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 2013

Project Reference Number

Project Registration

Project Title

Wireless Condition Monitoring Sensors with Integrated Diagnostics

Project Reference Number

Project Licensee(s)

National Grid Electricity Transmission

Project Start

July 2011

Project Duration

2 years and 9 months

Nominated Project Contact(s)

National Grid TO Innovation Team

Project Budget

£134,000.00

Summary

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 for installation and maintenance of these sensors, and removing the need for cables and batteries are the key aspects of the desirable fit and forget functionality.

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 should ideally be filled. 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 should be followed.

Recent developments in miniaturisation of digital electronic devices have fuelled the development of wireless sensor network technology. These networks are made up of a number of discrete sensor nodes, which integrate processing, sampling, storage and communications capabilities. By taking advantage of this technology, wireless diagnostic sensors have the potential to increase condition monitoring coverage without the need for cross-site cabling, simplifying deployment and reducing costs.

Through identifying general requirements for wireless condition monitoring systems, a modular approach could be defined for a multitude of sensors to be attached to the same underlying platform (for instance: RF, ultrasonic and thermal). In addition to sensing, wireless sensors such as this with suitable analytical capabilities can also support a level of on-board defect diagnosis. By diagnosing defects on-sensor, the volume of monitoring data can be drastically reduced at source so that only pertinent defect information is transmitted to monitoring engineers. This reduces the burden of transmitting data back to corporate networks, increasing system scalability and minimising the requirement for wideband communications links.

An initial laboratory study into this type of approach, targeted at Partial Discharge (PD) monitoring, has resulted in a promising new diagnostic technique built upon wireless sensor technology. This method has demonstrated detection and basic classification capabilities and, based on the knowledge gained from this study, implementing the UHF technique on a wireless sensor node has

been recognised as feasible. Based upon this prior work, a wireless condition monitoring platform technology demonstrator could be created using partial discharge detection and diagnosis as a reference application.

Nominated Contact Email Address(es)

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Problem Being Solved

Method(s)

Scope

Objective(s)

The aim of the project is to create:

- A low-cost, readily distributed diagnostic system architecture suitable for operating wirelessly within a substation
- A report detailing the feasibility and expected functionality of fully autonomous wireless sensors deployed in a range of environments when integrated with energy harvesting devices.
- Capability for integrating the technology within the Smart Asset Management System (SAM) to provide real-time diagnostics such as PD, 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.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

n/a

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

n/a

Geographical Area

Revenue Allowed for the RIIO Settlement

Indicative Total NIA Project Expenditure

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)

n/a

Please provide a calculation of the expected benefits the Solution

n/a

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

n/a

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

n/a

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)

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

Please demonstrate how the learning from the project can be successfully disseminated to Network Licensees and other interested parties.

Please describe how many potential constraints or costs caused, or resulting from the imposed IPR arrangements.<

Please justify why the proposed IPR arrangements provide value for money for customers.

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