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

Apr 2021

Project Reference Number

NIA_ENWL_025

Project Registration

Project Title

On-line assessment of neutral conductor integrity

Project Reference Number

NIA_ENWL_025

Project Licensee(s)

Electricity North West

Project Start

April 2021

Project Duration

2 years and 9 months

Nominated Project Contact(s)

InnovationTeam@enwl.co.uk

Project Budget

£625,000.00

Summary

An open circuit neutral on an LV cable, can lead to a severe voltage rise on the earth terminals at a customers' property. This, in turn, can cause damage to customer's wiring and appliances and represents a public safety hazard because elevated voltages are transferred onto exposed metallic parts. A broken neutral cannot be detected by traditional LV protection and we rely on customers to notify us of the symptoms of the issue. Automatic detection of an open circuit neutral, or if possible, indication that degradation is occurring, and a break may be likely to happen, together with indication of location, would allow a faster and much improved response for our customers and reduce the likelihood of equipment damage and potential for harm. This project will investigate whether data can be collected from the LV network and used for early detection of neutral degradation, and if possible, the location of an open circuit neutral condition.

Preceding Projects

NIA_ENWL009 - Cable Health Assessment - Low Voltage

Third Party Collaborators

Kelvatek

Nominated Contact Email Address(es)

innovation@enwl.co.uk

Problem Being Solved

An open circuit neutral, for example, on an LV cable, can lead to a severe voltage rise on the earth terminals at a customers' property (in theory as high as the phase to neutral voltage). This, in turn, can cause damage to customer's wiring and appliances and represents a public safety hazard because elevated voltages are transferred onto exposed metallic parts. A broken neutral cannot be

detected by traditional LV protection and we rely on customers to notify us of the symptoms of the issue. Furthermore, processes for identification and repair of a broken neutral are, at best, time consuming, and at worst, highly disruptive to affected customers, requiring significant interventions, including accessing premises. Automatic detection of an open circuit neutral, or if possible, indication that degradation is occurring, and a break may be likely to happen, together with indication of location, would allow a faster and much improved response for our customers and reduce the likelihood of equipment damage and potential for harm.

Method(s)

This project will investigate whether data can be collected from the LV network and used for early detection of neutral degradation, and if possible, the location of an open circuit neutral condition. The project will define any other data required to facilitate the analysis and how this data can be collected. An initial algorithm will be developed to carry out the analysis automatically and provide a report to the Electricity North West control room. Consideration will be given to any changes required to existing business processes.

Scope

The project will be split into two phases:

Phase 1: a desktop study to understand the different LV cable types, failure mechanisms for the neutral conductor and types of data required, including use of Smart Meter data, to enable detection.

**Stage Gate – at the end of phase 1 a decision will be made as to whether the method is viable and the project can continue to phase 2

Phase 2: develop and test a detection algorithm in a real network environment with a view to incorporating the algorithm in fault identification and location processes, including consideration of changes to existing business processes.

Objective(s)

To develop a tool that DNO's can use to analyse LV monitoring data to enable the early detection of neutral degradation on the LV networks.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

N/A

Success Criteria

Phase 1: Desktop study and data collection/interfacing:

WP1 - Identification of the physical traces neutral degradation produces at various parts of the network.

WP2 - Identify existing sources or potential sources of data that can be used to facilitate WP1.

Phase 2: Detection algorithm in real network environment:

WP3 - Develop the infrastructure needed to gather the data from the sources identified in WP2.

WP4 - Creation of algorithms to detect neutral degradation based on the data sources identified in phase 1.

WP5 - Use algorithm to identify real world networks with defective neutral conditions developing.

WP6 - Verify the algorithm by investigating and, if necessary, repairing the defective networks and demonstrating that subsequent data now demonstrates an intact neutral. This work package will determine the benefits of the algorithm to all UK DNO's.

Project Partners and External Funding

Kelvatek have significant experience in LV fault location and are best placed to help deliver this project.

Potential for New Learning

If successful, the project will deliver a method to automatically detect degradation of neutral conductors in low voltage cables, this method does not exist currently and will be applicable to all low voltage networks.

Scale of Project

This will depend on the identified suitable data sources and the existing deployment of the sensors used to collect the data, but it is expected that a minimum of one hundred suitable locations will be used across the Low Voltage Network.

Technology Readiness at Start

TRL1 Basic Principles

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

North West of England

Revenue Allowed for the RIIO Settlement

£0

Indicative Total NIA Project Expenditure

£562,500

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)

At time of registration it is not possible to estimate a saving. The first phase of the project is research to assess if the proposed Method is viable. If the project passes the Stage Gate we will calculate the benefits to customers.

Please provide a calculation of the expected benefits the Solution

Not required at this stage.

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

If successful, the Method will be applicable to the entire Low Voltage network across GB.

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

Not known at this stage.

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

Any tools or algorithms developed by the project can be used by other DNOs to detect early neutral degradation on their networks, improving safety of the network and improving reliability of supply and power quality to consumers.

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

This project addresses the objective “Enhance automation across our operations and make use of new technologies to improve network resilience” as part of our “Optimised assets and practices” themes.

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.

We have shared the project scope with the ENA Innovation Managers Group and reviewed the Smarter Networks Portal to check for any related projects. This assessment has confirmed there is no duplication with any previous project.

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

There is no current method to automatically detect degradation of the neutral conductor of low voltage cables and previously the type or quantity of data has not been easily available to investigate detection. With the availability of new sensitive and intelligently triggering monitors at the source end, as well as the continuing roll-out of SMETS II meters, this makes investigation into this method possible.

Relevant Foreground IPR

Not known at this stage

Data Access Details

Any data will be made avaialable upon request to Innovation@enwl.co.uk

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

The solution is at a low TRL, and it is currently unknown whether the Method is viable. There are a number of issues and risks to

overcome before the technology is mature enough to be used as part of a business as usual activity.

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

The project can only be undertaken as an innovation pilot given the high difficulty level and operational risks associated with the deployment of an unproven solution in network operations. There is a commercial risk that the solution trialled in the project is not adopted by the stakeholders involved following the trial period. This could be due to the fact that the solution has not reached the level of maturity required for business as usual application. If the project is successful, it will have proven a technical solution which will improve network performance.

This project has been approved by a senior member of staff

☑ Yes