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

Oct 2015

Project Reference Number

NIA_ENWL007

Project Registration

Project Title

Reliable, low-cost earth fault detection for radial OHL systems

Project Reference Number

NIA_ENWL007

Project Licensee(s)

Electricity North West

Project Start

October 2015

Project Duration

2 years and 1 month

Nominated Project Contact(s)

Electricity North West Innovation Team

Project Budget

£350,000.00

Summary

Prototype overhead line FPI equipment will be installed at approximately 10 sites. Locations will be selected based on a range of factors including performance. The circuit selection will also consider the number of customers, the overall length of overhead line associated with the feeder and considerations towards straightforward installation. Monitoring equipment will need to be installed at the selected sites to gather data to support development of the required algorithms. The FPIs will be integrated via a DNP3 interface into Electricity North West's existing network management system and will be monitored via Nortech's iHost system.

Third Party Collaborators

Nortech

Nominated Contact Email Address(es)

innovation@enwl.co.uk

Problem Being Solved

Rural distribution networks are largely comprised of long overhead lines, controlled via one or more circuit breakers and manually operated line switches, with typically low customer number densities. These networks often represent an operational challenge to network operators owing to the higher-than-average incidence of faults, the large geographic regions they serve, and the reduced availability of network automation. It is therefore imperative that reliable, robust, low-cost solutions are sought to advance the performance of these networks.

This project aims to target how network operators respond to faults, after they occur, by providing fault passage information to control engineers in real-time via SCADA. It builds upon existing architectures, already deployed for underground cable fault detection, using Earth Fault Passage Indicators and extending this functionality to rural OHLs.

Rural circuit configurations often give rise to longer-than-average restoration times during HV faults. This is due to the time it can take

to locate the fault using traditional methods and to carry out the switching operations to restore supplies. Locating faults on these overhead networks traditionally involves operational staff patrolling a line on foot or by vehicle. Multiple faults in an area, which can occur during storm conditions, can become extremely resource-intensive and impact the restoration performance considerably.

In order to improve restoration times, DNOs need ways of reliably identifying the fault location with appropriate accuracy thus reducing the time taken to isolate faulty parts of the network. This project is proposing to develop a low cost OHL mounted fault passage sensor that can be deployed at volume on OHL networks.

Method(s)

Electricity North West is proposing to carry out a trial to develop a new low-cost overhead line fault passage indicator (FPI) that will reliably communicate back to the main network management system. These devices will communicate in real time via existing SCADA to allow control engineers to see if fault current has passed specified points on the network, thus significantly reducing the possible number of circuit sections where the fault may be situated. The newly developed FPIs will leverage existing architectures deployed for underground cable systems and will be installed at specified locations on Electricity North West overhead networks, based on a defined site selection methodology. Analysis will then be carried out on the performance of the system, based on monitoring data collected throughout the trial period.

Scope

Prototype overhead line FPI equipment will be installed at approximately 10 sites. Locations will be selected based on a range of factors including performance. The circuit selection will also consider the number of customers, the overall length of overhead line associated with the feeder and considerations towards straightforward installation. Monitoring equipment will need to be installed at the selected sites to gather data to support development of the required algorithms. The FPIs will be integrated via a DNP3 interface into Electricity North West's existing network management system and will be monitored via Nortech's iHost system.

Objective(s)

• To reduce the time taken to locate faults on rural OHL networks
• To develop a method for reliable detection of earth fault and over-current on OHL networks
• Install overhead line fault passage indicators for overcurrent and earth fault detection using live line techniques
• Develop a method of overhead line FPI installation with minimal commissioning and set-up and without need for shutdown (including location methodology and installation method statement)
• Understand the impact of overhead line FPIs on DNO's ability to locate faults more quickly and restore supplies to customers more efficiently

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

1. Development of a Technical Engineering Specification for overhead line fault passage indicators
2. Installation and test procedures for overhead line FPIs
3. Communication to central system (iHost) with NMS compatibility via SCADA
4. Validation of overhead line FPI performance (reliable communications, earth fault detection, overcurrent detection)

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project is expected to deploy overhead line fault passage indicator equipment in approximately 10 locations on Electricity North West 11/6.6kV networks.

This scale of deployment will allow us to cover different network topologies and target locations where the overhead line FPI could be of maximum benefit. These sites will be chosen based on a defined site selection methodology.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project will take place in Electricity North West's licence area. Specifically on rural overhead line 11/6.6kV networks.

Revenue Allowed for the RIIO Settlement

This project aims to trial a new FPI technology for more effective fault response via network switching. No revenue for an equivalent technology was requested or allowed for in the RIIO settlement.

Indicative Total NIA Project Expenditure

300000

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)

This project has the potential to improve the time taken to restore supplies in both single event and storm event situations. We approximated that this could result in a 20 minute improvement in time off supply for customers affected by OHL faults. Initial estimates, looking at the relevant population of HV circuits indicate that for single event situations, savings could be in the region of £1 million per annum.

Please provide a calculation of the expected benefits the Solution

Expected financial benefits occur through improvements in reliability of rural networks.
It is estimated that use of FPIs on OHL networks could improve post fault location by 20 minutes versus traditional methods. For a typical OHL fault this could result in a reduction of approximately £2000 in IIS penalties and a further £250 in operator costs. More importantly customer satisfaction would be improved, particularly for worst-served customers.

Reliability base cost calculation
Relevant circuits x average number of customer per circuit x average number of faults per annum x average supply interruption duration (ASID) x value of lost load

Reliability method cost calculation
Uses the same equation as above but the number of faults and the ASID numbers are both reduced.

Operational efficiency
Relevant circuits are those where the fault restoration teams are able to reduce the time spent in locating faults by up to 20 minutes. This improvement is cumulative during atypical network events such as storms, where operational resources are stretched, owing to multiple concurrent faults.

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

As all DNOs have HV overhead line networks, of a similar construction to those in use in Electricity North West, this solution is readily applicable to all UK DNO systems.

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

The BaU target price for the roll-out of the solution across GB is £2000 per site – this includes the procurement and installation of FPI

technologies.

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 learning from this project will be relevant for any other Network Operator that is looking to detect faults in overhead line networks. The project will produce a site selection methodology used for targeting overhead line FPI deployment. As all Network Operators have overhead line networks this methodology could be adopted across the UK. The project will also produce a method statement for the installation of overhead line FPIs. This procedure will be relevant to all the other Network Operators.

Technical Engineering Specification will be developed for FPIs that are capable of detecting over-current and earth faults propagating through overhead line networks.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

Electricity North West's Innovation Strategy has customer service at its heart. Key aspects of this strategy include keeping customers better informed, offering new services and improving quality of service. Customers supplied via HV overhead line networks, which are affected by prolonged loss of supply without this technology deployed, will benefit from ENW's more rapid actions in terms of responding to network faults.

☑ 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