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

May 2019

Project Reference Number

NIA_NPG_032

Project Registration

Project Title

Boston Spa Energy Efficiency Trial

Project Reference Number

NIA_NPG_032

Project Licensee(s)

Northern Powergrid

Project Start

June 2019

Project Duration

2 years and 1 month

Nominated Project Contact(s)

Mark Callum

Project Budget

£500,000.00

Summary

Alternative, low cost voltage reduction trial

Nominated Contact Email Address(es)

yourpowergrid@northernpowergrid.com

Problem Being Solved

The advantages to customers of reducing network voltage, especially on the level of bills, have been established by several projects and studies previously undertaken within and without the electricity distribution sector.

Whilst establishing the benefits these previous projects have required the roll-out of relatively large amounts of expensive additional equipment on the distribution network at low voltage. This reduces the net benefit to the customer of voltage reduction.

A more financially efficient method would be to reduce target voltage at the 33/11kV level. Previously this has been done as a single adjustment but the impact across the whole of the downstream network is difficult to understand and predict leading to overly conservative, and therefore non-optimum, interventions. Also the impact is likely to change depending on non-network factors such as weather, time of day, season which further compounds this.
A dynamic assessment of downstream voltage and allied dynamic adjustment of target voltage at the 33/11kV transformer would overcome this issue

Method(s)

The project proposes to explore the use of existing 33/11kV voltage control systems alongside the opportunities offered by smart-metering to exploit low voltage reduction for electricity cost saving.

If successful this would provide an economically efficient method of implementing voltage reduction providing the maximum benefit to the customers with minimum network intervention and consequent inflation of the regulated asset base.

The project would run in three phases, with stage-gates between the phases to ensure that the project only continues while it is

providing value.

The three phases are:

- Phase 1 Effects of Voltage Variation on Demand in a Real-World Community
- Phase 2 Using distributed voltage monitoring as an input to dynamic voltage control to optimise efficiency and service
- Phase 3 Explore potential DSO offerings

In the first phase control and test networks will be defined and data collected from key locations in the trial area to establish baseline voltage and load profiles. The test network will then be modelled and the effects of various voltage reductions (implemented by reductions in the set point or target voltage on the voltage control equipment at the primary substation) on the profiles predicted. The modelled voltage reductions will then be tested iteratively on the real system, checking actual resultant profiles at each stage before choosing whether to progress to a further voltage reduction. From this, methods of modelling and establishing optimal voltage set points will be developed, an optimal setting ensuring that voltages remain within statutory limits for reasonable conditions and non-productive demand is minimised. There is potential that it will not be possible to establish a generic method of establishing modelled optimal voltage set points or that it will be concluded that a .

Assuming a methodology for establishing optimal voltage set points can be established in phase one, phase two will use this learning to attempt to develop a method of using voltage data from key locations on the network to produce a dynamically controlled voltage set point that produces a lower level of non-productive demand while maintaining statutory voltages. This will involve developing communications from the monitored key locations to the primary substation and processing this in real time to alter the voltage set point dynamically. There is the possibility that this may be practical even if a generic method of establishing modelled static optimal voltage set points is not. However it may prove that the costs or practicalities of establishing such dynamic voltage targets are unrealistic.

The third phase of the project will consider whether a dynamic set point technique could be used as a DSO flexibility offering. It will involve a literature review and an analysis of the transferable learning, but stop short of a physical trial. The output of this phase will may inform further project proposals.

This activity is being undertaken with the support of the Boston Spa community in general and the parish council in particular who have approached us with a view to improving their energy use and efficiency. Boston Spa is a small town with a population of around 4000 close to Wetherby in West Yorkshire. It is representative of many similar small rural towns.

Scope

This project will consider information from the EHV, HV and LV networks, smart meters and other network monitoring. The project seeks to create a non-network solution to creating capacity while simultaneously reducing customer bills.

Objective(s)

To test progressive voltage reductions as a method of minimising long term energy demand while staying within statutory voltage limits.

- Expected benefits will be modelled using system design tools prior to tests on the live system.
- Test the benefits of voltage control with an optimised passive set point for minimising long term energy demand.
- Test the benefits of voltage control with a dynamic set point for minimising long term energy demand.
- Examine the potential for using a dynamic set point for creating a DSO flexibility product.

Consumer Vulnerability Impact Assessment

n/a

Success Criteria

A successful project will be one in which each of the above deliverables are either successfully completed or if not there is a clear explanation of why the deliverable transpired to be unachievable.

Project Partners and External Funding

n/a

Potential for New Learning

The project will build upon the existing learning of projects such as Smart Street, LV Templates and our own BAU voltage reduction activity but proposes a different, but related methodology. It is anticipated that this will provide a separate option for DNOs wishing to achieve the impact of voltage reduction but with lower levels of network investment.

Scale of Project

The project is restricted to a amximum of three primary substations.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project will be implemented and tested in Boston spa in West Yorkshire. Subsequent implementation will potentially impact the whole of the Northern Powergrid.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£500k

Project Eligibility Assessment Part 1

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations

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

Work by ENWL as part of their Smart Street project indicated that savings for domestic customers up to £70 per annum each could be achieved through low voltage reduction. This method will not be applicable in all cases, and we anticipate that net benefit of this method is greater than the ENWL proposal, due to lower roll-out costs, but the headline saving could be in excess of £2bn per annum.

Please provide a calculation and/or description of the expected benefits of the solution

Not required. Project currently at TRL 3 – "Active research and development is initiated. This includes analytical and laboratory studies to physically validate analytical predictions or models of separate elements of the technology. Examples include components that are not yet integrated or representative but operate in a standalone basis. (ie Low System Readiness Level, SRL)".

However, assuming that the project is fully successful, the benefit to the GB customer over 20 years from commencement of the project and in accordance with the Ofgem CBA tool, is an NPV of between £2bn and £11bn depending on the level of saving that can be attributed to the project outcome (range of £20 to £100 **net** saving per customer).

This is a risk adjusted figure and assumes that the solution is generally applicable and that the likelihood of success (consistent with the starting TRL of 3) is around 30%. The exact benefits and thus NPV will depend on future energy use, energy costs and the continuation of current usage behaviour. For example the operation of personal renewables such as domestic solar PV would reduce the overall benefit.

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

The nature of the proposed method makes it entirely replicable across the whole of the GB electricity network.

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

This methodology is intended to be easily applied and could be rolled out without significant expenditure. The communications systems, network management systems, primary voltage control, smart meter sensing and other LV monitoring equipment required will be put on to networks anyway. This methodology looks to exploit, as far as possible, sunk (or soon to be sunk) costs. Initial implementation of new control methodologies and maintenance may be required but costs across the whole industry should be less than £25m

Requirement 3 / 1

Involve Research, Development or Demonstration

Projects 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

Involve Research, Development or Demonstration - Please select all that apply

☐ 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 Network Licensees will be able to use the learning generated as the outcomes will be relevant to all Network Licensees. All licensees have an interest in reducing network voltage to the advantage of their customers.

The Northern Powergrid innovation strategy specifically details the requirement to improve network reliability and availability and to reduce costs associated with running the network. This project contributes to those requirements. Further the project also investigates network and customer flexibility options which are also an explicit requirement of the strategy.

☑ 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. Networks must explicitly mention similar projects that they have considered and how these differ.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

ENWL and WPD have demonstrated the economic benefits of voltage reduction. This work proposes a different, more economic methodology to solve this problem.

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

The entire selection of required technologies, such as HV voltage control, LV monitoring, smart meter data have not been available.

Relevant Foreground IPR

n/a

Data Access Details

n/a

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

The costs fall upon the DNO the benefits all accrue to diretcly to customers.

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 project requires the building of new systems for voltage control and there is significant risk that the project will fail. Initial TRL is low as a complete system.

This project has been approved by a senior member of staff

☑ Yes