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

Aug 2019

Project Reference Number

NIA_NGTO034

Project Registration

Project Title

Environmental Exposure of Overhead Lines: Data Delivery for Physical Testing

Project Reference Number

NIA_NGTO034

Project Licensee(s)

National Grid Electricity Transmission

Project Start

September 2019

Project Duration

1 year and 4 months

Nominated Project Contact(s)

Ben Muncey

Project Budget

£886,000.00

Summary

One of the key factors affecting deterioration of overhead line (OHL) routes is the environmental conditions to which they are exposed. The two primary environmental factors which lead to OHL degradation are:

- Conductor wear caused by motion of conductors due to wind input
- Corrosion resulting from deposition of sulphur dioxide and chlorides (and local weather conditions)

Asset health models exist for capturing the risk to assets due to the environmental factors above. Determining correlation between the model and existing weather and condition data sets has allowed approaches to asset management to be refined, however, in order to maximise the benefit from these models, there must be confidence that predictions from the model correlate with the conditions observed on the network.

Nominated Contact Email Address(es)

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Problem Being Solved

One of the key factors affecting deterioration of overhead line (OHL) routes is the environmental conditions to which they are exposed. The two primary environmental factors which lead to OHL degradation are:

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- Corrosion resulting from deposition of sulphur dioxide and chlorides (and local weather conditions)

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model and existing weather and condition data sets has allowed approaches to asset management to be refined, however, in order to maximise the benefit from these models, there must be confidence that predictions from the model correlate with the conditions observed on the network.

As outlined within NGET's OHL Innovation Strategy, it is proposed that artificial ageing testing is undertaken (as well as modelling/simulation and further validation) to improve understanding of the behaviour of conductor systems. To determine the input for parameters to perform the testing, more detailed data than is typically output from asset health models is required.

If desktop asset health models can be verified in this way, it may be possible to extend OHL asset lives, allowing further optimisation of replacement and maintenance strategies, providing significant value to the consumer.

Method(s)

This project will make use of several numerical models to generate environmental and asset health data for OHL assets, in a form that will subsequently allow verification by physical testing. These models include:

- Numerical weather prediction model
- Turbulence intensity model
- Conductor icing model
- Aeolian vibration model
- Conductor galloping model
- Pollutant deposition model
- Corrosion model

Assuming sufficient accuracy can be demonstrated, using desktop numerical models is a cost-effective approach for generating OHL environmental exposure information, when compared to destructive testing or extensive inspections. The results from these models may be compared to:

- Accelerated ageing experiments
- Corrosion field measurements
- Past observed galloping events

Due to the fact that many thousands of OHL assets are exposed to the environment for decades, time series data for each asset results in large volumes of data. Long-term averages are not detailed enough however, when comparing outputs to physical tests. A practical approach to delivering asset health data, whilst balancing these two considerations, will be determined in the final phase of this project.

Scope

The project will deliver asset health data at span level, using localised simulated weather data. The asset health data will include:

- Aeolian vibration risk levels
- Conductor galloping risk levels
- Corrosion risk levels
- Asset life modifiers

The project will also investigate the key variables (beyond the outputs listed above) that may be required by other asset health modelling approaches, or when making comparisons to physical tests. Any variables idenfitied in this phase will be delivered in a suitable format, with practicality in mind, considering the potential overheads required to handle large volumes of data.

Objective(s)

To produce OHL asset health data that can be verified through physical testing.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be considered successful if the asset health data can be genereated for all OHL routes and packaged to allow use during physical testing.

Project Partners and External Funding

Not applicable

Potential for New Learning

The project should provide;

- An understanding of the data typically required for OHL asset health models and comparisons to physical tests, including provision of such data.
- Best-practice approaches to data handling when dealing with thousands of assets and many different measures of environmental exposure.

Scale of Project

Asset health data will be provided for over 4,000 km of NGET's OHL network. Environmental data will be provided for the full NGET OHL network. These assets are geographically diverse, and will cover a broad range of environmental exposure conditions. This will ensure that results from this project can be compared to a variety of physical tests.

For example, if a corrosion measurement campaign is conducted across the UK, it is likely that most measurement sites will be in a relatively close proximity to an OHL asset with data generated during this project.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

This project consists of the use of software and data to undertake computer modelling.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£886,000

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)

A one year delay to conductor replacement schemes planned in RIIO-T2 would result in significant savings. However, the majority of these replacement schemes relate to fully greased (FG) ACSR conductor to which a 10 year life extension has already been applied. Whilst it is possible that this project will contribute to a further life extension of FG ACSR conductor, it is more likely that the benefit will relate to core only greased ACSR or AAAC.

Please provide a calculation of the expected benefits the Solution

Assuming that a 5 year life extension could be applied to a third of conductor replacement schemes planned between 2023/24 to 2025/26 and that there are no other impacts to the plan that might influence the opportunity, a benefit of £16m would be realised.

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 Network Licensees 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 requirements of individual network licensees but it would likely cost around £200 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 recommendations, applicable to all utilities operating overhead lines, on how to combine model data and physical tests/records in relation to asset health.

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.

The work builds on the findings of previous NIA projects, including:

- Classification of Wind Exposed Overhead Line Spans [NIA_NGET0181]. This project aimed to develop understanding of how wind forces affect OHL assets, in terms of short-term and long-term damage.
- Novel Methodology for Assessing Environmental Exposure of OHL Routes [NIA_NGET0206]. This project developed the techniques identified for classifying wind exposure of OHL line routes and incorporated corrosion risk in order to better understand the effect of environmental inputs on conductor deterioration.

This project, however, focuses on the provision of data that can be compared to physical tests. This will lead to utilities being able to successfully implement desktop asset health models, with the potential to extend the life of assets and pass the cost savings to consumers.

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

Asset management models are continually being developed to provide improved reliability and accuracy. Consideration of the specific characteristics of individual spans has not previously been considered in this detail previously. If strong correlation can be demonstrated between modelling, physical testing and the defects observed on the network, it will allow further refinement of the approach to determining asset health.

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

Uncertainty remains over the data requirements for physical testing. As such, the provision of data needs to provide sufficient granularity to allow use in different needs cases. Realisation of the full benefit of this work will rely on the successful outcome of multiple innovation projects.

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 use of NIA funding ensures that learning obtained from the project is shared with other network licensees, maximising any benefit to the U.K. consumer.

This project has been approved by a senior member of staff

☑ Yes