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

Jan 2020

Project Reference Number

NIA_NGTO046

Project Registration

Project Title

Advanced Weather Forecasts for Dynamic Line Rating

Project Reference Number

NIA_NGTO046

Project Licensee(s)

National Grid Electricity Transmission

Project Start

January 2020

Project Duration

1 year and 4 months

Nominated Project Contact(s)

Oliver Cwikowski

Project Budget

£545,000.00

Summary

This project will systematically review the use of high specification weather forecast for the rating each of our asset types; with the focus being on Overhead lines (OHL). This will involve running various scenarios using a software based tool which will be developed as part of this project. This will allow the potential increase in asset ratings that can be obtained by using a higher specification forecast to be quantified, and a value based specification for a weather forecast system to be developed.

Nominated Contact Email Address(es)

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Problem Being Solved

The electrical transmission network is inherently limited by the individual power rating of assets that form the circuits which connect everyone across the country. When power flows are limited, generators must be coordinated to ensure that demand can be met, without exceeding the maximum ratings of any asset in the system. This results in constraint payments being paid to generators, as they are not able to operate at maximum power during these times.

These constraints result in fossil fuel technologies being used at times where, if not for the constraining transmission asset, a renewable technology would have provided the energy instead. National Grid attempt to alleviate these scenarios by providing enhanced ratings in specific circumstances. This reduces the number of times that constraints occur on the system, and the severity of those constraints.

NGET has several software packages, all of which use weather data to some degree. Many of these systems use assumptions about the weather and the performance of weather forecast systems. However, given the recent advances in computing power many suppliers are now offering higher specification weather forecasts, which could improve the uplift provided by enhanced ratings.

Method(s)

This project will systematically review the use of high specification forecast for each of our asset types; with the focus being on Overhead lines (OHL). This will involve running various scenarios using a software based tool which will be developed as part of this project. This will allow the potential increase in asset ratings that can be obtained by using a higher specification forecast to be

quantified, and a value based specification for a weather forecast system to be developed.

Scope

This project will cover the following scope items:

1. Integration of OHL rating model with high specification weather forecast

a. A high specification weather forecast will be integrated with National Grid's OHL rating models. This will allow different scenarios to be run over an extended period time. This will also allow key metrics to be validated. This tool will be used to identify the optimal requirements for a weather forecast for OHL ratings.

2. Demonstration of Integration with NGET system

a. A key operational requirement for a Dynamic Line Rating system is being able to send and receive the data at regular intervals in a controlled and secure manner. Part of this project will review these requirements by performing a demonstration integration and using this experience to inform how the Information Technology systems may influence the weather forecast specification. Two examples being, the number of times per day that data is transmitted and the size of each data transfer.

3. Advance Weather Analytics

a. Advanced data analytic techniques will be used to perform a review of the current conservatism in our ratings models. New equations to predict future ratings will developed using machine learning and artificial intelligence techniques to see if any significant improvement can be made reliably.

b. Further investigations will be made into the feasibility of incorporating OHL conductor sag data into the calculations. This will only be performed as a desktop exercise.

4. Feasibility into advanced weather analytics for other assets

a. A desktop investigation will be performed into whether the advanced weather forecasts could be used to benefit other asset types. This will involve reviewing the weather assumptions in our current ratings models and developing estimations of the potential benefit.

5. Workshops – Risks and Opportunities

a. Several workshops will be held to review the outcomes of the research and identify any further opportunities or risks that may come from adopting the project's recommendations.

6. Development of Specifications

a. The outcomes of the project will be put into a weather forecast and dynamic rating specification, to facilitate any adoption of the outputs a into a licensee's existing systems.

Objective(s)

The objectives of this project are to:

1. Integrate NGET's OHL rating model with a high specification weather forecast

2. Evaluate the improved performance offered by a high specification forecast
Develop a value driven specification for a dynamic line rating system which uses a high specification forecast

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

This project will be deemed successful if any of the following are true:

1. The project identifies the value that can be obtained using a high specification forecast.

2. New equations are developed for the OHL rating models based on the use of advance analytics techniques, which provide an improved dynamicratings algorithm.

Project Partners and External Funding

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Potential for New Learning

This project provides opportunity for utilities to review the benefits that can be offered from predictive and dynamic asset ratings. This could unlock additional value from their existing asset base.

Scale of Project

The size of the project has been chosen to ensure that the key questions can be answered around the benefits of using a high specification forecast in dynamic rating systems. A desktop and software based project was chosen in the first instance, as this allow the benefits to be identified prior to full scale development of the require IS infrastructure to accommodate a real system.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

Desktop & cloud computing

Revenue Allowed for the RIIO Settlement

none

Indicative Total NIA Project Expenditure

Total: £545k

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)

If this project was successful, this could increase the dynamic ratings that NGET currently provide. This could reduce constraint payments that consumers fund in the event power flows exceed the operational rating of the system, and enable low-carbon technologies to be used more frequently.

Please provide a calculation of the expected benefits the Solution

The exact benefits are difficult to quantify as constraints are not regular or simply to quantify. However, using the Unit Cost Allowances (UCAs) for static load increases as a benchmark. If a 400 kV 2 GW OHL route was updated by an average of 1% over a year, this would provide an uplift of 20 MW. Based on a range of UCAs, this could provide value to consumers in the order of £1m to £5m over a 40-year period.

However, NGET is not current incentivized financially to deliver constraint payment reductions. The main benefits from this project will be environmental as it will help to accelerate our low carbon future.

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

The main output of this project will be a value driven specification for a weather forecast. This will allow other utilities to develop their own dynamic rating systems with confidence that this type of system could deliver value. This specification could be directly adopted by all other licensees across the UK.

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

Assuming that other licensees have an existing automated rating system, then the cost of rolling this system out would be in the region of £300,000 per licensee.

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

This project will establish if higher specification forecasts can be used to improve the forecasted ratings of electrical transmission assets. This project would provide confidence that the same techniques could be used for other transmission and distribution networks.

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

Corporate Responsibility - Doing the right thing

☑ 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 most similar project on the ENA portal is NIA_NGET0105 which is a project which was run prior to this project and at a lower TRL level. This project sought to understand if there was spare capacity within the ratings calculations we currently use. The outcomes of NIA_NGET0105 have been used directly to develop the needs case for this project; and they supported the case for performing a more detailed and higher TRL investigation.

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

This project has not been attempted previously as the advances in weather forecasting technology have only become available recently. The recent advances in high specification and cheap cloud computing systems has enabled the fidelity of weather models and forecasts to be improved dramatically. These high fidelity services were not available until recently.

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

This project is not suitable to use internal funds for as the benefits are not clear. First, NGET is not directly incentivized to reduce constraint payments. Second, it is not clear that even with an improve algorithm and weather forecast a meaningful amount of power uplift could be obtained, as this highly depends on the level of uncertainty in the forecast rating. This puts the value from the use of the more expensive weather forecasts under question.

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 project can only be funded through the NIA as there are significant risks which warrant further investigation and development of this Innovation, prior to its use within the business. The main risks are: • No proven business case – While a value case has been defined for this project, this is only for consumers and not NGET. No matter what the outcomes of this project are, these will be valuable to utilities managing their assets; even if this demonstrates that certain avenues are not worth exploring further. However, these benefits are not sufficient for the business to justify this project's budget. • Uncertainty of outcome – There is significant uncertainty around whether an improve forecast will improve our existing rating system. This creates significant technical uncertainty around what could be achieved at the end of this project. Without the NIA funding these risks would never be mitigated, and the business would justifiably not research this area; resulting in the potential benefits never being obtained or investigated. If this Innovation is successful, the information will also be very valuable to other licensees; using the NIA funding ensures that the outcomes of this project can be shared widely.

This project has been approved by a senior member of staff

☑ Yes