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

Apr 2021

Project Reference Number

NIA2_NGESO001

Project Registration

Project Title

CrowdFlex

Project Reference Number

NIA2_NGESO001

Project Licensee(s)

National Energy System Operator

Project Start

April 2021

Project Duration

1 year and 0 months

Nominated Project Contact(s)

Cian McLeavey-Reville

Project Budget

£460,000.00

Summary

This project will explore the opportunities for households providing a reliable support to the network through aggregated energy flexibility, and develop a baseline methodology with recommendations for adoption .

Preceding Projects

SSET205 - My Electric Avenue (I²EV)

NIA_WPD_049 - Electric Nation - PoweredUp

NIA_UKPN0045 - Shift

NIA_WPD_040 - Multi Asset Demand Execution (MADE)

NIA_UKPN0021 - Domestic Energy Storage & Control

Third Party Collaborators

Octopus Energy

Ohme Technologies Ltd

Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

Problem Being Solved

The use of flexible energy technologies in the home is set to grow rapidly – EV chargers, heat pumps, storage heating, home batteries and others. However, there is limited understanding of how customers use these technologies today, how usage patterns differ between customer types and how these will evolve. The volume and accessibility of flexibility from domestic consumers is also unclear. There is a need for both the ESO and DNO/DSO to better understand which services domestic aggregated resources can reliably provide. These services may include ESO balancing services and DNO/DSO scheduled or unscheduled local flexibility response.

This project will explore the opportunities for households providing a reliable support to the network through aggregated energy flexibility, and develop a baseline methodology with recommendations for adoption .

Method(s)

This desk-based study will survey Octopus and Ohme's entire GB customer bases and will use an area within one of Scottish and Southern Electricity Networks (SSEN) licence area as a case study. The study will largely rely on Octopus Energy's and Ohme's datasets and analysis to determine how much flexibility can be provided from households and other characteristics of this flexibility such as reliability, speed and cost of provision.

The project partners will i) identify the primary parameters that govern flexible response – which may include technology type, demographic information, signal type, or flexibility characteristics – and use these to create cohorts with similar profiles of response (this process referred to elsewhere as the "segmentation methodology"); ii) provide flexibility statistics for cohorts and across whole dataset; iii) design and recommend practical trials to demonstrate flexibility provision and test key assumptions identified.

Risk Assessment

In line with the ENA's ENIP document, the risk rating is scored Low.

TRL Steps = 1 (2 TRL steps)

Cost = 1 (£460k)

Suppliers = 1 (2 suppliers)

Data Assumption = 1 (data supplied by suppliers for analysis)

Scope

While there is limited understanding concerning consumer behaviour, potential size and reliability of flexible response, the project partners believe there is a sizeable amount of flexibility within domestic consumers that is growing exponentially with the rapid growth of EVs. Additional technologies, especially heat pumps and residential batteries, also have inherent flexibility properties, however, these are further away from mass market.

The project will leverage project partners' unique datasets and analysis, based on their customers' participation in dynamic tariffs and use of electric vehicle charging, to provide:

- A quantification of the energy flexibility potential from households (i.e. looking beyond early adopters/sophisticated energy users alone to assess flexibility potential from mass market customers)
- The development of a segmentation methodology for identifying key parameters of domestic flexibility and separating households into discrete cohorts based on this
- An understanding of the cost of incentivising flexibility, allowing comparison against existing contracts

The project will extract and analyse Octopus Energy's and Ohme's data analytic models to provide a statistical analysis of domestic consumption and behaviour in response to dynamic tariffs. Focusing on mainstream low carbon technologies (electric vehicles, electric storage heaters, solar PV), customers will be segmented into cohorts, to study what inherent flexibility exists among them. Particular emphasis and granularity will be given to electric vehicle customer cohorts given the rapidly increasing deployment of this technology and the impact which it may impose on the network. Depth, speed and cost of response will be assessed across segments.

This project also includes the design of a next-phase trial. The project will provide recommendations for a follow on trial project which would seek to quantify and validate the results of the modelling exercise.

Objective(s)

- Understand characteristics of flexibility provision from households in different scenarios and different technology types
- Identify distinct segments of household flexibility for use in ESO/DNO/DSO operations
- Recommend key assumptions in the analysis to test in trials

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

We do not expect the project to have a direct impact on bills, as the content/outputs of the project are analytical in nature, and especially expect no negative bill impacts for vulnerable customers as a result of this project. There are some qualitative factors that could have an indirect impact on bills in the future. First, the dataset includes many customers with low carbon technologies - electric vehicles, heat pumps, home batteries, etc - which likely represents a more affluent socioeconomic grouping. It will be important to ensure that any recommendations made take this into account, especially when extrapolating to behaviour across the mass market. Second, the project will make recommendations for trial design. It will be important to ensure that target customer groups for the trials do not put vulnerable customers in a position of negative bill impact. We strongly expect trial design to be at worst case cost neutral to all participants and will likely include benefits e.g. participation incentives or lower rates during times of day.

Success Criteria

To provide a segmentation methodology (a characteristic framework for each cohort created with similar profiles of response), related statistics on domestic flexibility and trial design that inform NG and SSEN's understanding of domestic flexibility depth and reliability.

Project Partners and External Funding

Project Partners: National Grid ESO (lead party) with Scottish and Southern Electricity Networks

Octopus Energy Group Limited, and Ohme Technologies Limited will be undertaking the work

Potential for New Learning

Understanding residential behaviour and the potential depth of flexibility provision:

- ESO and SSEN would develop a much more granular understanding of how consumer behaviour and demand is changing.
- This would in turn provide an understanding of the make up of the various consumer cohorts and how they can participate in various balancing and ancillary markets
- A data-based methodology will allow ESO and SSEN to develop a clear point of view on the amount of flexibility that is available and accessible in the domestic segment

Future market design:

- ESO and DNOs will have access to data and insights that will help inform future strategies and markets, particularly how to influence consumption behaviour as well as test those hypotheses

Scale of Project

This project will span 6 months involving 4 project partners.

The objectives and outputs of the project require an investment of this scale to develop an appropriate level of detail in order to understand the characteristics of flexibility provision from households in different scenarios and different technology types, Identify distinct segments of household flexibility for use in ESO/DNO/DSO operations and recommend key assumptions in the analysis to test in trials

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

Octopus and Ohme's whole GB customer base & impact on ESO Operations & including SSEN Network areas in the North of Scotland and Southern central England.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£460,000

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:

This project will help facilitate the energy system transition by providing an understanding of how residential flexibility operates and what the potential could be across the whole network. There were 150,000 battery electric cars on the road in the UK in Q3 2020, according to DfT statistics, which could represent over 1GW demand if all cars used a 7kW charger at the same time. This will grow rapidly with several estimates putting growth in number of cars at more than 50% per year. At the same time, this and other low carbon technologies in the home represent a large amount of flexible capacity that could be utilised by national and distribution system operators to balance the grid and ease local constraints. Household flexibility also has the potential to lower bills – a UCL study estimated it could be worth £30.9bn for GB consumers by 2050. The project learnings will be used by the project partners to assess residential flexibility's use in their own system operations and ultimately expand the role of domestic flexibility in supporting the grid.

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

Not applicable.

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)

The value of the residential flexibility market is forecast to be huge – a cumulative saving of £30.9bn for GB consumers by 2050 according to a study by UCL. This project would be an important part of unlocking that value by giving ESO and DNOs/DSOs increased confidence in this flexibility. This could unlock greater participation of households in flexibility markets – allowing domestic customers to earn money or lower energy costs through providing a service to the grid.

Please provide a calculation of the expected benefits the Solution

Not required for research projects.

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

This will be the output of the project.

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

The cost to replicate depends on a number of factors including: i) size of geographic area; ii) specific type of analysis; iii) granularity of analysis zone (e.g. GSP group vs. substation); iv) data availability. Project partners expect to realise cost savings for new areas based on a similar level/complexity of analysis.

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

Understanding residential behaviour and the size of the prize:

- Licensees will develop a much more granular understanding of how consumer behaviour and demand is changing.
- This would in turn provide an understanding of the make-up of the various consumer cohorts and how they can participate in various balancing and ancillary markets
- A data-based methodology will allow licensees to develop a clear point of view on the amount of flexibility that is available and accessible in the domestic segment

Future market design:

- Licensees will have access to data and insights that will help inform future strategies and markets, particularly how to influence consumption behaviour as well as test those hypotheses

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

Not applicable.

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.

The project partners conducted a study of similar projects. Existing projects that considered EV charging or household flexibility were limited in scope, focused on a small geographic area or considered EV only. This project will focus on the potential for flexibility from mass market consumers, use real data from a large number of customers and consider the whole home including EV and other flexible technologies.

Reference projects include (key projects in bold):

- Residential Response
- My Electric Avenue (SSEN)
- Electric Nation (WPD)
- Home Response (UKPN)
- Project Shift (UKPN)
- Domestic Energy Storage & Control (UKPN)
- Multi Asset Demand Execution (WPD)

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

Not applicable.

Additional Governance And Document Upload

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

The project is the first to draw flexibility statistics from a broad mass market customer base, using actual customer consumption data on time of use tariffs and EV charging data. It will develop a segmentation methodology that allows networks to assess flexibility across different cohorts. It will also test the reliability and depth of customer response across different cohorts. This data will be a key input into network operations planning for domestic flexibility at a system and distribution level.

Relevant Foreground IPR

The anticipated results from this project are expected to include segmentation methodologies, reliability scores, and volume estimates of domestic flexibility. There should be no background IPR required to use these results.

Data Access Details

If it is deemed necessary to have access to background IPR to utilise the results, a request may be submitted to the ESO and project partners, if this is a reasonable request then any relevant data may be anonymised and redacted where necessary to protect any sensitive information. We don't foresee any requests for background IPR access being necessary.

The terms on which such data will be made available by National Grid can be found in our publicly available "Data sharing policy relatedto NIC/NIA projects" and https://www.nationalgrideso.com/futureenergy/innovation/get-involved. National Grid already publishes much of the data arising from our NIC/NIA projects at www.smarternetworks.org. You may wish to check this website before making an application under this policy, in case the data which you are seeking has already been published.

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

This project is the first phase of a programme of work that will give network licensees a deep understanding of how residential flexibility, particularly from EVs, will actually show up on the system. This is a vital piece of research to undertake before committing hundreds of £millions of consumer funds to design markets and systems to capture the value of this flexibility.

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 common value for networks from this project is significant. The learnings as well as the segmentation approach will be valuable for all networks to start to consider how mass market flexibility will impact, and potentially support their networks.

This project has been approved by a senior member of staff

☑ Yes