



Balancing Programme Engagement Event

28th November 2023

Welcome



Aims of Today



- Provide an updated overview of how we are transforming our balancing capabilities, both current & new.
- Share progress on delivery since our last Balancing Programme Event in June.
- Focus on the first few releases of the Open Balancing Platform, & what industry can expect to see.



- Understand how our transformation may impact you.
- Identify what information you need to know & when.
- Your insight to help us tackle key challenges in transforming our balancing capabilities.
- Future interests and how we continue to engage.



- To validate our roadmap aligns to industry priorities
- Collaborate on how we overcome any key challenges associated with transforming our balancing capabilities, on the road to net-zero operability.

Time	Title	Details
09:30 – 10:00	Arrival	Tea and coffee
10:00 – 10:05	Welcome	Aims of the day
10:05 – 10:15	Balancing Programme: Setting the Scene	Overview of the need for change & focus to 2025
10:15 – 11:15	Open Balancing Platform (OBP) Release Plan	<ul style="list-style-type: none">• Overview of the OBP roadmap out to 2025 inc. identified benefits
11:15 – 11:30	Break	Tea and coffee
11:30 – 13:05	Breakout sessions Breakout 1 (11:30 – 12:15) Breakout 2 (12:20 – 13:05)	<ul style="list-style-type: none">• Balancing Programme Roadmap Deep Dive• OBP Optimisation Logic• Transition & Innovation• OBP Demo
13:05 – 13:50	Lunch	
13:50 – 15:00	Breakout session Breakout 3 (13:50 – 14:35) Session Playback (14:40 – 15:00)	<ul style="list-style-type: none">• As above• Return to main room for breakout session playback
15:00 – 15:15	Enhancing Energy Storage in the Balancing Mechanism (BM): Post Event Updates	Progress update on the ESO's plan to enhance Energy Storage in the BM
15:15 – 15:45	Q and A	<ul style="list-style-type: none">• Slido/Open floor
15:45 – 15:55	Close	<ul style="list-style-type: none">• Next steps



Balancing Programme: Setting the Scene

Brendan Lyons

Introduction to the Balancing Programme

The aim of the **Balancing Programme** is to maintain and bring change into our **current balancing capabilities** to support Control Room operations, whilst we **transform to new balancing capabilities** that the ESO needs to deliver reliable and secure system operation, facilitate competition for the benefit of consumers and meet our ambition for net-zero carbon operability.

The Balancing Programme strives to enable the ESO to deliver on its mission to drive the transformation to a fully decarbonised electricity system by 2035 which is reliable, affordable and fair for all, and realise its ambitions:



Ensuring the electricity system can operate carbon free by 2025



Driving competition for the benefit of consumers



Being the net zero employer of choice

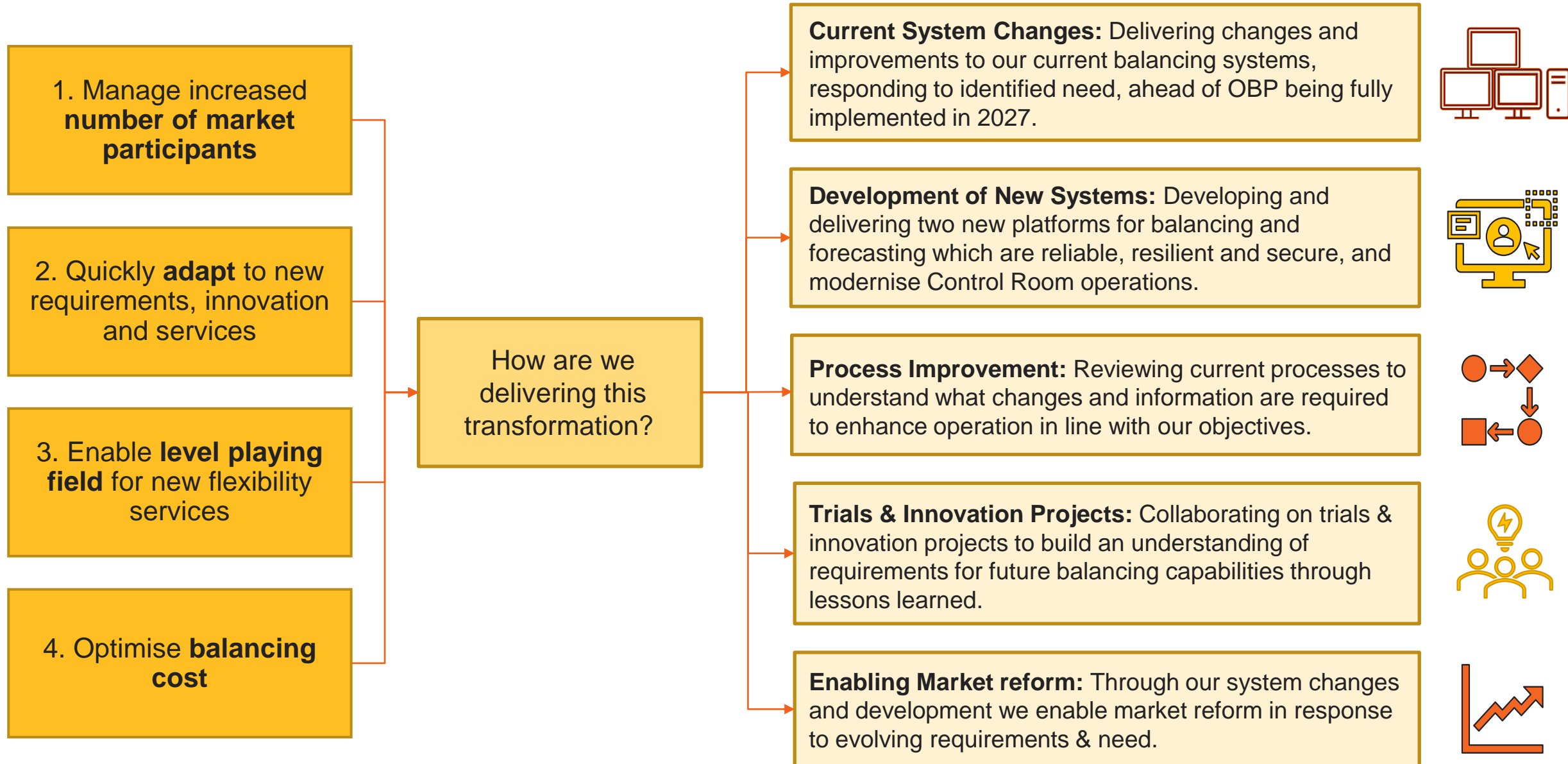


Engaging as a trusted partner



Being innovative, digital and data driven

Why do we need to Transform?



Programme Vision 2023 - 2025

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1. Manage increased **number of market participants**

2. Quickly **adapt** to new requirements, innovation and services

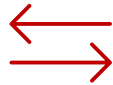
3. Enable **level playing field** for new flexibility services

4. Optimise **balancing cost**

Some key areas of focus for the Balancing Programme to 2025



We will deliver a **2nd Data Centre providing enhanced resilience** to the Open Balancing Platform (OBP)



Transition of **Electronic Data Transfer /Electronic Dispatch Logging** to the OBP Strategic platform. De-risk BM failure & enabling further changes to support storage management.



Build out **cross programme integration** – e.g., Integrated Energy Management System, Single Markets Platform and Data & Analytics Platform.



Enablers to support **Non-BM in the Open Balancing Platform (OBP)** enabling Ancillary Services Dispatch Platform (ASDP) Decommission in 2025.



Enhanced storage management with **Fast Dispatch** & new **Balancing Mechanism (BM) Quick Reserve service**.



Delivery of **MW Dispatch Service** (NGED & UKPN); to allow earlier connection of assets.



New **Platform for Energy Forecasting** enable ESO to update forecasting models with ever evolving energy landscape and data



Enabling delivery of **accurate and easily accessible forecasting data** to market participants through BMRA & ESO Data Portal



Decommissioning of EBS through the transition of functionality into BM



Roadmap for BP3 - 2025 and beyond elaborated, underpinned and interlocked with other programmes

Stakeholder Feedback – “You said, we did”

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Information on our website was not easy to find



We restructured our website to make information easier to find

You would like more regular updates between our events



We launched our Balancing Programme Newsletter

You would value direct discussions on specific topic areas



We set up specific stakeholder focus groups to allow for direct discussions

Better transparency was needed around the outputs of the stakeholder focus groups



We now publish all this information on the website and via our newsletter

Improve the dispatch of battery assets in the Balancing Mechanism



We held a stakeholder event to collaborate with industry on our plan

The battery zone needed to be included in OBP Release 1



We reprioritised activities to include this in OBP Release 1

Open Balancing Platform (OBP) Release Plan

Bernie Dolan & Nisha Bhamidimarri

Objectives of the Session



- Provide an overview of what industry can expect to see on day 1 of OBP R1.
- Provide a high level overview of the OBP specific roadmap out to Summer 2025, outlining functionality industry can expect to see
- Outline the benefits and value we have identified for the different releases of OBP.



- Provide an opportunity for stakeholders to:
 - Highlight any challenges they perceive in the proposed release schedule
 - Highlight any additional benefits/value add they perceive as this may support prioritisation within the release schedule moving forward.

Engineering Transformation

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Modern Architecture: The platform represents a significant architectural advancement, steering towards an authentic microservices architecture that inherently incorporates pre-designed elements for resilience, performance, and stability.



Modern Test approach with focus on Automation: Implemented Test First approach. Introduction of lower level testing, gradually reducing large inefficient E2E packs to catch issues much earlier in the development cycle. Fully comprehensive test automation results, enabling continuous Testing.



Monitoring, Proactive Incident Management and Observability. Adoption of Site Reliability Engineering (SRE) to implement continuous monitoring and proactive incident management. **Enabling observability** through Grafana/Kabana tool set. Enabling traceability of a user feature providing real-time insights and analytics to enhance performance, efficiency, and user satisfaction.



Transparency and continuous improvement through automated measurement: Adoption of automated DORA (DevOps Research and Assessment metrics) tracking development life cycle inefficiencies and enable process improvement to achieve agility and speed.

Microservices based architecture allowing further modernization and enhancement.

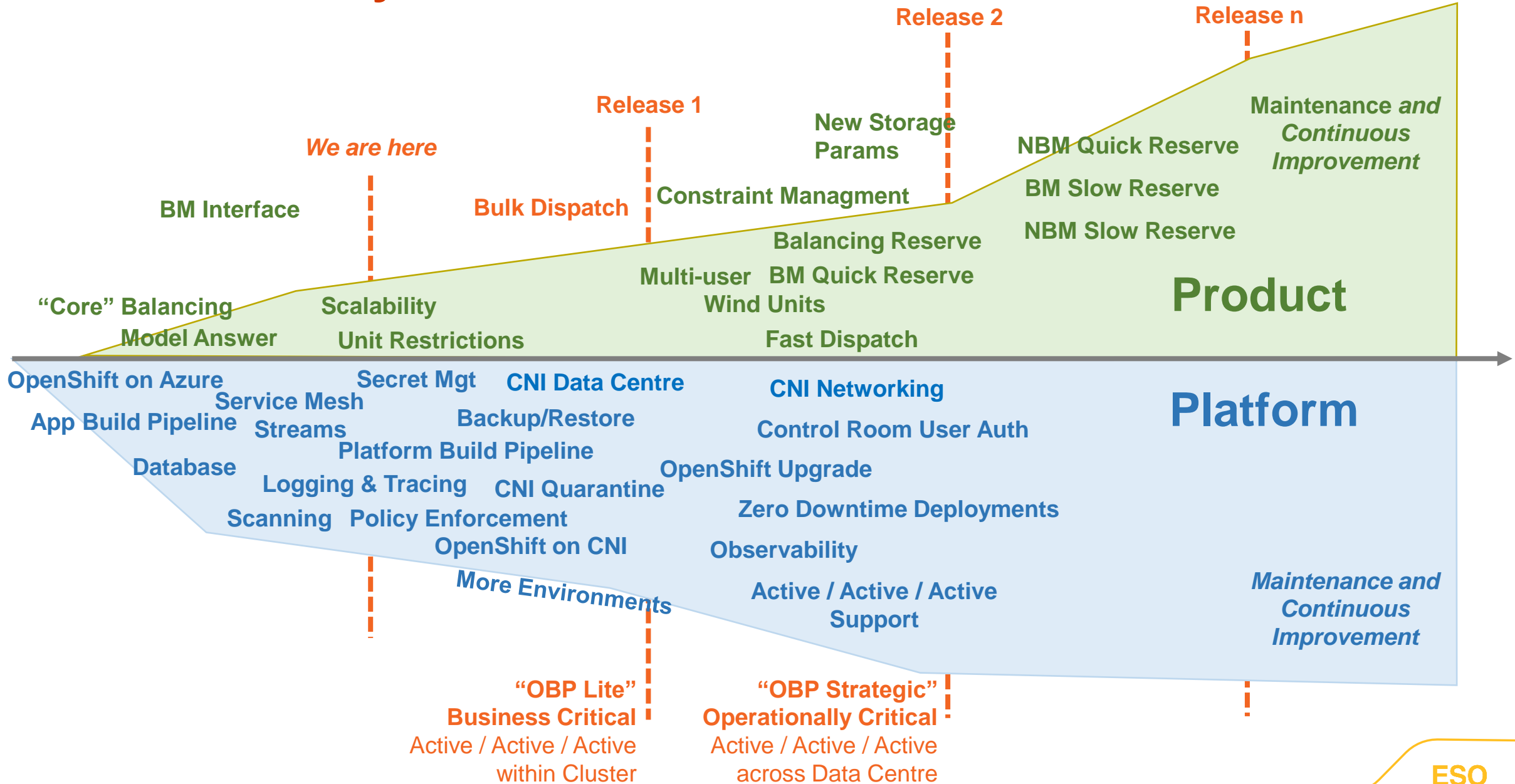
Automation code coverage 75% enabling ability to improve quality with speed.

Enhanced observability to continuously assess system behaviour, monitor the system health and business KPIs such as optimization, instructions etc.

Lead time for code change: Ability to make code change in >1 day from Developer environment (lowest) to the SIT environment (highest).

OBP...as a Journey

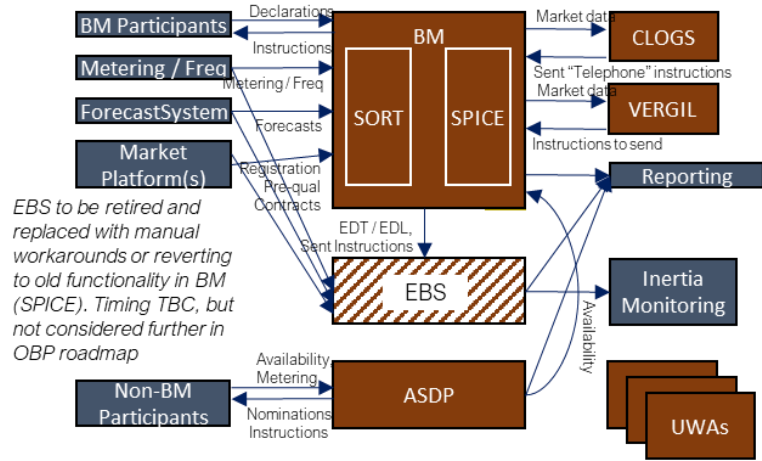
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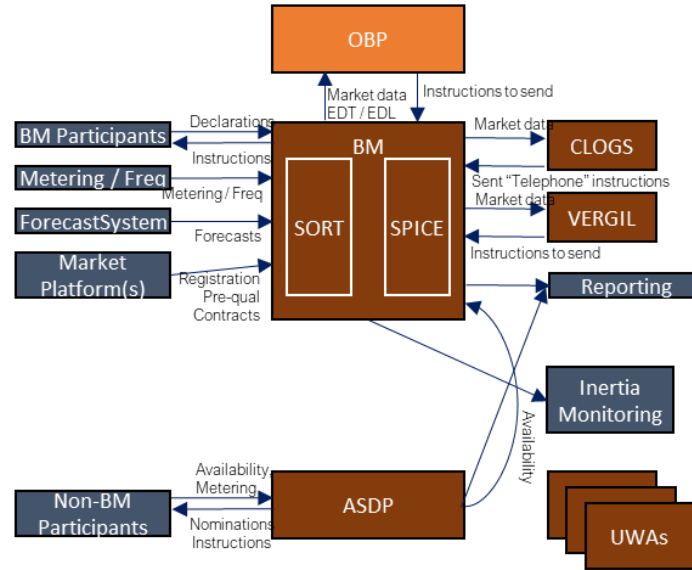
Additive Roadmap Long-Term View

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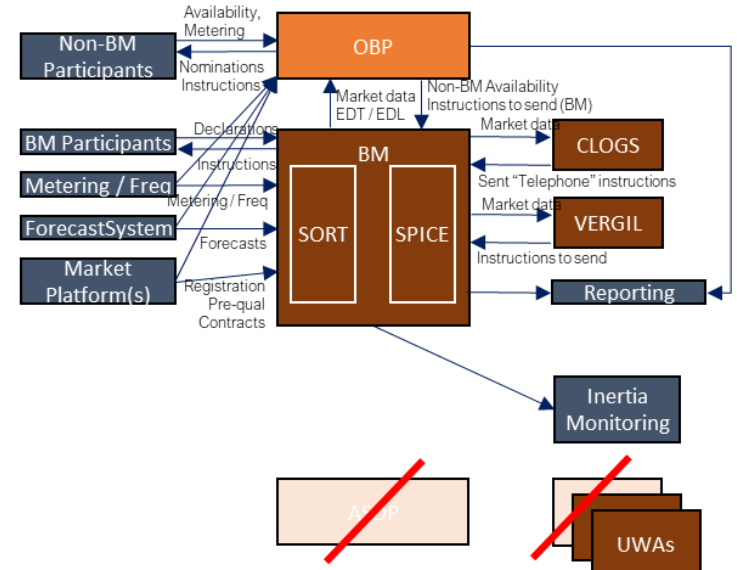
As-is



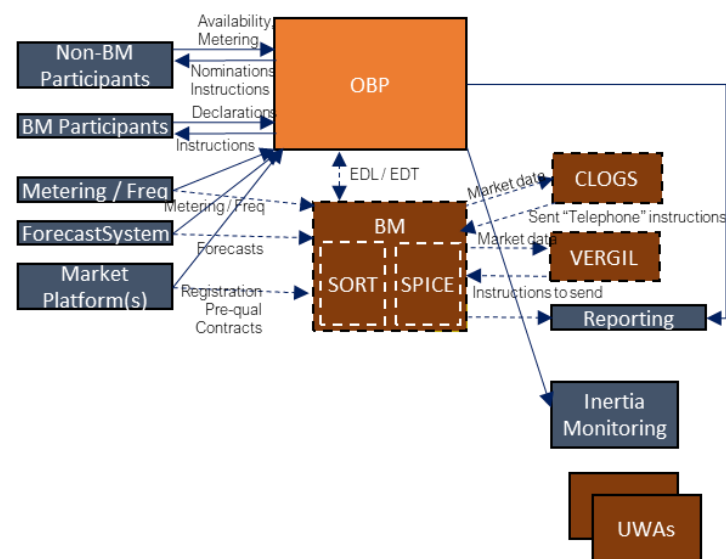
Step 1 – Scalable Ops (Dispatch)



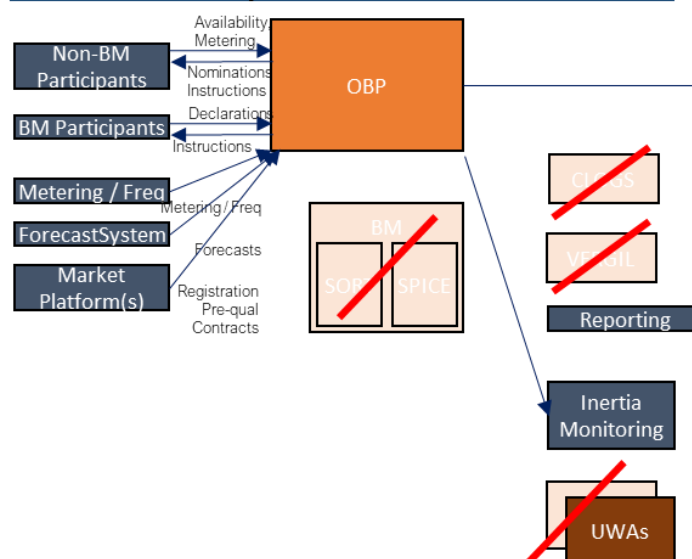
Step 2 – Ancillary, Reserve & Response



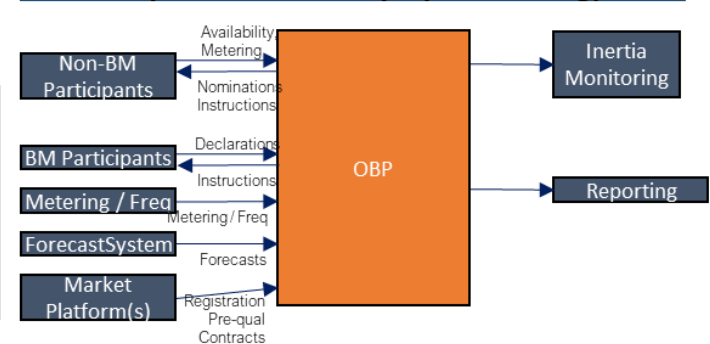
Step 3 – OBP Master



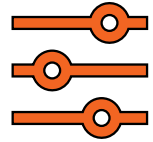
Step 4 – Decom BM



Step 5 – Scalable Ops (Scheduling)

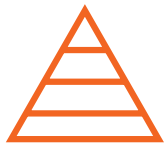


Until existing systems are fully decommissioned we have two types of release



- If an OBP release has a dependency on an existing systems then OBP must align with the other system's release schedule
- If the release is fully managed within OBP we adopt the philosophy of “release on demand”
- OBP will adopt continuous delivery – use feature “toggles” to promote regular deployment and “release on demand”

When evaluating what to implement and when, we must take into account the level of resilience the services requires



- Initially we go live with “OBP Lite” – this provides a resilient platform support within one Data Centre
- Later we implement “OBP Strategic” – automatic resilience across two geographically separate Data Centres
- While in OBP Lite the fail over if we lose an OBP Data Centre is to revert to existing systems and so some new services may be lost

Details of our First Release

We are going live with two zones on 12 December – the Battery Zone and Small BMU Zone

- In testing we have successfully optimised requirements for both zones and followed this by automatically issuing multiple instructions
- In the case of the Battery Zone we are typically issuing 25 to 50 instructions per run
- In the case of the Small BMU Zone the number of instructions is 40 to 80 (the Battery Zone is smaller than the Small BMU Zone)

In testing we have experienced issues with certain combination of technical parameters

- The key issue is the automatic conversion from the decimal MW values generated by the optimiser and the creation of instructions with integer MW values
- The issue does not arise in Battery Zone but can appear in up to 10% of instructions generated for the Small BMU Zone

To workaround this we have implemented the following

- All instructions that do not fully obey technical parameters are flagged to the control engineer
- These instructions are blocked from the automatic sending function
- The control engineer will manually adjust the invalid instructions and send them via existing systems

We are working on a number of proof of concepts to fix this issue

Winter 2023

Capabilities:

1. Bulk Dispatch of Battery Zone & Small BMU Zone

Enablers:

1. New IT Platform in one Data Centre
2. Interface to/from existing BM system

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Details of the capabilities and enablers:

- Transfer of zonal targets from existing Balancing Mechanism (BM). For two zones we will enable a control room user to select a proposed optimised set of instructions based on a least cost solution that satisfies the requirement, subject to all Balancing Mechanism Unit (BMU) constraints and send these instructions with a single button press.
- The platform is in place, serving as the foundation for future releases.

Benefits:

- Instructions will increase from 2-3 per minute to circa 50 instructions multiple times per hour.
- A more optimal solution will be available to the control room
- Reduction in skip rates
- Reduced CO2, increased use of flexible assets, improved situational awareness ~ £15m consumer benefit p.a.

Future support from Industry:

- Feedback after you start to receive instructions from the new tool
- Confirmation you can handle increased volumes of instructions

Spring 2024

Capabilities:

1. Fast Dispatch
2. Balancing Reserve

Enablers:

1. Full support for clock change
2. Interface for SCADA

Details of the capabilities and enablers:

- **Fast Dispatch** – allows the control room to take optimised fast actions from BMUs have that the correct technical parameters (this will not be limited to two zones)
- **Balancing Reserve** – Supports dispatch of BMUs that are successful in Balancing Reserve auctions
- Provides metering to OBP so that we can implement monitoring and improve situational awareness

Benefits:

- Improved use of flexible assets by providing control engineers the ability to instruct fast acting units to manage short term frequency deviations
- Additional revenue opportunity for BMUs via Balancing Reserve
- Increased situational awareness frees up time to consider other actions

Future support from Industry:

- More BMUs will receive an increase in the number of instructions – confirmation that volumes can be managed by control points

Summer 2024

Capabilities:

1. BM Quick Reserve
2. Bulk Dispatch Wind BMUs

Enablers:

1. Interface from Single Markets Platform

Details of the capabilities and enablers:

- Implementation of BM Quick Reserve
- Bulk dispatch of wind BMUs using heuristic rules that overcome these units not following PN
- Automated interface from SMP

Benefits:

- BM Quick Reserve provides new market opportunities for market participants
- BM Quick Reserve is forecast to reduce consumer costs through the procurement of a more economic new service
- Interface from SMP overcomes limitations from current manual process
- More efficient dispatch of wind BMUs – designed to mitigate the issue of these units not following submitted PNs

Future support from Industry:

- Support end-2-end testing of BM Quick Reserve
- Feedback on heuristic rules for dispatching Wind BMUs

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Autumn 2024

Capabilities:
1. Constraint management

Enablers:
1. Interface to Data Analytics Platform

Details of the capabilities and enablers:

- Provide decision support tools to the control room so that they can better dispatch to minimise the effect of constraints
- Improve off-line analysis to measure the effectiveness of actions
- Support audit of control room decisions

Benefits:

- Better constraint management allowing the control room to reduce the effect of system constraints – estimated benefit is circa £11m p.a.
- More feedback to the control room on the effectiveness of decisions

Support from Industry

- To some extent this is an “enabling” release providing more tools to the control room and less change for participants but is there more information you would like on this?

Winter 2024

Capabilities:

1. New storage parameters

Enablers:

1. OBP Strategic – second Data Centre
2. EDT/EDL mastered from OBP
3. Interface to Ancillary Settlement for Non-BMU (NBM)

Slido Poll

Details of the capabilities and enablers:

- Implementation of new storage parameters allowing the control room to plan use of limited duration assets in longer timescales
- EDT/EDL mastered from OBP allowing more flexible development opportunities
- New services on OBP now have full resilience
- OBP will have interface to the ESO settlement systems

Benefits:

- Better long term management of limited duration assets
- Removal of “15 minute rule” for limited duration assets allowing the ESO to send more optimal instructions
- Inclusion of new message types on EDT/EDL (e.g. supporting removal of fax machines)
- Interface to Ancillary Settlement is an enabler for moving NBM services onto OBP

Support from Industry

- Participation and support for Grid Code changes
- Testing of new EDT/EDL messages

Spring 2025

Capabilities:

1. Non BMU (NBM) Instruction Types

Enablers:

1. NBM Application Programming Interfaces (APIs)

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Details of the capabilities and enablers:

- Implement “open ended” and “arming” instructions on OBP to support new services planned for the future (NBM Quick Reserve and Slow Reserve)
- Develop external communication APIs on OBP and run in parallel with existing APIs to control points

Benefits:

- This an “enabling” release while we move capabilities from existing systems to OBP
- As such benefits are realised at a later date

Support from Industry

- Testing new interfaces

Summer 2025

Capabilities:

1. NBM Quick Reserve
2. BM Slow Reserve
3. NBM Slow Reserve

Enablers:

1. Pumped Storage Bid-Offer Acceptances (BOAs)

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Details of the capabilities and enablers:

- Major roll-out of new reserve services to both BMUs and non-BMUs. Features defined in new service terms.
- Development of control room screens to allow the issuing of Pumped Storage BOAs on OBP

Benefits:

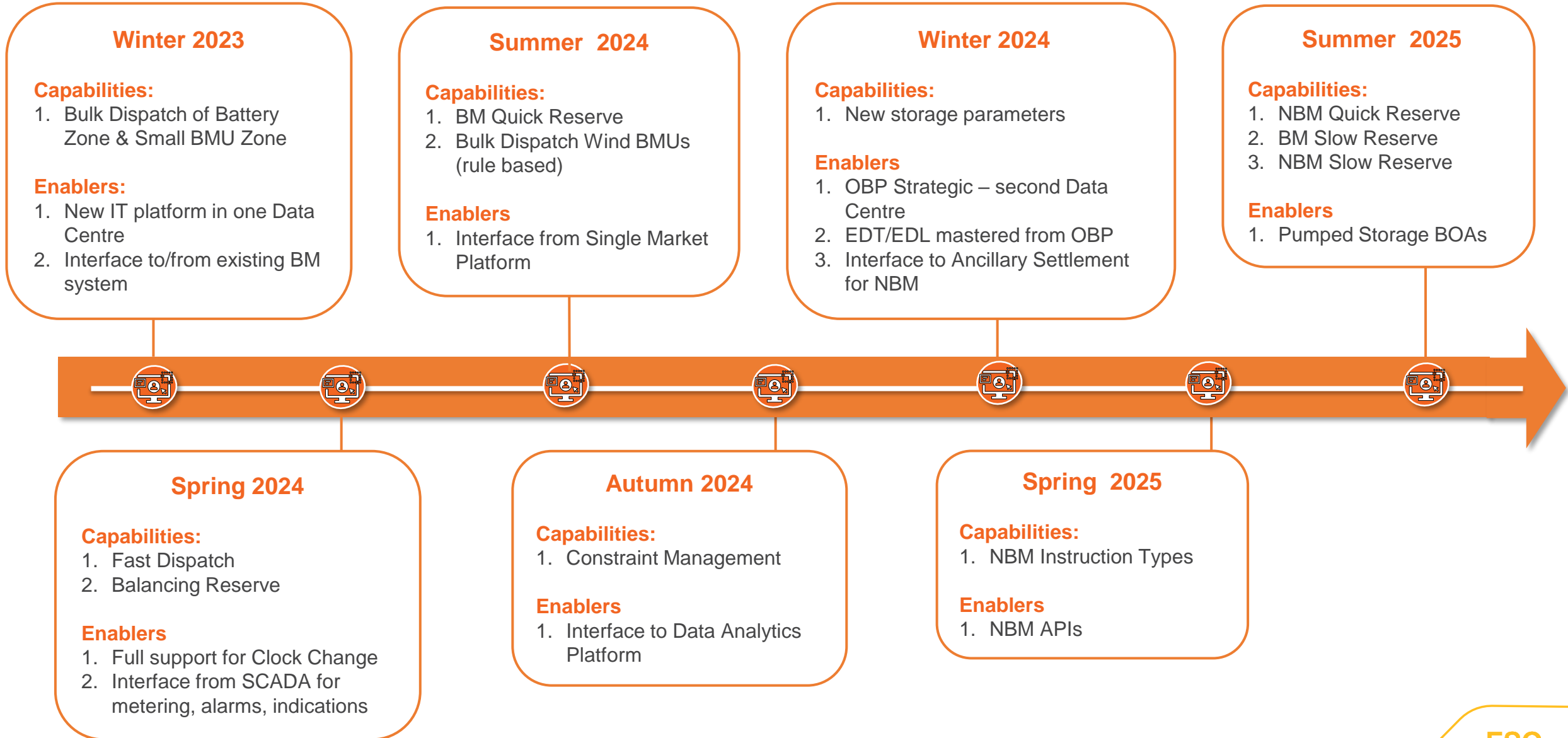
- New market opportunities for participants
- New services that are more economic and support net-zero ambitions
- Dispatch of BM and NBM from one system improving situational awareness and supporting better dispatch decisions – estimated benefit circa £8m p.a. (please note does not include benefits in bullet 2 which will be provided in other forums)


Support from Industry

- Testing of new reserve services
- Testing with Pumped Storage units

Open Balancing Platform Release Plan Timeline

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The background of the slide features a close-up, blue-tinted image of a microscope lens. Several bright, white light rays emanate from the lens, creating a sense of depth and focus. The overall aesthetic is clean and professional, typical of a scientific or technical presentation.

Balancing Programme (BP) Roadmap Deep Dive

Gabriel Diaz & Mili Gupta

Breakout Session

Objectives of the Session



- Provide an update on:
 - Roadmap progress since June 2023, and the benefits delivered
 - How we are transforming our balancing capability through to Autumn 2024, and the impact and benefits we expect to see
 - The changes market participants can expect to see for each release, and when



- Develop an understanding of:
 - How our transformation may impact you
 - What information you need from us throughout this transformation, and when
 - Any challenges, opportunities, & additional benefits you perceive in our Balancing Programme roadmap



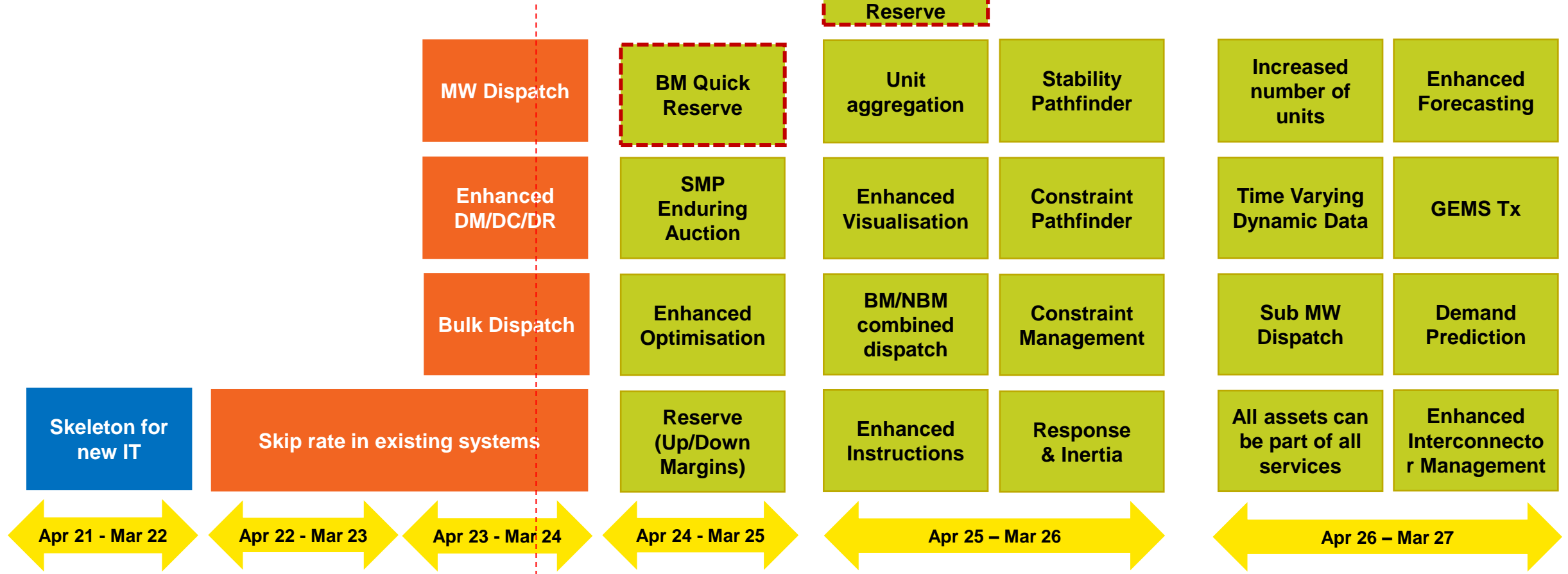
- Collaborate on how we overcome any key challenges associated with transforming our balancing capabilities.

Industry Co-created Roadmap – Version 3




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Our industry co-created transformation roadmap describes the functionality which will be delivered in our systems to help us realise the strategic objectives, and when

Key:
Blue Box – Complete
Orange Box – In progress
Green Box – Capabilities to come
 - - - - - Updated since Version 2



Time Horizon of Activities across 2023

-  Development of New Systems
-  Current System Changes
-  Trials

	June 2023		July 2023		September 2023	
Activity Name	Balancing Mechanism (BM) System Release - Constraint Management Pathfinder	Strategic Platform for Energy Forecasting (PEF) System Release - Foundation	Ancillary Services Dispatch Platform (ASDP) System Release: ASR NBM PN Visualization	ASDP System Release: Regional Development Programme NGED MW Dispatch	BM System Release: Inertia enablement	Small-scale aggregated assets: Live BM Trial
ESO Deliverable	Introduce functionality arm and disarm units and reduce manual effort through the introduction of new reason codes.	Delivered the foundation of the new Platform for Energy Forecasting (PEF) on our strategic cloud platform	Improved visualisation for non-BM Response services.	Delivery of NGED MW Dispatch Service - a constraint turn-down service. Business go-live for NGED will be late November.	Enabling the Inertia process in BM SPICE.	In conjunction with Power Responsive, we have started a trial to examine small scale assets operating in the Balancing Mechanism (BM).
Impacts	Automation of manual process and facilitating improved optimisation of how constraints are managed.	Enable the development of new forecasting features.	Increased control room visibility of dynamic response services	Allows the control room to turn down generation in the NGED area for units which have the relevant condition in their contract and are signed up for the service.	Enabling retirement plan for EBS	Temporary relaxation of the existing operational metering standards, for 3 months for new assets for a limited volume (50MW total, 10MW per company)
Benefit	Build on the ~£100m of constraint costs savings already delivered by the Pathfinder so far, as well as supporting the move to a zero-carbon future .	Enable development of our new forecasting platform to provide more accurate, frequent, granular, & easily accessible forecasting data to improve decision making ahead of real time .	Improved situational awareness for the control room re: dynamic response services	NGED can offer earlier connections to distributed assets who participate in the service than might otherwise be the case.	Part of a larger project that will enable us to retire EBS in 2024, providing a one-off saving of approx. £30.2m for the 1st year and an additional saving of £5.2m for the following 3 years	Evidence base development: <ul style="list-style-type: none"> Review the capability of assets operating in BM framework. Assess impacts and risks of aggregated smaller-scale assets operating in the BM. Evaluate benefits – Additional flexibility in the BM and impact on balancing costs.

Time Horizon of Activities across 2023



Development of New Systems



Current System Changes

November 2023

Activity Name	PEF System Release: Grid Supply Point (GSP) level Embedded Solar & Wind Forecast	ASDP System Release: Regional Development Programme UKPN MW Dispatch	ASDP System Release: Control Room Improvements	BM System Release: Vergil Single Dispatch (Phase 1)	BM System Release - Constraint Management Pathfinder (CMP)
ESO Deliverable	Enables incremental Grid supply point level embedded solar & wind power generation forecasting data flowing into balancing system (BM)	Delivery of the majority of the UKPN MW Dispatch Service - a constraint turn-down service. Delivery of the remaining UKPN MW Dispatch Service is scheduled for Feb 2024	STOR and non-BM Fast Reserve service ASDP system Improvements.	BM system enhancement reducing the time to issue instructions. This is an enabler towards introducing the new Balancing Reserve service	IEMS- BM Interface & Situational Awareness
Impact	Improved constraints management ahead of real time, enables lesser last minute / real time actions in BM.	Allows the control room to turn down generation in the UKPN area for units which have the relevant condition in their contract and are signed up for the service.	Improvement to a situational alert, log screen retention and auto cease functionality	Potential increase from 100 to 300 instructions per day 30 seconds per instruction down to 10	<ul style="list-style-type: none"> Remove dual maintenance for IRTIP status between IEMS and SORT Enable update of CMP pricing in SORT and automatically inform SHETL of disarmed units Reduced manual workload for the control room.
Benefit	Estimated consumer saving per annum: £17m-£28m Provide more certainty to market participants Anticipated to support reduction in balancing costs and the risk of constraints being breached in real time.	UKPN can offer earlier connections to distributed assets who participate in the service than might otherwise be the case.	Risk reduction and system use improvements	<ul style="list-style-type: none"> Improved real-time dispatch of smaller BMUs and batteries. Improved cost-order decisions. Improved speed to dispatch batteries and small BMUs - required to go live with balancing reserve. Balancing Reserve is planned to reduce balancing costs by £25m per month 	Time saving improvements for the control room → Increased amount of time for the control room to spend working on dispatch in merit order . Build on the ~£100m of constraint costs savings already delivered by the Pathfinder so far, as well as supporting the move to a zero-carbon future .

Time Horizon of Activities across 2023 & 2024



Trials



Development of New Systems



Current System Changes



Enabling Market Reform

November 2023

December 2023

January – March 2024




Activity Name	BM System Release – Integration & Decom Enablement	BM System Release: Control Room Improvements	Dynamic Regulation: Cap Increase	Open Balancing Platform (OBP) System Release – Winter 2023	Control Room Process Trials	ASDP System Release: Ancillary Services Reform (ASR) Response	ASDP System Release: Control Room Improvements
ESO Deliverable	Interfaces delivered to enable OBP to bulk dispatch small BMUs & batteries. BM changes to enable EBS decommissioning	ENCC requested usability improvements to dispatch (SORT) & scheduling (SPICE) tools.	Increase cap on current auction to 350MW	Bulk Dispatch of Battery Zone & Small BMU zone. IT Platform in 1 Data Centre Interface to/from existing BM system	Testing different approaches to the application of storage in meeting reserve requirements through to dispatch decisions.	Delivery of improvements in Dynamic Response services.	Improvements inc. new active screen for NBE & update on screen alert
Impact	Enables bulk dispatch for the Small BMU and Battery Zones, improving merit order dispatch Removes reliance on EBS	Improved navigation & situational awareness, saving users time & giving them more capacity to focus on merit order dispatch. Improvements to scheduling of batteries & CFD wind units.	Increasing the volume of procured Dynamic regulation	Instructions will increase from 2-3 per minute to circa 50 instructions multiple times per hour. Platform is in place - foundation for future releases.	Targeted dispatch in real time Potential for more Scheduling	Improved ability to arm & disarm units Improved visibility of future contract periods Improved visualisation for non-BM Response services	Improved functionality of the system
Benefit	Interfaces to enable OBP to bulk dispatch - estimated £11m savings. Part of a larger project that will enable us to retire EBS in 2024, providing a one-off saving of approx. £30.2m for the 1st year and an additional saving of £5.2m for the following 3 years.	Reduction of balancing costs (estimated > £2m per year) Support increased dispatch efficiency & a reduction in skip rates.	Support increased system security. Enhanced market opportunities.	A more optimal solution will be available to the control room Reduction in skip rates Reduced CO2, increased use of flexible assets, improved situational awareness ~ £15m consumer benefit p.a.	Reduced balancing costs	More flexibility and effective use of response services Improved control room situational awareness Increased ability to protect system security	Improved ability to dispatch

Time Horizon of Activities across 2024

-  Development of New Systems
-  Current System Changes
-  Trials
-  Process Improvement




	Winter	January – March 2024						
Activity Name	Storage Parameter Trials and start grid code change	BM System Release - Vergil BOA Extension Shortcuts	BM System Release: Ewic and Moyle Interconnector	BM System Release: Greenlink Interconnector	BM System Release: SPICE Changes	BM System Release: Control Room Improvements	Wind Power Generation Forecasting Product	
ESO Deliverable	Expedite the provision of data. Underpins ENCC process reviews and efficient dispatch of batteries ahead of grid code mod	Improvements to Vergil to reduce manual workload when extending BOAs on small BMUs and batteries	Remove legacy systems for E&M interconnector	Enable Greenlink interconnector for its commissioning date.	Enabling the Day Ahead Congestion Forecast and Trading Processes in SPICE	Improvements to Control Room dispatch tool (SORT).	Deliver generator level wind power generation forecasts using advanced analytics & modelling capabilities, & richer numerical weather prediction model data	
Impact	Greater number of instructions	Time saving improvements 45 seconds per extension to 10 seconds			This will be the final set of process changes which enable us to decommission EBS and realise the benefits	Improved situational awareness - increased visibility of frequency control instructions & instructed reserve	Improve decision making in control room and for market participants	
Benefit	More efficient dispatch	Enable improved merit order dispatch. Supports introduction of Balancing Reserve	Streamlined maintenance and support	The Greenlink interconnector is anticipated to provide additional energy security and the integration of low carbon energy sources.	Part of a larger project that will enable us to retire EBS in 2024, providing a one-off saving of approx. £30.2m for the 1st year and an additional saving of £5.2m for the following 3 years	More time for the control room to focus on merit order dispatch. >£2m expected annual reduction in balancing costs	Frequent, granular, & more accurate forecasting data to market participants Improved situational awareness for wind generation resulting in improvements in overall quality for ESO's forecasting capability	

Time Horizon of Activities across 2024

-  Development of New Systems
-  Current System Changes
-  Enabling Market Reform

	Spring 2024		May – June 2024		
Activity Name	Balancing Reserve	OBP System Release: Spring 2024	BM System Release: Bulk Disarm Response	BM System Release - Constraint Management Pathfinder & SCL	BM System Release: Control Room Improvements & OBP Interface
ESO Deliverable	Go-Live of a new product that will secure Regulating Reserve on a firm basis at day ahead	<ul style="list-style-type: none"> Fast Dispatch Balancing Reserve Full support for clock change Interface from SCADA for metering, alarms, indications 	Bulk arming and disarming of DM, DR, and DC response services by service and constraint	Additional usability improvements for CMP and changes to how costs will be calculated	Bulk MVAR dispatch Dispatch advice at forced SEL per unit Interface between OBP and BM.
Impact	Procurement of 500MW-2.5GW across all providers	<ul style="list-style-type: none"> Allows the control room to take optimised fast actions from BMUs have that the correct technical parameters (this will not be limited to two zones) Supports dispatch of BMUs that are successful in Balancing Reserve auctions Metering to OBP so that we can implement monitoring 	Improved ability to disarm and re-arm units providing dynamic response	New cost framework for intertrip scheme, the ability to instruct units for voltage separately from reactive power and the ability to instruct units separately for inertia	Consolidate > 100 screens into 1 Enable control room to reserve headroom on units Interface - provide data to enable OBP to better optimize for constraints
Benefit	Transparent Process Enhanced market opportunities Support increased system security	<ul style="list-style-type: none"> Improved use of flexible assets by providing control engineers the ability to instruct fast acting units to manage short term frequency deviations Additional revenue opportunity for BMUs via Balancing Reserve Increased situational awareness frees up time to consider other actions 	Support enhanced system security Potential to increase the amount of contracted response	Build on the ~£100m of constraint costs savings already delivered by the Pathfinder so far, as well as supporting the move to a zero-carbon future.	Control room improvements support reduction of balancing costs (estimated > £2m per year) Improved system performance

Time Horizon of Activities across 2024

-  Development of New Systems
-  Current System Changes
-  Enabling Market Reform

	May – June 2024		Summer 2024		September 2024	Autumn 2024
Activity Name	OBP Integration with Platform for Energy Forecasting (PEF)	ASDP System Release: Ancillary Services Reform (ASR) Response - Constraints	Quick Reserve	Open Balancing Platform Release – Summer 2023	PEF System Release: Solar Power Generation Forecasting – Enhancements	Open Balancing Platform Release Autumn 2024
ESO Deliverable	Technical delivery of a new interface between OBP and PEF	Delivery of improvements for Dynamic Response services	Product aimed primarily for reacting to pre-fault disturbances.	<ul style="list-style-type: none"> Implementation of BM Quick Reserve Bulk dispatch of wind BMUs using heuristic rules Interface from Single Market Platform 	Deliver Solar power forecasting product on PEF, & enhancements i.e., Model enhancements using richer data sets.	Constraint Management - Provide decision support tools to the control room. Interface to Data Analytics Platform
Impact	Enable transition of frequent, granular, and timely delivery of forecast data between the platforms	Ability to arm and disarm units by constraint.	Restore the energy imbalance quickly & return frequency close to 50.0 Hz	Enable BM quick reserve Overcome wind units not following PNs	Improved National & Grid Supply Point level solar power generation forecasts	<ul style="list-style-type: none"> Better dispatch to minimise the effect of constraints Improve off-line analysis to measure the effectiveness of actions Support audit of control room decisions
Benefit	Improved situational awareness & dispatch decision making in OBP.	<ul style="list-style-type: none"> More flexibility and effective use of response services. Improved control room situational awareness. Increased ability to protect system security 	Potential for enhanced market opportunities Transparent Process	<ul style="list-style-type: none"> New market opportunities for market participants BM Quick Reserve is forecast to reduce consumer costs through the procurement of a more economic new service Interface from SMP overcomes limitations from current manual process More efficient dispatch of wind BMUs – designed to mitigate the issue of these units not following submitted PNs 	Market participants have access to improved solar power generation forecasting data. Improvements to demand forecasting and reduction in balancing costs - contribute to the overall benefit case of forecasting enhancements ~£175-£190m; solar power is a component of national demand calculations	Better constraint management allowing the control room to reduce the effect of system constraints – estimated benefit is circa £11m p.a. More feedback to the control room on the effectiveness of decisions

Breakout Discussion



- Questions relating to any of the changes discussed so far?



- We want to hear from you:
 - How the changes may impact you
 - What information you need from us regarding these changes, and when
 - Any challenges, opportunities, & additional benefits you perceive with these changes



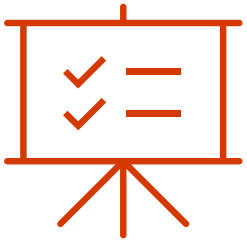
- We would like to collaborate on how we overcome any key challenges associated with transforming our balancing capabilities.

Transition & Innovation

Roya Ahmadi

Breakout Session

Objectives of the Session



Understanding our Transition approach

- How we are going to manage transitions within Balancing Programme
- Our initial plans for retiring ASDP



Innovation: Why we need it

- Our Collaboration with innovation team and sponsorship of multiple innovative projects.



Engagement and Collaboration

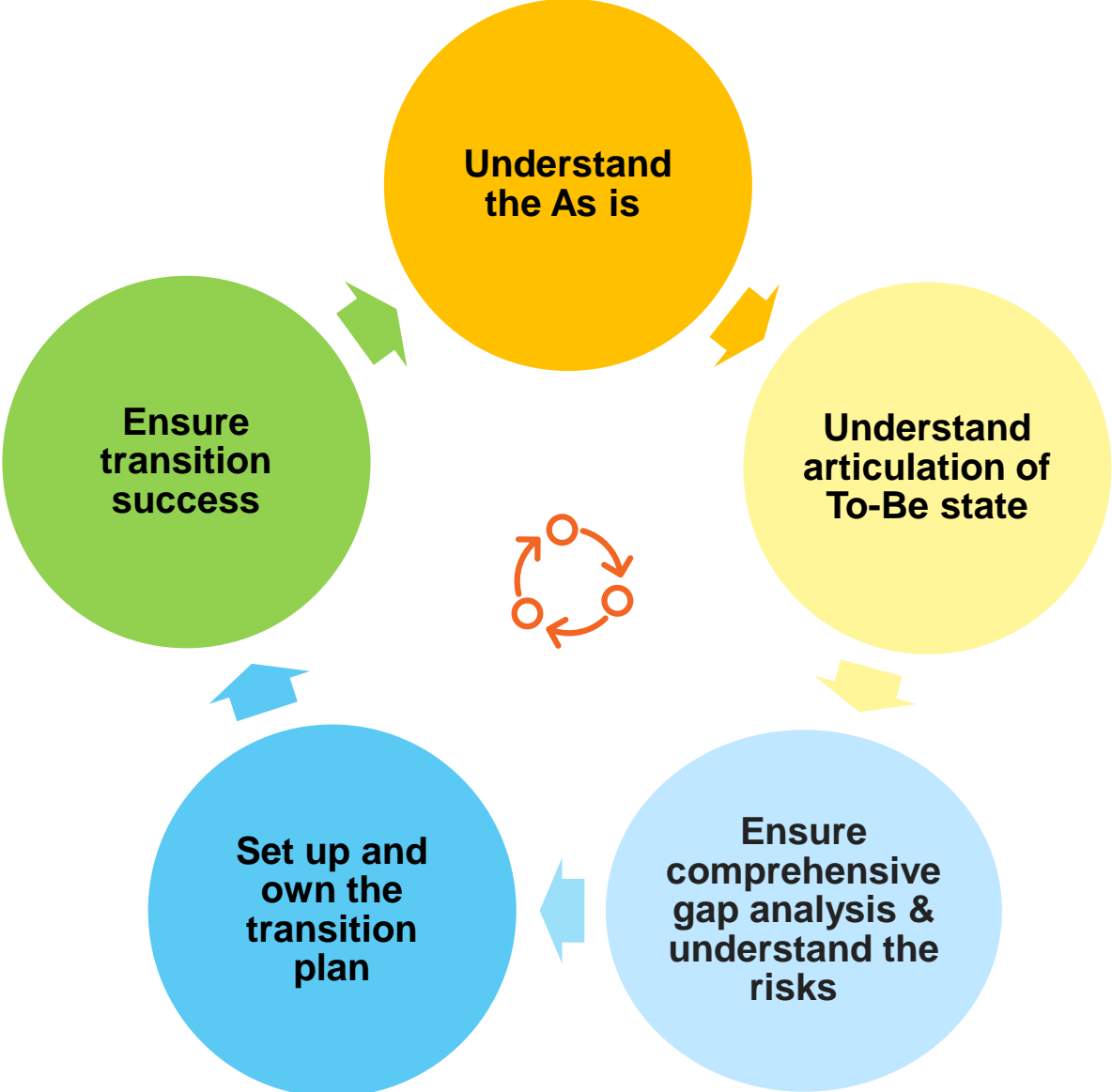
- Provide us with your feedback, suggestions, and potential concerns aiming to contribute to the development of effective and mutually beneficial transition strategies.

Balancing Programme Transition Management

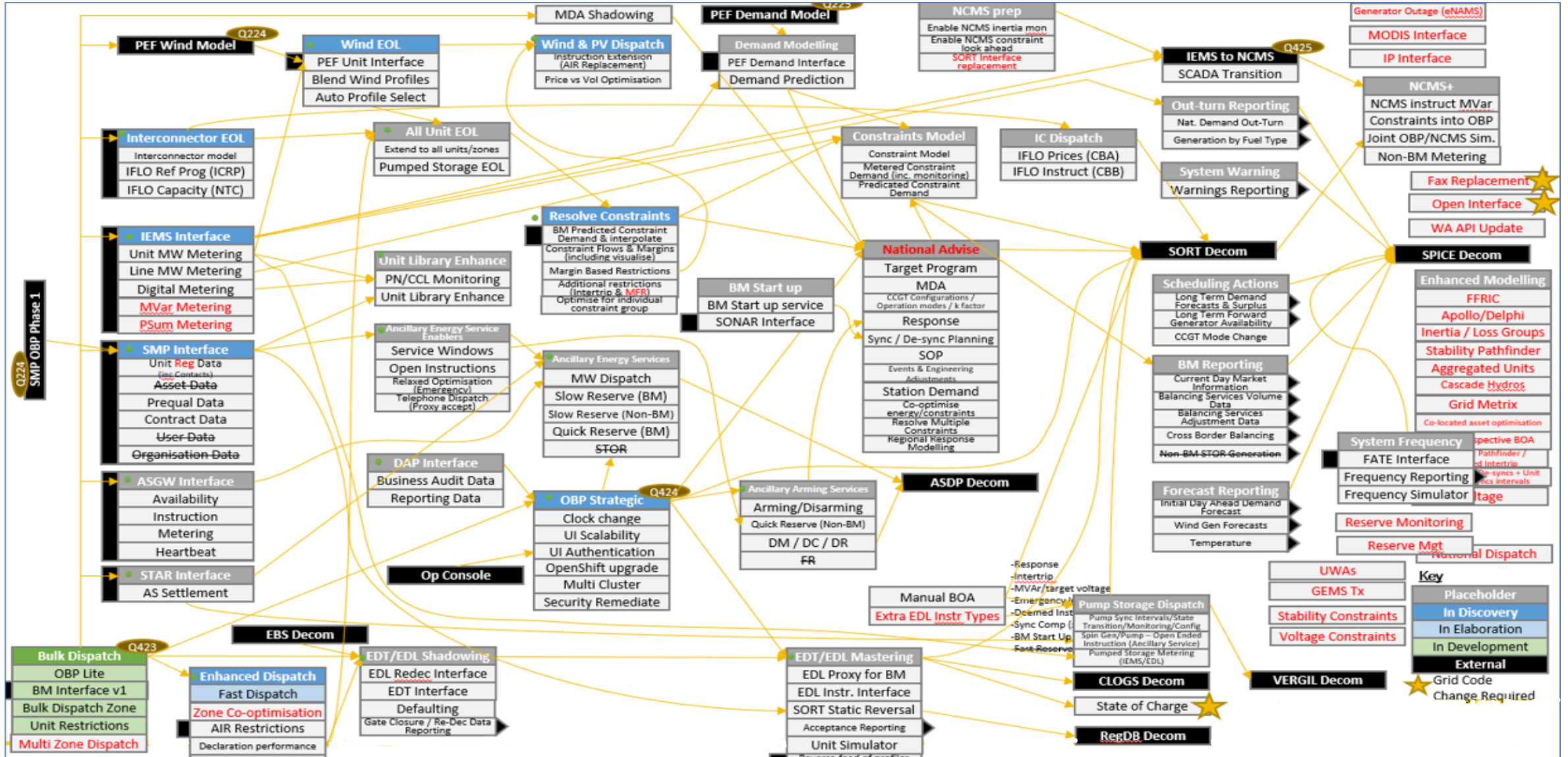
Slido #NovBPevent



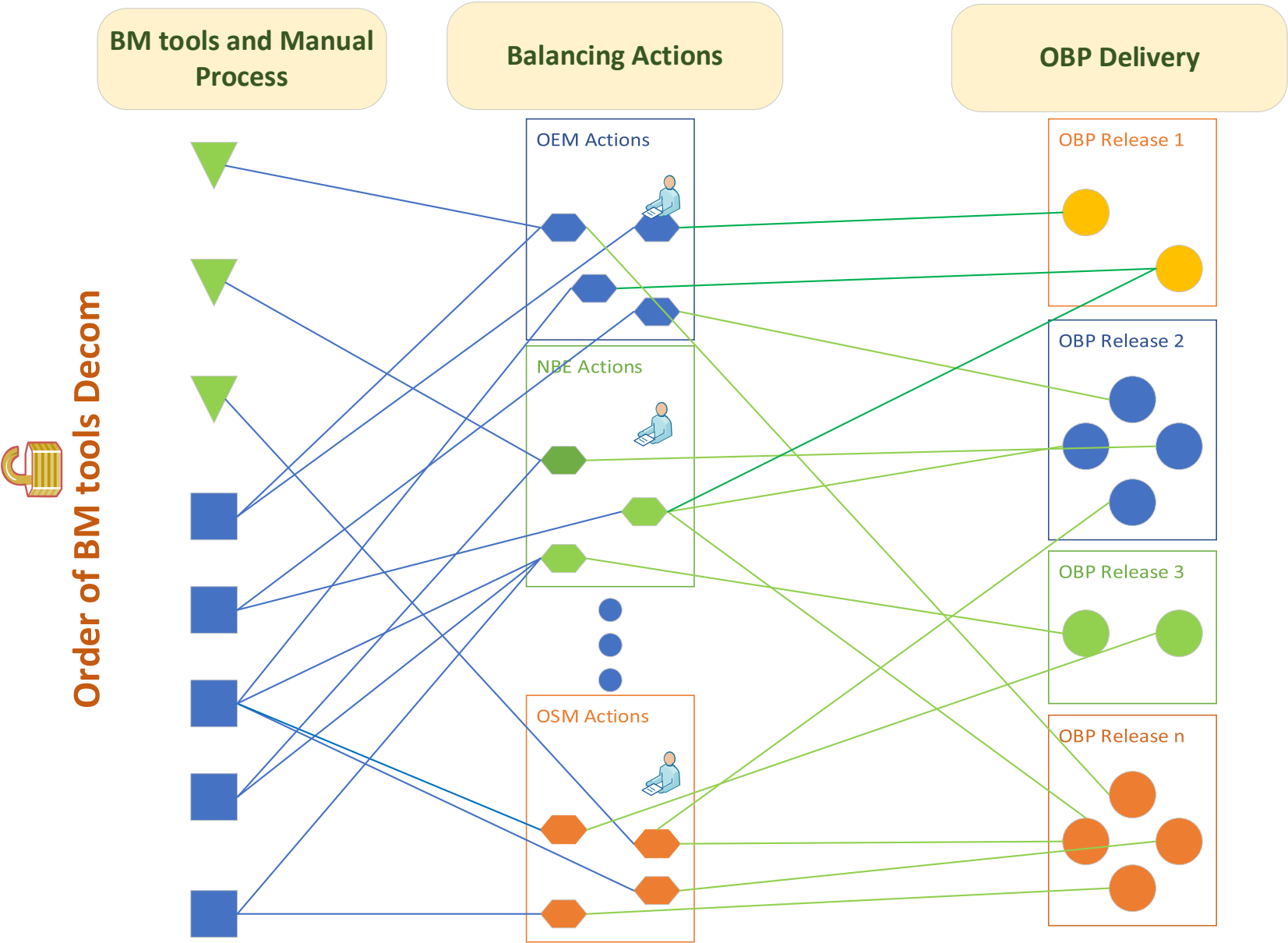
Balancing Programme Transition Management



Dependency View of the Roadmap



Transition Management Approach



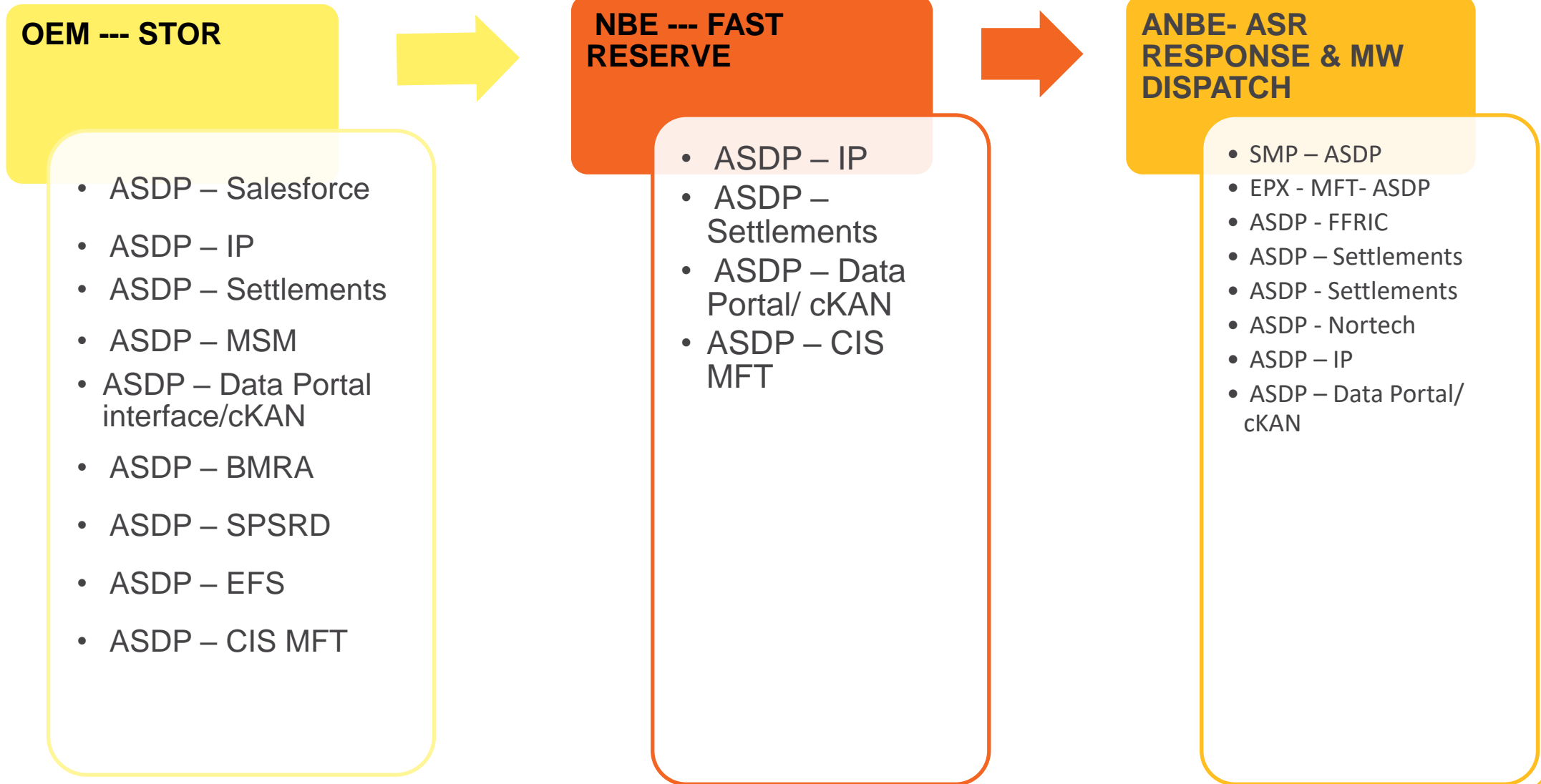
ASDP Retirement – Our High-Level Plan

Slido #NovBPevent

Mapping current balancing actions taken by control room operators within ASDP to relevant tools and services

Engagement with Market & Industry, Design and Development in OBP

ASDP to OBP Service by Service migration , participant onboarding and infrastructure retirement



Your Feedback and Comments

1

What is your preferred sequence for the delivery of services during this process?

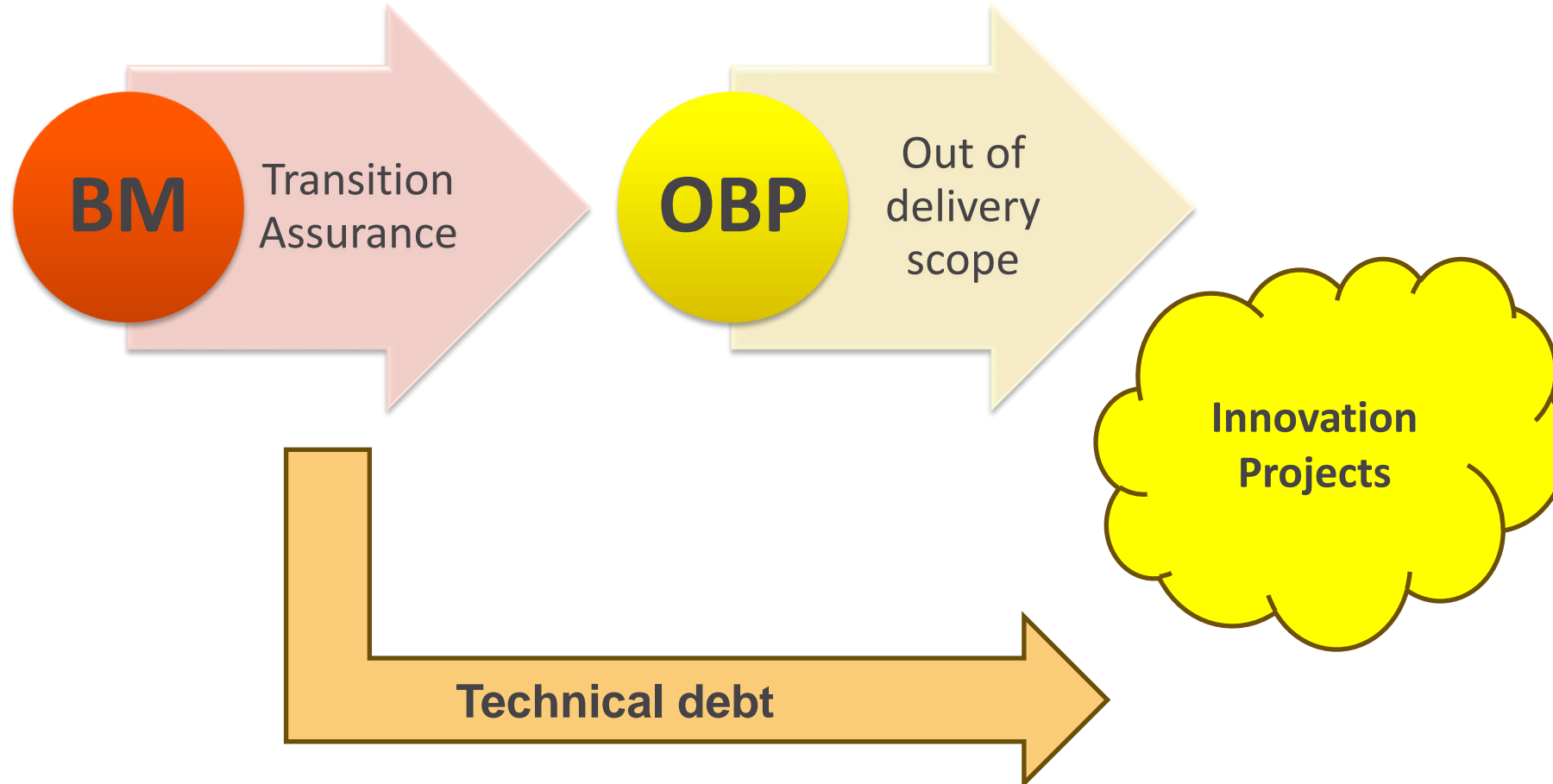
2

What specific modifications are required in the ASDP during the migration of services to OBP, particularly concerning interfaces?

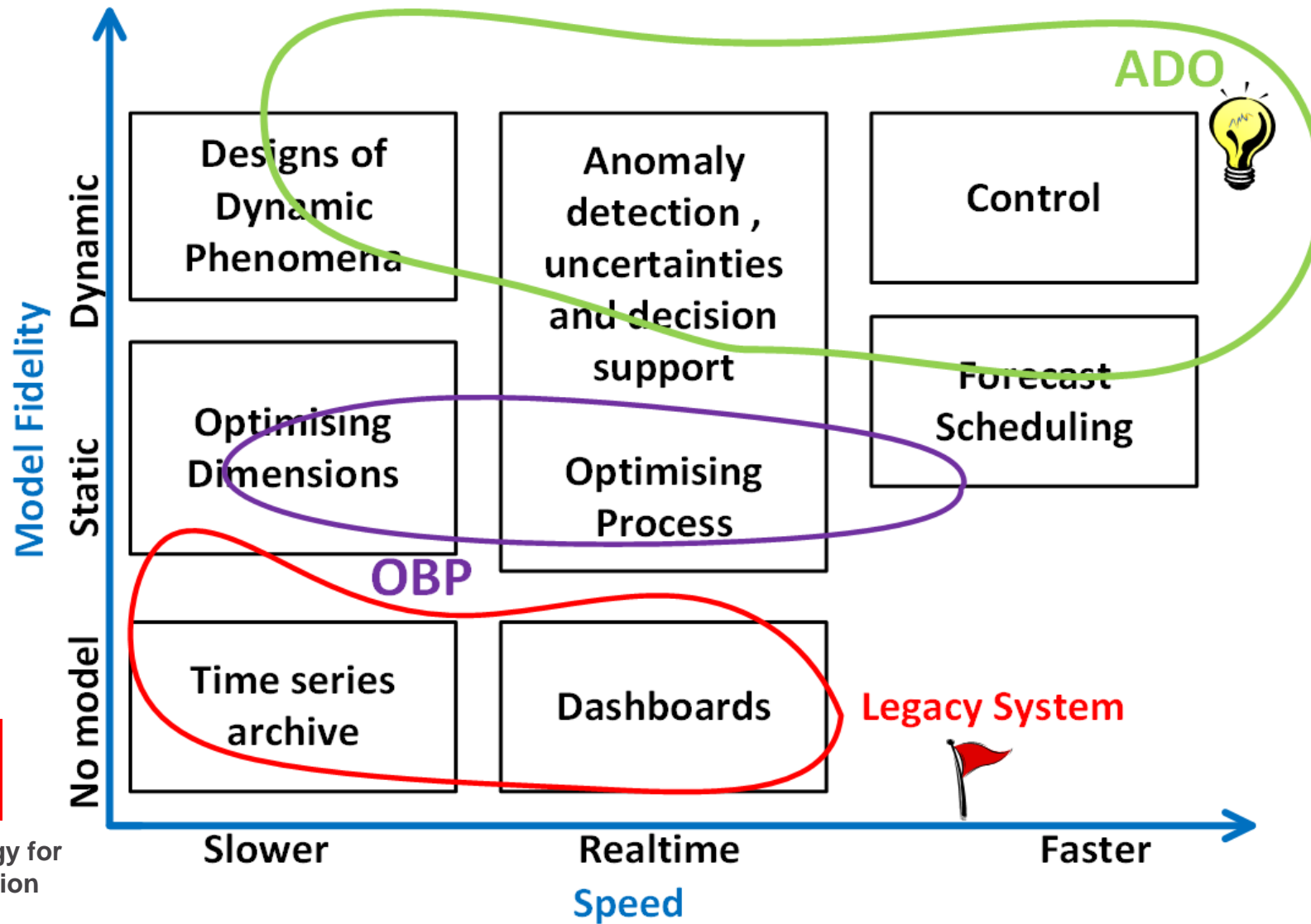
3

Could you provide an estimate of the timeframe needed for thorough testing in the event of interface modification?

Innovation: Why we need it



Innovation: Why we need it



MSBO

Model driven Strategy for Balancing Optimisation

Smithinstitute



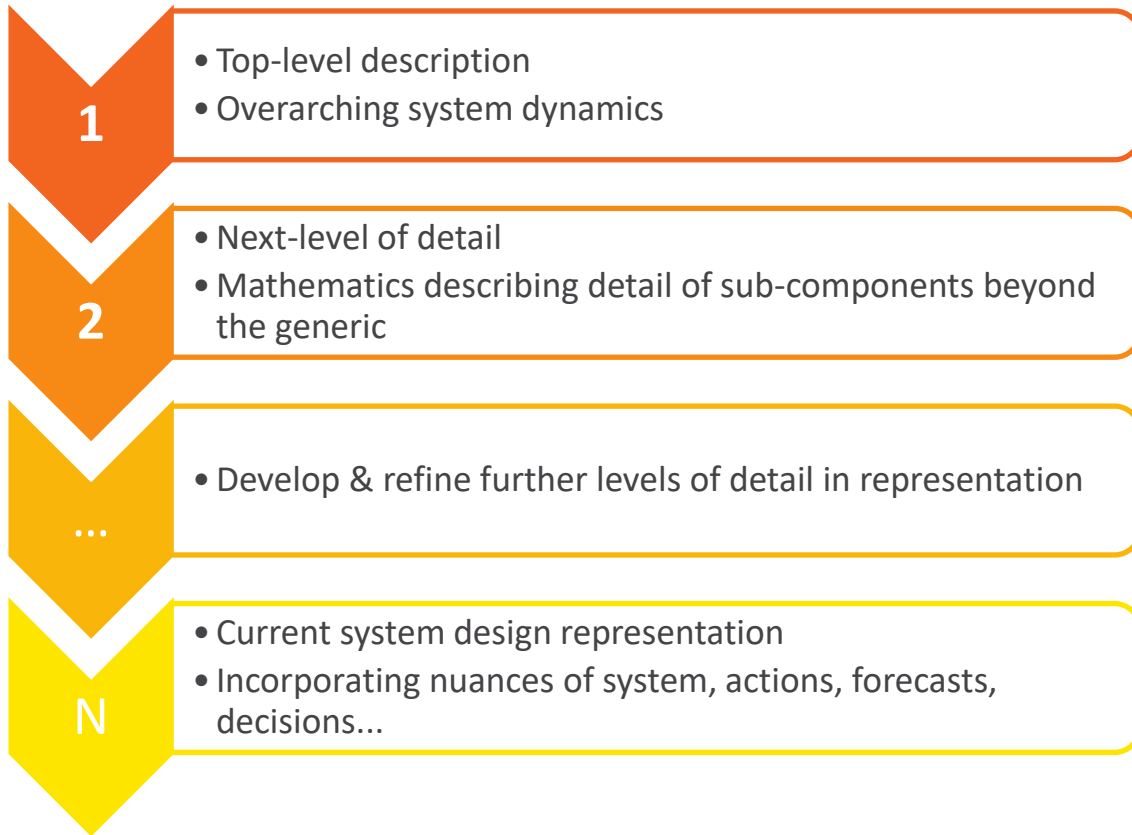
ADO

Advanced Dispatch Optimiser

IBM

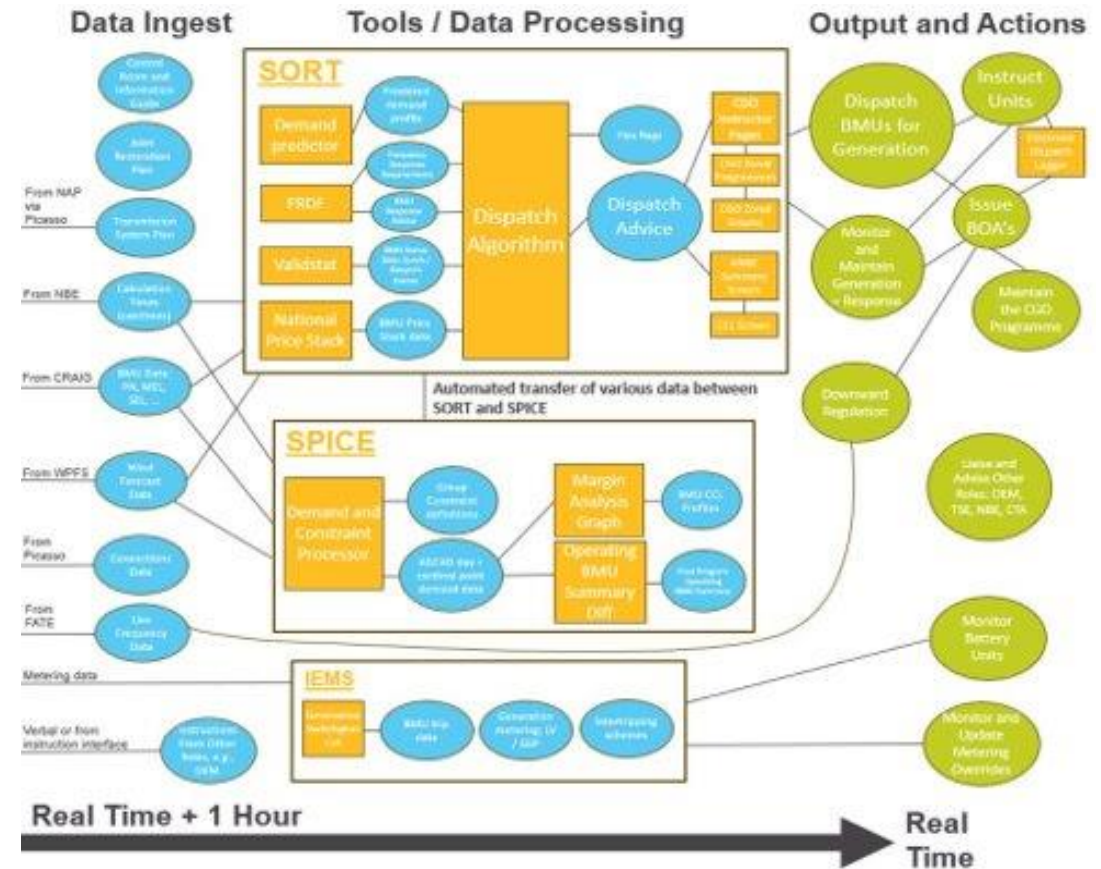
Model driven Strategy for Balancing Optimisation (MSBO)

Top-down, whole-system model



&

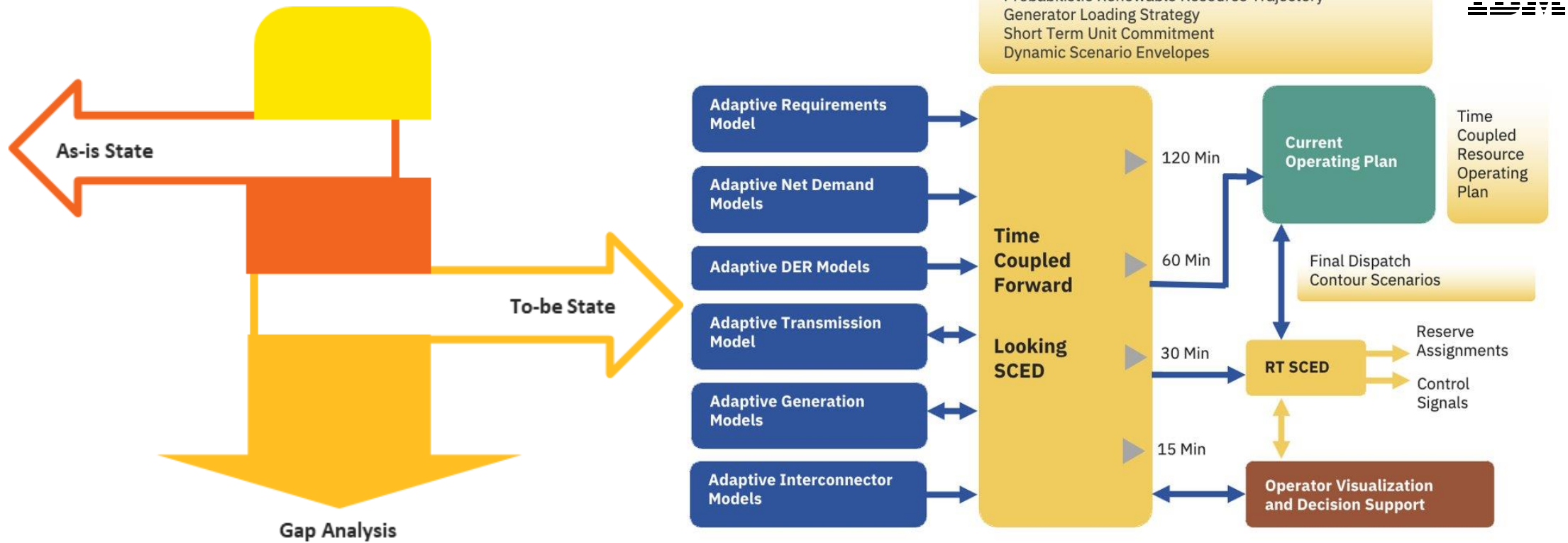
Bottom-up, detail via roles



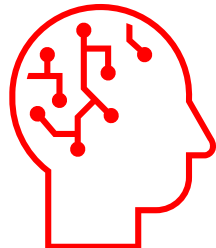
Advanced Dispatch Optimiser (ADO)

Slido #NovBPevent

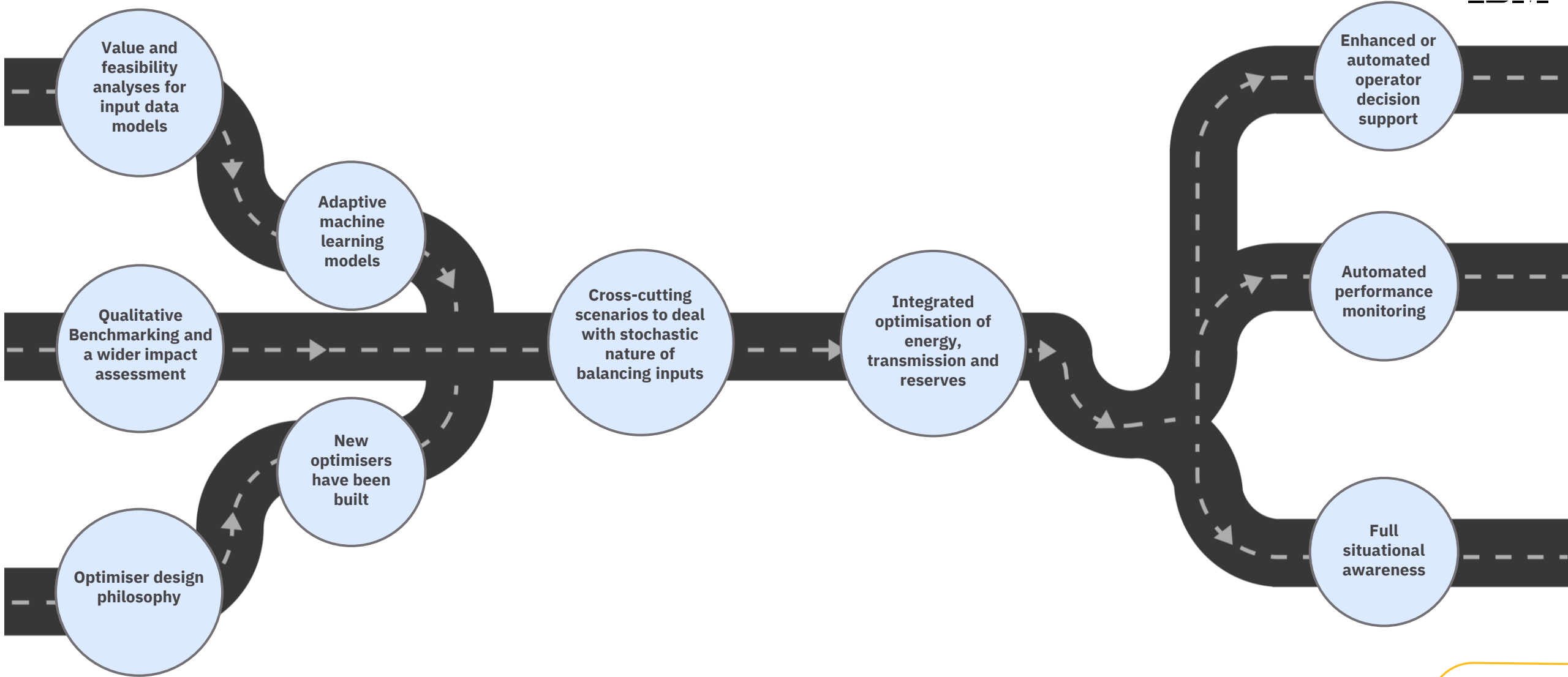
OBP



Strategic vision created by Google Tapestry



Street View Roadmap



Your Feedback and Comments

1

Are there any areas discussed that require additional clarification?

2

Do you have any suggestions for potential areas of improvement in regards to our Transition approach?
How would you like us to further engage with you on this topic?

3

Would you be interested in exploring collaborative initiatives together in the future?

An aerial photograph of a river with white water rapids. The water is a mix of dark green and white foam. On the right side, there are several bright blue, wavy, energy-like streaks that appear to be superimposed on the image. The overall scene is dynamic and energetic.

Open Balancing Platform (OBP) Optimisation Logic

Manos Loukarakis

Breakout Session

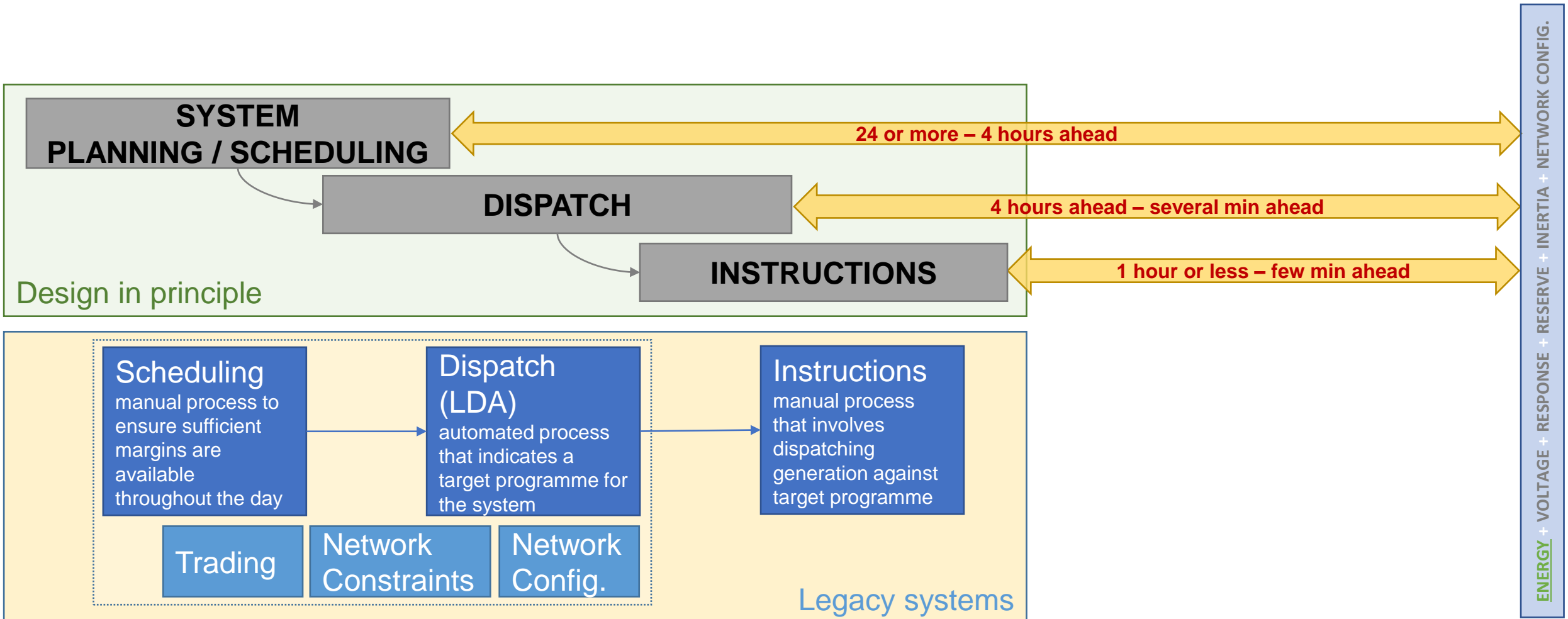
ESO

Session Aims

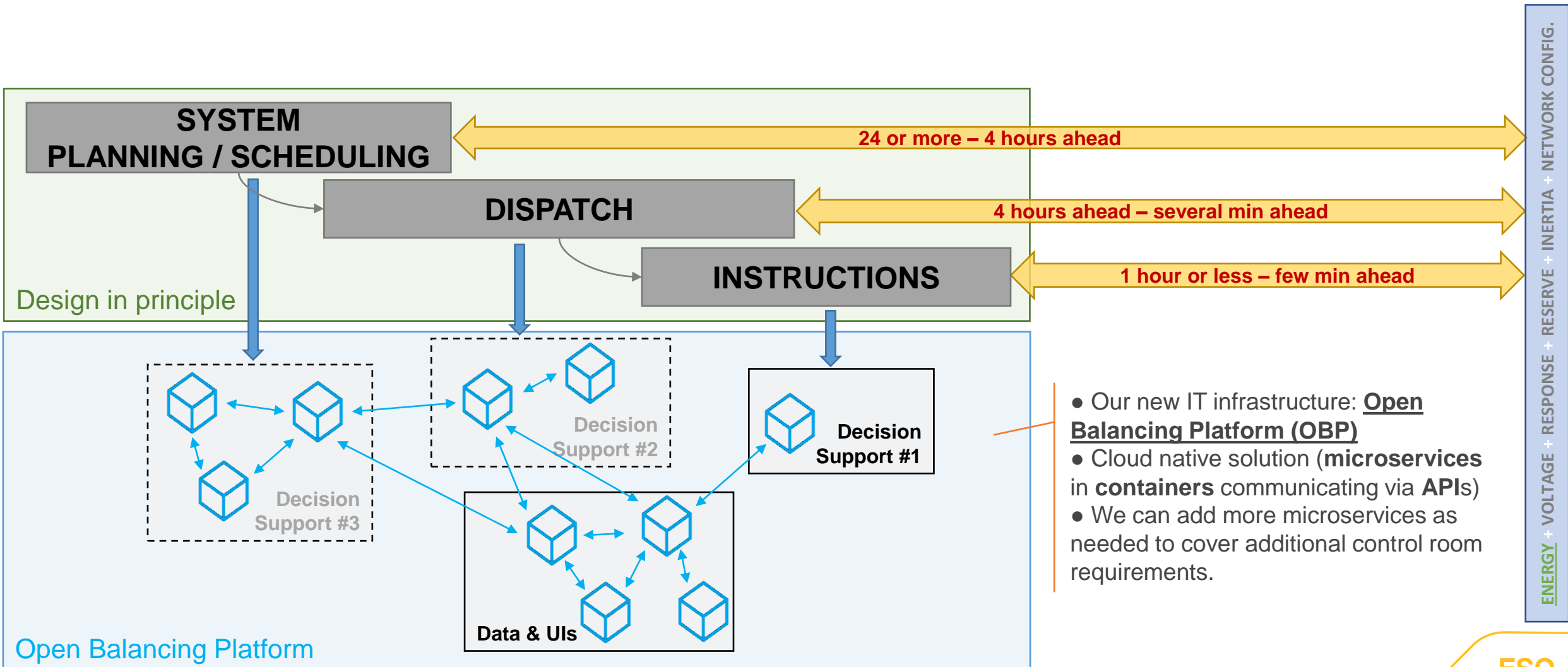
Based on past stakeholder meetings you've asked for:

- Details on application context / control room processes
 - **Context for OBP**
... how it relates with existing systems
 - **Context for Bulk Dispatch Optimiser (BDO)**
... how it fits within OBP and relative to existing systems
... what data / assumptions go into BDO
- Details on algorithms / optimisation
 - **BDO technical details**
- Demos / worked out examples
 - **A working example**

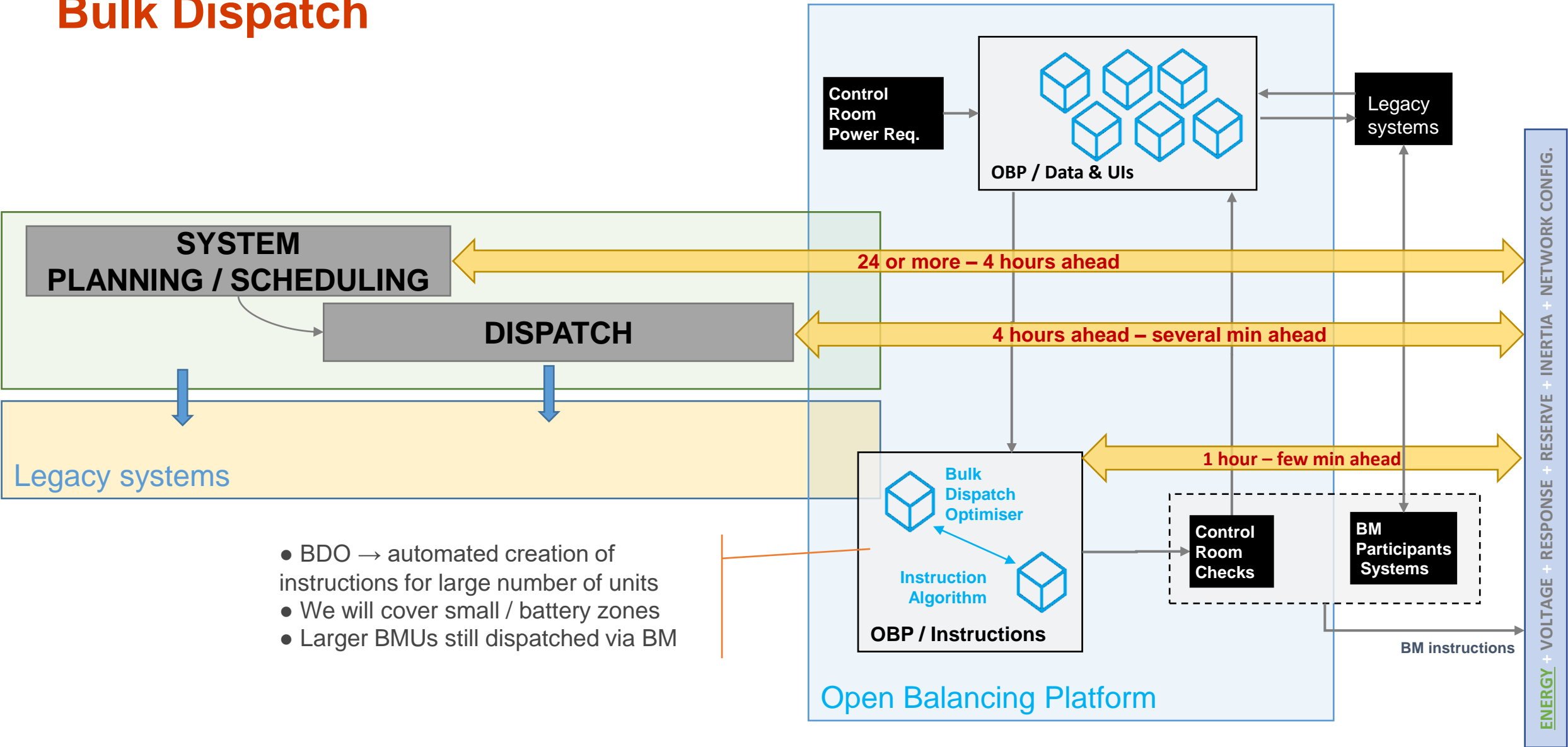
Current State-of-Play



Open Balancing Platform (OBP)



Bulk Dispatch



- BDO → automated creation of instructions for large number of units
- We will cover small / battery zones
- Larger BMUs still dispatched via BM

On Data and Other Flows

(1) Dispatch software calculates a target energy profile for the system and per zone

(2) Control room engineers review system state and manage risk
→ then derive power requirement by zone

Head/foot-room is affected by the exceptions logic.

(3) Control requirement sent to BDO (as a MW time-series)

- alongside BMU data including
- head/foot-room (calculated based on PN + BOAs)
 - dynamic data (ramp rates, etc.)
 - physical data (MEL, MIL, etc.)
 - unit state (e.g. MZT, MNZT related)

(4) BDO generates a MW time-series per BMU.

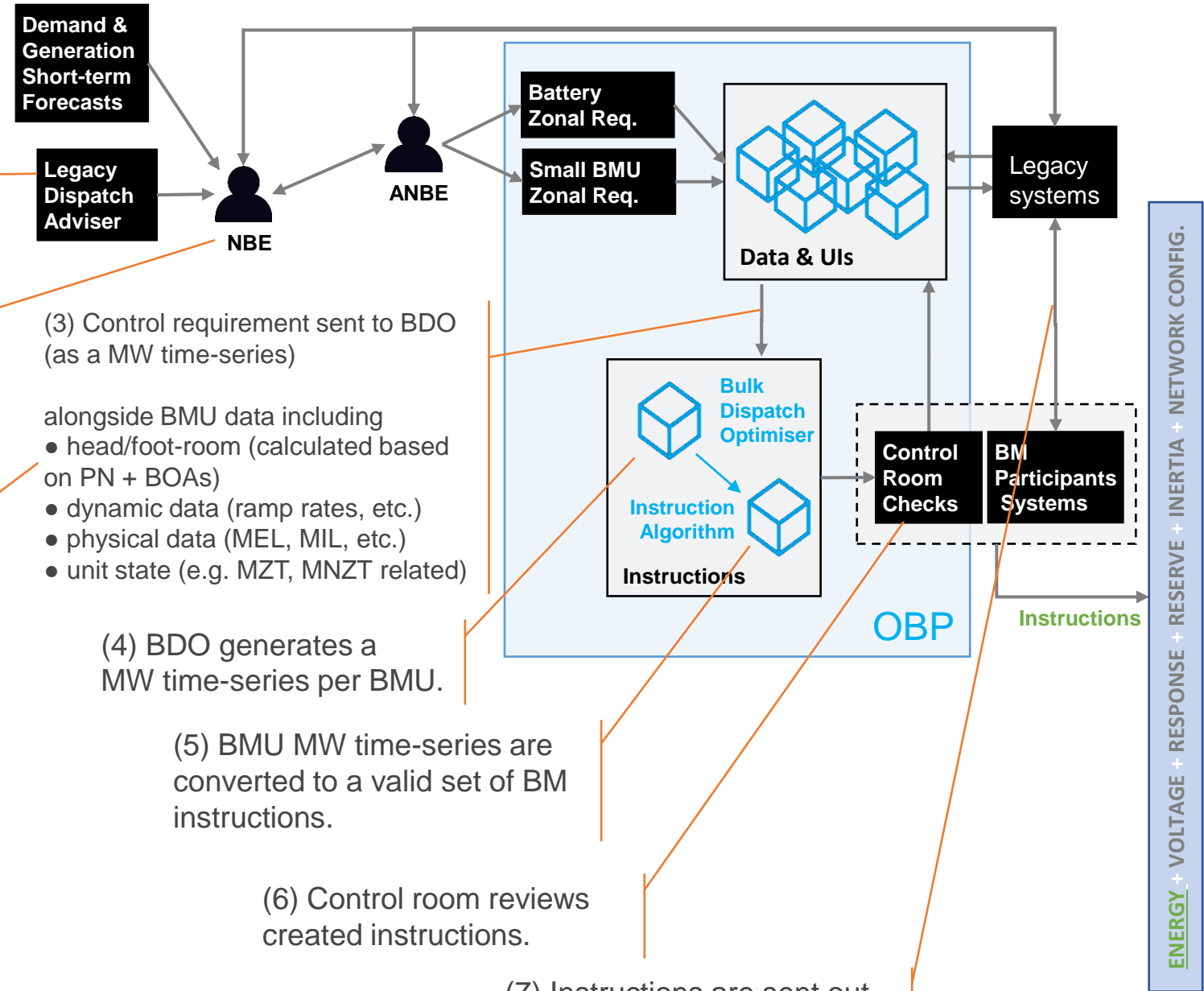
(5) BMU MW time-series are converted to a valid set of BM instructions.

(6) Control room reviews created instructions.

(7) Instructions are sent out via BM systems.

Impact on dispatch

- The combination of advice from LDA, forecasts, risk management approach defines volumes required at each step – path to meeting the imbalance volume can affect solution.
- The split of volume between zones is another factor that could affect the dispatch.

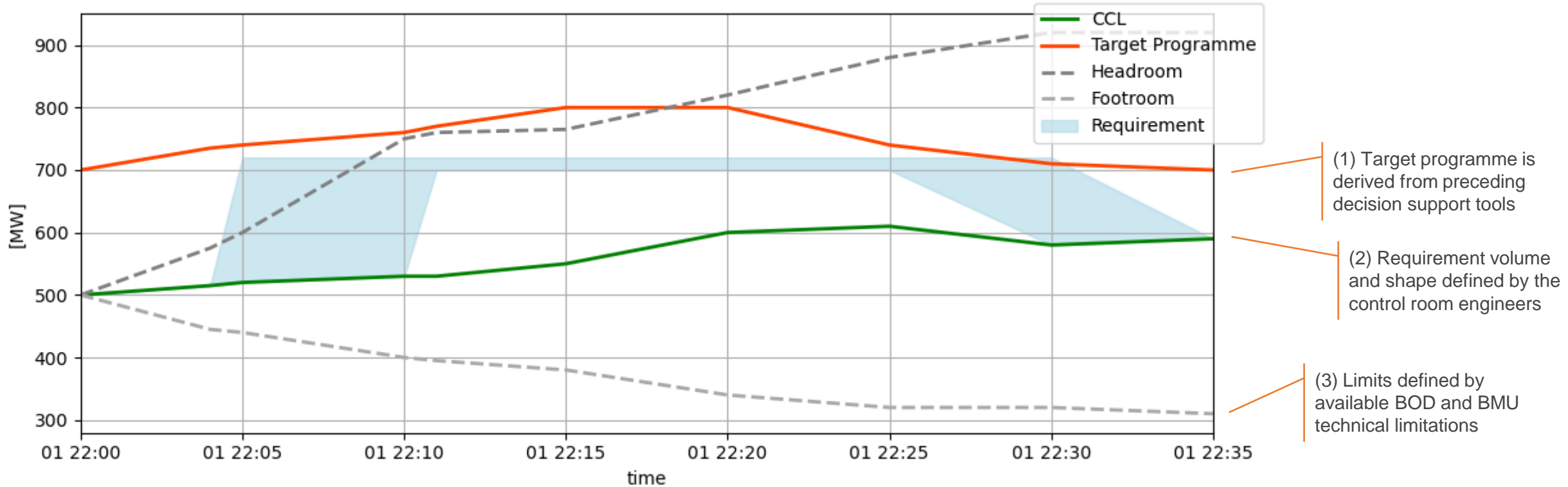


Bulk Dispatch Optimiser (BDO) Details

Modelling considerations:

- Requirement
- Objective function
- Ramp-rates
- Duration limited assets
- SEL/SIL
- MZT/MNZT
- Minimum flat top times (MFTT)
- Instruction creation

Control Requirement



... generation requirement

$$R_t^{DN} \leq \sum P_{u,t} \leq R_t^{UP}$$

BMU
Power total

Upper Requirement
Bound

Meeting exactly the requirement could lead to uneconomic decisions (requirement band instead)

Constraints are in practice "relaxed" to ensure we get a solution independently of actual availability.

Impact on dispatch

- Difference between bounds defines how fast ramping is required
- Duration of requirement will impact which units will be selected based on their state and relevant parameters (e.g. MZT, MNZT)

Objectives

... cost minimisation

$$\min\{\sum c_{u,t}\Delta P_{u,t}\}$$

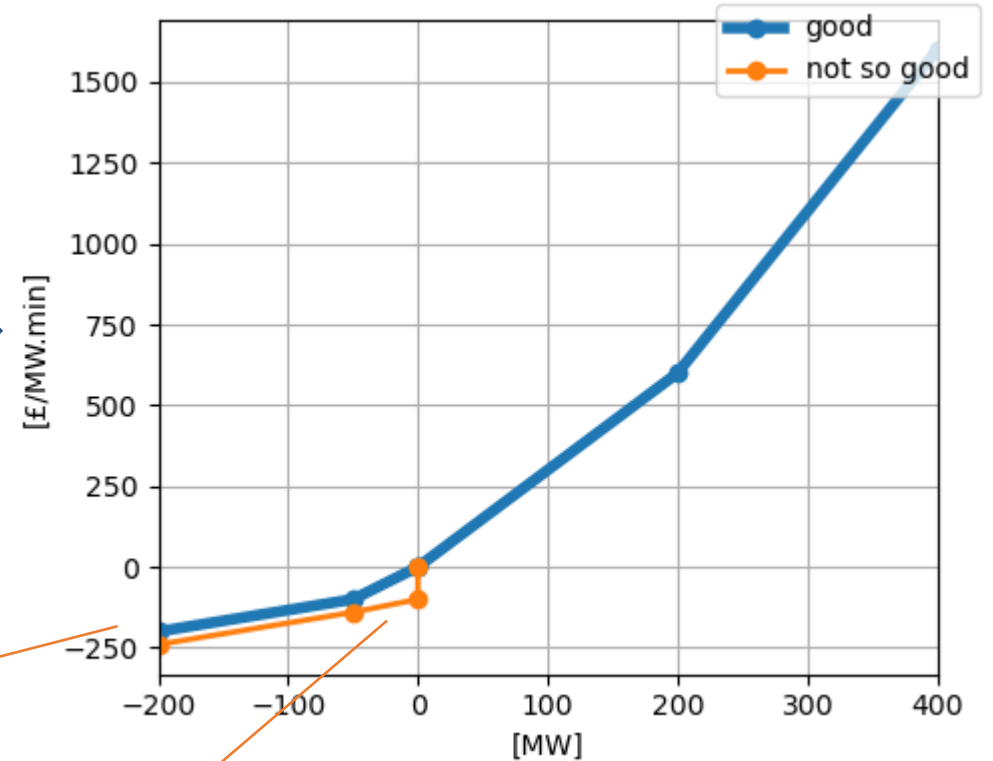
$$P_t = PN + BOAs + \Delta P_t$$

$$\Delta P_t = P_t^{OFFER} + P_t^{BID}$$

Cost per minute

New bids and offers derived from solution

From/to MW	Offer £/MWh	Bid £/MWh
200	120	
200	100	
-50		20
-150		10



- (3) Tie-breaking BMUs with equal prices
- Prices are perturbed by a small amount, based on a predefined ordered BMU list.
 - That list is randomly generated each time (this is to enable stability of solution over consecutive settlement periods, while ensuring fairness)

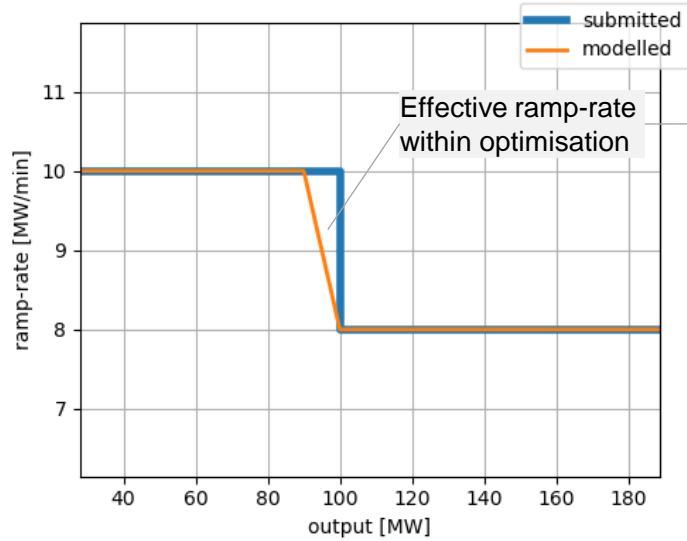
(1) Bid/offer data (BOD) are converted to cost curves

(2) Curves adjusted if we are aware that BMU PN does not reflect actual output (e.g. due to MEL/MIL redeclarations)

Impact on dispatch

- Tie-breaking process may be the reason why one BMU is selected over another (note it only matters for marginal units!)
- Inconsistencies between PN and actual position could affect what is dispatched.

Ramp Rates



... ramp rates model

$$P_{u,t+1} - P_{u,t} \leq RUR_{u,t}(P_{u,t})$$

$$P_{u,t+1} - P_{u,t} \geq RUR_{u,t}(P_{u,t}) + \dots$$

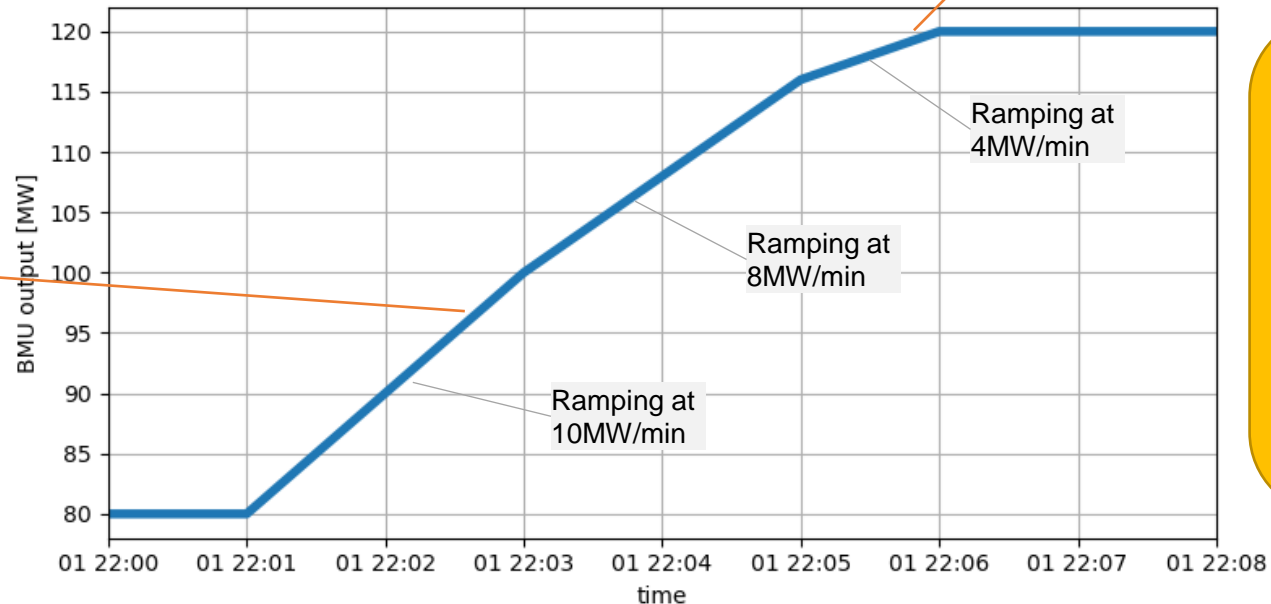
Most of the time ramp-rate is forced to maximum.

... but we relax this constraint to allow for slower ramping at the last time-step

(1) PNs do not always align with submitted ramp-rates – constraints are applied only when BMU is re-dispatched

(3) We still relax the constraints to allow BMU to reach any possible output level

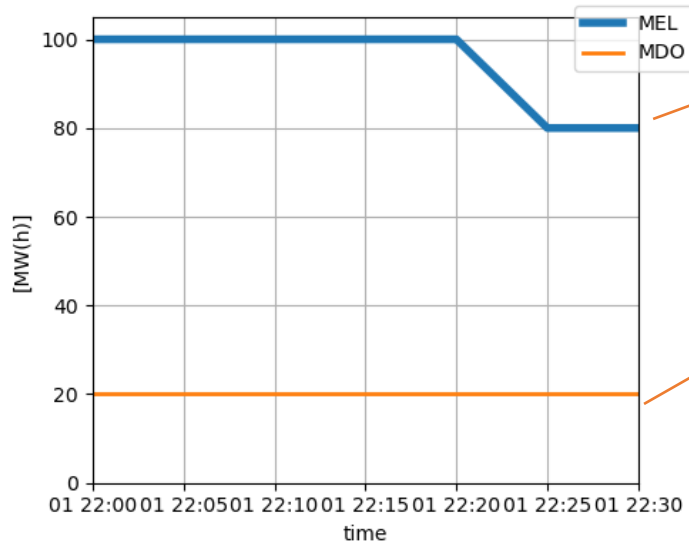
(2) BMUs generally dispatched at maximum rates
 ... this is to account for conventional BMUs which cannot do any ramp-rate
 ... and aligns with existing control room practices to dispatch as close to real-time to avoid unwinding



Impact on dispatch

- BOD and ramp-rates, alongside requirement largely determine dispatched units.
- Max. ramp rates requirement constrains the solution.

Utilisation (Energy)



(1) We use the closest to 0 value for the optimisation period as a reference for volume calculation.

(2) BMU assumed available (or as indicated by MEL/MIL or other parameters) during the whole optimisation window

Impact on dispatch

- Asset will be dispatched at any time over optimisation window, at any combination of power and energy allowed by constraints.
- Note that optimisation horizon affects asset utilisation.

... duration-limited BMUs utilisation

$$\frac{1}{60} \sum P_{u,t}^{OFFER} \leq MDO$$

$$\frac{1}{60} \sum P_{u,t}^{BID} \leq MDB$$

(for storage forum participants)

We are currently already implementing the simplest option of MDO/B, which aligns to current MEL/MIL based approach.

Extension to SoC (if needed) and relevant constraints are easy to change to.

Stable Import/Export Limits

... SEL/SIL limits

$$P_{t+1} \geq (r_t^U - r_{t+1}^U)SEL + \dots$$

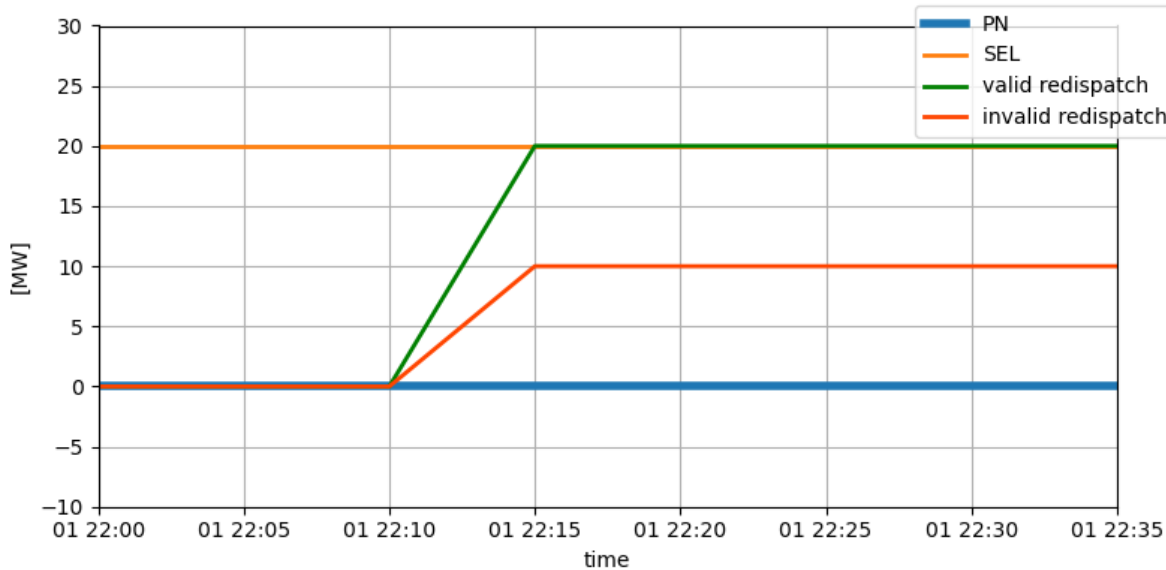
$$P_{t+1} \geq (r_t^D - r_{t+1}^D)SEL + \dots$$

If BMU is not ramping... it should be above SEL.

e.g. SIL limits are not relevant if BMU is

- not re-dispatched
- not in the export region (SIL applies otherwise)

(1) PNs do not necessarily respect SEL/SIL. We apply relevant constraints only when unit is re-dispatched.



Impact on dispatch

- Simply restricts how much the unit can be moved, or can enforce a larger redispatch amount.

In cases where e.g. SEL is much larger than the amount of power required, a more expensive unit without a similar limitation could be part of the least-cost solution.

Minimum Zero and Non-Zero Times

... MZT, MNZT

$$\sum_t^{t+MZT} x_i^{exp} \leq M(1 - x_t^{exp} + x_{t+1}^{exp})$$

If unit has been in export region in the last MZT minutes...

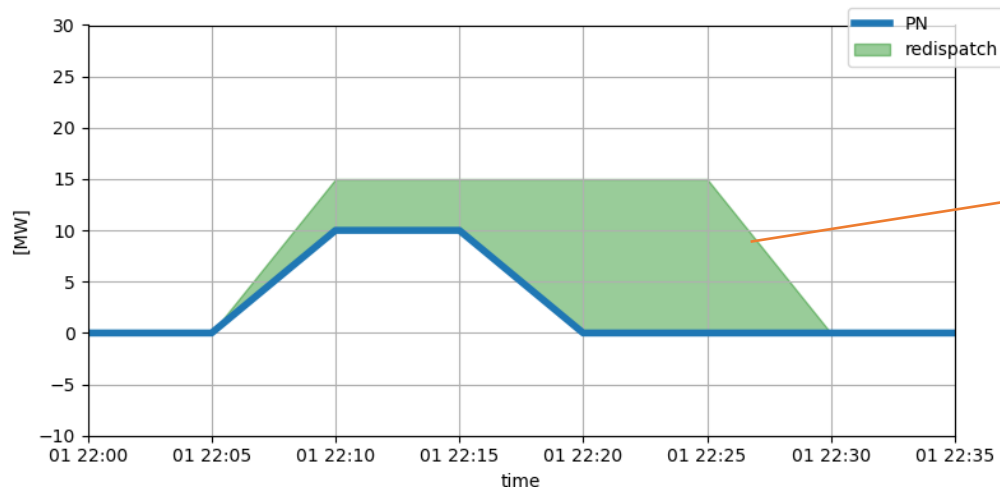
... then BMU cannot switch state to export

(1) PNs do not necessarily respect MZT/MNZT. We apply relevant constraints only when unit is re-dispatched.

$$\sum_t^{t+MNZT} \zeta_t \leq M(1 - \zeta_t + \zeta_{t+1} + \dots)$$

Similar to the above (with some added terms)

(2) For bidirectional assets we assume that ... if an asset leaves the import/export region it cannot go back into it unless MZT time has expired. ... if an asset leaves its zero/off state, it has to remain on for at least MNZT.



(3) Do not make worse principle ... implies that we process BMU time-series and if e.g. a BMU's PN is such that its MNZT appears to be 15min where its declared value is 40min, we will redispatch in such a way that the resulting non-zero time is no less than 15min.

Impact on dispatch

- State of BMU before and after optimisation horizon, can impact whether the unit is re-dispatched. BDO will not change the state of the unit outside the horizon.
- We are currently reviewing how BMUs with MZTs/MNZTs longer than the optimisation horizon should be scheduled.

Minimum Flat Top Times

... MFTT

$$\sum_t^{t+MFTT} y_t^U \leq M \cdot (y_t^U - y_{t+1}^U)$$

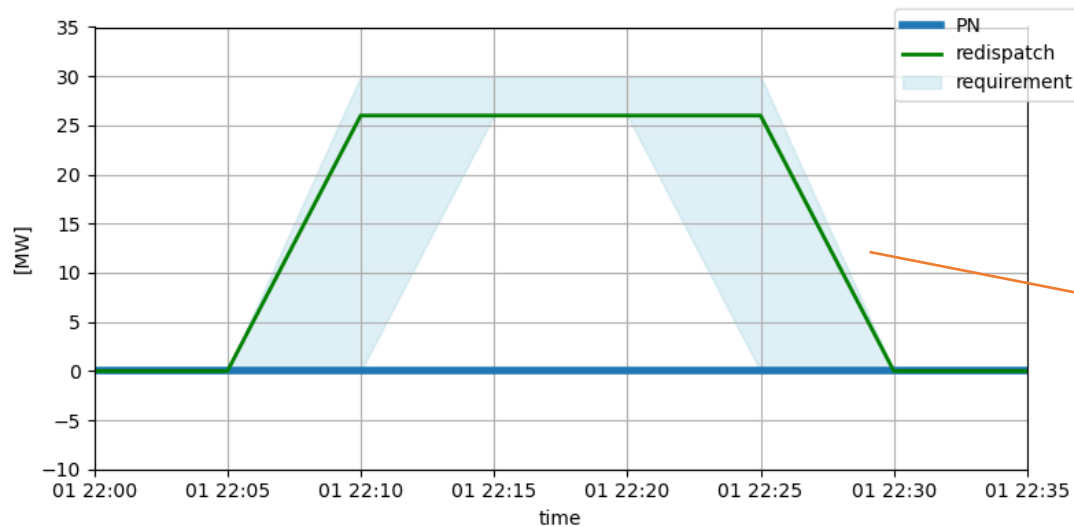
$$\sum_t^{t+MFTT} y_t^D \leq M \cdot (y_t^D - y_{t+1}^D)$$

If there is a ramping event in the last MFTT minutes...

... then BMU cannot ramp in the following minute.

(1) PNs need not necessarily respect MFTT. We apply relevant constraints only when unit is re-dispatched.

(2) The 'do not make worse' principle applies too – if BMU PN time-series indicate values shorter than assume the lower period is used.



Assuming this asset had an MFTT of 15min, it is dispatched for at least as long.

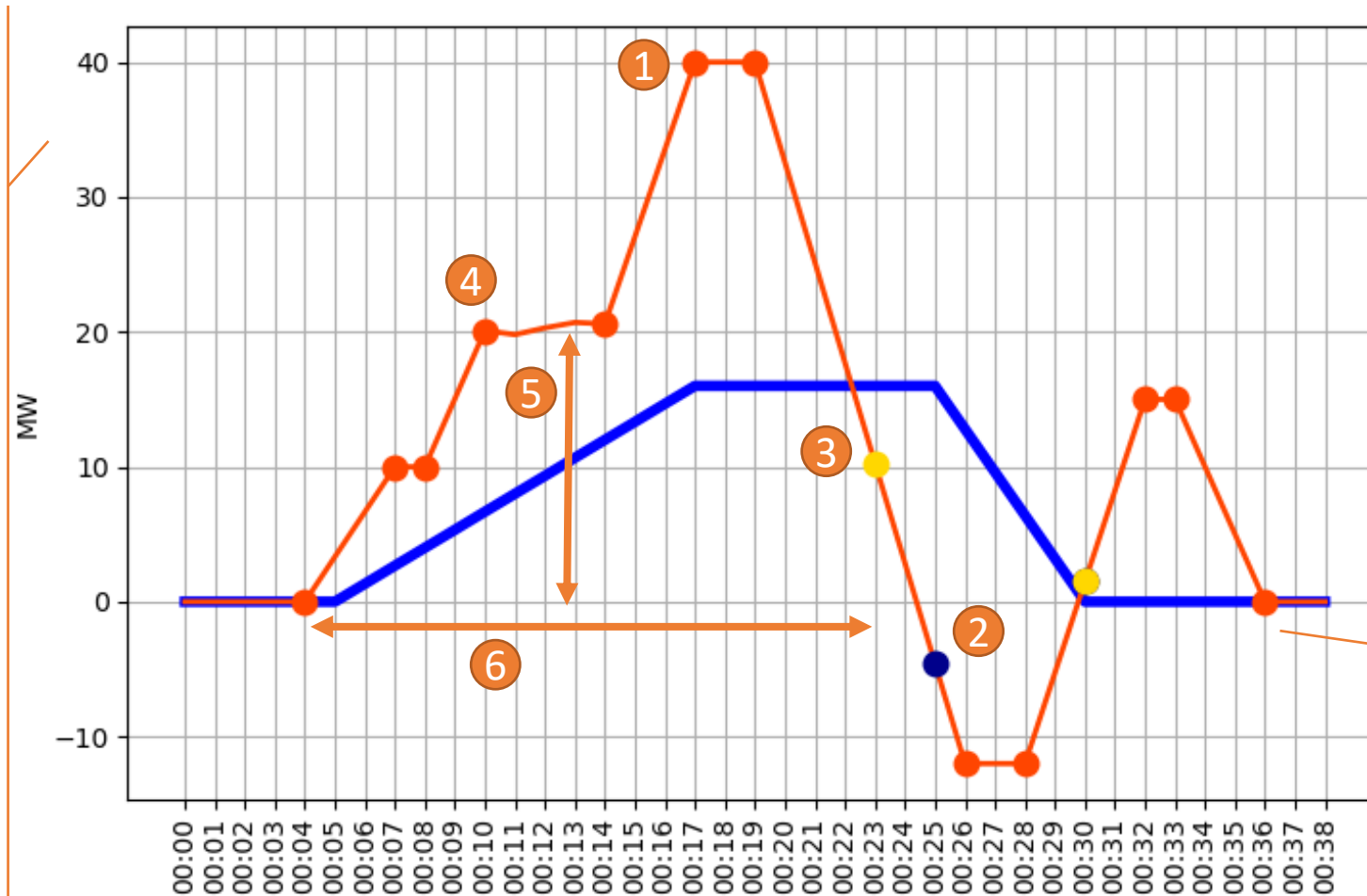
Impact on dispatch

- These ensure that larger BMUs are dispatched for an acceptable duration of time. Fast/flexible BMUs may be dispatched out of merit-order for very short duration requirements.
- It also allows controlling the structure of response control expects for a smoother / stable outcome. Currently for e.g. fast assets this is set to 1min.

Instruction Creation

Involves...

- (1) Defining breakpoints
- (2) Determining 0 crossing point.
- (3) Determining POCL crossing points.
- (4) Defining flats
- (5) Rounding to MW levels? Currently rounding towards CCL/POCL.
- (6) Adjusting BDO profile (making smaller) to ensure rounding to integer – and hopefully meeting MZT, MNZT requirements.



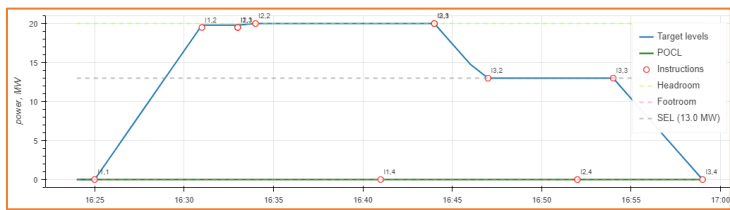
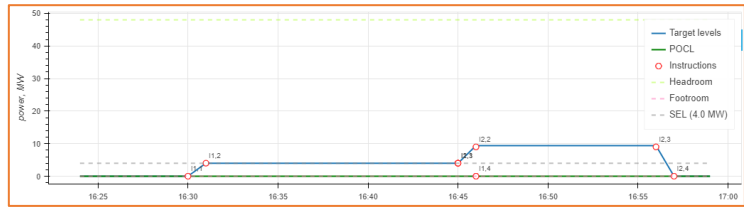
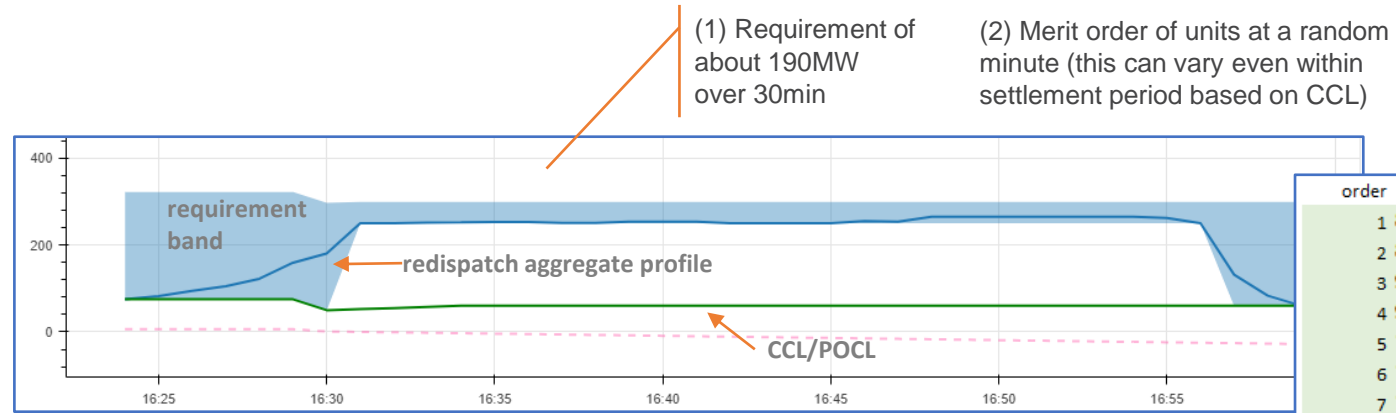
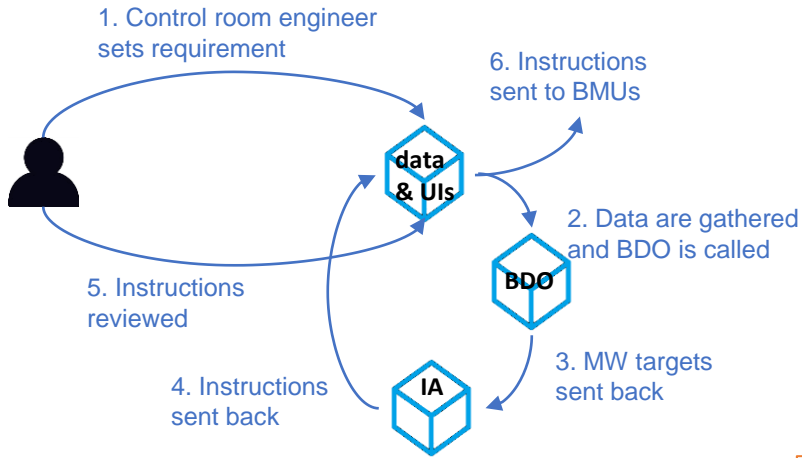
Issues

- Units with ramp-rates less than 1MW/min can be significantly affected by MW rounding required for instructions. This may also be the case for units with low capacity (say 1MW).
- If instructions end points cannot be matched to POCL unit cannot be dispatched. Can lead to skips.

Current challenges (especially around the SMALL BMU zone) relate to

- ... adapting optimised output to current BM bid/offer rules
- ... considering BMU ramping and MZT/MNZT constraints

An Indicative Example



order	offer price	redispatched
1	80.0 £/MWh	●●●
2	85.0 £/MWh	●●●
3	90.0 £/MWh	●●
4	95.0 £/MWh	●●
5	100.0 £/MWh	●●●
6	125.0 £/MWh	●●●
7	130.0 £/MWh	●
8	132.52 £/MWh	MNZT
9	133.9 £/MWh	SEL/RR
10	133.9 £/MWh	●
11	134.0 £/MWh	●
12	134.0 £/MWh	●
13	134.0 £/MWh	●
14	136.66 £/MWh	MNZT
15	137.0 £/MWh	SEL/RR
16	137.0 £/MWh	SEL/RR
17	137.0 £/MWh	SEL/RR
18	137.0 £/MWh	SEL/RR
19	138.0 £/MWh	●
20	138.0 £/MWh	●
21	139.29 £/MWh	MNZT
22	140.0 £/MWh	SEL/RR
23	140.0 £/MWh	●
24	141.0 £/MWh	SEL/RR
25	141.0 £/MWh	TB
26	141.0 £/MWh	MNZT
27	141.0 £/MWh	TB
28	141.0 £/MWh	SEL/RR
29	141.0 £/MWh	SEL/RR
30	141.0 £/MWh	MNZT
31	141.0 £/MWh	TB
32	141.0 £/MWh	●
33	141.0 £/MWh	
34	141.0 £/MWh	

Key consideration

Reasons for dispatching a unit out of merit order are not always obvious, even in cases where ... there are no system actions (constraints) involved. ... and the full data behind the case are available.

(1) Requirement of about 190MW over 30min

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

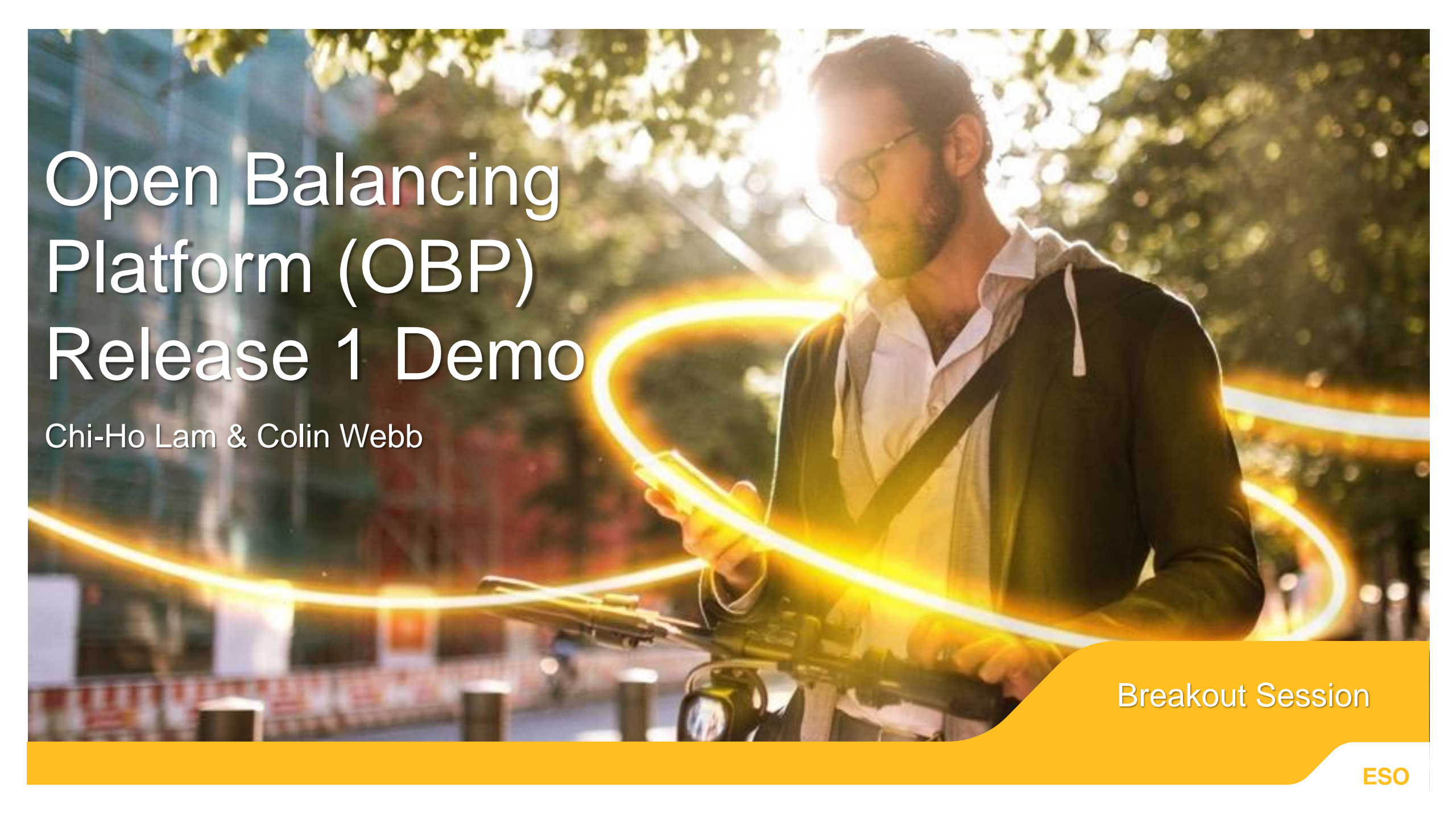
(3) Some units were not included in the solution due to long MNZT values relevant to the requirement

(4) Some units were dispatched out of merit order but in a common pattern – at SEL initially (due to their 30min MNZT) and for their last MFTT minutes at no more than their ramp down rate

(5) Some units were not used relative to others at same cost due to their tie-breaking rank for the day

(6) Units that had a high SEL relative to their ramp down rate were not part of the solution

(7) Some of the cheaper units were ramped down to account for the technical constraints of more expensive units



Open Balancing Platform (OBP) Release 1 Demo

Chi-Ho Lam & Colin Webb

Breakout Session

ESO

Requirement Formation – How the Control Room will Optimise



In OBP, the BDO will solve requirements specified by the Control Room against a MW & time profile, using all its available units whilst honouring technical parameters.



This means that if a unit's technical parameters are not compatible to the requirement, then the BDO would not seek to use the unit. For example, if a unit is at zero and MNZT is longer than requirement period, or if a ramp rate is slower than the requirement needs, then the units may not be used.

To help to seek to maximise use of units, but also support requirement optimisation, general guidance for Control Room use are as follows:



Build Large Requirements Up

- For large volumes – use multiple requirement/optimisations and build up the profile
- “Long and low” – for requirements up to 70 mins; max 300MW. Build the “baseline”
- For requirements < 30 mins; max 700MW



Battery Zone

- Due to “15 Min MEL rule” and the limited visibility of Battery Storage capacity, it is recommended that requirements to be set no higher than 500MW/15mins
- Control room would need to wait till battery providers redeclare MEL to reset available storage capacity if the known exhausted cheaper storage capacity is to be used

Enhancing Energy Storage in the Balancing Mechanism (BM): Post Event Updates

Gabriel Diaz

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)

Progress Update

Dispatch Data Transparency

- Initial analysis report produced by LCP Delta – currently under review for feedback and clarification. On track for completion in December.
- Early assessment to deliver new transparency solution under innovation project.

Enhanced system and process capabilities

- Training modules in line with OBP go-live activities undergoing, including changes to scheduling process.

Enable new Energy Storage parameters

- Electricity Storage Network (ESN) will support facilitation of industry view and feedback on preferred parameter option.
- Grid code modification – submission planned for December meeting.
- New EDL guidance ready for MEL/MIL declarations. To be shared after this event.

Co-create future capability and market solutions

- Feedback received on our roadmap was positive. Currently exploring a potential addition for improvements to MFR process.
- Follow-up webinar scheduled for 14th December. Registration still open.

A photograph of a person with blonde hair, wearing a denim jacket, with their arms raised in the air. They are standing in a field at sunset, with a crowd of people and tents in the background. The scene is illuminated by warm, golden light from the setting sun. There are some decorative elements: a white wavy line in the upper left, a white horizontal bar in the lower left, and a glowing purple and white circular light effect around the person's waist. The bottom of the image has a yellow gradient bar.

Q&A

Thank you

Next Steps



We welcome your feedback – please fill out the cards on the table



Materials will be published on our website



Follow-up webinar – Event Summary



You will be added to our mailing list for future updates

- Reach out to the team via email –
box.balancingprogramme@nationalgrideso.com

**Want to learn more about the Future
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