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

Sep 2015

Project Reference Number

NIA_UKPN0010

Project Registration

Project Title

Vertical Transition Straight Joints Innovative Inspection

Project Reference Number

NIA_UKPN0010

Project Licensee(s)

UK Power Networks

Project Start

September 2015

Project Duration

1 year and 11 months

Nominated Project Contact(s)

Lynne McDonald

Project Budget

£899,396.00

Summary

The project will develop an innovative product that will define the bandwidth at which HV cable joints fail. It is planned that this will be determined by performing the following activities:

- PD data collection on HV cable joints within substations in LPN
- Analysis of PD data to have a better understanding of partial discharge in cable joints
- Retrieval of defective joint(s) for forensic analysis in the laboratory to have a better understanding of joint failure and to provide confidence in the reliability and performance of detection system
- Data collected as part of the IFI project “Cable Pit Mitigation Strategy” will also be utilised
- A final product “Canary” will be developed which will be used to monitor the health of HV cable joints within substations and cable pits to identify high risk sites for controlled repair/replacement.

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Problem Being Solved

Until 1996, joints were installed inside the sub-station in a vertical position adjacent to the switchgear. UK Power Networks have approximately 4,000 sites in the London Power Networks (LPN) area that contain these Vertical Transition Straight joints (VTSJs); there are generally 2 per site.

The problem is that there is no established mobile or remote method to detect and identify pre-fault or fault conditions of these VTSJs on 11kV cable joints. Hence, it is necessary to develop a device and method that is both mobile and remote to monitor the health of HV cable joints and detect failure modes at which HV cable joints, specifically VTSJs, disrupt so those at higher risk of failure can be

identified for controlled planned replacements to be arranged. This would also support the management of failure occurrences and collateral damage inside the substation that poses a safety hazard to the public and members of staff.

Method(s)

Investigation and trial of the existing mobile PD technology (the PD Hawk device was proven on a different asset group in the IFI project “Cable Pit Mitigation Strategy”) will be used to detect the presence of partial discharge in VTSJs to potentially identify pre-fault or fault conditions.

Partial Discharge (PD) readings on existing VTSJs will be captured through undertaking site inspections at substation sites within the LPN area of UK Power Networks using the PD Hawk device. If and when a defective joint(s) is found, the joint sample will be retrieved for forensic analysis in the laboratory at EA Technology.

Following the PD data capturing exercise and laboratory analysis of joint sample(s) retrieved, a new product “Canary” will be developed which will specify a bandwidth of partial discharge at which joints are likely to fail.

The Canary is planned to be a mobile device that can be fixed at site for a chosen period, therefore an enhancement to the existing handheld PD Hawk device that is used at a given time of day at the point of inspection. This will provide the ability to monitor PD readings overtime which may lead to improved detection of PD failure modes and subsequently improved identification of sites at higher risk of failure for controlled replacement.

Scope

The project will develop an innovative product that will define the bandwidth at which HV cable joints fail. It is planned that this will be determined by performing the following activities:

- PD data collection on HV cable joints within substations in LPN
- Analysis of PD data to have a better understanding of partial discharge in cable joints
- Retrieval of defective joint(s) for forensic analysis in the laboratory to have a better understanding of joint failure and to provide confidence in the reliability and performance of detection system
- Data collected as part of the IFI project “Cable Pit Mitigation Strategy” will also be utilised
- A final product “Canary” will be developed which will be used to monitor the health of HV cable joints within substations and cable pits to identify high risk sites for controlled repair/replacement.

Objective(s)

The aim of the project is to successfully develop an innovative product that can monitor the health of HV cable joints and identify those at higher risk of failure for their controlled replacement, avoiding their catastrophic failure and related collateral damage which is currently a safety hazard to our staff and members of the public.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success of the project will be judged against the four objectives described below:

- Successful collection of PD data capture from a number of sites with HV cable joints
- Analysis of PD captured data to define the bandwidth at which HV cable joints are at higher risk of failure
- Retrieval of HV cable joint(s) where PD readings are deemed to be defective for forensic analysis in the laboratory
- Development of a new product (“Canary”) that can be used for monitoring the health of HV cable joints and cable pits to detect those with high partial discharge for their controlled replacement

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

Trial to capture PD data on HV cable joints in LPN and retrieval of identified defective joint(s) for forensic analysis from substations in LPN.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

London Power Networks

Revenue Allowed for the RIIO Settlement

There is no allowance in the RIIO-ED1 settlement for PD detection of VTSJs.

Indicative Total NIA Project Expenditure

£618,556.90

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)

If the project is successful in developing the product "Canary", expected savings after deployment of end product will mainly be derived from:

- Increased safety and minimised risk to staff and members of the public
- Improving network security with minimum interference to customers by identifying and replacing vertical straight joints in a controlled environment
- Avoiding any emergency fault repair/replacement costs associated with vertical straight joint failure in high density areas of LPN by the introduction of Canary

The NPV analysis performed showed that the expected savings over the ED1 period are expected to be approximately £0.53m with the assumption of saving six HV joint failures per annum over ED1 period after the implementation of the Canary device.

Please provide a calculation of the expected benefits the Solution

Base Cost: £0

Currently there is no cost allocated for the inspection, maintenance of existing HV VTSJs present in LPN area of UK Power Networks.

Method Cost: £14,580

Cost of deploying the solution but not the development of technology during ED1 period at project scale. This includes the cost of purchasing two Canary products after its development to monitor VTSJ sites and cost of recourse allocation when PD exception is reported.

Benefits: £97,655

It is assumed at least one VTSJ failure can be avoided per Canary device, per year, saving of £97,655 within the project.

Financial Benefits: £83,075

Financial benefits coming from the formula provided in the CBA document.

Base cost – (Method cost – Benefits).

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

Within GB DNOs, there are a number of HV cable joints where the device developed as part of this project “Canary” can be deployed to identify higher risk HV joint sites for controlled replacement before failure. Both horizontal and vertical joints can be monitored as can cable pits. Once developed, the device “Canary” will be available off the shelf for all DNOs.

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

The technology developed and assessed is for VTSJs but it can also be applied to HV Horizontal Joints as well as cable pits. Within GB DNOs, there are many HV horizontal cable joints and cable pits where this technology can be rolled out. The device developed “Canary” as part of the project may cost between £800 and £1,000.

As the technology can be deployed to either type HV joints, it is assumed if it is deployed to the same number of either type of HV joints to each DNO as of UK Power Networks i.e. 4000; it would cost approximately £194,400 for GB rollout.

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

If successful, the learning could be used by relevant network licensees to monitor the health of HV cable joints within substations and cable pits to identify high risk sites for controlled repair/replacement.

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