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NIA Project Registration and PEA Document

Date of Submission

Oct 2017

Project Reference Number

NIA_WPD_026

Project Registration

Project Title

DEDUCE (Determining Electricity Distribution Usage with Consumer Electronics)

Project Reference Number

NIA_WPD_026

Project Licensee(s)

National Grid Electricity Distribution

Project Start

October 2017

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Matt Watson, Innovation and Low Carbon Networks
Engineer

Project Budget

£180,562.00

Summary

To meet these aims the following scope of work is proposed:

- Investigate existing low cost sensors that can be used for indirect substation loading monitoring.
- Investigate new disruptive technologies to determine their suitability and accuracy for monitoring
- Use existing low cost measurement devices or packages (such as a smart phone or raspberry pi) to indirectly provide measurement
- Run a university based competition to enable non-traditional solutions to be explored

Third Party Collaborators

Loughborough University

Aston University

Problem Being Solved

DNOs currently have very limited visibility of LV networks. With Supervisory Control And Data Acquisition (SCADA) systems generally limited to 11kV feeders, visibility of LV network loading is restricted to Maximum Demand Indicators (MDI). These manual readings are generally supplemented with industry metering flows to develop an understanding of network loading.

MDIs are restricted by their need to be reset periodically as well as the potential for network back-feeds to distort readings.

A number of previous LCNF projects have looked into LV monitoring. This has pushed the market for LV monitoring forward significantly from the custom built units used for the Low Voltage Network Templates project, to a number of commercially available units available to date. WPD currently has Standard Techniques (STs) for the installation of ground mounted and overhead monitoring as well as a fully tendered framework agreement for the supply of such units.

These units depend primarily on the measurement of voltage and current to determine loading. Voltage is generally measured directly through the use of busbar clamps or modified fuse holders with a voltage take off point. Current is generally measured using Rogoswki coils. These units are capable of measuring the detailed loading of each phase on each feeder and provide a significant level of detail and granularity. However these devices are also costly due to the requirement for multiple sensors. This has limited their roll out to date.

Method(s)

This project looks to develop a low cost (sub £100) distribution substation monitor based on indirect loading measures (temperature, noise, vibration...). At a minimum this must give access to more granular and less error prone data than is currently acquired through MDIs.

The substation monitor is expected to develop a methodology for the acquisition of basic whole substation loading profiles as well as the optimal method for the delivery of such data to planning teams and simplicity of installation.

To meet these aims the following approaches are proposed:

- To investigate existing low cost sensors that can be used for indirect substation loading monitoring.
- To investigate new disruptive technologies to determine their suitability and accuracy for monitoring
- To use existing low cost measurement devices or packages (such as a smart phone or raspberry pi) to indirectly provide measurement
- To run a university based competition to enable non-traditional solutions to be explored

The trial of existing low-cost sensors and investigation of disruptive technology will be undertaken at Loughborough University by a researcher under the guidance of D Strickland, A Cross, M Thompson and R Ferris. 6-8 different sensors will be designed, built, tested and characterised in the laboratory with possible follow through to testing on University owned 11kV/400V facilities if applicable.

The university competition will be organised through Loughborough University and will be targeted at all UK University students. It will be launched in October to coincide with the start of the academic year. It is suggested that this follow a three stage process.

1. Students submit their ideas for measurement along with costing
2. The top teams are invited to build and submit a hardware prototype for testing and provided a budget of up to £500
3. The prototypes are tested and characterised. With a top prize going to the highest scored project.

Scope

To meet these aims the following scope of work is proposed:

- Investigate existing low cost sensors that can be used for indirect substation loading monitoring.
- Investigate new disruptive technologies to determine their suitability and accuracy for monitoring
- Use existing low cost measurement devices or packages (such as a smart phone or raspberry pi) to indirectly provide measurement
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Objective(s)

To main objectives are to develop, characterise and test sensors that could be used for indirect measurement for substation monitoring. The project is expected to develop a whole systems methodology from reading sensor data through inferring loading profiles from this measurement leading delivery of such data to the DNO.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

- Development of 6-8 sensors at Loughborough
- Entries from 8 Universities

- 5 University student entries taken forward to prototype
- Characterised performance of those sensors
- Business case for trial based deployment

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The project is designed to last for 10 months to tie up with the university year. Any shorter and there will be issues with timings of the competition in relation to exams and project submission dates resulting in a poor uptake.

Technology Readiness at Start

TRL1 Basic Principles

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The project will be run from Loughborough University in conjunction with Aston University and involving students from other UK universities. All project management and testing will be undertaken at Loughborough.

Revenue Allowed for the RIIO Settlement

£0

Indicative Total NIA Project Expenditure

£162,506

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 business case is based on reduced requirements for the installation of full monitoring at distribution substations.

Full monitoring installed cost: £2150

Low cost monitoring installed cost: £175

Ground mounted distribution substations being replaced for reinforcement of customer connections across WPD in RIIO-ED1: 3700

Units where monitoring is not required: 20%

Full Units avoided due to low cost monitoring: 15%

Based on the assumptions above, the following benefits can be achieved.

Base Cost= $0.8 * 3700 * 2150 = £6.37$ million

Method cost = $(0.8 * 3700 * 175) + (0.8 * 3700 * (1 - 0.15) * 2150) = £5.93$ million

Saving: £435,000

Please provide a calculation of the expected benefits the Solution

N/A (research project)

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

The benefits of low cost monitoring are relevant for all network licensees. This should enhance any current and future plans for the roll out of LV substation monitoring.

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

The costs of rolling out the monitoring are £175 per substation (against £2150)

Due to the direct nature of savings derived from avoided enhanced monitoring the cost of roll out across GB will be absorbed from funds earmarked for enhanced LV monitoring. Adding a low cost phase to the roll out of such monitoring should provide direct savings on the wider roll out.

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 benefits of low cost monitoring are relevant for all network licensees. This should enhance any current and future plans for the roll out of LV substation monitoring.

The project aims to develop new monitoring techniques that can be rolled out across the Networks to provide improved visibility for all Network Operators. The hardware from this project will go forward to a Network demonstrator and the associate knowledge of the hardware including drawings, configuration, calibration, usage of and changes to Network practice will be made publically available through publication in both conferences and through on-line project documentation on the WPD website.

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 challenge detailed in the Innovation strategy document on Network analogues (section 6.9.13 of the innovation strategy document).

- 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