

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

May 2022

### Project Reference Number

NIA\_SSEN\_0060

## Project Registration

### Project Title

Portable – Low Voltage Fault Passage Indicators (Portable – LV FPI)

### Project Reference Number

NIA\_SSEN\_0060

### Project Licensee(s)

Scottish and Southern Electricity Networks Distribution

### Project Start

May 2022

### Project Duration

1 year and 11 months

### Nominated Project Contact(s)

Kevin Dennis

### Project Budget

£353,750.00

## Summary

Project Portable – Low Voltage Fault Passage Indicators (Portable – FPI) is an innovative project to develop portable fault passage indicators that can be used on the low voltage underground network. The equipment will be designed to be used by DNO operational staff to help locate faults on complex radial networks by measuring fault current flow in spurs.

This has the potential to enable more efficient fault locating activities and therefore provide better service for customers. This project will last fifteen months. A previous NIA project, Low Voltage – Underground Fault Location Technologies (LV-UFLT) NIA\_SSEN\_0037, proved the concept of this innovation.

### Nominated Contact Email Address(es)

fnp.pmo@sse.com

## Problem Being Solved

Underground low voltage (LV) networks are complex networks where the identification and location of sustained faults can be challenging.

Low voltage underground faults are typically caused by aging cable and/or joint insulation layers which gradually break down allowing water ingress which causes momentary short circuits between the conductors. The resultant arcing can vaporise the water thereby removing the temporary short circuit. Eventually such faults will cause fuses to rupture, resulting in power outages.

Whilst fuse replacement can restore supply temporarily, eventually faults will become permanent, and repair is required before restoration is possible.

Locating faults to enable repair can be difficult, resulting in multiple excavations and lengthy restoration times, exacerbating the negative impact on customers. Thermal imaging, gas sniffing, and acoustic techniques to locate faults can be frustrated by networks where spurs cause long distances of cable to require inspection.

This project will develop the concept of portable fault passage indicators to identify which spurs are conducting fault currents to enable more efficient inspection, fault location, and repair.

## Method(s)

### PHASE 1 – Factory Development & Test Network Assessment.

Fault passage indicators will be developed in the suppliers factory and tested on a replica test network. This approach enables simulation of a range of faults under controlled conditions. The fault passage indicators will be benchmarked against various types of simulated low voltage faults, developing methodologies for using the equipment on the network.

### PHASE 2 - Field Trials

Fault passage indicators will be supplied to a selection of field teams in SEPD and SHEPD. The teams will be chosen to cover different network topographies and cable types. Field trials will run for 6-9 months to ensure use on a representative sample of cases. During that time, data from the field will be collected, analysed and compared with historical records to establish quantifiable improvements in fault location. In addition, the practical opportunities and challenges of deploying these devices in the operational environment will be assessed.

### PHASE 3 – Project Close Down

If the results from the phases above demonstrate technical and financial viability, a recommendation will be made for transfer into business as usual.

## Scope

To assess how fault passage indicator technology performs when managing faults on the LV Network. The project will consist of 3 Phases

- Phase 1 - (3 Months) – Development of suitable commercial solution from the previous proof of concept works completed in a previous NIA Project (Low Voltage – Underground Fault Location Technologies). Design process in preparation for field trials on DNO LV network.
- Phase 2 – (6 -9 Months) – Field trials using portable fault passage indicator technology on sustained LV faults.
- Phase 3 – (3 Months) Project evaluation that could lead to business as usual. Dissemination of project to other network licensees and interested parties.

## Objective(s)

### By the end of the project

- To have developed commercially viable portable fault passage indicators for use in conjunction with existing proven low voltage fault location technologies.
- To have developed business as usual processes for their use to efficiently locate low voltage faults on electricity distribution networks.
- To have disseminated the learnings from the project through annual or targeted events for the benefit of GB customers.

## Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Not applicable.

## Success Criteria

This project will be deemed a success if all planned activities are completed, enabling the complete evaluation of whether portable fault passage indicators devices are suitable complementary devices for quick underground low voltage fault location.

## Project Partners and External Funding

There are no project partners in this project and all funding will be from SSEN. The project will be supported by G.Lee-Vaughan and Bowden Bros.

## Potential for New Learning

1. The suitability of portable fault passage indicators to assist in fault location on the low voltage network.
2. Identifying situations where portable fault passage indicators may not be suitable to use on the low voltage network.

3. Acquire a better understanding of the types of faults where portable fault passage indicators on the low voltage network can be applied.

### Scale of Project

Operational staff from SSEN Distribution Depots will conduct trials using portable fault passage indicators on faults on the low voltage network. These methods will also be used in conjunction with other equipment already being used on the low voltage network. Within the 15 month project, test network and field trials will be carried out to assess fault confirmation results and the potential benefits. A project of lesser scale would be inadequate for the anticipated level of field activities.

The project can only be undertaken as an innovation project given the operational risks associated with the deployment of an unproven solution in network operations. The technology has been tested in a Laboratory Environment as part of NIA Project (Low Voltage – Underground Fault Location Technologies but requires a true network test to prove its viability. The proposed approach to low voltage fault finding also has an unproven business case, and the range of potential benefits should be tested before the tool can be deployed. As noted in the NIA guidance, certain projects are speculative in nature and yield uncertain commercial returns. This is the case with this project. 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 TRL 8 required for business-as-usual application. If the project is successful, it will have proven a technical solution which will improve network performance. The specific details regarding the benefits are captured under section 2b of this document.

### Technology Readiness at Start

TRL5 Pilot Scale

### Technology Readiness at End

TRL8 Active Commissioning

### Geographical Area

Portable Fault Passage Indicators will be used by operational staff in various locations across both the SEPD and SHEPD licence areas.

### Revenue Allowed for the RIIO Settlement

No revenue has been allowed for project in the RIIO-ED1 settlement.

### Indicative Total NIA Project Expenditure

The total expenditure is £353,750, of which 90% (£318,375) is allowable NIA expenditure

## 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)

In conjunction with DNO investment in the final proven equipment and associated training the project aims to reduce CIs and CMLs by locating faults more efficiently than is currently possible and reduce associated costly expository works.

#### Please provide a calculation of the expected benefits the Solution

Base Cost - Method Costs over 5 years (Based on 15% Success Rate)

Benefits/Savings because of CI/CML benefits, reduced excavations leading to quicker repairs due to fault location improvements and avoided costs of LV repairs due to

Prevented faults: £1,060,762

Method Cost = £934,918

Base Case = £1,995,680

Base Cost (£1,995,680) – Method Cost (£934,918) = Total Saving of £1,060,762

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

Developed methods will be based on outcomes of this project and will be fully transferable to all DNOs who want to acquire them. The method would have the potential to be deployed to all field teams working on underground cable fault repair or condition monitoring.

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

Costs and the associated benefits can be extrapolated out to include other GB networks if the technology is taken up, however these will depend on the region-specific requirements, i.e. number of units required, number of applicable low voltage on the network etc.

### 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

Knowledge acquired from testing and trials will be made available for dissemination to all distribution network operators. If the project proves that the new Portable – Low Voltage Fault Passage Indicators can help to locate underground cable faults, then the developed methods and processes will be transferable to all network operators and their subcontractors. If appropriate, knowledge can be transferred to equipment manufacturers for enhanced diagnostics tool development and to cable manufacturers for use in future underground cable design.

### 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

### 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.

Based on published RFI (Request for Information) and NIA information there are no known projects being undertaken by other network licensees to develop fault location technologies using portable fault passage indicators on the low voltage network.

### If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

Not Applicable

## Additional Governance And Document Upload

### Please identify why the project is innovative and has not been tried before

This project is a novel use of portable fault passage indicators to help support the pinpointing of low voltage underground cable faults. Fault passage indicators are commonly used on High Voltage Networks. This alternative is a novel use in the field of Low Voltage fault finding.

New processes to use the fault passage indicators in conjunction with distance to fault equipment and current pin-pointing equipment (Cable Sniffer, Thermal Imaging cameras and Acoustic technologies) will be developed.

### **Relevant Foreground IPR**

The Relevant Foreground IPR will be knowledge and reporting. The project will conform to the default IPR position under the NIA governance.

### **Data Access Details**

Not applicable

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

This project's activities are outside of BAU capabilities and seek to develop and trial processes not currently proven or approved for use on the low voltage electricity distribution network.

### **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**

Due to the associated commercial and operations risks this project cannot be undertaken without NIA support.

- Commercial – The cost of portable fault passage indicator equipment development, supply, and approval of its use on LV networks is outwith business as usual, and therefore requires separate resourcing.
- Operational – Development of processes for fault passage indicator equipment use is outside the scope of business as usual operational activities, and therefore requires separate resourcing.

### **This project has been approved by a senior member of staff**

Yes