Stability Market Design – Innovation Project

Webinar – 09/11/2021

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Agenda

- Project purpose and plan
- Initial analysis and implications
- Explore market objectives
- Discuss building blocks
- Next steps
- Q&A

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Background

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, retirals 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

What is it?

Inertia	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.
Short circuit level (SCL)	The amount of current that flows on the system during a fault
Dynamic voltage support	Dynamic voltage support stabilizes the system voltage.

Build upon the definition in GC0137.

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Stability solutions

BM actions

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

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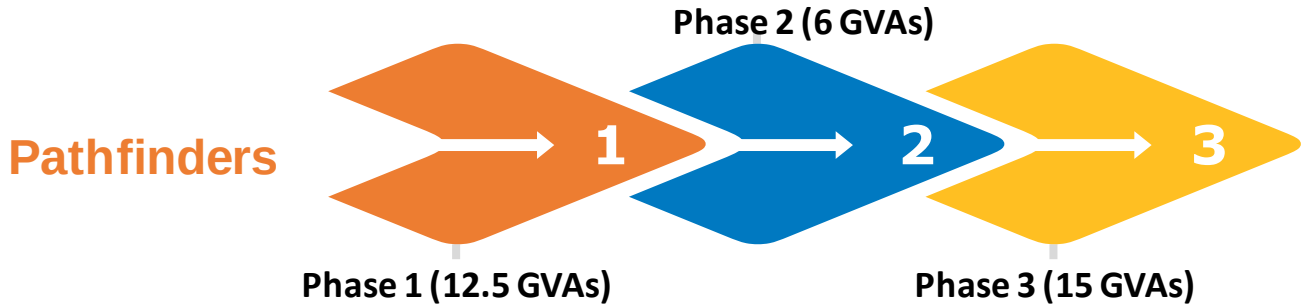
Pathfinders



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.

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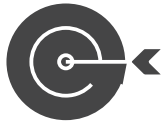
Core scope of work and overview of activities

1 → 2 → 3

Alignment, vision, objectives | **Design elements, strengths, weaknesses** | **Industry views, refinement, finalisation**

1a. Scene setting and scenarios

1b. Assessment criteria and objectives



2a. Market building blocks and design options

2b. Straw man assessment and end-to-end market design

3b. Final recommendations

3a. Stakeholder engagement

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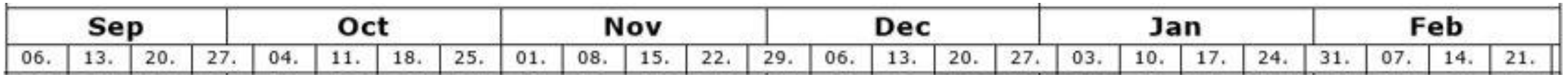
Project timeline



Setting the scene

Building Block & Straw-man
(assessment & modelling)

Questionnaire

1st external webinar

NIA Initial Recommendations

2nd external webinar

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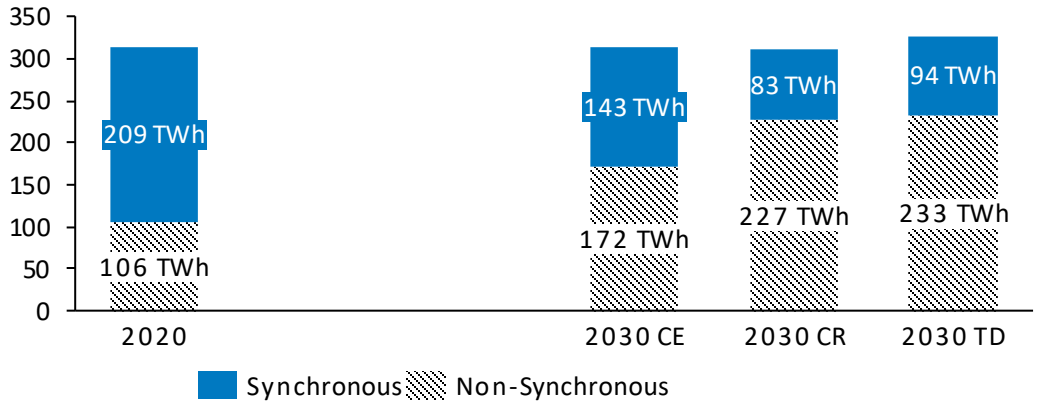
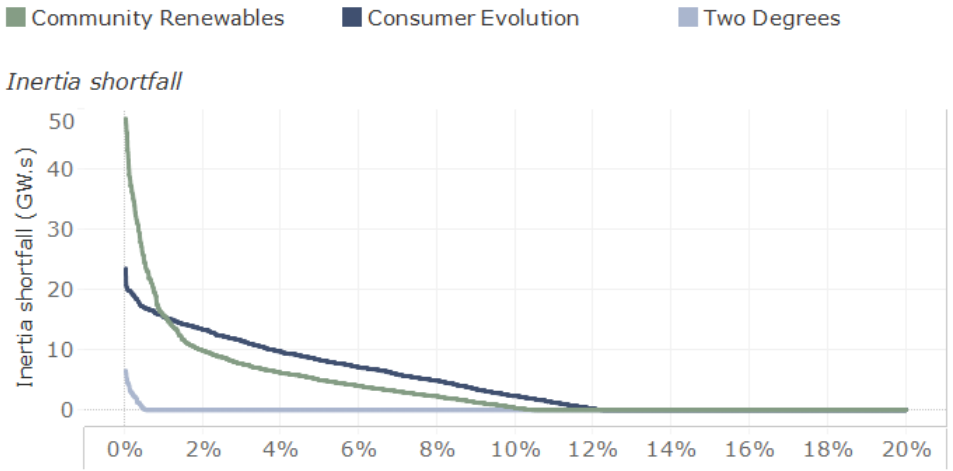
Future need: initial analysis

Growing penetration of non-synchronous



Non-synchronous generation exacerbates the need for stability services and will be more prolific in the future

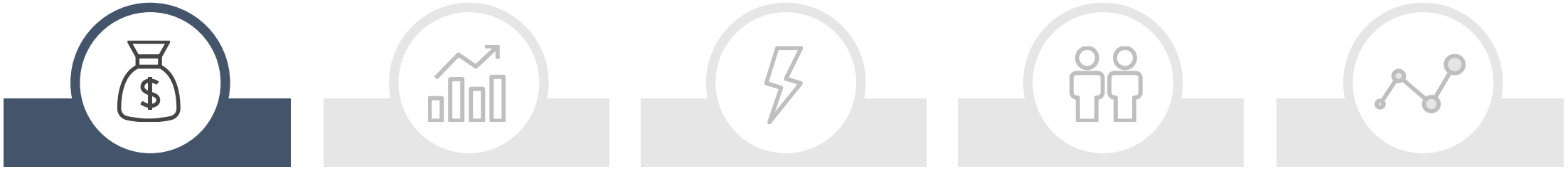
Expected shortfall in provision by 2030



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



New investment

Uncertainty

Requirements are not baseload

Existing providers

New technologies

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.

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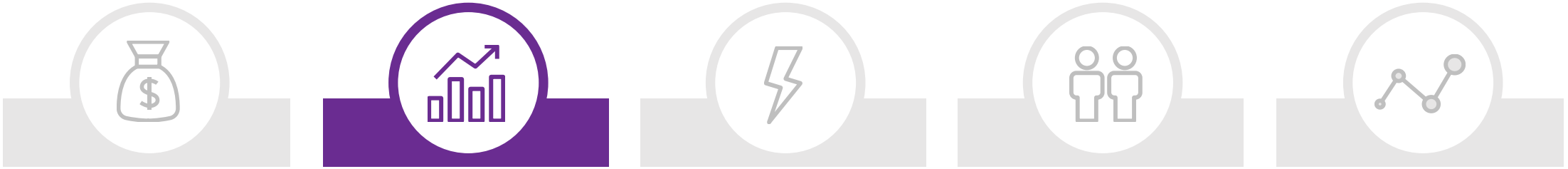
Implication of initial analysis



New investment

Uncertainty

Requirements are not baseload

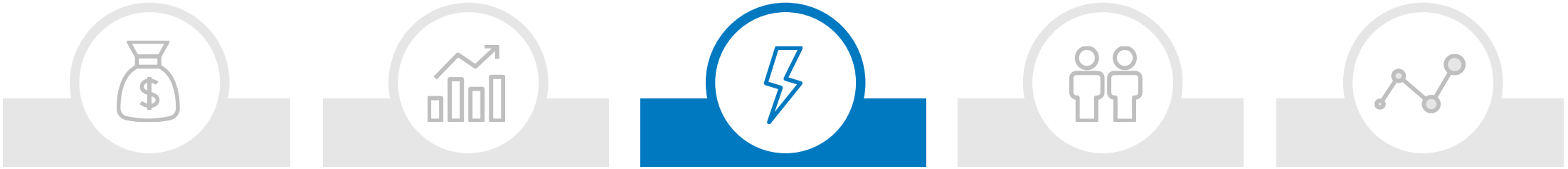
Existing providers

New technologies

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.

Implications of initial analysis



New investment | Uncertainty | **Requirements are not baseload** | Existing providers | New technologies

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.

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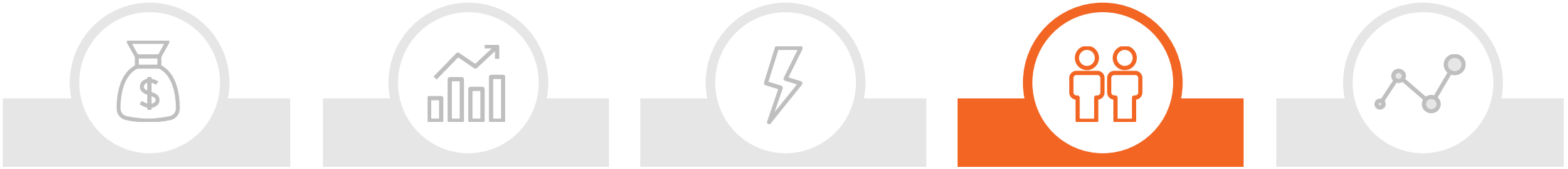
Implications of initial analysis

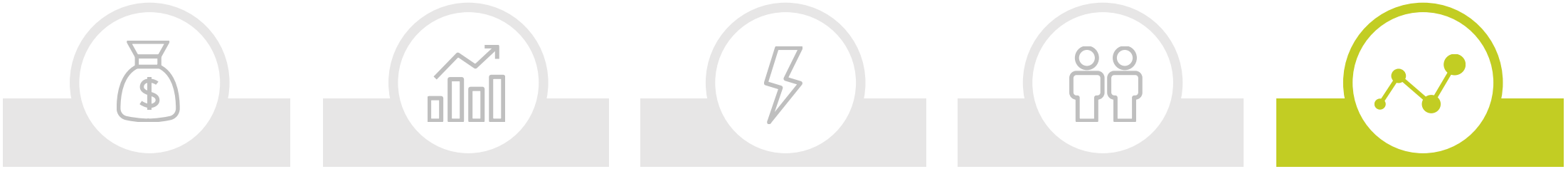


New investment | Uncertainty | Requirements are not baseload | **Existing providers** | New technologies

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.

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

Implications of initial analysis



New investment | Uncertainty | Requirements are not baseload | Existing providers | **New technologies**

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

The arrangements must cater for **new technologies** and solutions, being flexible to a range of different capabilities.

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Objectives framework

Primary objectives

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.

Secondary 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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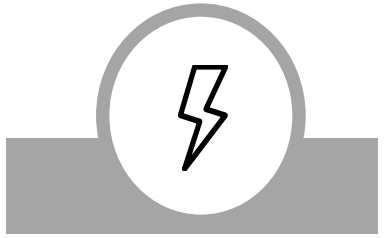
Building blocks

Timeframe

Eligibility



Pricing Mechanism

Bundling

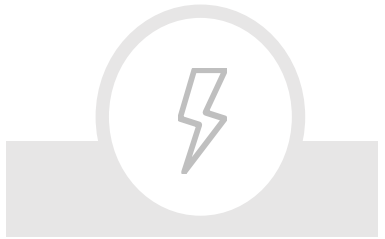
National & locational spec.

Product definition

Building blocks

Timeframe

Eligibility



Pricing Mechanism

Bundling

National & locational spec.

Product definition

Long-term

Short-term

Combination

- 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

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**

- *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

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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

Timeframe | **Eligibility** | Pricing Mechanism | Bundling | National & locational spec. | Product definition

Market considerations

	Capability	Availability
LT Firm	×	✓
LT Non-firm	×	✓
ST (Firm)	×	✓
Non-contracted (near real-time)	×	× *

** 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.

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Building blocks

Timeframe | Eligibility | **Pricing Mechanism** | Bundling | National & locational spec. | Product definition

Choices

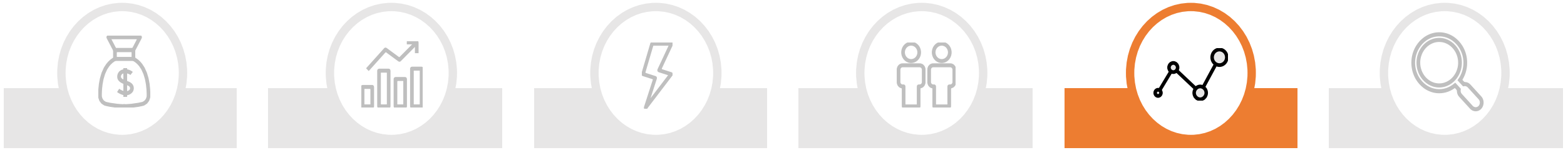
LT market: Simple bids for availability	Providers submit a simple availability price in the LT market. The price setting could be universal pricing (pay as clear) or discretionary pricing (pay as bid).
ST market price: simple bids for availability	In a ST market: market-based pricing for availability (could be pay as clear or pay as bid)
Incentives	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.
Consideration of market power and regulated pricing	Locational market power (especially in ST markets) may require regulatory protection
For services bundled with energy provision	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

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 | **National & locational spec.** | 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

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Building blocks

Timeframe | Eligibility | Pricing Mechanism | Bundling | National & locational spec. | **Product definition**

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:
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  - Sophie.Vancaloen@nationalgrideso.com
  - Rend.Nawari@nationalgrideso.com

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Thank you

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