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

Mar 2017

Project Reference Number

NIA_NGET0206

Project Registration

Project Title

Novel methodology for assessing environmental exposure of OHL routes

Project Reference Number

NIA_NGET0206

Project Licensee(s)

National Grid Electricity Transmission

Project Start

May 2017

Project Duration

1 year and 7 months

Nominated Project Contact(s)

Jonathan Hennah

Project Budget

£990,000.00

Summary

The scope of this project is to further develop the techniques identified for classifying wind exposure of OHL line routes and incorporate corrosion risk in order to better understand the effect of environmental inputs on conductor deterioration. The project will combine novel corrosion and mechanical wear models developed using advanced weather data and conductor response models.

The project can be split into the following work packages.• Corrosion classification based on weather and pollution modelling • Mechanical wear classification based on weather and mechanical response model• Verification of model and environmental risk classification against condition information

The inputs to the project will be learning from the previous NIA project, advanced weather data, pollution data, mechanical response model, corrosion standards, and asset condition data. The output of the project is a risk classification and probability of condition state for each span section of OHL route based on the mechanical frequency response in terms of cycles per year and a corrosion risk based on ISO corrosion standards which can be equated to material loss per year.

This project will be limited to ASCR circuits.

Nominated Contact Email Address(es)

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Problem Being Solved

One of the key factors that affect deterioration of OHL (Over Head Line) routes is the environmental conditions which they are exposed to. The two primary environmental factors which lead to OHL degradation are:
1. Conductor wear caused by motion of conductors due to wind input
2. Corrosion resulting from deposition of chlorides and other aerosols

National Grid's current method of environment exposure classification is based heavily on distance and elevation. Geographical and

climatic variability in the UK poses significant challenges for asset management of OHL routes because deterioration of OHL systems is highly dependent on localized environmental conditions.

This project proposes to trial a new approach to modelling overhead line deterioration by developing a robust environmental classification system using advanced weather data and pollution data combined with mechanical wear models and recognised international standards, to understand the environment as a modifier to degradation of OHL conductor and fittings systems. The accuracy of the model will be tested against existing condition data to establish whether it represents a reliable improvement to our existing approach.

If proven successful, this would improve OHL asset management by enabling optimization of asset investment through targeting the right assets at the right time and providing a clearer understanding of asset deterioration and likelihood of failure over time.

Method(s)

This project will develop a novel weather based methodology to predict environmental risks by combining advanced weather data, pollution data and mechanical wear models. This project will develop and further verify the methodology created in project NIA_NGETO181. The project will be delivered by undertaking the following steps:
• Creation of corrosion classification based on advanced weather and pollution modeling in line with ISO standards
• Creation of mechanical wear classification using advanced weather data and mechanical response models for OHL's
• Development of a combined risk classification system for the environmental input on OHL systems

The model will estimate wear in terms of number of vibration cycles and corrosion in terms of estimated material loss per year. The outputs of the wear and corrosion model will be validated against asset condition information including repairs and defects data in order to create the environmental risk classification system and to understand the effect of the environment as a modifier on OHL ageing. Project NIA _ETO181 has provided an initial proof of concept for modeling mechanical wear of OHL conductors in a variety of wind exposed environments using advanced weather data. However, to understand the total environment input over time a combined model of corrosion and wind induced motion needs to be developed. To verify the model effectively, a larger sample of routes is required across the full range of OHL operating environments.

The model will be route specific because it relies on localised weather and historic corrosion data for each area. To provide a sufficient sample size and enable delivery of the project objectives, the project will be trialed on National Grid's ACSR (Aluminum Conductor Steel Reinforced) routes.
The method has been selected as it provides a more accurate and repeatable determination of environment input to OHL systems. The proposed method of classification allows relationships to be drawn across all spans/towers between defect, failure rate and asset life. It will then be possible to more confidently infer future condition states of younger assets where there are fewer historic defects, failures and condition assessments.

Scope

The scope of this project is to further develop the techniques identified for classifying wind exposure of OHL line routes and incorporate corrosion risk in order to better understand the effect of environmental inputs on conductor deterioration. The project will combine novel corrosion and mechanical wear models developed using advanced weather data and conductor response models.

The project can be split into the following work packages.
• Corrosion classification based on weather and pollution modelling
• Mechanical wear classification based on weather and mechanical response model
• Verification of model and environmental risk classification against condition information

The inputs to the project will be learning from the previous NIA project, advanced weather data, pollution data, mechanical response model, corrosion standards, and asset condition data. The output of the project is a risk classification and probability of condition state for each span section of OHL route based on the mechanical frequency response in terms of cycles per year and a corrosion risk based on ISO corrosion standards which can be equated to material loss per year.

This project will be limited to ASCR circuits.

Objective(s)

To produce a novel methodology for the classification of total environmental input to OHL Systems in order to better understand the

environment as a modifier to OHL conductor and fittings degradation.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

This project will provide a new methodology for classifying environmental risk for OHL conductors and fittings base on environmental exposure. The project will be successful if the classification system developed proves to be accurate when verified against asset condition data.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

Project NIA_NGET0181 provided proof of concept for the technique of modeling wear risk for OHL routes. This project will develop the concept further and include corrosion risk. The model will be developed using ACSR conductor routes, which equates to 3390 route km. Verification of the new modelling method by comparison against existing condition data is key to proving the success of the method. The scale of the project is required to provide a sufficient size for verification to be meaningful and enable delivery of the project objectives.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

England and Wales

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£990,000

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 project will provide benefit to the customer through improved understanding of where resources are required to manage asset risk levels. Specifically this will include:
1. Optimisation of operating expenditure on condition assessment and painting where assets that see the greatest challenge from the environment are more frequently visited than those that see the least.
2. Enable greater understanding of the effect that the environment has as a modifier to conductor and fittings deterioration and support development of technical asset life for ACSR conductor systems.
3. Increased granularity of environment inputs and therefore provide a clearer understanding of capital investment priorities. This can improve the efficiency or effectiveness of an investment portfolio through better timing of major asset spend and support of minor, targeted spend to manage the reliability of overall circuits.

Please provide a calculation of the expected benefits the Solution

The project will deliver benefits through optimisation of OPEX expenditure and a potential reduction in CAPEX expenditure. The estimated cost benefit for savings on CAPEX expenditure from 2019 -2029 is £28.6 million. This estimate is based on deferring some OHL investment either during the period 2019 -2029 or beyond.

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

The methodology for classifying OHL routes based on environmental exposure will be applicable to the same or greater extent across all LNO's with OHL assets however, the information generated from this project will be route specific.

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

The cost of rolling this out across the GB network will be dependent on the LNO's requirements but it would cost around £290 per km of OHL route.

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 project will provide a methodology for an environmental risk classification system for OHL conductors and fittings and will develop an understanding of the link between environmental exposure and asset deterioration. If successfully verified this methodology for classifying environmental risk of OHL routes could be used by other LNO's for their OHL routes although route specific environmental data would be required.

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

This project fits within the value area of the Electricity Innovation Strategy:

Managing Assets - Managing assets throughout their lifecycle

☑ 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