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NIA Project Registration and PEA Document

Date of Submission

Apr 2017

Project Reference Number

NIA_SPEN0021

Project Registration

Project Title

Endbox G38 Level Detection

Project Reference Number

NIA_SPEN0021

Project Licensee(s)

SP Energy Networks Distribution

Project Start

May 2017

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Andrew McDiarmid

Project Budget

£80,000.00

Summary

This project will have 2 work packages:

1. Ultrasound Parameter selection

In this work package, the optimum ultrasound transmitters and receivers will be determined through experimentation on G38-filled equipment. This will also determine the optimum frequency or frequency range which may be used. The results of this will be drafted into a specification document.

2. Field Testing

This work package consists of testing the system in the field. This will require technician training, following which the system will be trialed in a series of varied substations as a series of substation inspections. The results of this testing will be recorded, and the results used to inform a policy document for the use of this equipment in the field.

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

A large number of transformers and switchgear on our networks use G38 compound in their endboxes as an insulator. The endboxes should be either full or almost full of G38 to ensure safe operation and reduce the risk of a flashover occurring. However, the G38 can leak out of the end box down the cables or through gaps in the box. Additionally, air pockets or voids may form in the body of the compound. Both of these issues will reduce the effectiveness of the G38 as an insulator, and can cause a flashover if not addressed.

Identifying these issues is difficult, however; while the G38 which leaks can stain the endbox or form puddles, these can't always be identified as G38 leaks, and are often cleaned up with no follow-up action. As such, endboxes with reduced levels of G38 are often unidentified. As a result, there have been a number of instances where a flashover has occurred, causing a large amount of damage to the substation and the substation equipment.

Previously, it had been suggested that a hammer or mallet could be used on the end box at various levels, and the resultant sound listened to to determine where the G38 level was. Aside from the safety concerns this raises (that is, that hitting an empty or partially empty end box with a hammer could cause internal damage that leads to a flashover), initial tests have shown that the sound difference is minimal and not sufficiently perceptible, due in part to the thickness of the end box metal.

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Method(s)

We have carried out an initial test of ultrasonic technology which has given us confidence that this technique has the potential to provide a reliable indication of G38 level. The project will develop a framework and methodology for determining whether an end box has a low level of G38 compound. This will be developed through the use of ultrasound equipment, applied in a novel way, and with experimentation to determine the optimum equipment and parameters for that application.

Scope

This project will have 2 work packages:

1. Ultrasound Parameter selection

In this work package, the optimum ultrasound transmitters and receivers will be determined through experimentation on G38-filled equipment. This will also determine the optimum frequency or frequency range which may be used. The results of this will be drafted into a specification document.

2. Field Testing

This work package consists of testing the system in the field. This will require technician training, following which the system will be trialed in a series of varied substations as a series of substation inspections. The results of this testing will be recorded, and the results used to inform a policy document for the use of this equipment in the field.

Objective(s)

The main objectives of this project regard the use of an ultrasound device to allow the level of G38 compound in an end box to be determined. This will require the verification of the technique on a wide variety of end boxes resulting in the generation of a policy document which will inform the further use of ultrasound devices in this way, and provide a framework for other licensees to make use of ultrasound equipment to detect G38 levels.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The delivery of the above objectives, within budget and within agreed timelines, as is reasonable depending on the knowledge at this stage of the development phase.

The project will be managed within SPEN applying due diligence and best practices where appropriate.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The scale of the project is appropriate for developing the parameters for the use of this technology. Testing on a smaller scale would not guarantee sufficient data to prove the efficacy of ultrasound for this application.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

The device will be tested in a number of sites across SP Energy networks. This will allow the technology to be tested across a wide and diverse range of devices.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£80,000

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 particular saving depends on the equipment; as an example, a recent incident involving a G38 endbox cost £70,000 to repair the damage caused and replace equipment. This cost, along with the additional cost of interruptions to customers and the potential for severe injuries or fatalities, can be avoided through the use of a detection method.

Please provide a calculation of the expected benefits the Solution

N/A – As outlined above, the savings are dependent on the equipment and the scale of the issues identified.

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

The project can be rolled out across all licensees, and it can be applied to all sites which have G38 equipment. This can be integrated into the usual substation inspection routine.

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

The rollout costs are not possible to determine at this stage as they are dependent on the final cost of the selected transmitters, receivers and ultrasound signal generator per unit, and the number of units each licensee would buy.

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 trialed 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

RIO-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 licensees have equipment which uses G38 as an endbox insulator. The issues which G38 endboxes have are, therefore, experienced by all licensees. As such, the learning which are generated through this project will be relevant to and usable by all licensees.

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