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

Dec 2013

Project Reference Number

NIA_NGET0065

Project Registration

Project Title

Voltage Optimiser Pilot

Project Reference Number

NIA_NGET0065

Project Licensee(s)

National Grid Electricity Transmission

Project Start

August 2011

Project Duration

3 years and 1 month

Nominated Project Contact(s)

Jude Robinson

Project Budget

£75,000.00

Summary

This R&D Project is to pilot the installation of a Voltage Optimiser at Rayleigh substation. This is to evaluate the claimed benefits of energy savings on electricity consumption by reducing the incoming LVAC supply voltage by a fixed amount into the site LVAC board. There are also additional benefits which are due the reduced heating and insulation stresses on the substation connected equipment, which should improve asset life and reliability.

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

National Grid have large substation sites that are often heavy consumers of electricity. Introducing a voltage reduction system into incoming supplies is common practice for office and industrial installations and large savings in energy consumption are claimed. If we can reduce the amount of energy consumed per substation, we can reduce the overall impact of our assets. The issue with the standard technology is that we do not know how this will interact with existing systems that are designed to interact with High Voltage equipment.

Method(s)

Demonstration

This pilot is to install an EMS Powerstar Voltage Optimiser on one of the incoming LVAC supplies at Rayleigh substation and to carry out an evaluation of the benefits and any deployment issues over a period of 1 year. There are 2 proposed options with different potential benefits:

?? 1 x 500kVA unit on one transformer

?? 2 x 500kVA units, 1 on each transformer

Scope

This R&D Project is to pilot the installation of a Voltage Optimiser at Rayleigh substation. This is to evaluate the claimed benefits of energy savings on electricity consumption by reducing the incoming LVAC supply voltage by a fixed amount into the site LVAC board. There are also additional benefits which are due the reduced heating and insulation stresses on the substation connected equipment, which should improve asset life and reliability.

Objective(s)

The project objectives are below:

To investigate the effects of voltage change on the substation equipment

To investigate how a voltage decrease can impact on energy bills

To investigate the two different arrangements of the EMS Powerstar hardware

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

This project will be successful if we trial the voltage optimiser equipment, and either understand why it is not suitable for installation, or decrease the energy bills for the substation and ensure the hardware is reliable in a high voltage environment.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project is focussed on a substation scale.

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

If successful, the project could be applied to the whole of the GB transmission system.

Revenue Allowed for the RIIO Settlement

Zero

Indicative Total NIA Project Expenditure

IFI - £48,000

NIA - £27,000

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)

The benefits are reduced energy consumption on energy metered sites and potentially improved asset life of LVAC connected equipment, due to reduced heating effects and insulation stresses. There will also be energy savings which will result in financial and emission savings benefiting National Grid.

EMS Powerstar has no moving parts and therefore minimum maintenance costs and procedures. A desktop study on a typical site concluded:-

?? Consumption 01/08/09 – 31/07/10 = 1,074,382kWh

?? Site voltage: Min: 233.6, Max 241.9, Ave: 237.8

?? Potential to reduce site voltage by 15V

?? Resulting in a percentage saving of kWh = 9.4% of kWh

?? kWh savings 100,992kWh, Tonnes of Carbon Dioxide saved 55.2 tCO2

If the desktop study is representative, there is potential savings of £2,760 saving in C02 per year, per site (cost of CO2 @£50/tonne)and a saving of £6,000 in energy consumption (assuming 6p per kwh), resulting in a saving of approximately £9,000 per site. Giving a payback period of between 3 and 6 years.

If this was applied to all 337 substations nationwide and they were all similar, it could result in a year on year saving of approximately £3m per year.

Please provide a calculation of the expected benefits the Solution

Base - Method = £2,760 in CO2 per site, as detailed above.

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

This could be rolled out to all of the GB transmission system if successful.

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

1 x 500kVA unit on one transformer, cost £27.5k inc. installation there are three transformers per site an approximately 330 substations in the GB network the cost would be upwards of £27m.

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

n/a

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

This project addresses the environmental theme through reduced energy savings and may potentially address reliability through extended asset lives.

☑ 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