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

Mar 2015

Project Reference Number

NIA_SPEN0001

Project Registration

Project Title

Smart Building Potential Within Heavily Utilised Networks (Re-registered LCNF T1 Project)

Project Reference Number

NIA_SPEN0001

Project Licensee(s)

SP Energy Networks Distribution

Project Start

April 2015

Project Duration

1 year and 7 months

Nominated Project Contact(s)

Watson Peat & Geoff Murphy

Project Budget

£621,000.00

Summary

1a) Model the load on each secondary substation in postcode areas G1 and G2 and quantify the demand contribution made by each commercial building. (Commenced under LCNF Tier 1)

1b) Explore how the introduction of DSR in these buildings could potentially reduce loads during ‘overload’ periods.

2a) Survey candidate buildings for DSR trial suitability and install DSR equipment including communications in up to 10 buildings. (Complete under LCNF Tier 1)

2b) Carry out a number of trial DSR interventions at varying times of day over the course of a year and analyze results to evaluate capability of the buildings to provide DSR in real world conditions.

Preceding Projects

SPT1006 - Smart Building Potential Within Heavily Utilised Networks

Third Party Collaborators

Siemens

University of Strathclyde

Derryherk

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

Networks within City centres are the most economically important to the country, the most heavily utilised and the most expensive to reinforce. To this extent these networks will be at the forefront of issues arising from the much anticipated low carbon technology loads and increased penetration of Distributed Generation (DG). There is an expectation that Distribution Network Operators (DNOs) need to deliver the solutions to these problems not just through traditional means, but through the integration with existing building management systems to help create minimum-cost low carbon energy systems.

Glasgow is Scotland's largest City and is undergoing dramatic change towards sustainable regeneration driven by Glasgow City Council (GCC). With around 1.5 million square metres of office space in the city centre, managing the peak load demand of this space could have major cost benefits to a DNO through provision of ancillary services to the grid and the potential deferment of costly city centre grid infrastructure upgrades.

The UK and Europe are moving towards a common standard (EN15232) for energy performance classification in buildings, this standard considers both energy efficiency and dynamic load management (i.e. demand side response). The challenge is to explore the benefits to DNOs, through the projected widespread adoption of the EN15232 standard within buildings, and understand how the DNO can proactively engage with public and private building stock in Cities, to leverage benefit for all of the City stakeholders.

Method(s)

1. **Future low carbon energy systems modelling - Technical/Commercial**

   Building on existing scenario and cost models (such as the WS3 Smart Grid Forum model) we will investigate specific requirements for future low carbon city centre networks. Utilising real network and stakeholder energy data, the benefits from Demand Side Response (DSR) will be modelled and the cost of each scenario estimated. This will result in a robust network model of a city centre environment where the cost and network impact of smart grid interventions such as DSR can be assessed against traditional reinforcement within a range of future low carbon scenarios.

2. **DSR Intervention - Technical/Commercial**

   In partnership with GCC, a range of DSR compliant buildings will be assessed for DSR energy management potential. These will be audited to EN15232 to provide a baseline for load reduction measures. Energy control devices (with communications) will be installed to trigger pre-arranged load shedding when requested by the DNO. The audit will identify which loads can be controlled and which are suitable for peak load shedding. Shedding of load at peak periods will be investigated, amongst others, for reduced network loading at times of emergency N-1 requirement. Industry standard protocols will be used to connect the energy management module to the existing Building Management System (BMS). An enhanced centralised management system will be provided through Technical Strategy Board (TSB) project funding to manage the DSR Signal and record the load reduction achieved and this data will be utilised for analysis and reporting by SPEN and GCC within the LCNF and TSB project.

Scope

1a) Model the load on each secondary substation in postcode areas G1 and G2 and quantify the demand contribution made by each commercial building. (Commenced under LCNF Tier 1)

1b) Explore how the introduction of DSR in these buildings could potentially reduce loads during ‘overload’ periods.

2a) Survey candidate buildings for DSR trial suitability and install DSR equipment including communications in up to 10 buildings. (Complete under LCNF Tier 1)

2b) Carry out a number of trial DSR interventions at varying times of day over the course of a year and analyze results to evaluate capability of the buildings to provide DSR in real world conditions.

Objective(s)

Key outcomes will be:

1. Development of a city centre network model where cost and impact of smart grid interventions can be assessed. Physical DSR interventions will complement the modelling by;

2. Gaining experience in the application of DSR measures to city centre building stock;
3. Achieving measurable results to peak load reduction;
4. Understanding and quantifying the role DSR could play in cost-benefit analysis of future reinforcement;
5. Understanding the resource DSR may represent in terms of ancillary services to the network;
6. Integrating the use and monitoring of DSR into our systems. The net result for customers will be a potential increase in low carbon technologies that can be deployed on the network, without the need for future costly and potentially disruptive grid infrastructure reinforcements.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Creation of a 'LCT Energy Scenario Model', DSR intervention data and project reports that contributes to:

1. Understanding of the cost advantages that DSR as a smart grid intervention may bring against traditional reinforcement in the context of City centres;
2. Understanding of the real levels of peak load reduction available from office buildings and establishment at city scale of the potential these interventions can provide;
3. Understanding of the expected vs. actual response and reliability of DSR response and the impact of load reductions on potential network constraints and assessment of deferment value of DSR.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

Stakeholder engagement is through participation from GCC. Modelling of the city centre infrastructure will cover up to half of the relevant Primary and 11kV network in Glasgow's dense city centre shopping and commercial zone. Up to 10 buildings and potentially more will be involved in the project, with a variety of uses, and it is felt that this will present sufficient variety and complexity to test the effectiveness of the technology and peak load savings possible across a range of different building types and uses. The sample represents a suitable range of buildings that the results will be applicable to a great many buildings across Glasgow and many other similar Cities. Additional TSB funding of £101k has been leveraged to help achieve this scale.

Technology Readiness at Start

TRL6 Large Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

This project will be focussed in the heart of Glasgow City Centre Commercial and Shopping centre. A coherent network topology within this area will be modelled. The chosen buildings for DSR intervention trialling will be within or representative of buildings within this energy & infrastructure dense City centre zone.

Revenue Allowed for the RIIO Settlement

Load related reinforcement allowance associated with urban areas in SPD and SPM combined is approximately £25m. Potential savings on this amount will be estimated by reviewing individual schemes once the effectiveness of the method has been assessed.

Indicative Total NIA Project Expenditure

£90k total NIA project expenditure In addition, expenditure of £385k has been incurred under the LCNF Tier 1 project, and collaborators are contributing £146k giving a total project budget of £621k as stated above.

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)

The cost of an additional primary substation in a city centre could be as high as £5m due to the increase land, planning and environmental requirements. In addition it can cost up to £2m to provide the new 11kV network cable and secondary substations within commercial buildings. As such a final city centre reinforcement cost could be as high as £7-8m.

The replication costs for the Method are estimated at £1m - £2m per for an existing primary substation area, but in doing so it could potential defer a conventional reinforcement cost of £7m - £8m.

Please provide a calculation of the expected benefits the Solution

Base Cost

The scale of this project is 10 commercial buildings volunteered by our project collaborator. The Base Case solution to reinforce an equivalent number of buildings to cater for the transition to the carbon plan would require a new 11kV circuit and secondary substation reinforcement of around £300k.

Method Cost

The methodology being trialled under this project is costing £621k, however if the method was repeated there would be a significant reduction to this cost as there would be no requirement for analysis, dissemination, reduced project management etc. The exact reduction is not yet known, however SPEN are confident that it would be as high as 25%, therefore the Method Cost is likely to be £465k.

Base Cost – Method Cost

£300k - £465k = -£165k

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

We estimate that the learning from this project will be applicable to approximately 20 -30 city centres and urban areas across the UK.

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

The replication costs for the Method are estimated at £1m - £2m per primary substation area deferring a conventional reinforcement cost of £7m - £8m. Rolling out this technique in 20 – 30 cities and urban areas would result in total roll out costs of £20m - £60m, deferring conventional reinforcement costs of £140m to £210m for 8 – 9 years.

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

Investigation of the financial benefit of DSR from Commercial buildings against traditional reinforcement and informing DNO's and existing Smart City stakeholders on how to realise this potential will be the key components of the project. Demand side response (DSR) is a recognised smart grid intervention to offset the 'Carbon Plan' growth in electrical load through the introduction of Electric Vehicles and transfer to electrical heating. This solution will develop the potential for the use of this DSR intervention in the context of commercial buildings in City Centres highly utilised networks

The project will demonstrate the capability of this solution, when scaled up, to facilitate these aspects of the Carbon Plan in Glasgow city centre. We estimate that the learning from this project will be applicable to approximately 20 -30 city centres and urban areas across the UK.

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.

n/a

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

n/a

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

n/a

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

n/a

This project has been approved by a senior member of staff

☑ Yes