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

Nov 2015

Project Reference Number

NIA_SSEPD_0020

Project Registration

Project Title

Overhead Line Vibration Monitoring System

Project Reference Number

NIA_SSEPD_0020

Project Licensee(s)

Scottish and Southern Electricity Networks Transmission

Project Start

November 2015

Project Duration

4 years and 1 month

Nominated Project Contact(s)

SSEN Future Networks Team

Project Budget

£300,000.00

Summary

Under IFI project 2014_08 Monitoring of Conductors and Poles, a prototype sensor system, comprising line mounted sensors, and a communications system was developed to operate on overhead lines up to 11kV. This project will take that work further to produce a production ready system. The newly developed sensors will be encased within environmental protective cases, and are powered by solar panel, which trickle charges a backup battery within the case. They will then be installed on overhead lines in several areas of the distribution network and left for an extended period of time to determine the suitability for use, in terms of effect on the installed infrastructure, ability to withstand weather events, and ability to maintain power on during the winter months.Connections to the SCADA system will be made and tested.

Nominated Contact Email Address(es)

transmissioninnovation@sse.com

Problem Being Solved

In many rural areas of the country, the distribution network is carried via overhead lines, at 33KV, 11KV and LV. These lines are susceptible to damage by wind carried debris, inadvertent collision by farm and forestry vehicles, and even kites, fishing lines, and yacht masts, dependent on where they are in relation to normal activities carried out by the public. There are also occasions where the poles supporting the lines are moved by surrounding ground becoming soft, or vehicle collision, but which does not cause a break in the line. As the lines are usually uninsulated, there is a risk of death to anyone that makes contact with them. In forest or wooded areas, there is the possibility of trees or large branches falling and coming to rest against a line or pole, but not breaking the line.
In each of these situations, the overhead lines are protected by appropriate equipment but conditions which do not immediately initiate the operation of protection systems such as the minor movement of poles or contact by trees are difficult to detect and may remain until reported by third parties or our own staff.

Method(s)

The Technical method will show that the developed microcircuitry mounted in an environmental enclosure will be able to detect line collisions and pole movements, and pass the alarms to a gateway installed in a substation many spans away from the sensor location. The project will determine whether using solar panels to power small microcircuits throughout the shorter winter months is feasible, and whether electronics can operate during the depths of winter. The project will also be testing whether we can use a licence free radio frequency to communicate at short range to a gateway device that can then pass information on to the control room Supervisory Control and Data Acquisition (SCADA) system.

Scope

Under IFI project 2014_08 Monitoring of Conductors and Poles, a prototype sensor system, comprising line mounted sensors, and a communications system was developed to operate on overhead lines up to 11kV. This project will take that work further to produce a production ready system. The newly developed sensors will be encased within environmental protective cases, and are powered by solar panel, which trickle charges a backup battery within the case. They will then be installed on overhead lines in several areas of the distribution network and left for an extended period of time to determine the suitability for use, in terms of effect on the installed infrastructure, ability to withstand weather events, and ability to maintain power on during the winter months.
Connections to the SCADA system will be made and tested.

Objective(s)

The project will:
1) Prove whether the production prototypes produced will survive winter months when mounted on live overhead lines;
2) Determine whether there is any sign of degradation to the wires where the sensors are mounted;
3) Will indicate whether there is any sign of vegetation encroachment onto the overhead line network;
4) Prove whether, or not, the sensors can communicate quickly and effectively with the SCADA system;
5) Provide an indication that non vegetation objects have collided with an overhead line or pole, examples would be poles moving due to soft ground, line collisions by raised farm trailers or forestry vehicles;
6) Determine the viability of deploying the sensor system as an alternative to replacing sections of overhead line with underground cabling.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be a success if:

1) It can be confirmed whether or not the system is able to detect the collision between the overhead wires and trees, branches and/or farm, forestry, or construction vehicles, on live lines.
2) It can be confirmed whether or not the sensors, and communication system can withstand the effects of the weather on the system;
3) It can be confirmed whether or not the mounting of the sensors will have a deleterious effect on the overhead lines;
4) It has determined if and when the sensor system is a viable alternative to replacing an overhead line with underground cabling

Project Partners and External Funding

N/A

Potential for New Learning

The learning from this project will prove the ability of the prototype production sensors to withstand extremes of weather, the ability of local solar cells to power micro electronic devices in low light levels, the ease of fitting of the sensors on overhead lines, and the ability of the sensors to provide meaningful indications of vegetation encroachment and collisions by farm, forestry, or construction vehicles. All of these points will be of interest to other DNOs that have similar issues with vegetation management and safety critical crossing point sites.

Scale of Project

In order to provide the maximum benefit from the project, the sensors will have to be installed in at least 2 different geographic areas, 1 will be within Forestry/Woodland, and the other will be in an exposed coastal area. This will allow for the 2 major objectives of the project to be met. A further site may be used if it is required to provide further evidence of the sensor efficacy.

Technology Readiness at Start

TRL6 Large Scale

Technology Readiness at End

TRL9 Operations

Geographical Area

Within the SHEPD and/or SEPD licence areas.

Revenue Allowed for the RIIO Settlement

At this stage no saving on expenditure can be assumed.

Indicative Total NIA Project Expenditure

The indicative Total NIA Project Expenditure is £300,000, 90% of which (£270,000) is Allowable NIA 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)

There are several potential sources of cost savings from this project.
1) Reduction in costs due to damage from vegetation;
2) Reduction in costs due to not undergrounding cables in high risk areas.
3) Reduction in costs due to advance notice of pole movement to minimize sag.
The cost of the system per site is going to be £1700, (3 sensors, 1 aggregator, 10 repeaters and 1 Gateway), whereas the cost of undergrounding 3 spans at a site averages £9000, dependent on the terrain, and ability to access it with machines. Hand digging will be twice this cost.

There is also the reduction in risk of fatalities and serious injury due to wires drooping close to the ground due to pole movement, or collisions with the wires by vehicles. The average frequency of a fatality on the SSEPD distribution networks is 1 every 3 years. So reducing the possibility of a fatality will give a Project Benefit rating for Safety of 5, in accordance with the ENA NIA Project Benefits Guide approved by Ofgem on 18th September 2015.

Please provide a calculation of the expected benefits the Solution

The projected financial benefits for the project, (3 sites in total) excluding the potential safety benefits are:
Base cost for 3 sites : £27,000
Method Cost to replicate the project for 3 sites: £ 8,100
Financial Benefit is £27,000 - £8,100 = £18,900

The Safety Benefit, using the ENA NIA Benefits Guide, averaged out for an annual basis would be £1,565,000 ÷ 3 = £521,667

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

The system would be able to be rolled out across all network operators' overhead line networks, where they have issues with vegetation encroachment or potential collisions by farm or forestry vehicles.

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

The quantity of 100 costs for the monitor (3 sensors and 1 aggregator) is £200, with repeaters at £50, and substation gateways are £1000. The cost per installation will depend on how far the sensors are mounted from the nearest substation, and whether there is

communications to the substation already in place.

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 testing of the prototypes will allow for all UK Network Licensees to be confident in the system. The system will be made available to all on a commercial basis, so that it can be used to mitigate similar issues across the UK distribution Network.

Conductors on overhead lines have always been susceptible to damage by unwanted objects coming into contact with them. This can be trees/branches from overhanging vegetation, shrubs growing up through the lines, and debris blown onto the lines; in addition collisions between vehicles operating in close proximity to overhead lines, carrying out forestry clearance, farm work, or construction site work, which result in fatalities, are common enough throughout the UK for there to be concern within the industry. A system that can provide real time notification of vegetation impacts, pole movements causing sag, and vehicle collisions will assist in the prevention of loss of supply, and fatalities due to vehicle collisions with overhead lines.

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.

Following Reference to the ENA Smarter Grid Portal and research using internet search engines, it can be said that there are no other electronic overhead line sensors with wireless communications being trialed within the UK for vegetation management and safety considerations. SSEPD has another NIA Project, NIA_SSEPD_0017 in progress. This project is complementary to that one.

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