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NIA Project Registration and PEA Document

Date of Submission

Jan 2020

Project Reference Number

NIA_SSEN_0044

Project Registration

Project Title

Smart Hammer

Project Reference Number

NIA_SSEN_0044

Project Licensee(s)

Scottish and Southern Electricity Networks Distribution

Project Start

February 2020

Project Duration

4 years and 2 months

Nominated Project Contact(s)

Kevin Dennis

Project Budget

£930,000.00

Summary

The challenge when using a standard hammer to assess the pole condition is sound perception of an individual and associating it to the correct asset health score. A standard hammer is also unable to provide granular detail of a pole condition or automate the same data directly into an asset database. These sounds can be perceived differently depending on the operator, therefore providing inconsistent data.

Third Party Collaborators

Spectral Line Systems Ltd

Abelon

University of Strathclyde

Energyline Ltd

Tirna Electronics Ltd

Thor Poletest

Sorbus

Energy Innovation Centre

EA Technology

ACUTEST

ResiDrill

Nominated Contact Email Address(es)

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Problem Being Solved

Wood poles are typically used as a structure support on electricity distribution overhead line networks in the UK. Like other assets, there is a statutory requirement to inspect their integrity on a regular basis and this is usually addressed through simple visual inspection and hammer testing. Achieving consistent accurate data is a challenge, which can lead to inefficiencies with follow on works.

The Hammer test is used to identify the presence of internal or external wood decay through the feel of the hammer striking the wood and the sound this produces. Overhead Linesmen test poles as a safety check, before attempting to climb poles to carry out their duties. Asset Teams use overhead line assessor operatives to test wood poles as part of their daily duties capturing and recording the status of our network for Asset replacement planners.

The method of testing a wood pole is to use a standard hammer to strike the pole and for the operative to assess the audible response as an indication of the quality of the asset. However, the outcome of this assessment only provides basic information such as pass, fail, suspect. This is then used by the linesman to determine whether the pole is safe enough to climb or not. In parallel, the Asset assessment team has been trained to interpret the sound of the hammer strike into a score in the range of one to five. This information enables subsequent decisions regarding pole replacement.

The challenge when using a standard hammer to assess the pole condition is sound perception of an individual and associating it to the correct asset health score. A standard hammer is also unable to provide granular detail of a pole condition or automate the same data directly into an asset database. These sounds can be perceived differently depending on the operator, therefore providing inconsistent data.

Results from initial inspections, referred to as Health Classifications, are collected and form part of the asset database. When an operative identifies a suspect pole classification there will be a requirement for a secondary more detailed, time consuming and costly assessment of the wood pole to specifically identify the extent of decay or damage.

The secondary test would be carried out by a different and more experienced operative who would be competent in using secondary pole testing equipment.

Method(s)

1. Development of Smart Hammer. This will be carried out within 6 stages, including factory testing and small sample field tests.
2. Trials will take place across all SSEN Operational Regions to test and prove the Smart Hammer on poles within the networks. I.T implementation will also be carried out during these trials

Scope

STAGE 1 - SMART HAMMER DEVELOPMENT - X-Models

- X Model Development
- Define Hammer Evaluation Test strategy
- Evaluate Accelerometer sensors
- Make Sensor Selection

STAGE 2 - SMART HAMMER DEVELOPMENT - A-Models

- A Model Development
- Create automated testing environment
- Determine Utilization Parameters
- Develop Data extraction
- Field Trial Smart Hammer to Identify the Sensor Selection.
- Create Draft Training Material

STAGE 3 - SMART HAMMER DEVELOPMENT- B-Models

B Model Development. Refine & Build Prototype Hammer with finalised Sensor Selection

SSE Evaluate IT System for Maximo Integration

Refined Automated Swing Test for operational improvement

Prototype Field Trials & Evaluation

STAGE 4 - SMART HAMMER DEVELOPMENT - Pre- Pod-Models

Build Pre-Production of finalized Hammer

I.T – Maximo integration

Data Analytics Trial

Pre-Prod Models Field Test & Evaluation

Policy & Procedure to approve network testing.

Create Training Material

STAGE 5 - Field Trials

Undertake Field Trials

Capture Trial Data

Field Trial Evaluation

Compare Baseline & Field Trials

Recommendations for BAU

STAGE 6 - Closure

Finalize Policies & Procedures

Finalize Training Material

Objective(s)

By the end of the project

1. To have established the technical and commercial viability of using a Smart Hammer with accurate and repeatable results.
2. Conduct consistent and reliable initial wood pole inspections as an alternative to the traditional hammer test method.
3. The ability to capture pole data and integrate with asset databases
4. To have disseminated the learning from the project through annual or exceptional events for the benefit of GB customers.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

1. Early identification of equipment not to take through development phases and field trials.
2. Ability to test poles within asset health scoring matrix.
3. Ability to detect pole replacements without the need for secondary invasive techniques.
4. Ability to notify systems that secondary testing is required with more advanced technical equipment.
5. Low cost Smart Hammer which is affordable to issue to all overhead line assessors and linesmen.
6. Efficient consistent pole test scores no matter who uses the hammer.
7. Ability to capture the information from the Smart Hammer in the asset database via a Smart Phone application.
8. Ability to capture granular detail of pole condition to enable desktop assessments for efficient planning.
9. Ability to demonstrate wood pole asset health with accuracy – Data assurance and improve accuracies in reporting.
10. Opportunity to improve and make internal processes more efficient adopting Smart Hammer as a front-line tool and a create a

response matrix.

Project Partners and External Funding

n/a

Potential for New Learning

All licensees which use wooden poles will benefit from the development of a Smart Hammer that can assess the condition of wooden poles that is both accurate and efficient in application. This will allow for a significant improvement in the quality of the asset condition data for these assets.

Scale of Project

Operational staff from seven SSEN Distribution Regions will conduct trials using Smart Hammer on their network. These methods will also be used in conjunction with other equipment already being used on the network.

Within the duration of the project, product development, factory tests and field trials will be carried out to assess Smart Hammer output. A project of lesser scale would be inadequate for the anticipated level of field activities.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

Trials will be conducted in SEPD and SHEPD licence areas.

Revenue Allowed for the RII Settlement

None

Indicative Total NIA Project Expenditure

The total expenditure is £820,000 of which 90% (£738,000) 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)

Base Costs (per year):

Secondary Inspection cost = £286,747

Total cost = £286,747

Method Costs (per year): Breakeven

Smart Hammer costs = £60,360

Secondary Inspection cost = £225,383 (@ 21.4% reduction in secondary inspections)

Total cost = £285,743

Increased benefits will be achieved with higher reduction in secondary inspections

30% Reduction in secondary inspections = £86,024

40% Reduction in secondary inspections = £114,699

50% Reduction in secondary inspections = £143,374

60% Reduction in secondary inspections = £172,048

70% Reduction in secondary inspections = £200,723

Please provide a calculation of the expected benefits the Solution

Base cost – Method cost = £286,747 – £285,743 = £1,004 benefit per year for 21.4% reduction in secondary inspections.

Additionally, there will be a £28,675 benefit per year for each 10% additional reduction in secondary inspection. Benefits from IIS

reduction are excluded.

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

Developed methods will be based on the development of the Smart Hammer and will be fully transferable to all DNOs who want to acquire them. The method would have the potential to be deployed to all applicable field teams.

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

Costs and the associated benefits can be extrapolated out to include other GB networks if the technology is taken up. These will depend on the region-specific requirements, i.e. number of units required, number of poles on the network etc.

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

This technology could standardise the inspection protocol for overhead line wood poles in the industry throughout the UK.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

1.1 Asset health and Productivity (Service, Safety); Specifically:

- Cost-effective asset monitoring and accurate knowledge of the state of our assets
- New methods of asset health assessment

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.

There are existing solutions and a current NIA project which investigates pole testing equipment. However, these new tested solutions are only for secondary, more in-depth assessments, and not the initial testing done every day. Secondary equipment is too expensive, complex and not practical to be used as a front-line tool to test poles. Smart Hammer is a low-cost instrument used as an everyday tool that will reduce the need for use of secondary testing equipment.

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

The project is innovative as it is developing and trialling a novel solution that has not been done in the UK before now.

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

There are no funds available within the RIIO-ED1 settlement to carry out this type of project. The TRL of the tool being developed is also too low to be funded by BaU and as such requires additional resources to be spent on it before it can reach BaU readiness.

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 within this project is unproven with a high level of cost uncertainty in the finalised product, placing the business case in the high-risk category. It would therefore not attract BaU funding from the business. The method developed by the project will be replicable across all network areas, therefore it requires NIA support.

This project has been approved by a senior member of staff

Yes