

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

Aug 2022

### Project Reference Number

NIA\_UKPN0082

## Project Registration

### Project Title

LV Fault Passage Indicator

### Project Reference Number

NIA\_UKPN0082

### Project Licensee(s)

UK Power Networks

### Project Start

September 2022

### Project Duration

0 years and 10 months

### Nominated Project Contact(s)

innovation@ukpowernetworks.co.uk

### Project Budget

£75,000.00

## Summary

This project will design, manufacture, test and trial a low voltage fault passage indicator (LV FPI) that can meet the requirements of a functional specification. The LV FPI will be placed underneath the cast iron bell housing of a LV link box. When fault current passes through a solid link within the link box the LV FPI will indicate that it has sensed the fault current, but will not indicate for fault current passing through solid links on adjacent phases. This will allow operational staff to isolate a faulty section of underground cable and reduce the time to restore customer supplies.

### Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

## Problem Being Solved

Low Voltage (LV) underground distribution networks are made up of underground cables, joints and link boxes (the latter provide flexibility to move demand from one substation to another). However the number of cable faults due to age and deterioration is increasing. To restore electricity supplies, Distribution Network Operators (DNOs) can isolate faults by rearranging the LV network by removing links in the link box. To restore supplies more quickly, operational staff need to determine which set of links to remove. A fault passage indicator (FPI) that senses the passage of fault current will assist in faster supply restoration. Having tested the market no supplier had a commercial product that meets our functional specification.

## Method(s)

Following an EIC Call for Innovation a supplier has been selected to design and test a LV FPI meeting the UK Power Networks technical specification "ETS 05-6005 Specification for LV Fault Passage Indicator". The network trial will consist of 100 units. The trial aims to demonstrate that the use of LV FPIs reduce the time to restore customer supplies and hence reducing Customer Minutes Lost (CMLs). For example, the LV FPI could be used with LV circuit breakers (CB) that trip and reclose if no fault is found allowing operational staff to determine which section of the LV circuit is likely to contain the defect that will eventually result in a supply

interruption.

During the trials the LV control engineer will record the location of LV FPIs and record in the fault report the success of the indication in reducing restoration times.

## Scope

The selected supplier will develop and test a LV FPI. A trial of 100 units will be carried out to prove that they meet the specification and indicate faults correctly. A number of LV circuits that historically perform poorly will be selected and LV FPIs will be installed in the link boxes along each circuit. The reason for the choice of these circuits is to increase the likelihood of faults occurring so that the reliability of the LV FPI can be assessed.

## Objective(s)

The objective of the project is to demonstrate that the LV FPI developed can reliably indicate the passage of fault current and demonstrate that it can be used with LV CB to help identify the faulty section of incipient faults that are restored by the LV CB.

The expected outcome is that customers not on the faulty section can have their supplies restored more quickly.

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

Not Applicable

## Success Criteria

A LV FPI is developed that meets UK Power Networks functional specification.

A reduction in the time to restore supplies where the fault is identified by the LV FPI.

## Project Partners and External Funding

Prysmian Cables and Systems Ltd will develop a LV FPI.

There is no external funding support.

## Potential for New Learning

A fit for purpose LV FPI that can assist in reducing the time to restore customers' supplies on healthy sections of underground cable. The results of the trial will be disseminated at Innovation events and publications.

## Scale of Project

Prysmian will manufacturer 100 units that can be installed in LV link boxes. Each LV link box will need between three and nine FPIs. This will allow about 20 link boxes to have LV FPIs deployed. The project will work with an operational team to ensure the FPIs are optimally deployed to demonstrate that the FPIs deliver the expected benefits.

## Technology Readiness at Start

TRL4 Bench Scale Research

## Technology Readiness at End

TRL9 Operations

## Geographical Area

The project will take place in LPN as central London has a large number of LV circuits that are sectionalised using link boxes.

## Revenue Allowed for the RIIO Settlement

No revenue has been allowed in the current RIIO settlement

## Indicative Total NIA Project Expenditure

Expected total cost of project £75,000

Total Allowable NIA Expenditure £67,500

## 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)

There will be a reduction in time for fault location approx. 20 minutes per LV fault where the network has multiple legs fed via link box(es).

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

The average number of incidents in LPN involving LV mains cables over the last five years is 6,852. Assuming an average of 52 customers are supplied on a LV circuit, one sixth (half the customers across one of three phases) will be restored 20 minutes quicker i.e. 9 customers, reducing CML and saving £570k. Assume only quarter of the faults are covered with LV FPI in link boxes giving the benefits shown above.

$9 \text{ customers} * 20 \text{ minutes} / 2.4\text{M (LPN)} * £1.09\text{M (CML incentive)} * 25\% = £142\text{k}$

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

UK Power Networks has over 115,000 link boxes across all three licence areas. Many will be at normal open points (NOP), but in major towns and cities these are also used to allow reconfiguration of the LV networks. Having FPIs installed in a non-NOP link box will allow faster restoration of customer supplies.

All DNOs use link boxes so could benefit. The LV FPI functional specification can be shared with the other networks, so they can carry out procurement events. Once purchased these LV FPI will reduce customer restoration times.

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

As the LV FPI will be a high volume product the expected cost of each LV FPI is expected to be less than £50. A two way link box will require three LV FPIs whereas a four way link box may require up to nine devices. The cost for rolling out this Method across GB will be dependent on the number of link boxes that sectionalise the LV circuits that mostly occur in densely populated areas.

Once the LV FPIs have been procured they can be issued to operational staff who can install the devices in LV link boxes during their normal operational duties. There shouldn't be any additional installation costs.

### 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**

n/a

**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 will deliver value in the Efficient and Effective focus area of our Innovation Strategy, by improving quality of supply and reducing CMLs where possible.

**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 will develop a simpler device than the communicating device proposed in Link Alert NIA\_UKPN0031. This projects prototype is expected to be an affordable high-volume device that only senses the passage of fault current.

**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**

LV FPIs that can be used in link boxes were tried before but have proven to be unreliable. Recent technology advances hope to demonstrate that the design and reliability has been improved.

### **Relevant Foreground IPR**

A design of LV FPI can demonstrate the requirements of the functional specification.

### **Data Access Details**

To view UK Power Networks' Innovation Data Sharing Policy, please visit [here](#).

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

There is still a risk that the technology cannot demonstrate the reliability required to allow reduced restoration times.

### **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**

There is a technical and commercial risk that the prototype developed is unable to meet the requirements of the functional specification. For example, the LV FPI does not indicate correctly or is affected by fault current flowing on adjacent phases within the link box.

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

Yes