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

Jun 2019

Project Reference Number

NIA_SPEN_0046

Project Registration

Project Title

Enabling Monitoring and Control of Underground Assets

Project Reference Number

NIA_SPEN_0046

Project Licensee(s)

SP Energy Networks Distribution

Project Start

June 2019

Project Duration

5 years and 2 months

Nominated Project Contact(s)

Ian MacPherson

Project Budget

£999,995.64

Summary

Linkboxes and basement sub-stations are located upto 2 metres+ underground in urban environments with limited mobile network coverage areas with limited availability of power sources.

The project enables the ability for the DNO/DSO to gain visibility of these Assets through wireless connectivity in-order to remotely monitor, analyse, report, and configure these Assets remotely which in turn removes the need for personnel to visit the site to investigate and rectify faults under normal operational conditions.

The key challenge is to identify a wireless solution which can in a cost-effective manner penetrate these underground facilities and enable the DNO/DSO to provide the same service capabilities currently available for ground-mounted sub-stations and link boxes.

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

There are various projects which could benefit from a Low Power Wide Area Network Solution, with the delivery of a modular solution comprising multiple sensors, a long life battery, and an RPMA modem which will address a wide variety of use cases for equipment in hard to reach areas, potential examples include:-

- Temperature (for example, Link Box failure detection, Dynamic Line Rating)
- Intrusion detection (for example, when outside cabinet doors are opened)
- Power measurement (for example, Overhead line faults, Project Fusion)
- Environmental (for example, floods)
- Asset Tracking (for example, mobile generators)
- Remote configuration (for example, LV sub-stations, Project Fusion)

Future DNO projects that could benefit from an LPWAN solution are as follows:

- Dynamic Line & cable Rating – sensor measurement of overhead lines and underground cables
- Fault Passage Indicators- Isolation of overhead line faults in rural areas.
- Linkbox monitoring – failure projection through temperature monitoring
· Basement substation – monitoring and control of substation assets

Linkboxes and some sub-stations are located upto 2 metres+ underground in urban environments with limited mobile network coverage areas and limited availability of power sources.

The problem to be addressed, therefore, is finding a cost-effective communications technology that can be deployed easily, provide the ability to be battery powered, and penetrate underground SP Energy Network Facilities.

Method(s)

This project will aim to investigate the feasibility of utilising the Random Phase Multiple Access (RPMA) wireless technology to achieve wireless coverage underground and in-building where other technologies can't achieve this technically or economically.

The Proof of Concept (PoC) investigation will install monitoring devices on a limited range of linkboxes and sub-stations to establish whether the communication solution can provide a cost effective technical solution.

The Location of the trial will be in Edinburgh around the New Town location where the majority of basement sub-stations and high-priority link-boxes are located from a high profile perspective. The Test Area will provide coverage to 250 Link-boxes and upto 50 basement sub-stations.

The project includes funding for multiple base stations to provide wireless backhaul from Linkboxes and Sub-Stations which will be located and deployed at SP Energy Network sub-stations.

There are three use-cases that can be deployed and demonstrated during the trial utilising off-the-shelf hardware components:

Trial Phase 1:

1) Linkbox and sub-station Temperature Monitoring
a. This is the primary use case for the trial inorder to validate and test the RPMA Wireless connectivity

Trial Phase 2:

2) Basement Substation Command & Control
a. NCP remote management to a DNP3 enabled SP Energy Networks NCP

3) LV Monitoring and Control
a. Utilising EA technologies VisNet Hub to monitor Feeders (Current, Voltage, Power etc... per Phase) and the EA Alvin Recloser status (ability to also provide Remote ALVIN Command & Control for BAU)

Scope

To enable this trial the following five key stages have been identified:

· Radio Planning and Site Surveys to identify optimal sites for the Radio Base Station equipment to cover the identified area for link-boxes and sub-stations.
· Installation utilising off-the-shelf radio modems and PT-100 sensors
· Monitoring and reporting on the wireless technology
· Trialling of SPEN specific Linkboxes and LV Feeder Monitoring solutions
· BAU Migration which prepares the solution for adoption for Business As Usual

Objective(s)

This project will aim to investigate the feasibility of utilising the Random Phase Multiple Access (RPMA) wireless technology to achieve wireless coverage underground and in-building where other technologies can't achieve this technically or economically.

The Proof of Concept (PoC) investigation will install monitoring devices on a limited range of linkboxes and sub-stations to establish whether the communication solution can provide a cost effective technical solution.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Successful deployment and operation of the Linkbox and basement substation Command & Control with the utilisation of RPMA technology, such that operation teams could have visibility of Linkboxes and basement substations through PowerOn, PI, Healthview, and any real-time analysis & alerting system.

Project Partners and External Funding

Trilliant and EA Technologies

Potential for New Learning

The ability to utilise wireless technologies to monitor and control underground electrical LV assets

Scale of Project

The trial area is the centre of Edinburgh. This 1.4km square area includes 250 linkbox locations and 50 underground substations. For the trial up to 40 locations will be remotely monitored to get a reflective view of the various challenging locations

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The trial area is the new town area of Edinburgh which is populated by businesses and consumer footfall.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£999,995.64

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)

Manual inspection of 33% of the 30000 Linkboxes a year assuming 16 per day per person and £400 a day equates to £250k per year. If manual inspection is reduced to once every six years then the average saving per year is £125k. If the Linkboxes increase to 100,000 then the saving is £417k per year
500 units out of 30,000 are replaced each year at a cost of £3.3 million (£6.6k per Linkbox) and if Proactive monitoring can reduce this by 5% then this would save on average £165k a year. If the Linkboxes grow to 100,000 then the per year saving would be £550k a year.

Please provide a calculation of the expected benefits the Solution

The base cost for 30,000 link box inspection is £250k per annum.
The method cost is £125k per annum
Therefore the expected financial benefits are £125k per annum.

Deferring the replacement of Linkboxes each year through pro-active monitoring would result in an expected financial benefit of £165k a year

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

The method will be replicable across all network licensee areas where there is requirement to deploy sensing, control and communication equipment to underground electrical assets

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

The cost to roll-out the solution across GB will be at the discretion of the respective DNOs and their internal policy requirements. However, further investigation of the potential benefits this solution can offer GB customers will be established as the project progresses.

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 wireless technology, if proven, can be utilised by other network licensees to access their equivalent underground network assets.

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.

RPMA is a wireless based technology which is deployed in selected countries but hasn't been deployed in the UK for DNO type applications.The ability to monitor link boxes is a DNO requirement but the ability to utilise RPMA for wireless connectivity to both link boxes and underground substations is a new challenge.

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

SPEN has not previously found a technology that can provide communications access to the underground assets in major cities and

RPMA would appear to enable the ability to gain access underground. The key aim of the project is to analyis and report on the ability for RPMA to be used as a cost effective communications technology that can be deployed easily, provide the ability to be battery powered, and penetrate underground SPEN facilities.

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

As the RPMA trial has the potential for benefits across all DNO and it's unproven technology within the DNOs, it will benefit from NIA support.

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

The technology risks posed by this project are high due to the innovative technology which is unproven within the DNOs. This means the project may only be undertaken with NIA support

This project has been approved by a senior member of staff

☑ Yes