Window leaving the unit fully depleted.

The FSoE Model calculated the cost optimal load point for this asset indicated by the blue dotted line.

To implement the optimiser output four BOAs would be required, and the State of Energy will remain within the State of Energy limits indicated as a percentage in this example between 0% and 100%.

Several Workgroup members raised concerns with the use and definition of Limited Duration Asset (LDA). At Workgroup 12 some Workgroup members proposed (and it was

agreed) to create a new Grid Code defined term: Energy Constrained BM Unit. After consideration and review with the NESO Legal Team, NESO and some other Workgroup members believed this was not necessary in Legal Text as there is no reference to it in the proposed Grid Code Legal Text changes. At Workgroup 13 it was proposed to remove the defined term Energy Constrained BM Unit from the proposed draft Legal Text to avoid proliferation of terminology e.g. Long Duration Asset but use it in Guidance and Explanation notes.

Example scenarios considered as part of the Workgroup

To support the development of the solution **Annex 06** shows several different scenarios when calculating MDO/MDB.

Impact on Bid Offer Acceptances (BOAs)

The Proposer confirmed that BOAs must be deliverable, and the Workgroup debated at length the impact of the new parameters on BOAs, particularly on when the exemption scenarios above are involved.

Diagrammatic model below used to help the Workgroup to visualize a 'day in the life' and what is expected from BM Units in terms of declaring MDO/MDB. Inclusive of what would happen if in Settlement Period (SP)4, a BM Unit would be able to redeclare SP1 and SP2 non- zero.

Scenarios	Pre-Gate Closure	Gate Closure	Gate Closure	Gate Closed	Post-Gate Closure +1	Post-Gate Closure +2	Post-Gate Closure +3	Post-Gate Closure +4	Post-Gate Closure +5	Post-Gate Closure +6
BAU	Commercial Agreement/ Default value	MDO/ MDB sent or BOA issued by ESO	MDO/ MDB sent or BOA issued by ESO	Declaration is fixed	ESO issue BOA					
Technical exception or Frequency Event		MDO/ MDB sent or BOA issued by ESO	MDO/ MDB sent or BOA issued by ESO	Declaration is fixed	MDO/ MDB redeclared or BOA issued by ESO					

Scenarios		Pre-Gate Closure	Gate Closure	Gate Closure	Gate Closed	Gate Closure +1	Gate Closure +2	Gate Closure +3	Gate Closure +4	Gate Closure +5	Gate Closure +6
BAU		Commercial Agreement/ Default value	MDO/ MDB sent or BOA issued by ESO	MDO/ MDB sent or BOA issued by ESO	Declaration is fixed	ESO issue BOA					
Technical exception or Frequency Event			MDO/ MDB sent or BOA issued by ESO	MDO/ MDB sent or BOA issued by ESO	Declaration is fixed	MDO/ MDB redeclared or BOA issued by ESO					

Scenarios			Pre-Gate Closure	Gate Closure	Gate Closure	Gate Closed	Gate Closure +1	Gate Closure +2	Gate Closure +3	Gate Closure +4	Gate Closure +5	Gate Closure +6
BAU			Commercial Agreement/ Default value	MDO/ MDB sent or BOA issued by ESO	MDO/ MDB sent or BOA issued by ESO	Declaration is fixed	ESO issue BOA					
Technical exception or Frequency Event				MDO/ MDB sent or BOA issued by ESO	MDO/ MDB sent or BOA issued by ESO	Declaration is fixed	MDO/ MDB redeclared or BOA issued by ESO					

Figure 1. Moving timelines

= Gate
= HH Settlement Period
= Exception
= Closure window

NESO management of Data

The Workgroup queried whether NESO would be able to manage the volume of data they would receive from Industry if they were able to re-declare every minute until Gate Closure, as the current system is due to be replaced in early 2025.

The Proposer confirmed that depending on when the modification was approved the data would either go directly into OBP which will be able to handle up to 40,000 BM Units. However, if this wasn't in place, they would take data, and legacy systems will pass to new system for OBP to complete the data crunching so were confident in their solution.

The Proposer confirmed that MDO and MDB would neither improve nor worsen the situation with the Automated Network Management Systems (ANM) which was being picked up more widely by the Whole System Management Team.

Workgroup members requested reassurance from NESO regarding the handling of data, the NESO SME confirmed that internal reassurance work was being conducted to ensure that the IT infrastructure could handle the data. The NESO SME mentioned that preliminary checks had been done, and the final reassurance would be completed before the proposal is sent to Ofgem for a decision.

Electricity Balancing Regulation (EBR) Implications

Article 18 sets out the rules for creating markets and how balancing products should be set up across the GB market. It states that Transmission System Operators (TSOs) (NESO) should have terms and conditions developed for balancing services, which are submitted to and approved by Ofgem. The terms and conditions related to balancing should be developed by NESO, NESO is responsible for managing change and maintaining the T&Cs relating to balancing for Balancing Service Providers (BSPs) and Balance Responsible Parties (BRPs).

The interaction has been identified between GC0166 and the mapped Article 18 sections within the Regulated Sections of the Grid Code.

Regulation on Wholesale Energy Market Integrity and Transparency (REMIT) Interaction

During the discussion around whether MDO/MDB are technical or commercial dynamic parameters, a Workgroup member commented that if the parameters relate to trading, then there would be an interaction with REMIT.

A Workgroup member stated that there should be a clear distinction drawn between factors that can feed into the MDO/MDB calculation when it's submitted and what are valid reasons to redeclare MDO/MDB after gate closure are, therefore, REMIT is out of scope, especially for 1-hour batteries BM Units need to declare 1 hour ahead.

The Proposer re-iterated that NESO is seeking certainty from the solution, including that BM Units only redeclare parameters for technical not commercial reasons.

Capacity Team Alignment

The Proposer confirmed with NESO Electricity Market Reform (EMR) team that the Proposed solution for GC0166 is aligned with the current EMR thinking.

Pros and Cons of Certainty versus Flexibility

The Proposer confirmed that the aim of this modification is to facilitate increased economic dispatch of Electricity Storage Module assets and to enable improved operational planning allowing NESO to factor in these modules for longer term planning (up to 24 hours ahead), which is directly linked to providing certainty and that the exemptions introduced for BM Units to redeclare MDO/MDB provided additional flexibility.

NESO noted that they had considered the balance between certainty vs flexibility, the Workgroup requested further clarity on this. The Proposer confirmed that by fixing MDO/MDB inside the BM Window it would limit trade outside the BM window. This is a consequence of existing market arrangements.

The Proposer also considered only allowing MDO/MDB to increase in the BM Window but to achieve this the BM Unit would need to hold back a large amount of energy which they felt did not strike the right balance of certainty versus flexibility.

Currently limited duration assets use the "MIL/MEL 30-minute" rule to inform NESO of the available energy for a bid or offer. This limits the length of possible BOAs.

Having a declared value of MDO/MDB covering all the BM Window allows NESO to have a longer-term view of a BM Units availability during this vital period.

However, as MDO/MDB can be redeclared at any time during the BM Window reduces NESO's certainty.

NESO must be able to calculate the amount of reserve on the system regardless of the volume of contracted reserve. The new parameters give NESO an accurate view of the

reserve provided by BMUs inside the BM Window and enables more accurate calculation of available reserves for the same period a PN is submitted for outside the BM window.

At the start of the BM Window, after Gate Closure, NESO will have a view of the imbalance caused by market participants not balancing overall.

However, there is still a great deal of uncertainty caused by errors in demand forecasts, errors in forecasting renewables, interconnector swings etc.

To avoid unwinding costs NESO will not close the imbalance immediately, instead it will take some actions to reduce the imbalance but also wait until closer to real-time to take final actions when forecasts get better.

MDO/MDB provide the Control Room with a longer period of certainty but, given that MDO/MDB can be redeclared with no notice this volume can be withdrawn when NESO may have been relying on it.

The alternative situation of fixing MDO/MDB but allowing FPNs to vary is also undesirable. NESO may have a fixed MDO/MDB but now it cannot rely on the scheduled position of the BM Units.

This is worse than the current situation where renewables struggle to follow their FPNs because in this case NESO can use forecasts of weather to give a measure of what will happen but trading by Electricity Storage Module s is something they cannot predict.

On balance NESO believes the solution will provide certainty of reserve levels within the BM Window. Which is the intention of the BM Window. Uncertainty due to trading and so the redeclaring of MDO/MDB outside the BM window still remain however the accuracy of reserve calculations is improved for this period as now NESO will have an accurate view of reserve levels outside the BM Window with the caveat that it can be redeclared at any time by BMUs.

It does mean that at the point of decision NESO can take more economic actions over longer timescales provided they take the BOA before the BM Unit adjusts its PN after the BM Window and redeclares its MDO/MDB.

Guidance Note versus Grid Code Content

The Workgroup discussed the possibility of introducing a guidance note to support compliance to the proposed arrangements. Whilst there was some support for this, it was noted by several Workgroup members and the Proposer that the intention was that the solution would be articulated well enough in the Grid Code to not require any additional guidance notes.

Implementation Approach and Costs

Workgroup discussed the need for a clear implementation timeline, with several Workgroup members emphasising the importance of specifying a definite timeframe to ensure all affected parties are prepared. It was also suggested that a backstop date be included to ensure timely implementation. Workgroup also discussed process concerns, including the need for relevant personnel to sign off on the solution. NESO provided written assurance to be submitted alongside the proposal to Ofgem that the solution proposed will meet the requirements of the original submission, and revised Modelling was provided to address this point, circulated to Workgroup members including Ofgem. NESO believe that the proposed solution will meet the requirements of the original submission.

The Workgroup discussed the implementation and costs of the proposed solution, including the timeline for activation and the need for Industry readiness.

The timeline for operational activation was discussed, with a proposed range of 6 to 12 months following implementation of MDO/MDB in the Grid Code. Workgroup members emphasised the need for Industry readiness and the importance of a realistic implementation schedule.

i) NESO to confirm readiness according to the OBP Programme,
ii) NESO confirm date MDO/MDB are added to the Grid Code
iii) Further consultation with Industry through appropriate channels e.g. GCDF before final submission of GC0166 to Final Modification Report (FMR).
iv) Monitoring Industry progress against implementation timeline to be tracked including through GCDF.

A Workgroup member highlighted the need to consider costs for all parties, not just NESO. It was suggested to include a statement in the Workgroup Report to invite wider industry feedback on potential costs.

Concerns were discussed about whether Industry could implement the changes within the proposed timeline. The importance was emphasised of ensuring that all affected parties are ready for the changes.

NESO SME explained that the consultation process would gauge industry readiness and provide a more accurate timeline for implementation, emphasising the importance of ongoing consultation with Industry stakeholders.

Consideration of other options

The Workgroup considered several options, however these were not incorporated in the solution or raised as Alternative Requests.

Redeclaration criteria

The Proposer stated that NESO needs to have a view of the energy available after Ancillary Services commitments have been considered. Ancillary Service contracts interactions affect the volume of energy available, and this feeds into the ongoing discussion about ability to redeclare MDO/MDB past gate closure.
MDO and MDB are designed not be a default parameter for short duration assets and they will need to be redeclared when the State of Energy of the BM Unit changes.
The Workgroup has had extensive discussion around whether the parameters are technical or commercial, with several Workgroup members considering that the distinction between technical and commercial considerations is often blurred, and that NESO intention for them to be entirely technical parameters is too restrictive.
NESO holds the position that Battery representatives will not be able to redeclare in the window/ past gate closure in all but very specific and pre-defined circumstances.

BM Owners submitting FSoE limit data

Up until the last Workgroup meeting, ahead of the Workgroup Consultation, the proposed solution was that BM Unit Owners submitted the FSoE limits (min and max) to NESO after a change due to an auction for an Ancillary Service. With the time span for the FSoE limits including all known future ancillary auctions. However, as detailed in the Planning: Future State of Energy (FSoE) and Flow for Asset Specific Models section above, the solution is now for NESO to calculate the data values thus removing the need for BM Units to submit this data.

Tranche MDO and MDB

It was discussed whether it would be useful for BM Units to submit committed capacity and committed reserved capacity as separate quantities. This was rejected on the basis that it was out of scope as NESO then would need to use the two numbers to derive the values they would need to use, and this was discussed early on as not being the intended outcome.

1. Capacity and
2. Committed / Reserved.

Workgroup Consultation Summary

The Workgroup held their Workgroup Consultation between 18 November 2024 – 09 December 2024 and received 14 non-confidential responses and 0 confidential responses. The full responses and a summary of the responses can be found **Annex 07**.

The following numbers of respondents indicated that the Proposer's solution better facilitated the Applicable Objectives than the Baseline: 10 for (a), 10 for (b), 10 for (c), 6 for (d) and 4 for (e). 8 respondents agreed with the implementation approach, whilst 4 disagreed. Two respondents did not state whether they agreed or disagreed with the implementation approach. Several respondents expressed concern regarding the implementation schedule suggesting a longer period prior to go-live is required or a potential transitional period to ensure processes are fully operational.

Numerous respondents highlighted areas where they felt further clarification was required to the draft legal text. These included uncertainty around the definitions of MDO/MDB, MEL/MIL, FSoE, limited/unlimited and insufficient clarity to understand the full intent of the proposal, what data is required, how it should be submitted, or how it will be used. A few respondents felt the level of FSoE accuracy to be achieved over the proposed time horizon was unrealistic due to the dynamic nature of trading and the potential operational activities within a day.

10 respondents agreed MDO/MDB are technical dynamic parameters. One respondent felt the differentiation between technical and commercial parameters was unhelpful and believed it would be better to concentrate on rules around what Trading Point/Control Point should submit for the asset. Another respondent felt it was difficult to define a solely technical parameter when it comes to asset dispatch. 8 respondents agreed the FSoE proposed was a technical parameter whereas other respondents felt additional clarity was required to make an informed decision.

Legal Text Agreement

Workgroup discussions focussed on Legal text development throughout each Workgroup. In Workgroup 13 a detailed review of the legal text changes was undertaken, and the Proposer sought agreement from Workgroup members on each change, addressing any questions or concerns.

The Proposer provided clarifications on specific changes to the legal text, and addressed questions raised by members during the review.

A Workgroup member raised questions about the legal text, specifically regarding the calculation of Maximum Delivery Offer and Maximum Delivery Bid. Proposer explained that MDO is calculated as the volume of energy that can be delivered if a bid offer acceptance were to start at that minute until the end of the BM window, and that the value must be deliverable at any minute within the window. The importance of accurate data submission and the impact on the Future State of Energy modelling was emphasised.

Adjustments to the legal text were made based on the feedback received, and Workgroup agreed on the changes to the legal text. Workgroup members were asked to confirm their acceptance of the proposed changes to the legal text and agreed on specific changes. Final agreement was reached, ensuring that all changes were accepted and that there were no outstanding concerns.

The legal text for this change can be found in **Annex 03**.

Terms of Reference

At Workgroup 13, Workgroup members reviewed and agreed that the terms of reference had been met, including the consideration of implementation and costs, review of the legal text, and consultation with industry experts. Workgroup members confirmed that the terms of reference regarding EBR implications have been met and discussed the impact of the proposed changes on the balancing code and the need for a month-long consultation process.

What is the impact of this change?

Proposer's assessment against Grid Code Objectives	
Relevant Objective	Identified impact
(i) To permit the development, maintenance, and operation of an efficient, coordinated and economical system for the transmission of electricity	**Positive** The new parameters will allow Electricity Storage Modules to inform NESO of energy available over time, instead of NESO having to derive this from existing parameters that were not intended for this purpose.

(ii) To Facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity);	**Positive** The dispatch of these assets will not be limited using heuristic rules but will be based on the declared capability of the assets.
(iii) Subject to sub-paragraphs (i) and(ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole;	**Positive** Allowing Duration Assets to declare their available energy allows for better operational planning by NESO and better managing of margins and constraints.
(iv) To efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and	**Neutral** Does not affect NESO obligations.
(v) To promote efficiency in the implementation and administration of the Grid Code arrangements	**Neutral** The change is not related to administration of the codes.

Proposer's assessment of the impact of the modification on the stakeholder / consumer benefit categories	
Stakeholder / consumer benefit categories	Identified impact
Improved safety and reliability of the system	**Positive** Currently NESO uses what is called the "30-minute rule" to estimate the energy available and the charging opportunities from Electricity Storage Modules. NESO uses the modules declared Maximum

	Import Limit and Maximum Export Limit and then limits the length of instructions to 30 minutes. This reduces the ability to issue instructions for longer than 30 minutes and gives us no information on the expected future state of these modules to allow planning. Improving the quality of data, we get from these modules will mean we can manage margins and constraints more accurately and efficiently, so improving safety and reliability of the system.
Lower bills than would otherwise be the case	**Positive** More quality information allows for greater efficiency in markets so aiding overall consumer benefit.
Benefits for society as a whole	**Positive** Renewable energy resources contribute directly to the reduction of greenhouse gases. However, they are intermittent in nature and the ability to store energy is a vital part of the overall energy mix if we are to operate in a safe and efficient manner. This modification allows better management of Electricity Storage Modules and so has an overall benefit for society.
Reduced environmental damage	**Positive** Supports new providers and technologies. Current processes limit the use of limited duration assets.
Improved quality of service	**Positive** The use of Electricity Storage Modules supports greater use of renewable energy resources and therefore, our net-zero ambitions for the future.

Workgroup Vote

The Workgroup met on 19 March 2025 to carry out their Workgroup Vote. The full Workgroup Vote can be found in **Annex 09**. The table below provides a summary of the Workgroup members view on the best option to implement this change.

For reference the Applicable Grid Code Objectives are:

i) *To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity*

ii) *To facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity);*

iii) *Subject to sub-paragraphs(i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole;*

iv) *To efficiently discharge the obligations imposed upon the licensee by this license* and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and*

v) *To promote efficiency in the implementation and administration of the Grid Code arrangements*

** See Electricity System Operator Licence*

The Workgroup concluded unanimously that the Original better facilitated the Applicable Objectives than the Baseline. One Workgroup member abstained from voting.

Option	Number of voters that voted this option as better than the Baseline
Original	12

When will this change take place?

Implementation date

GC0166 will be introduced into the Grid Code 10 Business Days following a decision by the Authority. Operationally the new Dynamic Parameters will be introduced within a

proposed range of 6 to 12 months following implementation of MDO/MDB in the Grid Code.

Date decision required by

Q2 2025

Implementation approach

Control Room Systems, Auction Systems, Market Services

Interactions

☐CUSC	☒BSC	☐STC	☐SQSS
☐European Network Codes	☒ Article 18 T&Cs[2]	☐Other modifications	☐Other

NESO have been in regular engagement with Elexon during the development of GC0166, and by propose to raise a modification to the BSC to enable the publication of these Data items on Balancing Mechanism Reporting Service (BMRS). This may be after consultation and Panel prior to any Authority decision on GC0166 if appropriate to meet the agreed Industry implementation timeline, whilst minimising any risk of late changes affecting the BSC work.

Acronyms, key terms and reference material

Acronym / key term	Meaning
ANM	Automated Network Manager Systems
BC	Balancing Code
BESS	Battery Energy Storage Systems
BM	Balancing Mechanism
BMRS	Balancing Mechanism Reporting Service
BM Unit	Balancing Mechanism Unit

[2] If your modification amends any of the clauses mapped out in Annex GR.B of the Governance Rules section of the Grid Code, it will change the Terms & Conditions relating to Balancing Service Providers. The modification will need to follow the process set out in Article 18 of the Electricity Balancing Regulation (EBR – EU Regulation 2017/2195). All Grid Code modifications must be consulted on for 1 month in the Code Administrator Consultation phase, unless they are Urgent modifications which have no impact on EBR Article 18 T&Cs. N.B. This will also satisfy the requirements of the NCER process.

BOA	Bid Offer Acceptance
BSC	Balancing and Settlement Code
BRP	Balance Responsible Parties
BSP	Balancing Service Provider
CCL	Capped Committed Level
CL	Committed Level
CUSC	Connection and Use of System Code
EBR	Electricity Balancing Regulation
EMR	Electricity Market Reform
FPN	Final Physical Notification
FSoE	Future State of Energy
GC	Grid Code
GDCF	Grid Code Development Forum
IEMS	Integrated Energy Management System
LDA	Limited Duration Asset
MDB	Maximum Delivery Bid
MDO	Maximum Delivery Offer
MEL	Maximum Export Limit
MIL	Maximum Import Limit
MWh	Megawatt-hour
NESO	National Energy System Operator
NETS	National Electricity Transmission System
OBP	Open Balancing Platform
PN	Physical Notification
REMIT	Regulation on Wholesale Energy Market Integrity and Transparency

SCADA	Supervisory Control and Data Acquisition
SIL	Stable Import Limit
SEL	Stable Export Limit
SME	Subject Matter Expert
SoE	State of Energy
SP	Settlement Period
SQSS	Security and Quality of Supply Standards
STC	System Operator Transmission Owner Code
TSO	Transmission System Operator
T&Cs	Terms and Conditions

Annexes

Annex	Information
Annex 01	GC0166 Proposal Form
Annex 02	GC0166 Terms of Reference
Annex 03	GC0166 Legal Text
Annex 04	GC0166 Redeclaration inside BM Window
Annex 05	GC0166 Habitat Dispatch Planning Tool (from Action 15)
Annex 06	GC0166 Calculating MDO and MDB, Worked Examples
Annex 07	GC0166 Workgroup Consultation Summary and Responses
Annex 08	GC0166 Future State of Energy Model Worked Example
Annex 09	GC0166 Workgroup Vote
Annex 10	GC0166 Workgroup Attendance Log
Annex 11	GC0166 Workgroup Action Log