WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

Date of Submission

16/10/2017

NIA Project Registration and PEA Document

Notes on Completion: Please refer to the **NIA Governance Document** to assist in the completion of this form. Please use the default font (Calibri font size 10) in your submission. Please ensure all content is contained within the boundaries of the text areas. The full-completed submission should not exceed 6 pages in total.

Project Registration

Research Area (Please select one)

☐ Low Voltage & 11 kV Networks	☒ Network Monitoring	☐ Commercial
☐ Low Carbon Generation & Connections	☐ Safety, Health & Environment	☐ Energy Storage & Demand Response
☐ Network Operations, Comms & IT	☐ Low Carbon Technologies	☐ High Voltage Networks
☐ Various		

Project Title

DEDUCE (Determining Electricity Distribution Usage with Consumer Electronics)

Project Reference

NIA_WPD_026

Funding Licensee(s)

Western Power Distribution East Midlands, Western Power Distribution West Midlands, Western Power Distribution South Wales, Western Power Distribution South West

Project Start Date

23/10/17

Project Duration

Years	Months
1	0

Nominated Project Contact(s)

Matt Watson, Innovation and Low Carbon Networks Engineer

Project Budget

£180,562

Problem(s)

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
- Run a university based competition to enable non-traditional solutions to be explored

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.

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

Technology Readiness Level at Start

1

Technology Readiness Level at Completion

4

Project Partners and External Funding

Loughborough University is the main partner
Aston University is a subcontractor to Loughborough.

Potential for New Learning

There is good potential for new learning. The knowledge gained will be in the areas specified below:

1. A list of sensors or technology that can be used to provide substation monitoring
2. The functionality, accuracy, reliability and cost of this instrumentation
3. The methodology behind taking the sensor data and converting it to meaningful information (for example load current)
4. A process for using this information
5. A plan for a long term field trial of any promising technology

Results will be disseminated through a conference and also reports which will be made available through the WPD and University websites.

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.

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 in the RIIO Settlement

£0

Indicative Total NIA Project Expenditure

£162,506

Project Eligibility Assessment

Specific Requirements 1

1a. An 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 systems and 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	☐

Specific Requirements 2

2a. Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees ☒

Please answer one of the following:

i) Please explain how the learning that will be generated could be used by relevant Network Licenses.

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.

ii) Please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the Project.

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

Is the default IPR position being applied?

Yes	☒
No	☐

If no, please answer i, ii, iii before continuing:

i) Demonstrate how the learning from the Project can be successfully disseminated to Network Licensees and other interested parties

ii) Describe how any potential constraints or costs caused, or resulting from, the imposed IPR arrangements

iii) Justify why the proposed IPR arrangements provide value for money for customers

2b. Has the Potential to Deliver Net Financial Benefits to Customers ☒

Please provide an estimate of the saving if the Problem is solved.

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 financial benefits of a Development or Demonstration Project (not required for Research Projects). (Base Cost – Method Cost, Against Agreed Baseline).

N/A (research project)

Please provide an estimate of how replicable the Method is across GB in terms of the number of sites, the sort of site the Method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.

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.

2c. Does Not Lead to Unnecessary Duplication ☒

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

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.

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This project is unique because it has;

1. Low target cost
2. Uses Indirect measurement techniques
3. Investigates Innovative sensor packaging (reuse or reapplication of consumer or second hand products)

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

N/A