NIA Project Registration and PEA Document

Date of Submission

Dec 2013

Project Reference Number

NIA_NGET0033

Project Registration

Project Title

Wireless Condition Monitoring Sensors with Integrated Diagnostics

Project Reference Number

NIA_NGET0033

Project Licensee(s)

National Grid Electricity Transmission

Project Start

July 2011

Project Duration

3 years and 1 month

Nominated Project Contact(s)

Carl Johnstone

Project Budget

£133,000.00

Summary

The scope of this project is:

- A low-cost readily distributed diagnostic system architecture suitable for operating wirelessly with a substation.

- A report detailing the feasibility and expected functionality of fully autonomous wireless sensors deployed in a range of environments when integrates with energy with energy harvesting devices.

- Capability for integrating the technology within the SAM 'Smart Asset Management System' to provide real-time diagnostics (e.g. PD, environmental) to monitoring engineers.

- A technology demonstrator based upon a low-power partial wireless discharge (PD) detector and diagnostics package that can be used for PD identification.

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

Existing approaches to substation diagnostics typically involve mains-tethered instrumentation for data acquisition. It is prohibitively expensive to roll out this type of scheme widely due to cost and cabling constraints, which inevitably leaves gaps in condition monitoring coverage that could lead to unexpected asset failure. In addition, diagnostic systems have become significant assets in themselves, requiring trained personnel to operate them. This approach adds additional complexity to the task of a monitoring engineer, whose primary concern must be the operational state of plant rather than the intricacies of a diagnostic system. Therefore, a non-obtrusive, integrated approach to diagnostics would be an efficient and economic alternative.

Method(s)

The method that has been proposed for this project is as follows;

1. Carry out an initial study into wireless sensor networking applied to substation condition monitoring to identify relevant prior work and applicable industry standards (Strathclyde).

2. Build a prototype wireless diagnostic sensor system as a reference implementation for a general-purpose wireless condition monitoring architecture (Strathclyde).

3. Perform on-site trials of the sensor to characterise its performance in the field (Strathclyde, National Grid).

4. Integrate the technology with National Grid Smart Asset Management system to give a greater understanding of plant health to monitoring engineers (Strathclyde, National Grid).

Scope

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- A low-cost readily distributed diagnostic system architecture suitable for operating wirelessly with a substation.

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Objective(s)

Condition monitoring plays an increasingly important role in asset management and diagnostics for high-value equipment. New technology and advances in sensing capabilities enable us to understand more about the asset and thus make optimal maintenance decisions (e.g. maintain on condition). Minimising the requirements are the key aspects of the desirable 'fit and forgot' functionality.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

This project will be successful if we can improve the knowledge around the condition monitoring area and deliver new functionality on to the electricity transmission network.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project is focussed at Substation level

Technology Readiness at Start

TRL6 Large Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

This project should provide learning that is replicable to the whole of the GB transmission system, but will be delivered in Strathclyde.

Revenue Allowed for the RIIO Settlement

Zero

Indicative Total NIA Project Expenditure

IFI – £73k

NIA - £60k

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 principle of condition monitoring is to avoid asset failure. The cost of a transformer failure is in the region of £5m, therefore if condition monitoing can save 1 asset only, this cost will be avoided.

Please provide a calculation of the expected benefits the Solution

Base - up to £2000 per sensor, or not technically feasible at all

Method - £300 per sensor, and delivering work that is not technically feasible.

B-M = £1,700 per sensor

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

This techniques can be applied to all substations, all OHL towers, and all underground cable routes on the National Grid system.

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

For substation roll out, we have calculated £300 x 50 sensors x 365 subs = £5.5m

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

This learning from project can be used by all network licensees who wish to implement a condition monitoring strategy, based on National Grid's experiences.

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