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 2016

Project Reference Number

NIA_NPG_011

Project Registration

Project Title

Distributed Storage & Solar Study (DS3)

Project Reference Number

NIA_NPG_011

Project Licensee(s)

Northern Powergrid

Project Start

August 2016

Project Duration

3 years and 4 months

Nominated Project Contact(s)

Paris Hadjiodysseos

Project Budget

£250,000.00

Summary

The scope of the project covers residential PV and distributed energy storage and is testing whether the existence of storage provides the opportunity to amend design policies to allow the connection of more PV than would otherwise be the case before there is a need to trigger reinforcement. It involves the installation of up to 40 energy storage devices and will also look at the extent to which these can be used to reduce winter peak loading.

Nominated Contact Email Address(es)

yourpowergrid@northernpowergrid.com

Problem Being Solved

The growth in PV systems will have the potential to increase thermal loading and cause voltage issues on low voltage distribution networks, particularly where these develop in clusters such as on social housing schemes. Whilst the rate of growth of PV systems has slowed since the reduction in feed in tariff payments, the removal of the requirement for those installing PV systems on such schemes to pay for any reinforcement required, means that those projects that do go ahead may result in a reinforcement need, funded from future DUoS charges.

An emerging technology is the use of residential storage to allow PV owners to make more use from their PV panels and possibly, in the future, benefit financially from ToU tariffs and trading on frequency response and demand-side markets. These technologies are commercially available now from companies like Tesla and Moixa, etc and their use is forecast to grow, particularly associated with PV installations, initially as retrofits and eventually as part of the initial installation.

The problem we are investigating is the impact that distributed residential energy storage can have on a DNO network and whether this impact is sufficient to require additional design guidance on the connection of PV associated with storage – which may allow more PV to be connected to the network.

Method(s)

Barnsley Metropolitan Borough Council have installed a PV in its region by establishing a community benefit society called Energise Barnsley. Energise Barnsley wishes to trial energy storage units in a number of these houses and are working with Moixa to provide participant residents with cost savings from using these batteries to) make more use of their solar energy.

Northern Powergrid has agreed to fund the purchase and installation of 40 energy storage units in return for access to the data from these houses via the Moixa monitoring and control platform. Northern Powergrid shall use this platform to run a series of trials over two years to monitor the extent to which the control of these batteries to provide maximum customer benefits also provides the DNO with network benefits in the form of reduced peak solar generation and reduced peak loading.

Moixa and Energise Barnsley are activiely collaborating in the delivery of the project.

Scope

The scope of the project covers residential PV and distributed energy storage and is testing whether the existence of storage provides the opportunity to amend design policies to allow the connection of more PV than would otherwise be the case before there is a need to trigger reinforcement. It involves the installation of up to 40 energy storage devices and will also look at the extent to which these can be used to reduce winter peak loading.

Objective(s)

The objective of this project is to develop sufficient data to determine whether it would be appropriate for design engineers to take into account the presence of distributed residential energy storage when considering an application to retrofit significant amounts of PV on social housing schemes. It will also explore the extent to which such battery systems can be used to reduce the winter evening peak load.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The key success criteria is to obtain data streams that are sufficient to provide statistically robust conclusions on whether design engineers can, or cannot, take account of the existence of distributed energy storage units to increase the amount of PV that can be connected to an low voltage feeder / substation.

The project is knowledge development, likely to improve planning assumptions and network planning activities. It is therefore low TRL.

Project Partners and External Funding

No project partners, no external funding.

Potential for New Learning

The purpose of this project is to explore the aggregated impact that distributed residential energy storage will have on the network, specifically with the objectives to:

* Learn to what extent battery in the home can be controlled to:

* Reduce the peak output of a PV installation;

*Reduce the evening peak loading;

* Learn what battery penetration is needed to make a difference to network constraint caused by daytime PV output or evening peak loading;

* Determine whether an additional de-rating factor would be appropriate for design studies on PV installations that propose to have batteries at some properties.

* Determine whether it would it be valid for design engineers to apply different design parameters to new housing estates without PV but equipped with batteries behind the meter

* To gain a DNO understanding of the Moixa Cloud aggregation platform and how a DNO can interact with it, and potentially other similar platforms, to dynamically manage DNO constraints

The project will feed into national design guidance for housing estates containing LCTs.

Scale of Project

The project will aim to install 40 energy storage units on two LV feeders fed from a single distribution substation . One feeder has 42% PV penetration and the other 20%.

The trials will run for two years, encompassing two summer trials in which peak solar output will be the focus and two winter trials in which peak evening loading will be the focus.

The scale of the project has been designed to ensure that we are able to detect the effect of the storage on the load at feeder level via substation monitoring.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

Barnsley, South Yorkshire.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£250,000

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:

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)

In the case of the PV retrofit to social housing, improved design knowledge may allow more properties to be included in a scheme before any reinforcement is required which, although the social housing providers no longer have to fund the network reinforcement, will allow them to develop all or the majority of their scheme quicker than they would otherwise be able to do so.

This reduction in reinforcement requirements also keeps future DUoS costs down for all customers, which benefits everyone.

The connection of more solar supports the GB targets for increasing the amount of renewable generation. The connection of more storage behind the meter allows for more of this energy to be used locally, thereby reducing losses and carbon emissions.

By building on and adding to the existing design data created by innovation projects to date we shall improve the robustness of the resultant design parameters which can then be used by Northern Powergrid and all other DNOs to form a set of design rules that will efficiently and effectively assess how best to accommodate PV applications that also include distributed storage.

Looking at just the avoidance of reinforcement cost, this project could save over 50 times its costs over a RIIO regulatory period, using a modest assumption as follows:

Reinforcement costs associated with a PV cluster could be:

* Loop service unbundling (£700 per service)

* The replacement of all or part of the LV main (£125 per metre)

* The replacement of the distribution transformer (£14,000 per transformer)

So, if it were possible to avoid the replacement of a transformer, 300m of LV cable and the unbundling of 10 services, the avoided reinforcement costs would be in the region of £59k. If each DNO region were to be able to save reinforcement costs on just 2 schemes per year, then the total avoided costs would be in the region of 12 x 2 x £59k = £1.4m pa or £11m per price control period, which is forty-five times the cost of this project.

Please provide a calculation of the expected benefits the Solution

This is a research'/knowledge generation project

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

The method will be applicable to all underground LV networks which are either:

Retrofitting solar PV with storage on an existing housing development; or

Installing solar PV and storage on a new housing development.

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

Roll-out costs are negligible.

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 data from this project may be used by Northern Powergrid and all other DNOs to form a set of design rules that will efficiently and effectively assess how best to accommodate retro-fit PV applications that also include distributed storage.

The output of this project will also be used to provide updates into relevant Northern Powergrid design policies and input into the periodic review of Engineering Recommendation P5 – "*Methods to determine demand characteristics for LV underground networks which are designed for newhousing developments*", which has been recently refreshed with learning from LCNF projects to take into account the emergence of low carbon technologies connected to the distribution network.

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 project outcome will help designers with the connection of increasing amounts of solar PV on existing LV networks. With respect to our Innovation Strategy, this project will investigate the utilisation of customer flexibility to contribute to:

* Future proofing for network technologies

* Providing faster cheaper connections for customers; and

* Being a socially responsible organisation.

☑ 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.

This project will build upon the learning from NIA funded solaBRISTOL and Innovate UK funded ERIC but will not duplicate their findings. We have studied these projects, and in the case of ERIC, discussed at length with the originating network operator previous outcomes.The knowledge generated will also be designed to be comparable with the CLNR test cells.

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

Legacy change

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

Legacy change

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

Legacy change

This project has been approved by a senior member of staff

☑ Yes