NIA Project Registration and PEA Document

Date of Submission

Mar 2018

Project Reference

NIA_NPG_025

Project Registration

Project Title

Lightning Prediction

Project Reference

NIA_NPG_025

Project Licensee(s)

Northern Powergrid

Project Start

March 2018

Project Duration

2 years and 7 months

Nominated Project Contact(s)

Michael Rice

Project Budget

£250,000.00

Summary

Lightning prediction application.

Nominated Contact Email Address(es)

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Problem Being Solved

Lightning strikes are an inherent danger and concern to the electricity distribution system, and although there are systems available to detect lightning strikes that have already occurred, and to some extent forecast lightning from a wider perspective, there are currently no lightning strike prediction tools that can indicate the likelihood of a lightning strike within the next hour within a nominated 1km2 area.

From a safety perspective, approximately 60 people a year are struck by lightning with a number of them being fatal. Extensive network equipment damage is also caused by strikes with the consequences ranging from supply outages to delays in planned maintenance work.

The ability to better predict lightning strikes would ensure a safer operational environment for field staff and would help in the anticipatory operational deployment of resources to those areas of the network where asset damage, as the result of lightning was expected. Additionally verification of predictions would potentially influence planning and investment to harden those parts of the network most at risk from repeated damage. This would result in a safer and more reliable network and provide a system to assess the impact of climate change on network operations.

Method(s)

This project aims to take existing historical lightning data coupled with new real-time data and analysis and , through a programme of software development, produce an API (Application Programming Interface) based, mobile tool with a web interface capable of predicting lightning risk to people and risk of network asset damage with a much improved geographic certainty over currently available systems. Implications for operational processes to support the improved notice and analysis of lightning strike location will be undertaken.

Scope

The scope of the project is all assets at all voltages potentially subject to damage lightning strikes. The key impact is expected to be at HV and EHV.

Objective(s)

The project will:
Identify and develop suitable existing data sets and data analysis algorithms and techniques which could be used to provide fault anticipation functionality
Develop a web-enabled software tool, building on existing and new databases, to predict lightning activity to a geographic area of 1km x 1km.
Field test, verify and refine this tool.
Assess operational implications of tool use.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

For this project to be considered a success the primary objectives will be met and prototype lightning prediction algorithms and functions will be demonstrated, in an appropriate "field-ready" application.
Dissemination of the learning to the Distribution Network Operator community is also regarded as key success criteria.

Project Partners and External Funding

None

Potential for New Learning

Current lightning prediction tools are not capable of predicting potentially dangerous strikes to with sufficient geographic or temporal certainty. This project aims to use both historic data and real time information to improve this. This has not been achieve previously and as such the learning generated is new and of relevance to all electricity system operators.

Scale of Project

The project is primarily desktop/laboratory scale. During the initial stages of the project the scale of the project as the prediction methods are researched and algorithms developed the project's scale will be small. As the project develops limited field deployment on a pilot basis will be undertaken. Full-scale roll-out is an issue for later business as usual adoption and funding,

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project is applicable to both Northern Powergid's Northeast and Yorkshire licence areas.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£250, 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 Northern Powergrid network currently experiences around 1200 incidences of lightning damage each year at a cost to repair of around £2.5m. We anticipate that the application of this system and the analysis that this will make possible would allow us to mitigate around 10% of this cost pus will provide an improvement in service level through improved network reliability. The nature of the GB system menans that it is estimated that this value would be increased at least six-fold if applied across the whole of the national network before other opportunities such as application to transmission is taken into account.

Please provide a calculation of the expected benefits the Solution

The project is low TRL at initiation. An estimate of the financial benefits indicates that the project would provide a net benefit to the customer of around £250k per annum from 3 years after the completion of the project. This is a high error estimate and has not been discounted.

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

It is anticipated that this technique would be applicable to all Distribution Network Operators in the UK, as well as to the Transmission System. There is potential further relevance for gas networks but their issues with lightning damage are different and less well understood.

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

The main costs associated with rolling out this method on the network are likely to be low. Some costs, associated with integrating the system into operational and control systems may be required but it is anticipated that the lightning prediction system will operate and deliver value as a stand-alone web-enabled system. Most DNOs already subscribe to the core data-streams that it is expected will be required for this application.
An initial estimate is that significant implementation of project outputs could be undertaken for significantly less than £200k per DNO of additional costs depending on the precise nature of operational and planning changes required to implement.

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

n/a

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

The project supports the key innovation objective of improving the reliability and availability of the network, identified by stakeholders as their most important objective.

☑ 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.

No systems to predict lightning at the appropriate geographic and temporal resolution are available and as such this project is leading edge and does not include duplication of any previous work.

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

Improvements in the availability and geographic precision of weather related data have prevented the production of this type of tool within the parameters of the defined project previously. The current work represents a significant improvement in technology to date.

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

The project outcome has a relatively high risk of technical and/or economic failure. Other projects with more favourable risk profiles have been prioiritsed ahead of this.

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 low initial TRL of the project presents a significant technical risk of failure of at least 50% in bringing the project to the final TRL of 8. That risk is then compounded by the commercial risk that the mitigation of 10% of lightning costs cannot b#e acheived. Overall the project is a combination of both high technical and commercial risk. No source of funding for this is available where the risk of failure can be offset against the risk of success of other projects within a portfolio struture and therefore NIA has been selected as the most appropriate funding stream.

This project has been approved by a senior member of staff

☑ Yes