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

Mar 2021

Project Reference Number

NPG_NIA_036

Project Registration

Project Title

Polesight

Project Reference Number

NPG_NIA_036

Project Licensee(s)

Northern Powergrid

Project Start

March 2021

Project Duration

2 years and 1 month

Nominated Project Contact(s)

pro tem Chris Goodhand

Project Budget

£350,000.00

Summary

Building on the Foresight project, Polesight seeks to extend the technological and operational approach of anticipatory fault detection and management to the edge-case of overhead lines and pole mounted transformers for LV.

Preceding Projects

NIA_NPG_007 - FORESIGHT – LV pre-fault recognition and management

Third Party Collaborators

EA Technology

Nominated Contact Email Address(es)

yourpowergrid@northernpowergrid.com

Problem Being Solved

Electricity Network Operators have improved the performance of High Voltage networks and consequently significant proportion of customer interruptions and customer minutes lost now result from Low Voltage (LV) faults.
Most of the LV network is not comprehensively monitored. Responses to faults tend to be reactive as the condition of LV circuits (both overhead and underground) at any point in time is unknown and there is no capability of predicting the timing and location of faults before the event occurs.

The Foresight Project, undertaken by Northern Powergrid (2017-2021) has developed equipment and methods aimed at finding and fixing LV cable faults, on underground circuits, before they fail. The project has produced a dataset from a fleet of low-cost detectors that is being used to provide almost real-time health assessment, via characteristic pre-fault behaviour, for LV underground cable

circuits. Once a level of health criticality has been reached, additional equipment is deployed to determine the within-circuit cable section responsible for the observed pre-fault activity. Once located, positive proactive action can be taken avoiding unplanned supply interruptions and improving customer service levels and satisfaction.

The Foiresight solution is proving beneficial for cable-based urban networks with high customer densities, but this is not the case at the periphery of urban areas where overhead lines and pole-mounted substations are utilised. Here many 200/315kVA transformers, mounted in an “H” pole configuration, feed housing estates and light industrial units and there is a need to ensure that all parts of the network can enjoy the same benefits that have been seen from the Foresight project.

A similar cost-effective solution is required for pole-mounted substations where 1-2 LV circuits are more typical, and where faults may occur from either the downstream LV cables or the overhead networks from which they are fed.

Method(s)

Building on the learning from the Foresight project, Polesight will develop and test a low-cost sensing/monitoring system which enables DNO’s to monitor LV pole-mounted networks, identify developing faults then to locate the position of defects which will develop into LV faults before supply interruptions occur.
The program of work includes a relatively small-scale filed trial with the aim of verifying the efficacy of the system, identifying any practical issues associated with wider deployment of the system and to identify associated costs and the economics of that deployment..

The output of the project will be a functional specification which can be used by any GB DNO for such a solution.

To inform the specification, a piece of hardware, likely to be a hybrid combination of EA Technology’s VisNet Hub and Guard, the latter developed on the Foresight project, will be adapted to suit the pole-mounted environment (weather conditions, customer numbers and price point). The resulting low-cost system will be deployed on pole mounted substations with a mixture of overhead and underground circuits.

The key project stagesare as follows:
* Deploy a mixture of Guard and VisNet Hub LV equipment to monitor selected Pole mounted substation LV circuits
Identify and categorise pre-fault signature waveforms for LV overhead Lines/cables and pole top furniture (insulators)
* Deploy prototype low-cost sensor devices which incorporate pre-fault recognition algorithms based on the pre-fault signatures which are to be identified in this project. (These sensors will be developed by EA Technology in parallel to this project)
* Produce draft equipment specifications and network operating procedure documents to enable transfer into business as usual the management of pole mounted substation circuit faults by intervening before supplies are interrupted by faults or at the very least, identify where the fault is located in a more expedient manner.
* Draw conclusions for pole top LV fault and pre fault management approaches that are applicable to all DNO’s.
* Assess the issues and economics associated with broader deployment of the developed technology.

Scope

This project is to improve our understanding of indicative pre-fault behaviour relating to pole mounted substations, their outgoing circuits and the development of management options for LV Overhead Line networks. Scope includes operational issues and economics/business case assessment.

Northern Powergrid has a large population of such LV networks and the learning from the Foresight Project will provide additional insight into the expected failure types and how these could be applied to pole mounted substations.

Objective(s)

Primary project objectives of the project are:

* Detection and location of developing faults from pole mounted equipment, enabling remedial works to be carried out as part of a planned program of work before faults develop into loss of supply events.
* Demonstration of the use of a network of low-cost sensing devices installed on pole mounted substations and associated communications.
* Development of a strategy and protocol for detection and location of incipient faults on the LV pole mounted substations.
Knowledge relating to the evolution of pole mounted substation and circuit defects into supply interrupting faults using a method which minimises the impact on customers.
* Development and testing of novel techniques to potentially deliver a significant decrease in DNO CMLs and CIs originating from

pole mounted substation circuit faults.
* Demonstration that low-cost sensing devices help to identify issues early in order to support network performance improvements.
* Deliver and report conclusions, technical, operational and economic, that relate to the implementation and management of pole mounted substations that are applicable to all GB LV networks
* Develop a functional specification for a Pole Mounted Substation monitor with the added functionality of pre-fault detection.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Project success criteria are the successful delivery of the listed project objectives or the halting of the project, having concluded that the objectives are either not technically and/or economically feasible, at any of the project stage gates. In either case a successful outcome would include dissemination of the project findings and the learning developed.

Project Partners and External Funding

None

Potential for New Learning

The success of the project will provide DNO's with a more comprehensive method of determining and reacting to pole mounted substation circuit faults before they occur, via a new technological approach allied to a method of working to engage LV network restoration teams and information records with detailed pre-fault location and proactive fault management. All of these are of direct relevance to all network licensees and some elements of this learning may additionally inform other fault management approaches.

Scale of Project

To understand pole mounted substation pre-fault behaviour and intervention options, it is necessary to instrument and monitor an area of network where enough faults will occur during the duration of the trial. We have selected worst performing network pole mounted construction types to improve the chances of observing the faults. To ensure that we will experience a statistically valid number of faults over two years the following volumes of equipment have been specified:

Sensing:
50 modified Guard devices installed across the identified circuits to alert pre fault signatures to suit the Pole Mount environment
20 modified VisNet Hub monitoring devices with the option to develop and trial new algorithms/apps relating to faults to suit the pole mount environment

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

The precise location for installation of technology will be determined as part of the project. Any location on the Northern Powergrid network may be selected.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£300,000

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)

The additionality to the Foresight project's financial benefit, as a result of further extending the reach of anticipatory fault management is unclear but is estimated to be in the range £1-2m per annum during ED3.

Please provide a calculation of the expected benefits the Solution

The limited field trials mean that the impact of the trial itself is minimal.

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

The project outcomes is applicable to all GB networks. It is initally estimated that around 20% of LV pole-mounted substations would be suitable for and benefit from this approach. A conservative estimate is that 60-70k sites across GB.

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

Coists at this time are noty known. the project aiums to assess the economics and unit cost for such an implementation.

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 DNOs have LV overhead lines and their associated pole mounted transformers. Project learning will therefore be applicable to all relevant network licensees.

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

The project specifically addresses issues of reliability and restoration times, both identified by the customers as their number one priority. The project outcomes also allow us to reduce the impact of releiability on vulnerable customers by reducing the number of unplanned outages and allowing the customer to be prepared and for us to ensure that appropriate support and mitigation can be put in place.

☑ 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.

This project builds on Foresight. The learning from this cutting edge project has been constantly compared with the state of the art and no similar applications suitable for LV OHL networks can be found.

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

The project builds on the current state of the art and relatively new learning outcomes delivered by the Foreight project.

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

whilst the Foresight learning is encouraging it merely hints as to what can be done using in the alternative araena of overhead lines (as opposed to underground cables). As such the technological risk, consistent with the initial technology readiness level, inherent in the Polesight project remains high and the returns in the case of a successful project remain uncertain. the porject itself does not deliver benefit and further develoipment work will be need to bring the project from the final TRL of 7 to a full working, ready for field solution.

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

NIA allows the key technical and economic risks to be investigated and mitigsated before the potentially substantially late-stage costs required to bring this solution to market. the operational economics of a Polesight product are unknown and the suitability of the underlying technology approach for overhead lines as opposed to underground cables is, as yet unknown. This therefore warrants a limited NIA funded development and deployment project.

This project has been approved by a senior member of staff

☑ Yes