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NIA Project Registration and PEA Document

Date of Submission

Oct 2017

Project Reference Number

NIA_SPEN0025

Project Registration

Project Title

Low Cost Fault Current Measurement of Wooden Poles

Project Reference Number

NIA_SPEN0025

Project Licensee(s)

SP Energy Networks Distribution

Project Start

November 2017

Project Duration

2 years and 7 months

Nominated Project Contact(s)

SPEN - Geoff Murphy UKPN - Ian Cooper NPG - Andrew Webster

Project Budget

£712,404.00

Summary

The project will design and develop a laboratory prototype of the Method and if successful, finalise the design and supporting information to enable further stages of development including field trials and preparation of the product for commercialization.

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

~~There are two Problems that this project seeks to address

1. Wooden Pole Insulator Failure:

Many of the structures necessary to support the distribution of electrical power have failure modes that cause them to become live under certain environmental conditions (for example rain or high humidity). This creates a hazard to service personnel and the public which is difficult to find. A good example is wooden power poles which can become dangerous when the ceramic insulator has failed. Here the wooden pole becomes the prime resistor to ground and when moisture lowers its resistance to the "wrong" value it becomes a shock hazard.

2. Fault Passage Indication:

Insulators can become damaged during their lifetime, these can be in the form of cracks (in porcelain), electrical tracking paths (in polymeric insulators) etc. Under certain weather conditions this damage can cause failure of the insulation, which results in a flash over causing the protection systems to operate. These faults can be particularly hard to find as the insulation failure mechanism is weather dependent. As a result a method to identify fault current passage through poles is useful as it will reduce the area of inspection to a smaller number of poles with indication of significant current flow.

Method(s)

~The Method would be a card containing a low cost electrochemical cell device being attached to wooden poles to identify the level of fault current passage through that pole.

The Method exploits the fact that the resistance of an electrochemical cell is much lower (at about 100?) than a section of wooden pole. As a result, the current will come out of the wooden pole and flow through the electrochemical cell, causing a visible change in the cell which increases with current flow, providing a semi-quantitative measure of total current flow.

Additionally (subject to successful investigation in the project), the Method would include on the same card a fuse which would blow if the current exceeded a critical level (e.g. 35mA) and provide a record that a current flow of approximately this value was reached at least once in the period between installation and inspection.

Scope

The project will design and develop a laboratory prototype of the Method and if successful, finalise the design and supporting information to enable further stages of development including field trials and preparation of the product for commercialization.

Objective(s)

The objectives and activities of the project are:

Stage 1: To develop and demonstrate a Laboratory prototype

- Consult with DNOs on the sensitivity range required for the device
- Select appropriate electrochemical cell chemistry and develop a laboratory demonstrator showing the appropriate sensitivity in something approximating the final plastic card format
- Estimate the accuracy of the device and the key factors that limit resolution and accuracy
- Provide initial costs estimates of a final device

Stage 2: Development of trial units and capture feedback on the design

- Develop demonstrator and conduct initial testing
- Produce 10 units for 3rd party testing
- Review test data

Stage 3: To develop “large scale trial” units

- Produce 200 devices for evaluation by DNOs

Stage 4: Commercialisation support for the product

- Market analysis
- Preparation for manufacturing

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The main success criterion for the project is that the Method is able to achieve its design targets of:

- Resolution
- Accuracy
- Cost
- 20 year life when deployed as a long term indicator

Other success criteria are:

- Successful development of laboratory prototype.
- Successful development of trial units.

- Deployment of units in the field.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The Project expects to develop the Method in a laboratory setting with the creation of a number of prototypes to demonstrate the efficacy of the Method.

The project will then develop into a larger scale trial of 200 units.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The development of the Method will initially take place solely at the facilities of the project partner TTP.

The location of the large scale trial will be determined during the project.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

The total Project cost is £712,404

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)

For the purposes of estimating the savings, the two Scottish Power Energy Networks license areas and two scenarios have been considered.

- First scenario: Transient faults becoming permanent faults (where the source protection has reclosed >2 times in the previous 30 days). In these instances the new device could reduce the fault location and isolation time giving an estimated annual CML benefit of £53k.
- Second scenario: Avoiding the unnecessary replacement of suspect insulators following permanent faults. In such circumstances, the device would be used to identify failed insulators (by detecting current leakage). The estimated annual saving for this scenario is £110k.

It is also anticipated that safety benefits will be achieved but these will depend on the deployment strategy and have not been estimated at this stage.

Please provide a calculation of the expected benefits the Solution

Base Cost: £15,000

Based on the time spent to locate 50 transient faults turning into permanent faults after more than 2 reclose operations.

Method Cost: £21,080

Cost of deploying the solution.

Benefits: £163,000 annual savings for scenarios 1 and 2.

Financial Benefits: £156,920 Base cost – (Method cost – Benefits)

NPV of the benefits over the RIIO ED1 period to 2022/23 is estimated to be £885,884.

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

The Method could be applied across all Network Licensees except LPN, and would be applicable to all unearthed poles, representing about 90% of the pole population (circa 5 million)

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

The total cost of deployment of the Method for the two scenarios considered has been estimated to be in the region of £21,080 for the

two SPEN license areas.

If this Method was rolled out to all the license areas this would equate to a cost of £137,020.

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

All Network Licensees except from LPN (due to the fact that there are no wood poles in this license area) will be able to use the learning generated as the outcomes will be relevant to each individual Network Licensee;

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.

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