Enhancing Energy Storage in the Balancing Mechanism

16th October 2023

ESO

Introductions & Objectives

Objectives for the day

- Achieve a common understanding of the underlying barriers to Storage dispatch
- Introduce an independent review of the current ESO Dispatch Transparency Dataset and obtain feedback for a common solution of what a new dataset should look like and what those metrics are
- Update industry on what market reforms and technology changes the ESO has planned, and is exploring, to enhance the use of storage in balancing – take feedback and agree on next steps
- Agreement from participants on which additional storage parameters can be implemented in the BM and on how to take this forward
- Seek feedback on what trials could help us further develop capabilities and parameters for limited storage assets

Our Plan to Enhance Energy Storage in the Balancing Mechanism

Dispatch Data Transparency

Using independent expert analysis, we will build an enhanced Dispatch Transparency Data Set to provide a deeper understanding of operational actions in the control room and drive improvement opportunities in collaboration with industry – ***December 23*** (analysis and methodology)

Enhanced system and process capabilities

In line with the transition to our new Open Balancing Platform (OBP), we will review and enhance our control room processes and training to enable greater use of Storage assets in our balancing activities – ***December 23***

Enable new Energy Storage parameters

We will facilitate the industry agreement of new parameters to enhance use of storage in the (Balancing Mechanism) BM and will deliver the integration of these in our systems and processes – ***April 24*** (SCADA) and ***December 24*** (EDL/EDT)

Co-create future capability and market solutions

We will work with you to co-create a plan to develop the capability and future market design solutions that will enable efficient dispatch of all assets in the BM - ***Starts today*** (ongoing review with industry)

Event Agenda

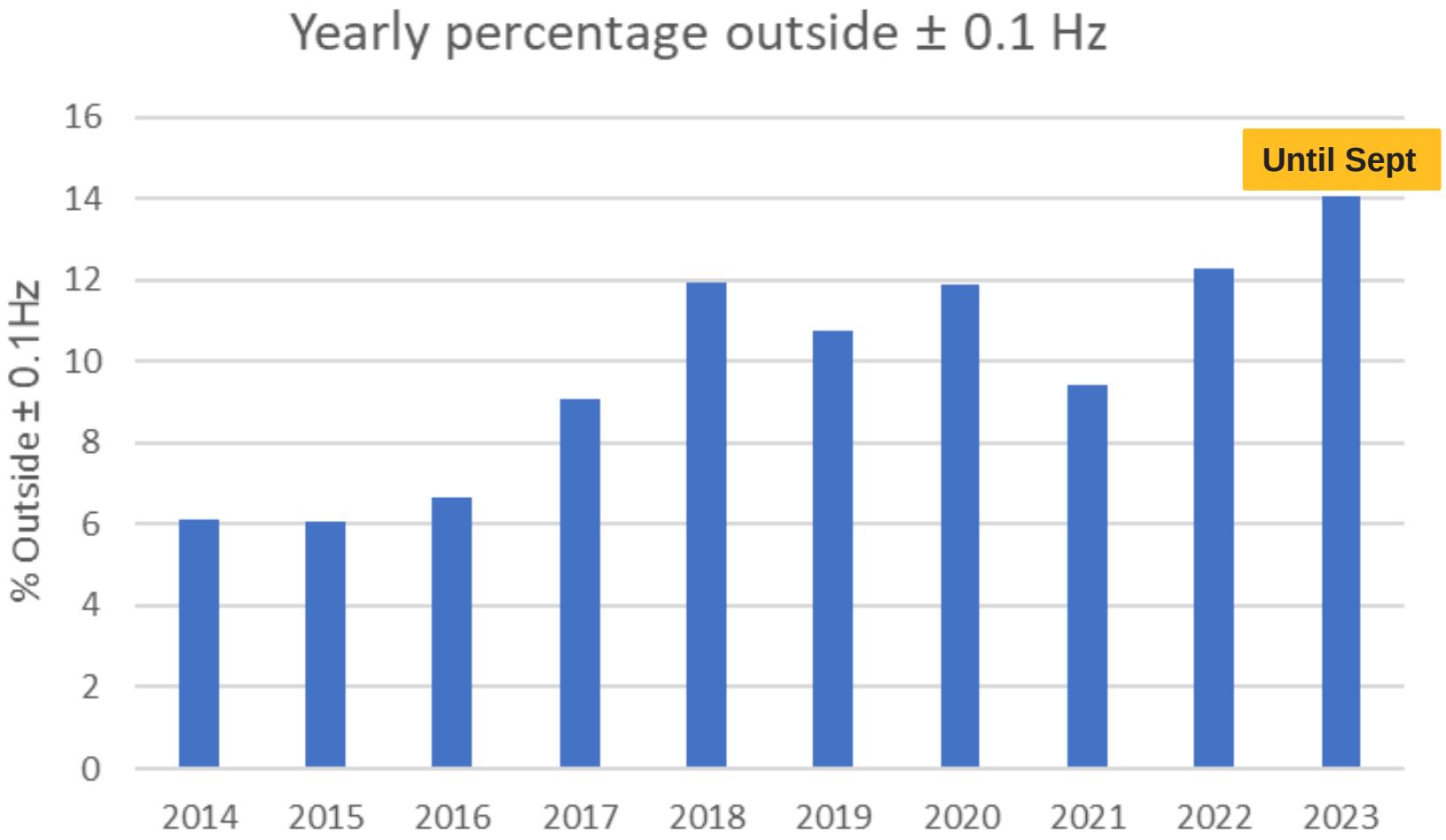
#enablingstorage

Time	Title	Details
09:30 – 10:00	Arrival	Tea and coffee
10:00 – 10:10	Welcome	• Overview of recent Industry feedback • Our Plan to enhance Energy Storage in the BM
10:10 – 10:40	Dispatch in Practice	• Dispatch in Practice
10:40 – 11:30	Data Transparency and Analysis	• LCP independent analysis on the ESO's transparency data
11:30 – 12:10	ESO Workstreams to enhance Energy Storage in the Balancing Mechanism	• Balancing Programme update on key deliverables and examples of improvements • Market Reforms that will improve dispatch in the BM
12:10 – 12:25	BM Redeclarations	• Highlighting the need for changes required to MEL/MIL redeclarations
12:25 – 13:15	Lunch	
13:15 – 16:00	**Breakout sessions** Breakout 1 (13:15 – 14:00) Breakout 2 (14:05 – 14:50) **BREAK 14:50 -15:00** Breakout 3 (15:00 -15:45) Playback (15:45 -16:00)	• ESO capability to schedule & dispatch limited duration assets – Storage parameters • ESO Roadmap & Trials • LCP Independent Insights & Analysis – deep dive • *Return to main room* for breakout session playback
16:00 – 16:30	Q and A	• Slido/Open floor
16:30 – 16:45	Close	• Next steps

Dispatch in Practice

Key Points – Volatility

- Volatility is increasing and requires more flexibility



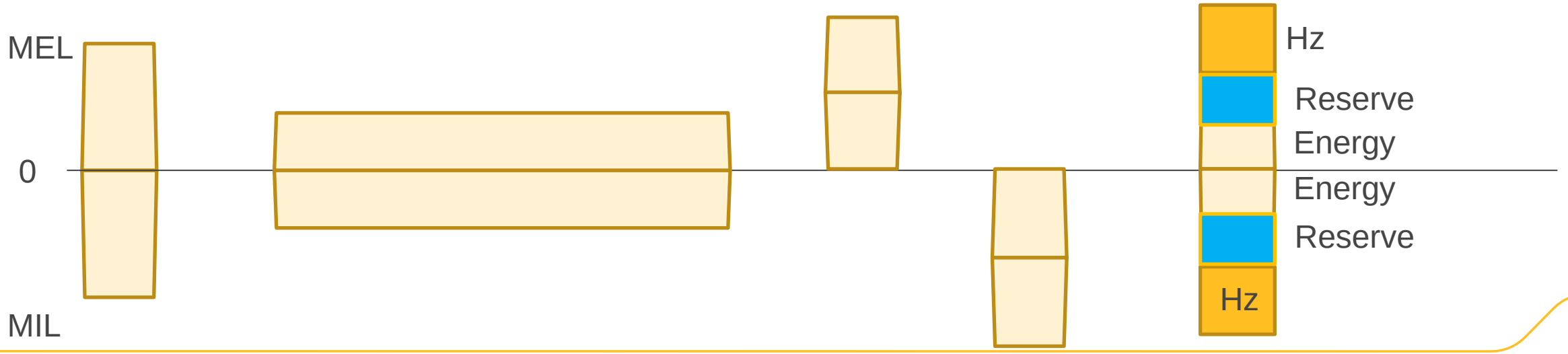
Key Points – Capability

To maximise the use of available flexible assets

1- the ESO need to know what capacity is available in both directions during the scheduling process to offset more expensive actions, like synchronising Plant or Trading on Interconnectors.

2- have bulk instruction capability to ensure zonal, number of units and workload is not a reason for “skips”

Ideally we will create both these capabilities to unlock the full potential of Batteries



Key Points - Process

- The National Balancing Engineer , who controls the system Frequency and sets the targets for all the Zones, also dispatches the Battery and Hydro zone.
- The Zonal Balancing Engineers dispatch the remaining Zones. The target for all Zones are set by the National Balancing Engineer.
- This is to ensure these fast moving resources are used optimally during all three ESO stages:
  - Scheduling
  - Energy Imbalance Correction
  - Fast Frequency Correction
- We have trialled all combinations. It is most optimal to have the NBE dispatch the fastest moving assets in response to an instant change in Frequency where the alternative can only be for the NBE to set a new target for a ZBE.

ESO Dispatch Walkthrough

To fully understand why and how Batteries are dispatched, I will explain how the overall control room process works. The end result of the entire process is Dispatch of all assets including Batteries.

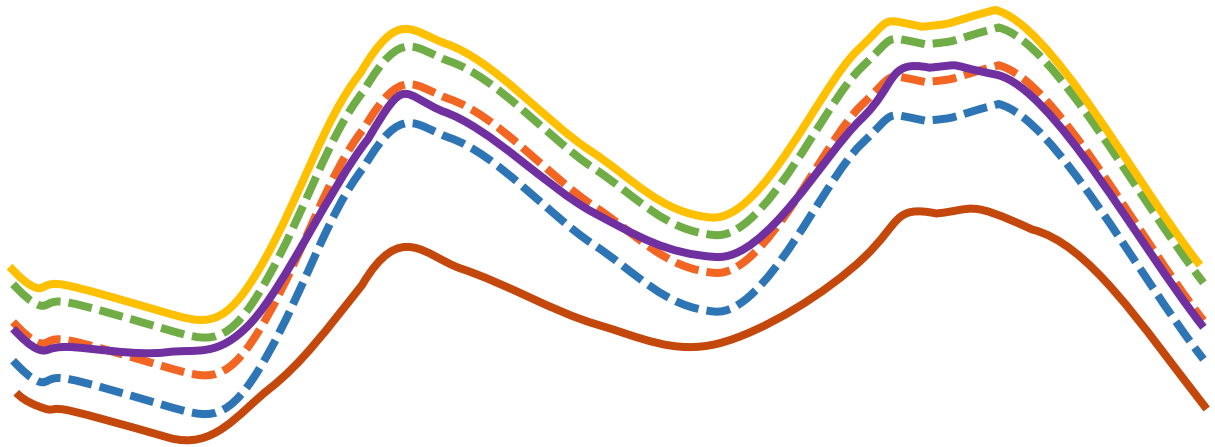
- We have two control rooms with 26 people split into three teams. Transmission, Strategy and Energy.
- Transmission Team calculate transmission constraints. 0 to 32 hours rolling.
- Strategy Team overlay the market options onto the constrained transmission network, to meet all requirements. 30 min granularity. 0 to 32 hours rolling. (We now have a System Operating Plan, with all requirements met.)
- Energy Team improves the granularity of scheduling by rescheduling the zero to 12 hour period. In 5 min granularity. Every 5 mins. Energy Team then Dispatch all Zones, updated every second.

Scheduling

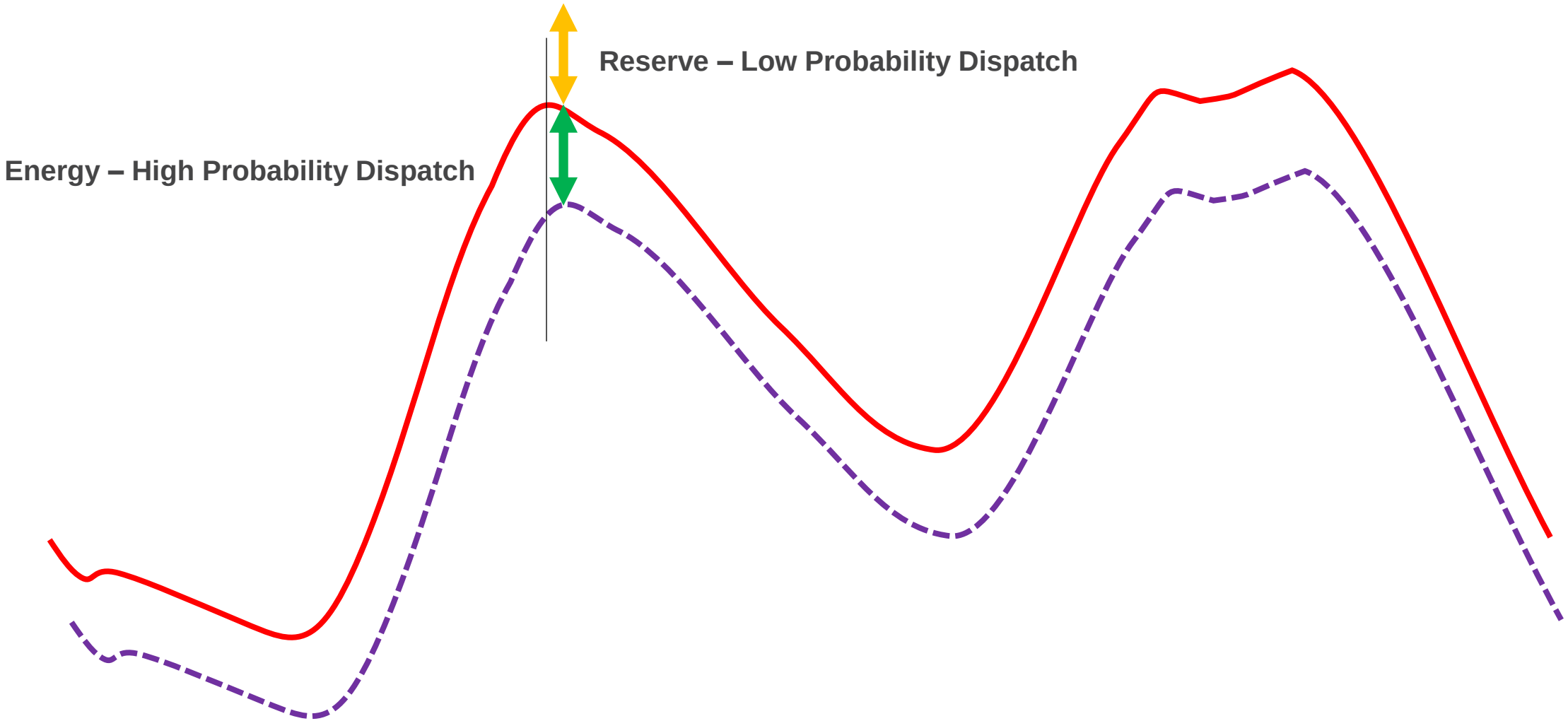
Expected Maximum
Total maximum output for scheduled BMUs, after adjustments

Expected Operating Level
Total scheduled BMU PNs and additional BMUs at SEL, after adjustments

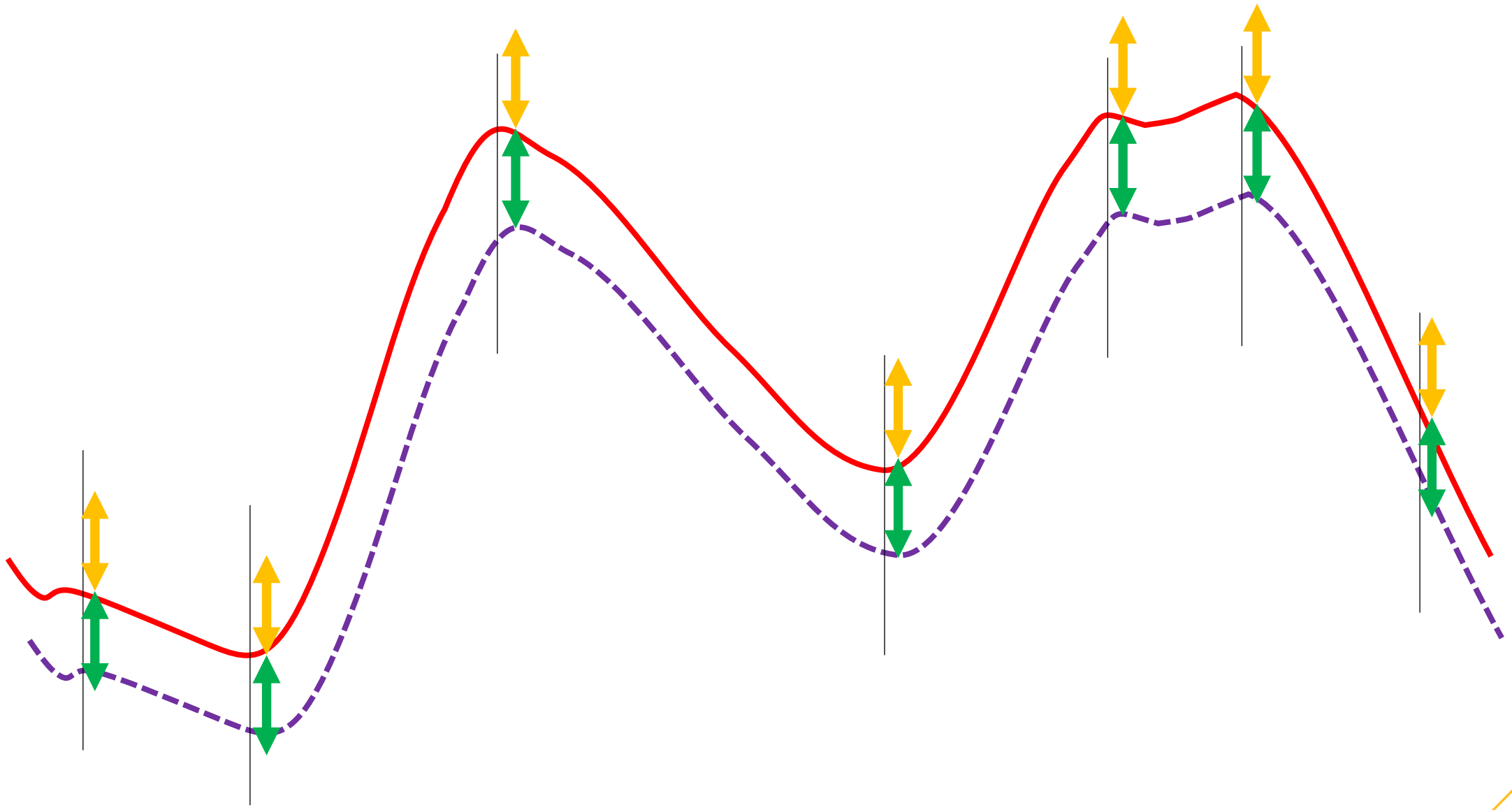
Expected Minimum
Total minimum output for scheduled BMUs, after adjustments



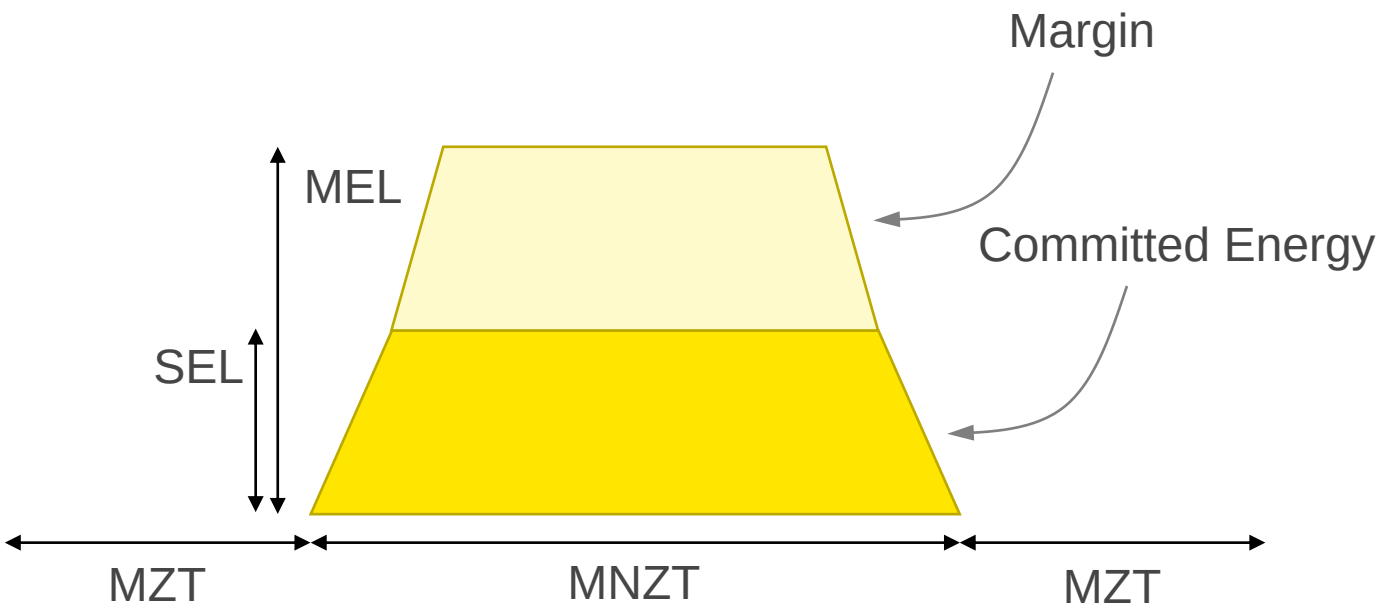
Scheduling

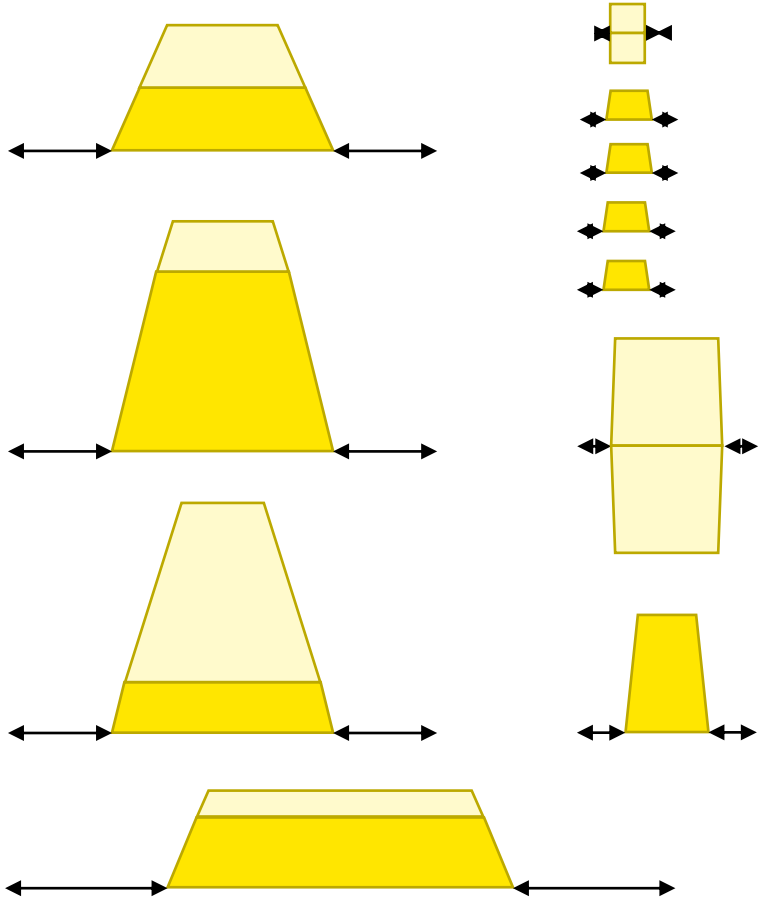

Reserve – Low Probability Dispatch
Energy – High Probability Dispatch

Scheduling



Scheduling – Energy and margin

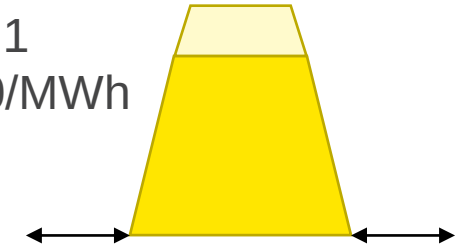


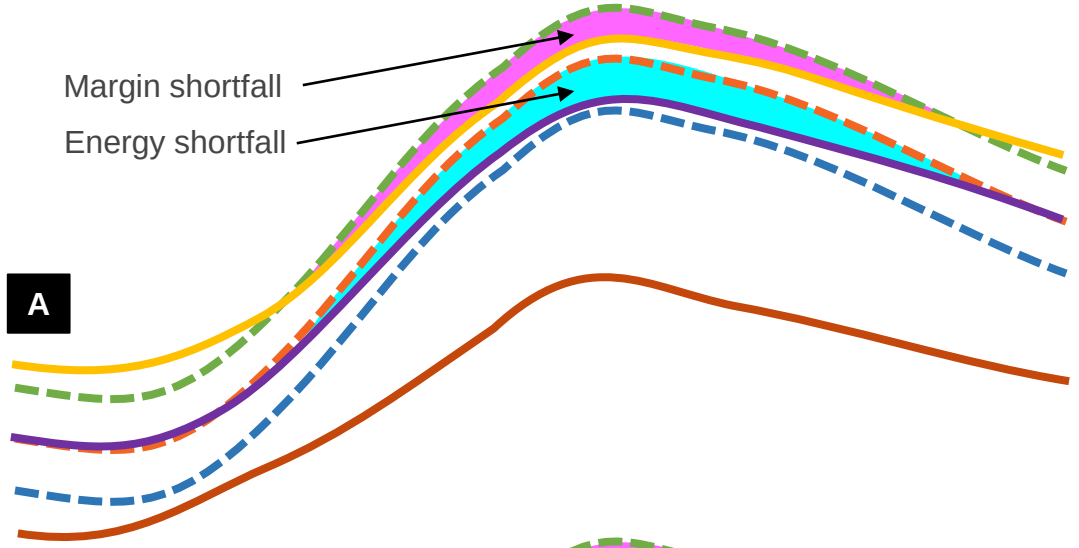


Scheduling – Energy and margin

Positive Reserve Requirement
Demand
Negative Reserve Requirement

Gen 1
£120/MWh



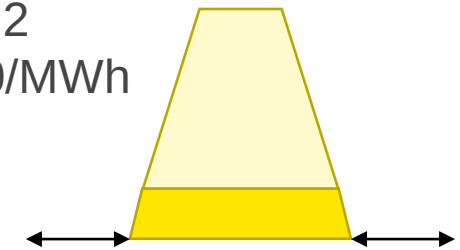


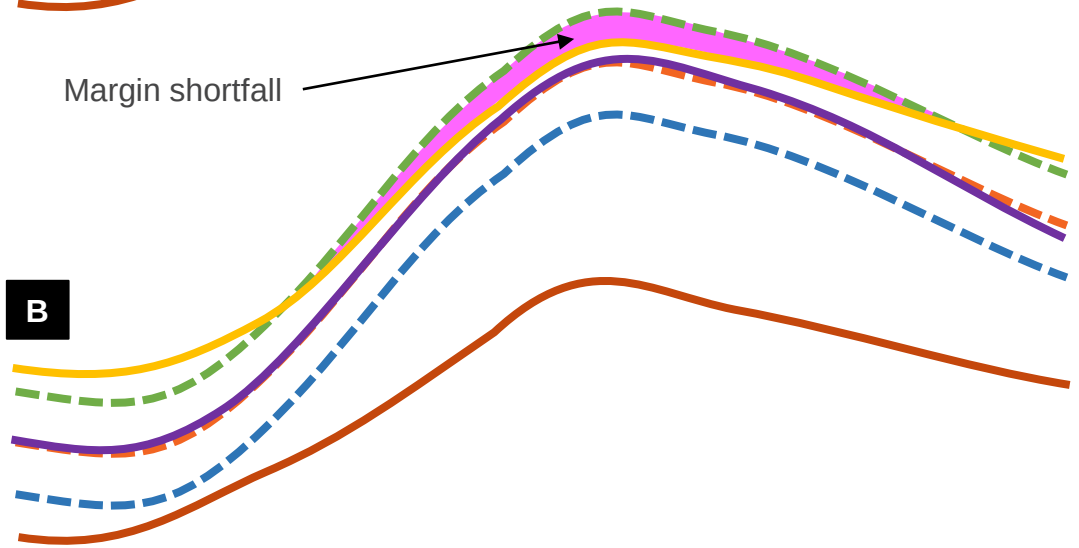
Day A
Market short vs demand forecast and additional positive margin required

Target – lowest energy price

Schedule Gen 1

Gen 2
£150/MWh



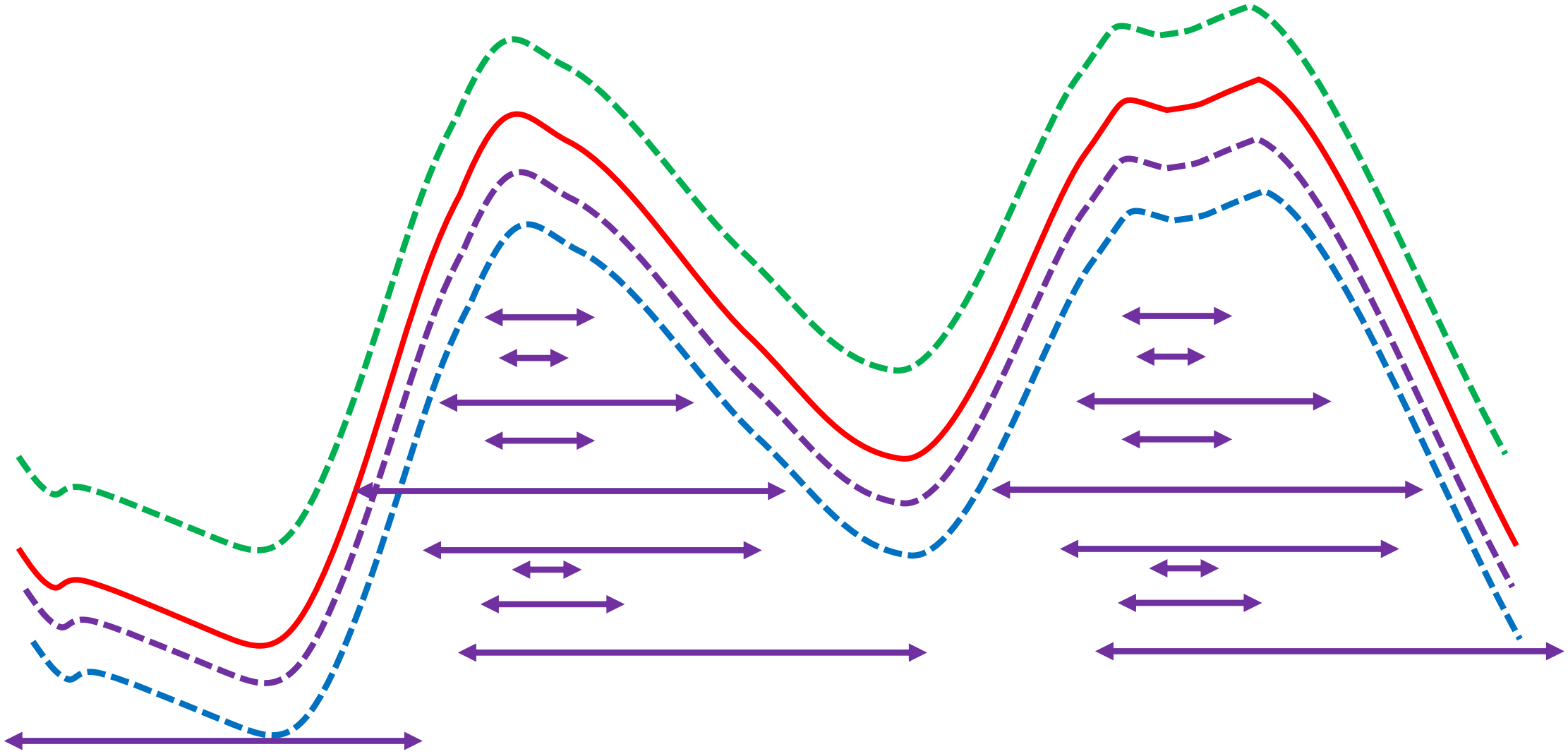


Day B
Market satisfying demand forecast but additional positive margin required

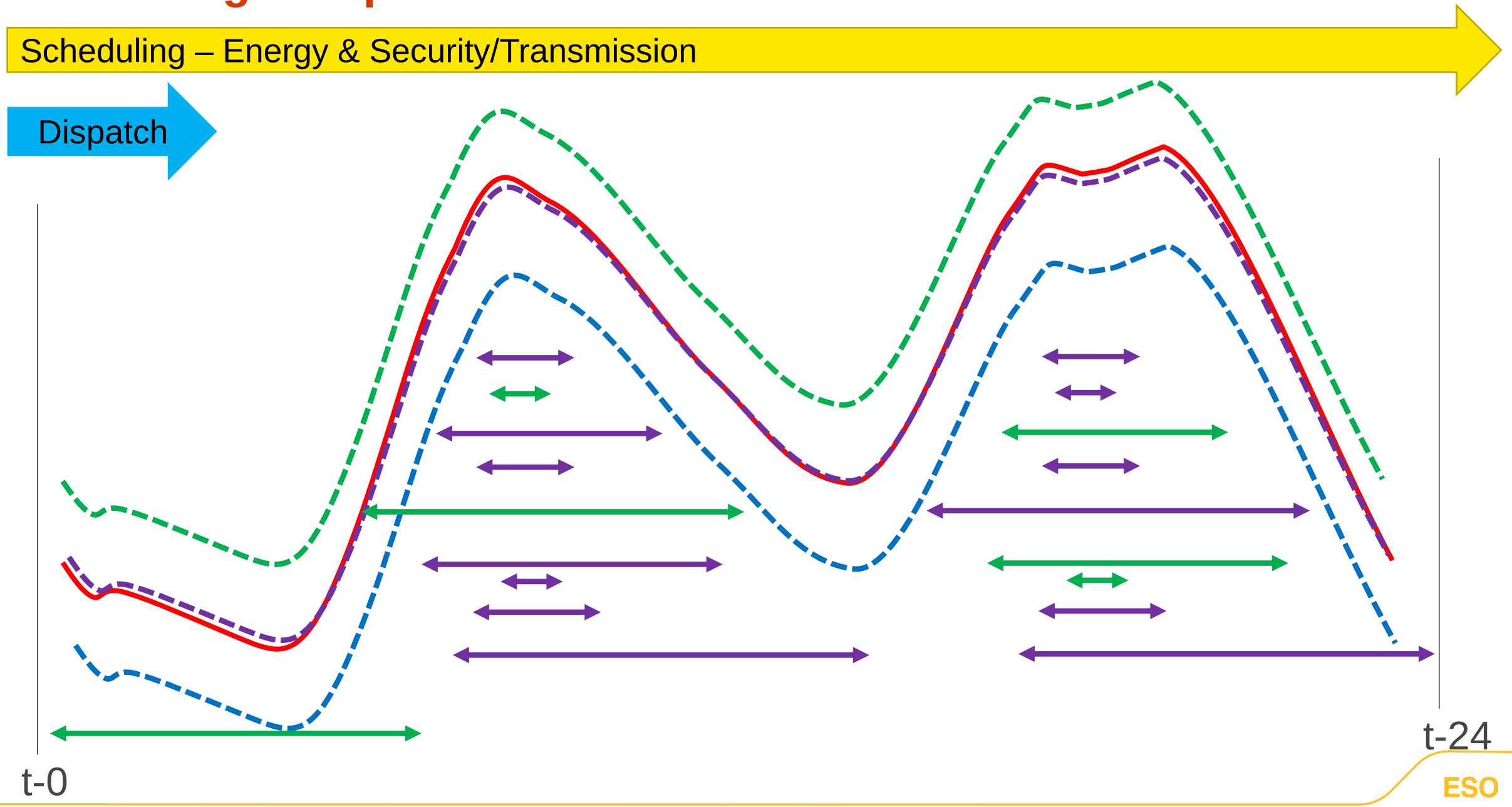
Target – lowest committed cost

Schedule Gen 2

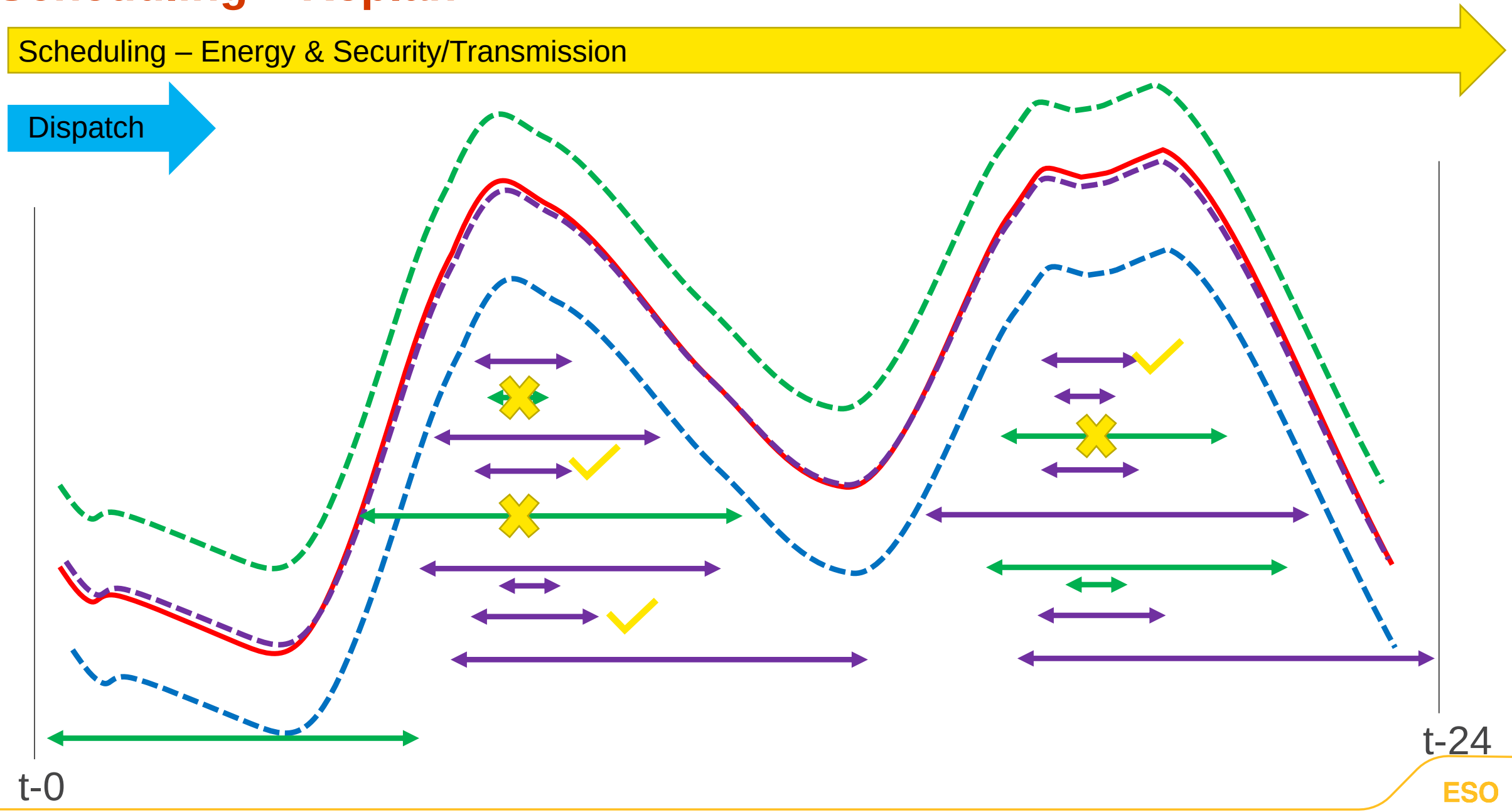
Scheduling – Replan



Scheduling – Replan



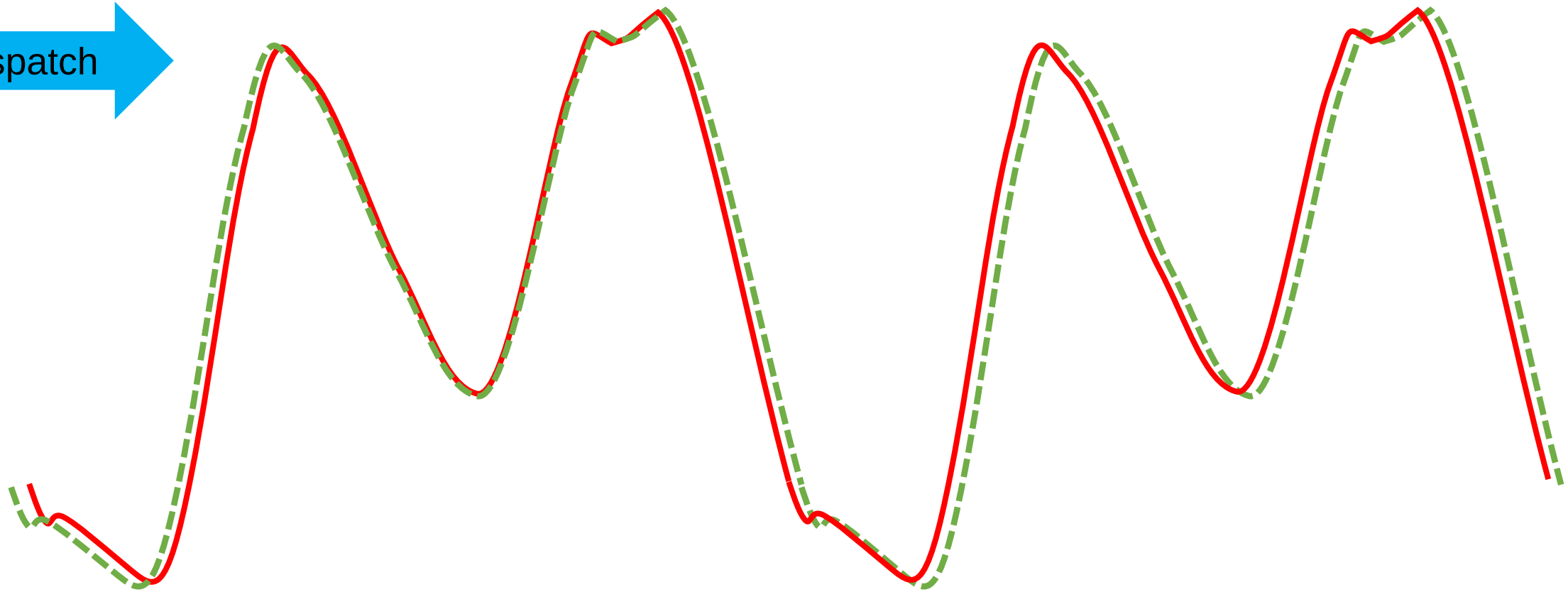
Scheduling – Replan



Scheduling

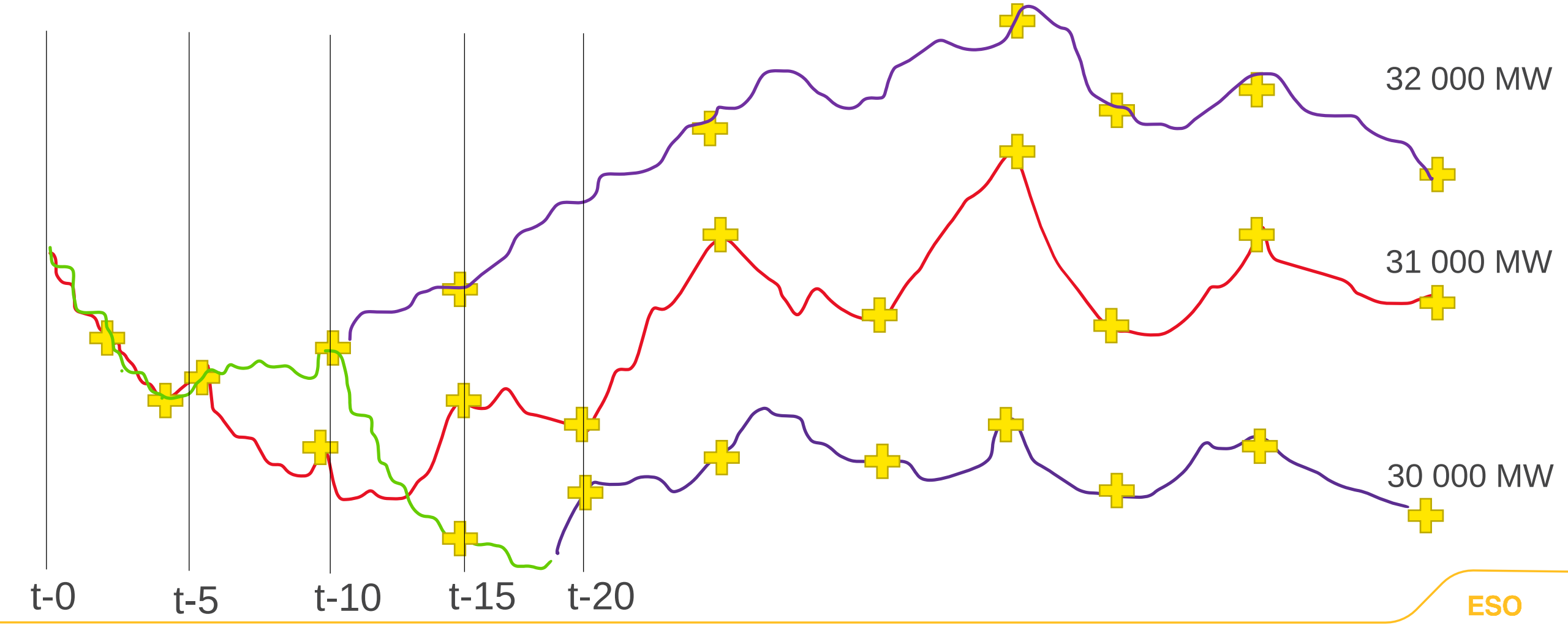
Scheduling 30min granularity, updated as data changes

Dispatch

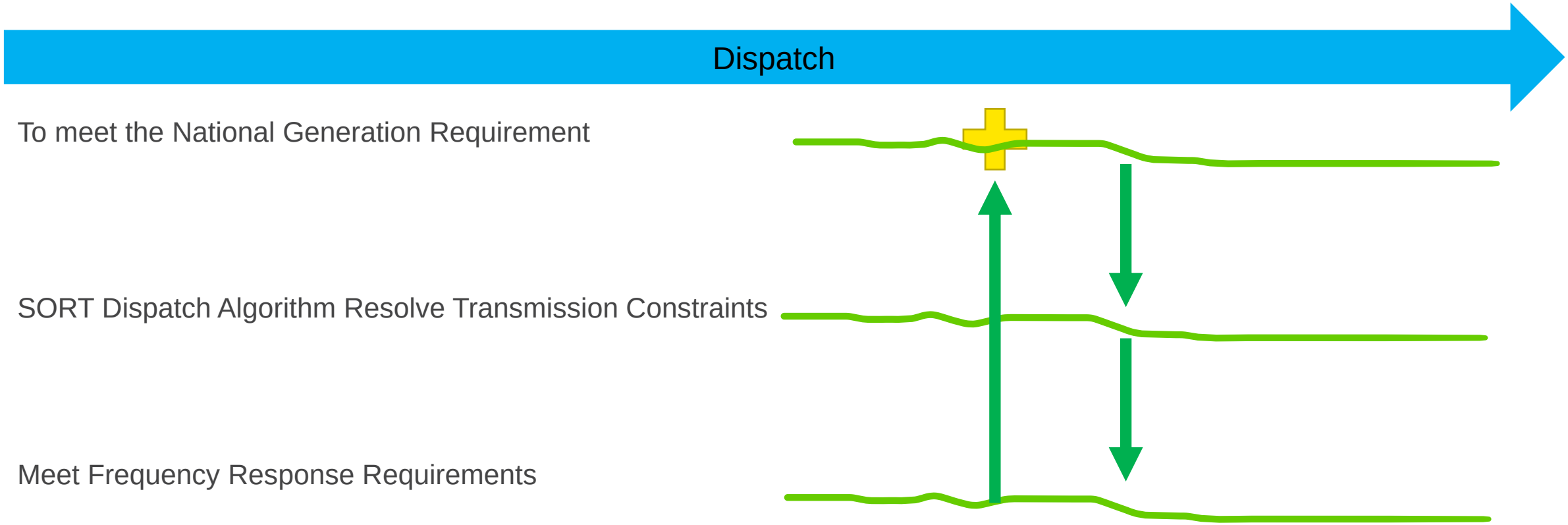


Dispatch

Dispatch is a rolling 60 to 90 min period



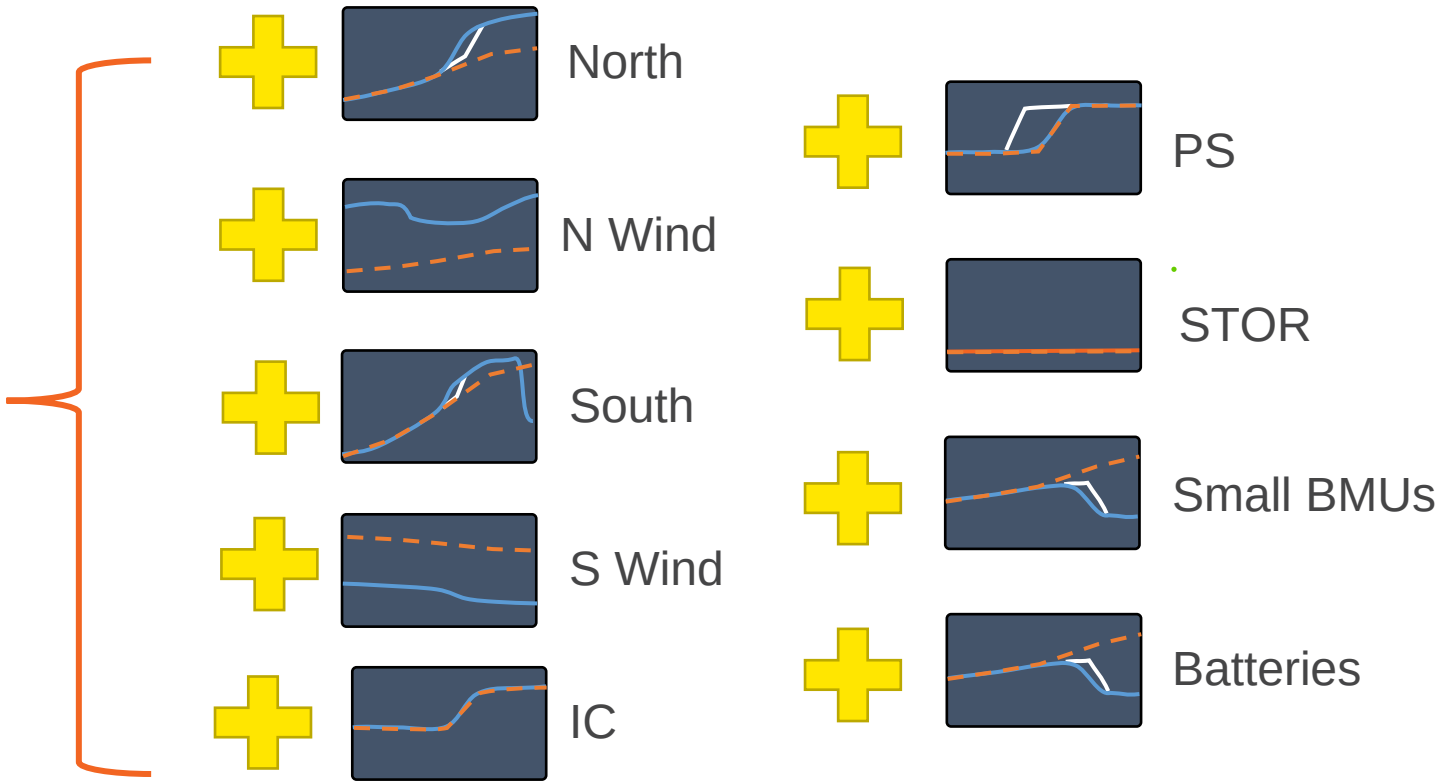
Dispatch


Dispatch
To meet the National Generation Requirement
SORT Dispatch Algorithm Resolve Transmission Constraints
Meet Frequency Response Requirements
Meet Energy Balance Requirement

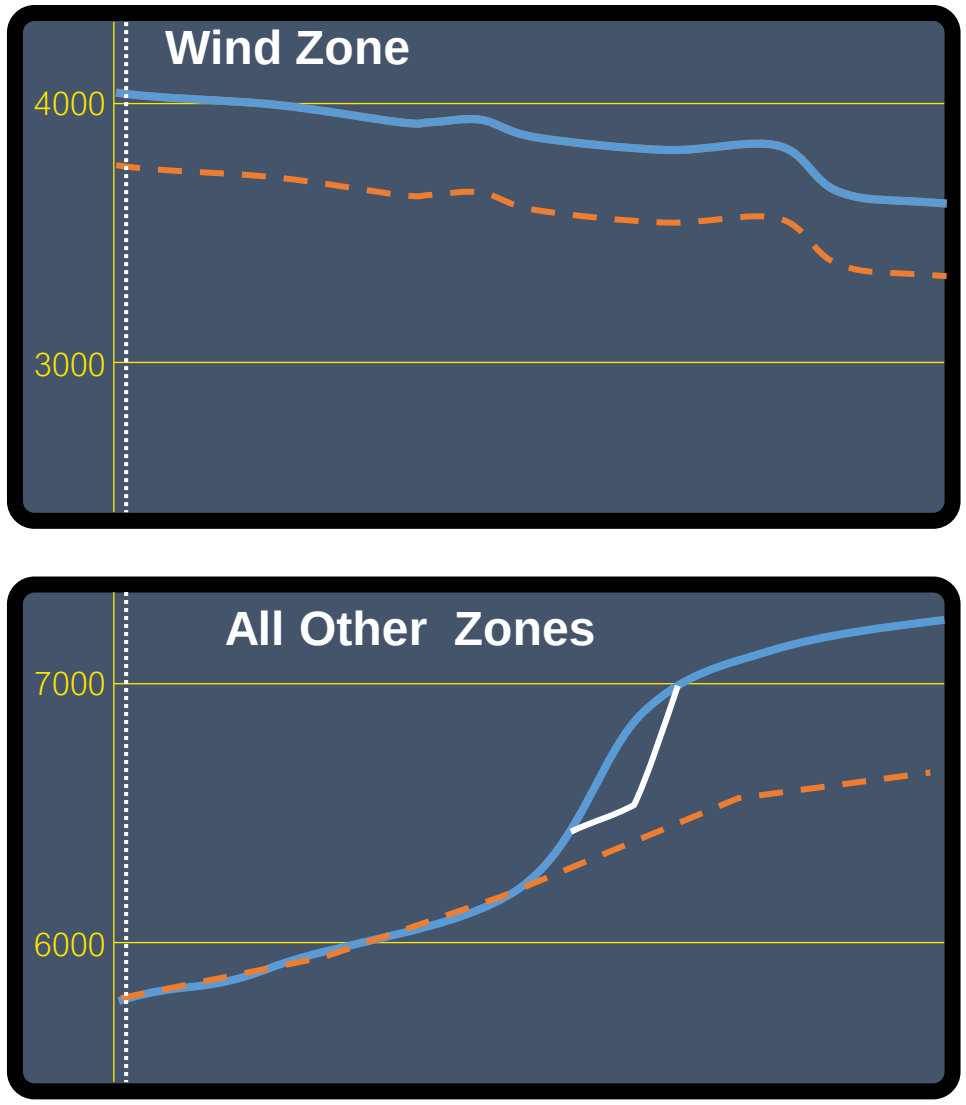
Dispatch

Dispatch

The National Target is the Sum of All the Zones



Energy Balancing



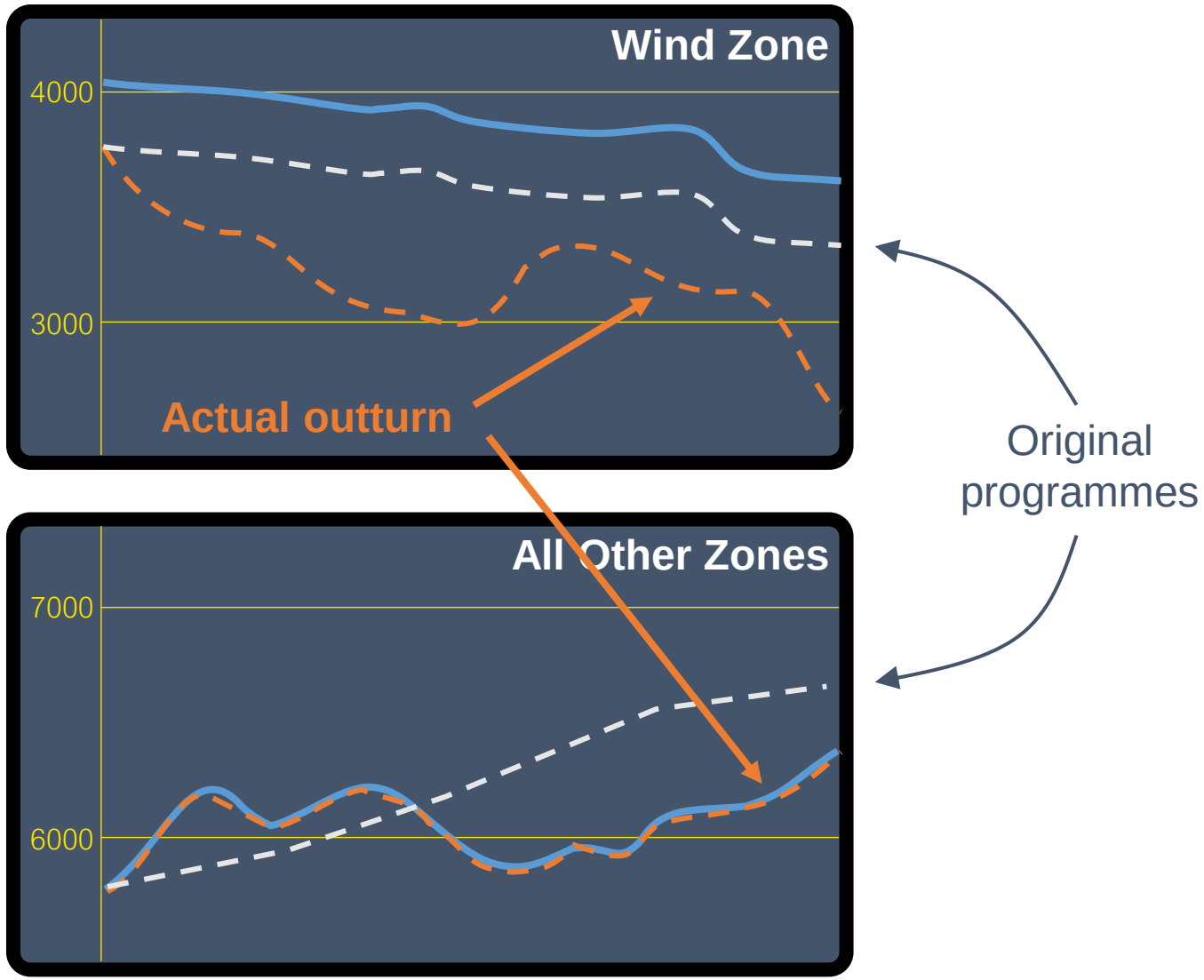
Zone Target – instruction from National Balancing Engineer to Zonal Balancing Engineer (ZBE)

Capped Committed Level (CCL) = FPN + BOAs, capped by MEL

ZBE sends BOAs so that CCL matches zone programme

CCL Zone Prog

Energy Balancing



No BOAs required in wind zone so CCL remains equal to FPN

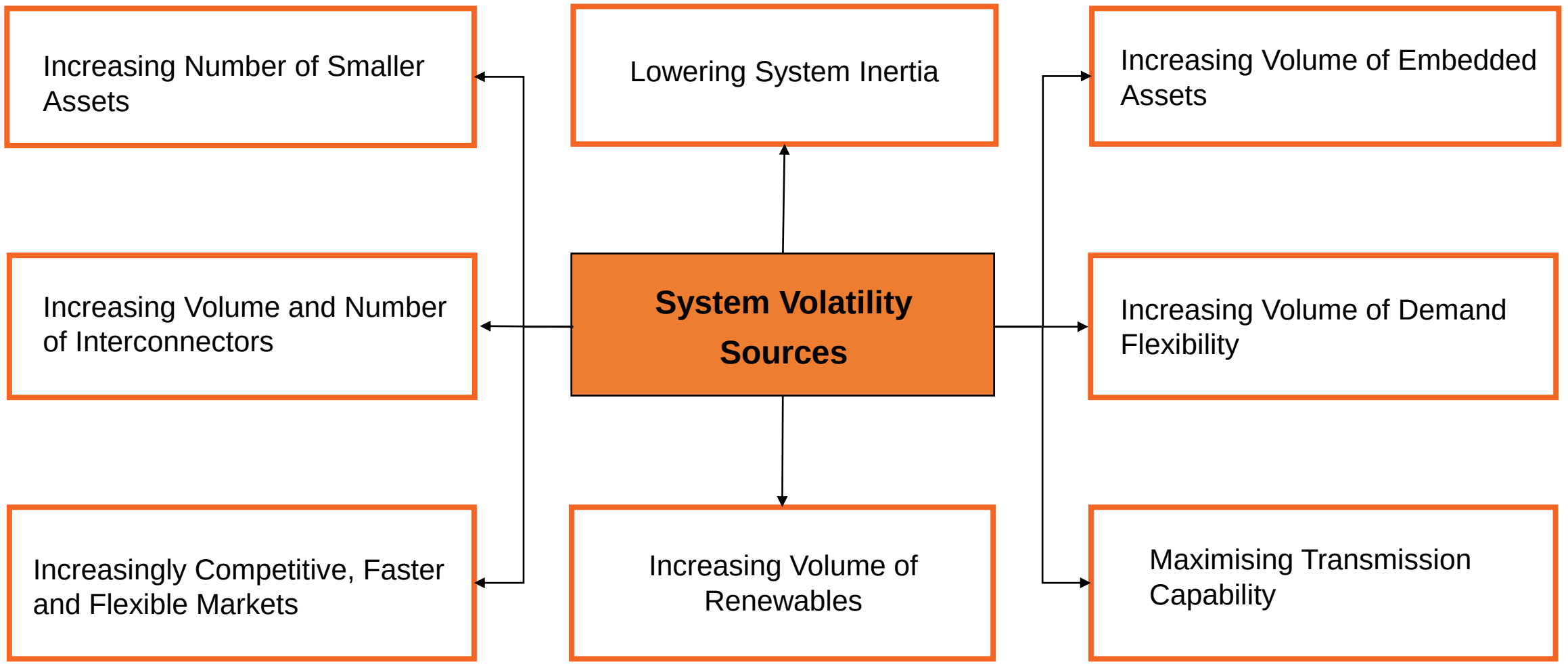
Wind programme updated to match real-time metering +/- projected change

Other Zones programme updated to compensate

BOAs issued on other units to meet new programme, with the risk of having to unwind prior instructions

CCL Zone Prog

System Volatility Sources



In summary

To maximise the use of flexibility we can improve in two areas

Capability

- **New Storage Parameters** can enable the ESO to use the capacity from Flexible Assets by providing the visibility required during Scheduling and Dispatch.
- **Bulk Dispatch** will enable quicker dispatch of multiple units which gives the NBE more options under times of high volatility and workload.

Process

- **NBE controls zones (including the Battery Zone)** allows Fast Frequency correction which allows more opportunities to be dispatched.

Most common reasons why a battery unit is skipped?

1

The National Balancing Engineer changes a zonal target when a different zone would have been more economic. So the ZBE will instruct in merit in that zone, but out of merit nationally, to meet the zonal target.

Reason: Dispatch Optimiser runs every 5 minutes and system conditions changed faster. Human error or workload too high to manually calculate most economic Zonal Management

Solution: Bulk Dispatch / Fast Dispatch and Storage Parameters will reduce workload. This will free up time to manually calculate next best options between the 5 minute SORT Dispatch Optimiser Runs

2

The National Balancing Engineer could not send enough instructions fast enough to meet the new Battery Zone Target.

Reason: Dispatch capability is slow. Even though Vergil is an improvement and can create BOAs much faster.

Solution: Bulk Dispatch should eliminate this reason in most conditions.

3

The capacity of Batteries were not taken into account when long notice Scheduling commitments were made. This results in more restrictions such as MNZT and SEL within Dispatch.

Reason: The ESO cannot calculate capacity on Batteries at lead times greater than 15 minutes currently.

Solution: Storage Parameters to enable future Scheduling to be more accurate.

LCPDelta

BM Dispatch Transparency Analysis

National Grid ESO

OCTOBER 2023

Introduction and Background

Introduction to the project

Balancing Mechanism (BM) Dispatch Transparency Analysis

The ESO engaged LCP Delta to independently assess BM dispatch transparency and dispatch efficiency.

We have split this work into two phases. This will include independent quantitative analysis and a qualitative workstream that includes stakeholder engagement.

Project Scope

Phase 1 – approach and methodology introduced today

- Stakeholder engagement – gathering feedback on BM dispatch decisions
- BM dispatch efficiency analysis
  - Independent, technology neutral, analysis covering past 12 months.
  - Identifying “in-merit” BM bids & offers that were not accepted.
  - Categorise these based on ESO’s dispatch transparency reasons and parameters that will restrict unit’s dispatch.
  - Identify specific days for further analysis.

Phase 2 – due November 2023

- Finalised BM dispatch efficiency analysis.
- Further detailed analysis – focusing on of a set of days identified in Phase 1.
- Stakeholder engagement – final findings.
- Report on and address the information asymmetry between industry and the ESO.
- Review the suitability of the Dispatch Transparency data and the current reason codes.
- Understand the impact that upcoming changes to the BM and the ESO’s dispatch processes/rules may have.
- Where appropriate, make recommendations to the ESO to improve dispatch efficiency and/or transparency on dispatch decisions.

The Balancing Mechanism

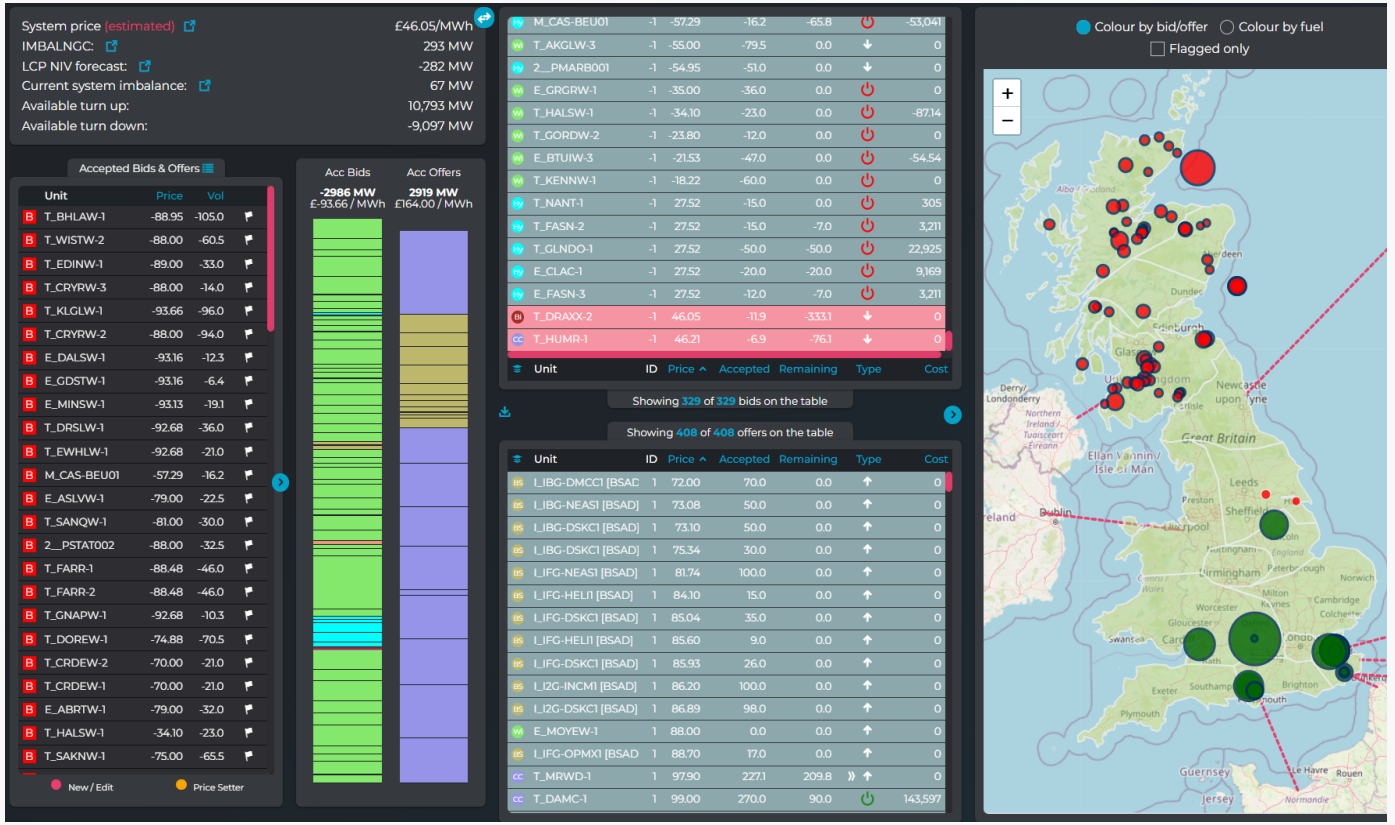
Balancing Mechanism (BM) Dispatch Transparency Analysis

What is the Balancing Mechanism (BM)?

- The BM is the ESO's primary tool for balancing supply and demand, as well as managing system needs in real time
- It becomes active post-gate closure (1hr before the start of each settlement period)

How does the BM work?

- Each BM Unit (BMU) submits Bid Offer Pairs for each settlement period (up to 5). Each pairs consists of the prices that the BMU is willing to incrementally increase (offer) or decrease (bid) their power output (or consumption) for a certain tranche of volume.
- If the BM were a simple energy market with infinitely flexible units, Bids and Offers would be accepted in merit order – taking the most cost-effective action first.
- However, the BM solves a multitude of energy and system needs, with constraints on the flexibility of units as well as their ability to meet certain system needs.

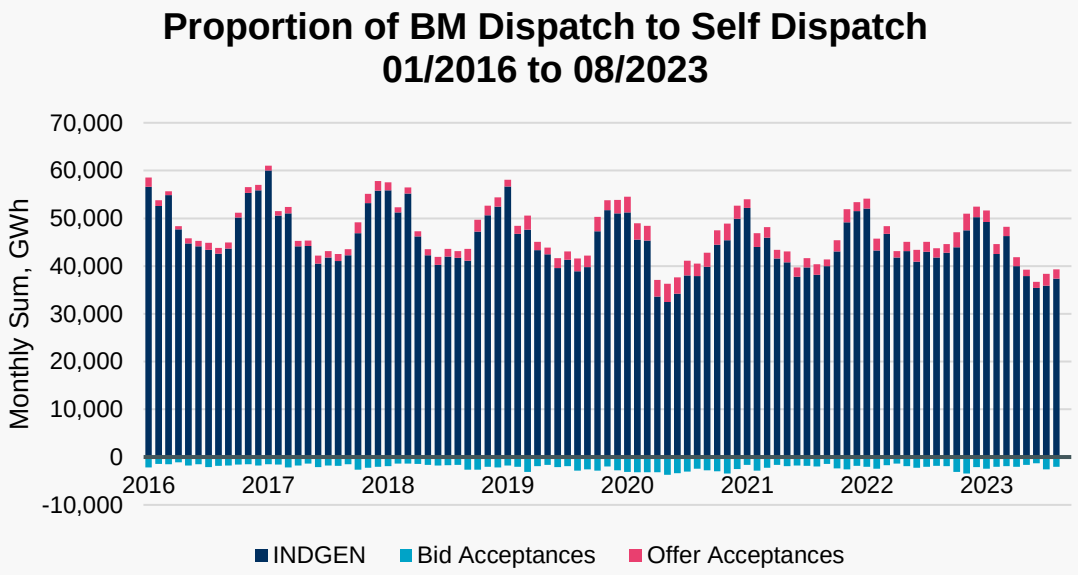


BM Dashboard - Enact – LCP Delta's power market analytics platform

Balancing Mechanism dispatch

The BM makes up a small proportion of dispatch in the GB market, but is increasingly important

- Indicated Generation (INDGEN) is a metric which aggregates all submitted Final Physical Notifications (FPNs). On the right, we have compared it to Bid Offer Acceptances (BOAs) in GWh.
- This provides a proportion of BM dispatch vs the wholesale market.
- The BM represents a small proportion of overall dispatch.
- Nevertheless, the BM is an increasingly important revenue stream for smaller, flexible assets.
- Improved utilisation of these assets in the BM will be important, both in terms of providing an investment signal and ensuring that the GB system delivers value for consumers.
- BM acceptance (BOA) volumes for battery storage have increased over 2023, partially due to increased volatility, but also driven by changes introduced by the ESO. Despite this trend, the proportion (%) of BOAs issued to battery storage remains low.



Out of merit dispatch in the BM

Definition

Why does it happen?

Three broad categories:

- First, some out of merit acceptances are unavoidable in the BM as currently designed. For example, due to locational constraints, system stability and unit-level constraints.
- Second, some are necessary for operational reasons and are not preventable under current ENCC and wider industry practices. This includes reasons such as time constraints for decisions, legacy processes and inaccuracy of participant data.
- Finally, some should be avoidable under existing practices. These are categorised as “unexplained”.

Why is it a concern?

- When unexplained “skips” occur, balancing costs are greater than they need to be, going against the ESO Licence condition. ESO therefore strives for zero preventable skips.
- Reducing some inefficiencies requires investment in control room infrastructure, or regulatory changes. These should be introduced in a proportionate and timely manner.
- Represent lost revenues for industry participants. This ultimately will impact returns and investor confidence in the GB power market.

The ESO has historically separated the types of skips into two distinct buckets of explained and unexplained skips, the latter of which is of significant concern to the market.

Current Overarching Skip Rate Categorisation

Skip rates are categorised as skips that have a reason assigned, and ones that do not

Explained Skip

- An explained skip is when a Bid/Offer (BO) that is in economic merit order is "skipped over" by the ESO for a more expensive action, but for legitimate reasoning.
- This can be because of system need and the skipped unit not being able to meet that need. This can also be for any reason that falls into the alternative action reason codes: i) Frequency, ii) Flexibility, iii) Incomplete, or iv) Zonal Management.

Unexplained Skip

- An unexplained skip is when a BO that is in economic merit order is "skipped over" by the ESO for a more expensive action, and no valid reason can be assigned.
- This could be due to control room error or because of legacy systems and infrastructure.

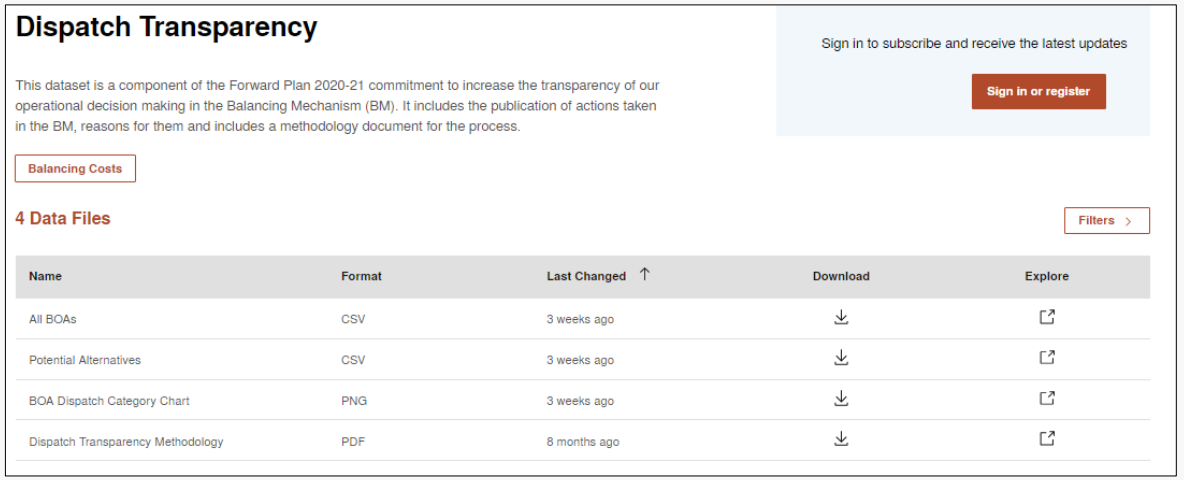
We have found that this terminology and definition is not consistently understood across industry and may not suitably frame the concern that ESO stakeholders are experiencing.

BM Dispatch Transparency Dataset

Overview

What is it?

- **All BOAs** file – data on all Bid-Offer Acceptances, including categories where applicable, to indicate BOAs which could not substituted for an alternative.
- **Potential Alternatives** file – data on potential alternatives, including the reason why each alternative was not accepted (where available).
- **BOA Dispatch Category Chart** – visual representation of the dataset.
- **Dispatch Transparency Methodology** – explains in detail how the dataset is compiled, including an explanation of the Categorisation and Reason Codes used in the All BOAs and Potential Alternatives data respectively.
- The dataset is updated weekly and is publicly available on the National Grid ESO Data Portal or through the Data Portal API.
- The dataset is an important first step towards the goal of improving transparency over dispatch decisions in the BM.
- The data plays a useful role in the analysis that we are carrying out for the quantitative workstream.



www.nationalgrideso.com/data-portal/dispatch-transparency

Analysis

Stakeholder engagement

Approach

Stakeholders

- We have engaged with stakeholders to gather their **feedback on BM dispatch decisions**.
- Stakeholders include battery operators, aggregators, traders, incumbents and battery developers / owners.
- These stakeholders have been chosen to capture a **broad range of opinions** from different actors in the market.
- Engagement is ongoing and we intend to **complete our engagement** of a sample of **stakeholders in the coming days**.
- This afternoon's breakout session will contribute to our findings, and **views reflected in our report**.

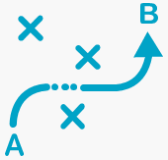
Discussion guide

Discussions have been structured according to a discussion guide which we independently developed.

The discussion guide covers three main areas:

1. **Skip rates** – understanding, experience and expectations of asset skipping.

2. **Transparency dataset** – use of the dataset, improvements that could be made and feedback on reason codes.



3. **Solutions** – views on the progress that has been made so far, expected impact of upcoming changes and suggested solutions.

Stakeholder engagement

Emerging themes

Dispatch Transparency Data sets

- A reoccurring theme from all stakeholders is the perceived need for **ESO's IT systems to be updated**.
- From most stakeholders, there was an **understanding** of the **ESO's caution to change**.
- The **majority** of the stakeholders have engaged with the ESO's Dispatch Transparency Dataset, however they have noted the reason codes **do not provide the necessary insight** to fully explain ESO's decisions. It was also suggested that some reason codes **were not the root cause**.
- A frequent finding was that stakeholders felt that manual errors, wrongly tagged reason codes and data gaps have **affected the reliability of the data** ESO has provided.
- The **timing** of the data publication from ESO has been **considered appropriate**.

Findings

"Negatively impacted"

A common theme from our interviews found that stakeholders thought their assets / interests had been negatively impacted by assets being skipped in the BM.

"Lack of automation"

Stakeholders believe that the IT systems and lack of automation are the main factors that contribute to asset skipping. It highlighted how outcomes can vary depending on how they engage with the control room.

"Asset size"

Size of assets was highlighted as a perceived control room bias.

"Impacting investment"

The expectations of the BM has not aligned with stakeholders' expectations at project development and investment stage, impacting their appetite to further invest in the sector.

Stakeholder engagement

Emerging themes

Skip Rate definitions and views

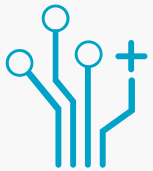
- There were **varying views** of what constituted an explained or an unexplained skip.
- Most stakeholders **captured specifics** within the definition of explained and unexplained skips.
- So far, a **third of stakeholders** find that it is better reflected as **market inefficiency**.
- Some highlighted a view of operation inconsistency in the ENCC. This alludes to skip rates being linked to individual practices and increased engagement resulting in more dispatch.
- One stakeholder referred to skip rate calculations of whether a cheaper action has been skipped for a more expensive action as the **“naïve skip rate”**.
- A stakeholder referred to skip rates being due to a result of (1) resources within the ESO becoming too **stressed** and (2) **systems are not** able to facilitate **battery dispatch**.
- Stakeholders believe that **assets are being skipped** because of **control room limitations**.

Remedies to the Skip Rate Issue

Stakeholders are disappointed by the perceived **lack of progress** that's been made to resolve the issue.

Addressing the ‘**size of asset’ perceived bias** was highlighted as a possible remedy by one stakeholder. They suggested that smaller assets should be considered more in the future.

Stakeholders are optimistic that upcoming market changes **will help to resolve asset skipping**.



One stakeholder suggested compensation for battery storage or **exploring the implementation of further trials** such as 'Reserve from Storage’.

Redefining BM dispatch efficiency

Economic and uneconomic dispatch

- From our engagement, we recognise the need to find terminology and definitions that better reflects genuine BM actions, and actions that results in inefficient outcomes.
- We have tried to capture in these definitions where a technically supramarginal BOA (in that instance) in the BM is required to maintain system stability or security, and where an action is seemingly uneconomic and inefficient.
- We have also encompassed the ESO's licence requirement to run the system as a total cost efficiency but recognise at this time there is no specified timeframe which it should be managed economically efficient over.

Economic BM dispatch

Economic dispatch is where a BOA is actioned to minimise the cost of meeting the requirement, taking into account the volume required and the duration of the requirement.

The acceptance may not always be the most favourable action when looking at the £/MWh price in an individual settlement period.

The action could appear out of merit when looking only at a single period, but when looking at the requirement as a whole, the acceptance incurs less overall cost than any combination of feasible alternatives.

This can be the case whether the requirement is for energy or for a specific system need, such as voltage or inertia.

Uneconomic BM dispatch

Economically inefficient dispatch. These actions cover any BOA actioned by the ESO when a more favourably priced action is present in Bid Offer Data (BOD), and the accepted action does not result in a lower overall cost to the ESO, with no discernible system need that is being addressed.

Avoidable uneconomic dispatch actions negatively impact on BM participants and the economic efficiency of the mechanism.

We welcome feedback on these definitions

Changes that could improve dispatch efficiency

Further recommendations will be provided in Phase 2 of this project

Economic Dispatch

When a unit that would otherwise be in merit is not dispatched in favour of a seemingly more costly action to meet a system need. This can be improved by BM design change and increasingly meeting system needs through balancing services.

Uneconomic dispatch

When a unit that would otherwise be in merit is not dispatched in favour of a more expensive unit for no discernible reason. This is largely driven by human error or dispatch limitations that are not defined in the BM Dispatch Transparency methodology. It can be improved by improving ESO dispatch processes and tools.

Upcoming changes to improve Economic dispatch

- Increasing Dynamic Regulation volume cap to 350MW
- Quick Reserve, Balancing Reserve
- State of Charge replacing 15-minute rule

Upcoming changes to improve Uneconomic dispatch

- VERGIL Single Dispatch
- Open Balancing Platform: Bulk dispatch
- Control Room Process trials
- Fast dispatch

Upcoming changes will be considered more in the following ESO led section

Uneconomic BM Dispatch levels – Quantitative Analysis

Balancing Mechanism (BM) Dispatch Transparency Analysis

With a redefinition of “skip rates” we will quantify the uneconomic BM dispatch levels. This will be phased over two stages. Economic BM dispatch rates are out of scope at this stage, but will be reviewed

Phased Analysis

Phase 1 – overarching uneconomic BM dispatch levels

BM dispatch efficiency analysis:

- Independent, technology neutral, analysis covering past 12 months.
- A nine-stage analysis of uneconomic dispatch levels.
- Identifying “in-merit” BM bids & offers that were not accepted.
- Categorise these based on ESO’s dispatch transparency reasons and parameters that will restrict unit’s dispatch.
- Identify specific days for further analysis into phase 2.

Phase 2 – deep dive into 5 sample days

- Following engagement on our approach, providing a finalised BM dispatch efficiency analysis.
- Using analysis from Phase 1, identify 5 sample days over the 12-month period.
- We will work with ESO to understand decisions taken on the selected days.
- The selected days should represent useful case studies to understand current limitations and deliver recommendations to drive improvements in dispatch efficiency.

We welcome your engagement and support. There will be the opportunity to critique our Phase 1 analysis approach in this afternoon's breakout session.

Methodology

Multi-stage approach

We have separated our analysis of Balancing Mechanism dispatch decisions into multiple stages

- Each stage represents a different definition of what constitutes an uneconomic dispatch action.
- We start with a very broad definition of an uneconomic dispatch action in the initial stage.
- At each subsequent stage, we progressively tighten the criteria for what qualifies as an uneconomic dispatch action.
- The criteria used to determine the number of an uneconomic dispatch actions at each stage are outlined over the following pages.

This staged approach recognises that there will be different views on whether certain types of uneconomic dispatch decisions are avoidable or justified

- Some uneconomic dispatches might be unavoidable at present given current systems and processes but could potentially be avoided in future.
- Later in the presentation, we introduce some upcoming changes to control room systems and processes which are expected to make certain types of uneconomic dispatch actions more avoidable.
- The magnitude of the reduction in the uneconomic dispatch action rate from one stage to the next can give an indication of what changes could be prioritised to deliver a more significant improvement in dispatch efficiency.

Quantifying Uneconomic BM Dispatch – Methodology

A multi-stage approach

Phase 1 analysis, at each stage:

- Calculate the level of uneconomic dispatch
  - %, on a volume basis, of in-merit bids and offers that were not dispatched
- Covering a 12-month period
- Split out by technology (e.g. CCGT, Battery Storage, etc)
- And by unit size (given current limitations around bulk dispatch)

Phase 2 analysis:

- Deep dive into selected days
- Provide insight into the cost of uneconomic dispatch, in terms of consumer cost and impact on asset revenues

Project aims

1. **Improve transparency and efficiency of dispatch**
2. **Consistent definitions and metrics**
3. **Practical recommendations**

Methodology

Multi-stage approach

Stage 0

Bid and offer data is collated, this dataset includes:

- All volume made available in the first bid-offer pairing in each direction that was more attractive than the highest priced offer or lowest priced bid accepted (i.e. it was “in-merit”).
- The accepted actions include those taken for Energy balancing (unflagged) but **excludes those taken for System reasons** (system flagged).
- Actions taken for System reasons are also excluded from setting the highest priced offer and lowest priced bid, to which alternative actions are compared.
- **Long-duration actions** (those lasting 3 hours or more) are excluded from setting the prices to which duration-limited units are compared.

Stage 1

Volume from units with an NDZ (Notice to Deviate from Zero) of **greater than 90 minutes are excluded**:

- The rationale here is that units with NDZ of 90 minutes or more are not available to be turned on in the BM.
- NGESO cannot reposition a unit until after gate close, when the unit’s self-dispatch becomes final.
- Gate closure occurs 60 minutes before the start of the respective settlement period.
- This leaves a 90-minute window for BOAs to be issued, between gate closure and the end of the settlement period.
- So any unit that requires notice of 90 minutes or more to turn-on (and is not already running) cannot be instructed in the BM.

Stage 2

Each bid offer action is assessed for feasibility versus the Maximum and Stable Import and Export Limits (MEL, SEL, MIL and SIL) and Physical Notifications (PNs) submitted for each unit.

Potential uneconomic dispatch action volumes may then be capped or excluded as applicable.

Methodology

Multi-stage approach

Stage 3

Where a unit has a partial acceptance, any potential "skip" volume in the direction opposing the acceptance is excluded.

Stage 4

Where, in the NGESO Dispatch Transparency 'All BOAs' dataset an exclusion has been included for a bid-offer acceptance, any potential remaining "skip" volume associated with that action is excluded.

The exclusions considered include:

- Geometry – where a unit's flexibility is constrained by ramp rate limits.
- Response – where a unit has been positioned to provide response services.
- Constrained No Loss Risk – where a unit has positioned to contain a potential loss on the system within the bounds of response capability.

Stage 5

Bid-offer actions that are to 'Unwind' an accepted action are excluded.

- The unwind option is the bid component of a positive bid-offer pair, or the offer component of a negative bid-offer pair.
- The unwind option isn't accessible until an acceptance is issued in the other direction.
- This allows the ESO to undo a previously issued BOA, at a price set by the operator of the unit.
- Unwind actions are therefore infeasible in the absence of a BOA.
- If a BOA has been issued, then the unwind option will have been excluded at Stage 3.

Methodology

Multi-stage approach

Stage 6

In stages 6-8 we factor in the reason codes listed in the Potential Alternatives data (part of the NGESO Dispatch Transparency dataset).

These reason codes explain why certain alternative actions could not be taken instead of the accepted action.

Alternative action reason codes excluded at stage 6 are:

- **Unit below SEL**
- **Incomplete**

We believe these two reason codes to be the least likely to be disputed as legitimate reasons for passing over a unit.

Stage 7

Alternative action reason codes excluded at this stage are:

- **Frequency** – actions taken to manage the frequency of the system that meets <= 5 minutes to and at target level, and absolute change to target level >30MW.
- **Flexibility** – actions that procure flexible units on the system to cover periods of uncertainty and generation variability. This will involve dispatching flexible BMUs with a faster RUR/RDR or positioning slower units to meet energy requirements so faster units provide flexibility.

We expect that these two reason codes will provoke more debate as to whether they are justified and that any judgements would need to be made on a case-by-case basis.

Stage 8

Alternative action reason codes excluded at this stage are:

- **Zonal Management** – if a BOA action is executed, but an alternative action was available at a lower cost in a different zone, the BOA action that was executed is considered a zonal management required action.

We add this reason code as the final stage because we expect it to be the most heavily disputed.

Next Steps

Next steps and key deliverables

We will deliver a final report that will cover a full assessment of this BM inefficiency

Overarching Uneconomic Dispatch Rate Calculations

Providing an overarching calculation of uneconomic dispatch rates in the Balancing Mechanism over the 12-month period to September 2023. This will be based on the multi-stage methodology outlined in this session.

Deep-Dive into sample days

Following us ascertaining the overarching calculation of the uneconomic dispatch rate, we will select 5 sample days to deep-dive into the actions in that day.

Stakeholder engagement

We will synthesise stakeholder engagement and provide the ESO with a full understanding of the results of our engagement. We will also use this stakeholder engagement to inform our further qualitative assessment of uneconomic and economic BM dispatch practices.

Qualitative assessment

Using our analysis and stakeholder engagement, we will produce an assessment of:

- Our findings of the suitability of the ESO's dispatch transparency data, and the dispatch transparency methodology.
- The drivers of the ESO's actions in the control room that requires economic BM dispatch actions and critiquing the practice. This will include reviewing the impact the practice has on industry.
- Reviewing any BM reforms upcoming and how they may impact the market inefficiency.
- Providing any recommendations to improve the ESO's BM dispatch actions to maximise the cost effectiveness of the current BM.

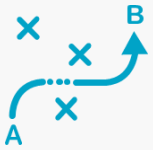
Next steps

Breakout session

This afternoon we are looking for your engagement on:

1. **Skip rates** – understanding, experience and expectations of asset skipping.

2. **Transparency dataset** – use of the dataset and improvements that could be made. Feedback on reason codes.



3. **Solutions** – views on the progress that has been made so far, expected impact of upcoming changes and suggested solutions.

4. **Our proposed methodology** for calculating uneconomic dispatch in the Balancing Mechanism.

ESO Workstreams to improve the Balancing Mechanism

ESO

What have we covered so far?

What is the underlying issue?	What blockers do we need to overcome to manage this?	What are these blockers leading to for market participants?	What are we delivering?

System Volatility is increasing

- Legacy tool's ability to dispatch large numbers of smaller assets
- Lack of visibility of capacity available from flexible assets over different timeframes

→ **Uneconomic skips**

System changes
Addressing difficulties in dispatching by improving the balancing capability available to control engineers

Process changes
Reviewing our processes to understand what changes and information are required to ensure we are making the most economic decisions across differing timeframes

- Increased redispatch for both system and energy reasons leads to high pressure on BM

→ **Economic skips**

Market reform
Developing pay-as-clear markets that increase transparency of ESO needs outside of the BM

Design Principles

Efficient Dispatch

Competition (Short-Run)

Participants seek to offer better prices and quantities than those offered by other participants - considers only existing assets.

Locational Signals in Dispatch

Capacity is constructed & services are provided in the right places.

Dispatch Performance

Balancing Capability enables efficient dispatch for all

Efficient Investment

Competition (Long-Run)

Similar to short-run, however assets expected to exist in the future, given expected new build and retirement decisions.

Locational Signals in Investment

Capacity is constructed & services are provided in the right places.

Investability

Clear investment signals which market participants and investors can respond to and rely on.

Value for Money

Net Consumer Benefits

Costs to consumers do not outweigh the benefits.

Practicality

Practical to implement, transition to and operate.

Adaptability

Flexible to changes in balancing service requirements and the technology mix.

Coherence

Market participants can make decisions about where to bid, which are efficient for both the participants and the system.

Transparency

Decisions are made in a clear and predictable way to minimise uncertainty around ESO's decision making.

What have we delivered so far?

	What have we delivered?	How has this supported storage assets?
Market framework 	Frequency response markets - Dynamic Containment (September ‘21) - Dynamic Moderation (May ‘22) - Dynamic Regulation (April ‘22)	**Considerable contracted availability of batteries in each response markets (up to 11th October 2023):** - Dynamic Containment – 24522 GWh - Dynamic Response – 2616 GWh - Dynamic Moderation – 800 GWh
System improvements 	- New battery zone in SORT - Screens for bi-directional dispatch - Automatic Instruction Repeater - Enhanced functionality for economic dispatch (e.g. Price Band Instructions, BOA by constraint views, GUI navigation enhancements, Additional BMU metadata)	**Increased volumes assets being dispatched due to:** - **Time to make decisions:** 12,000 hours annually saved in building our plans - **Time to enact instruction:** 80% reduction of in workload zonal balancing engineers during times of high wind - 40% estimated performance improvement of EDL and EDT as a result of system improvements so no need to phone control points - **Having all available information:** Improved situational awareness
Industry engagement 	- Balancing programme quarterly events - Dispatch Transparency webinars - Storage stakeholder group - Response/ reserve consultations	**Increased transparency of the market, tools and data we require to ensuring we deliver value for money.**

Recent Success: Increased Battery Dispatch

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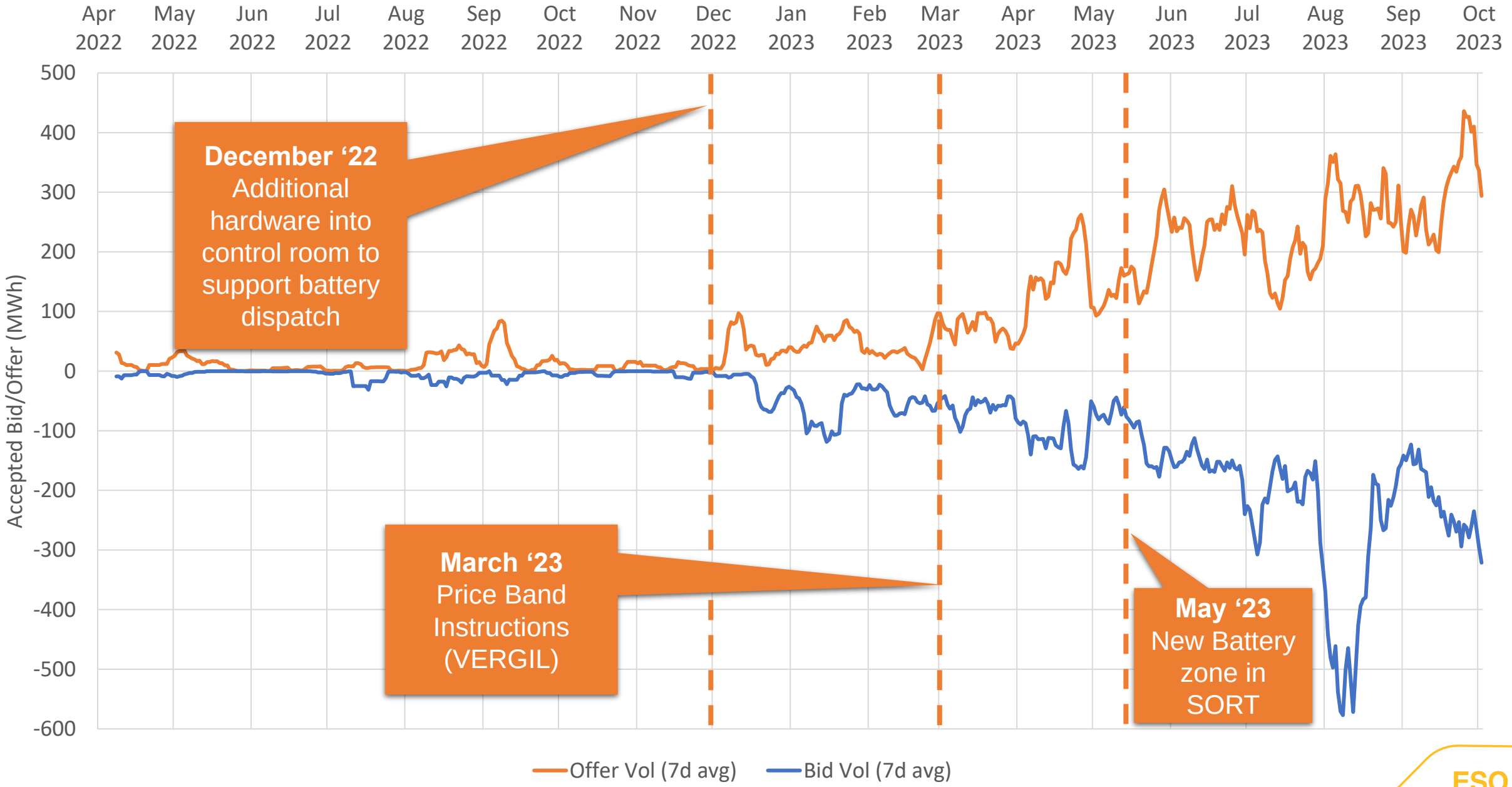
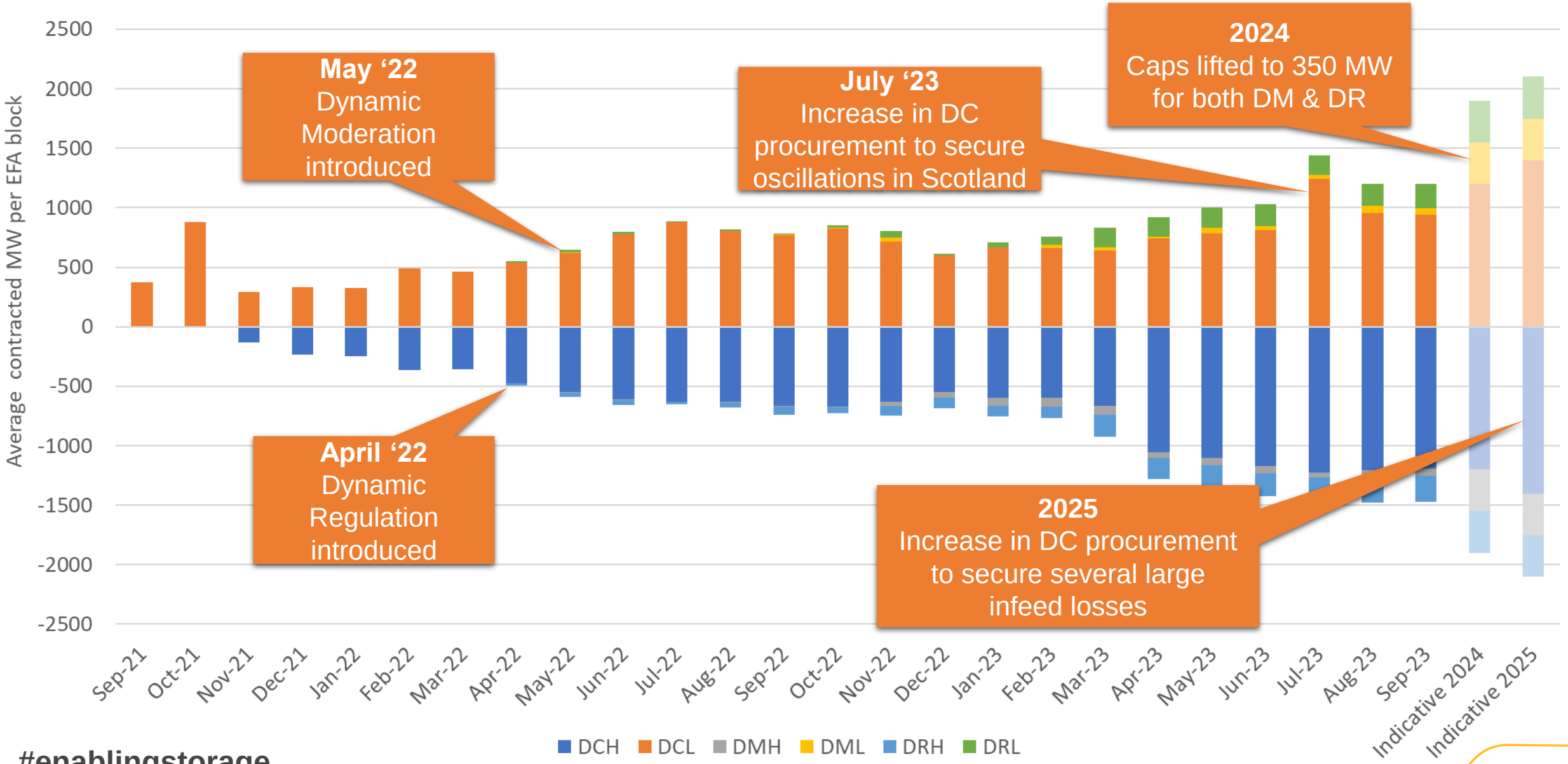


Joint Success: Batteries procured for frequency response services



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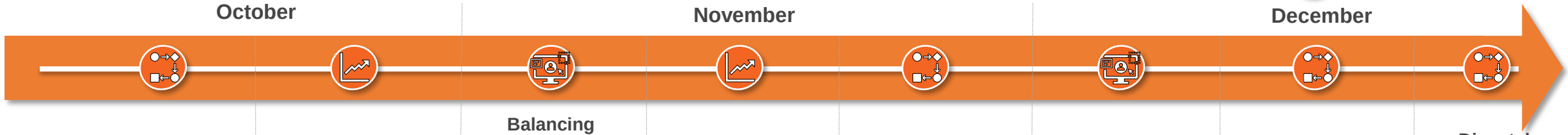
ESO

Time horizon of activities across 2023

- Market reform
- Process improvement
- System improvement



	Connections 5 Point Plan – 5: Interim Offer for BESS	Co-optimised and stacking of response services (Auction)	Balancing Mechanism System Change - Vergil Single Dispatch (Phase 1)	Dynamic Regulation: Cap increase	Hackathon	Open Balancing Platform: Release 1	Control room process trials	Dispatch transparency action plan published
ESO deliverable	1st tranche of accelerated storage connections offers **10GW from 2026**. **Non firm up to gate closure**	Enabling market providers to tender across the suite of response services	System enhancement reducing the time to issue instructions	Increase cap on current auction to **350MW**	Machine learning competition to address understand errors in short-term forecasts and understand battery behaviour of charging and discharging	Bulk Dispatch of Battery Zone & Small BMUs	Testing different approaches to the application of storage in meeting reserve requirements through to dispatch decisions.	Publication of dispatch transparency action plan following LCP independent review
Design principles								
Impact	Greater bulk-dispatch capability in terms of total volumes.	Provides flexibility to market providers to simultaneously participate across the response suite of services	Potential increase from **100 to 300 instructions per day** **30 seconds per instruction to 10**	Increasing the volume of procured Dynamic regulation	Improved forecasting short term battery behaviour	Consistency in optimisation **2-3 instructions per minute** to **300 instructions** multiple times per hour	Targeted dispatch in real time Potential for more Scheduling Reduced balancing costs	Consistent understanding across industry

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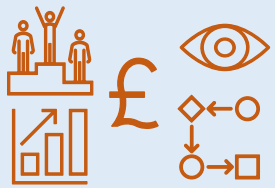
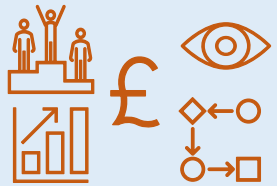
ESO

Time horizon of activities across 2024

- Market reform
- Process improvement
- System improvement

	Winter		Spring		Summer	Autumn	Winter
	Storage Parameter Trials and start grid code change*	**Balancing Reserve**	**Balancing Mechanism System Change - Vergil Single Dispatch (Phase 2)**	**Open Balancing Platform - Fast Dispatch**	**Open Balancing Platform - State of Charge** (single value from SCADA)	**Quick Reserve**	**OBP: Automated interface to SMP and Enduring Auction**	**Open Balancing Platform: Fully resilient platform**
ESO deliverable	Expedite the provision of data. Underpins ENCC process reviews and efficient dispatch of batteries ahead of grid code mod	Go-Live of a new product that will secure Regulating Reserve on a firm basis at day ahead	System enhancement reducing the time to issue instructions	Allows for quicker bulk dispatch, specifically targeting assets that are used for fast frequency correction	Ability to view and utilise State of Charge from SCADA in balancing	A new product aimed primarily for reacting to pre-fault disturbances to restore the energy imbalance quickly and return frequency close to 50.0 Hz	Automated connections between registration and market auction platforms to the control systems	EDL/EDT moved to new platform which will no longer be reliant on legacy systems
Design principles								
Impact	Greater number of instructions More efficient dispatch	Procurement of **500MW-2.5GW** across all providers. Transparent Process	Potential **increase from 100 to 450 instructions** per day **45 seconds** per instruction to **10 seconds**	Greater number of instructions More efficient frequency correction – aim to be able to issue **(up to 300)** bulk instructions within **1 minute**	Can remove the reliance on the 15-miniute rule for Dispatch	Procurement of up to **1400 MW across all providers** Transparent Process	More frequent auctions	Fully support new storage time varying parameters, as well as more services No reliance on legacy systems for fallback

*** Dependent on outcome of today's breakouts**

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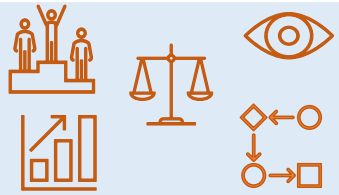
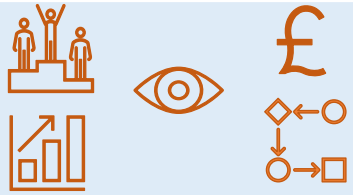
ESO

Time horizon of activities across early 2025

- Market reform
- Process improvement
- System improvement

Spring

Summer

	Open Balancing Platform: Enhanced optimisation	Open Balancing Platform: BMU/Non-BMU Combined Dispatch	Quick Reserve on non-BMUs
ESO deliverable	Co-optimisation of multiple services in one place	Support for Non-BMU and services into OBP, allowing for treating BMU and Non-BMU equally in terms of co-optimisation and dispatch	Extension of the Quick Reserve service introduced for BMUs in 2024 to Non-BMUs, with co-optimisation and Dispatch via OBP
Design principles			
Impact	Automated optimisation across several services, ensuring the most economic actions are taken across differing timescales	Co-optimisation across multiple services as well as BMU and Non-BMU, ensuring equal and most economic treatment of BMU and Non-BMU	Co-optimisation of Quick Reserve for BMUs and Non-BMUs, ensuring equal and most economic treatment of BMU and Non-BMU for Quick Reserve

BM Redeclarations

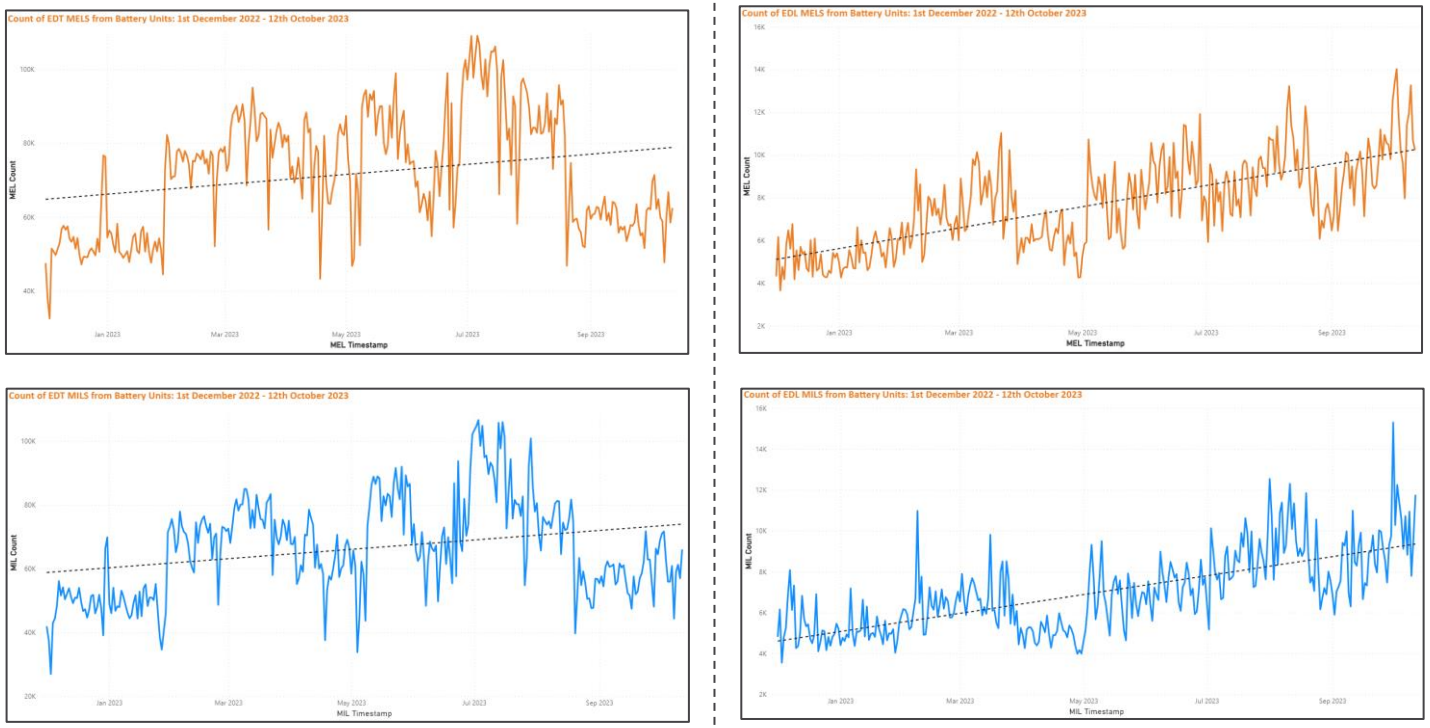
ESO

BM Redeclarations

What's the problem? Why now?

Large volumes of MIL/MEL redeclarations from battery assets are causing significant processing loads in our systems, creating performance issues and affecting data publication via BMRS. Since December 2022 we have experienced an significant increase in the number of redeclarations.

Increased use of batteries in the BM in recent months has highlighted the issue and triggered the need for action to reduce the high volume of redeclarations.



What we have done to date

- Analysed MEL/MIL submissions in the last 3 months and found data duplications and highly granular redeclarations for small changes
- Contacted a number of providers to understand the reasons for these high volumes and highlighted our findings
- Agreed interim measures to reduce high volumes and implemented data corrections

What we need to do next

- Further engagement with providers with high volume submissions – we need your help!
- Circulate new guidance on MEL/MIL submissions ahead of OBP R1 go-live in December – update at Balancing Programme event in November

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Panel discussion/Q&A

Close

Next Steps

Today

- Co-create a plan to develop the capability and future market design solutions.

November 2023

- Provide an update on progress at Balancing Programme engagement event
- Guidance on MIL/MEL redeclarations ahead of OBP go-live

December 2023

- Follow-up engagement event
- LCP report including methodology and analysis

April 2024

- Trial new storage parameters in OBP via SCADA

Thank you

Next Steps

We welcome your feedback

Website updates

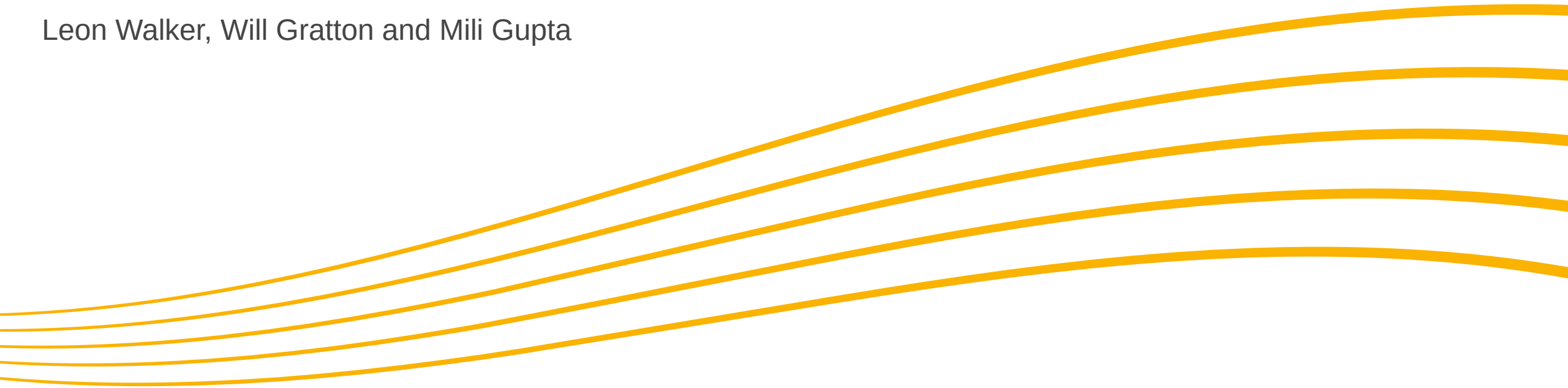
You will be added to our mailing list for future updates

- Reach out via email – **box.futureofbalancingservices@nationalgrideso.com**

Appendix – Breakout slides

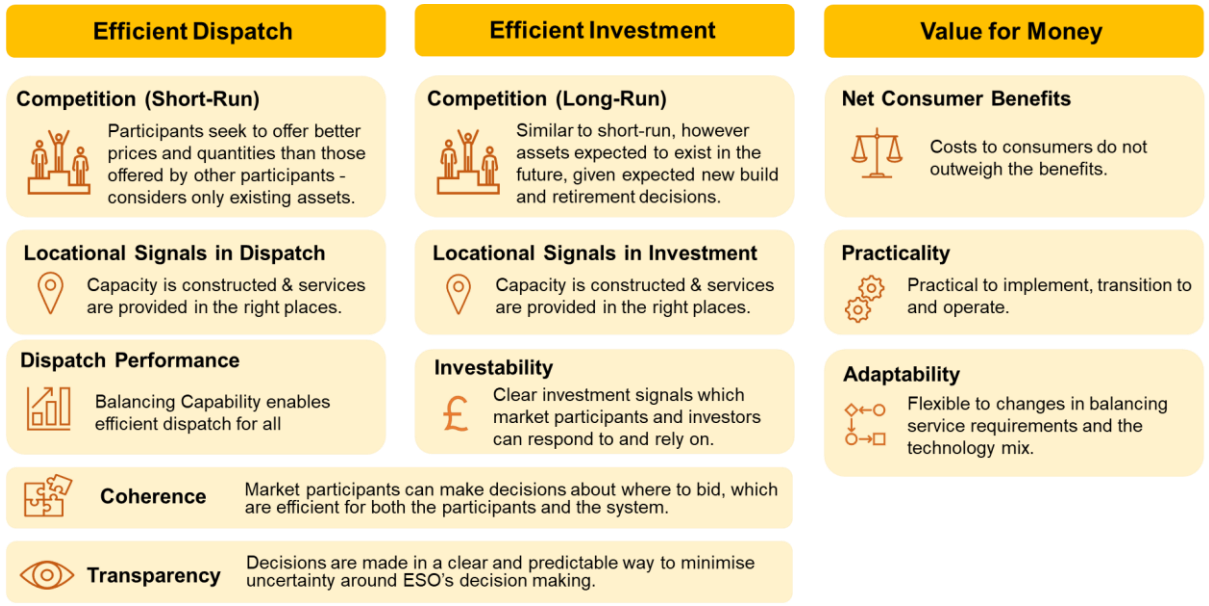
ESO Roadmap and Trials

Leon Walker, Will Gratton and Mili Gupta



Aims of the breakout

- To collaborate with you and understand does the proposed 18-month horizon of activities meet the design principles outlined
- What are your priorities?
- Are there any activities which are missing?
- Do you wish to be involved in any of these initiative e.g., testing, trialling etc
- What metrics do you propose?



- Colour Coding of post-its:

Missing (Yellow)	Comments about deliverables (Orange)	Miscellaneous (Green)	Involved (Salmon)	Metrics (Pink)

- Colour Coding of Priority Stickies:

Yellow – Top, Blue – Least Priority

ESO workstreams to enhance Energy Storage in the Balancing Mechanism

2023

2024

October:

- **Connections 5 Point Plan** – 5: Interim Offer for BESS, 10GW of accelerated storage connections
- **Co-optimised and stacking of response services (Auction)** – Provides flexibility to market providers to simultaneously participate across the response suite of services

November:

- **Balancing Mechanism System Change - Vergil Single Dispatch** – Less time to issue instructions, leading to potential instruction increase (~30 seconds to ~10 seconds per instruction)
- **Dynamic Regulation** – Increase volume cap to 350MW
- **Hackathon** – Forecasting short term battery behaviour

December:

- **Open Balancing Platform (OBP) Release 1** – Bulk Dispatch of Battery Zone & Small BMUs
- **National Grid ESO dispatch transparency action plan shared following LCP independent review**
- **Control room process trials** – Testing new approaches to meet reserve requirements with storage assets

Autumn:

OBP: Automated interface to SMP and Enduring Auction – Easier update to control room systems allowing more frequent auctions.

Summer:

Quick Reserve – a new product to secure pre-fault disturbances by restoring energy imbalances quickly and return the frequency close to 50.0 Hz. Increasing the markets storage assets can participate

Spring:

- **Fast dispatch** – quicker bulk dispatch, specifically targeting use of batteries
- **OBP: State of Charge (SCADA)** – Allow replacement of 15-minute rule in dispatch

Winter:

- **Balancing Reserve** – A product to secure day ahead Regulating Reserve - storage assets can participate
- **Grid code changes/Storage parameter trials** – Start the formal process of a grid code change to underpin the efficient dispatch of batteries. Expedite the provision of data that will underpin ENCC process reviews and efficient dispatch of batteries (Subject to today's breakouts)

2025

Winter:

- **OBP: Fully resilient platform** – Platform can now support more services without relying on legacy systems for fallback
- **OBP: EDL moved to new platform + new message types** – Support for new storage time varying parameters

Spring:

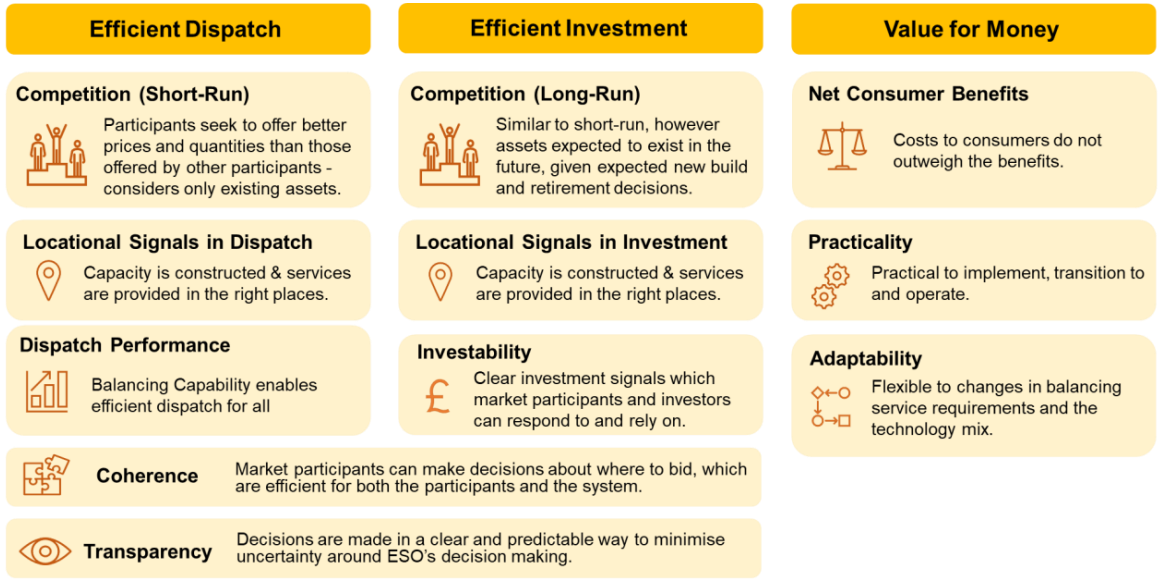
OBP: Enhanced optimisation – Co-optimisation of multiple services in one place

Summer:

- **OBP: BMU/Non-BMU Combined Dispatch**
- **Quick Reserve on non-BMU** – Enhanced Visualisation for control room supporting decision making

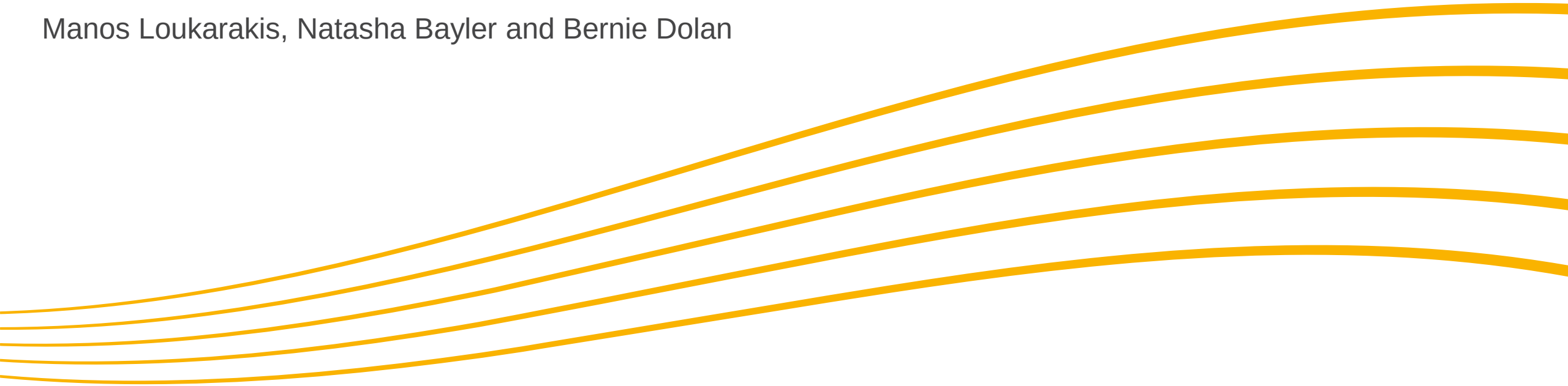
Next Steps

- We will collate and share the feedback from today
- We will review our 18-month time horizon of activities within the whole ESO in-line with your input
  - Ensure meets the principles defined
  - Ambitious but deliverable
  - ESO alignment
- Any proposed changes will be shared
- Activities where you have shown interest, we will reach out with proposals to ensure ongoing collaboration



New Parameters for limited duration assets

Manos Loukarakis, Natasha Bayler and Bernie Dolan



Aims of Today

- Seek agreement on proposal for additional Storage parameters
- Discuss approach to take this forward
- Signpost new redeclaration guidance is incoming

Problem Statement

Short Term (Dispatch)

- How to get beyond the limitations of the 15 minute rule
- Increasing utilisation of limited duration assets in dispatch
- How can assets provide accurate technical limits to the ESO

Long Term (Scheduling)

- How to utilise limited duration assets in planning timescales
- How to ensure best total value for customers given the different technical parameters for assets
- Provide the ESO confidence in the long-term management of risk

Communication Mechanism

- What is the easiest way to send and receive data between the ESO and Limited Duration Assets

Work to Date & Feedback

Balancing Programme Storage Stakeholder Forum
✓ Five meetings held in 2023

Presented to the Grid Code Development Forum
✓ Completed 2 August

We need a "gear change" in the way we work with ESO

Keep it simple

We don't mind sending you what we have right now

The ESO shouldn't be optimising our assets

A level playing field can only be guaranteed by having code changes

Grid Code changes take too long

Tell us what you need and we will just give it to you

Current Situation

The “15 minute rule”

- The ESO cannot be sure of the available energy from a storage unit
- To overcome this we use the “15 minute rule”
- The ESO will not issue an instruction beyond 15 minutes and uses the Maximum Import Limit (MIL) and Maximum Export Limit (MEL) to determine the amount of energy that can be safely dispatched
- After issuing an instruction the ESO waits for a redeclaration of MIL/MEL before issuing another instruction
- This advice is contained in the following document Stacking with BM (nationalgrideso.com)
- This rule has a number of shortcomings and so we have been engaging with industry on suggestions for new parameters that can be used to optimise the dispatch of Storage units

Parameters Discussed in detail so far

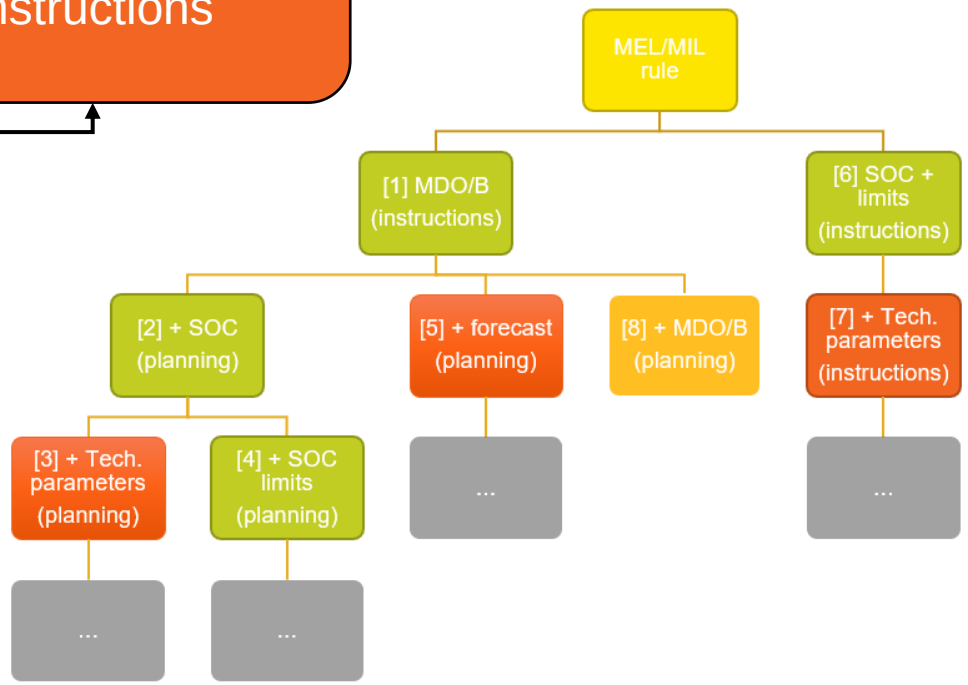
Special thanks to Shell and Tesla who have provided detailed analysis

State of Charge (SOC)
For other asset types equivalent physical attributes

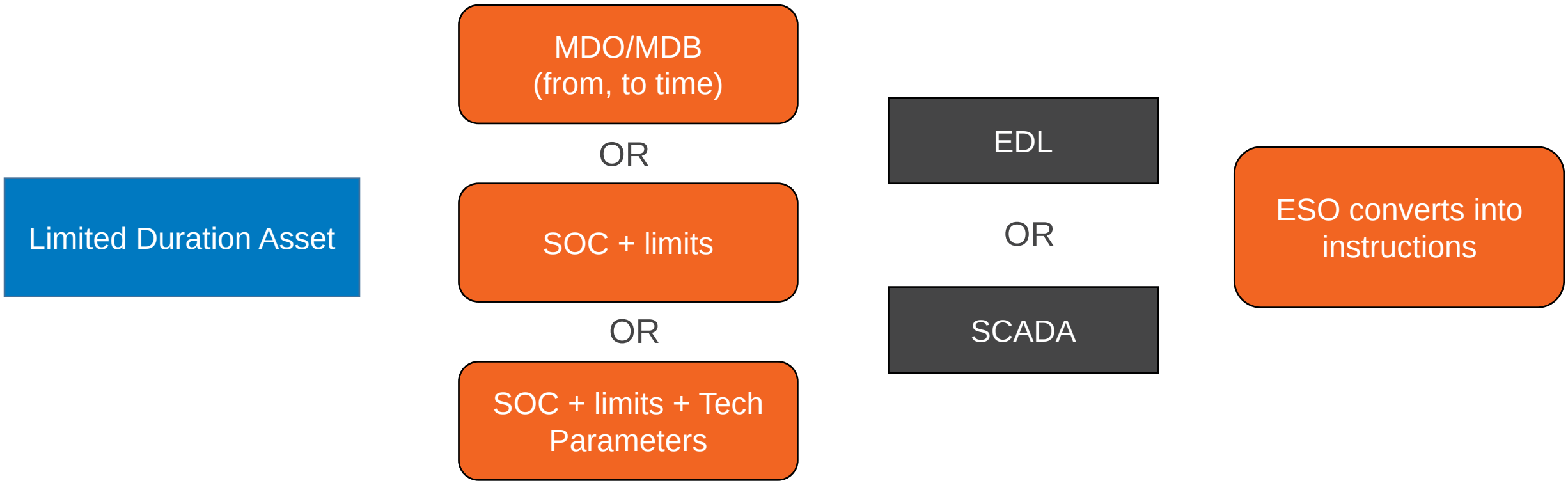
MDO/MDB
Maximum Deliverable Offer/ Maximum Deliverable Bid

Model

ESO converts into instructions



Solutions in Dispatch Timescales



Discussion & Feedback – Dispatch

What extra information would the ESO need to model an asset?

Do you have a preference between MDO/MDB and SOC?

If you favour a "SOC type" how can we make this technology neutral?

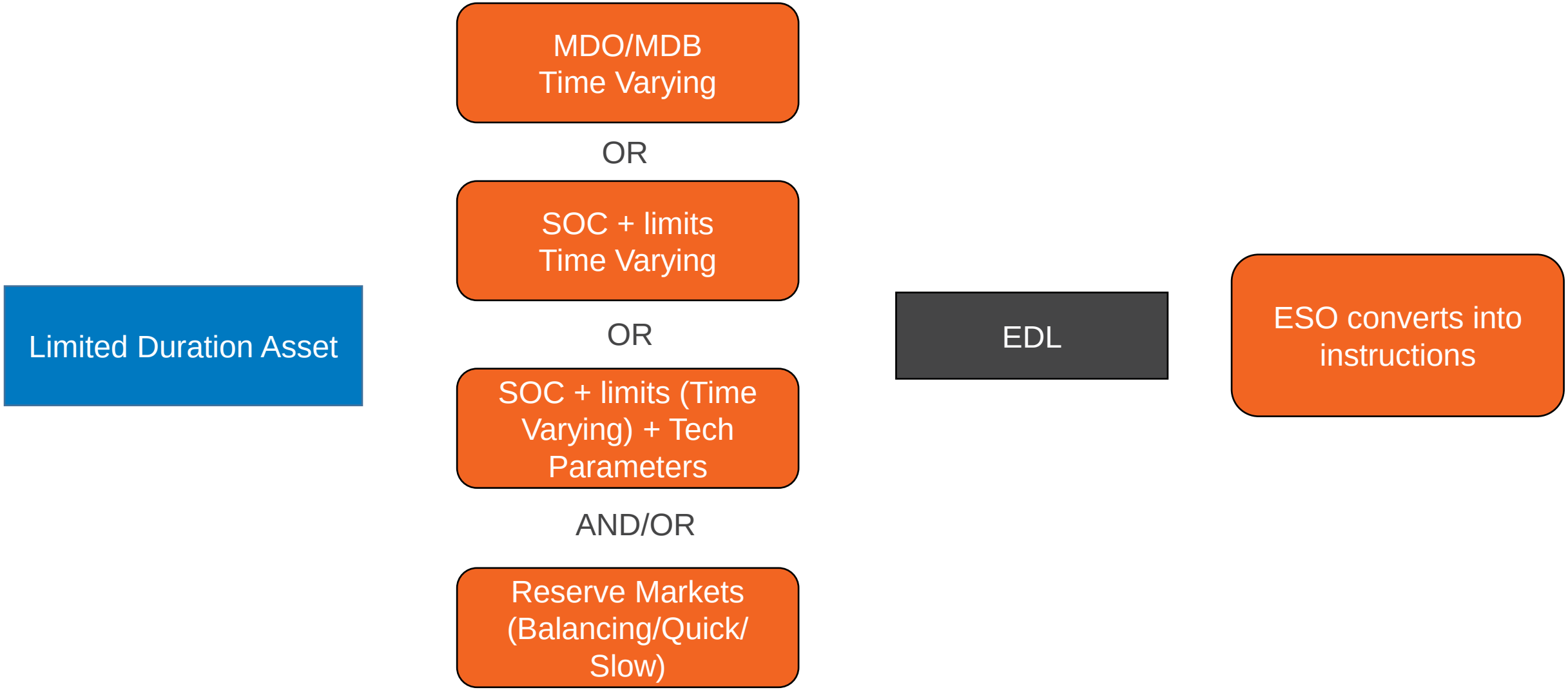
Discussion & Feedback – Comms & Codes

Do you agree this needs a Grid Code change?

Could you send some data via SCADA?

How long would it take for Market Participants to change EDL clients?

Solutions in Scheduling Timescales



Discussion & Feedback – Scheduling

Will new Reserve markets solve planning issues?

What extra data does the ESO need to model these assets?

Do you have a preference for MDO/MDB versus SOC in planning timescales?

How accurate can information be beyond gate?

Do you believe the ESO should optimise Limited Duration Assets?