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

Apr 2015

Project Reference Number

NIA_SSEPD_0004

Project Registration

Project Title

Ultrapole

Project Reference Number

NIA_SSEPD_0004

Project Licensee(s)

Scottish and Southern Electricity Networks Distribution

Project Start

April 2015

Project Duration

0 years and 10 months

Nominated Project Contact(s)

SSEN Future Networks Team

Project Budget

£45,000.00

Summary

This project is a transfer from an existing IFI project, whose purpose is to determine whether it is possible to develop a non-intrusive product that ultrasonically determines the condition of a wood pole. To deliver the project aims there is a need for an instrument that is easy to use in the field, takes non intrusive measurements, and has the ability to operate at ground level over the entire length of the pole. Such an instrument would prevent the need for digging around the base of the pole disturbing previously good ground conditions, or climbing the pole to make measurements at height. In order to create such a product, the majority of the trial will be conducted in a lab due to the low TRL of the innovation.

This project aims to complete a technical study into the feasibility for such a device with the milestones and deliverables as laid out below.

Milestones:

- M2.1 – Requirements Specification capture
- M2.2 – Mechanical Design of alpha-prototype rig and scanning head
- M2.3 – Manufacturing of alpha-prototype rig
- M2.4 – Production of Prototype Study Report

Deliverables:

- D2.1 – Prototype Study Report
- D2.2 – Detailed Proposal for 2nd phase development and exploitation activities

Third Party Collaborators

Acuity

Energy Innovation Centre

Nominated Contact Email Address(es)

fnp.pmo@sse.com

Problem Being Solved

Wooden poles are used extensively throughout the utility networks to carry LV and MV cable networks across open countryside and in rural areas. Current Health & Safety legislation requires that risk assessments are regularly undertaken to assess their health status in terms of the load bearing strength of the pole, which is usually buried to a good depth in soil or tarmac. The pole may extend to several meters in height.

Currently, this assessment requires the use of ladders and climbing equipment to assess the state of the pole close to its main load bearing area (the top one third of its length) and digging to assess the condition of the root of the pole. This is both time consuming and involves some risk to the operative, either in climbing or digging around the base of the structure

Method(s)

There are currently several invasive instruments on the market for detecting wood rot, based on both acoustic (hammer in nail, tap and listen) and ultrasonic (slice shadow) technologies. Ultrasound works in this environment by detecting changes in wood density which results in an acoustic path impedance variation between different wood densities. This change can be caused by rotted fibers within the pole, or other features such as drilled holes etc. This density change produces a discernible energy reflection at the boundary which can be analysed and visualized in an instrument. To the best of our knowledge, current products on the market adopt a variety of techniques but all are restricted to detecting rot in very close proximity to the point at which the measurements are being taken.

This technical project follows on from a previous IFI project that helped understand the underlying physics behind the principle of ultrasound being addressed within the project. This project will address three key equipment developmental challenges that will need to be solved to have a functioning product:

1. The development of a device configuration that can facilitate the water or gel borne coupling of the ultrasonic energy in the wooden pole, into a form that meets the portability requirements of ‘in the field’ deployment.
2. The development of a scanning head arrangement to work within the above device configuration that will provide the scanning geometry – identified during the first stage (IFI funded) - that is needed to image the entire volume of the pole.
3. The development of the initial processing and imaging SW required to, potentially, merge the images obtained from different circumferential points around the pole to provide the imagery required to enable the device operator to detect areas of rot or decay (i.e. abnormal ultrasonic regions within the pole)

Scope

This project is a transfer from an existing IFI project, whose purpose is to determine whether it is possible to develop a non-intrusive product that ultrasonically determines the condition of a wood pole. To deliver the project aims there is a need for an instrument that is easy to use in the field, takes non intrusive measurements, and has the ability to operate at ground level over the entire length of the pole. Such an instrument would prevent the need for digging around the base of the pole disturbing previously good ground conditions, or climbing the pole to make measurements at height. In order to create such a product, the majority of the trial will be conducted in a lab due to the low TRL of the innovation.

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Objective(s)

1. Demonstrate the underlying physics principles can detect a change of wood condition
2. Define the mechanical design of the prototype test rig
3. Manufacture the prototype rig
4. Evaluate the performance of the prototype rig in a lab environment

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

1. Successfully demonstrate the ability of the underlying physics
2. Build a prototype that is able to detect a change in wood condition

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

Scale of the project is small, focusing on proving the concept within laboratory conditions

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

Laboratory work – potential site measurements completed in DNOs patch

Revenue Allowed for the RIIO Settlement

At this stage no saving on expenditure can be expected during project implementation.

Indicative Total NIA Project Expenditure

The indicative Total NIA Project Expenditure is £45k, 90% of which (£40.5) is Allowable NIA Expenditure.

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)

The device could reduce the need for pole replacement with significant associated cost savings.

Please provide a calculation of the expected benefits the Solution

£123,829,628 - £121,404,621 = £2,425,007 (NPV)

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

As all license operators extensively use wood poles for their Distribution networks, this technique would be of benefit to all operators.

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

(Unit cost * units/area * license area) + (license area * training costs) = £1,425,000

Assumptions
- Unit cost is £8,500
- 25 units bought per license area
- Training on unit use £25,000 per license area
- 6 license areas

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

All network operators have a large fleets of wood poles used through their networks. As such the learning will be very applicable to all DNOs and TNOs.

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