Optimisation Stakeholder Focus Group

2 June 2025

13:30 – 15:00

Manos Loukarakis, Optimisation Manager

Nicolas Melchor, Optimisation SME

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Agenda

Time	Agenda Item	Details
13:30	Welcome & Introductions	• Recap of Optimisation Stakeholder Focus Group discussions to date • Open Balancing Platform (OBP) system overview
13:40	Dispatch Journey	• What is National Dispatch? • How does it fit into control room processes?
14:00	Q&A	
14:10	Target/Fast Dispatch in Production	• Dispatching units in the small BMU zone against a target programme
14:30	Future Improvements	• Ongoing work towards improving dispatch in OBP
14:45	Q&A	
15:00	**Meeting Close**	

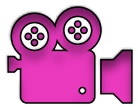
Audience Participation

There is time allocated to Q&A after each section - we will take all questions during this part of the agenda to ensure we get through all pre-prepared content.

Please raise your hand & come off mute ensuring to state both your **name and organisation** - this will enable us to follow up with you after the webinar if necessary.

Out of scope questions will be forwarded on to the appropriate NESO team or expert for a direct response. We may ask you to contact us by email to ensure we have the correct contact details for the response.

If you have any further questions after the Focus Group, please get in contact with us at **box.balancingprogramme@neso.energy**



Today's Optimisation Focus Group will be **recorded and published online** after the session, along with the slide pack.

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Optimisation So Far

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Optimisation Group Timeline & Feedback

June 2023 (online)

- Initial kick-off / group scope
- Bulk Dispatch intro

November 2023

(BP engagement event, Optimisation session)

- Control processes structure
- Bulk Dispatch optimiser (BDO) details

February 2024 (online)

- BDO details (costs)
- Fast Dispatch

June 2024

(BP engagement event, Optimisation session)

- Fast Dispatch demo
- Instruction algorithm

November 2024

(BP engagement event, Optimisation session)

- National Dispatch intro
- Intro to GC0166 parameters, group constraints & wind

June 2025 (online)

- National Dispatch details
- Production examples

- Group constraints management (optimised)
- Limited duration asset modelling
- Risk management in control
- More documentation
- More on future challenges/problems
- Comparison with other System Operators (SO)

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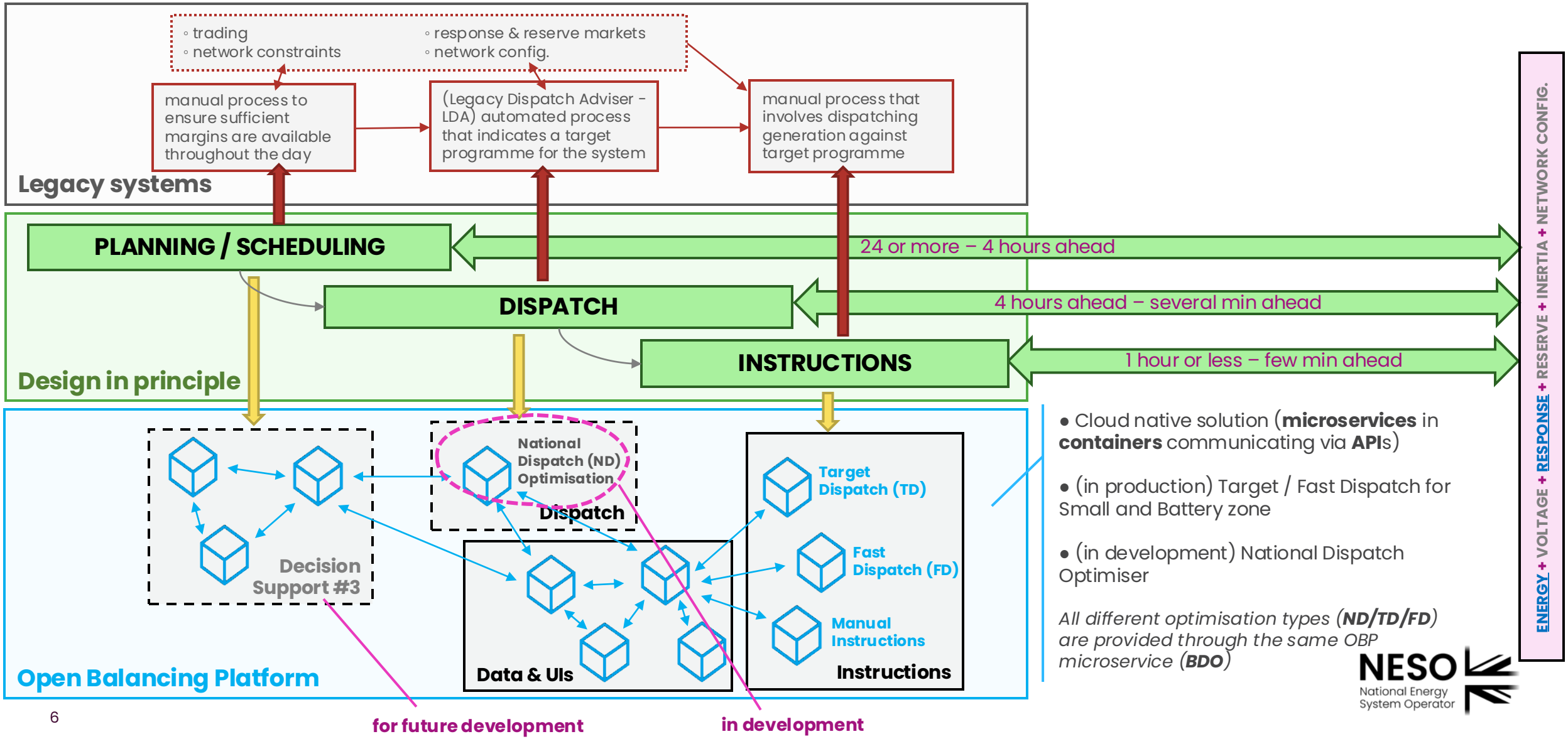
Open Balancing Platform Overview



- Cloud native solution (**microservices** in **containers** communicating via **APIs**)
- (in production) Target / Fast Dispatch for Small and Battery zone
- (in development) National Dispatch Optimiser

*All different optimisation types (**ND/TD/FD**) are provided through the same OBP microservice (**BDO**)*

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OBP Roadmap

Please note – GC0166 implementation date is dependent on the outcome of the Grid Code Modification process

PI 15 (Jan 25 - Apr 25)

OBP Capabilities:
1. Constraint Management
2. Manual instructions

OBP Enablers:
1. Interface to Ancillary Settlement for NBM
2. Non-BM APIs

PI 16 (Apr 25 - Jul 25)

OBP Capabilities:
1. Non-BM Instruction Types
2. Non-BM Quick Reserve
3. **National Optimiser**
4. Pumped Storage BOAs
5. Bulk Dispatch Wind BMUs (rule based)

PI 17 (Jul 25 - Oct 25)

OBP Capabilities:
1. BM & Non-BM Slow Reserve
2. Move MW Dispatch
3. Move Response (DC/DM/DR)
4. Optimisation within a Constraint

OBP Enablers:
1. Ready to decommission ASDP
2. OBP becomes Operationally Critical

PI 18 (Oct 25 - Jan26)

OBP Capabilities:
1. Constraints Pathfinder
2. Stability Pathfinder
3. Manage Sync/De-sync

OBP Enablers:
1. Ready to decommission ASDP
2. EDT/EDL mastered from OBP
3. PEF Integration

PI 19 (Jan 26 - Apr 26)

Capabilities:
1. Interface to NCMS for constraints
2. Response and Inertia

Retire ASDP, VERGIL & CLOGS

Key:
- Complete
- **PI:** Programme Increment
- **Focus of the 1st part of this session**

Abbreviations: **DC:** Dynamic Containment **DM:** Dynamic Moderation **DR:** Dynamic Regulation **BOA:** Bid Offer Acceptance **DX:** Dynamic Response **VERGIL:** Versatile Graphical Instruction Logger **NCMS:** Network Control Management System **EDL:** Electronic Dispatch & Logging **EDT:** Electronic Data Transfer **ASDP:** Ancillary Services Dispatch Platform **CLOGS:** Contingency Logging System

Public

Dispatch Journey

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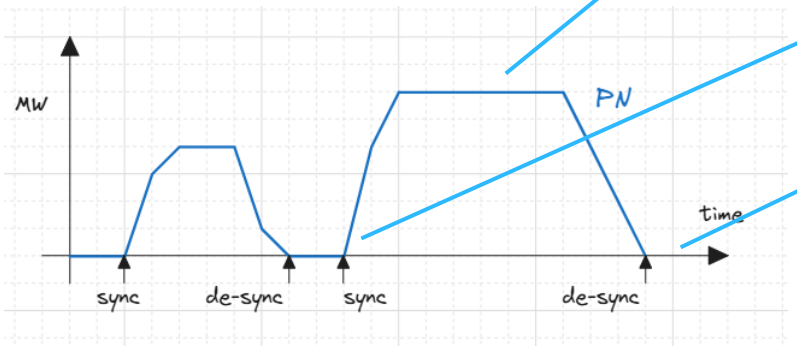
Planning Set-up

Margin analysis

Scheduling / Planning

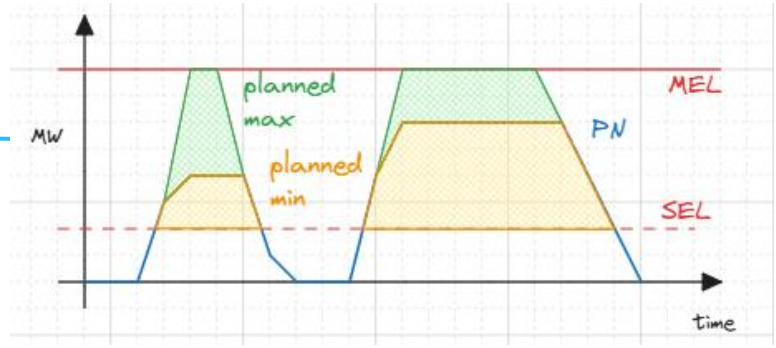


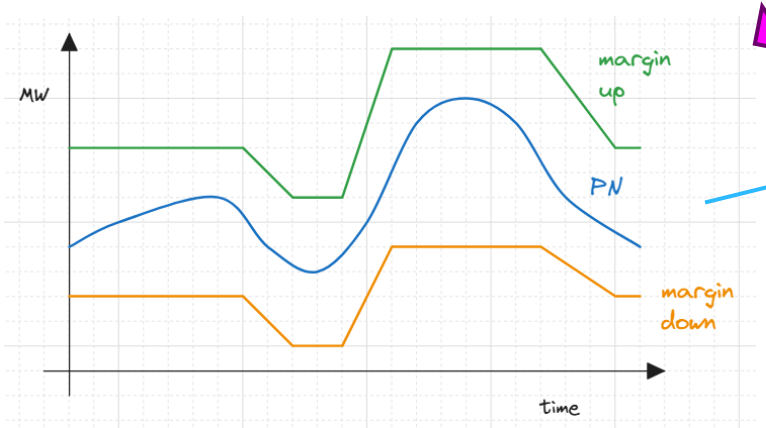
(1) Sync/Desync events may be inferred by the unit BM submissions and defaulting data.

(2) When synced a BMU is expected to ramp up to at least SEL, and then can generate up to MEL.

(3) When de-synced, it is at 0.

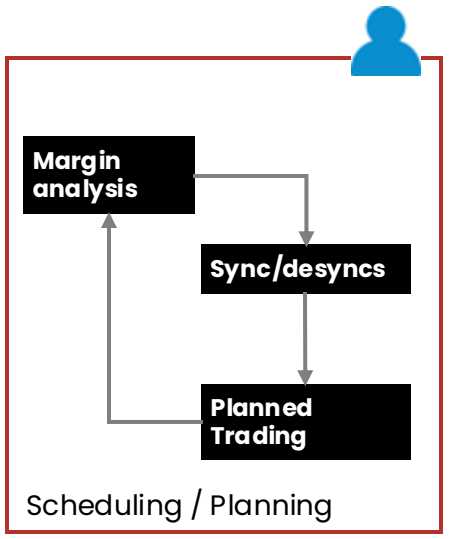
(4) Based on the unit sync/desyncs it is possible to calculate what the unit can contribute to any imbalance.

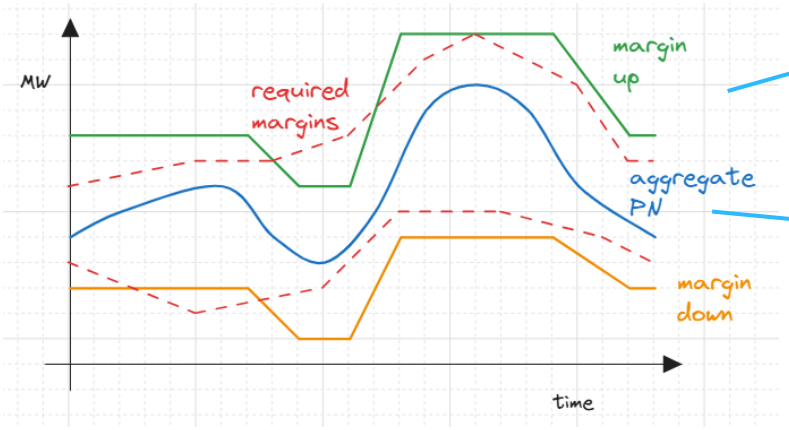




(5) Margins may then be aggregated across all units for a system-view;
It follows that generation requirement should fall within these margins (at system and group constraint level).

Planning Adjustments

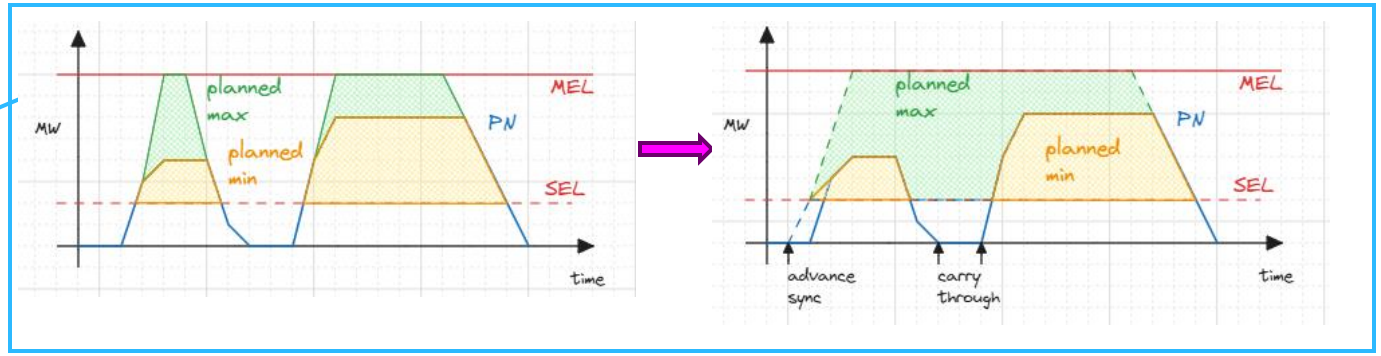




(1) Required margins (dependent on system conditions)

(2) Available margins can be adjusted up/down by adjusting unit events – note that for conventional BMUs both up/down margins are moved (based on MEL/SEL).

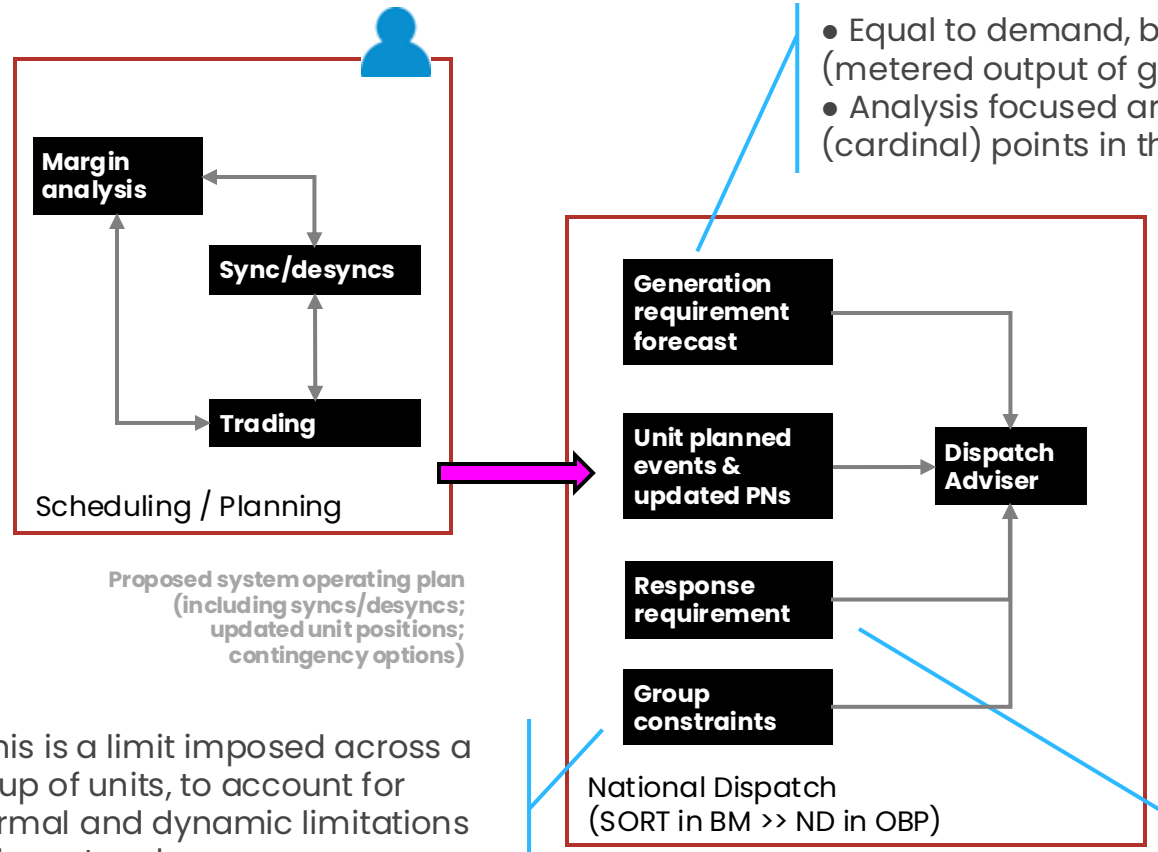
(3) Trading can be done for specific BMUs; or over interconnectors



- Once we have a configuration that meets margin requirements, it becomes the System Operating Plan.
- Unit planned events (sync/desyncs) are given inputs to National Dispatch.

National Dispatch inputs

Abbreviations:
- **MFR:** Mandatory Frequency Response
- **ND:** National Dispatch



- Equal to demand, but not exactly (metered output of generators)
- Analysis focused around key (cardinal) points in the day.

- This is a limit imposed across a group of units, to account for thermal and dynamic limitations of the network
- Derived through a separate methodology, that depends on demand forecasts and unit schedules

- Set to cover largest loss, factoring in expected BMU response
- Dynamic response products procured day-ahead are subtracted from the requirement
- National dispatch looks after MFR (additional response needed in the day)

- Dispatch runs every 5min, generating advice for the next 4-5hours.
- OBP (via ND) will replace the legacy dispatch process

National Dispatch as an Optimisation Problem

Abbreviations:
- **P:** Primary Response
- **S:** Secondary Response
- **H:** High Response

This is a Mixed Integer Linear Programming (largely due to MFR) problem that

… meets demand / generation requirement :: $\sum_{all.BMUs} power = requirement$

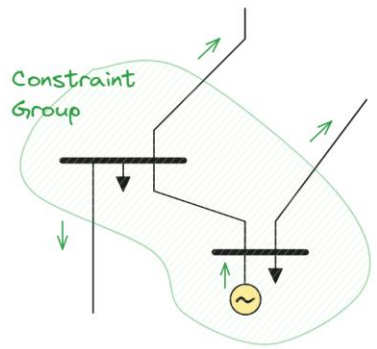
… meets response requirement :: $\sum_{all.BMUs} response \geq requirement$ for each type of service (P,S,H)

… considering

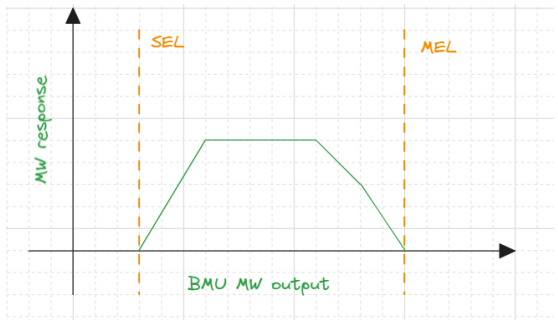
… … BMU ramp-rates

… … BMU MFR capability

… limited by network / group constraints :: $\sum_{group.BMUs} power - groupDemand \leq groupLimit$

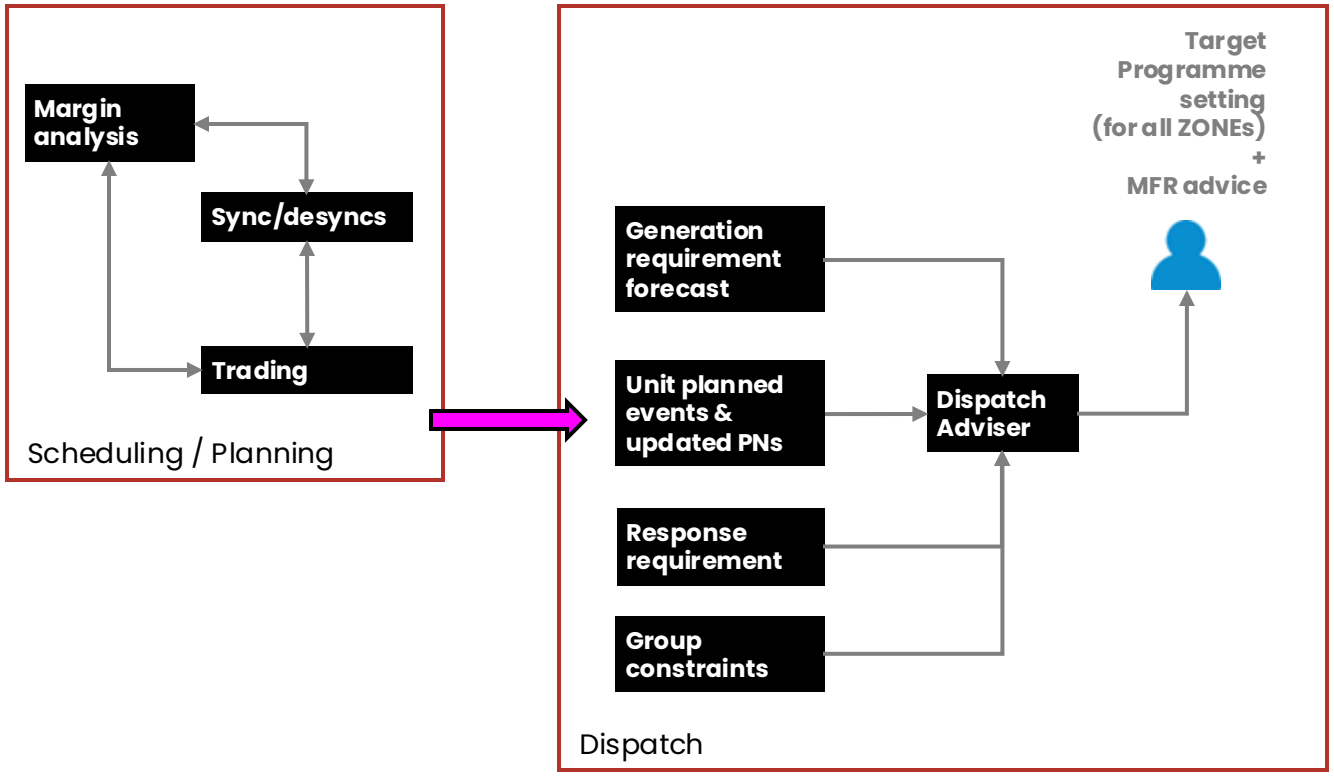


- Constraint group demand is the sum of demand forecasts in the group GSPs
- The limit is indicative of total group transfer (not typically associated with a specific e.g. circuit technical characteristic)



- MFR is all or nothing
- Capability based on testing
- DC/DM/DR are not explicitly modelled currently (volumes are assumed to be priced-out)

National Dispatch Outputs



- Generates "advice" at individual unit level, e.g.

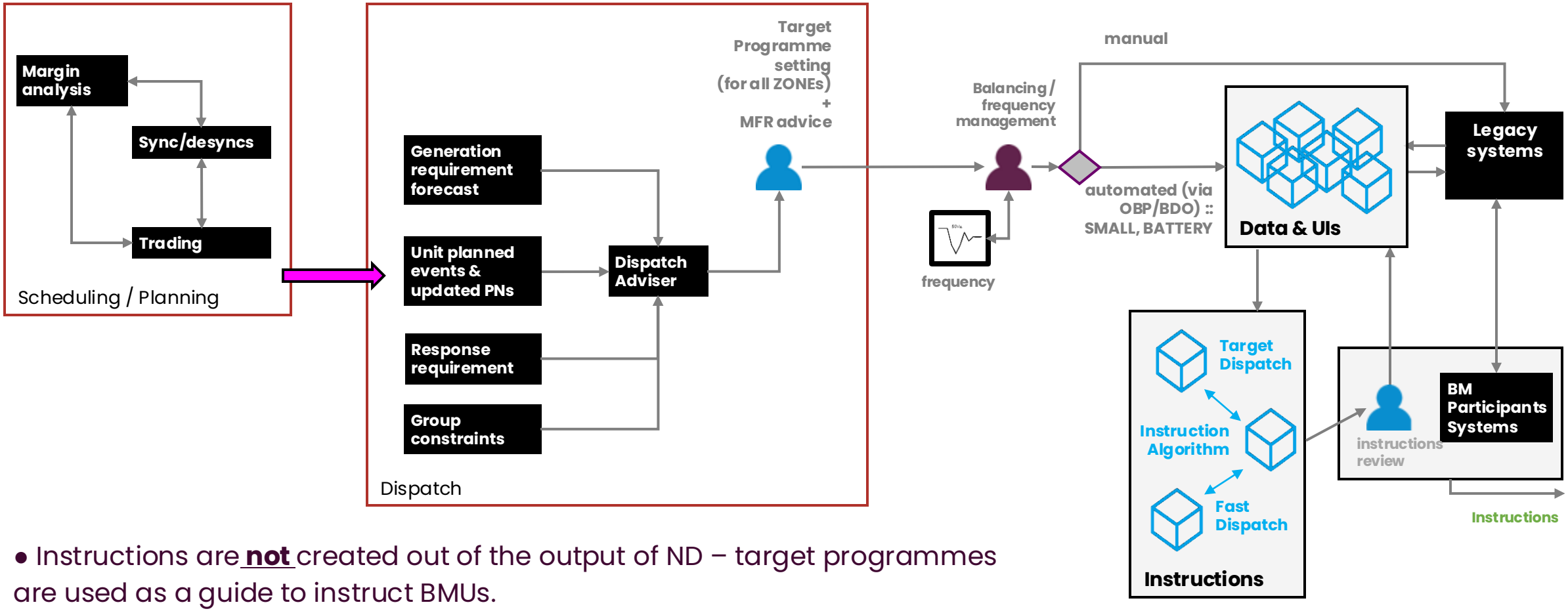
UNIT-1	10:05	10:10	10:25	...
MW	100	150	150	...
MW-Pry	0	0	50	...
MW-Sec	0	0	50	...
MW-High	0	0	0	...

- Output MW of individual BMUs are aggregated by ZONE – these are the **target programmes**.
- ZONEs is a mechanism for managing the workload involved around issuing individual BOAs

ZONE	10:05	10:10	10:25	...
NORTH	1000	1500	1600	...
SMALL	0	600	500	...
BATTERY	200	100	0	...
...	...	...	...	...

- Target programmes or the input generation requirement may be manually edited if issues with the data and frequency are identified.

After National Dispatch



- Instructions are **not** created out of the output of ND – target programmes are used as a guide to instruct BMUs.
- ND works in absolute terms, FD in relative terms. TD is somewhere in between.

Optimisation-Based Dispatch Processes Compared

Abbreviations:

- **MFTT:** Minimum Flat Top Time
- **MZT:** Minimum Zero Time
- **MNZT:** Minimum Non-Zero Time
- **SEL:** Stable Export Limit
- **SIL:** Stable Import Limit

	Scheduling	National	Target	Fast
Control process time				
… out of which solve time	<30min	<5min	60s	10s
Scope	all units	all units	zone	zone
… look-ahead	24+ hours	4-5 hours	1-1.5 hours	30min
… runs		every 5'	on demand	
Constraints				
… generation requirement	✓	✓	✓	✓
… response requirement	✓	✓	×	×
… ramp rates	✓ (simplified)	✓ (simplified)	✓	✓
… SEL/SIL	✓	×	✓	✓
… MZT/MNZT	✓	×	✓	✓
… MFTT	×	×	✓	✓
… group constraints	✓	✓	×	×
… response capabilities	×	✓	×	×
… margins	✓	×	×	×

All produce target MW profiles at unit level.

FD/TD currently are enabled for BATTERY and SMALL (we will be looking to enable them for other ZONEs)

Non-BMUs are not fully integrated into these processes yet

Commitment decisions are not done in national dispatch – these are manually handled before that point (we will be looking to align how our dispatch processes work over time)

If planning was cast as an optimisation problem…

These are currently handled via a different (unit restrictions based) logic (this may change in the future)

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Q&A

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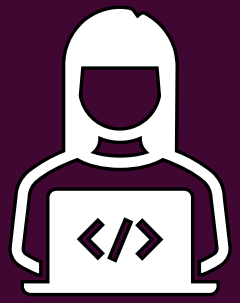
Target/Fast Dispatch in Production



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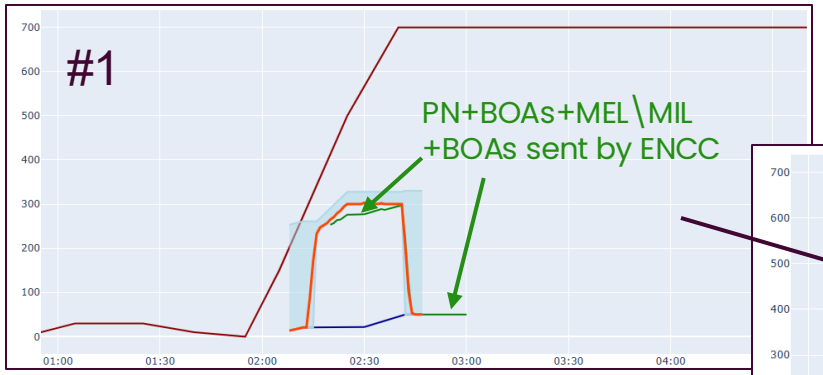
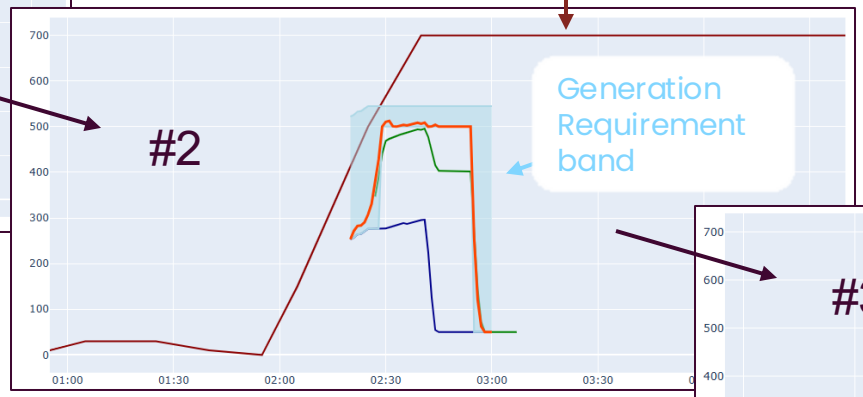
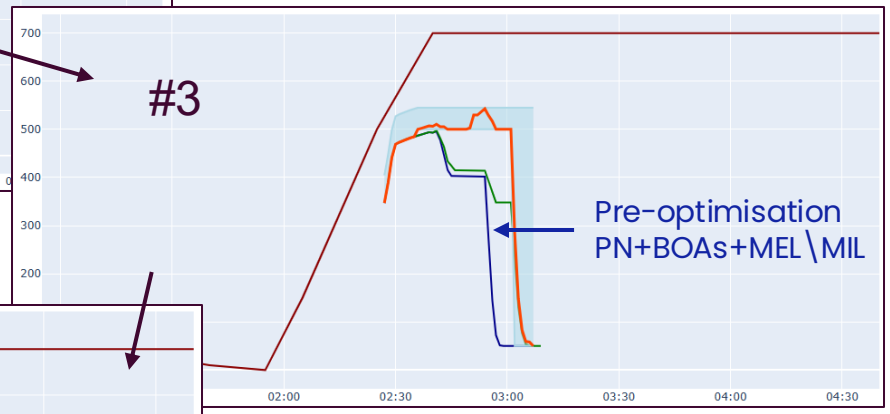
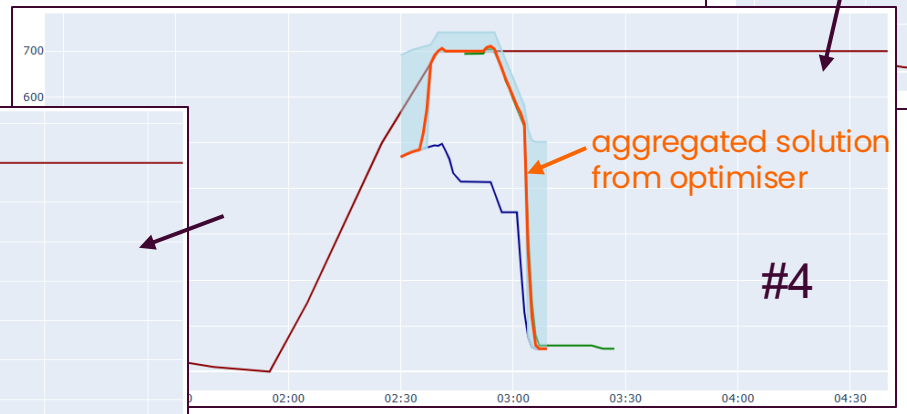
From National Dispatch to SMALL BMU Zone

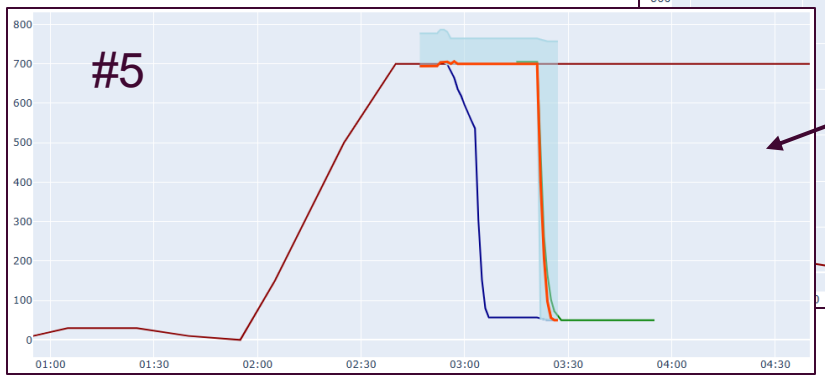


Target programme for SMALL BMU zone from the national dispatch









Assistant National Balancing Engineer managing the SMALL BMU zone required 5 OBP runs + manual BOAs to reach the generation programme defined by the national dispatch tool "System Operation in Real Time (SORT)"

Key considerations

... ENCC Energy Team performs multiple OBP runs + manual BOAs to meet generation programme

... Target programme is not fixed, and it could be modified at any minute depending on the value of frequency and its trend

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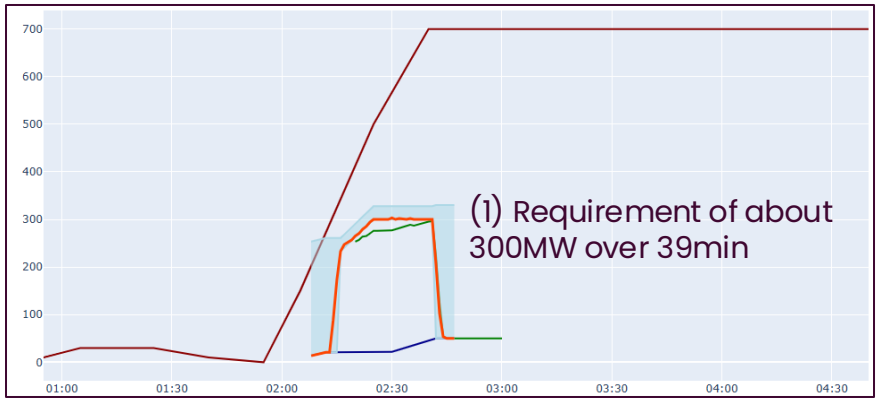
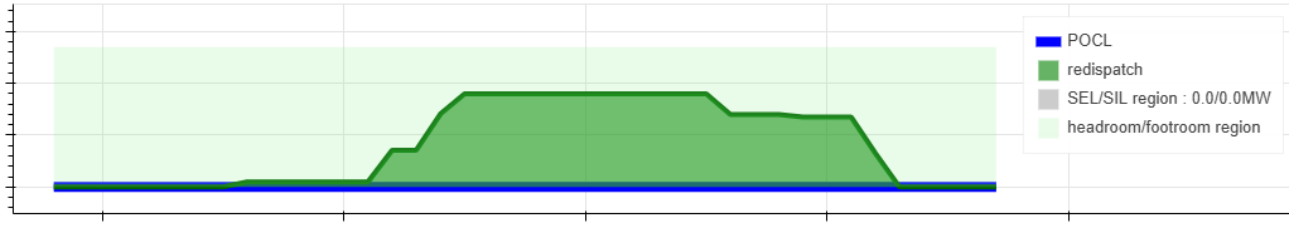
Run #1





Colour	Meaning
	Fully loaded by optimiser and dispatched by ENCC engineer
	Partially loaded by optimiser and dispatched by ENCC engineer
	Declined by ENCC engineer
	Units in merit but not dispatched by optimiser

Unit	Price (£/MWh)	Reason
1	131	-
2	131	-
6	132.9	MNZT greater than optimisation window
7	132.9	-
8	132.9	Other
9	132.9	-
10	132.9	-
11	133	Other
12	133	-
13	133	Other
3	133	Other
14	133	-
4	133	-
5	133	-
15	133.9	-
17	136.9	MNZT greater than optimisation window
16	137	Other
18	137	Other
19	138	Other
21	138.2	-
8 units not included		
29	144.6	-
28 units not included		
44	154	-
83	154.2	-
11 units not included		
83	158.4	-

(2) Merit order of units at a random minute (this can vary even within settlement)

(3) Cheapest units are fully dispatched to meet baseline requirement

(4) Some units are partially dispatched to meet the shape of the requirement

(5) Expensive units are manually declined by ENCC engineers

(6) **Other:** Arriving at a solution that does not achieve the lowest possible cost may result in some units within merit not being included by the optimiser, or those units may have parameters that prevent them from shaping the requirement at the lowest cost (closest to the lower requirement).

Key considerations

...The optimiser yielded a solution that is within 2% of the minimum possible cost

...The solution could potentially be 2% cheaper with more units in merit being included and less partial loadings

... A solution with the lowest cost could still have units in merit that are not included and partial loading

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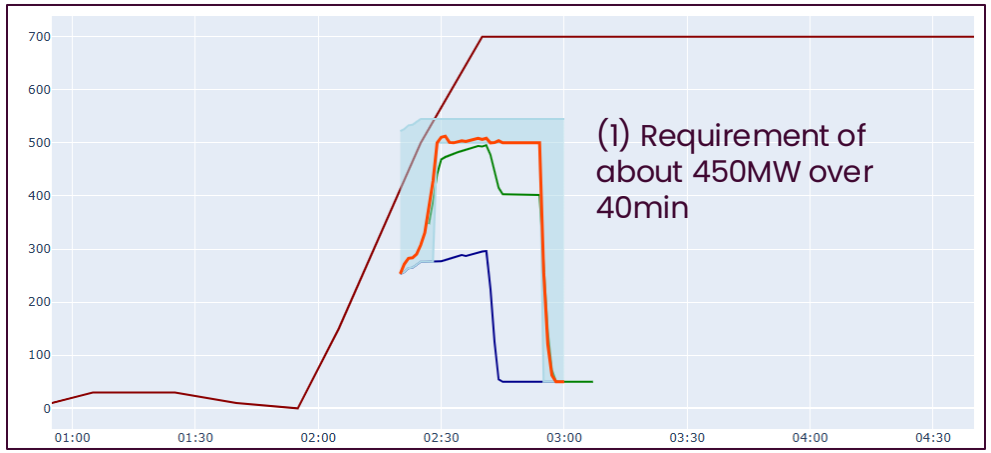
Run #2

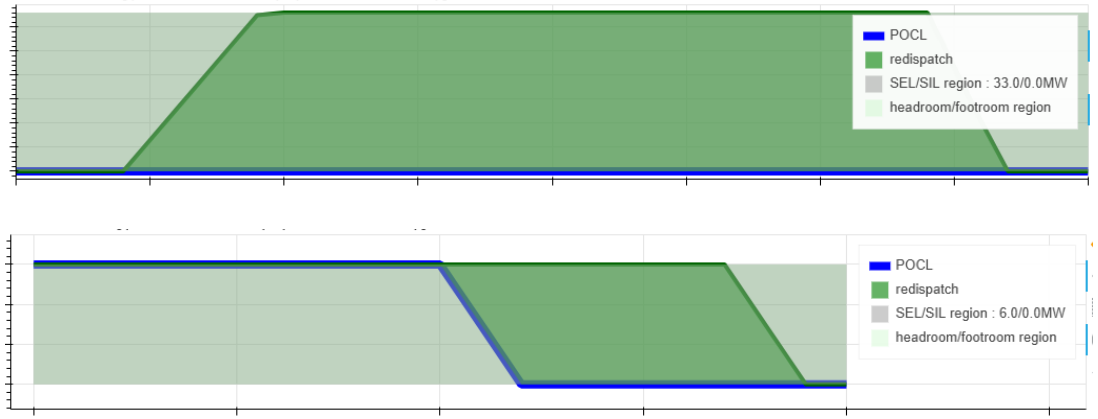
Colour	Meaning
	Fully loaded by optimiser and dispatched by ENCC engineer
	Partially loaded by optimiser and dispatched by ENCC engineer
	Declined by ENCC engineer
	Units in merit but not dispatched by optimiser



(2) Merit order of units at a random minute (this can vary even within settlement)

(3) Unit that was not dispatched in previous run has now been fully dispatched

(4) BOA for cheap units can get extended



...Part 1

Unit	Price (£/MWh)	Reason
5	102.3	Other
1	131	-
2	131	-
6	132.9	Other
7	132.9	-
8	132.9	-
9	132.9	Other
10	132.9	-
11	133	-
12	133	-
13	133	-
3	133	-
14	133	-
4	133	-
5	133	Other
15	133.8	Other
16	136.3	-
17	136.3	MNZT greater than optimisation window
18	136.9	Other
19	138	-
21	138.2	-
20	138.8	-
22	139.3	-
23	139.3	-
24	139.3	Other
25	140.0	Other
26	140.5	-

...Part 2

Unit	Price (£/MWh)	Reason
27	140.8	Other
28	141.4	Other
29	144.6	-
5 units not included		
36	147	-
7 units not included		
43	149.5	-
42	149.7	-
44	150	-
46	150.4	-
47	150.9	-
3 units not included		
51	151	-
52	151.6	-
53	151.7	-
58	152	-
55	152.7	-
54	152.8	-
56	152.8	-
57	153	-
59	153.7	-
6 units not included		
66	156.3	-
67	156.6	-
4 units not included		
72	158.6	-
73	159.5	-

(5) Most expensive units are declined by ENCC engineers

Key considerations

...The optimiser yielded a solution that is within 3% of the minimum possible cost

...The solution could potentially be 3% cheaper with more units in merit being included and less partial loadings

... A solution with the lowest cost could still have units in merit that are not included and partial loading

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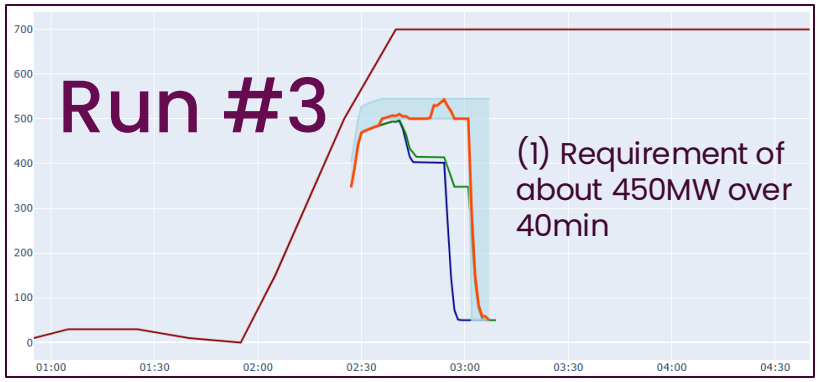
Colour	Meaning
	Fully loaded by optimiser and dispatched by ENCC engineer
	Partially loaded by optimiser and dispatched by ENCC engineer
	Declined by ENCC engineer
	Units in merit but not dispatched by optimiser

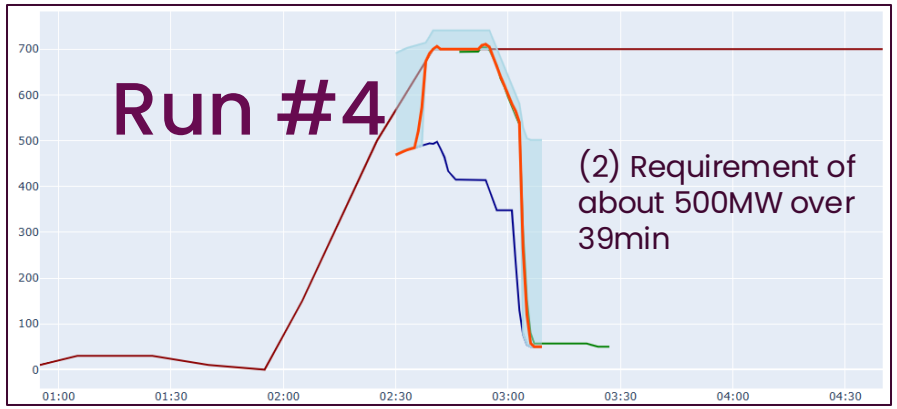


...Part 1

Unit	Price (£/MWh)	Reason
1	131	-
2	131	-
3	132.8	-
4	132.8	-
5	132.8	Other
6	132.9	Other
7	132.9	Other
8	132.9	-
9	132.9	Other
10	132.9	-
11	133	-
12	133	-
13	133	-
14	133	-
15	133.8	Other
16	135.9	-
17	136.0	MNZT greater than optimisation window
18	136.5	Other
19	138	-
20	138.4	-
21	138.9	-
22	139.1	Other
23	139.1	-
24	139.1	Other
25	139.6	Other
26	140.2	Other
27	140.9	-
28	141.05	-

...Part 2

Unit	Price (£/MWh)	Reason
29	144.6	-
6 units not included		
36	147	-
6 units not included		
43	149.5	-
44	149.9	-
45	150.15	-
46	150.4	-
47	150.9	-
3 units not included		
51	151	-
52	151.6	-
53	151.7	-
54	152.25	-
55	152.7	-
56	152.75	-
57	153	-
58	153.25	-
59	153.7	-
6 units not included		
66	156.3	-
67	156.6	-
4 units not included		
72	158.2	-
73	159.5	-
74	162.6	-
3 units not included		
78	181	-



... Part 1

Unit	Price (£/MWh)	Reason
6	132.9	MNZT greater than optimisation window
7	132.9	Other
9	132.9	Other
5	133	Other
15	133.8	Other
17	136.3	MNZT greater than optimisation window
18	136.9	-
21	138.2	-
22	139.3	Other
24	139.3	-
25	140	-
26	140.5	-
27	140.8	-
28	141.4	-
29	144.6	-
30	145.9	-
32	146.9	MNZT greater than optimisation window
33	147	Other
34	147	Other
35	147	Other
36	147	-
6 Units not included		
45	149.4	-
43	149.5	-

... Part 2

Unit	Price (£/MWh)	Reason
42	149.7	-
44	150	-
46	150.4	-
47	150.9	-
48	150.9	-
49	150.9	-
50	150.9	-
51	151	-
52	151.6	-
53	151.7	-
58	152	-
55	152.7	-
54	152.8	-
56	152.8	-
57	153	Other
59	153.7	-
6 units not included		
66	156.3	-
67	156.6	-
4 units not included		
72	158.6	-
73	159.5	-
74	162.6	-

(3) Merit order of units at a random minute (this can vary even within settlement)

Key considerations

... The optimiser yielded a solution that is within 7% of the minimum possible cost for Run #3

... The optimiser yielded a solution that is within 2% of the minimum possible cost for Run #4

...The solutions for both runs could potentially be cheaper with more units in merit being included and less partial loadings

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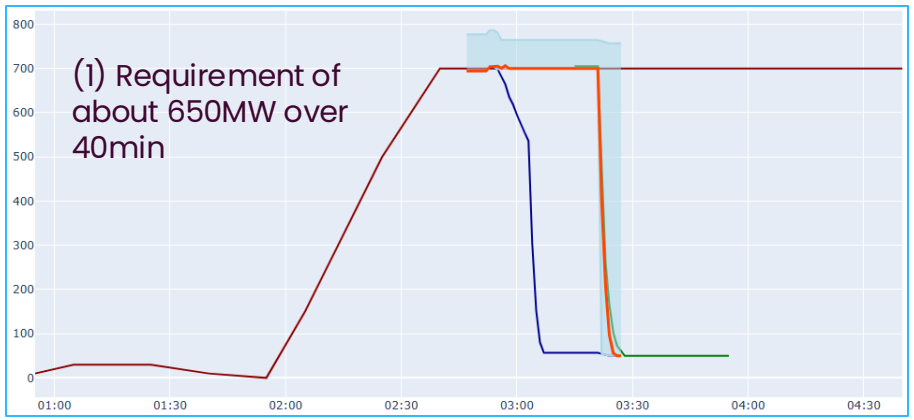
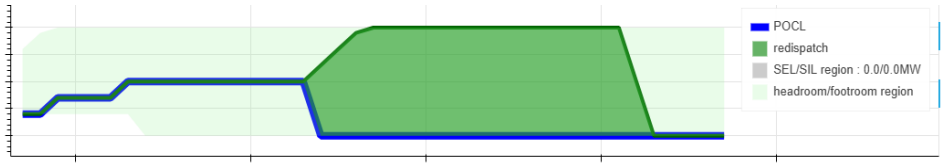
Run #5





Colour	Meaning
	Fully loaded by optimiser and dispatched by ENCC engineer
	Partially loaded by optimiser and dispatched by ENCC engineer
	Declined by ENCC engineer
	Units in merit but not dispatched by optimiser

(2) Merit order of units at a random minute (this can vary even within settlement)

... Part 1

Unit	Price (£/MWh)	Cause of skip
1	131	-
2	131	-
84	132.4	MNZT greater than opt. window
3	132.5	-
4	132.5	-
5	132.5	Other
6	132.9	Other
7	132.9	-
8	132.9	-
9	132.9	-
10	132.9	-
11	133	-
12	133	-
13	133	-
14	133	-
15	133.8	Other
85	133.9	MNZT greater than opt. window
86	134.7	MNZT greater than opt. window
16	135.5	-
18	136.2	-
20	138	-
19	138	-
22	138.9	Other
23	138.9	-
24	138.9	-
25	139.15	Other
21	139.5	-
26	139.85	Other

... Part 2

Unit	Price (£/MWh)	Cause of skip
28	140.7	-
27	141	-
29	144.6	-
30	145.1	-
31	146	-
32	146.9	MNZT greater than opt. window
33	147	Other
34	147	Other
35	147	-
36	147	-
37	147	Other
38	147	Other
39	149	Other
40	149	-
41	149	Other
42	149	-
43	149.5	-
44	149.8	-
46	150.4	-
47	150.9	-
48	150.9	-
45	150.9	-
49	150.9	-
50	150.9	Other
51	151	-
52	151.6	-
53	151.7	-
54	151.7	-

... Part 3

Unit	Price (£/MWh)	Cause of skip
56	152.7	-
55	152.7	-
57	153	-
59	153.7	-
60	154	Other
61	154	Other
62	154.3	Other
64	154.3	Other
58	154.5	-
63	154.9	Other
65	155.7	MNZT greater than opt. window
68	156.2	Other
66	156.3	-
67	156.6	-
69	157.2	Other
72	157.8	-
70	158.5	Other
71	158.5	Other
73	159.5	-
74	162.6	-

Key considerations

...The optimiser returned a solution within 0.2% of the minimum possible cost

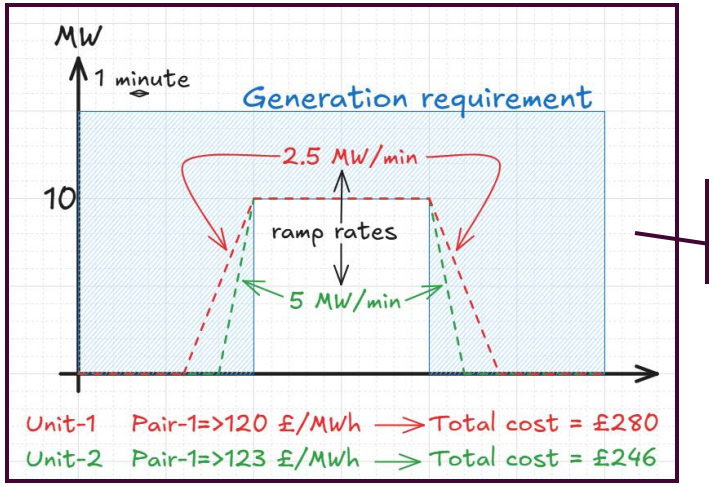
...The solution picked the units that better meet the shape of the requirement at the lowest total cost for the 40 minutes

... Total cost ≠ Price

... Total cost is impacted by price but also by ramp rates, MZT, MNZT and other parameters

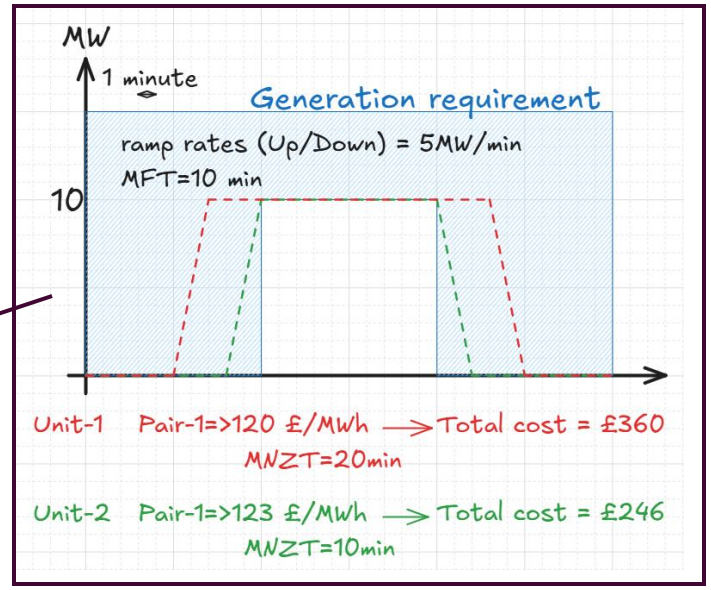
(3) Expensive unit with MZT=MNZT=1 and fast ramp rates is fully dispatched as it allows to meet the shape of the requirement

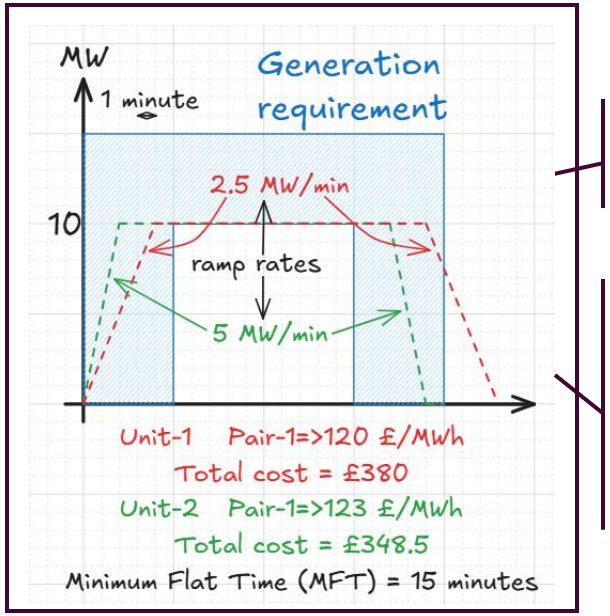
Interaction of Parameters and Shape of Requirement



(1) Optimiser will choose unit with lowest cost even if it has a higher price.

(4) MNZT value might make the unit with the lowest price to have a higher total cost compared to another unit with shorter MNZT





(2) MFT represents a commitment to keep a unit flat for a predefined time

(3) Optimiser would not dispatch the unit with cheaper price as it would not fit in the time length of the generation requirement. It would also have a higher total cost.

Key considerations

… Assume all examples have their Physical Notification (PN) at zero for all units

… In certain circumstances, various parameters can result in the overall cost of a unit with a lower price exceeding that of a unit with a higher price.

… Some units might have parameters that would not allow them to be dispatched within the optimisation window

… There are more interactions of parameters that might cause that the optimiser does not dispatch a unit in merit

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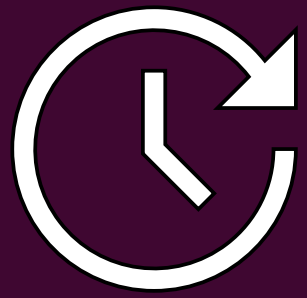
Future Improvements



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Future Steps – Longer Horizons – Exploration Stage

… Several units in merit are not dispatched as a consequence of short requirement length or height

… Longer look ahead could potentially solve this issue

… Current practice is to issue shorter generation requirements due to uncertainty in the forecast

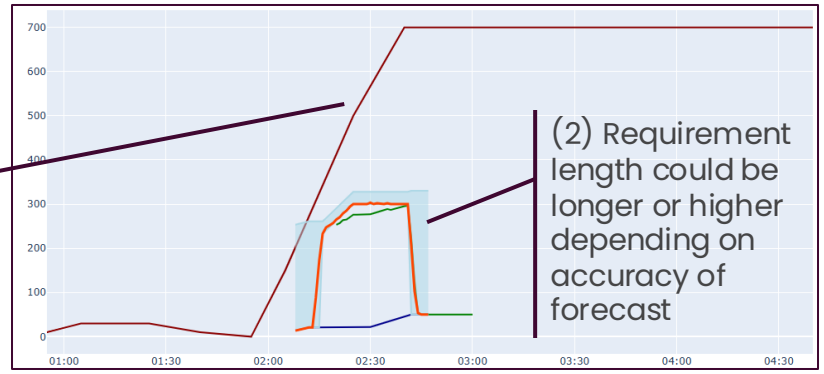
… We are seeking methods to enhance this process based on forecast quality and addressing performance issues related to the optimiser

Key considerations

… Longer optimisation horizons might help with dispatching more units in merit and partial loadings in SMALL BMU zone

… Filtering the optimiser solution to get the minimum instructable profile can help to manage the uncertainty of the forecast for longer optimisation horizons

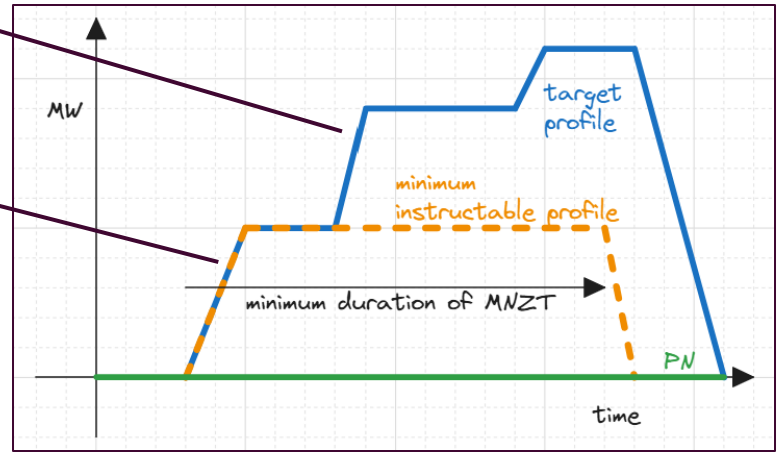
(1) Generation programme can change over time as new forecasts become available



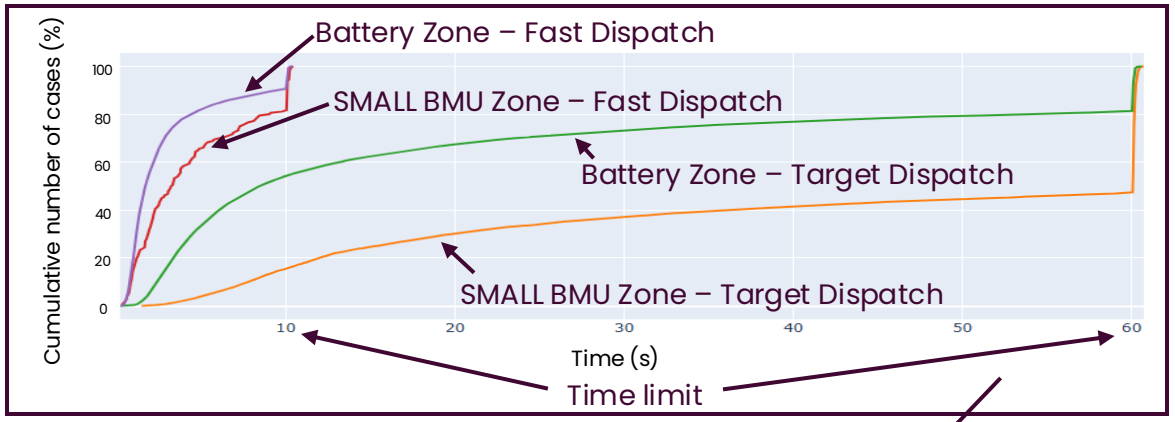
(2) Requirement length could be longer or higher depending on accuracy of forecast

(3) Optimiser can create multiple instructions for the same BMU to meet the shape of the requirement

(4) It might be better to instruct the minimum instructable profile for longer horizons as those instructions would be defined for a forecast that might change depending on the frequency of the system at that moment



Future Steps – Sampling - Exploration Stage

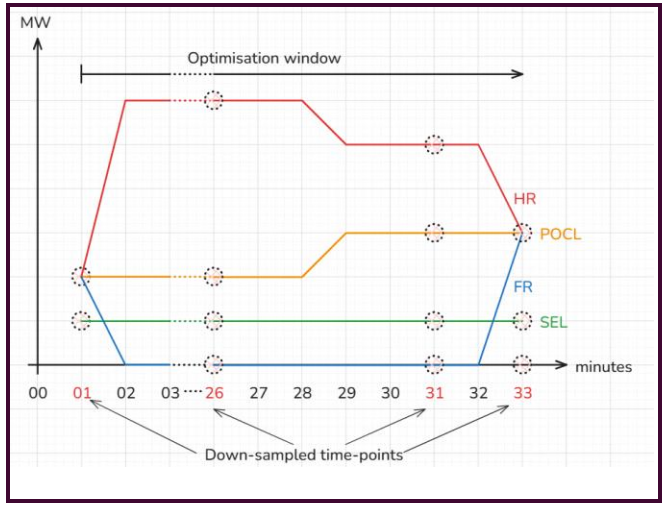


(1) Analysis performed with data from a month of OBP runs

Zone	Dispatch	
	Fast	Target
SMALL	~80%	~50%
Battery	~90%	~80%

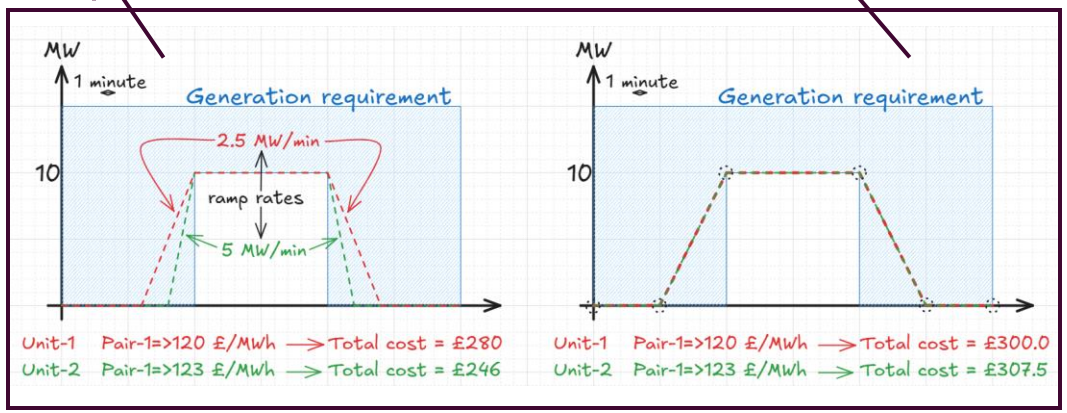
(2) Percentage of cases where OBP return solutions within the minimum possible cost and in the defined time limit

(3) Sampling reduces the number of timepoints from 1-minute granularity to 5-minute granularity



(4) Optimiser will choose unit with lowest cost even if it has a higher price.

(5) With sampling both units will ramp with the same speed and the optimiser will choose the one with lowest price



Key considerations

… Sampling reduces the number of timepoints, then optimises the reduced problem and finally returns the solution to 1-minute granularity

… Improves performance by solving smaller problems

… helps to dispatch more units in merit if they are not included as a consequence of slower ramp rates

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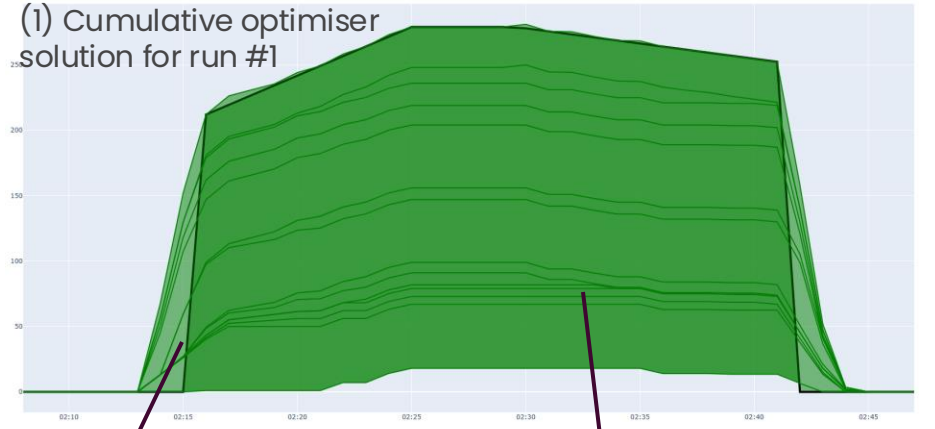
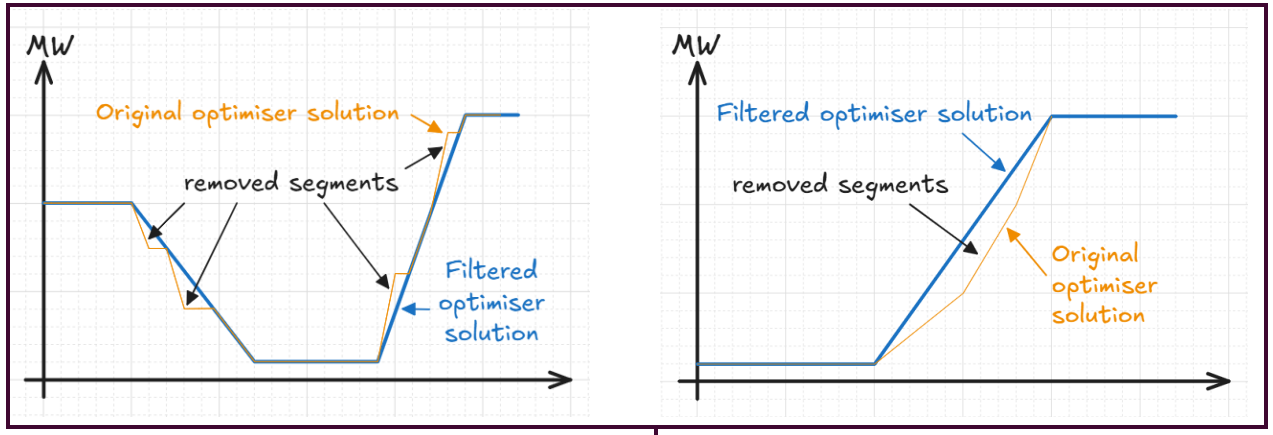
Filtering Instructions and MFT – Recently Deployed to OBP Systems in ENCC





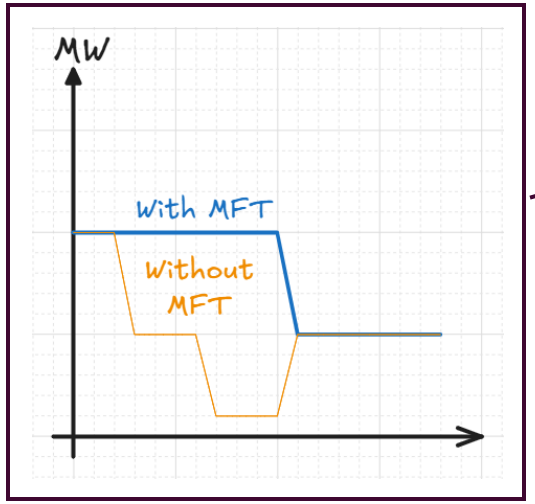
(4) The optimise might try to fit the shape of the requirement by creating small instructions (segments). Those instructions are filtered to return a more uniform set of instructions

Key considerations

... Filtering removes completely instructions that a human operator would not normally dispatch (such instructions might have been seen before as partial loading or come with very small volume)

... MFT reduction improve the ability of the optimiser to dispatch more units in merit

(7) The optimiser was not dispatching some units in merit as a consequence of long MFT values in combination with other parameters. MFT has been recently shortened and more units in merit are dispatched



(6) Optimiser could create many short instructions to best meet the shape of the requirement, but Minimum Flat Time (MFT) prevents this behaviour in most cases

Q&A

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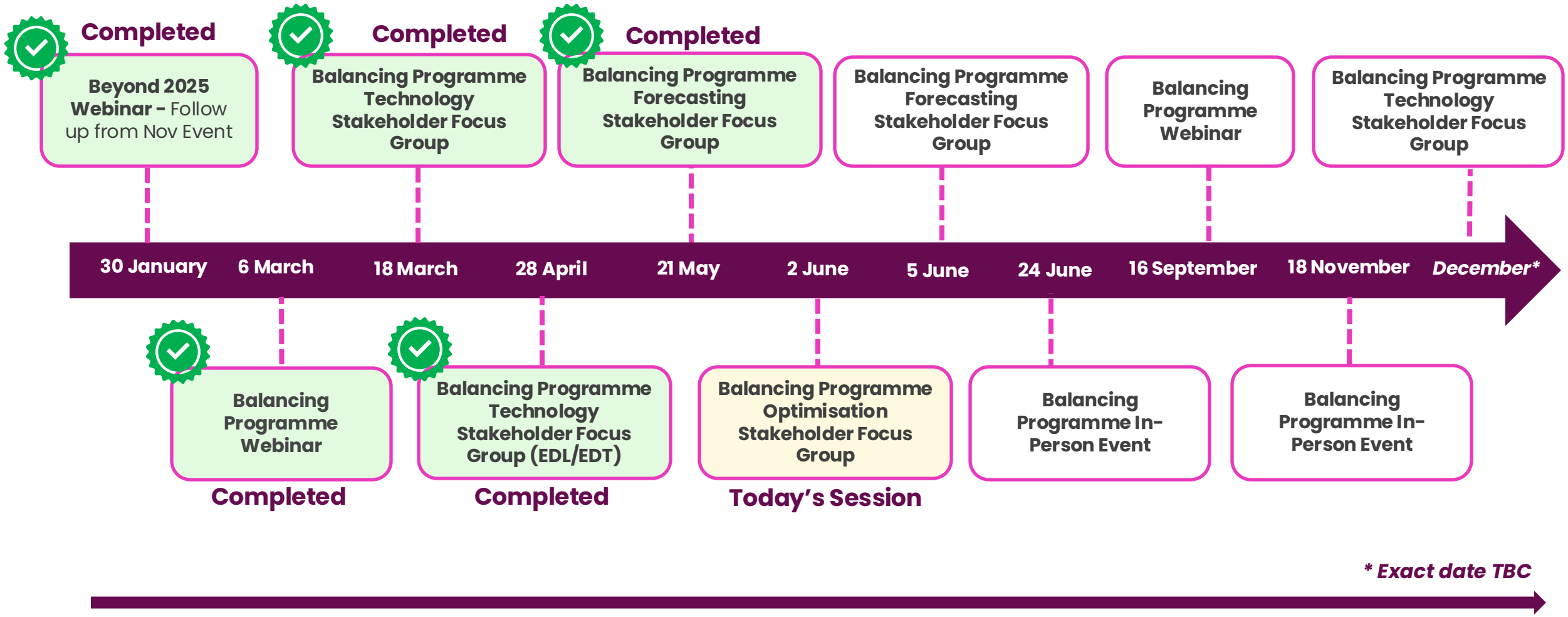
2025 External Engagement Timeline



** Exact date TBC*

Balancing Programme **relationship management meetings** throughout 2025 & **external NESO newsletters 'Energising Progress'** with Balancing Programme content issued regularly, providing updates between online & in-person events. **Further Stakeholder Focus Group dates** to be added throughout 2025.

Closing Remarks . . .

We welcome your feedback & questions – please get in contact with us at **box.balancingprogramme@neso.energy**

The recording and slides from today's session will be published on our website by close of this week.

Our 24 June 2025 in-person Balancing Programme Event has reached capacity – if you would like to attend, please register your interest **here** or scan the QR code, and if spaces become available, we will contact you.

24.06.25 Event

Subscribe to our new NESO newsletter **here** - please select **Future of Balancing Services inc. Balancing Programme** to keep up to date.

Sign-up to our other Stakeholder Focus Groups for Technology & Forecasting - **Balancing Programme Stakeholder Focus Groups.**

If you are interested in a regular meeting with a representative from the Programme and would like more information, please get in contact using the email address above.

NESO National Energy System Operator

Thank you

Optimisation Stakeholder Focus Group

2 June 2025

13:30 – 15:00

Manos Loukarakis, Optimisation Manager

Nicolas Melchor, Optimisation SME

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