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

Jul 2015

### Project Reference Number

NIA_WPD_008

## Project Registration

### Project Title

Improved Statistical Ratings for Distribution Overhead Lines

### Project Reference Number

NIA_WPD_008

### Project Licensee(s)

National Grid Electricity Distribution

### Project Start

July 2015

### Project Duration

3 years and 1 month

### Nominated Project Contact(s)

Paul Jewell - Policy Manager; Sven Hoffman - Company Overhead Line Engineer

### Project Budget

£747,554.00

### Summary

This project will use the test rig facility to gather 2 years of conductor and weather data. This data will be analysed to validate and update overhead line ratings, update existing tools and methodologies, and produce a software tool that will enable GB DNOs to further optimise regional or line specific ratings.

### Problem Being Solved

Distribution overhead line ratings are based on CEGB research work and further assumptions described in ENA ACE 104 and ENA ER P27 published nearly 30 years ago. Recent work testing these assumptions have found some of them to be erroneous, with the result that existing distribution line ratings are now considered out of date. In the meantime, changing demands on networks are increasing the pressure to maximize overhead line capacity. In addition, existing ratings take no account of regional differences in climate, nor of any changes in climate that may have occurred over the last 30 years. Taken in conjunction, this means that load-related decisions to replace or reinforce lines are currently based on inaccurate ratings. Future climate change is predicted to put further pressure on line capacity. Distribution Network Operators (DNOs), therefore, need a cost-effective, up-to-date and robust methodology (supported with the necessary tools) for calculating and optimizing overhead line ratings at both the regional and line specific level, both for today and the future.

### Method(s)

A previous DNO collaborative project under the Innovation Funding Incentive established an overhead line test rig to monitor weather conditions and temperatures of different conductors at various current levels.

Under this project, the test rig will be operated continuously at a set current for 24 months, with conductor temperatures and weather conditions recorded at specified time intervals. At the end of the first 12 month period, an in depth analysis of the data collected will be undertaken.

When the data collection activity has been completed, following intensive data analysis the OHRAT and OHTEMP tools (which calculate line ratings and temperatures respectively) will be updated. Revisions of ENA ACE 104/ENA ER P27 will also be completed.

Using the data collected and analysed by the project, a more sophisticated overhead line assessment software tool will be developed. This tool will build on the algorithms developed for the OHRAT/OHTEMP update and allow alternative weather data sets provided by the Met Office (or from other sources) to be analysed, enabling more comprehensive line rating assessments (regional or line specific) to be made. By using predicted weather datasets, assessments could even be made about future line ratings, taking climate change into account.

In parallel with the data analysis and software tool development, the test rig will continue to gather data, with a second 12 months' data being used to provide further confidence in the statistical relationships established with the first 12 months' data.

## Scope

This project will use the test rig facility to gather 2 years of conductor and weather data. This data will be analysed to validate and update overhead line ratings, update existing tools and methodologies, and produce a software tool that will enable GB DNOs to further optimise regional or line specific ratings.

## Objective(s)

- To monitor the weather conditions and co-incident temperatures of various conductors at various current levels in order to provide a new dataset for the assessment of the weather risk element of probabilistic ratings and to derive a methodology for quantifying this risk, in combination with load risks, in order to calculate line ratings.
- To update ENA ER P27 and ENA ACE 104.
- To validate the updated CIGRÉ methodology for calculating conductor temperature from load and weather data, allowing the possibility of future "desk top" re-runs of the project to cover different locations and time periods.
- To update existing software tools, and to provide a new software tool to enable more comprehensive (regional or line specific) rating assessments to be made.
- To engage with the Met Office to enable rapid provision of appropriate weather data sets.

## Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

## Success Criteria

- Sufficient data collection to build a robust model of overhead line ratings.
- Analysis of that data to produce a model that enables more robust rating of overhead lines than the current model.
- A new software tool to enable more comprehensive (regional or line specific) rating assessments to be made.
- A robust, accurately informed revision of ENA ACE 104 and ENA ER P27.

## Project Partners and External Funding

n/a

## Potential for New Learning

n/a

## Scale of Project

The size of the test rig has been designed to allow modelling of conductor design temperatures and rating by testing a range of conductors with differing design temperatures; a reduction in heh range of conductors tested would comprimise the validity of the models produced from the data arising from the project.

The duration of the project is essential to modelling the effects of the widest practically attainable range of weather conditions on different conductor types.

## Technology Readiness at Start

TRL4 Bench Scale Research

## Technology Readiness at End

TRL8 Active Commissioning

## Geographical Area

The test rig will be sited in WPD's West Midlands licence area.

## Revenue Allowed for the RIIO Settlement

None

## Indicative Total NIA Project Expenditure

Western Power Distribution - £268,874.64

Electricity North West Ltd - £72,727.2

Northern Powergrid - £77,820.30

Scottish & Southern Energy Power Distribution - £82,012.5

SP Energy Networks - £81,264.6

UK Power Networks Ltd - £90,099

Total NIA Expenditure - £672,798.24

# 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)

Without any improvement to the rating methodology, and with known loads and load growth forecasts, a proportion of GB DNO 33kV overhead lines will have to be reinforced during RIIO-ED1.

The cost of reinforcement is approximately £50,000 per cct-km and WPD have forecast that 218 cct-km of 33kV overhead line will have to be reinforced during RIIO-ED1. It is anticipated that 10% of the predicted reinforcement volumes could be deferred for 5 years.

In addition to the planned reinforcement, there could be savings from the avoidance of Dynamic Line Rating schemes where loads are uncertain or embedded generation needs to be managed.

## Please provide a calculation of the expected benefits the Solution

Project cost (maximum) is £747,554.

The impact on the Base Case NPV (£27.44 million) by deferring investment in overhead line reinforcement and avoiding investment in 2 DLR projects each year for the last 3 years of RIIO-ED1 over a 16 year period is £-25.69 million (i.e. a negative NPV). This is £1.75 million better than the Base Case NPV, a saving. (See Option 2 in document "PID0004 CBA RIIO ED1 v8" which can be made available upon request).

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

Improvements to ratings will be applicable to all overhead line networks operated by all GB DNOs. The deployment as an alternative to DLR is applicable to all GB DNOs where there is need and suitability. This is estimated to be 2 DLR alternatives each year.

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

The improvement to ratings and the revision to ENA ACE104/ENA ER P27 are included in the project so no further rollout costs are expected. The roll out of the of DLR alternatives is assumed to be £50,000 per installation.

## 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

For new lines, improvements in ratings could allow smaller conductors and lighter, shorter, structures to be used, providing savings in construction costs.

For existing lines, improvements in ratings can allow reinforcement projects to be delayed; load growth and/or new connection applications might be accommodated with increased ratings where previously the line would require reinforcement.

### 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.

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