Scottish and Southern Energy Power Distribution

Date of Submission

October 2015

NIA Project Registration and PEA Document

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.

Project Registration

Project Title	Project Reference
Overhead Line Vibration Monitoring Phase 2	NIA_SSEPD_0017

Project Licensee(s)	Project Start Date	Project Duration
Scottish Hydro Electric Power Distribution, Southern Electric Power Distribution	Oct 2015	9 Months

Nominated Project Contact(s)	Project Budget
David MacLeman	£380,000

Problem(s)

The Overhead Line (OHL) network is extensive across the two Scottish and Southern Energy Power Distribution (SSEPD) distribution licence areas, and is mainly in rural areas, where there is a lower density of population. The Lines are susceptible to damage, which causes a number of outages each year. The problem of severe weather is well known, but less obvious are the problems and damage that can be caused by every day events such as by farm animals leaning on poles or stays or from trees and other vegetation growing in close proximity, and falling onto the lines, or making fleeting contact with the overhead wires. There are areas of the country where farm and forestry work take place underneath lines, and these have resulted in contact with one or more of the conductors, causing the protection systems to trip, resulting in interruption of supply to customers.

There is a need for Distribution Network Operators (DNO's) to be able to detect several OHL issues that do not necessarily cause an immediate customer Interruption, but would result in one in time; and DNOs need to try and identify whether a protection system trip is spurious, or an indication that something more serious is occurring.

DNOs also have a licence obligation to ensure that each OHL they own maintains the clearances required by the ESQCRs (Electrical Safety, Quality, and Continuity Regulations).

Method(s)

Wire mounted sensors will be deployed incorporating electronics for detecting change in angle, wire sag and impact of a wire strike.

The sensors can be self-powered using energy harvested off the line, and will be able to operate at voltages between 11kV and 70kV. Data will be organized by server software and stored for analysis.

The system will detect and analyse data from vibration and movement monitoring of overhead lines in a live high voltage environment.

The project will complete development of an innovative new way of sensing that damage has occurred to the overhead line network, even though an outage has not occurred, using self powered medium voltage sensors.

Scope

This project will complete the development of a technical method that commenced in a previous Innovation Funding Incentive (IFI) project. In that project, wire mounted sensors incorporating electronics for detecting change in angle, wire sag and impact of a wire

strike were developed. The IFI phase led to the production of prototype sensors which demonstrated proof of concept through successful vibration testing on overhead lines.

This project will install a sample of the prototypes on representative sections of live overhead lines and monitor their performance, as well as that of the server, over a period of 3 months. At the end, an evaluation will be carried out to confirm the suitability of the system for vibration and movement monitoring in a live high voltage environment.

This project will include the final development and demonstrate the ability of previously developed prototype sensors and the supporting server to provide notification of impacts to OHL conductors and/or movement of the supporting poles, so that the DNO control room can be able to decide on the appropriate action that could avoid outages, reduce the impact of vegetation on the overhead network, and reduce the potential for serious injury/death to members of the public.

Objective(s)

• To demonstrate that wire mounted sensors can sense and differentiate between wire strikes and wire sags, and other sources of conductor movement including e.g. wind, animal rubbing, birds perching and vehicles passing.

• To demonstrate that the information from the sensors can be used to discriminate between varying types of wire impacts, and reject false positives, e.g. heavy birds landing or colliding with the line.

• This project will try to establish if the prototype sensors can be self-powered using energy harvested off the line, are able to operate at voltages between 11kV and 70kV and that the associated server software is fit for purpose

Success Criteria

The project will be a success if it can demonstrate whether or not wire mounted sensors can be used to improve customer service by improving the management of contact with, and damage to, overhead lines and poles.

Technology Readiness Level at Start	Technology Readiness Level at Completion
6	9

Project Partners and External Funding

N/A

Potential for New Learning

The project will allow the Network Control Room to discriminate between different causes of wire strikes, and therefore act appropriately. We currently are not able to carry out this discrimination without a visit to the collision site and a visual examination of the cause. The product developed will be freely available on the commercial market, and the results of the project published on the ENA smart grid projects portal.

Scale of Project

The project will install sensors on live sections of the North Scotland distribution OHL Network. The potential benefits from this project justify a rigorous assessment of the outstanding development activities hence the scale of the project is deemed commensurate.

Geographical Area

The sensor locations are still to be decided, but will be within mainland Scotland.

Revenue Allowed for in the RIIO Settlement

There is no revenue allowed for in the RIIO ED1 settlement.

Indicative Total NIA Project Expenditure

Total NIA expenditure will be £380,000 of which 90% (£342,000) is Allowable NIA Expenditure.

Project Eligibility Assessment

Specific Requirements 1

1a. A 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 learning that is generated will be available for other DNO's to be able to assess whether or not the system would be suitable to be used on for their Overhead Line networks.

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

2b. 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 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

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

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

The costs of CIs and CMLs caused by OHL impacts over the last 4 years averages out to £10 million per annum. It is estimated that a saving of 5% of the costs of these CIs and CMLs will be able to be saved. The estimated savings are £500k per annum.

ii) 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).

The Base cost of carrying on without knowing the location of faults is £500k
The Method cost of replicating the project at this scope is £100k
So the financial benefit will be £400k.

iii) 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 method can be replicated across the whole of the UK distribution network at 11KV to 66KV. The sensors would be installed at locations where there is identification of potential issues arising from either airborne or ground based impacts to the OHL network.

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

The costs of rolling out the method across the UK are dependent on the number of sites that the other DNOs decide this method would be beneficial for. The cost per site (for 100 sites), for sensors, and aggregator, and licences to use the Server Management Software (sms) software will be approximately £8.5k. The cost per site for a smaller number and larger number of sites will be open to commercial negotiation. There will be additional costs for installing the sensors and training staff to use the sms software, and for providing a LV feed to power the aggregator.

2d. Does Not Lead to Unnecessary Duplication 

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

Following research using internet search, there are no known sensors currently on the market or in development that are able to be self powered and operate at such high voltages.

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