NIA Project Registration and PEA Document

Date of Submission

Apr 2015

Project Reference Number

NIA_SPEN0005

Project Registration

Project Title

Portable Radiometric Arc Fault Locator (RAFL)

Project Reference Number

NIA_SPEN0005

Project Licensee(s)

SP Energy Networks Distribution

Project Start

April 2015

Project Duration

1 year and 7 months

Nominated Project Contact(s)

Nicol Gray & Andrew Park

Project Budget

£150,000.00

Summary

This scope of this proof of concept project will aim to modify an existing partial discharge (PD) monitor, which will then be tested in the field on a poorly performing circuit.

The key stages of the project are as follows:

- Hardware Modification

- Software Modification

- Laboratory simulation and factory testing followed by on-site installation and development

Third Party Collaborators

Energy Innovation Centre

Kelvatek

University of Strathclyde

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

Transient faults on the OHL distribution network can be costly to repair, impact on customer service and quality of supply and contribute to an increase Customer Interruptions (CIs) and Customer Minutes Lost (CML) penalties. DNO capabilities generally centre around sufficient detection and protection capability but no fault location capability. Certain transient, intermittent faults are not apparently obvious to field staff. The circuit continually trips, field staff manually reset and re-energise, but this does not address the root cause. These faults are frustrating, time consuming and costly to locate.

Repeated manual resetting is an inefficient use of resource not to mention a source of frustration. Accumulated CIs and CML and the associated penalties they incur are real consequences of an inability to establish the root cause of relatively minor, but frequent incidents.

Method(s)

This proof of concept project continues learning generated through previous IFI project (IFI1413 Portable RAFL) to investigates the feasibility of a portable Radiometric Arc Fault Locator (RAFL) to identify the location and to facilitate the quicker resolution of arc fault incidents.

A RAFL system will provide a means of locating incidents in a general area, possibly specific location thus improving the use of resources by reducing time spent tracing faults and decreasing the amount of CI/CMLs and their associated fines. Working with our project partners Elimpus, this project will aim to utilise an existing Partial Discharge monitor to develop a prototype RAFL array which will then be tested and evaluated in the field.

Scope

This scope of this proof of concept project will aim to modify an existing partial discharge (PD) monitor, which will then be tested in the field on a poorly performing circuit.

The key stages of the project are as follows:

- Hardware Modification
- Software Modification
- Laboratory simulation and factory testing followed by on-site installation and development

Objective(s)

At each stage of the project the following objectives have been identified.

Stage 1 Objectives

Redesign of the enclosure and components to allow for external operation. Specifically for use on a typical 11kV wood pole overhead network. Incorporation of a suitable HF band antenna and pre-amplifier with regards to on-site suitability and technical suitability. Identification of suitable deployment locations will also be carried out at this stage.

Stage 2 Objectives

Successful modification of software to allow real-time sampling from antenna and for the analysis software to be able to respond to partial discharge fault events.

Stage 3 Objectives

Laboratory testing and simulation will be carried out, followed by on-site testing with a mobile prototype system for calibration and reliability of measurement purposes through HV switching on the DNO network. FAT testing will be carried out with any identified improvements implemented and the system will then be deployed on the 11kV network. The first genuine 11kV fault will determine any further developments required and potential future project.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Successful completion of this project will provide a system that will provide the following benefits:

- The ability to accurately detect and locate arc faults
- The ability to monitor and trend arc fault occurrence over time
- Faster resolution to fault situations
- A reduction in CI / CML penalties

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This proof of concept project will aim to develop a working prototype unit, which will be evaluated and tested both in a controlled laboratory environment and also in the field.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

A poorly performing area of network in the SPD license area (East Lothian) has been chosen for this proof of concept project

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Total project expediture £150,000

IFI - £100,000

NIA - £50,000

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)

SPEN have undertaken Cost Benefit Analysis (CBA) utilising the Ofgem ED1 CBA tool and has identified a number of feasible scenarios and benefits achieved from the use of RAFL as a method to locate OHL arc faults. The CBA identified an 8 year NPV ranging from £0.23M to £0.93M.

Please provide a calculation of the expected benefits the Solution

It is estimated that a fully operation system, strategically deployed in the network, would have the ability to reduced CI / CMLs associated with permanent faults through improved fault finding, whilst also reducing the volume of recurring transients faults and those which become permananet in nature. Over the 8 year RIIO period this gives

Base cost = Avoided CI / CML costs

Method cost = Cost to deploy innovation

£1,000,000 - £630,000 = £370,000

Assumptions

- Reduction in CML by 20 minutes
- Units used in 3.5% of damage (live) faults
- Units used in 3.5% of non-damage (transient) faults
- 0.25% reduction in transient faults likely to become permananent in nature

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

Every network operator experience similar challenges when it comes to locating faults on the OHL network.

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

Proof of concept project - if succesfully further work will be required to advance the TRL level and generate a detailed understanding of

the total costs to roll out this method to UK operators.

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

This project is expected to provide all Network Licensees with an understanding whether this technology can successfully provide accurate fault location of OHL 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)

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