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

May 2014

Project Reference Number

NIA_NGET0149

Project Registration

Project Title

Investigation of Aeolian Insulator Noise

Project Reference Number

NIA_NGET0149

Project Licensee(s)

National Grid Electricity Transmission

Project Start

May 2014

Project Duration

2 years and 2 months

Nominated Project Contact(s)

Richard Morris

Project Budget

£90,000.00

Summary

The purpose of the project is to determine the source of the problem (i.e. inherent design flaw giving rise to audible tone from insulators under certain wind conditions) with a view to developing a type test that will remove this problem in the future.

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

National Grid uses a range of insulator types on its overhead line transmission network, Insulators can be made of glass, porcelain or polymeric materials, each potentially to a number of designs and specifications. In recent years there has been a preference to install glass insulators as these are readily recyclable at end-of-life.

Under certain wind conditions overhead line insulator strings may resonate resulting in an audible tonal noise. This has resulted in a number of complaints in recent years, most commonly from people living near overhead line routes refurbished with glass insulators.

Method(s)

The issue is to be fully investigated through wind tunnel testing of known “problem” and “non problem” insulators. The wind tunnel at MIRA is one of the few in the world capable of testing full scale structures and a special rig will be adapted to take heavy strings of up to 20 insulators drawn from across National Grid. The method will be to vary wind speed and insulator string angle at 0.5° increments and listen for audible tones. Specialist noise monitoring and recording equipment will be set up to record objective results, and investigations will be carried out to determine the exact source of each tone as far a reasonably practical.

Manchester University will be engaged to model the theory of Aeolian mechanisms on insulators which will support and inform the MIRA testing and also help interpret the results.

The outputs of the R&D will be to devise a revised and improved testing procedure for insulators and to embed this into insulator procurement and design processes, and most importantly to feed back findings to select most appropriate solution(s) (i.e. informed insulator replacement) for existing lines with wind noise problems.

Scope

The purpose of the project is to determine the source of the problem (i.e. inherent design flaw giving rise to audible tone from insulators under certain wind conditions) with a view to developing a type test that will remove this problem in the future.

Objective(s)

Development of a revised type test and an associated reduction in future noise complaints

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project will be:-

There are several steps to this work and success criteria for each are given below:

- Report from Manchester University regarding the theory of Aeolian and resonance mechanisms in insulators
- Successful completion and erection of the insulator test rig
- Successful replication of Aeolian generated noise in controlled wind tunnel environment
- Update to relevant policies and procedures to define new test regime for type registration

Project Partners and External Funding

MIRA, Nuneaton – wind tunnel test facility

University of Manchester – Acoustic modeling expertise

Mosdorfer CCL, Oakham – modifications to wind tunnel test rig.

No external funding.

Potential for New Learning

This problem has been discussed with partners and no known research into this issue applicable to National Grid has been forthcoming. We will understand better the mechanisms involved in the generation of audible tones from insulators, the relevant parameters that cause wind noise and how different types and designs of insulators react to wind.

Scale of Project

The project will involve computer modeling and lab-based assessment.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The wind tunnel testing will take place at the Motor Industry Research Institute (MIRA), located near Nuneaton in Warwickshire. Manchester University's School of Mechanical, Aerospace and Civil Engineering, based in Manchester, will carry out computer modelling and provide expert advice. Mosdorfer CCL are based in Oakham and have been contracted to modify an insulator test rig.

Revenue Allowed for the RIIO Settlement

Zero.

Indicative Total NIA Project Expenditure

The total project expenditure is £90,000

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)

This work will help to reduce the number of complaints due to this problem which in turn will reduce spending on insulator replacement. The cost of investigating complaints can vary widely but can typically take 1-2days of staff time plus the cost of sophisticated equipment and travel. The cost of replacing a set of suspension insulators (two circuits) is typically to be £10,000 per tower, not including outage costs.

Please provide a calculation of the expected benefits the Solution

Not required for research projects

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

The outputs of this work will change National Grid's specification for OHL insulators and as such be applicable to all future insulators purchased.

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

The only costs will be those required for the resource to update relevant policies and specifications and communication of changes across the business. This is expected to be less than £10,000.

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

Many companies will use the same insulators as National Grid and as such the results should be applicable to all operators of 132, 275 and 400kV overhead lines

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.

National Grid has already engaged with industry bodies and academia on this issue. No known literature relevant to the UK is known to exist.

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