WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

Date of Submission

April 2016

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**
Superconducting Cables – Network Feasibility Study	WPD_NIA_015

Project Licensee(s)	**Project Start Date**	**Project Duration**
Western Power Distribution East Midlands, Western Power Distribution South Wales, Western Power Distribution South West, Western Power Distribution West Midlands	May 2016	14 Months

Nominated Project Contact(s)	**Project Budget**
Yiango Mavrocostanti - Innovation & Low Carbon Networks Engineer	£95,000

Problem(s)

The increasing number of electricity distribution networks reaching their capacity limits means that the need for network reinforcement will continue to grow. Reinforcing our networks using conventional approaches involves among others, building new electricity substations and installing additional transformers at the sites where capacity needs to be enhanced. This is incredibly challenging in urban environments due to limited land availability and high costs, creating the need to investigate alternative solutions.

Method(s)

The problem can be solved by installing new transformers or substations where it is easy to do so and then transferring their capacity to the networks that need it. Due to their high efficiency, small volume and high capacity, superconducting cables are an attractive solution for connecting new equipment to the physically remote networks that require the additional capacity.

In this project, a feasibility study will be performed to determine whether such an implementation should be considered.

The project will consist of the following 3 work packages:

1. Review of superconducting cable technologies (3 months)

   This involves a comprehensive Cost Benefit Analysis of different superconducting cable technologies and comparison to traditional cable solutions. As part of this work package a number of manufacturers will be asked to provide information on their products including their benefits and limitations, the installation, operational and repair procedures and their capital and operational costs. The learning from previous trial projects will also be captured.

2. A case study of installing a demonstration cable in WPD's networks (6 months)

   In this work package, a site for the possible installation of a trial superconducting cable in WPD's network will be selected and a detailed study will be undertaken to justify the selection of the site, explain the installation procedures and requirements and present the costs. The study will also consider the future requirements of the installation including operational procedures, maintenance, response to faults, repair and modelling of installation in WPD's power system analysis tools. Finally, all of the

aspects of the proposed implementation will be compared to a conventional solution to provide clear conclusions.

3. Learning overview and recommendations (3 months)

The final work package will provide an overview of the learning that was captured in the previous two stages of the study and based on the outputs recommendations will be made for a network trial.

Scope

The project will assess the benefits and technical issues of using superconducting cables to provide additional capacity in dense urban environments. In such locations land prices or availability can be problematic in establishing new substations.

Objective(s)

This project is a feasibility study with the aim to improve knowledge of the technology's benefits, challenges and costs to determine whether a demonstration project is appropriate.

Success Criteria

A comprehensive review of superconducting cable technology is presented. A case study of how the technology can bring benefits to WPD's networks is demonstrated and a relationship with manufacturers has been established. A viable pathway leading to a trial project is recommended where full details of capital and operating costs is documented.

Technology Readiness Level at Start	Technology Readiness Level at Completion
3	4

Project Partners and External Funding

The project partner is University of Bath.

Potential for New Learning

As the first comprehensive study examining the feasibility of using superconducting cables in UK distribution networks, it will provide significant learning and could possibly lead to the UK's first trial.

Other DNOs will also be able to gain a comprehensive understanding of superconducting cables after reviewing this project's reports and results. They can use the presented case study as an example to evaluate the benefits that could be brought to their networks by this technology. The knowledge from manufacturers could also be used by other DNOs if they wish to pursue trial projects.

Scale of Project

This project is a 14 month feasibility study.

Geographical Area

Areas that require additional capacity but do not allow the implementation of traditional solutions due to land availability, cost or other constraints will have the biggest benefit from a superconducting cable technology implementation. This would typically represent a dense, urban environment. Therefore, cities such as
Birmingham, Bristol, Cardiff and Nottingham will be considered.

Revenue Allowed for in the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£85,500

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.

Other DNOs will be able to gain a comprehensive understanding of superconducting cables after reviewing this project's reports and results. They can use the presented case study as an example to evaluate the benefits that could be brought to their networks by this technology. The knowledge from manufacturers could also be used by other DNOs if they wish to pursue trial projects.

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

In dense, urban environments it is not possible to build new substations to provide additional capacity due to land availability and cost constraints. This creates the need to investigate new solutions for capacity enhancement in such areas.

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.

This is a research project, so the exact saving is not known at this stage but this is exactly what the project will examine.

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).

Research Project - Not required.

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.

Research Project - Not required.

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

Research Project - Not required.

2d. Does Not Lead to Unnecessary Duplication 

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

This is the first comprehensive study examining the feasibility of using superconducting cables in UK distribution networks.

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

N/A