WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

Date of Submission

July 2015

NIA Project Registration and PEA Document

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.

Project Registration

Project Title	Project Reference
Project Reference Improved Statistical Ratings for Distribution Overhead Lines	WPD_NIA_008

Project Licensee(s)	Project Start Date	Project Duration
Electricity North West Limited, Northern Powergrid, Scottish and Southern Energy Power Distribution, Scottish Power Energy Networks, UK Power Networks, Western Power Distribution	Jul 2015	2 Years 6 Months

Nominated Project Contact(s)	Project Budget
Paul Jewell - Policy Manager; Sven Hoffman - Company Overhead Line Engineer	£747,554

Problem(s)

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have found some of them to be erroneous, with the result that existing distribution line ratings are now considered out of date.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.

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.

Technology Readiness Level at Start	Technology Readiness Level at Completion
4	8

Project Partners and External Funding

Potential for New Learning

This project will lead to an improvement in the understanding of overhead line conductor ratings by updating ENA ACE 104/ENA ER P27, the OHRAT and OHTEMP tools; these are currently based on more than 30 year old research that has been found in earlier work to be over-simplistic and could possibly lead to erroneous rating of overhead conductors.

This project will also enable the development of new tools for deployment throughout all GB DNOs in the form of a tailored weather package to be produced by the Met Office and a software tool that will enable overhead line designers and operators to better manage overhead line loading within statutory limits and design new overhead lines that are more cost-effcient.

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.

Geographical Area

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

Revenue Allowed for in 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

Specific Requirements 1

1a. A 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 systems and 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	☐

Specific Requirements 2

2a. Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees ☒

Please answer one of the following:

i) Please explain how the learning that will be generated could be used by relevant Network Licenses.

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.

ii) Please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the Project.

2b. Is the default IPR position being applied?

Yes	☒
No	☐

If no, please answer i, ii, iii before continuing:

i) Demonstrate how the learning from the Project can be successfully disseminated to Network Licensees and other interested parties

ii) Describe any potential constraints or costs caused or resulting from, the imposed IPR arrangements

iii) Justify why the proposed IPR arrangements provide value for money for customers

2c. Has the Potential to Deliver Net Financial Benefits to Customers ☒

i) Please provide an estimate of the saving if the Problem is solved.

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.

ii) Please provide a calculation of the expected financial benefits of a Development or Demonstration Project (not required for Research Projects). (Base Cost – Method Cost, Against Agreed Baseline).

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).

iii) Please provide an estimate of how replicable the Method is across GB in terms of the number of sites, the sort of site the Method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.

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.

iv) 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.

2d. Does Not Lead to Unnecessary Duplication ☒

i) Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

This project will lead to the improvement of overhead line conductor ratings by updating ENA ACE 104 / ENA ER P27, the OHRAT and OHTEMP tools and by developing new tools for all GB DNOs. As the activities are being undertaken as a collaborative project, any unnecessary duplication will be avoided.

ii) If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.