Date of Submission

21 May 2019

NIA Project Registration and PEA Document

Notes on Completion: Please refer to the **NIA Governance Document** to assist in the completion of this form. Please use the default font (Calibri font size 10) in your submission. Please ensure all content is contained within the boundaries of the text areas. The full-completed submission should not exceed 7 pages in total.

Project Registration

Project Title		**Project Reference**
Low Voltage – Underground Fault Location Technologies (LV-UFLT)		NIA_SSEN_0037
Funding Licensee(s)	**Project Start Date**	**Project Duration**
SEPD	June 2019	18 Months
Nominated Project Contact(s)		**Project Budget**
SSEN NIA Programme Delivery Manager – Joe McNeil		£346,000

Contact Email Address

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Lead Sector

Electricity Distribution	☒	**Gas Transmission**	☐
Electricity Transmission	☐	**Gas Distribution**	☐

Other Sectors

Electricity Distribution	☒	**Gas Transmission**	☐
Electricity Transmission	☐	**Gas Distribution**	☐

Research Area

ED - Network improvements and system operability	☐
ED - Transition to low carbon future	☐
ED - New technologies and commercial evolution	☒
ED - Customer and stakeholder focus	☐
ED - Safety, health and environment	☒
ET - Network improvements and system operability	☐
ET - Transition to low carbon future	☐
ET - New technologies and commercial evolution	☐
ET - Customer and stakeholder focus	☐
ET - Safety, health and environment	☐

Problem(s)

Underground low voltage (LV) networks are complex networks where the identification and location of sustained and transient faults can be challenging. Transient faults are typically caused by aging insulation layers which gradually break down allowing water ingress and causing 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 sustained power outages. Whilst fuse replacement can restore the supply temporarily, eventually the fault will become permanent and a repair is required before restoration is possible.

These transient faults result in frequent temporary supply interruptions which affect the quality of service to customers. When these faults become permanent, pinpointing their location can provide difficult, resulting in lengthy restoration times, exacerbating the negative impact on the customers experience.

Under current practice, when a fault occurs, it can be detected through 2 complementary methods. Cable sniffing detects gas particles emitted from cable faults and thermal imaging cameras detect heat emitted from faults. However, these fault-finding technologies have limitations which make some faults difficult to detect. This project is seeking ways of improving the LV fault location techniques and increase the available options to resolve them.

Method(s)

Using novel technical methods to assess off-the-shelf technologies for their viability to complement existing tools, to provide a more holistic approach to quick pin-pointing of faults on the LV network. The method will follow a staged process as described below:

PHASE 1 - Test Network Assessment.

A range of acoustic devices and fault passage indicators (FPIs) will be trialed on a test network. This approach enables simulation of a range of faults under controlled conditions. Different acoustic devices and fault passage indicators will be benchmarked against each other so that the most technically capable ones can be identified.

PHASE 2 - Field Trials

From Test Network Trials more of the most technically capable devices identified in the foregoing phase will be obtained and passed to a selection of field teams in SEPD/SHEPD. The teams will be chosen to cover different network topographies and cable types. The trials will run for 12 months to ensure a decent representative sample of use 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 or challenges of deploying these devices in a real operational environment will be assessed.

PHASE 3 – Project Close Down

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

Scope

To assess how acoustic and FPI technologies perform when managing faults on the LV Network. The project will consist of 3 Phases

- Phase 1 - (3 Months) – Evaluation of identified technologies on a test network. Design process in preparation for field trials on DNO LV network.
- Phase 2 – (12 Months) – Field trials using technologies on sustained LV faults and transient fault circuits.
- 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 established the technical and commercial viability of the best in class of acoustic cable fault location devices and fault passage indicators working in conjunction with existing proven LV fault location technologies.
- To have maximised the portfolio of technologies available for LV fault location and made recommendations for optimal adoption of the suitable devices for business as usual use.
- To have disseminated the learning from the project through annual or exceptional events for the benefit of GB customers.

Success Criteria

This project will be deemed a success if all planned activities are completed, enabling the complete evaluation

of whether acoustic devices are suitable complementary devices for quick underground LV fault location

Technology Readiness Level at Start	Technology Readiness Level at Completion
TRL5	TRL7

Project Partners and External Funding

There are no project partners in this project and all funding will be from SEPD

Potential for New Learning

1. The suitability of acoustic technology and FPI's to assist in fault location on the LV network.
2. Identifying situations where acoustic technologies and FPI's may not be suitable to use on the LV network.
3. Acquire a better understanding of the types of fault where acoustic Technology and FPI's on the LV network can be applied.

Scale of Project

Operational staff from 9 SSEN Distribution Depots will conduct trials using acoustic and FPI's on faults on the LV network. These methods will also be used in conjunction with other equipment already being used on the LV network. Within the 18-month project, test network and field trials will be carried out to assess fault confirmation results and the benefits being produced. A project of lesser scale would be inadequate for the anticipated level of field activities

Geographical Area

Trials will be conducted as follows.

1. SEPD
2. SHEPD

Revenue Allowed for in the RIIO Settlement

None

Indicative Total NIA Project Expenditure

The total expenditure is £346,000, of which 90% (311,400) is allowable NIA expenditure

Project Eligibility Assessment

Specific Requirements 1

1a. A 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 systems and 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	☐

Specific Requirements 2

2a. Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees ☒

Please answer one of the following:

i) Please explain how the learning that will be generated could be used by relevant Network Licenses.

Knowledge acquired from testing and trials will be made available for dissemination to all distribution network operators. If the project proves that new Low Voltage Underground Fault Location Technologies 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.

ii) Please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the Project.

Is the default IPR position being applied?

Yes	☒
No	☐

If no, please answer i, ii, iii before continuing:

i) Demonstrate how the learning from the Project can be successfully disseminated to Network Licensees and other interested parties

ii) Describe how any potential constraints or costs caused, or resulting from, the imposed IPR arrangements

iii) Justify why the proposed IPR arrangements provide value for money for customers

2b. Has the Potential to Deliver Net Financial Benefits to Customers ☒

Please provide an estimate of the saving if the Problem is solved.

In conjunction with DNO investment in the final proven equipment and associated training the project will reduce CIs and CMLs by locating faults more effectively than is currently possible, reducing costly expository works. This creates a more reliable network for our customers. On top of a reduction in CIs and CMLs there will also be a reduction in operation costs as less excavation work needs to take place.

Please provide a calculation of the expected financial benefits of a Development or Demonstration Project (not required for Research Projects). (Base Cost – Method Cost, Against Agreed Baseline).

Base Cost - Method Costs over 5 years (Based on 20% 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: £813,486

Method Cost = £2,543,326

Base Case = £3,356,812

Base Cost (£3,356,812) – Method Cost (£2,543,326) = Total Saving of £813,486

Please provide an estimate of how replicable the Method is across GB in terms of the number of sites, the sort of site the Method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.

Developed methods will be based on off the shelf solutions 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.

Based on the number of units required, the expected minimum initial outlay will be around £950,000 based on adoption by SSEN alone. The total cost of rollout in GB will depend largely on the level of uptake by peer network licensees and other factors such as volume-based savings.

2c. Does Not Lead to Unnecessary Duplication ☒

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

Based on published RFI and NIA information there are no known projects being undertaken by other network licensees to develop fault location technologies using Acoustic and 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.

Additional Governance Requirements

Please identify that the project is innovative (i.e. not business as usual) and has an unproven business case where the risk warrants a limited Research, Development or Demonstration Project to demonstrate its effectiveness ☒

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

This project is a novel use of acoustic detection equipment and fault Passage indicators to help support the pin pointing of Low Voltage Underground cable faults. Acoustic and fault passage indicators are commonly used on High Voltage Networks. This alternative is a novel use in the field of Low Voltage fault finding. Working in conjunction with distance to fault equipment and current pin-pointing equipment (CableSniffer & Thermal Imaging cameras) A complete toolbox of Low Voltage fault solutions will be identified along with a process enabling engineers to tackle all types of Low Voltage faults using the correct equipment.

ii) Please identify why the Network Licensee will not fund such a Project as part of its business as usual activities

This project is outside of the Normal BAU activates and it is not, yet network proven on the Low Voltage Network. If this was to be deployed as BAU before proofing this could incur significant lost investment being attributed on to the consumer.
Similarly, as this is a trial it is not being deployed equally across the Distribution Networks business and thus cannot be considered BAU.

iii) 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 both equipment procurement, training and use of PIU for fault identification would be a significant undertaking for a novel use of a known technology.
- Operational – The use of this device during trial may at times incur additional Operation time constraints with additional work require to ensure proof of concept for the PIU being used as a fault identification unit.

Please confirm this project has been approved by a senior member of staff ☒