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

Aug 2019

### Project Reference Number

NIA_UKPN0052

## Project Registration

### Project Title

Energy Exchange: Market-Based Curtailment Management

### Project Reference Number

NIA_UKPN0052

### Project Licensee(s)

UK Power Networks

### Project Start

September 2019

### Project Duration

3 years and 0 months

### Nominated Project Contact(s)

Rita Shaw

### Project Budget

£985,800.00

### Summary

There are limitations to the existing system which manages Flexible Distributed Generation (FDG) connections, which in turn limits the ability of connected Distributed Energy Resources (DER) to support the GB energy system. The system issues are as follows:

1. Current system is based on a last in first out (LIFO) system. It does not consider the distance of a customer from the nearest substation, which in some cases leads to higher overall DG curtailment.
2. Existing FDG only applies to generation. It does not enable other types of DER to connect flexibly.
3. Some FDG customers would be interested in participating in National Grid balancing services. However, if a generator was curtailed when called on to provide a balancing service, there would be a financial penalty imposed on them. We understand from our customers that the risk of penalties outweighs the benefit of participating in the market, which limits their ability to maximise income from their assets.

We anticipate a second influx of additional DG across GB networks sometime in the future. As it takes time to reinforce the network, it would be advantageous to identify where it is appropriate to maximise network capacity using market-based solutions. This will benefit customers and the network, and allow network-based solutions to be deployed quickly when and where they are needed.

Ofgem have asked the ESO and network companies to “lead on reviewing incremental improvements to the allocation of access rights (eg better management of connection queues, allowing generation who have non-firm connections to trade with others to reduce the extent they are curtailed, enabling the exchange of access rights between users).”

### Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

### Problem Being Solved

There are limitations to the existing system which manages Flexible Distributed Generation (FDG) connections, which in turn limits the

ability of connected Distributed Energy Resources (DER) to support the GB energy system. The system issues are as follows:

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## Method(s)

The project aims to address the problems identified above by completing a feasibility study of a "Market-Based Curtailment Mechanism" (MBCM) operated by the DSO. This would develop and test market based approaches for managing curtailment of generators connected to the network, and signal where network reinforcement is the best value solution. The project will also consider how market-based curtailment management can integrate with the national Balancing Mechanism, and provide flexible generators with a single 'route to market' for capturing flexibility value. If the feasibility study proves to be a viable option, the MBCM will go through a live trial period. This will run concurrently with the current system to prove monetary value.

## Scope

Outline the scope and deliverables (further detailed in P6).

Project is split into different tasks:

1. Project Kickoff and Initial Market Design (initial cost-benefit analysis and sizing the market opportunity).
2. Data Analysis from existing FDG curtailment data.
3. Detailed Market Design and Stakeholder Engagement
    a) Modelling market design(s)
    b) Sensitivity testing
    c) Engagement and trial design

May 2021 update based on the outcome of tasks 1-4

4. Market Simulation and cost-benefit analysis
5. Trial: Develop contract and trial processes / methods with new market rules applied to a sample of planned outages – including amending the live outage planning, tracking and integration platform (Network Vision), but without live curtailment trading
6. Closedown (project write-up)

## Objective(s)

Key Objectives:

· Better understand the feasibility of market-based curtailment management, and what is required to holistically deploy one. This may include recommendations for what regulatory incentives are required to make this viable.
· Understand from historic FDG curtailment data what the potential benefits are of a MBCM.
· Forecasting future levels of curtailment, given current levels of growth in rooftop solar and electric vehicles.
· To design a system compatible with multiple technology and commercial solutions.
· Quantify the financial value of market-based curtailment management for customers and the DSO.
· Quantify impact the system will have on UK decarbonisation.
· To simulate market-based curtailment management and, if successful, carry out a live trial.
· Develeop learning on whether allowing generators who have non-firm connections to trade access rights with others will lead to holistic system benefit.
· Use learnings from MBCM to develop a more sophisticated reinforecement trigger. This will signal when reinforcement is the least cost solution when taking into consideration the cost of curtailment.

Desired Outcomes:

· Progress towards a DSO – greater understanding of what will be required.
· Enable better management of connection queues.
· Improve the profitability and reduce curtailment for DER, especially low carbon technologies, on our network .
· Facilitate the low carbon transition of the UK economy.

## Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

## Success Criteria

The project will be deemed a success if:

- The analysis and market development conclusively demonstrates how a MBCM can lead to whole-system benefit.
- If a live trial is pursued, learnings are developed to improve the management of FDG connections. This could include reducing curtailment of generation, hence aiding the UK's low carbon transition plan.
- Learnings are developed to demonstrate that there are benefits to opening up flexible connections to multiple technology and commercial solutions (wind, solar, batteries, DSR).
- Prove to have significant financial value for both DSO and customers.
- Learnings support identification of areas where reinforcement is a least-cost option compared to continuing with flexible management.

## Project Partners and External Funding

The project will be carried out with support from three key project partners:
1. Our incumbent ANM provider, Smarter Grid Solutions, will support in analysing historic Flexible DG curtailment data as well as simulating market behaviours.
2. Overall project support will be given by a strategic consultant, to be identified through a competitive procurement process
3. An academic partner will support the development of market approach.

No external funding.

## Potential for New Learning

The proposed project has the potential to generate solutions which can be shared with the entire community of GB DSOs and ESO. Lessons that will be shared are expected to include:
- Best practice for the efficient FDG management.
- Aiding the UK in its decarbonisation process.
- How the transitional period may look shifting from DNO to DSO and the potential interaction between, DSOs, ESO, aggregators and customers.
- Understand if a new platform is required to help DER manage network access and secondary trading.

We will disseminate lessons learned from the project via our regular Innovation reporting channels, as well as the project closedown report. Other licensees will be invited to participate in demonstrations of the developed tool.

## Scale of Project

The MBCM system will be simulated across the existing FDG connections. Trial scale will be determined based on the findings earlier in the project to ensure that an appropriate scale is chosen to deliver best value for money. This will reduce operational risk, whilst also being able to measure the improvement that can be achieved using the MBCM system. We believe that testing the tool at an operational scale is appropriate to capture the full range and scale of the potential benefits that can be achieved.

The learnings from this project will provide valuable insight into how curtailment management and network access arrangements can be improved. This will be the case regardless of whether a MBCM solution is deployed at a wider scale following the project.

## Technology Readiness at Start

TRL3 Proof of Concept

## Technology Readiness at End

TRL5 Pilot Scale

## Geographical Area

EPN and SPN

## Revenue Allowed for the RIIO Settlement

We did not include expenditure relating to the development of market-based curtailment management in our RIIO-ED1 business plan submission.

## Indicative Total NIA Project Expenditure

£985,800

# 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)

Previous modelling work found that curtailment cost to FDG customers could be reduced by 5-45%. This was supported by the more detailed simulation in Task 3 of the project, indicating a range of 5-74%.

There is a possibility that this could also lead to new FDG connections, and would lead to associated savings.

## Please provide a calculation of the expected benefits the Solution

Baseline: Equivalent base costs remain the same once the method is applied, therefore £0k

Method Cost:
Project Cost = £1.30m
Rollout Cost = £0.60m
Annual Cost = £0.20m in ED2 period

Benefits:
Reduced cost of curtailment to customers at UK Power Networks = £0.24m in ED1, £3.5m over ED1 and ED2 (just associated with planned outages, additional benefit for unplanned)
New Flex connection encouraged by reduced curtailment cost (assume one connection before the end of ED1) = £9.2m
This is based on the savings in section 2c above - conservatively assuming benefits of 10-25% of expected curtailment volume in one licence area.

(3.5 + 9.2) – (1.30 + 0.60 +5*0.2) = £9.8m net benefits, £8.4m on NPV basis

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

All DNOs in GB have connected distributed generation. Any successful outcomes as a result of this project will be directly relevant to all DNOs. UK Power Networks has 9.3 GW of connected distributed generation. That is 32% of GB total (29 GW). Therefore, expected benefits across the rest of GB will likely be proportional to this ratio.

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

It is estimated that rolling this method out across GB will include a per-DNO cost as it is intricately linked to the Active Network Management systems and strategies for each organisation.

At this stage, it is estimated to cost £0.6m per DNO to roll out this method.

### 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

All distribution networks have DG on their systems. Therefore they will benefit from an efficient MBCM system. Additionally, the information gathered will provide invaluable knowledge into the type of platform a future DSO will operate on.

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

The issue of inefficient customer curtailment which causes inadequate capacity ustilisation, loss of income and higher emissions into the environment.

☑ 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.

No simulation or live trials of Market-Based Curtailment across FDG zones have been completed in GB.

Existing work on this subject to date is more focused around bi-lateral capacity trading. This is not a sustainable solution as the

amount of DER on the network increases.

The work completed in this project will provide information and support to ongoing ENA work, particularly in the Open Networks Project and the Access and Charging Targeted Charging Review. This will be relevant to all DNOs.

### 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

This project naturally follows on from the Flexible Plug and Play NIC project, which demonstrated that it is possible to flexibly connect DG faster and more efficiently. This project has not been tried before because levels of DG were low and it was not warranted. It is more important now than ever before to evolve network arrangements to facilitate connection and optimisation of resources for customers' benefit. This project will further support and provide evidence to the Network Access & Forward-Looking Charging Review that Ofgem is carrying out.

### 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

There is currently no consensus regarding the evolution of flexible DG connections, and there will be significant work to progress this. Market mechanisms of this nature have not yet been tested and they are still unproven thus the risk of failure remains. These need to be tested and proved effective to deliver effective market-based curtailment management to networks. A trial environment in order to produce the evidence is required for before a further roll-out can be recommended.

### 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

The majority of benefits from this project will be to existing and future DER customers. In a normal commercial organisation, this would not be sufficiently compelling to pursue.

### This project has been approved by a senior member of staff

☑ Yes