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NIA Project Registration and PEA Document

Date of Submission

Oct 2020

Project Reference Number

NIA_UKPN0068

Project Registration

Project Title

FutureLink

Project Reference Number

NIA_UKPN0068

Project Licensee(s)

UK Power Networks

Project Start

November 2020

Project Duration

3 years and 10 months

Nominated Project Contact(s)

Oussama Yousfi, Paul Williams

Project Budget

£478,000.00

Summary

The Croydon area of UK Power Networks, until the 1930s, ran on a DC electricity distribution network. When this finally transitioned to AC to align with the rest of the UK, the low voltage network was not updated to three-phase equipment. Ever since, this has been run as a two-phase system which uses special distribution transformers, LV pillars and link boxes. It is known as the Scott Network, named after the engineer who designed it. It is believed that this type of LV distribution system is unique to the whole of the UK.

Due to the increase in DC electronic equipment being connected to the distribution network, such as EVs, batteries and solar PV, there has been an increase in research around whether or not it may be suitable to transition some low voltage networks to DC.

The legacy Scott link boxes are at the end of their service lives and must be replaced. To our knowledge, there are no suitable two-phase double busbar LV link boxes available on the market today. Although it is possible to use two 4-way link boxes designed to run on a three-phase network, to replace one Scott link box, this limits the ability for the network to be run on DC in the future.

Additionally, the possibility of producing a double-busbar LV link box has the potential to enhance LV network operability and reliability. Such a product is also not available on the market and has to our knowledge, not been developed and tested before.

Nominated Contact Email Address(es)

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Problem Being Solved

The Croydon area of UK Power Networks, until the 1930s, ran on a DC electricity distribution network. When this finally transitioned to AC to align with the rest of the UK, the low voltage network was not updated to three-phase equipment. Ever since, this has been run as a two-phase system which uses special distribution transformers, LV pillars and link boxes. It is known as the Scott Network, named after the engineer who designed it. It is believed that this type of LV distribution system is unique to the whole of the UK.

Due to the increase in DC electronic equipment being connected to the distribution network, such as EVs, batteries and solar PV, there has been an increase in research around whether or not it may be suitable to transition some low voltage networks to DC.

The legacy Scott link boxes are at the end of their service lives and must be replaced. To our knowledge, there are no suitable two-phase double busbar LV link boxes available on the market today. Although it is possible to use two 4-way link boxes designed to run on a three-phase network, to replace one Scott link box, this limits the ability for the network to be run on DC in the future.

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Method(s)

The FutureLink project aims to complete a design for a modern two-phase double busbar link box that can be used to replace the legacy Scott Network link boxes.

Prototypes will then be tested for network use. If successful, two units will be trialed on the live network for a period of time to understand whether or not they are suitable for wider rollout.

Scope

The project scope will be to design, develop, test and trial a modern two phase link box. Two units will be trialed in the Croydon area.

Objective(s)

The objective of the project is to develop a piece of plant that can be used as a modern like-for-like replacement link box for the Scott Network.

Desired outcomes:

- Link box for Scott Network developed and tested to understand whether it is ready for BAU rollout
- Understand the likely customer savings from using a single Scott link box replacement instead of the existing solution of using two 4-way link boxes.
- Understand the potential for reduced customer disruption if link box replacements can be made more quickly, reducing roadworks in the Croydon area

Develop a design for a device to maintain the ability for the Croydon LV network to be run on DC, which is an area of increased research.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

- An approved design for a modern Scott link box is created
- Prototypes of the approved design are received and tested
- Results of the testing are used to either confirm suitability for network trial or learnings are taken onboard to modify the design and produce new prototypes.

Project Partners and External Funding

TE Connectivity were the project delivery partner. However, they are no longer able to deliver the product and have formally dropped out of the project. This was due to problems with their supply chain which made the production costs of their units rise significantly.

Prysmian have been identified as an alternative supplier based on the original tender for this project and they have been selected as the new delivery partner. The costs associated with developing this solution have increased. However, the per unit costs should the project succeed still achieves a notable benefit to the network.

Potential for New Learning

Potential for new learning across the following important areas:

- Improved understanding of a double busbar link box design and its applicable use on a standard three-phase LV Network, which could be of relevance to all DNOs;
- Design for a DC-compatible link box which will support the learnings of the LV Engine and DC Share NIC projects.

Scale of Project

The scale of the project is to complete equipment design, test and trial two units. Reducing the trial to a single unit would have a negligible impact on cost and would increase the risk of the project. Having two units to trial mean that if issues are encountered with one unit, the trial can still continue. There are over 650 legacy Scott link boxes on the network, and therefore the trial represents less than 1% coverage. More detail on potential benefits from this project can be found in a later section in this document.

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL9 Operations

Geographical Area

The trial will be undertaken in the Croydon area of UK Power Networks, which is part of the SPN licence area.

Revenue Allowed for the RIIO Settlement

There was no allowance for development and trial of DC-ready network equipment in UK Power Networks' RIIO-ED1 settlement.

Indicative Total NIA Project Expenditure

This project has no other external funding, therefore NIA expenditure = 90% x £288k = £259.2k.

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)

- Replacing a legacy Scott link box at the moment requires two four-way three phase link boxes. This leads essentially to a doubling of material and labour costs to change a single link box.
- There are over 650 legacy Scott link boxes in the Croydon area.
- It is estimated that £5k can be saved per installation
- Therefore $650 \times £5k = £3.25m$

If these are replaced over the course of 10 years, savings per year will be £325k.

Please provide a calculation of the expected benefits the Solution

- The scope of the project is to design and test the products and then trial two units on the network. There will be no net savings for the scope of the project without the BAU rollout.

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

- As noted previously, it is believed that the Croydon network is unique. In the medium term, it is expected that the direct use of the Scott Link Boxes would be limited to the 650 units in this area.
- However, if DC LV networks are proven to be more cost effective in future, then these could be used all across the UK. UK Power Networks alone has over 100,000 LV link boxes which could potentially use this feature.

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

The roll out costs will be made up of:

- The cost of training staff to install and use the new Scott link boxes.
- The cost of buying the Scott link boxes. The estimated cost at BAU for one of these units is less than £4,000.

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

RIO-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

Developing a double busbar link box that is appropriate for use on a 2-phase AC network, as well as a DC network will provide useful learning for other DNOs:

- Learnings around double busbar link box configuration could lead to network reliability improvements for all DNOs. A DC-ready link box could benefit all DNOs as LV DC networks area of research and interest.

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

There are a number of projects led by other GB DNOs that are looking into LV DC networks. However, none of them involve the use of link boxes. Therefore, we are confident that no unnecessary duplication will occur in this project. It is believed that the developments in this project will be complementary to the other ongoing projects below.

Projects in this area that we are closely keeping tabs on are:

- DC Share (WPD NIC) <https://www.westernpower.co.uk/projects/dc-share>
- LV Engine (SPEN NIC)
- Transition to LV DC distribution networks Phase 1 and 2 (SPEN NIA) https://www.smarternetworks.org/project/nia_spen_0028
https://www.smarternetworks.org/project/nia_spen_0047

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

To our knowledge, there are no other networks in GB where such an opportunity exists. This project has not been trialed previously at UK Power Networks because: - Until now a supplier hadn't been identified that was willing to develop a device of this nature - The condition of the legacy Scott link boxes did not warrant it; - DC LV network research is now an active area and it is believed that the potential benefits of this make a compelling case for why the Croydon area should be maintained as a DC-ready network.

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

There is risk associated with developing and testing a new product for network use. Developing DC-ready equipment is an innovative activity that is beyond the business as usual activities of UK Power Networks.

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 undertaken as an innovation pilot given the operational risks associated with the deployment of an unproven solution on the network. As noted in the NIA guidance, certain projects are speculative in nature and yield uncertain commercial returns. This is the case for with this project, as there is a commercial risk that the solution developed, as part of the project is not adopted by the stakeholders involved following the trial period. This could be due to the fact that the solution has not reached the level of maturity required for business-as-usual application. This risk is being mitigated against, through early engagement with stakeholders and ensuring requirements are clearly defined and documented. If the project is successful, it will produce a strong technical solution, which will lead to customer benefits. The specific details regarding the benefits are captured under section 2b of this document.

This project has been approved by a senior member of staff

Yes