Stability Market Design – Innovation Project
Webinar – 09/11/2021
Agenda

• Project purpose and plan
• Initial analysis and implications
• Explore market objectives
• Discuss building blocks
• Next steps
• Q&A
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Historical
Where are we coming from?

Historically, stability was provided as a by-product of generation.

Today
Where are we today?

Rapid growth in renewables, retirements of synchronous generation and changes to the structure of demand will result in heavier reliance on proactive system stability management by the ESO.

The management of grid stability has become increasingly expensive and we are exploring new commercial options for stability services.

Future
Where are we going?

The ESO has set an ambitious target to be capable of running the GB system on zero-carbon electricity by 2025.

We need to define the optimal design for a potential future stability market.
### Stability products

<table>
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<tr>
<th>What is it?</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Inertia</strong></td>
<td>The kinetic energy stored in the rotors of the synchronous generators that will carry on spinning and slow down the change in frequency in case of a sudden change in system frequency.</td>
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<td><strong>Short circuit level (SCL)</strong></td>
<td>The amount of current that flows on the system during a fault.</td>
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<td><strong>Dynamic voltage support</strong></td>
<td>Dynamic voltage support stabilizes the system voltage.</td>
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Stability solutions

BM actions

Balancing Mechanism actions can reduce the largest infeed or procure inertia to manage the ROCOF.

The NOA Stability Pathfinders look for the most cost-effective way to address stability issues in the electricity system.
Purpose of the work

- The Stability Market Design project is a research study looking at the optimal design for a potential GB stability market.
- This could allow the ESO to start to develop a stability market and best optimise long term and short-term stability procurement.

Started in Sept 2021 - aim to finish in Feb 2022

Innovation project, study-based
Engaging with wider industry
Core scope of work and overview of activities

1. Alignment, vision, objectives
   - 1a. Scene setting and scenarios
   - 1b. Assessment criteria and objectives

2. Design elements, strengths, weaknesses
   - 2a. Market building blocks and design options
   - 2b. Straw man assessment and end-to-end market design

3. Industry views, refinement, finalisation
   - 3a. Stakeholder engagement
   - 3b. Final recommendations
Project timeline

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<tr>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
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Setting the scene

Building Block & Straw-man (assessment & modelling)

Questionnaire

1st external webinar

NIA Initial Recommendations

2nd external webinar
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Growing penetration of non-synchronous generation exacerbates the need for stability services and will be more prolific in the future.

Even with current arrangements, shortfalls/requirements in provision may still occur, the range of uncertainty is vast across scenarios.

Data sources: FES 2019, ESO data portal, Stability Pathfinders
Implications of initial analysis

Renewables push conventional generators out of merit, displacing firm inertia, SCL and reactive power support. Stability requirements will likely be greater than today but also different from the current needs.

There is a need for **new investment** in resources that can provide stability services, which requires a market design that sufficiently incentivises investors to develop new solutions.
Net requirements in the next 10 years will increase, but will be very sensitive to the evolution of the energy mix, the pace of renewable deployment and electrification of the transport and heat sectors.

Requirements are uncertain, with a wide range in needs between scenarios, this uncertainty must be considered in the design arrangements.
Requirements will be different from the current needs, varying significantly under different operational situations within the power system. Different operational situations are primarily distinguished by: the level and distribution of renewable generation and load.

Requirements are not baseload, they vary by time of year, time of day, and location (esp. in relation to SCL and dynamic reactive power). Remuneration/procurement should consider this variability in needs.
Implications of initial analysis

- New investment
- Uncertainty
- Requirements are not baseload
- Existing providers
- New technologies

Need to consider role of technologies that are providing or could be providing stability services as a byproduct, including the role of existing providers.

There are existing providers who are inherently providing the services already through normal market dispatch (or through the BM) – these providers should be carefully considered.
The arrangements must cater for new technologies and solutions, being flexible to a range of different capabilities.

With the resource mix changing and expectations of a reduced role for conventional technologies, it is essential that new technologies are able to be active in service provision.
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Objectives framework

Ensuring **cost-efficient provision** of services needed to **maintain system stability and security** in the interest of consumers and to be able to operate a zero-carbon grid.

**Primary objectives**

**Practical**: ease of implementation, operation and transition

**Enduring (stable)**: suitable and adaptable to future challenges

**Freedom of choice**: avoiding lock-in, giving ongoing choice in the market for providers and for ESO as buyer, ensuring liquidity and mitigating market power

**Transparent**: visibility of service values and clear procurement decisions

**Investable**: respecting existing and supporting efficient future investments

**Technology neutrality**: being non-discriminatory between technologies with equivalent capabilities.
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Building blocks

- Timeframe
- Eligibility
- Pricing Mechanism
- Bundling
- National & locational spec.
- Product definition
We are looking at both short and long-term solutions, while taking into account the provision from existing Pathfinders. We will need a route to market when Pathfinders' contracts expire, whether through short-term or long-term markets. Some continued LT procurement seems necessary, as decisions must be taken in investment timeframes to ensure adequate capability. Availability uncertainty for weather driven providers (e.g. wind farms) means a short-term mechanism is needed to some extent, which leads to the idea of a firm/non-firm LT market.

*Non-firm: availability is not committed at the time of striking the contract. Potentially suitable for renewable energy service providers.*

LT contract duration and timing of (any) ST process is to be addressed separately.

Options:
A. LT procurement for all needs (firm + non-firm*)
B. LT Market (for some needs, to replace Pathfinders) + ST market (top-up)
C. ST only (in combination with existing Pathfinders for LT provision): status quo
Building blocks

**Definitions:**
- Capability: Supplier is able to be available in some defined future time period
- Availability: Supplier is active and service is operationally available to the SO

### Market considerations

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<tr>
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<th>Capability</th>
<th>Availability</th>
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<tbody>
<tr>
<td>LT Firm</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>LT Non-firm</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>ST (Firm)</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Non-contracted (near real-time)</td>
<td>✗</td>
<td>✗ *</td>
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*note: possibility of BM payments for positioning*

### Global eligibility
Where stability services where traditionally provided for free (as an inherent feature of synchronous generation) these services may in future need to be paid for as an additional service.

### Selective eligibility
* e.g. top-up, new technologies, technical characteristics

### Compromise?
Availability price could be different for different providers *e.g. firm/non-firm, uncontracted or (in energy terms) out-or-merit capacity.*
**Building blocks**

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>Eligibility</th>
<th>Pricing Mechanism</th>
<th>Bundling</th>
<th>National &amp; locational spec.</th>
<th>Product definition</th>
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<tbody>
<tr>
<td>LT market: Simple bids for availability</td>
<td>Providers submit a simple availability price in the LT market. The price setting could be universal pricing (pay as clear) or discretionary pricing (pay as bid).</td>
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<tr>
<td>ST market price: simple bids for availability</td>
<td>In a ST market: market-based pricing for availability (could be pay as clear or pay as bid)</td>
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<tr>
<td>Incentives</td>
<td>For non-firm providers, availability payments must give sufficient incentive to offer stability services when they are needed: this might require some dynamic pricing (e.g. for availability itself, or via the BM for energy consequences of creating availability). Note links to non-delivery $$ for firm providers.</td>
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<tr>
<td>Consideration of market power and regulated pricing</td>
<td>Locational market power (especially in ST markets) may require regulatory protection</td>
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<tr>
<td>For services bundled with energy provision</td>
<td>Note the possibility of using existing BM and other settlement mechanisms to deal with the energy cost consequences of ensuring availability on the day e.g. part-loading etc</td>
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</table>
Building blocks

**Timeframe**

**Eligibility**

**Pricing Mechanism**

**Bundling**

**National & locational spec.**

**Product definition**

**Individual stability service**

- Separate procurement (potentially at different times) for the 3 relevant stability services (inertia, SCL, dynamic voltage support)

**“Combinatorial auction” with bundled price**

- Each bid is made for packages of services (quantity & availability for each service, with a single price offer for the package)
Building blocks

**Timeframe**

**Eligibility**

**Pricing Mechanism**

**Bundling**

**Product definition**

### Requirements: National & locational aspect

SCL and dynamic voltage are considered regional. Inertia is currently national (but there are some locational considerations e.g. if all providers were in a similar region).

### Effectiveness factor

**Options:**
- Procurement through ‘effectiveness factors’ (scalars, either applied to price or volume)
- OR Grouping of providers with similar effectiveness factors into zones

### Co-procurement by region

**Options:**
- Procurement for each region independently (could be at different times)
- OR co-procurement for each region in a collective process, considering the potential for one provider to meet needs in multiple regions
The product being procured is availability

**Standard ratios of services per provider or user-defined capability**
- **Options:** Standard products using fixed ratios of provision between the services OR user-defined products with variable ratios of provision

**Delivery windows**
- Consideration of delivery windows for availability (e.g. season, time of day) based on system needs
- Settlement interval duration (presumption is half hour to fit with other settlement mechanisms)

**Other characteristics**
- Non-delivery consequences (linked to firm/non-firm)
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Next Steps

• Slides and the recording will be published next week
  https://www.nationalgrideso.com/future-energy/projects/stability-market-design

• We want to seek further feedback on our options as well as alternative views/suggestions. After this webinar, we are also launching a questionnaire

• 2nd webinar in February with final results of this study

• If you have questions, you can contact us:
  • AmirHessam.Alikhanzadeh@nationalgrideso.com
  • Sophie.Vancaloen@nationalgrideso.com
  • Rend.Nawari@nationalgrideso.com
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Thank you