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

Sep 2019

Project Reference Number

NIA_SPEN_0043

Project Registration

Project Title

Bethesda Home Hub

Project Reference Number

NIA_SPEN_0043

Project Licensee(s)

SP Energy Networks Distribution

Project Start

October 2019

Project Duration

2 years and 9 months

Nominated Project Contact(s)

Ralph Eyre-Walker

Project Budget

£120,250.00

Summary

This project is exploring a method to look to customers to shift their electricity usage to times of the day or night when demand on the network is traditionally lower. This involves changing people's routines and habits until they feel they are getting all of the electricity they need, for minimal inconvenience, while also avoiding peak usage times when possible. This project will explore this specific problem and trial a novel commercial arrangement as part of a potential solution. This will run through the Ofgem initiative "Innovation Link", set up to promote innovation through a regulatory sandbox environment.

Third Party Collaborators

Energy Local CIC

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

The transition to a low carbon future, and the introduction of Low Carbon Technologies such as Electric Vehicles (EVs), heat pumps and storage heaters, combined with the impacts of distributed generation is going to place huge demands on the electricity distribution network. Any increase in demand needs to have the network infrastructure to cope with that demand which in many cases will result in significant network reinforcement. However, as the network capacity always needs to be sufficient to meet the peak demand, any methods of reducing the peak demand are of great value.

One such method is to look to customers to shift their electricity usage to times of the day or night when demand on the network is traditionally lower. This involves changing people's routines and habits until they feel they are getting all of the electricity they need, for

minimal inconvenience, while also avoiding peak usage times when possible. This project will explore this specific problem and trial a novel commercial arrangement as part of a potential solution. This will run through the Ofgem initiative "Innovation Link", set up to promote innovation through a regulatory sandbox environment.

Method(s)

Energy Local and partners are developing a domestic home hub to allow households to schedule appliances to run at the optimum times. A probability signal is sent out each 24 hours with 48 values to indicate 'how good or bad' each half hour during the day is to use power. This is based on a forecast of the community's demand, the forecast of local renewable generation and a Time of Use Tariff however other parameters could be taken into account. The household can schedule appliances according to when they need an appliance to be finished, how long it takes and whether it can be interrupted.

The hub can be used to control plug sockets, electric vehicles chargers (including the amount of charge needed) and heat pumps and storage heaters. The plan is to improve the control of storage heaters to take into account thermal comfort and develop control of dehumidifiers.

Control of storage heaters for those off gas, and reduced bills, will help those in fuel poverty. Community energy groups that use local generation to charge electric community transport via flexible arrangements will tackle transport poverty in rural areas. This adds value and builds on work funded by Redress to include the fuel poor within Energy Local.

This facilitates local balancing at an LV level; it complements and feeds into SPEN's work of how to operate as a DSO at 132kV to 11kV under the E-Port Energy project. The aim is to harness the ability of households to balance their energy locally as much as possible and to use incentives from the supply market that encourage the right customer behaviour to benefit the network. This is the first project to take this approach for local balancing.

The key concept for this project is to change the people's habits and maintain new habits. Under exceptional circumstances the technology could be used for an automatic turn down as well.

Alongside this, De Montfort University is modelling the project to develop 'what if scenarios'. It is developing the concept of parameters to give:

Flexibility - a measure of people's willingness to be flexible at different times of day and for different demographics
Stayability - a measure of people's ability to maintain new habits over time for different demographics

These parameters then provide a method for tracking the success of any trial method to change peoples' habits and maintain them. In addition, the communications in use will enable remote voltage measurements on LV feeders via the meters in real time.

A novel commercial arrangement with customers will also be trialed through this project. Different frameworks will be developed to enable a DNO to provide an incentive via or in addition to their charging framework. It will be investigated as to whether this is possible via rewards for changing habits to balance locally measured capacity or peak use at particular times of day.

The following work packages will deliver added value to the existing BEIS funded project 'Flexibility Through Communities' developing demand side management at a local domestic level to integrate DNOs needs and develop new flexible solutions and flexible commercial arrangements.

Scope

Work Package 1: 12 Months (Month 1 – Month 12) £10,250

Energy Local (and De Montford University)

A study will be undertaken with De Montfort University to understand how the parameters for 'flexibility' and 'stayability' could be used for planning to compare the use of Demand Side Response (DSR) with conventional reinforcement. It will be explored as to how these parameters could be developed and integrated into planning processes and data, initially on a small scale. Following this the impact will be modelled over a larger area of network, and applied to the areas selected for Work Packages 2 and 3.

Work Package 2: 12 months (Month 1 – Month 12) £50,000

Energy Local (and De Montford University)

A small community area will be selected where there are a cluster of participants on one or two feeders to investigate the impact of demand side response on local balancing of local generation. This will then be extrapolated to understand the impact for local balancing and the 11kV network. Where possible, control will be installed to allow automatic scheduling of as much household demand as possible (e.g. control of EV charging, storage heaters, heat pumps and dehumidifiers).

The following areas will be explored:

Understand if there are mechanisms for local balancing to manage the network with fail safe systems to trip generation if it fails.
Investigate whether remote voltage measurements can be used to improve network control or network planning. How could these measurements be received by SPEN (e.g. an API)
Can the forecasts of demand for different demographics or generation (particularly hydro) be used to improve network planning.
Note that Energy Local has permission to use household data with partners but it will be kept anonymous.

Work Package 3: 15 months (Month 1 to Month 18) £55,000

Energy Local (and ElectraLink; and TMA)

Different frameworks will be developed to enable a DNO to provide an incentive via or in addition to their charging framework. It will be investigated as to whether this is possible via rewards for changing habits to balance locally measured capacity or peak use at particular times of day. Further investigations will include as to whether it is possible group users together (i.e. local generation or demand) to monitor the impact of their collective behaviour on the network or by new user types (e.g. domestic users with PV or EV chargers).

Using Electralink's flow builder tool, new appropriate dataflows will be developed for a DNO to apply these rewards via their normal charging processes (via suppliers) with no or minimum change to the software. Working with TMA (a data collection agency) it will be checked that, once these dataflows are identified, they are easily used and implemented. It will be checked with the suppliers that household tariffs could reflect these rewards.

A new means to encourage efficient behaviour and flexible solutions will be developed via a reward scheme along with potential new user groups. Working with ElectraLink and the data collector (TMA) it will be investigated as to how they can be practically implemented. Working with a supplier, it will be investigated as to how the rewards can be reflected effectively in bills, and their impact will be trialed on a small scale.

Examples of user group categories are given below (the list is not exhaustive):

Generation and demand at the same voltage area on the same network: Consumers consisting of generation and demand at the same voltage level that balance locally. A reward for balancing and avoiding times of peak demand could be via a differentiation in charges for locally balanced power to that drawn from elsewhere or via a time of use capacity charge (users could select their maximum capacity).
Local balancing: A group type of user of consumers consisting of generation and demand between low voltage and 11kV are rewarded for balancing locally. A reward for balancing and avoiding times of peak demand could be via a differentiation in charges for locally balanced power to that drawn from elsewhere or via a time of use capacity charge (users could select their maximum capacity).
Solar panels: A user type for a home with solar panels taking into account that they benefit from the availability of the network even when using power generated on site. This could be via a time of use capacity charge or reward (users could select their maximum capacity)
Electric vehicle charger: A user type for those with a home EV charger or other significant loads that may be used over considerable lengths of time that incentivises charging at off-peak times.
Capacity charge – all domestic users: A time of use capacity charge or reward for all domestic users (users could select their maximum capacity).

New data flow development / testing

Mapping of data flows and testing new data flows is pivotal to this stage of the project. ElectraLink's Data Transfer Service (DTS) is an established information interchange that uses a common set of industry requirements to facilitate business-critical processes, such as settlement, change of supplier and metering, which are implemented through a centralised communications service. The DTS enables the transfer of data between industry participants, including the parties involved in the project trials, who are familiar with existing data flow formats and interfaces.

Under the project trials, ElectraLink's Flow Builder tool will provide a platform for prototyping proposed flows to meet new industry

requirements where users can swiftly design new flows in real time to match upcoming changes and perform end to end testing to reduce the likelihood of process errors. Users can also collaborate easily and share these with the industry or with selected partners to enable swift creation and implementation of bi-lateral commercial flows.

The new data flows will be designed within an innovation sandbox environment. Some system changes are likely to be needed to be made by TMA, the Data Collector albeit this would be the case with any approach to developing and testing new flows.

The advantage of using ElectraLink and its Flow Builder tool, in a safe innovation sandbox environment, is that the project will be utilising an existing SPEN asset (the DTS) as the established information exchange; Flow Builder having been designed to integrate fluidly with the DTS.

Work Package 4: 9 months (Month 18 to Month 27)

Energy Local £5,000

A period of monitoring customer behaviour to measure how they maintain the new habits developed. Capture learning.

Objective(s)

1. Demonstrate the impact of DSR for local balancing and its ability to manage constraints ahead of safety critical active network management schemes at LV. Demonstrate how flexible solutions and business models benefit the network and deferment of reinforcement. Model of the impact at scale.
2. Demonstration of how readings from meters at remote points of the network and forecasts of demand and generation can be used for network management or planning, and provide more accurate planning and lower cost connections.
3. Development of new parameters to quantify the impact of DSR for planning purposes and how these can be used in network planning in future. This can defer reinforcement via flexible solutions.
4. Test a practical framework (a penalty and reward scheme) to encourage efficient behaviour on the network and demonstration of how it can be implemented within dataflows. Evidence for the impact of reward and penalty scheme for Ofgem. This will encourage more efficient behaviour to reduce network reinforcement.
5. Demonstration of how DSR and flexible solution can help tackle fuel poverty and transport poverty.
6. Better interaction and understanding of the network by communities.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

1. New parameters developed and demonstrated successfully to quantify the impact of DSR for planning purposes and how they can be used in network planning in the future to defer reinforcement.
2. Application of a practical and novel commercial framework demonstrated to be successful in encouraging efficient behaviour on the network, and how it can be implemented to reduce peak demand and reduce network reinforcement requirements.
3. Successful demonstration of how DSR can proactively help tackle fuel and transport poverty.
4. Improved interaction and understanding of the network by the local communities.

Project Partners and External Funding

Energy Local are the key supplier. De Montford University, ElectraLink and TMA will subcontract to Energy Local.

These work packages complement and add value to the existing BEIS funding project “Flexibility Through Communities”.

Potential for New Learning

The two key areas of new learning are:

The application of new parameters to measure people’s habits and behaviour and feasibility for using these parameters during network planning activities.
The application of a new commercial arrangement with customers and the feasibility for such a scheme to reliably reduce peak demand on the network.

Scale of Project

£120,250 NIA funded.

30 month duration.

SPEN will complement the project with the following business funded activities:

1 day per month Stakeholder Engagement
8 hours per month Design
Contingency and substation monitoring requirements

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

This will be a pilot study based in the relatively small geographical area of Bethesda. However the learning will be applicable across the UK electricity distribution network.

Revenue Allowed for the RIIO Settlement

NA

Indicative Total NIA Project Expenditure

£120,250

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)

£460k savings based on avoided network reinforcement in the area of Bethesda

Please provide a calculation of the expected benefits the Solution

Base cost: £573k of network reinforcement (new Primary Substation and associated plant and cabling)

Cost of incentive scheme (full rollout if this trial is successful): £112k

Savings: £460k

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

These savings can be replicated for any other populated area of the UK where similar reinforcement might be required in order to meet the demands of a low carbon future.

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

These would be calculated on a case by case basis based on:

- The potential network reinforcement required
- The required level of demand side flexibility to avoid such reinforcement

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

The challenge associated with increasing demand on the network is common across the industry. The learning and tools will be applicable to all network planning activities at distribution level for all Network Licenses.

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

n/a

☑ 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.

There are no other projects that have tested this commercial arrangement previously. Other projects are investigating the control of domestic LCT devices, however this area is not key to the learning for this project.

This project is complementary to the FUSION project (funded through the Network Innovation Competition allowances).

FUSION is intending to stimulate a market where customers can be paid for flexibility during times of high demand. Customers will be informed of times when additional capacity is required on the network and be incentivised for providing that capacity by either reducing their own demand or increasing generation. Note that this will normally be facilitated with large (higher demand) customers rather than individual residential customers – however groups of residential customers may have the chance to contribute via an aggregator.

Bethesda Home Hub is working on an individual customer level and is specifically focused on understanding how likely customers are to change their behaviour regarding electricity usage, develop and then maintain new habits. This is therefore complementary to FUSION as it will provide additional learning regarding the feasibility of groups of residential customers having an impact on the FUSION market via aggregators.

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

As DUoS is fixed there is no existing mechanism to apply this specific commercial arrangement available. The opportunity to trial such an arrangement is therefore innovative and will provide evidence for benefits and feasibility of wider scale application.

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

As this arrangement is novel it is therefore not part of business as usual activities and carries a risk associated with the success of the project.

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

There is a risk associated with how successful the arrangement is likely to be. If the customers fail to change or maintain new habits there will be no benefit to the network.

This project has been approved by a senior member of staff

☑ Yes