

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 2017

### Project Reference Number

NIA\_UKPN0024

## Project Registration

### Project Title

Pole Current Indicator

### Project Reference Number

NIA\_UKPN0024

### Project Licensee(s)

UK Power Networks

### Project Start

May 2017

### Project Duration

1 year and 7 months

### Nominated Project Contact(s)

Matthew Reeves  
(Matthew.Reeves@UKPowerNetworks.co.uk), Ian Cooper  
(Ian.Cooper@UKPowerNetworks.co.uk)

### Project Budget

£282,685.00

## Summary

The scope of this project is to develop and demonstrate a device that will be able to identify those poles (and infrastructure) that have had or are in the process of having a breakdown in insulation, which is leading to a leakage of current. The principle behind the device has been proven in a laboratory, and this project aims to build upon this to develop a device which can be used in the field.

It is applicable to all GB DNOs as well as some transmission assets; transmission wooden poles and towers.

This project will address various issues that can occur when there is an insulation failure namely:

- Health and Safety issues due to electric shock;
- Quality of supply due to failure of insulation being a precursor to a permanent fault; and
- Network losses.

The confidence on this stems from the fact that a prototype working under simulated live running operating conditions has successfully demonstrated that the concept and principles work as predicted. Equally, the field trial stage will further refine the unit through iteration and provision, for this has been made in the overall project spend.

The project will be split into three stages:

- **Stage 1 (Product readiness):** The main objectives of this phase will be to complete the Research and Development on differing pole make up and produce the prototype Tags.
- **Stage 2 (Manufacture Readiness and Handheld Diagnostic Instrument):** The main objective of this phase will be to produce the handheld diagnostic instrument which shall be capable of interrogating a TST device and downloading or viewing historical fault data.
- **Stage 3 (Field trials):** The main objective of this phase will be to carry out field trials in both training and operational environments.

## Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

## Problem Being Solved

A pole experiencing breakdown in its insulating properties can represent a serious risk of electric shock for anyone (including animals) in close proximity to the pole. The fault condition may not be immediately apparent without sophisticated test equipment and may present itself on a transient basis.

Furthermore wooden pole structures are generally regarded as safe to touch at any time by the industry and the HSE, whereas in fact any pole structure can have unsafe thresholds due to faulty insulation components at which time the wood pole can become dangerous to touch.

Network losses arising from the breakdown of insulators are currently unquantified as protective relays at the substation are tested for faults under 3 - 5 k $\Omega$  and will not detect a fault below this threshold, where the resistance at the fault could be up to several M $\Omega$ . The fault and the voltage across the pole will, as a consequence of this, be present indefinitely unless there is a further failure.

Finally, there is clear evidence from research conducted to date that under certain circumstances such as heavy saline and/or factory pollution or cracked/damaged insulators when wet, impedance levels may be insufficient to prevent danger on the 11kV network from the effects of current leakage.

## Method(s)

A Touch Safe Tag (TST) Pole Current indicator will provide a visual indication of active or historical earth leakage so as to present a comprehensive picture of the insulation properties of a pole.

The TST technique to be developed is essentially straightforward in that it contains electronic components and specifically developed algorithms that measure the electricity current 'leaking' down the pole, to provide a visual indication of active earth leakage and/or evidence of historical leakage. The device is fixed to the wooden pole with no additional physical connection to ground or pole top, and in effect, uses the leaking current as its power source to trigger the indicator.

## Scope

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## Objective(s)

At the end of the Project, DNOs will have a product that when affixed to a pole will give historical and real time indicators of earth

current leakage. This will inform DNO staff of the environment into which they are entering prior to undertaking work on the pole.

At the same time, DNOs will have a facility whereby they can communicate with the general public through a process of education, that should the indicator be illuminated, it is clear at the outset that the pole has been or is hazardous and should not be touched but reported for assessment by the DNO instead.

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

n/a

### Success Criteria

The project will be deemed successful if the following are met;

- Design, manufacture and testing of initial TST device
- Design and manufacture of Handheld Diagnostic Instrument
- Successful field trials so as to promote adoption by all DNOs

### Project Partners and External Funding

n/a

### Potential for New Learning

n/a

### Scale of Project

The project is taking a working laboratory prototype, integrating it with various other technologies and developing a working field ready prototype. Approximately 100 units will be demonstrated as part of the trial. Alongside this, a smarter device with inbuilt memory will be developed with the aim to be able to interrogate further. One hand-held diagnostic instrument will be developed to provide further detail from the smarter device, with the aim to be able to analyse further detail which should enable better understanding of the problem.

### Technology Readiness at Start

TRL3 Proof of Concept

### Technology Readiness at End

TRL8 Active Commissioning

### Geographical Area

It is expected that the trial deployment will take place in both SPN and EPN areas. Specific locations will be identified in the early stages of the project.

### Revenue Allowed for the RIIO Settlement

Nil

### Indicative Total NIA Project Expenditure

£282,685

## 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)

It is estimated that a targeted deployment of the technology would deliver the following savings:

Benefits	Estimated Annual Savings (£)
Avoided Pole Replacement from fire	£10,000
Avoidance of Insulator Replacement	£92,000
Faster Fault location	£46,000
Network Losses	£40,000
Total	£188,000

It is also expected that safety benefits would be achieved but these will depend on the deployment strategy, and these have not been estimated at this stage.

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

The proposed benefits are subject to the following assumptions:

- It has been assumed that 0.2% of the unearthed HV pole population is experiencing some form of losses. This will be examined and explored further during this project.
- Assumptions have been made on the number of relevant faults, due to the detail of recorded causes.

To the end of ED1, it is forecasted that the NPV will be in the region of £540k. Yearly costs are as follows;

	Annual/£'s
Base Cost	£12,000
Method Cost	£88,000
Benefit	£188,000
Financial Benefits (Base cost - (Method cost - Benefits)	£112,000

The Base Cost used above is an estimate of what is currently spent fault finding annually on the HV overhead network in operational time, but does not return all of the benefits expected from the new method. The method costs include all expenditure required to gain

the expected benefits.

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

The issue of leakage of current on wood poles is relevant across all the GB electrical network operators. Therefore, if successful, it will provide an extremely useful tool that could potentially avert injury, loss of supply and reduce electrical losses.

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

The total number of unearthed poles in the UK is estimated to be circa 5 million. Assuming a targeted deployment to 10% of the population and a unit cost of £6 per device, the cost of rolling out the method across GB would be in the region of £3m.

### **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**

The primary benefit of the device is to identify leakage and therefore savings from reducing technical losses, CIs and CMLs along with replacing insulators identified as faulty or above a certain leakage threshold.

The issue of danger arising from a breakdown in insulation on a pole is a situation that is an issue to all of the GB network operators. Learning from this project will create a device that will not only be able to identify if an insulator is causing unnecessary electrical losses, but also if the pole is live and presenting a safety issue to operational staff and the public.

#### **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

- 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.**

n/a

**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**

n/a

**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**

n/a

**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**

n/a

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

Yes