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NIA Project Registration and PEA Document

Date of Submission

Sep 2015

Project Reference Number

NIA_UKPN0014

Project Registration

Project Title

Solid Cable Replacement Prioritisation

Project Reference Number

NIA_UKPN0014

Project Licensee(s)

UK Power Networks

Project Start

September 2015

Project Duration

1 year and 6 months

Nominated Project Contact(s)

Lynne McDonald

Project Budget

£141,056.00

Summary

This project will carry out analysis on all, 33kV, 66kV and 132kV solid cables within UK Power Networks' DNOs and create a HI model for all solids cables operating at, 33kV, 66kV and 132kV.

Nominated Contact Email Address(es)

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Problem Being Solved

Within UK Power Networks operating licence areas there are 4,022km of solid cables running at 33kV, 66kV and 132kV. Within all GB DNOs there are 18,098km of solid cables in operation at these voltages.

These cables have been installed since the 1900s, with the majority being installed in the 1960s. As these cables age the likelihood of faults increase. This can be in joints or along the cable itself, due to degradation of materials of construction.

The current accepted practice for resolution following fault is to replace a short section in the location of the fault with XLPE cable and re-energise the circuit.

While this will restore supply to customers following the fault it does not represent best value to customers, as over years multiple faults may cost more than overlays or replacing of sections of cable with modern cable with a lower likelihood of failure.

Although no HI model for solid cables exists, anecdotal evidence suggests:

- Paper Insulated Lead Covered (PILC) cable has a higher rate of failure over time when it is positioned on steep gradients
- Early versions of XLPE have a higher incidence of failure compared to historical PILC cable.
- Solid cables which have faulted previously have a higher fault incidence rate

- Generally older cables have a higher fault incidence rate

However, the above anecdotal evidence has not been analysed to prove it is the case. This prevents investment funding for solid cable replacement as it cannot be shown there is a benefit to customers in replacing the cable.

Method(s)

The project will review fault history of solid cables to identify how prioritisation of investment can be made to reduce CIs and CMLs. It is planned this will be carried out by:

- Collation of all recorded faults on the network
- Extraction of all data on cables (GIS, asset registers, cable loading history)
- Analysis of faults against cable type (construction type, location, voltage, age, type of lay, historic loading)
- Identification of factors that affect the likelihood of failure of solid cable
- The above analysis will be based on faults at EHV voltages, to enable sufficient data to be collected for statistical analysis.

Following analysis of historic faults and identification of solid cable failure factors:

- Development of model to input all current data on cables (construction type, location, voltage, age, etc.) to calculate prioritisation of replacement for cables.
- Model to enable to the comparison of costs of a cable to identify where it is beneficial to customers to replace a solid cable (i.e. cost of CIs/CMLs outweighs the cost of replacement)
- Modelling and HIs will be calculated for cables operating at 33kV, 66kV and 132kV only, as these cables are the most costly to replace and will add the most value to customers.

Scope

This project will carry out analysis on all, 33kV, 66kV and 132kV solid cables within UK Power Networks' DNOs and create a HI model for all solids cables operating at, 33kV, 66kV and 132kV.

Objective(s)

The objective of this project will be to identify solid cable assets operating at 33kV, 66kV and 132kV where it would be cost beneficial to customers to replace, as opposed to carrying out multiple fault repairs. By carrying out this analysis a cost benefit can be proven for the replacement of old cables to ensure best value for customers.

The specific objectives are:

- Collation of historic faults with asset registers in place (linking to the fault to cable information)
- Analysis of faults and trends for cables operating at 33kV, 66kV and 132kV, leading to identification of factors that affect the likelihood of failure of solid cables
- Collation of all sources of information into a model to allow identification of cables at increased risk of fault
- Output of model to identify cables where replacement would be beneficial to customers

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success of the project will be judged against the four objectives described above:

- Linking of historic faults with asset registers to produce picture of historic cable faults (reason for fault, type of cable used, type of lay, age, location, etc.) leading to production of a table of historic faults.
- Identification of factors that affect the likelihood of failure of a solid cable, leading to the production of a short report identifying trends to be considered what planning asset replacement of solid cables.
- Collation of all asset registers to produce model with sufficient asset data to allow identification of high risk/customer cost beneficial cables.
- Output of model – identification of cables where it is more beneficial to the customer to replace the cable rather than repair.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project will analyse all solid cables at EHV and 132kV within UK Power Networks' three DNOs.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

Solid cables at EHV and 132kV in all three DNOs will be reviewed.

Revenue Allowed for the RIIO Settlement

Approximately there is £2.64m per annum allocated for solid cable replacement work on EHV and 132kV levels for RIIO-ED1 period but the investment needs to be optimised to target high risk circuits at EHV and 132 kV.

Indicative Total NIA Project Expenditure

£141,056 is the total expenditure which we expect will be incurred during the duration of the project

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)

By identifying solid cables operating at 33kV, 66kV or 132kV where replacement is required, a clearly defined asset life for solid cables could be made, extending asset lives and reducing the planned investment of £21.10m in RIIO-ED1 leading to efficiencies for customers.

It is estimated the total potential savings from this project could be up to 10% of the budget for replacement of 33kV, 66kV and 132kV cables in UK Power Networks' three DNOs; this would represent a saving of up to £2.11m without taking out project cost for model implementation. If taken account saving is £2.09m as project cost equates to £0.024m.

Please provide a calculation of the expected benefits the Solution

A CBA has been used to confirm expected return from this project if successful, this can be summarised as:

Base cost: £21.10m

Based on the capex expenditure is required for any unplanned replacement work and maintenance of existing 4,022km of EHV and 132kV solid cables 2016 – 2013.

Method cost: £19.01m

This is made up of:

£0.024m – the repeatable implementation cost for the project. This cost includes the extraction of cable data and ongoing maintenance cost of resource allocation to make decisions based on results from the tool. It does not include any costs for the development of the tool, only the cost of analysing the data.

£18.99m – it is assumed the project will introduce 10% savings through optimising the allocated budget for EHV and 132kV solid cables. The remaining 90% of the budget would be unchanged and would still require to be spent. Therefore 90% of the base cost £21.10m is £18.99m.

Benefits: £2.09m

Benefits will arise from better planning and 10% efficiencies on 132kV and EHV solid cables.

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

All DNOs within Great Britain operate solid cable networks at EHV or above. There are approximately 18,098 km of solid cables operated by Great Britain DNOs. Therefore it is estimated that model could be built and used by each DNO that operate this type of cable.

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

Based on the following assumptions, it is estimated that the cost of rolling out to GB would be approximately £0.107m

- Across the DNOs in GB, there are approximately 18,098km of EHV and 132kV solid cables where the solution can be deployed.
- The repeatable implementation cost of the project is £0.024m for 4,022km of solid cables. Based on that for 18,098km of cables it would cost approximately £0.107m.
- This is based on the 10% benefits expected on capex expenditure for solid cables during ED1 period. The remaining 90% budget would remain unchanged.

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 trialed 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

If successful, the learning could be used by relevant network licensees to analyse the performance of their solid cable networks and prioritise the replacement of poor condition cables.

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