Balancing Costs Strategy
Factors that Impact Balancing Costs with influence level that ESO has over these factors

- These 15 factors are not mutually exclusive; they directly or indirectly influence each other.
- ESO has different levels of influence on these factors.
- The level of influence may change with FSO and the new roles this will bring.

**UK Government Policy**
Energy Security Strategy
- e.g. 50 GW of offshore wind by 2030, Whole system energy strategy, nuclear strategy

**EU Policy**
e.g. Clean Energy Package, Cannot buy more than 30% reserve and response and day ahead

**Grid code changes**
FRCR, Grid forming, Fixed BSuoS

**Interconnectors**
New interconnectors imminent, flow on interconnectors depends on market price

**Wholesale electricity prices**
Set entirely by wholesale market but directly drives BM prices

**Network outages**
We optimise when outages take place but still has a significant impact on balancing costs

**Generator Outages**
Balancing options more limited when these are significant

**Transmission Network build**
What, where and when new transmission networks coming online alleviates constraints

**New Products and Services**
ESO can design new ancillary services and procure them according to rules of transmission licence, European laws etc

**New Generator Connections**
When and where new generators connect to the transmission network

**Market Design**
REMA: incentives on market actors to schedule and trade in a way that respects system security

**Operating Margin**
The level of operating margin required to cover demand changes or generation breakdowns is defined by ESO.

**Market Monitoring**
ESO will notify Ofgem of potential market misuse or identify potential market changes required

**System Modelling and Data**
We build system models that result in published data e.g. demand forecasting and transmission constraints

**Control Room/BM**
Balance supply and demand at lowest cost whilst meeting security standards

- Very little influence
- Some influence
- Strong influence
Balancing Costs Timeline

- Capacity Market Auctions
- Forward Power Markets
- Services, contracts and markets are designed by ESO e.g. pathfinders, ancillary services
- Initial transmission network outage planning is conducted

- Day-ahead auctions for ancillary services
- Market refine their positions
- BMUs provide Physical Notifications
- Transmission network outage planning process finalised to ensure system security

- The ESO refines forecasts for demand and generation
- Intraday markets runs
- BMUs update PNS and prices
- ESO may make trades with generation units or interconnectors
- Units with a long "Notice to deviate from zero" may be instructed or warmed

- BMUs submit Final PNs before gate closure
- Dynamic data of BM units is updated where a technical change has been made
- Bid and Offer prices submitted
- System operating plans are continually refined

- BMUs are repositioned to account for physical network limitations, or to manage real-time energy imbalance, through accepting bids and offers
- Generator failures are managed through response and reserve products
- Ancillary services are enacted to maintain system safety and security

Gate Closure

30 mins (Settlement Period)

ELEXON ‘Cash out Analysis’

Post-event analysis used for future products and services and to improve future system balancing
The ESO’s Strategic Levers
Our Strategy

Levers to minimise balancing costs

<table>
<thead>
<tr>
<th>Network Planning &amp; Optimisation</th>
<th>Commercial Mechanisms</th>
<th>Research, Innovation, Engagement</th>
<th>Control Room Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designing the GB network and managing delivery of changes to optimise availability and reduce Constraints.</td>
<td>Designing and Procuring new services, with greater competition at an optimised price.</td>
<td>Experimenting with first in sector approaches and technologies, collaborating with Industry and Academia.</td>
<td>Using enhanced products and services provided to the Control Room, optimising security, supply and cost.</td>
</tr>
</tbody>
</table>

How we use this leverage

- **2025 Zero Carbon Operability**
  - Analyse
  - Report & Contextualise
  - Influence
  - Deliver

- **2030 Enable 50GW offshore wind**

- **2035 and beyond Net Zero Power system**
Network Planning & Optimisation

Costs associated with congested electricity networks make up a large proportion of balancing costs. Network planning and optimisation initiatives have potential to make a significant impact on constraint costs in particular.

Where we are

• Highly congested network.
• Highly localised metropolitan demand centres.
• Geographically focussed variable energy sources.

What we are doing*

• Pathfinders.
• Continual Network Build such as the NOA.
• Western Link and Eastern Link.
• Connections Reform.
• Regional Development Programmes
• Outage Optimisations
• Consideration of Connections Reform, demand incentives, generation locational incentives.

Where we want to be

• Optimise constraints so that energy is priced fairly and competed for dispatch.
• An efficiently designed network that reduces unnecessary costs and support the continued connection of new generation.

* For the full list of activities in this area can be found in our balancing costs portfolio.
Commercial Mechanisms

These are initiatives where we design and procure new services to balance the system sometimes often of the balancing mechanism, with greater competition at an optimised price.

*For the full list of activities in this area can be found in our balancing costs portfolio.*
Research, Innovation, Engagement

In an evolving energy industry, we want to ensure that we are most effectively using innovative solutions to minimise balancing costs. We engage in many projects that experiment with first in sector approaches and technologies, collaborating with industry and academia.

**Where we are**
- Engaged industry.
- Regular engagement with government and regulation.
- Commenced many varying research and innovation projects.
- The ESO provide a lot of advice and direction on industry decisions (such as FRCR).

**What we are doing**
- Ongoing research and innovation projects to identify, triage, and mitigate Balancing Costs.
- Ongoing consultations and discussions with government, regulators, and industry.
- Greater reporting and publicising of Balancing Costs analysis and strategy.

**Where we want to be**
- Continued strong engagement with industry.
- Stronger engagement with government and regulation.
- Better engagement with the public.
- As part of the FSO, we want to move to a more holistic viewpoint of the energy system, through whole energy planning, advisory roles, and emergency preparedness.

*For the full list of activities in this area can be found in our balancing costs portfolio.*
Control Room Processes

Balancing GB's electricity system is an incredibly complicated task, with significant and difficult decisions being made from second-to-second. Our control room has fantastic capability in balancing the grid, but we are always looking to optimise our systems and processes to ensure that we are keeping up to date with the high standard that we like to set, and that we are adapting to industry changes.

*As outlined in our Balancing Programme*
The ESO’s Strategic Timeline
2025 – Zero Carbon Operability

We will be able to operate the network for a time interval, if the market provides the correct generation mix, using 100% zero carbon electricity by 2025 with lowest cost solutions.

**Strategy**

Our initiatives across all categories will:

- Increase operability envelope for secure system operation (Control Room Actions, Innovation & Technology).
- Enable new zero-carbon providers for ancillary services (Network Planning & Optimisation, Commercial Mechanisms).

**Impact**

Our increased ability to operate a zero carbon system will reduce balancing costs through:

- mitigating/eliminating frequency risks
- alleviating constraints
- reducing renewable generation curtailment
- competitively procuring services in advance to reduce need for expensive interventions in the BM.

---

**Activity essential for 2025 zero carbon operation (Operability Strategy Report 2022)**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>DG</td>
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<tr>
<td>Reformed Markets</td>
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</tr>
</tbody>
</table>

**Stability**

- ALOCP: Removes the risk of DFR activation at lower inertia levels
- Phase 1: 12.5GWs of inertia
- Phase 2: 6.5GWs of inertia and 11.5GVA SCL for Scotland
- Phase 3: 17GVA of inertia and 12.7GVA SCL for ESW

**Inertia monitoring**: Implementing first of its kind inertia monitoring tools, providing instantaneous, real-time data.

**Voltage**

- Mersey: Reduce the reliance on a single CCGT for voltage in one area
- Pennines: Expand the learning to cover a larger area and reduce reliance on a number of units
- ESW: Cover the whole of ESW to ensure no reliance on machines to manage voltage

**Efficiency**

- Increased access to existing capability through changes to codes and developments with the Transmission owners.

**Restoration**

- ESRs Services: Ensured that all ESRs services are in place and do not require units to be ‘warmed’ to provide the service.
2025 – Zero Carbon Operability

ALoMCP, FRCR & Dynamic Containment

**Context**

- Increasing renewable generation is leading to lower system inertia.
- The rate of change of frequency (RoCoF) is higher as a result and, without management, loss of mains protection is at greater operational risk.

**Initiatives**

1. Accelerated Loss of Mains Change Programme (ALoMCP) 2017 - 2022
2. New Response Services (Dynamic Containment, DC) 2020

**Impact**

- All three initiatives have significantly reduced volume of bids for stability required to manage largest losses and increase system inertia
- Without them, we would need over 1.5 TWh of additional actions in 2023/24 to ensure system security, costing at least £1,100m
2030 – 50GW of Offshore Wind

Context

• Constraint costs are projected to rise to up to £3bn/year by 2028 (FES scenario ‘Leading the way’).

• Driven by increasing offshore wind capacity to reach government target of 50GW by 2030 from ~10 GW in 2023.

• We are mitigating these forecast balancing cost rises with **Network Planning & Optimisation** initiatives.

Acceleration of Strategic Transmission Investment (ASTI)

• We have collaborated with Ofgem on Acceleration of Strategic Transmission Investment (**ASTI**) framework

• Our **HND** and **NOA7 refresh** identify onshore and offshore transmission network projects to be accelerated.

• Significant shift in how large projects are identified, assessed, and funded.

Impact on balancing volumes and costs

• Ofgem sanctioned 26 projects in December

• Accelerating these projects will deliver additional **balancing costs savings of up to £2.1bn** and enable benefits of decarbonisation through increased offshore wind capacity
2030 – 50GW of Offshore Wind

NOA Network Services Procurement (Pathfinder) Projects

Context

- Pathfinders launched May 2019 to proactively target known network issues that would increase balancing costs as we progress to net zero power system.
- We identified innovative, strategic solutions to these issues (Network Planning & Optimisation) and secured lower cost, long-term contracts for these services (Commercial Mechanisms), with significant balancing costs savings through to 2035.

Impact on balancing volumes and costs

- Voltage Mersey, Stability Phase 1 and CMIS are beginning to reduce balancing costs and volumes.
- Costs have reduced as long-term contracts are cheaper than using the BM, or TO counterfactual build.
- Volumes have reduced as we are procuring services through long term contracts rather than via the BM.
- CMIS B6 has additionally reduced volume of pre-emptive curtailment when there is risk of a fault.
- These trends will continue with remaining pathfinders, with forecast total balancing costs savings of >£15bn out to 2035.

<table>
<thead>
<tr>
<th>Pathfinder</th>
<th>Contract start</th>
<th>Contract end</th>
<th>Savings to date (£m)</th>
<th>Total forecast savings (£m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability Phase 1</td>
<td>Jan 20</td>
<td>Apr 27</td>
<td>26</td>
<td>128</td>
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<tr>
<td>Stability Phase 2</td>
<td>Apr 24</td>
<td>Mar 34</td>
<td>-</td>
<td>130</td>
</tr>
<tr>
<td>Stability Phase 3</td>
<td>Apr 25</td>
<td>Mar 35</td>
<td>-</td>
<td>14,900</td>
</tr>
<tr>
<td>Voltage Mersey</td>
<td>May 22</td>
<td>Apr 31</td>
<td>13</td>
<td></td>
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<tr>
<td>Voltage Pennine</td>
<td>Apr 24</td>
<td>Mar 34</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td>CMIS B6 Interim contracts</td>
<td>Apr 22</td>
<td>Sep 23</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>CMIS B6 2023/24</td>
<td>Oct 23</td>
<td>Sep 24</td>
<td>-</td>
<td>40-60</td>
</tr>
<tr>
<td>CMIS B6 2024/25</td>
<td>Oct 24</td>
<td>Sep 25</td>
<td>-</td>
<td>70</td>
</tr>
<tr>
<td>Total savings</td>
<td></td>
<td></td>
<td>117</td>
<td>15,293</td>
</tr>
</tbody>
</table>
### Context

- **Constraint costs** will continue to be a major driver of increasing balancing costs as more offshore wind is connected.

- The role of the ESO is changing. As we become a **Future System Operator (FSO)** we will be in a better position to drive **government policy** and provide expert advice on network planning.

### Strategy

- We have already made fundamental changes in the way we deliver network infrastructure solutions via the **Holistic Network Design (Network Planning & Optimisation)**.

- These changes will continue as we develop a **Centralised Strategic Network Plan (CSNP)** to plan onshore and offshore more holistically and as the FSO take on new roles as a whole energy system planner (Network Planning & Optimisation).

- This will go hand in hand with the fundamental changes happening via **connections reform** (Network Planning & Optimisation) and **Net Zero Market Reform** (Commercial Mechanisms).

- A **holistic, whole energy system network plan** in an environment where **efficient decision making** can thrive will enable us to meet the challenges of net zero and is the key to driving down balancing costs in the longer term.
If you have any questions or queries relating to the Balancing Costs Strategy, please reach out to box.Balancing.Costs@nationalgrideso.com

For further information on ESO publications please visit: nationalgrideso.com