Balancing Programme
Quarterly engagement session
15th June 2023
Welcome

- Fire Exit Procedures
- Facilities
- Plan for the day
- Engage
## Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
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<tbody>
<tr>
<td>09:30 – 10:00</td>
<td>Arrival</td>
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<tr>
<td>10:00 – 10:05</td>
<td>Welcome</td>
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<tr>
<td>10:05 – 10:15</td>
<td>BP Strategy &amp; Vision</td>
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<tr>
<td>10:15 – 11:00</td>
<td>BP Benefits and Case for Change</td>
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<td>11:00 – 11:15</td>
<td>BP Roadmap</td>
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<td>11:15 – 11:30</td>
<td>Break</td>
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<td>11:30 – 12:15</td>
<td>Breakout session 1 (OBP Demo, Balancing Trials, Dispatching Wind, Stakeholder focus groups)</td>
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<td>12:15 – 13:00</td>
<td>Breakout session 2 (OBP Demo, Balancing Trials, Dispatching Wind, Stakeholder focus groups)</td>
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<td>13:00 – 13:45</td>
<td>Lunch</td>
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<td>13:45 – 14:30</td>
<td>Breakout session 3 (OBP Demo, Balancing Trials, Dispatching Wind, Stakeholder focus groups)</td>
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<td>14:35 – 15:05</td>
<td>Designing and delivering the future power system</td>
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<td>15:05 – 15:15</td>
<td>Break</td>
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<td>15:15 – 15:30</td>
<td>Dispatch Transparency</td>
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<td>15:30 – 16:00</td>
<td>Q and A panel</td>
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<td>16:00 – 16:15</td>
<td>Close</td>
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Introductions & Aims of the day
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 everywhere and meet our ambition for net-zero carbon operability.
Balancing Programme Strategy and Vision
Balancing Transformation vision

The programme strategic objectives and the new enabling business capabilities were set to address the scalability challenges and modernise the core platforms to provide increased reliability and flexibility in line with RIIO-2 business plan.

**Strategic goals**

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<th>ESO ambitions</th>
<th>Business plan benefits areas</th>
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<td>Security of Supply</td>
<td>Reduced emission</td>
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<td>Competition everywhere</td>
<td>Flexible technologies</td>
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<td>Zero carbon</td>
<td>Greater interconnection</td>
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<td>Whole system</td>
<td>Better inertia management</td>
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**BTP Strategic Objectives**

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

**Focus**

Controlled automation and scalable efficiency
Flexibility and maintainability
Equality and data availability
Optimisation and effectiveness

**New Balancing Capabilities**

Controlled Automation with process and user interface integration
Flexible platform with continuous solution improvement
Data harmonisation and openness by design
Advanced optimisation and continuous improvement

Modern, open, reliable, resilient and secure technology platform
Aims of today

SHOW

• Our achieved progress so far and the benefits delivered
• How we are transforming our balancing capability
• A cohesive view of how we are working together to meet our ESO ambitions

LISTEN

• Understanding of how our transformation may impact you
• Your insight to help us tackle key challenges of transforming our balancing capabilities
• Future interests and how we continue to engage

COLLABORATE

• To validate our roadmap aligns to industry priorities
• Plan how we overcome the challenges on the road to net-zero operability
Balancing Programme
Benefits and Case for Change
Current Balancing System Benefits

- Used to balance supply and demand in real time.
- In BP1 we’ve delivered significant changes, in a highly complex environment.

What we’ve delivered (BP1) | Future Improvements (BP2)
--- | ---
✓ Enabling several initiatives across ESO including DM/DR, DFS, RDP and Pathfinders. | ✓ Further dispatch improvements & control room efficiencies
✓ Improved system performance and resilience | ✓ Additional enablers for wider ESO initiatives.
✓ Improved dispatch efficiency & large reduction in control room workarounds | ✓ Begin the transition and strategic migration to OBP
✓ Decommissioning of EBS

**BP1 Benefits**

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<tr>
<td><strong>£48m</strong></td>
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Realised through reduction in balancing costs.
Forecasting Benefits

- Accuracy of forecasting is pivotal in the efficiency and reliability of balancing the system.
- The key customers of the forecasts are the market participants and the Electricity National Control Centre (ENCC)

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<tr>
<th>What we’ve delivered (BP1)</th>
<th>Future Improvements (BP2)</th>
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<tr>
<td>✓ Increased accuracy of National, Solar &amp; Grid Supply Point (GSP) forecasts</td>
<td>✓ Continuous forecasting product improvements- Including new wind power generation forecasting product</td>
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<tr>
<td>✓ Transformation of processing &amp; delivery time both internally and externally</td>
<td>✓ Strategic cloud platform for energy forecast (PEF) with integration to Open Balancing platform (OBP)</td>
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<td>✓ Improvement in visualisation and dashboards for control room users</td>
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| BP1 Benefits | £368m |

Realised as savings in balancing and reserve costs due to improved forecasting products
Benefits and the case for change

Direct benefits delivered by Balancing Transformation

<table>
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<tr>
<th>Submission</th>
<th>2021/22</th>
<th>2022/23</th>
<th>2023/24</th>
<th>2024/25</th>
<th>2025/26</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td><strong>Dec 2019</strong>¹</td>
<td>£9.4m</td>
<td>£12.1m</td>
<td>£30.7m</td>
<td>£44.5m</td>
<td>£55.7m</td>
<td><strong>£152m</strong></td>
</tr>
<tr>
<td><strong>June 2022</strong>²</td>
<td>£0m</td>
<td>£0.5m</td>
<td>£11.6m</td>
<td>£55.0m</td>
<td>£123.8m</td>
<td><strong>£191m</strong></td>
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Net present value (NPV) delivered by RIIO-2 plan (enabled by Balancing and Network Control)

<table>
<thead>
<tr>
<th>Submission</th>
<th>5 year NPV</th>
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<tbody>
<tr>
<td>December 2019</td>
<td>£1,754m</td>
</tr>
<tr>
<td>May 2022⁴</td>
<td>£2,581m</td>
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</tbody>
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¹ – half of the A1 CBA as submitted in the December 2019 RIIO-2 plan
² – provisional figure for engagement only. Subject to change in final BP-2 submission
⁴ – figures subject to change in final BP-2 submission
Balancing Programme roadmap
Industry Co-created Roadmap – Version 2 – drivers for change

- Bring forward migration of background components like EDT/EDL and other comms services
- Increased resilience and expected changes for new data flows, e.g. state of charge and fax replacement
- Bring forward replacement of old business continuity systems
- Reduce reliance on telephone instructions when we have a larger number of control points by increasing IT resilience
- Design of reserve services under review
- Wait for greater flexibility offered by Open Balancing Platform to implement
- Redesign of GEMs under review with Scottish Power supplier
- Wait for greater flexibility offered by Open Balancing Platform to implement
Industry Co-created Roadmap – Version 2

Years changed to Financial Year End
FY23 means before Apr 2023

Key:
Blue Box – Complete
Orange Box – In progress
Green Box – Capabilities to come
## Movement – Priority in version 1 roadmap / priority in version 2

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<tbody>
<tr>
<td>Core</td>
<td>Skeleton for IT</td>
<td>Core</td>
<td>5</td>
<td>Stability</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>Enhanced DM/DC/DR</td>
<td>1</td>
<td>5</td>
<td>Sub MW Dispatch</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>MW Dispatch</td>
<td>1</td>
<td>5</td>
<td>Enhanced instructions</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>Bulk Dispatch</td>
<td>1</td>
<td>5</td>
<td>Aggregation</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>Skip rate in existing IT</td>
<td>1</td>
<td>6</td>
<td>Increased no. instructions</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>Enhanced Visualisation</td>
<td>2</td>
<td>6</td>
<td>GEMs Tx</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>SMP Enduring Auction</td>
<td>3</td>
<td>6</td>
<td>All assets can take part</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Enhanced optimisation</td>
<td>3</td>
<td>6</td>
<td>Time varying data</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Reserve (Up/Down Margin)</td>
<td>5</td>
<td>7</td>
<td>Enhanced IC management</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>BM/NBM combined dispatch</td>
<td>4</td>
<td>8</td>
<td>Enhanced Forecasting</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>Constraint Management</td>
<td>3</td>
<td>8</td>
<td>Demand Prediction</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Constraint Pathfinder</td>
<td>3</td>
<td></td>
<td>NBM Optional Reserve</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Response &amp; Inertia</td>
<td>4</td>
<td></td>
<td>GEMS Dx</td>
<td>5</td>
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</tbody>
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Dispatching Wind
WHAT DO YOU MEAN THE WIND CHANGED?!
The Wind challenges

Wind accounts for a significant volume on the system, with increasing number of providers

Wind is increasingly used to solve constraints

There are significant manual processes to manage Wind

Wind is volatile – PN, metered output and power available is generally unreliable

Forecasting process is challenging

Complex cost calculations from PN vs Volume from actual wind output
Handling wind – an interim solution

- Interim solution in OBP will seek to level the playing field
- Allows for optimisation of all wind providers
- Manages bringing Wind back on with unreliable Wind data/forecasts/PNs
- Improved forecasting and automated selection
- Handling “Zero Cost BOAs”
OBP interim solution for wind

To enable OBP to Bulk Dispatch Wind units there will be several parts of new functionality (1-7):

1. Metering & PA
2. Selectable forecasts
3. Blending logic
4. Forecast logic
5. Use of OBP Optimiser, to instruct in price merit order and pricing logic for Wind/zero cost BOAs
6. Monitoring and extending of active instructions and visualisation of forecasts
7. Semi-automatic ‘step back’ of wind units, individually or in bulk level
Improved Forecasting and Forecast selection (based on matching recent history with Forecast). This will allow us to use the Optimiser to reduce the wind output for managing active constraints.

Interim solution will use the OBP Release 1.0 optimisation capability already developed, with additional support for wind.

Requirements will be either set for a Target Zone, or a Constraint limit.

We will be able to take a Wind unit to SEL, or 0 – depending on their M(N)ZT values, and instruction length required.

Optimiser will take into account “true cost” vs volume received, allowing for issues with Wind data, i.e. Zero Cost BOAs.
Managing zero cost BOAs for constraints management

For Wind (or any) units that are generating above their PNs, then any instruction to bring the unit to the PN would be at zero cost – i.e. a zero cost BOAs.

Therefore, the cheapest set of actions, in an active Constraint scenario, is to take all the zero-cost volume for any units that are generating above PN.

Proposal is to create instructions to take over generating Wind units to at least 1MW below their PN.

If more MWs are required, then the optimiser would consider costed MWs below PN in an economical manner (i.e. price merit order, taking into account the overall requirement shape and dynamic parameters).
Holding process

The system will continue to monitor instructed wind units and in an ongoing constrained environment, the instructions will be automatically extended subject to dynamic parameters, PN, forecasts (etc.) and being in merit order.

Where dynamic parameters, PN, forecasts or changing prices impact the merit order, users will be made aware to investigate/take action.
Upward Journey

Bringing Wind back is trickier than taking Wind off due to uncertainty with where it will return to – use of Power Available and Forecast data

We do not want all the Wind instructions to end at the same time and it is uncertain as to where the wind output will return to

OBP will allow user to determine how many MWs to return at a given time

OBP will determine which units will be allowed to return and will manage the return to PN by creating short instructions to “step back” the unit(s), in increments (e.g. 0-> SEL, 50% of PN, PA, PN)

After a given time, if a Wind Unit does not reach its Instructed level, we assume it has reached its maximum wind output. No need for a new incremental instruction. Forecast selection to be checked

OBP will determine if a further unit may be released following the same process
Strategic Wind approach - next steps

- Explore industry changes to improve Wind Data
- Better PNs will allow optimisation with confidence
- Improved Forecasts and Forecast Selection
- Learn from other markets where Wind is better integrated
OBP Demo
The problem of scale: National Balancing

The Control Room has a manual based process for the interpretation of optimisation and subsequent dispatch.

With increasing number of smaller units, the Control Room has an urgent need to scale and automate its processes for optimisation, dispatch and monitoring.
Today’s challenges in the Control Room

- Heavily dependent on manual activity
- Control Room have to search and find units to dispatch individually
- Unit data is not always valid
- Users have to manually enforce rules such as the "15 minute rule for batteries"
- Dispatch in cost order may not be cost optimised overall
- Time taken (40s) for individual instruction leads to drive to send fewer but larger and longer instructions
- Pressure and stress impacts during critical periods
- Time spent “doing” rather than “managing”
OBP Release 1.0 Storyboard

Balancing Mechanism

- Shift handover
- Nick Reviews Situational Awareness
- Nick creates Target for Zoe
- Zoe accepts Target
- Zoe is made aware of the new target programme
- Zoe is made aware of the successful/failed optimisation run
- Zoe can review the optimised profile
- Zoe Sends Requirement for her Zone
- Zoe Creates Requirement for her Zone
- Zoe sends the requirement to the optimiser

- Zoe Approves Optimiser Output
- The instructions are sent out
- Zoe Monitors her Instructions
- Zoe Monitors her Instructions
- Zoe can review the optimised profile
- Zoe can review the optimised profile
- Zoe Monitors the instructions

- Zoe can remove units from the draft list of instructions
- Zoe can view individual units
- Zoe can view individual units
- Zoe can view individual units
- Zoe can view individual units

- System automatically excludes units
- System automatically excludes units
- System automatically excludes units
- System automatically excludes units
- System automatically excludes units

- Nick Reviews Situational Awareness
- Nick Reviews Situational Awareness
- Nick Reviews Situational Awareness
- Nick Reviews Situational Awareness
- Nick Reviews Situational Awareness

- Zoe creates a restriction
- Zoe creates a restriction
- Zoe creates a restriction
- Zoe creates a restriction
- Zoe creates a restriction

- Zoe Monitors her Instructions
- Zoe Monitors her Instructions
- Zoe Monitors her Instructions
- Zoe Monitors her Instructions
- Zoe Monitors her Instructions

Notifications only shown for the relevant ZBE
Instruction Volumes – Release 1.0

What will happen to dispatch efficiency and hence to the dispatch rate of smaller units when *competitively priced*?

Should we expect a dramatic increase in dispatch or a gradual rise over a long period?

- 4-8 Optimisations per hour
- Up to 300 Instructions per Optimisation Run
- Each Unit can receive, at most, 1 instruction per minute “LOG_TIME”
- Providers with multiple units may receive multiple instructions in a minute
Are there any concerns on the likely increased number of shorter/smaller instructions received?

What are your thoughts on how we plan to Optimise and create/send "linked" instructions?

How quickly would you respond and be ready for a second instruction? Do you need a minimum length of instruction?

How many instructions (for multiple units) can you process at a time?
## Optimisation – Feedback from Feb 2023 Event

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
<th>Scenario 4</th>
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<tbody>
<tr>
<td><strong>Flat Top Time</strong></td>
<td><strong>Min delta MW</strong></td>
<td><strong>Near MEL, MIL, SEL, SIL action</strong></td>
<td><strong>Splitting large MW instructions</strong></td>
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<tr>
<td>There would need to be a maximum flat top duration. Wasn't aware this was standard practice now t.b.h.</td>
<td>Surely this is an issue for conventional generation not batteries.</td>
<td>Makes sense technically but closer to net zero will “rounding up” (e.g. 95MW to 100MW CCGT gas plant unabated) increase emissions vs bringing up low carbon generation?</td>
<td>Given the make up of future system this is not a big issue.</td>
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<tr>
<td>JD</td>
<td>TF</td>
<td>TF</td>
<td>Seems sensible from a risk perspective.</td>
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<tr>
<td>Makes sense technically – only Q is whether 5 minutes is enough for all technologies (e.g. CCGTs)</td>
<td>Is this available for storage?</td>
<td>Unclear on the benefits to balancing costs.</td>
<td>Optimising across multiple assets for the sake of ramp rates is a bandage for being stuck with minute resolution.</td>
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<tr>
<td>JD</td>
<td>TF</td>
<td>TF</td>
<td>HM</td>
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<tr>
<td>What is the objective function and will this favour flat tops?</td>
<td>Part of the reserve/balancing product parameters?</td>
<td>For thermal units this will be heavily ambience driven. Not sure this is required.</td>
<td>How would this work for BESS?</td>
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**Optimisation – Feedback from Feb 2023 Event**

**Scenario 5**
**State of Energy**

- Using MEL/MIL is inefficient as start to lose power availability within 15 minutes. State of Charge rather than Energy is good WH.
- MIL, MEL and max import & export duration should feed into the optimiser.
- SOE of the unit is not necessarily all commercially available.

**What are the alternatives if you don’t use SOE?**
- Struggle to see you’d manage otherwise.
- JB

**1MWh may cost less to get back than the next MWh for a battery. It would be useful to be able to give different prices to different MWhs in the same way gas units can have different prices for different units.**

**MIL, MEL and max import & export duration should feed into the optimiser.**

**Isn’t this for providers not ESO to determine?**

**Does this need a grid code change initially or could storage provider provide it duration parameter voluntarily via an API?**

**What are the alternatives if you don’t use SOE?**
- Struggle to see you’d manage otherwise.
- JB

**Where does Active Network Management fit in this?**
- Sam Bolterill

- Need to formally ask generators what they can do. This must be a known factor.

- Can this be a user parameter?
- TF

**scenario 6**
**Max number of instructions**

**Where does Active Network Management fit in this?**
- Sam Bolterill

**Can we set a default value? It depends also on unit recovery time**
- SIMA

- Bring it on

- Can this be a user parameter?
- TF
Balancing Trials
We are developing new ways to balance electricity supply and demand and manage a low carbon electricity system

We use trials where there is **uncertainty** or a **knowledge gap**, allowing us to ‘learn by doing’

Running trials can help:

- Test innovative ideas in a safe environment
- Increase collaboration across the industry
- Encourage a ‘fail fast’ mindset, where ideas are tested before large resource is put behind it
- De-risk and/or streamline the launch of new services

Trials can support ESO and the industry:

- Move towards a zero-carbon GB electricity system by 2025 and continue towards fully decarbonised by 2035
- Reform ESO’s ancillary services and balancing markets to make markets more efficient, accessible and liquid
- Identify potential capabilities that reduce or shift peak demand energy consumption or generation
- Ensure reliability, affordability and fairness for all

The ability to trial new capabilities will benefit the entire industry and unlock value

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What have trials delivered so far

**Domestic Reserve Scarcity trial**
Creating the pathway to the world leading Demand Flexibility Service

- > 100,000 Households participating in demand turn down events
- 8 Events between Feb – Mar ‘22
- 197 MWH Demand turn-down volume

**Powerloop**
Identifying the barriers and capabilities of domestic EV chargers operating in balancing activities

- Demonstrated the ability to alter charging behaviour in response to instructions from the ENCC to meet energy imbalances
- **Reduce balanced costs** - potential of cheaper energy balancing option than currently available
- **Value for participating consumers** – Improved tariffs due to BM participation leading to reduced running costs
- Highlighted barriers in current market framework and a pathway for smaller-scale aggregated assets entering the BM
REVEAL is an innovation project looking to provide tools to make the trialling of new capabilities easier and faster for the ESO and external stakeholders.

Our aim for REVEAL is to:

- Enhance robustness for future trials
- Make it easier and faster to run trials
- Encourage and test innovations
- Increase industry collaboration
- Increase capacity for running more trials

What is your understanding of REVEAL?

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REVEAL Quiz

1. The scope of REVEAL is...
   - A tool where live trials can be facilitated
   - A tool to help organise trials and facilitate collaboration
   - Clear processes to support the function of trials
   - Supporting developing an enabling regulatory environment for trials

2. The number of stakeholder groups engaged in Phase 3 of REVEAL...
   - 27
   - 89
   - 110
   - 68

3. Phase 3 has delivered...
   - Roadmap for implementation
   - High-level technical designs
   - Business case
   - Stakeholder engagement with ESO and wider industry
4a. You said: Open communication and ideation with ESO is critical

A. We did: Defined processes that allow only ESO to suggest trial ideas

B. We did: Added the option to receive trial notifications to future phases

C. We did: Added a form to suggest trial ideas to future phases

4b. You said: Transparency in the trial process is important

A. We did: Added a feedback mechanism for participants to future phases

B. We did: Added a dashboard showing an overview of all trials to future phases

C. We did: Created a generator to select trials and participants at random

4c. You said: Clear and accurate information is essential for trial planning

A. We did: Developed a clear comms plan to support trials from start to finish

B. We did: Defined new processes to ensure sufficient information is shared from the start

C. We did: Created a generic information pack that is handed out at the start of every trial

5. REVEAL Phase 4 involves...

A. Further discussions to define REVEAL

B. Building a Proof of Concept (POC)

C. No next steps at this stage
REVEAL’s solutions

We have defined and designed two technical solutions and supporting business change processes – which will help facilitate the trialling of new capabilities and industry collaboration – underpinned by an enabling regulatory environment.

Business Change
Developing clear processes, organisational design, governance structure and a realistic implementation roadmap

Live Trial Environment
A dedicated, configurable environment for the execution of live trials

Trial Management Platform
A web-based set of tools for communication, trial planning and information sharing (ESO and industry)

Regulatory Environment
Focus on supporting development of policy-led sandbox and identifying ways to potentially streamline the derogation process
Next steps

**Reflection**
- REVEAL team to review outputs from today’s discussions and feed into our plans

**Phase 4**
- First stage is building a POC

**Involvement of industry**
- Further updates shared through usual channels
- Further engagement with REVEAL team
- Sharing trial ideas
Stakeholder focus groups
Groups

**Forecasting**
- Sumit Gumber
- One meeting to date
- Feedback on Terms of Reference and Forecasting Problem & Improvements

**Optimisation**
- Emmanouil Loukarakis
- One meeting to date
- Feedback on Terms of Reference and Ways of Working

**Storage**
- Natasha Bayler
- Five meetings to date
- Now moving to Grid Code changes
**Optimisation Stakeholder Group Terms of Reference**

**Remit**
- Align internal balancing enhancements with industry expectations
- Active involvement in sessions to identify and work through problems and opportunities
- Provide details on how new optimisation algorithms are intended to work
- Receive feedback from market participants
- Share test results and examples with market participants
- Allow market participants to suggest their own test cases
- Provide greater understanding of when decisions may be taken “out of merit” due to transmission system constraints
- Work together to understand the current pain points of market participants
- Identify changes that may be need to industry codes to reflect evolving practice

**Engagement**
Engage with stakeholders monthly on an ongoing basis. Will have a mix of remote and in person events. We will also be available to have a 1:1 meeting if any stakeholder would like this. We welcome your input to ensure we develop plans that are ambitious and achievable and have considered the priorities of our stakeholders.

We propose to have dedicated collaborative forum events to gather your views as set-out below:

**Logistics**
- The stakeholder group will be an open forum for new attendees to join at any point.
- Sign up details will be through MS forms and will be shared on the website and via email.
- We will send meeting details by email and on the website.
- We will share the outcome of each event following the 1st phase, as well as questions and answers on the ESO website.

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Comments on Optimisation Terms of Reference

What do you like?

- Regular opportunity to meet, collaborate, share
- Regular feedback opportunities
- Quality of data released by ESO – far greater than other markets
- Allowing the industry to help shape development
- ESO openness to collaborate and take input
- These collaboration sessions are very welcome

What could be better?

- Data reliability – frequent outages of balancing data
- Data quality and handling – data format can be inconsistent and hard to retrieve
- Greater transparency on how the ESO solves the optimisation problem
- More information of what the ESO is looking to achieve or solve via new products or services
- Roadmaps need to be updated monthly
- Whistle stop introductions don’t give enough information on people experiences and expectations. Is there somewhere we can write this and store
- Fair & applicable treatment enforcement of industry rules across tech types
- Define, build, release timeframes – setting expectations
- More opportunity to feedback (or consideration) on technical aspects of BESS (or other assets) in relation to how they operate within markets
## What do you want from this Group?

### A broad perspective of the challenges within optimisation in the electricity industry

- Understand the as-is and what is proposed for December. What time do we have to influence?

### Market design and algorithm design explainers

- Have you looked at other best practices globally?
- What challenges research organisations should be addressing looking to the next generation of developments required in control room algorithms?

### What do you want from this Group?

- Insights form other TSOs also experiencing a rapid transition e.g. ERCOT, Australia, CAISO, EirGrid and how they are approaching the optimisation challenge.
- More understanding of the role / use of flexible assets in balancing (how do you want to use us / how are we valuable to you?)
- This could also be linked to demos – for instance linking model specs to how lowest marginal cost units are not always the best ones to schedule.

### Documentation with worked examples to detail technical knowledge (market design, rules and algos), followed up with demonstration to workings in practice

- Get clarity on information visibility / reporting requirements for providers – what information promotes participation and market liquidity.
- Seams like a key piece of missing info for any algorithm is available headroom / footroom (ie State of Charge) will this be done using MEL/MIL.

### Detailed documentation on how the optimisation takes place would be perfect. The maths, algorithms, rules, etc Prevents misunderstandings with why dispatch instructions happened and allows recreation

- Gain an understanding of how DER and smaller assets will be used by the ESO across products and services.
- Get insight into ESO AND provider requirements for the “rules” around optimisation – e.g. ramp up and ramp down times of selected resources and how that plays across multiple requests.

### Gain an understanding of the data feeds and integrations with existing related systems, required going forward for the OBP to function efficiently

- Understand the roadmap for promoting control room visibility of flexibility actions by time and place.
- A demo will likely bring it to life more. Generally I think a combination of worked examples and a demo. Maybe even a tool to play with to see how it works.

### Understand the roadmap for promoting control room visibility of flexibility actions by time and place

- Demos would be great – much easier to understand Control Room decisions when we understand what they can see or do.

### Demos/examples are super useful (with some maths). We can then try the problem ourselves, spot any clear errors and question “what would happen if X changed in this example

- Get insight into ESO AND provider requirements for the “rules” around optimisation – e.g. ramp up and ramp down times of selected resources and how that plays across multiple requests.

### Good to manage what benefits will be delivered and when

- Collect requirements for the solver roadmap and for the user community that may emerge from the discussions.

### Detailed documentation on how the optimisation takes place would be perfect. The maths, algorithms, rules, etc Prevents misunderstandings with why dispatch instructions happened and allows recreation

- More understanding of the role / use of flexible assets in balancing (how do you want to use us / how are we valuable to you?)

### Understand the roadmap for promoting control room visibility of flexibility actions by time and place

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- Collect requirements for the solver roadmap and for the user community that may emerge from the discussions.
Storage Stakeholder Group Terms of Reference

Remit
- Align internal balancing enhancements with industry expectations
- Active involvement in sessions to identify and work through problems and opportunities
- Work together on potential grid code changes to allow for smooth transitions
- Provide an empathic voice for storage market participants within the balancing programme
- Work together to understand the current pain points of market participants
- Work with the group to put forward changes to current processes such as the “15min battery workaround”
- Align our internally generated personas with market participants
- Agree future ways of working and operational parameters for limited storage units

Engagement
Engage with stakeholders monthly on an ongoing basis. We will have a mix of remote and in-person events. We will also be available to have a 1:1 meeting if any stakeholder would like this.

We welcome your input to ensure we develop plans that are ambitious and achievable and have considered the priorities of our stakeholders.

We propose to have dedicated collaborative forum events to gather your views as set out below:

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<td>• Challenge and clarify assumptions</td>
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Logistics
- The stakeholder group will be an open forum for new attendees to join at any point.
- Sign up details will be through MS forms and will be shared on the website and via email.
- We will send meeting details by email and on the website.
- We will share the outcome of each event following the 1st phase, as well as questions and answers on the ESO website.
New Parameters for limited duration assets - Approach to Grid Code change

Questions we asked at last Storage Stakeholder Group
- Would simple parameters like Maximum Delivery Volume (Export/Import) – MDVE and MDVI be worth pursuing?
- Do we need a maximum period as well? (current rules have this but do we need export/import?)
- Should these be time-varying?
- How do we use batteries longer term?

Replies so far
- Immediate replies from the day are available on mural board
- Two parties have sent detailed analysis and their own suggestions (which is very appreciated)

What do you think?
- Please use post-its to give feedback
New Parameters for limited duration assets - Approach to Grid Code change

What do you think the change should look like?

Feedback 1
• Go for MDVE/MDVI now
• Longer term too complicated for ESO to optimise all assets – providers to send this to ESO

Feedback 2
• Should give ESO all details to optimise
• Some details would have to be confidential (efficiency etc)
The purpose of this forum is to establish a working group focused on improving the transparency and accessibility of energy forecasting data, increasing the accuracy of energy forecasts, and exploring innovative methods of forecasting through the use of new data and modelling techniques.

The group will collaborate with industry stakeholders to align ESO’s forecasting enhancements with their expectations, and continuously engage with them to develop plans that are ambitious and feasible.

**Objectives**

- Improve the transparency and accessibility of energy forecasting data
- Improve the accuracy of Energy forecasts (Demand & Generation)
- Explore innovative methods of forecasting using new data and modelling techniques.
- Collaborate with stakeholders to align forecasting enhancements with their expectations

**Stakeholder Collaboration & Engagement Process**

- Learn from stakeholders' experiences and understand their current pain points in forecasting
- Plan and implement improvements for the future of forecasting in line with the balancing programmes forecasting roadmap and the evolve initiative
- Engage with stakeholders bi-monthly* on an ongoing basis, both remotely and in person.
- Encourage stakeholder input to ensure plans are ambitious, achievable, and in alignment with industry priorities

**Logistics**

The working group will operate as an open forum, allowing for new attendees to join at any point during the process.

Sign-up details will be available through MS Forms, with the information shared on the website and via email.

Meeting details, as well as any changes, will be communicated through email and posted on the website.

The outcome of each working group meeting, from the first meeting onwards, will be shared, along with related questions and answers, on the ESO website
# Forecasting Working Group – May meeting summary

## What We Discussed

- Reviewed Terms of reference
- Provided update on Forecasting Roadmap
- **Forecasting Problem – Re-Cap**
  - How do we forecast
  - Virtual demand
  - Visibility of embedded generation
- **Forecasting Improvements**
  - Wind Power forecasting improvements
  - Step towards modelling non-renewables embedded generation

## What could be better?

- Information on when New Forecasting product / model in implemented
- Understanding of Virtual Demand
- Information on when existing model is updated / changed
- Publication of virtual demand
- Historical Information on forecasting models
- Understand all inputs to our forecasting models (List of Model inputs)
- Real time system demand
Designing the future power system
The carbon journey so far

By 2025 the ESO has a target to operate the Transmission network carbon free for short periods
By 2035 the electricity network needs to operate carbon free all year round
The current challenges and how we are meeting them

Increased amounts of decarbonisation of the electricity system has resulted in changes in four key areas:

- Less dispatchable generation
- More asynchronous generation
- More variable sources of generation
- Generation moving to different areas
The current challenges and how we are meeting them

Each of these changes brings about five **engineering challenges** which have to be resolved using new and existing technology to operate a zero carbon network.

- **Generation moving to different areas**
  - Improved services to mitigate lower inertia

- **More asynchronous generation**
  - New services to replace capability

- **More variable sources of generation**
  - Replace services to access new providers and demand side capability

- **Less dispatchable generation**
  - New services to reduce costs
The gap to 2035

Year round zero carbon operation in 2035 introduces a further change and two further **challenges** to system operation.

- Less dispatchable generation
- More asynchronous generation
- More variable and unpredictable demand
- More variable sources of generation
- Generation moving to different areas
The gap to 2035

Getting to zero carbon operation in 2035 introduces a further change and two further challenges to system operation which have to be resolved using new and existing technology to operate a zero carbon network.
The gap to 2035

Energy over and under supply

By 2035 there could be excess demand in nearly 50% of hours in the year.

Excess demand solutions
- Carbon capture generation
- BECC generation
- Nuclear

Excess demand and generation solutions
- Very long duration storage
- Hydrogen production and generation
- Increased variable demand
- Interconnection
Our Market Reform Strategy

Vision
Transforming markets that enable zero carbon operability from 2025 and will set us on the trajectory for full decarbonisation by 2035

Strategic Framework

SHORT-TERM
We monitor and assess efficiency of existing and new markets, intervening where necessary to protect consumers

MEDIUM-TERM
Our markets roadmap adapts to changing landscape and knits together our short- and long-term strategy

LONG-TERM
Our NZMR programme sets out the long-term vision for markets and policy, as well as achievable pathways to getting there

Strategic Enablers

Horizon scanning
Scanning for longer-term trends; medium-term forecasting and analysis to understand impacts of new markets and reforms on broader markets.

Market Design Framework
A new Market Design Framework has been developed to ensure we are designing markets in a robust, comprehensive and transparent way

Collaboration
Engage stakeholders and MAC via a series of formal channels where we listen to feedback on market efficacy and also present and collaborate on our market developments.

Efficiency analysis
Monitor and assess the efficiency of existing and new markets, intervening where necessary
Our Market Design Framework

Market Design Objectives

- Efficient Dispatch
  - Meets balancing service needs in real time using the optimal combination of supply and/or demand-side resources.

- Efficient Investment
  - Gives investors sufficient certainty over revenues to obtain financing, ensuring future system requirements are met by the right technology mix in the right locations, at lowest cost to society.

- Value for Money
  - Selects outcomes that are in the best interest of current and future consumers.

Market Design Principles

- Competition (Short-Run)
  - Locational Signals in Dispatch
  - Coherency
  - Transparency

- Competition (Long-Run)
  - Locational Signals in Investment

- Net Consumer Benefits
  - Practicality
  - Adaptability

- Investability
Short-Term Market Reform

- Transparency of requirements
- Transparency of auction outcomes and methodologies
- Improvements to buy orders used in response and reserve auctions

Acting swiftly to implement solutions to mitigate security of supply risks and maximise balancing cost saving opportunities

- Winter contingency contracts – access to over 2GW of capacity
- Demand flexibility service – over 1million homes & businesses
- Balancing Reserve – up to £900m of consumer value in next 3 years
RIIO-2 BP1 workplan included an ambitious suite of reforms to our services and digital infrastructure

- Roadmap Regularly Published
- Annual Cycle Process being implemented
- Show and Listens Used
- Co-creation with industry
- Agile methodology applied
- Analysis to support decisions

Delivery of high quality services/platforms that meet customer needs and deliver value to the end consumer
Medium-Term Market Reform

Frequency Response Annual process

1. **Diagnose**
   - Roadshows & 1:1s
   - Review product backlog
   - Impact assess and prioritise potential changes covering service design, contracts and IT

2. **Design**
   - Amend contractual terms
   - Define IT requirements
   - Host webinar
   - Launch EBR consultation *(duration: 1 calendar month)*

3. **Develop**
   - Amend contractual terms (based on EBR feedback)
   - Amend IT requirements (where applicable)
   - Respond to EBR consultation and submit to Ofgem *(duration: 2 calendar months)*

4. **Implement**
   - Receive Ofgem decision
   - IT testing and delivery
   - Provider unit testing and onboarding *(where applicable)*

Annual service development cycle
Medium-Term Market Reform

Reserve Reform

‘This decision to delay reserve has been taken in light of the significant changes that would have been required in our existing, legacy balancing systems and processes, given the complexity of the new service designs. In the midst of a complex and rapidly evolving systems change environment, we believe it is more prudent to re-evaluate these changes to consider if implementation into our legacy systems is still appropriate, as opposed to direct implementation into our Open Balancing Platform (OBP).

Postponing the rollout of our new Reserve services grants us the opportunity to re-examine our proposed service designs, evaluate our IT options, and collaborate with you more effectively. This will ensure that the best solutions are delivered and that the necessary updates to our balancing systems are apt for enhancing our operational toolkit and are better aligned with the implementation of our future systems.’
Key strategic objectives and case for change

**ESO Mission**
To drive the transformation to a fully decarbonised electricity system by 2035 which is reliable, affordable and fair for all

**ESO 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

**RIIO2 BP benefits areas**
- Reduced emission
- Flexible technologies
- Situational awareness
- Greater interconnection
- Better inertia management
- Balancing mechanism outage

**New Balancing Capabilities**
- Automation and decision support tools
- Flexible platform
- Data harmonisation
- Advanced optimisation

Modern, open, reliable, resilient and secure technology platform
What is in scope of the Balancing Transformation Programme?

This investment delivers the Open Balancing Platform (OBP), a new real-time balancing capability to replace legacy ESO balancing systems (EBS, BM and ASDP) and processes and support zero carbon grid operations. The programme will deliver value incrementally, with an intermediate mode of operation in which enhancements will be first implemented in the current systems, and then integrated in OBP.
Open... to change

- Standard technology
- Well specified APIs
- Transparent programme governance
- Configurable services
- Observable system
- Faster deployment of new market products

Balancing... for net zero

- Harmonisation
- Optimisation
- Visualisation
- Benefit and risk focused roadmap
- User led journeys
- All data in one place
- Enhanced support tools

Platform... to enable

Set of technologies and practices enabling development and operations to deliver faster business value in CNI with security and resilience
Dispatch Transparency
What is a “skip rate”?

- A skip is a BOA (Bid Offer Acceptance) instruction sent by the ESO Control Room to increase or decrease the output of a generator but **at a price that was higher than an alternative option**. The ESO “skipped” an option that appears to be more economic.
- Skip Rate generally refers to **the number of times a skip occurs** in a given period such as a day.

Why worry about skips?

- The ESO has a licence condition to operate efficiently and economically and a target to reduce the balancing cost as much as possible.
- There are genuine skips where alternative instructions could have been sent for a lower cost. However, most actions that appear to be skips in data analysis are taken for operational reasons and are not preventable.
- The ESO strives for zero preventable skips.
Dispatch Transparency

- Actions taken in merit order, or out of merit order due to electrical parameter (category applied)
- Actions that have reason groups allocated (category applied, or reason group applied)
- Actions with no category applied or reason group identified

Total BOAS per year: 575k
Scheduling – Energy and margin

- Generally short – additional energy required
- Significant variation on ramp – additional margin required

- Market notifications
- Reserve requirement
- Market imbalance
- Demand & reserve requirement
- Demand
- Generally short – additional energy required
Dispatch Transparency - Root Cause

<table>
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<tr>
<th>Reason Group</th>
<th>Caused by:</th>
<th>Improve:</th>
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<tr>
<td>Frequency</td>
<td>Time to make decisions</td>
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<td>Flexibility</td>
<td>Complexity of decisions</td>
<td>Situational awareness</td>
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<td>Incomplete</td>
<td>Efficiency of dispatch process</td>
<td>Better dispatch advice</td>
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<tr>
<td>Zonal Management</td>
<td>Legacy processes</td>
<td>Dispatch mechanism</td>
</tr>
<tr>
<td>Reason not auto assigned</td>
<td>Accuracy of participant’s data</td>
<td>Capture required data</td>
</tr>
<tr>
<td></td>
<td>Unavailability of contextual information</td>
<td>Processes and policies</td>
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Approach to System Changes

- Automating & simplifying time consuming, manual processes
- Improving Situational Awareness
- Improving dispatch advice
- Process Improvements

These changes give users additional time and improved information to facilitate merit order dispatch
Current system developments (related to improved dispatch)

- **R0**
  - Additional BMU metadata
  - Automatic Instruction Repeater

- **IR1/R1**
  - Automatic Instruction Repeater Enhanced
  - GUI navigation enhancements

- **IR2/R2**
  - BOA by constraint views
  - Screens for bi-directional dispatch

- **IR3/R3**
  - Price Band Instructions
  - New battery zone

May/June 22

- **May/June 22**
  - Delivered

Sept/Nov 22

- **Sept/Nov 22**
  - Delivered

March/June 23

- **March/June 23**
  - Future Release

- **Autumn 23**
  - Future Release

*Full Scope of release is TBC

- **IR4/R4**
  - Further improvements to navigation, filtering, sorting and constraint management*
Recent Success: Increased Battery Dispatch

- December 22: Additional hardware into control room to support battery dispatch
- March 23: Price Band Instructions (VERGIL)
Panel discussion/Q&A
Recap
Aims of today

- Our progress on what we have achieved so far and the benefit it delivers
- How we are transforming the balancing capability of our control room
- A cohesive view of how we are working together to meet our ESO ambitions

- How our transformation will impact you
- Your insight into how we tackle some of the key challenges of transforming our balancing capabilities
- What you would like to see in the future and how we continue to engage

- To understand if our roadmap delivers against your priorities
- Plan how we overcome the challenges on the road to net-zero operability
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.balancingprogramme@nationalgrideso.com

Next event in October (location TBC)