

# Webinar

# Grid Code Modification

# GC0166

15 December 2025

# Welcome

Time	Agenda	Presenter
11.00 – 11.05	<b>Welcome, Slido, overview and roadmap</b>	Steve Baker
11.05 – 11.10	<b>Proof of Concept and next steps</b>	Philippa Banks
11.10 – 11.15	<b>BM and OBP timeline</b>	Bernie Dolan
11:15 – 11:40	<b>GC0166 data deep dive</b>	Laura Burdis
11:40 – 11:55	<b>Answers to your questions</b>	The team
11:55 – 12:00	<b>Brief feedback survey</b>	John Clifford

# Access throughout Sli.do #DTP



## Live Q&A later

- **Ask your questions as early as possible** to give our experts time to prepare response
- **Please provide your name and organisation** – we only answer live questions from identified parties
- **Up-vote questions by 'liking' them** – we will aim to answer them in up-voted order
- **All questions will be captured and answered**, during or after the webinar
- **Questions beneficial to a wide audience** may be added to our published Q&A on the [Skip Rates](#) page of the NESO website

## Brief feedback survey

- Essential to understand how our plans and deliveries are being received

# Overview and roadmap

Steve Baker

# Overview

- GC0166 introduces Grid Code changes to enable effective usage of the increasing numbers of Electricity Storage Modules with Limited Duration operating in the BM, and reflect their bi-directional nature
- Authority decision 22 Oct 2025 requires implementation of new Dynamic Parameters within 12 months of implementation into the Codes (i.e. by 5 Nov 2026)
- Consequential BSC Modification P499 is anticipated to be implemented in their standard Jun 2026 release, facilitating full E2E rollout
- NESO are working with Industry partners to implement these changes
- This webinar provides an update on the implementation roadmap, timeline and data deep dive with the opportunity for a Q&A

# Grid code GC0166

Parameter Name/ term	Definition
Bid Acceptance	An acceptance by a <b>BM Unit</b> of a <b>Bid-Offer Acceptance</b> to decrease its export onto, or increase its import from, the <b>National Electricity Transmission System</b> , where in this context import and export are as defined in the <b>BSC</b> .
Future State of Energy (FSoE)	For each <b>Electricity Storage Module</b> , this is a series of MWh figures and associated times, which is calculated by <b>The Company</b> using the data provided under BC1.A.11.1, making up an estimated profile of the energy stored in that <b>Electricity Storage Module</b> .
Maximum Delivery Offer (MDO)	As defined in BC1.A.1.5 <b>Dynamic Parameters</b> .
Maximum Delivery Bid (MDB)	As defined in BC1.A.1.5 <b>Dynamic Parameters</b> .
Offer Acceptance	An acceptance by a <b>BM Unit</b> of a <b>Bid-Offer Acceptance</b> to increase its export onto, or decrease its import from, the <b>National Electricity Transmission System</b> , where in this context import and export are as defined in the <b>BSC</b> .

## BC1.A.1.5 Dynamic Parameters

**Maximum Delivery Offer (MDO)**, being a series of MWh figures and associated times making up the profile of the maximum volume of **Offer Acceptances** by a **BM Unit** which can be instructed by **The Company** through **Bid-Offer Acceptances (BOA)** via a **BM Participant** with respect to one or more of their **BM Units**, such that within the current **Balancing Mechanism Window Period**, the **BM Unit's Committed Level** can be adhered to, and contracted **Ancillary Services** can be delivered.

**Maximum Delivery Bid (MDB)**, being a series of MWh figures and associated times making up the profile of the maximum volume of **Bid Acceptances** by a **BM Unit** which can be instructed by **The Company** through **Bid-Offer Acceptances (BOA)** via a **BM Participant** with respect to one or more of their **BM Units**, such that within the current **Balancing Mechanism Window Period**, the **BM Unit's Committed Level** can be adhered to, and contracted **Ancillary Services** can be delivered.

# Grid code definition

## BC1.A.1.11 Electricity Storage Module Future State of Energy (FSoE) Modelling

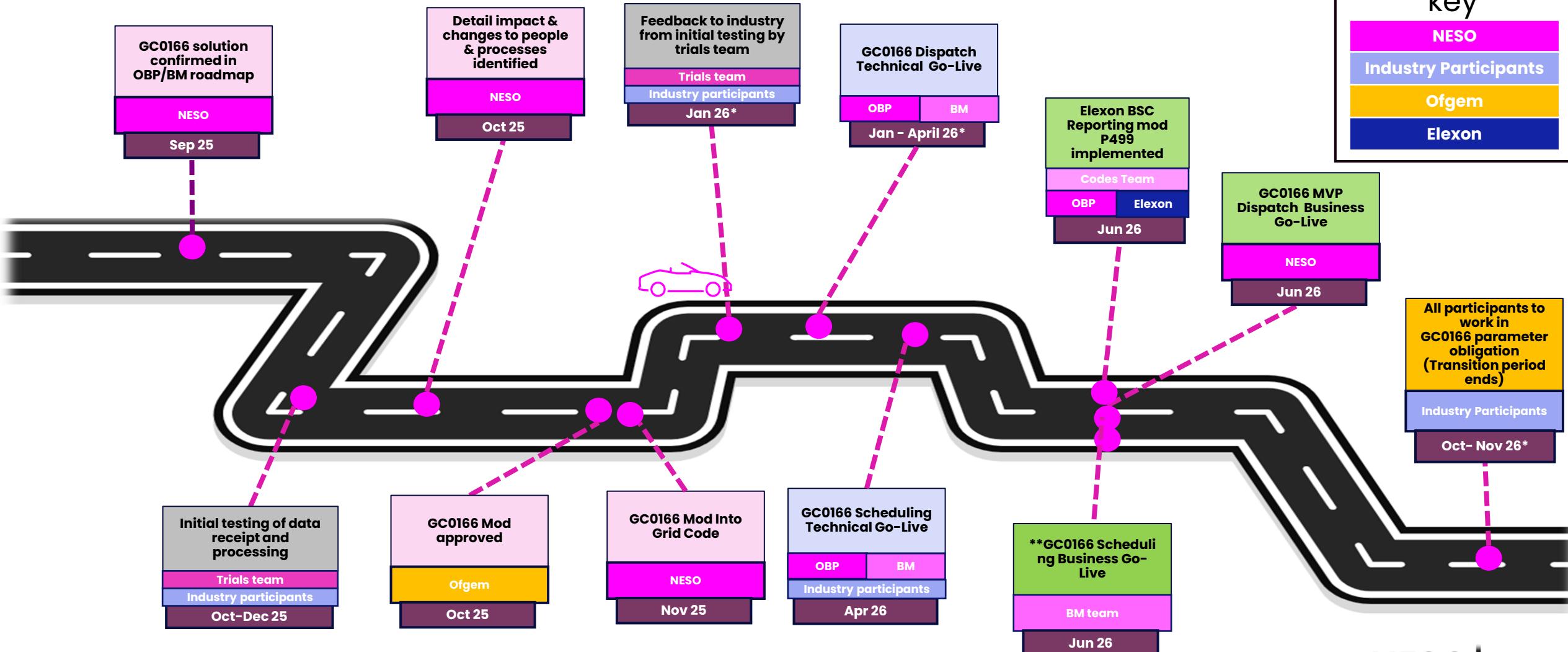
**BC1.A.1.11.1 BM Participants** who own and/or operate **Electricity Storage Modules** must provide asset specific relevant data when requested by **The Company** based on bilateral discussions to allow for modelling by **The Company** of **Future State of Energy (FSoE)** and the limits of operation that an **Electricity Storage Module** must obey.

**BC1.A.1.11.2** These models will be used for planning purposes beyond the end of the **Balancing Mechanism Window Period** to the end of the time when interim data is available to **The Company**. **The Company** may use such models to simulate the effect of **Bid-Offer Acceptance** and a **Physical Notification** on the **Future State of Energy (FSoE)**. The requirements for **System Ancillary Services** and/or **Commercial Ancillary Services** within the model will be derived by **The Company** from auction data.

## BC2.5.3.4 Resubmissions to Maximum Delivery Offer (MDO) and Maximum Delivery Bid (MDB) for a BM Unit may only be made following Gate Closure for a Settlement Period in the event of:

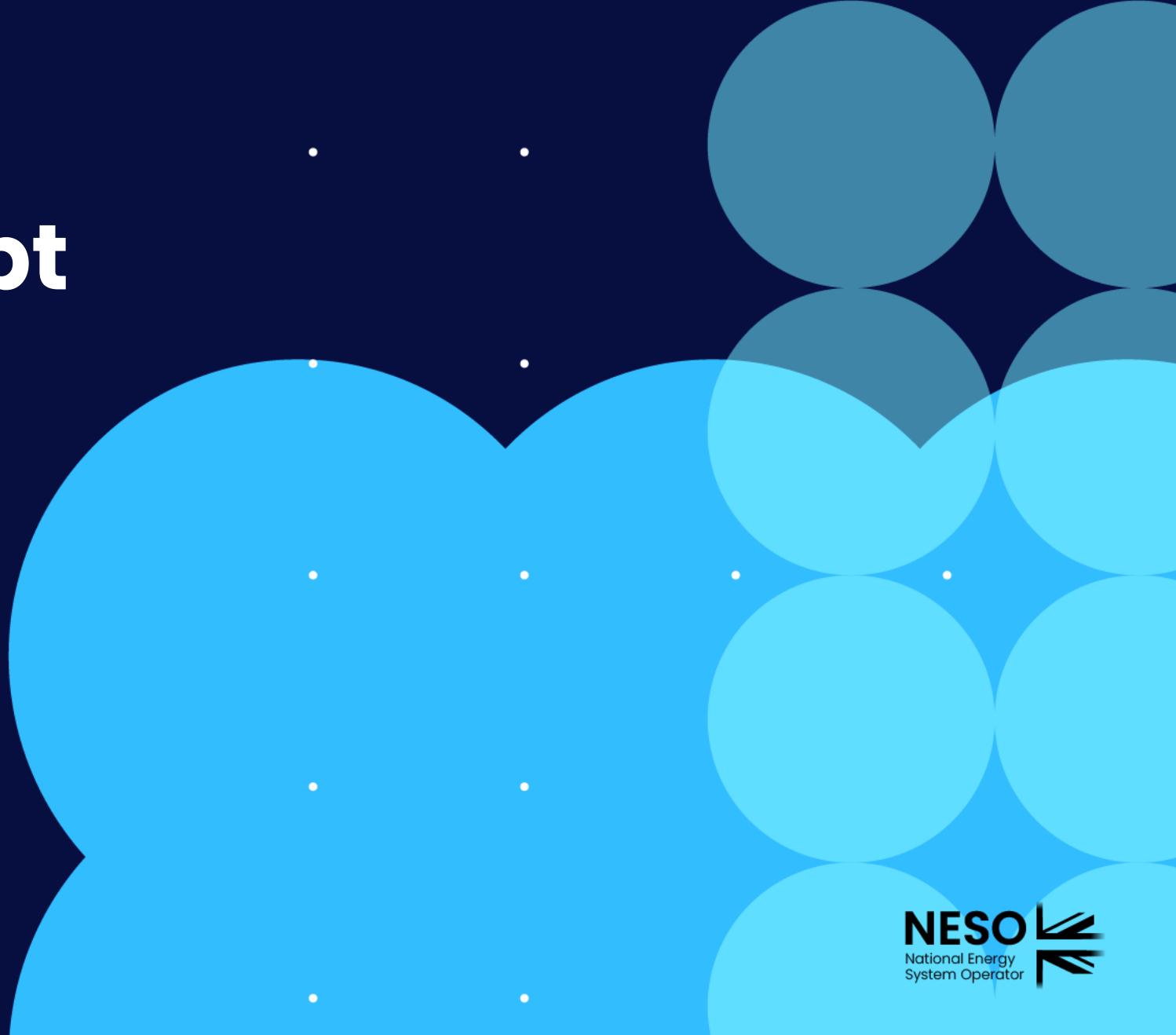
- a. The **BM Unit** no longer being able to achieve the previously stated value as a result of an unavoidable **Event**. Examples of such an **Event** include (but are not limited to) **Plant** breakdowns, or **Events** requiring a resubmission on safety grounds (relating to personnel or **Plant**); or
- b. The **Company** issuing a **Bid-Offer Acceptance (BOA)** in respect of the **BM Unit**; or
- c. 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**; or
- d. Submission of a change to a **Physical Notification** for the **BM Unit** under BC1.4.2(a) which covers the **Settlement Period** after the **Balancing Mechanism Window Period**.
  - For the purposes of clarity, if a **BM Participant** doesn't submit values by 11:00 each day for the next **Operational Day** they will default to the **MDO** and **MDB** values previously submitted until updated.

# GC0166 External Roadmap (MVP)



# Proof of Concept and next Steps

Philippa Banks



# Proof of Concept (PoC) by Trials team

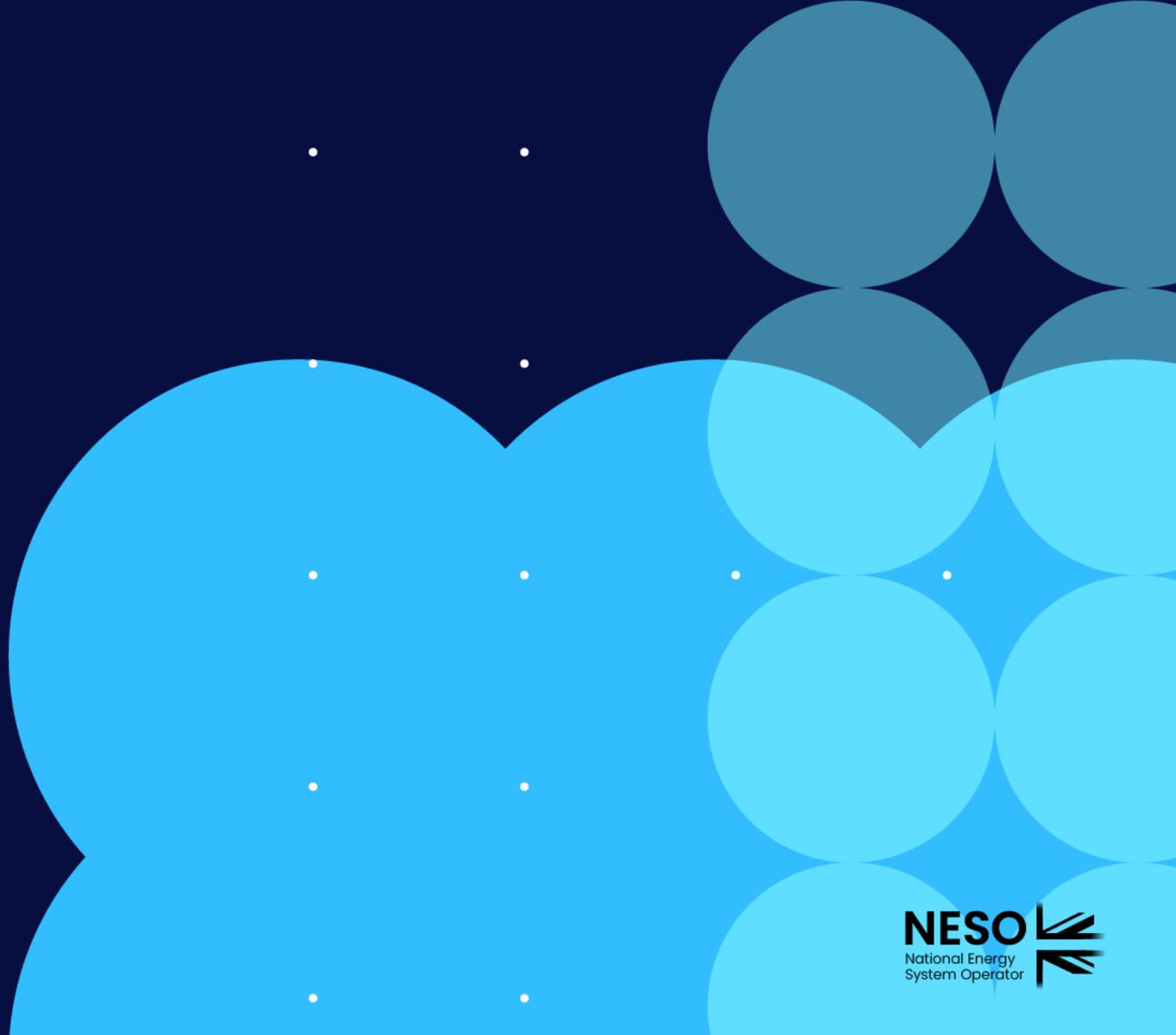
- NESO Trials team has undertaken PoC data collection with Market Participants
- 17 units have supplied MDO/MDB data and FSofE Data to NESO, based on actual units following real-time instructions, initially for a two-day period
- PoC evaluated multiple data combinations to identify potential issues – outcomes have contributed to information presented in this webinar
- POC data collected, together with NESO exploring calculations of MDO/MDB, has led to NESO changing how customers should calculate these parameters
- POC2 will be in early Jan 26 for 'new' way of calculating MDO/MDB
- NESO preparing Best Practice Document that considers all feasible combinations and outlines how data should be generated and submitted to NESO, as well as how NESO will utilise this information – main objective to remove ambiguity.
- Contact Trials team on: [box.balancingprogramme@neso.energy](mailto:box.balancingprogramme@neso.energy)

# GC0166 and FSoE Testing for LDAs

- Following the POC, NESO wishes to run end-to-end testing of MDO/MDB, including additional parameters in Feb/Mar with aim of improving FSoE model accuracy
- Using NESO trials platform, Reveal, participants will be invited to connect test BMUs to the platform and stream data as if the units were live in the Balancing Mechanism (BM)
- NESO and participants will co-create 'real world' scenarios providing opportunity for hands-on experience with new parameters ahead of business go-live
- Parameters and performance data ingested will be used to support development of optimiser and identify potential improvements to FSoE model, leading to improved accuracy of LDA scheduling
- Trial aims to consider all feasible data combinations and identify potential challenges which will feed into Best Practice Document
- Contact Trials team on: [box.balancingprogramme@neso.energy](mailto:box.balancingprogramme@neso.energy)

# BM and OBP timeline

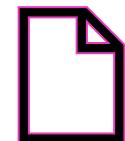
Bernie Dolan



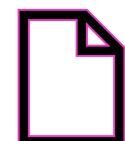
# Status



Working sessions held with seven suppliers of EDL/EDT software sharing information on GC0166 and answering queries. Of the seven only five will make changes – the other two do not supply Limited Duration Assets. **One party is ready to test with NESO, the others plan to start development in 2026**



A version of the Data Validation, Consistency and Defaulting Rules (DVCD) was consulted on as part of the GC0166 Workgroup. The DVCD has been shared with software suppliers for their comments. Expect **to publish final version in Jan 2026**



A new version of the EDL Message Specification is under development. **Expect to share with software suppliers for review in Jan 2026, final release Feb 2026.**



Changes to the legacy version of EDL (BM EDL) are now in system test. **Will be ready for external testing in Jan 2026.**



Changes to the OBP version of EDL (OBP EDL) and additional changes for processing MDO/MDB are under elaboration. **Expect development in Feb 2026 when OBP EDL will be ready for external testing**

# GC0166 Trials



Trial data for MDO/MDB has been received from seven parties. NESO is using this data to check interpretation of GC0166 rules. This data will be used in testing Fast Dispatch (FD), Target Dispatch (TD) and the National Dispatch Optimiser (NDO). **Feedback on initial data in Jan 2026, FD/TD testing in Feb 2026, NDO in May 2026**



Following feedback parties may be asked to **submit modified data (Jan 2026)**



REVEAL platform will be used to stream MDO/MDB values to OBP. Data will be used to create instructions and send back to parties. This will test turnaround time for next declaration – **planned Mar 2026**

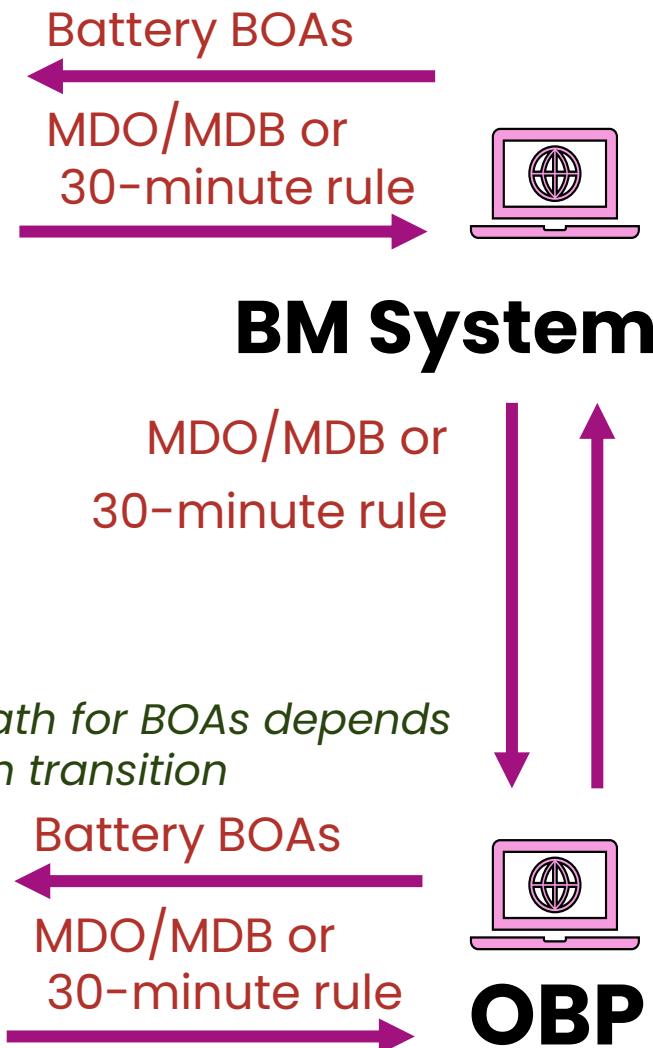
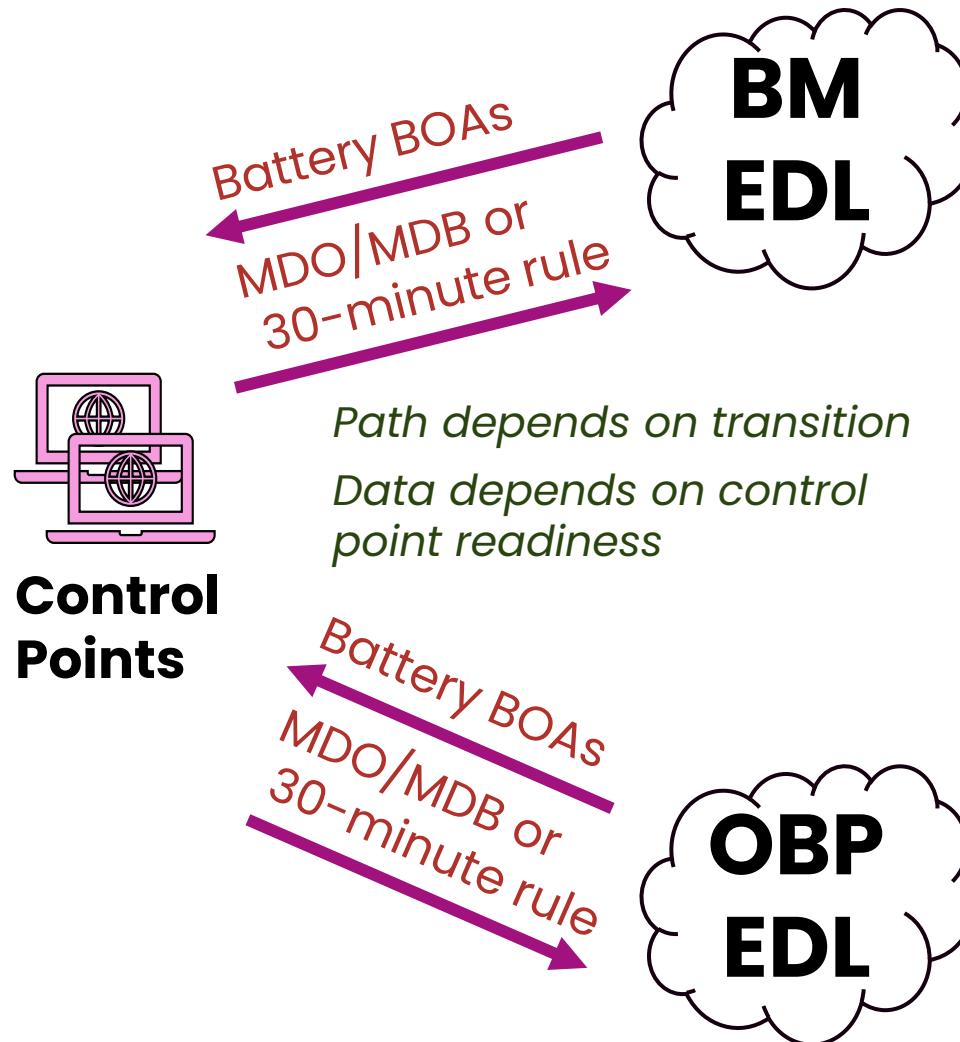


FSOE parameters to be compared to metering (SCADA) and performance data to understand the validity of these models – **validation Mar 2026**

# Implementation

-  OBP changes for Fast Dispatch, Target Dispatch and the Battery Volume Calculator expected to be in **System Test in Mar 2026, Technical go-live Apr 2026, Business Go-live Jun 2026**. The Battery Volume Calculator considers how much battery capacity is behind a constraint in scheduling timescales
-  BM EDL changes **expected to be in production Feb 2026**
-  NDO due to start **parallel run Jan 2026**, expected that NDO will provide **master target programme in May 2026**, FSOE in NDO expected to be in **System Test in Apr 2026, Business go-live Jun 2026**
-  Provide data to BMRA for publication – **System Test in Mar 2026, Business go-live Jun 2026**
-  Switch over from 30-minute rule to MDO/MDB for providers that are ready – **Jun 2026**

# Overview



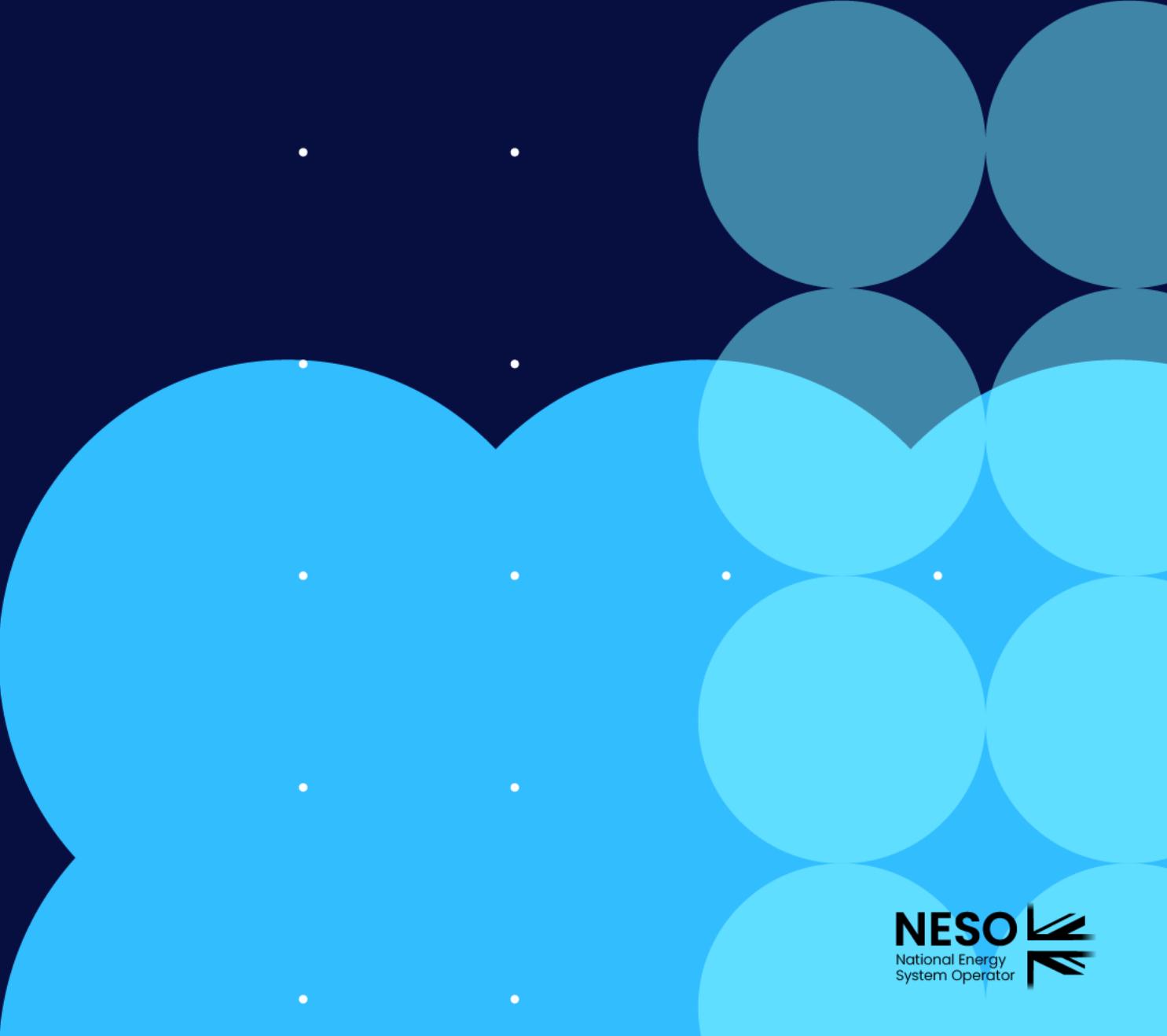
*BM does not use MDO/MDB – still assumes 30-minute rule*

*30-minute rule  
Engineering Adjustment  
Battery BOAs  
(Path for BOAs depends on transition)*

*OBP FD TD, NDO using mixture of BMUs still on 30-minute rule and those on MDO/MDB  
Scheduling uses FSOE  
Battery Volume Calculator*

# Deep dive

Laura Burdis



# Methodology: MDO/MDB

- Based on insights from GC0166 trial, decision made to simplify MDO/MDB
- Previously, values represented purely instantaneous MWh amounts – now adjusted to exclude reserve/response volumes, ensuring unit can meet ancillary service requirements
- Main function of MDO/MDB to inform NESO about available MWh volume for instruction/scheduling
- MDO/MDB should be calculated to reflect MWh available for BOA (scheduling decision outside BM Window) from the current minute onward
- MDO/MDB submissions made with 1-min granularity, matching horizon for which PN submitted
- If unit must have specified MWh available at time 't', volume must be reserved for period prior to "t" to guarantee availability; protection typically covers 4 settlement periods before "t"
- Example: if BOA sent at 10:29 and BM Gate shifts from 11:30-12:00 at 10:30, unit can submit PN change for 12:00-12:30 to adjust MWh status for 12:30; if "t" is 12:30, protected window is 10:30-12:30
- However, depending on unit's trading strategy and relationship between Power (MEL/MIL) and Volume Capacity (MWh), protection period may need to extend beyond 4 settlement periods

# Methodology: MDO/MDB

## Calculation steps

1. Determine MWh volumes that must be available at time 't' ( Required SOE)
2. Determine how long it would take to create MWh volumes at "t" if unit was at opposite state of energy prior to "t" (Charge/Discharge Time)
3. Determine how much time is required to trade (Trading Time)
4. Create MDO/MDB protected range and submit values to NESO

## Frequency Response

- MWh volume required at start of each period must be protected through MDO/MDB
- MW range must be protected with MEL and MIL, as is done already today

## Reserve

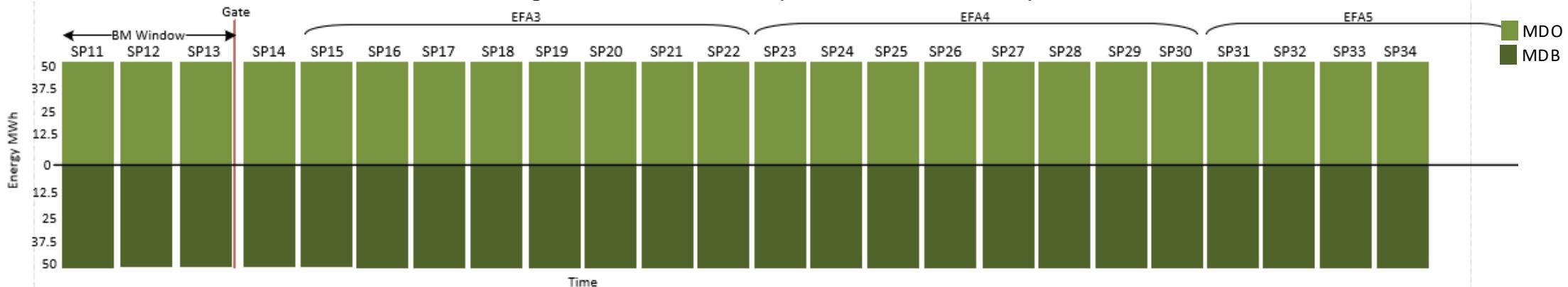
- MWh volume required at start of each period must be protected through MDO/MDB
- In period where reserve can be used by NESO, MWh volumes must be available to NESO through MDO/MDB

## Test

Protected period should consistently precede delivery period. Where no BOA issued, no additional services are contracted, no PN changes occur, and frequency remains 50Hz, MDO/MDB values are expected to remain accurate throughout the day. In practice, minor adjustments may be necessary due to fluctuations in frequency and variations in ambient temperature from forecasts etc.

# Scenario 1 – Zero PN & No BOA

100 MW/100MWh unit at 50% initial charge & 100% efficiency; no reserve or response contracts

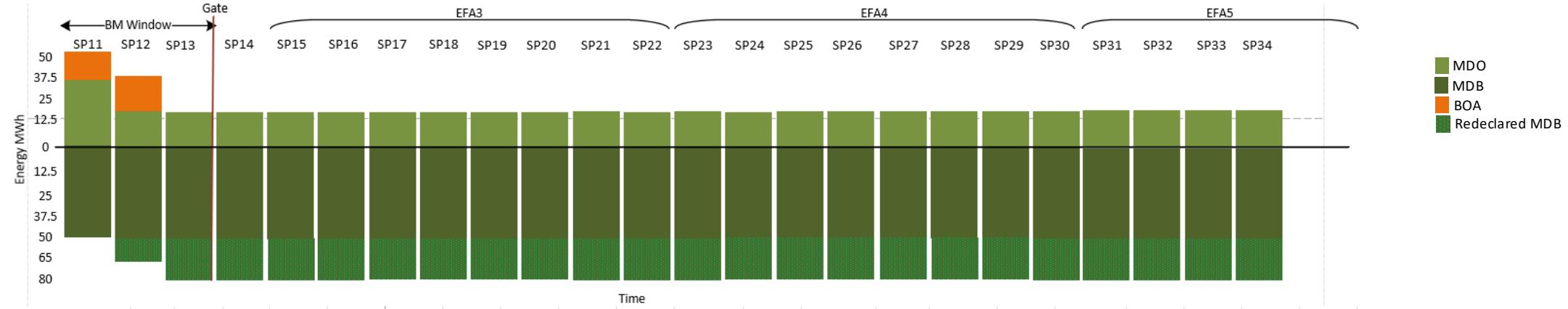


	Time	SP	SOC %	PN	BOA	MEL	MIL	Dynamic Moderation		Positive Quick Reserve		Negative Quick Reserve		Positive Slow Reserve		Negative Slow Reserve		Declared			
								DML		DMH		PQR		NQR		PSR		NSR		MDO	MDB
								MW	MWh	MW	MWh	MW	MWh	MW	MWh	MW	MWh	MWh	MWh		
BM window	05:00-05:30	SP11	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	05:30-06:00	SP12	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	06:00-06:30	SP13	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	06:30-07:00	SP14	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
EFA3	07:00-07:30	SP15	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	07:30-08:00	SP16	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	08:00-08:30	SP17	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	08:30-09:00	SP18	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	09:00-09:30	SP19	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	09:30-10:00	SP20	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	10:00-10:30	SP21	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	10:30-11:00	SP22	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	11:00-11:30	SP23	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	11:30-12:00	SP24	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
EFA4	12:00-12:30	SP25	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	12:30-13:00	SP26	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	13:00-13:30	SP27	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	13:30-14:00	SP28	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	14:00-14:30	SP29	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	14:30-15:00	SP30	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	15:00-15:30	SP31	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	15:30-16:00	SP32	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	16:00-16:30	SP33	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	16:30-17:00	SP34	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
EFA5	17:00-17:30	SP35	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	17:30-18:00	SP36	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00

- Unit declares available volume as MDO, MDB
- Since there is no planned PN or any reserve or response contracts unit declares all available volume to NESO as MDO/MDB

# Scenario 2 – Zero PN & a BOA

100 MW/100MWh unit at 50% initial charge & 100% efficiency; no reserve or response contracts

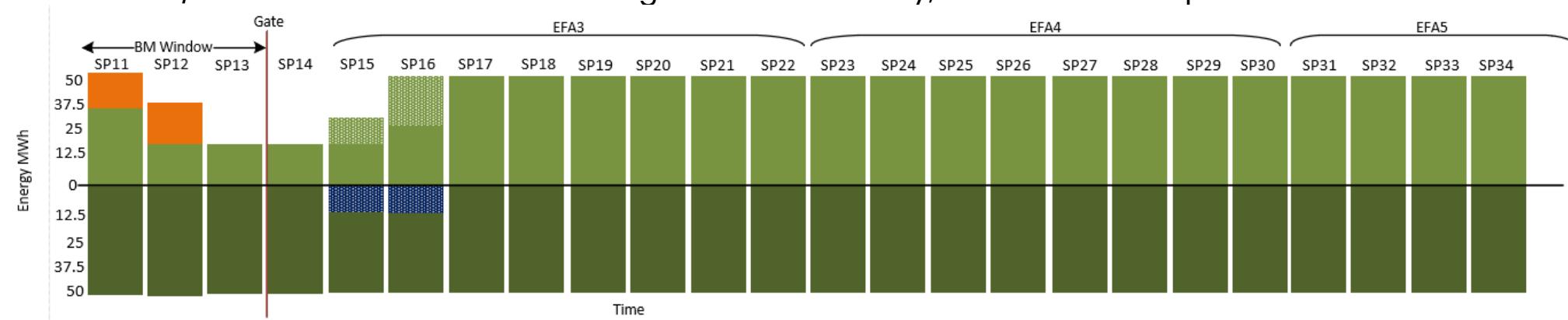


Time	SP	SOC %	PN	BOA	MEL	MIL	Dynamic Moderation				Positive Quick Reserve		Negative Quick Reserve		Positive Slow Reserve		Negative Slow Reserve		Declared		Re-declared		
							DML		DMH		PQR		NQR		PSR		NSR		MDO	MDB	MDO	MDB	
							MW	MWh	MW	MWh	MW	MWh	MW	MWh	MW	MWh	MW	MWh	MWh	MWh	MWh	MWh	
BM window	05:00 - 05:30	SP11	35	0.00	30.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	35.00	65.00
	05:30 - 06:00	SP12	20	0.00	30.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	06:00 - 06:30	SP13	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	06:30 - 07:00	SP14	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
EFA3	07:00 - 07:30	SP15	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	07:30 - 08:00	SP16	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	08:00 - 08:30	SP17	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	08:30 - 09:00	SP18	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	09:00 - 09:30	SP19	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	09:30 - 10:00	SP20	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	10:00 - 10:30	SP21	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	10:30 - 11:00	SP22	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	11:00 - 11:30	SP23	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	11:30 - 12:00	SP24	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
EFA4	12:00 - 12:30	SP25	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	12:30 - 13:00	SP26	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	13:00 - 13:30	SP27	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	13:30 - 14:00	SP28	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	14:00 - 14:30	SP29	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	14:30 - 15:00	SP30	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	15:00 - 15:30	SP31	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	15:30 - 16:00	SP32	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	16:00 - 16:30	SP33	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	16:30 - 17:00	SP34	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
EFA5	17:00 - 17:30	SP35	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	17:30 - 18:00	SP36	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	18:00 - 18:30	SP37	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	18:30 - 19:00	SP38	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00
	19:00 - 20:00	SP39	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	80.00

- Unit declares available volume as MDO, MDB.
- A BOA sent in SP11 causes MDO/MDB to be redeclared. i.e. MDO is now reduced and MDB has increased.

# Scenario 3 – Non-Zero PN & BOA

100 MW/100MWh unit at 50% initial charge & 100% efficiency; no reserve or response contracts

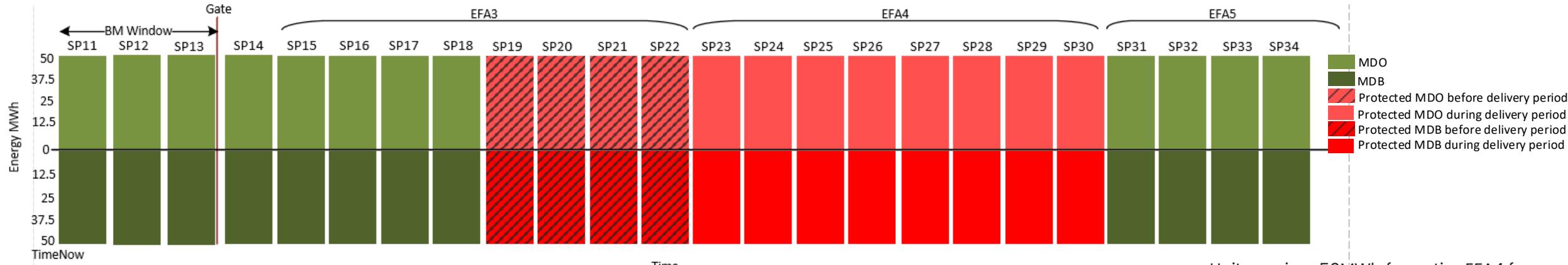


Time	SP	SOC %	Dynamic Moderation						Positive Quick Reserve		Negative Quick Reserve		Positive Slow Reserve		Negative Slow Reserve		Declared		Re-declared	
			DML		DMH		PQR		NQR		PSR		NSR		MDO	MDB	MDO	MDB	MDO	MDB
			MW	MWh	MW	MWh	MW	MWh	MW	MWh	MW	MWh	MW	MWh	MWh	MWh	MWh	MWh	MWh	
BM window	SP11	35	0.00	30.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	35.00	50.00		
	SP12	20	0.00	30.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	50.00		
	SP13	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	50.00		
	SP14	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	50.00		
EFA3	SP15	35	-30.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	35.00	50.00		
	SP16	50	-30.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP17	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP18	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP19	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP20	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP21	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP22	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP23	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP24	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
EFA4	SP25	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP26	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP27	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP28	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP29	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP30	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP31	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP32	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP33	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP34	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
EFA5	SP35	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		
	SP36	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00		

- A BOA sent in SP11 causes MDO/MDB to be redeclared i.e. MDO is now reduced and MDB has increased
- In the above example, unit submits a charge PN in SP15 & SP16 along with re-declaring MDO/MDB to bring the unit back to previous SoC

# Scenario 4– Zero PN & No BOA, Response contract

100 MW/100MWh unit at 50% initial charge & 100% efficiency; 50MW Dynamic Regulation(DR) response bi-directional contract in EFA4

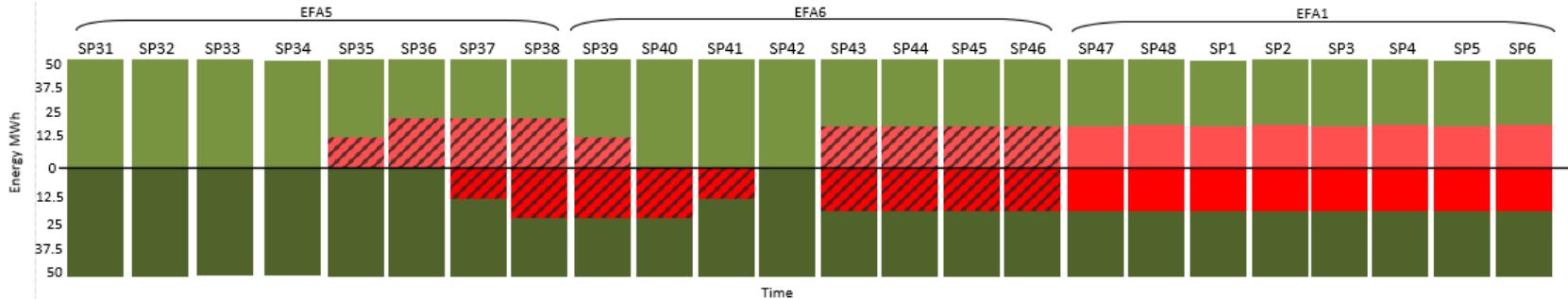


Time	SP	SOC %	Dynamic Containment				Dynamic Regulation				Dynamic Moderation				Declared	
			DCL		DCH		DRL		DRH		DML		DMH		MDO	MDB
			MW	MWh	MW	MWh	MW	MWh	MW	MWh	MW	MWh	MW	MWh	MWh	MWh
BM window	SP11	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	SP12	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	SP13	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	SP14	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
EFA3	SP15	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	SP16	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	SP17	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	SP18	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	SP19	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	0.00
	SP20	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	0.00
	SP21	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	0.00
	SP22	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	0.00
	SP23	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00
	SP24	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00
EFA4	SP25	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00
	SP26	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00
	SP27	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00
	SP28	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00
	SP29	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00
	SP30	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00
	SP31	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	SP32	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	SP33	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	SP34	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
EFA5	SP35	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00

- Unit requires 50MWh for entire EFA4 for delivering Dynamic Regulation Low & High (DRLH)
- Upon activation, needs to provide 50MWh for 60 mins continuously in either direction
- To enable unit to deliver 50 MW DRLH response In EFA4, the unit needs to ensure it has the correct SoC at the beginning of the contract period. If NESO issues a BOA, the last timepoint the unit will have enough time to return to required SoC before start of contract period is SP18. Therefore, the provider will need to protect volume from at least EFA3.SP19.
- Providers to add additional protection period based on unit efficiency, time required to trade

# Scenario 5 – Zero PN & No BOA, Reserve & Response contracts

100 MW/100MWh unit at 50% initial charge & 100% efficiency; 50MW Dynamic Containment(DC) bi-directional contract in EFA1; 20 MW Positive Quick Reserve (PQR) contract in SP39,SP40 & Negative Quick Reserve (NQR) contract in SP41 & SP42



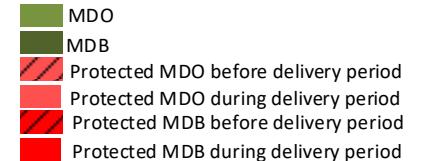
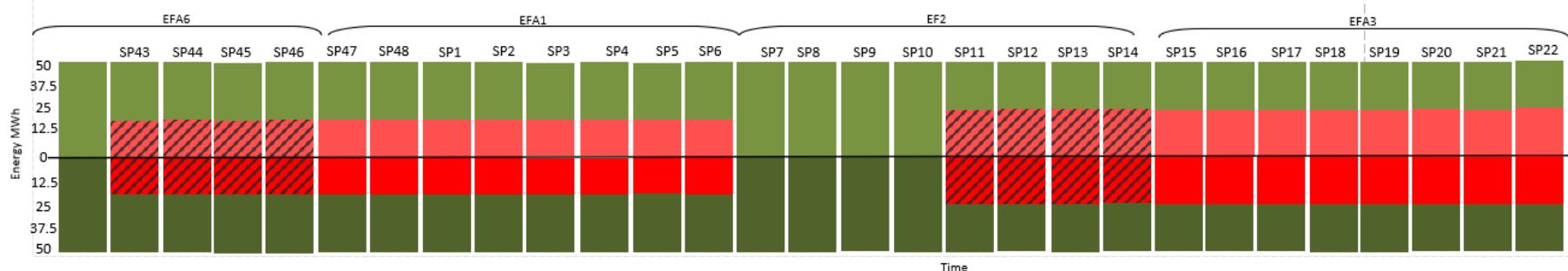
MDO  
 MDB  
 Protected MDO before delivery period  
 Protected MDO during delivery period  
 Protected MDB before delivery period  
 Protected MDB during delivery period

- Unit requires 12.5 MWh for entire EFA1 for delivering Dynamic Containment Low & High (DCLH). Upon activation it needs to be able to provide 50MWh for 15 mins continuously in either direction
- To enable unit to deliver 50 MW DCLH response In EFA1, the unit needs to ensure it is at the correct SoC at the beginning of the contract period. If NESO issues a BOA, the last timepoint the unit will have enough time to return to required SoC before start of contract period is SP42. Therefore, the provider will need to protect volume from at least EFA6.SP43
- Unit also needs to have 10 MWh reserve volume in SP39, SP40, SP41 & SP42 for Positive & Negative Quick Reserve respectively
- To enable the unit to hold 20 MW positive Quick reserve for entire SP39 and SP40 each, the provider would need to protect required volume from at least SP35 and release that volume in the contracted period. Similarly, for Negative Quick Reserve provider would need to protect required volume from at least SP37.
- Providers to add additional protection period based on unit efficiency, time required to trade

Time	SP	SOC %	PN	BOA	MEL	MIL	Dynamic Containment		Positive Quick Reserve		Negative Quick Reserve		Positive Slow Reserve		Negative Slow Reserve		Declared			
							DCL		DCH		PQR		NQR		PSR		NSR		MDO	MDB
							MW	MWh	MW	MWh	MW	MWh	MW	MWh	MW	MWh	MW	MWh		
EFA5	15:00 - 15:30	SP31	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	
	15:30 - 16:00	SP32	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	
	16:00 - 16:30	SP33	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	
	16:30 - 17:00	SP34	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	
	17:00 - 17:30	SP35	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	40.00	50.00	
	17:30 - 18:00	SP36	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	30.00	50.00	
	18:00 - 18:30	SP37	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	30.00	40.00	
	18:30 - 19:00	SP38	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	30.00	30.00	
EFA6	19:00 - 19:30	SP39	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	20.00	10.00	0.00	n/a	0.00	n/a	40.00	30.00	
	19:30 - 20:00	SP40	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	20.00	10.00	0.00	n/a	0.00	n/a	50.00	30.00	
	20:00 - 20:30	SP41	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	20.00	10.00	0.00	n/a	50.00	40.00	
	20:30 - 21:00	SP42	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	20.00	10.00	0.00	n/a	50.00	50.00	
	21:00 - 21:30	SP43	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50	
	21:30 - 22:00	SP44	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50	
	22:00 - 22:30	SP45	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50	
	22:30 - 23:00	SP46	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50	
EFA1	23:00 - 23:30	SP47	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50	
	23:30 - 00:00	SP48	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50	
	00:00 - 00:30	SP1	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50	
	00:30 - 01:00	SP2	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50	
	01:00 - 01:30	SP3	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50	
	01:30 - 02:00	SP4	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50	
	02:00 - 02:30	SP5	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50	
	02:30 - 03:00	SP6	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50	

# Scenario 6- Zero PN & No BOA, Response contracts

100 MW/100MWh unit at 50% initial charge & 100% efficiency; 50MW Dynamic Containment(DC) bi-directional contract in EFA1 and 50 MW Dynamic Moderation (DM) bi-directional contract in EFA3

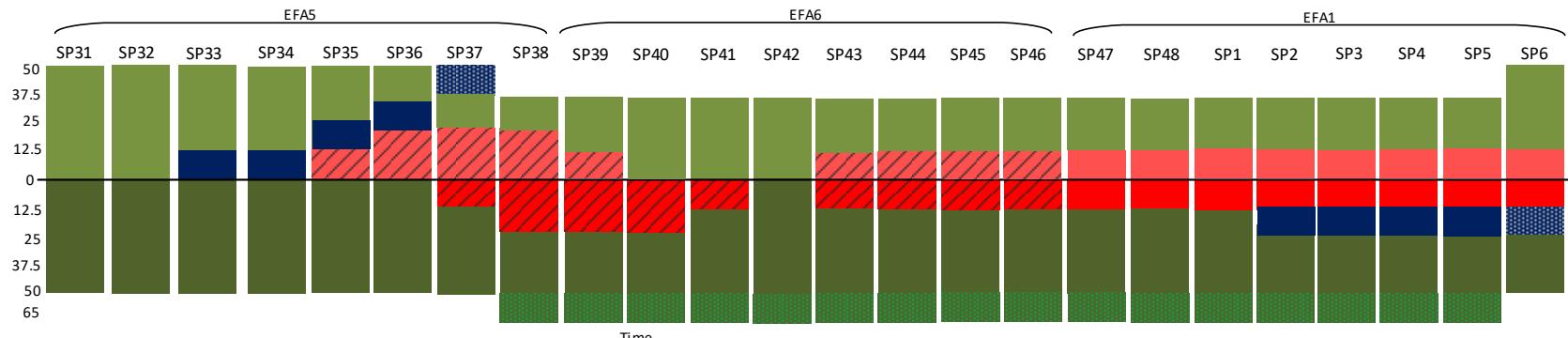
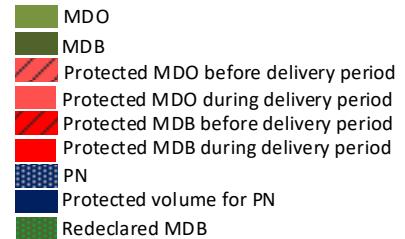


Time	SP	SOC %	PN	BOA	MEL	MIL	Dynamic Containment		Dynamic Regulation		Dynamic Moderation		Declared						
							DCL		DCH		DRL		DRH		DML		DMH		
							MW	MWh	MW	MWh	MW	MWh	MW	MWh	MW	MWh	MWh	MWh	
EFA6	20:30 - 21:00	SP42	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	21:00 - 21:30	SP43	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50
	21:30 - 22:00	SP44	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50
	22:00 - 22:30	SP45	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50
	22:30 - 23:00	SP46	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50
EFA1	23:00 - 23:30	SP47	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50
	23:30 - 00:00	SP48	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50
	00:00 - 00:30	SP1	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50
	00:30 - 01:00	SP2	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50
	01:00 - 01:30	SP3	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50
	01:30 - 02:00	SP4	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50
	02:00 - 02:30	SP5	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50
EFA2	02:30 - 03:00	SP6	50	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	37.50	37.50
	03:00 - 03:30	SP7	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	03:30 - 04:00	SP8	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	04:00 - 04:30	SP9	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	04:30 - 05:00	SP10	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	05:00 - 05:30	SP11	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	25.00	25.00
	05:30 - 06:00	SP12	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	25.00	25.00
EFA3	06:00 - 06:30	SP13	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	25.00	25.00
	06:30 - 07:00	SP14	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	25.00	25.00
	07:00 - 07:30	SP15	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	0.00	n/a	50.00	25.00	50.00	25.00	25.00	25.00
	07:30 - 08:00	SP16	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	25.00	50.00	25.00	25.00	25.00	25.00	25.00
	08:00 - 08:30	SP17	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	25.00	50.00	25.00	25.00	25.00	25.00	25.00
	08:30 - 09:00	SP18	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	25.00	50.00	25.00	25.00	25.00	25.00	25.00
	09:00 - 09:30	SP19	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	25.00	50.00	25.00	25.00	25.00	25.00	25.00
	09:30 - 10:00	SP20	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	25.00	50.00	25.00	25.00	25.00	25.00	25.00
	10:00 - 10:30	SP21	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	25.00	50.00	25.00	25.00	25.00	25.00	25.00
	10:30 - 11:00	SP22	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	25.00	50.00	25.00	25.00	25.00	25.00	25.00

- Unit requires 12.5 MWh for entire EFA1 for delivering Dynamic Containment Low & High (DCLH) & 25MWh for entire EFA3 for delivering Dynamic Moderation Low & High (DMLH)
- Upon DCLH activation it needs to be able to provide 50MWh for 15 mins continuously in either direction
- Upon DMLH activation it needs to be able to provide 50MWh for 30 mins continuously in either direction
- To enable unit to deliver 50 MW DCLH response in EFA1, the unit needs to ensure it is at the correct SoC at the beginning of the contract period. If NESO issues a BOA, the last timepoint the unit will have enough time to return to required SoC before start of contract period is SP42. Therefore, the provider will need to protect volume from at least EFA6.SP43
- Similarly, for DMLH the provider will need to protect volume from at least EFA2.SP11
- Providers to add additional protection period based on unit efficiency, time required to trade

# Scenario 7- Non-Zero PN & No BOA, reserve and response contracts

100 MW/100MWh unit at 50% initial charge; 50MW DC bi-directional contract in EFA1; 20 MW Positive Quick Reserve (PQR) contract in SP39,SP40 & Negative Quick Reserve(NQR) contract in SP41 & SP42; 30 MW discharge PN in SP37 & 30 MW charge PN in SP6

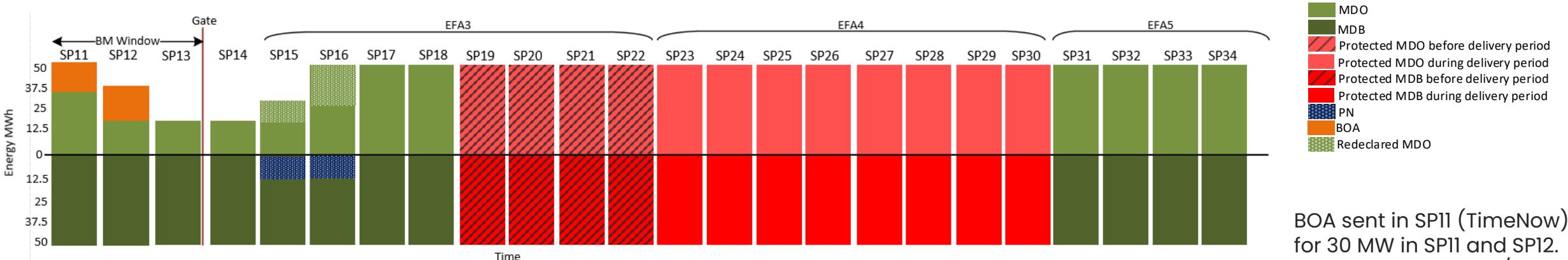


Time	SP	SOC %	Dynamic Containment						Positive Quick Reserve		Negative Quick Reserve		Positive Slow Reserve		Negative Slow Reserve		Declared			
			PN	BOA	MEL	MIL	DCL		DCH		PQR		NQR		PSR		NSR		MDO	MDB
							MW	MWh	MW	MWh	MW	MWh	MW	MWh	MW	MWh	MW	MWh		
EFA5	SP31	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	SP32	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00
	SP33	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	35.00	50.00
	SP34	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	35.00	50.00
	SP35	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	25.00	50.00
	SP36	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	15.00	50.00
	SP37	35	30.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	15.00	n/a	15.00	55.00
EFA6	SP38	35	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	15.00	45.00
	SP39	35	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	20.00	10.00	0.00	n/a	0.00	n/a	0.00	n/a	25.00	45.00
	SP40	35	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	20.00	10.00	0.00	n/a	0.00	n/a	0.00	n/a	35.00	45.00
	SP41	35	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	20.00	10.00	0.00	n/a	0.00	n/a	35.00	55.00
	SP42	35	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	20.00	10.00	0.00	n/a	0.00	n/a	35.00	65.00
	SP43	35	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	22.50	52.50
	SP44	35	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	22.50	52.50
	SP45	35	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	22.50	52.50
EFA1	SP46	35	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	22.50	52.50
	SP47	35	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	22.50	52.50
	SP48	35	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	22.50	52.50
	SP1	35	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	22.50	52.50
	SP2	35	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	22.50	37.50
	SP3	35	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	22.50	37.50
	SP4	35	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	22.50	37.50
	SP5	35	0.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	22.50	37.50
	SP6	50	-30.00	0.00	50.00	-50.00	50.00	12.50	50.00	12.50	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	22.50	37.50
	SP7	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00

- Unit requires 12.5 MWh for entire EFA1 for delivering Dynamic Containment Low & High (DCLH). Upon activation it needs to be able to provide 50MWh for 15 mins continuously in either direction
- To enable unit to deliver 50 MW DCLH response in EFA1, the unit needs to ensure it is at the correct SoC at the beginning of the contract period. If NESO issues a BOA, the last timepoint the unit will have enough time to return to required SoC before start of contract period is SP42. Therefore, the provider will need to protect volume from at least EFA6.SP43
- Unit also needs to have 10 MWh reserve volume in SP39, SP40, SP41 & SP42 for Positive & Negative Quick Reserve respectively
- To enable unit to hold 20 MW positive Quick reserve for entire SP39 and SP40 each, the provider would need to protect required volume from at least SP35 and release that volume in the contracted period. Similarly, for Negative Quick Reserve provider would need to protect required volume from at least SP37.
- In addition, it will also need to protect additional volume from at least SP33 to meet PN in SP37. Similarly, need to protect volume from at least SP2 to meet PN in SP5
- Providers to add additional protection period based on unit efficiency, time required to trade

# Scenario 8 - Non-Zero PN & a BOA; Response control

100 MW/100MWh unit at 50% initial charge & 100% efficiency; 50MW DC bi-directional contract in EFA4; BOA sent in SP11 and SP12

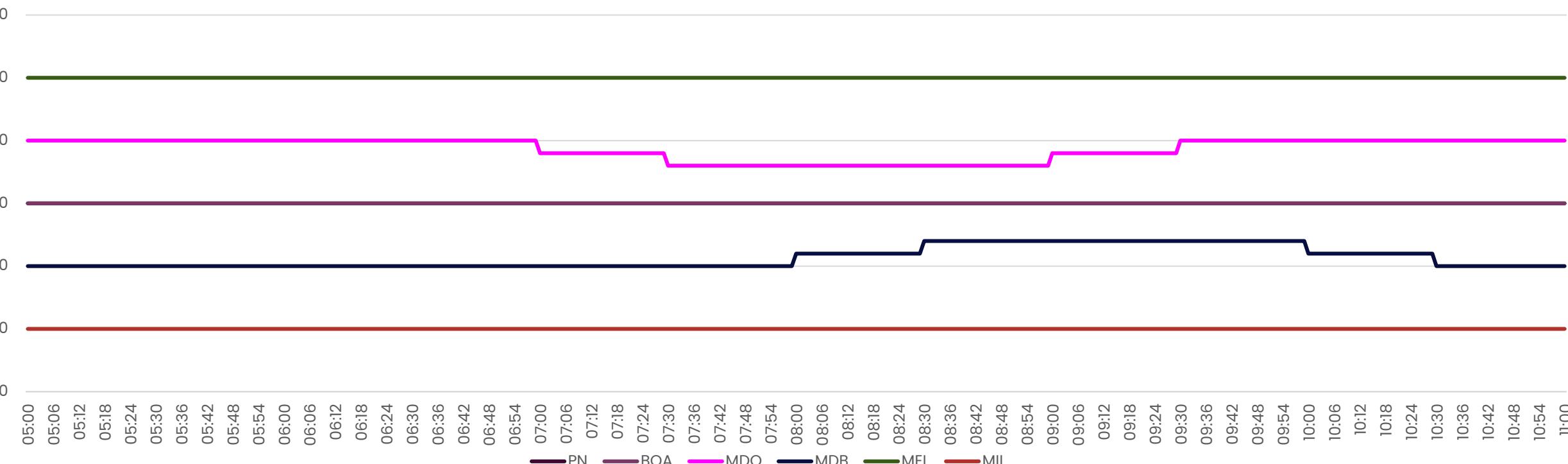


BOA sent in SP11 (TimeNow) for 30 MW in SP11 and SP12. This will lead to MDO/MDB being re-declared

- In this example, the unit also puts a charge PN in SP15 and SP16 so that they are in the right state of charge to deliver the 50 MW DRLH Response contract
- Providers to add additional protection period based on unit efficiency, time required to trade

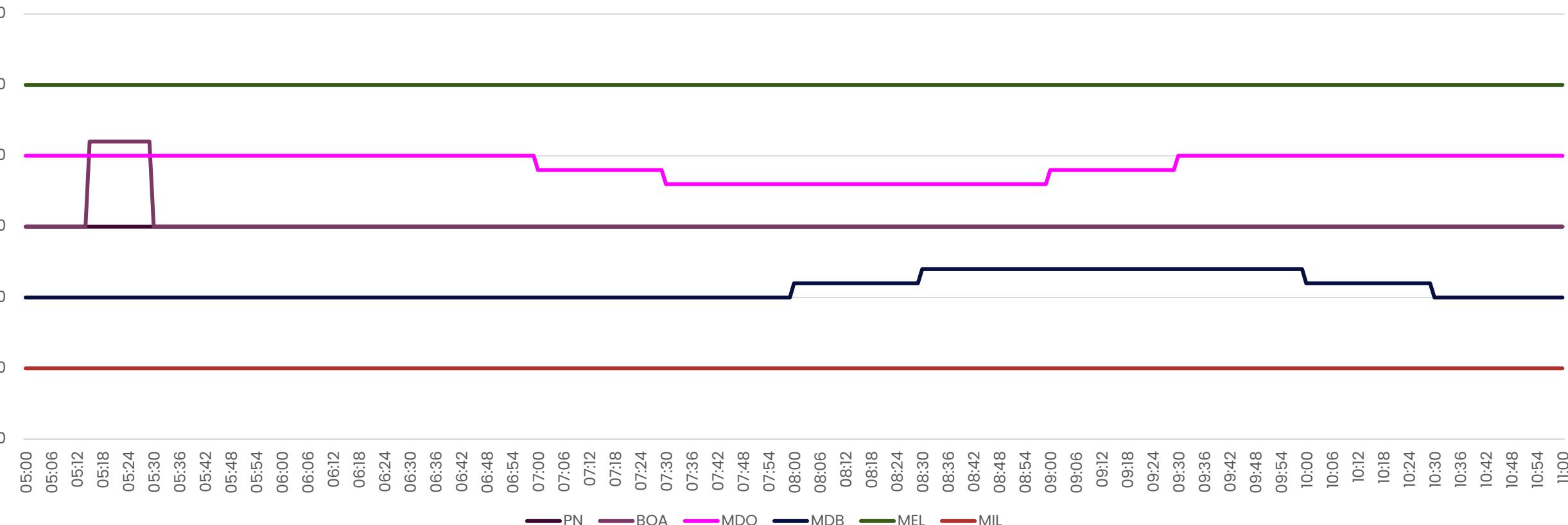
	Time	SP	SOC %	PN	BOA	MEL	MIL	Dynamic Containment		Dynamic Regulation		Dynamic Moderation		Declared		Re-declared			
								DCL	DCH	DRL	DRH	DML	DMH	MDO	MDB	MDO	MDB		
								MW	MWh	MW	MWh	MW	MWh	MWh	MWh	MWh	MWh		
BM window	05:00 - 05:30	SP11	35	0.00	30.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	35.00	50.00
	05:30 - 06:00	SP12	20	0.00	30.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	50.00
	06:00 - 06:30	SP13	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	50.00
	06:30 - 07:00	SP14	20	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	20.00	50.00
EFA3	07:00 - 07:30	SP15	35	-30.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	35.00	50.00
	07:30 - 08:00	SP16	50	-30.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00
	08:00 - 08:30	SP17	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00
	08:30 - 09:00	SP18	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00
	09:00 - 09:30	SP19	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	0.00	0.00	0.00
	09:30 - 10:00	SP20	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	0.00	0.00	0.00
	10:00 - 10:30	SP21	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	0.00	0.00	0.00
	10:30 - 11:00	SP22	50	0.00	0.00	100.00	-100.00	0.00	n/a	0.00	n/a	0.00	n/a	0.00	n/a	0.00	0.00	0.00	0.00
EFA4	11:00 - 11:30	SP23	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00	0.00	0.00
	11:30 - 12:00	SP24	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00	0.00	0.00
	12:00 - 12:30	SP25	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00	0.00	0.00
	12:30 - 13:00	SP26	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00	0.00	0.00
	13:00 - 13:30	SP27	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00	0.00	0.00
	13:30 - 14:00	SP28	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00	0.00	0.00
	14:00 - 14:30	SP29	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00	0.00	0.00
	14:30 - 15:00	SP30	50	0.00	0.00	50.00	-50.00	0.00	n/a	0.00	n/a	50.00	50.00	50.00	50.00	0.00	0.00	0.00	0.00

# Scenario 9: Zero PN, No BOA



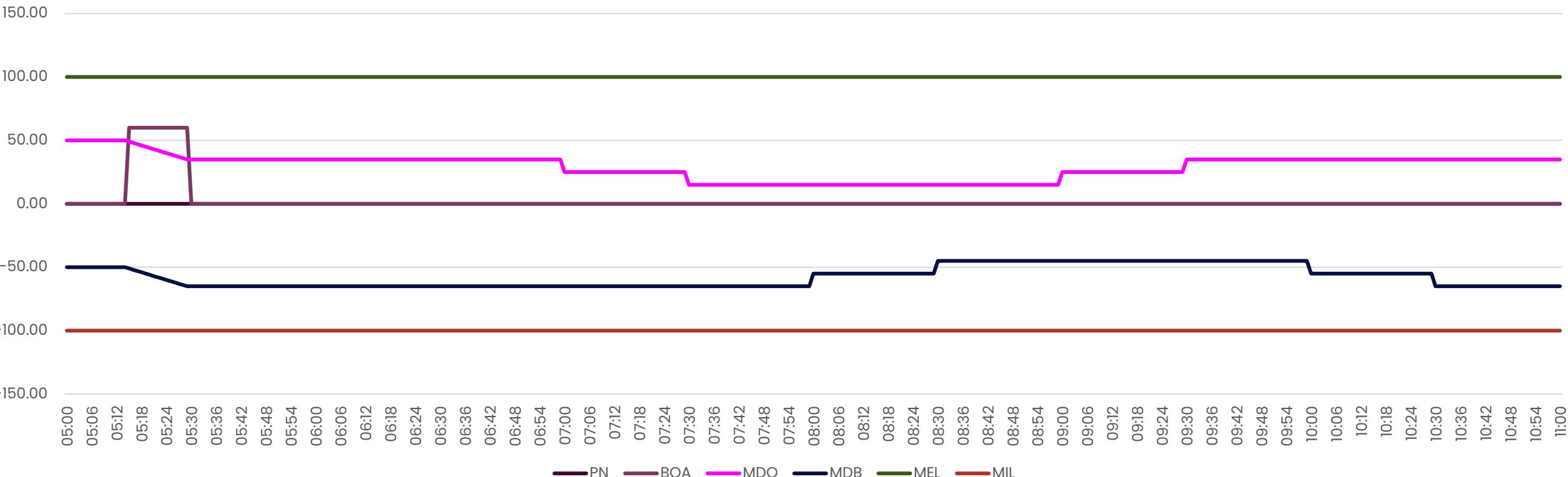
- 100 MW/100 MWh unit @ 50% SoC and efficiency of 100%,
- Unit has a Positive Quick Reserve contract from 09:00 – 09:30 (20 MW) and 09:30 – 10:00 (20 MW)
- Unit has a Negative Quick Reserve contract from 10:00 – 10:30 (20 MW) and 10:30 – 11:00 (20 MW)
- **TimeNow = 05:00 → Unit has zero PN and no BOA**

## Scenario 10: Zero PN, 1st BOA sent



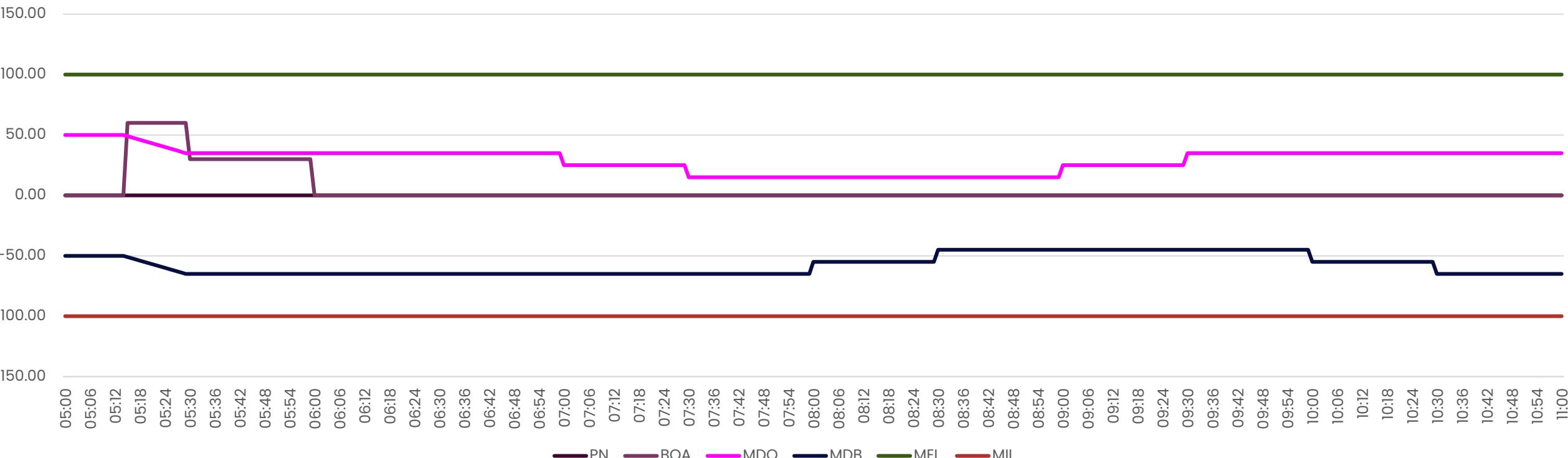
- 100 MW/100 MWh unit @ 50% SoC and efficiency of 100%,
- Unit has a Positive Quick Reserve contract from 09:00 – 09:30 (20 MW) and 09:30 – 10:00 (20 MW)
- Unit has a Negative Quick Reserve contract from 10:00 – 10:30 (20 MW) and 10:30 – 11:00 (20 MW)
- **TimeNow = 05:02 → Unit has zero PN and 1st BOA sent from 05:15 for 60 MW for 15 mins**

# Scenario 11: Zero PN, 1st BOA, MDO/MDB redeclared



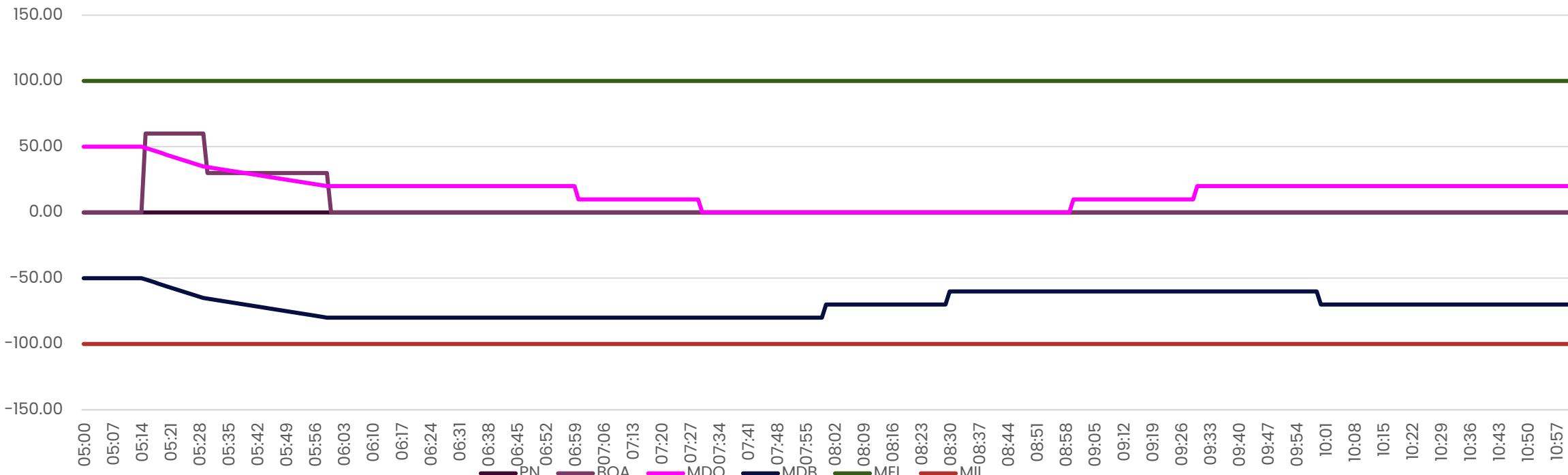
- 100 MW/100 MWh unit @ 50% SoC and efficiency of 100%,
- Unit has a Positive Quick Reserve contract from 09:00 – 09:30 (20 MW) and 09:30 – 10:00 (20 MW)
- Unit has a Negative Quick Reserve contract from 10:00 – 10:30 (20 MW) and 10:30 – 11:00 (20 MW)
- **TimeNow = 05:04 → Unit redeclares MDO/MDB values (MDO decreases, MDB increases)**

## Scenario 12: Zero PN, 2nd BOA sent



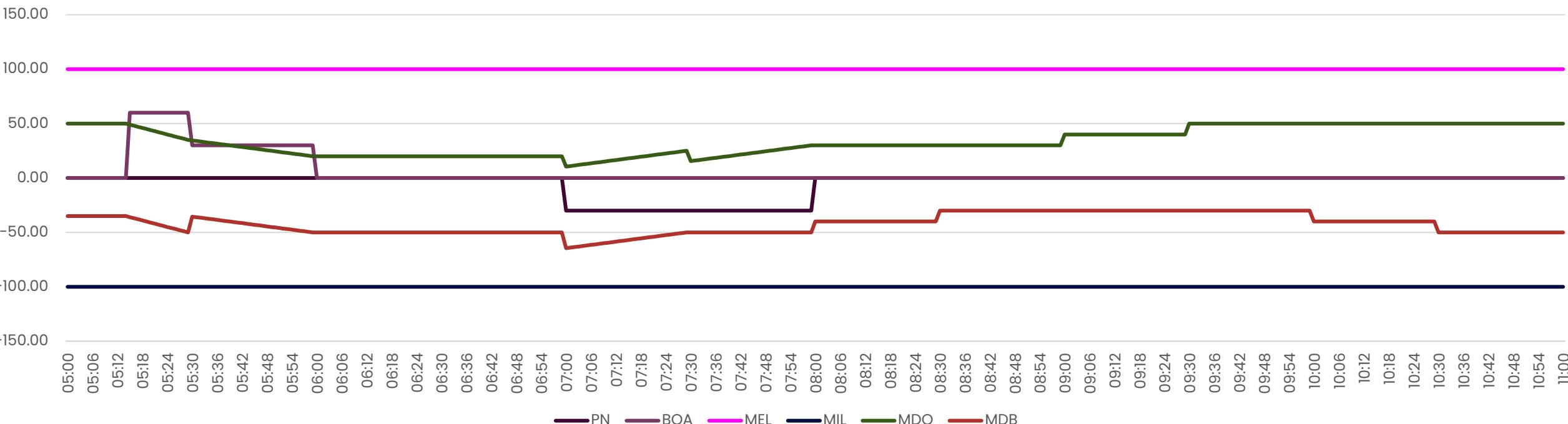
- 100 MW/100 MWh unit @ 50% SoC and efficiency of 100%,
- Unit has a Positive Quick Reserve contract from 09:00 – 09:30 (20 MW) and 09:30 – 10:00 (20 MW)
- Unit has a Negative Quick Reserve contract from 10:00 – 10:30 (20 MW) and 10:30 – 11:00 (20 MW)
- **TimeNow = 05:20 → Unit has zero PN and 2nd BOA sent from 05:30 for 30 MW for 30 mins**

## Scenario 13: Zero PN, 2<sup>nd</sup> BOA, MDO/MDB redeclared



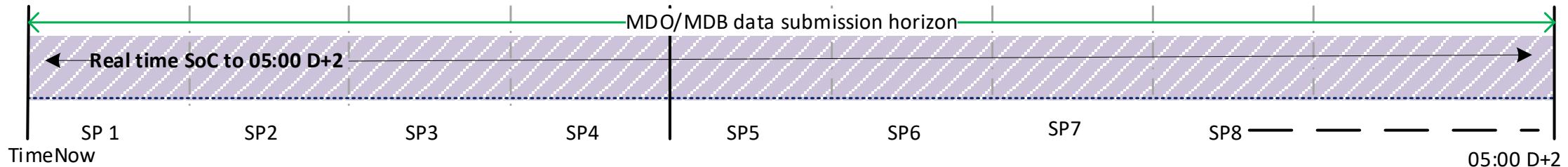
- 100 MW/100 MWh unit @ 50% SoC and efficiency of 100%,
- Unit has a Positive Quick Reserve contract from 09:00 – 09:30 (20 MW) and 09:30 – 10:00 (20 MW)
- Unit has a Negative Quick Reserve contract from 10:00 – 10:30 (20 MW) and 10:30 – 11:00 (20 MW)
- **TimeNow = 05:22 → Unit redeclares MDO/MDB values (MDO decreases, MDB increases)**

## Scenario 14: Non-Zero PN, 2 BOA's, MDO/MDB redeclaration



- 100 MW/100 MWh unit @ 50% SoC and efficiency of 100%,
- Unit has a Positive Quick Reserve contract from 09:00 – 09:30 (20 MW) and 09:30 – 10:00 (20 MW)
- Unit has a Negative Quick Reserve contract from 10:00 – 10:30 (20 MW) and 10:30 – 11:00 (20 MW)
- **TimeNow = 05:26 → Unit puts a charge PN from 07:00 – 07:30 (30 MW) and 07:30 – 08:00 (30 MW)**
- **Unit redeclares MDO/MDB values to protect PN**

# Future State of Energy (FSoE) model Implementation



Once MDO/MDB is utilised we will start implementing the FSoE Model to increase the accuracy of the Scheduling process. This will be used in addition to MDO/MDB data. As the FSoE model will not be 100% accurate the MDO/MDB data will ensure the actual BOA does not exceed the MWh capability by even a minute.

The FSoE model will require a combination of the below data. The trials we are running will validate exact data requirements.

All below is static, one value covering the operational day received via Single Markets Platform (SMP), apart from **Real time SoE** – which will be received via the SCADA system (IEMS). SMP values can be changed at any time and the system will refresh every 30 minutes.

- Max SoE, ( NESO calculate time varying limits from Reserve and Response contracts)
- Min SoE,
- Charging efficiency
- Discharging efficiency
- SoE limit positive
- SoE limit negative
- Daily cycle limit
- MWh cycle limit
- MW power capability import
- MW power capability export
- MWh export
- MWh import
- **Real time SoE**

# Supporting documentation

- Industry worked example spreadsheet



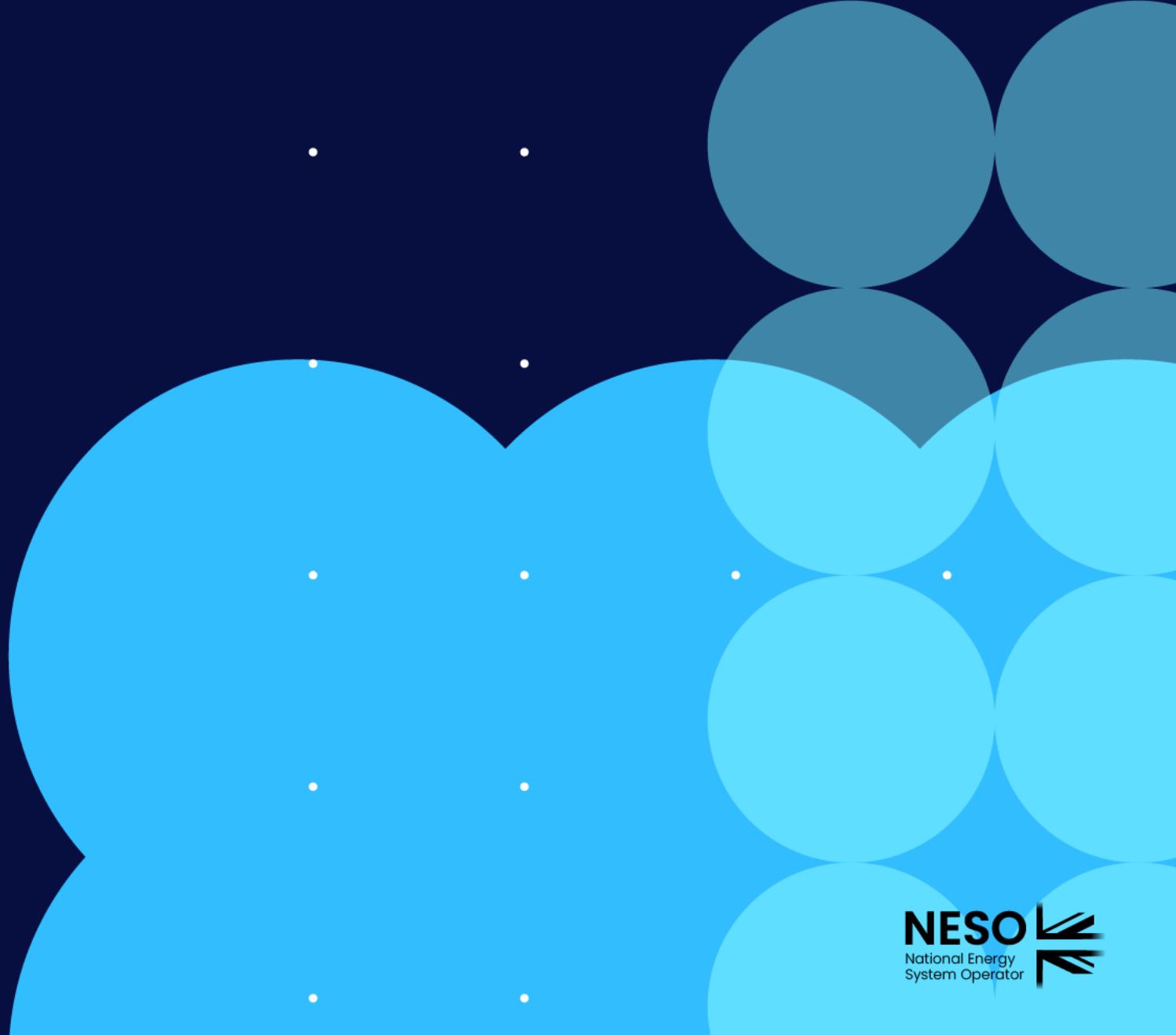
30min Granularity  
Scenarios



1 min Granularity  
Scenarios

# Q&A

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# Engage with us

## Previous events

**27 Feb** [Battery & Skip Rates webinar](#) – methodology/data interpretation

**1 May** Skip Rate Forum – [Project updates](#), [Engagement & Code activity](#) and breakout sessions: [Datasets](#) | [Methodology](#) | [Materiality](#)

**16 Jul** [deep dive](#) on definitions/calculations at [Operational Transparency Forum](#) (OTF), plus weekly updates at OTF

**7 Aug** [Webinar](#) – Skip rates data interpretation (dashboard), constraints and other updates including **GC0166** Proof of Concept (PoC) testing

**16 Sep** [Webinar](#) (*Balancing Programme*) – including **GC0166** PoC testing

**3 Nov** [Webinar](#) – Stage 5 & 6 data, Materiality, **GC0166**, Dispatch Strategic Review, Root Cause Analysis, skips behind constraints, and skip rate target reduction target

**18 Nov** [Updates](#) (*Balancing Programme event*) – Skips behind constraints, Root Cause Analysis, Dispatch Strategic Review, **GC0166** and skip rate reduction target

## Skip Rates webpage

[Overview & data dashboard](#) |

[Technical info](#) | [Link to data portal](#) |

[Event recordings & slides](#) | [Progress updates](#) | [Q&A](#)

## Future events

28 Jan – Dispatch Transparency Forum

**Mailbox** – Send us your questions:  
[@neso.energy](mailto:box.SkipRates@neso.energy)

# Brief feedback survey

Sli.do #DTP



## Please assist us

*For all projects in our Dispatch Transparency Programme, not just GC0166*

- We have not received much feedback this year
- Essential for us to understand how our plans and deliveries are being received
- Respondents will not be visible to each other
- Individual responses will not be shared during the event or published afterwards
- We will repeat this survey over time to monitor perceptions, identify trends and guide our focus

# Thank you

