Stability Market Design
Innovation Project

Thought Piece

March 2022

nationalgridESO

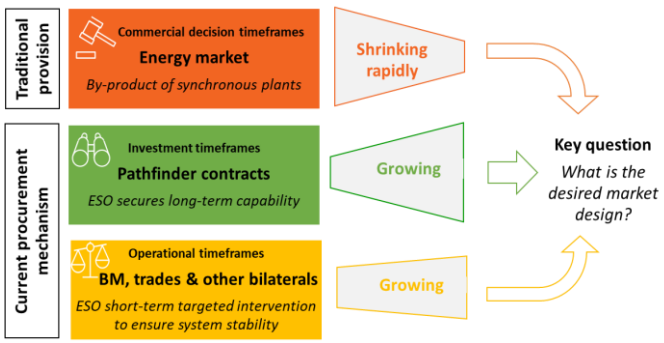
Developing an enduring market solution to solve stability challenges

We have an ambition to operate a zero carbon grid as well as ensuring the operability of the electricity system based on our Security and Quality of Supply Standard (SQSS). This includes the need to manage system stability, including inertia, short circuit level (SCL) and dynamic voltage support. Traditionally, system stability has been inherently provided by synchronous generators as a by-product of the delivery of energy, as well as by synchronous elements of demand (e.g., motors). As non-synchronous generation in Great Britain (GB) grows and displaces synchronous machines, managing system stability is becoming increasingly challenging.

Phase 1 of the Stability Market Design innovation project explored a potential enduring market design for the procurement of stability services with a critical focus on value for GB consumers.

How we manage system stability today

Today we manage stability through various market arrangements. Stability is inherently provided by synchronous generators operating in the wholesale market. This is how the bulk of our requirements have been met in the past. As of 2020, our forecast longer-term stability shortfall is now procured through our stability pathfinders. Our current stability pathfinders meet system stability needs until the end of 2027, but our requirements will continue to grow beyond this point, needing additional investment. Short-term stability needs are procured through the Balancing Mechanism (BM) and trades within operational timeframes. However, procuring stability through the BM can be expensive and carbon intensive as we largely rely on synchronising CCGTs in the BM to provide stability.



What is Stability?

Stability is one of the key characteristics of the electricity system. Stability is the inherent ability of the system to quickly return to acceptable operation following a disturbance. Stability products include inertia, short circuit level (SCL) and dynamic voltage support.

Overview of Stability Market Design innovation project

We kicked-off the Stability Market Design innovation project in September 2021 in partnership with consultants AFRY. Through this study-based innovation project, we explored a potential enduring market design for the procurement of stability services. The primary objective of our stability market is to ensure cost-efficient provision of services needed to maintain system stability and security in the interests of consumers.

Stakeholder input was critical to shaping the case for change and informing decisions on key market design choices. We co-created with industry through industry webinars and a survey that allowed stakeholders to provide detailed views and feedback to design an effective market. You can listen to the webinars here.

The recommendation for the enduring stability market design was developed based on a qualitative and quantitative assessment of different market design options. The analysis used AFRY's BID3 model and ESO's stability requirement analysis based on FES 2019 data.

The recommended solution for a stability market

The core recommendation of the Stability Market Design innovation project is to develop a combination of a dedicated short-term market (day-ahead) with a long-term market (building on the well-functioning pathfinder approach) for stability services, while retaining the BM option as a backstop. This approach combines the benefits of both the long- and short-term markets while mitigating the drawbacks of procurement in a single timeframe.

This hybrid approach over multiple timeframes also aligns with stakeholders' feedback during our engagement, with the majority favouring a combination of short- and long-term markets.

What are the main benefits of a long-term market?

- A long-term market is the best way to secure significant new capex-heavy investment that will enable us to meet a shortfall in system stability requirements. The stability pathfinders 1, 2, and 3 will ensure that there is adequate capability to meet our requirements until the end of 2027. However, there is, and will continue to be, a need for further investment in stability capability as synchronous generation retires.
- Long-term contracts can also bring significant cost benefits to consumers and reduce carbon emissions. We have seen that our pathfinders' contracts led to fewer balancing actions in the BM, which can be expensive and carbon intensive.

What are the key weaknesses of a long-term only market?

- Although stability pathfinders have bought many benefits, the procurement process is still largely ad-hoc and therefore there is room for enhancing transparency with more systematic communications on our requirements and running of procurement events.
- A long-term only market could lead to over- or under-procurement as requirements are variable and unpredictable. Over-procurement is clearly not cost-efficient for consumers, while under-procurement would lead to potentially very high costs in the BM, or even security risks if there is a lack of capacity available in the operational timeframes.
- A long-term only market raises some challenges in accommodating all providers. Indeed, such contracts can expose providers to unmanageable risks over the contract duration (e.g., due to availability requirements or uncertainty of utilisation costs). Additionally, long-term only markets may create barriers to some weather-dependent providers due to high availability criteria.

What are the main benefits of a short-term market?

A short-term market dedicated to stability does not exist currently but could mitigate some of the weaknesses listed above.

- A short-term market would offer a route for providers that are not able to make long-term commitments, such as grid-forming technologies for inertia, and therefore, increase competition.
- Incentivising the provision of stability services through a new short-term market would reduce the need for actions in the BM, thereby improving cost and carbon efficiencies.
- A short-term market could offer a future route to market for providers currently under pathfinders when their contracts expire from 2026 onwards.
- A short-term market also allows for additional short-term provision to cope with volatile system needs. This will enable us to reduce over- and under-procurement risks.

Why can taking stability BM actions be expensive and carbon intensive?

Procuring sufficient stability capability in the BM typically relies on turning up synchronous generation (e.g. CCGT) to increase stability as well as turning down non-synchronous generation (e.g. wind or interconnectors) to keep the system balanced.

What are the key weaknesses of a short-term only market?

- A short-term only market may not deliver the required investment needed for additional stability capacity, as it would not provide clear enough long-term price signals for investment in high-capex assets.
- As we are the only buyer of stability products in GB, some providers may be exposed to the potential risk of stranded assets if we change our requirement needs or procurement rules.
- The lack of long-term hedging could expose us to shortages and the risk of being a 'distressed' buyer which can lead to scarcity and extreme pricing, as well as system security issues.

In light of the above, we are therefore recommending the development of both a short- and long-term market for the procurement of stability services.

What our quantitative analysis tells us

AFRY's quantitative analysis reinforces the case for multiple market timeframes as a desirable option. The analysis (using FES 2019 data) is in the full report from the innovation project here

In the analysis, the status quo (including pathfinders 1, 2 and 3) was compared to the recommended approach of a long- and a dedicated short-term market. The assessment indicated the recommended approach will reduce re-dispatching costs (by ~£30m in 2026 and ~£58m in 2030, Two Degrees scenario) and emissions (by ~0.4mtCO_2 in 2026 and ~0.3mtCO_2 in 2030).

The short-term market provides sufficient value to incentivise grid-forming technologies to enter the stability market, increasing the total stability provision, which in turn results in reduced re-dispatch actions for stability, primarily from CCGTs.

It is important to note that these results based on a high-level cost benefit analysis, using FES 2019 data. While there appear to be clear benefits from this recommended market approach, we will need to update the analysis with the latest stability requirements based on FES 2021 data to understand the benefits more accurately. Due to substantial market developments since FES 2019, we expect even more non-synchronous generation in the near term under our FES 2021 scenarios which suggests the magnitude of potential benefits could be increased with an updated view.

What is grid forming?

Historically, weather-driven technologies (e.g., wind, solar), interconnectors and batteries did not provide stability due to the technology of their convertors. However, they can now replicate some of the characteristics of synchronous generators and provide stability. This is called 'grid forming' capability. The technical specification have been developed through Grid Code GC0137 here.

Additional benefits that are not included are[1]: the possibility to reduce our spend on other services, such as reactive power; reduction of over- and under-procurement risks; and increasing market transparency.

Looking into the future

In line with the ESO Market Transformational Stages, Phase 1 of the innovation project looked at key high-level strategic questions to assess whether a new market approach would provide efficient investment and dispatch signals, as well as value for money.

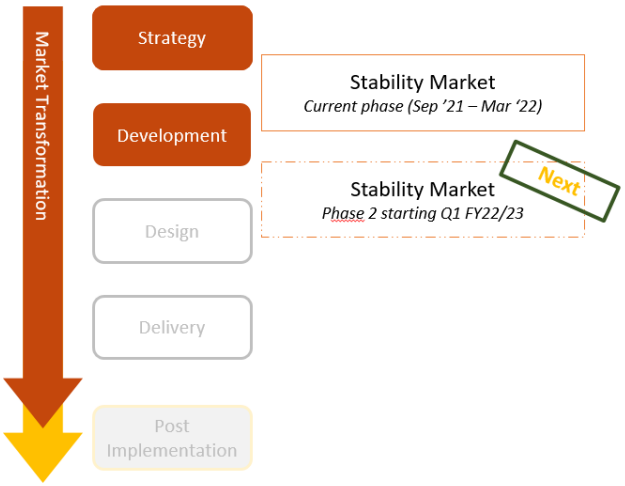
Phase 1 is in line with delivering our RIIO2 Business Plan commitment to, by March 2022, define the scope of development, engage with industry and develop a plan to deliver a potential stability market. Several market design questions remain to be answered before moving on to detailed design and delivery. We have a Business Plan commitment to initiate a plan to deliver the stability market by the end of March 2023, subject to a positive detailed cost-benefit analysis.

We are aiming to launch Phase 2 in Spring 2022 to focus on more detailed development and design questions such as:

[1] We have not estimated the costs of implementing and operating a market including readiness in terms of and plan for a number of key new processes and tools to be developed such as modelling requirements, tender and auction processes, etc.

- Exploring the interactions between stability and other services, such as voltage and frequency response.
- Refining some of the market design options, as well as our procurement strategy including:
    - Which providers should be eligible for participation and payment?
    - What would be the volume split between the long-and-short-term markets?
    - What is the optimal contract duration for a long-term market?
- A thorough cost benefit analysis with an expanded modelling horizon beyond 2030.

This second phase of our project will also require co-creation with industry to further design the new stability market, and to understand how to implement it most effectively for all stakeholders. We look forward to continuing our work together on this exciting project.



Contact us

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