Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

NIA Project Registration and PEA Document

Date of Submission

Dec 2018

Project Reference Number

NIA_NGSO0017

Project Registration

Project Title

Frequency Response Auction Trial

Project Reference Number

NIA_NGSO0017

Project Licensee(s)

National Energy System Operator

Project Start

December 2018

Project Duration

2 years and 7 months

Nominated Project Contact(s)

Adam Sims

Project Budget

£1,142,000.00

Summary

We propose to design, implement and trial a weekly cleared price auction for a volume of frequency response. The aim of the trial is to test the hypothesis that closer to real-time procurement of frequency response will lower overall procurement costs by increasing liquidity and transparency in the market, and deliver a stable market price for the relevant products.

Third Party Collaborators

EPEX Sport SE

ESP Consulting

Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

Problem Being Solved

One of our roles as an enhanced, more independent Electricity System Operator (ESO) is to provide equal access to all balancing services suppliers and so provide better value for our customers. The rapid pace of change of the GB electricity system has resulted in a significant increase in non-traditional providers, and in market complexity, meaning that our approach to procuring balancing services needs to adapt to keep pace with these changes.

Frequency response is procured commercially through a monthly pay as bid tender called Firm Frequency Response. There are 3

critical issues with the current process of tendering month-ahead:

- Month-ahead is too far ahead for non-traditional providers, such as renewables and Demand Side Response (DSR), to be able to predict and therefore confidently bid their availability
- The lack of standardised product windows makes like-for-like assessments very difficult, and therefore some assumptions must be made. This makes it very difficult to be transparent to the market about why certain bids were chosen over others
- The increasing number of providers and bids is becoming unmanageable to assess and process, due to the very short timescales between submission of bids and publication of results

Note: Frequency response is an automatic change in generation or demand to counteract changes in system frequency. System frequency changes when there is a mismatch in the energy added to the system by generators and the energy taken off the system by demand consumers. This mismatch acts to either speed up or slow down the frequency of the grid, and frequency response is the balancing service used to counteract this change.

'Dynamic' response is used to continuously follow and control minor deviations in frequency due to small imbalances in generation and demand. 'Static' response activates when a fixed frequency limit is breached. It is used, in conjunction with dynamic response, to contain large frequency events such as generator or demand trips

Method(s)

We propose to design implement and trial a weekly cleared priced auction. The trial will seek to procure a small, defined volume of frequency response through a weekly cleared price auction. The products will be standardised and our requirements communicated to the market ahead of time. The auction will operate alongside our existing commercial and mandatory markets. The auction will use pre-defined conversion factors to automatically trade off between more than one product, including low/high and static/dynamic frequency response.

Scope

We propose to design, implement and trial a weekly cleared price auction for a volume of frequency response. The aim of the trial is to test the hypothesis that closer to real-time procurement of frequency response will lower overall procurement costs by increasing liquidity and transparency in the market, and deliver a stable market price for the relevant products.

WP1: Design. Following a brief project initiation, this phase will deliver the detailed solution design of the auction platform, the flows and interfaces required, and any IT and operational procedures.

WP2: Development. Based on the detailed design, this phase will specify, build and internally test the auction platform and operational procedures, before developing governance arrangements, providing training and testing with some third-parties in a secure environment.

WP3: Trial. This phase will trial the auctioning of real MW of frequency response to understand the impacts of closer-to-real-time procurement on the market.

Objective(s)

At the end of the project, the ESO will understand the impact of closer-to-real-time procurement on:

- Market liquidity
- Diversity of providers
- Ability for renewables and DSR to bid
- Market and price transparency
- Market and price stability
- Cost of frequency response vs counter-factual
- Cost of administering frequency response market vs counter factual
- Internal systems and processes

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be successful if the trial is able to demonstrate:

- Closer to real-time procurement resulted in increased market liquidity vs current approach (FFR tender)
- Non-traditional providers, such as renewables and DSR, are enabled to enter the market
- Providers are satisfied with the auction platform, process and transparency of results (feedback and surveys)
- Time and cost are saved in NG vs current approach

Project Partners and External Funding

The auction platform will be developed and run by EPEX SPOT.

No external funding will be sought.

Potential for New Learning

Weekly procurement of a complex suite of products has not been done before anywhere in the world. It is not guaranteed to work, and we need to test the optimal mix of short- and long-term procurement. The learning from this will be the first of its kind, and will be hugely valuable to other market and network operators thinking of procuring flexibility closer to real time.

Scale of Project

This project will have a GB-wide reach. We will be trialing a new approach to procuring frequency response, that any flexibility provider in GB (transmission-connected or embedded) can participate in.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

This project will focus on the entirety of the GB system as covered by the National Grid System Operator.

Revenue Allowed for the RIIO Settlement

None.

Indicative Total NIA Project Expenditure

£1.14m

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

n/a

How the Project has potential to benefit consumer in vulnerable situations:

n/a

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

We believe that procuring frequency response closer to real time will result in cost savings of ~£320k p.a. due to the introduction of more competition into the market.
During the trial, we will be able to explicitly measure these cost savings, as we will be able to compare the price achieved in the auction to what we buy in the mandatory market.

If the auction platform is successfully implemented into BAU, there will be a cost saving associated with not having to manually assess an increasing number of tenders every month. We estimate this saving at ~£40k p.a.

There will also be qualitative benefits from the auction, if successful, including increased transparency of procurement and a more level playing field for non-conventional flexibility providers as they will be better able to predict their output closer to real time.

Please provide a calculation of the expected benefits the Solution

The introduction of competition in the FFR static market in 2017 reduced costs by around 50% by increasing competition from 5 providers to ~45 (800% increase). Assuming a linear relationship between price reduction and increase in number of providers (and assuming zero increase in competition gives zero cost savings) gives a ratio (% increase in providers / % reduction in costs) of 800/50=16.

The current mandatory market has 125 providers (excluding wind and inflexible plant which prices itself out of the market). There are approximately 106 wind generators which could participate in the market, giving a potential increase in the number of providers of 85%.

Using the same linear relationship between increase in the number of providers and the reduction in cost gives an estimated cost reduction of 85% / 16 = ~5%.

2017/18 total spend on Mandatory Frequency Response (MFR) = £20.38M.
Average volume of Mandatory Frequency Response procured is 300MW.
Forecast average volume procured from the trial is 100MW (1/3 of the MFR volume).
The current cost to procure that 100MW in the MFR market is £20.38M / 3 = £6.83M.
Procuring that 100MW in the trial, where increased competition drives a cost reduction of 5%, means that the trial would deliver an annual saving of
Using the calculated cost reduction from increased competition of 5% gives an annual saving of ~£360k, or ~£720k over the two year trial period.

Moving beyond the trial period, it is assumed that more and more MW would be procured through the auction, delivering more annual

savings due to increased competition. And assuming that the annual tendering process will be completely replaced, that would deliver an additional £40k p.a. in internal efficiencies.

Please provide an estimate of how replicable the Method is across GB

While the concept of a weekly cleared-price auction for frequency response will not be directly replicable for DNOs, the learnings from procuring flexibility closer to real-time will be directly replicable to all DNOs who are considering developing flexibility markets. Also, the structure of the market, and the specifications and design of the auction, will be highly valuable for all said DNOs to adapt to their own requirements.

Please provide an outline of the costs of rolling out the Method across GB.

The cost of fully implementing an auction approach for all commercial frequency response volume is estimated to be £1-5M.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

☐ A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).

☐ A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)

☑ A specific novel operational practice directly related to the operation of the Network Licensees system

☑ A specific novel commercial arrangement

RIIO-2 Projects

☐ A specific piece of new equipment (including monitoring, control and communications systems and software)

☐ A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven

☐ A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)

☐ A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology

☐ A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution

☐ A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

As the Distribution System Operators (DSOs) model continues to emerge, DSOs will be interested in developing and trialing their own flexibility markets and platforms. Our auction trial will demonstrate the impact of close to real-time procurement of a highly complex suite of frequency products on a whole range of factors, from liquidity to cost to customer satisfaction. This will all be hugely valuable learning to DSOs as they start to develop their own thinking in this field.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

In early 2018 National Grid published the first ever System Operator Innovation Strategy, which lists 16 strategic priorities. This project addresses the following:

- Creating markets for the future
- Unlocking flexibility
- Managing volatility in a low-inertia system
- Enabling more non-synchronous connections
- Developing Distribution System Operators (DSOs) and whole-system operability

☑ Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Is the default IPR position being applied?

☑ Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

A review of existing NIA projects has revealed no similar projects. It is highly unlikely that such projects exist anywhere since no other party has the specific interests of the GB System Operator and so would not design a project to address these specific problems.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

n/a

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

Weekly procurement of a complex suite of products with iterative optimization of procurement through value relationships has not been done before anywhere in the world. Other auctions for balancing services exist, e.g. FCR in Germany, but are based on a pay as bid or are for a single product with a single time window. EMR auctions are a highly complex auction process (descending clock-face auction algorithm), held infrequently and for long-term products. They are designed and underwritten by BEIS, and ESO implementation is a license condition.

Relevant Foreground IPR

n/a

Data Access Details

n/a

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

Procuring closer to real time is not guaranteed to be the best way forward – we need to test this before rolling out as BAU. Implementation through BAU would involve significant investment in terms of money, time and resource to change IT systems, control room processes, reporting and market information, etc. with no guarantee that it would deliver any benefit. For example, one of the goals is to get participation from intermittent technology types who have previously not provided balancing services, such as wind and solar. Whilst we are consulting with them and ensuring the design of the auction addresses barriers as much as possible, it may be that they still do not participate and no value is gained. We need to test the optimal mix of short- and long-term procurement before implementing as BAU.

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

Commercial risk: we will be testing the tradeoffs between long-and short-term procurement, as well as the exchange rates between products, to determine the optimal approach. Implementing an auction without testing these could result in very sub-optimal procurement. Market prices may be too volatile, revenue for parties may not be consistent enough, automation of existing assessment processes may deliver less economic results, conversion factors may be too opaque for market participants, etc. Technical / operational risk: we need to develop an approach in an agile way, in consultation with our internal and external Customers and Stakeholders to ensure that the process actually works, does not become a barrier, and results in efficiencies rather than in added effort for the SO and for flexibility providers.

This project has been approved by a senior member of staff

☑ Yes