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NIA Project Registration and PEA Document

Date of Submission

Sep 2015

Project Reference Number

NIA_UKPN0011

Project Registration

Project Title

Small Bore Cable Replacement Technology

Project Reference Number

NIA_UKPN0011

Project Licensee(s)

UK Power Networks

Project Start

September 2015

Project Duration

1 year and 8 months

Nominated Project Contact(s)

Lynne McDonald

Project Budget

£1,114,650.00

Summary

The project aims to demonstrate alternative techniques to the traditional replacement approach for EHV cables employed by GB DNOs. The project will trial identified techniques at a number of sites where there are circuits of small bore cable. The main objectives are to:

- Conduct a market assessment (nationally and internationally) of the available techniques and suppliers that use offer alternative approaches when replacing fluid filled cables to the traditional open cut lay approach.
- Select a number of replacement techniques to be tested and the sites within each licence area for them to be trialled. At the moment, only two replacement techniques have been scoped for inclusion.
- Undertake trial cable replacements at the identified circuits for each identified technique.
- Assessment of each replacement technique and collation of trial results.
- Peer review undertaken of trial results with other DNOs.

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Problem Being Solved

Within UK Power Networks operating licence areas there are 6,431km of cables running at 33kV, 66kV and 132kV.

Within all GB DNOs there are approximately 24,275km EHV and 132kV cables in operation that this technology could be applicable to.

These cables were installed since the 1900s, with the majority being installed in the 1960s. As these cables age the likelihood of faults increases. This can be in joints, ancillary equipment or along the cable itself, due to degradation of materials of construction. The only

method available to reduce customer interruptions on cable that has faulted multiple times is to replace it.

The current accepted practice for the replacement of EHV cable is the open cut lay of a new parallel route, followed by the abandonment of the old cable, including the decommissioning of the oil or gas cable. This represents a significant investment in order to replace EHV cables.

A number of new technologies are becoming available to enable the replacement of a fluid filled cable by removal of the existing cable and insertion of a new solid cable along the same route. These technologies have been trialled on large cross section area cables in rural locations however they have not been proven on small bore cables in urban environments that may be in close proximity to other circuits or services. If these technologies could be tested within real-environment network conditions this would enable GB DNOs to significantly reduce the cost of replacing EHV cables, and thus provide better value to customers and allow more cables to be replaced reducing fluid leakage, gas leakage, Customer Interruptions and Customer Minutes Lost.

Method(s)

The project will test emerging replacement techniques of EHV cable as an alternative to traditional open cut approaches currently used at urban sites.

The main activities will be:

- Identify and generate a list of potential suppliers involved in the replacement of EHV cables through market assessment.
- Contact the identified potential suppliers and gather an up to date detailed understanding of the emerging tested and untested techniques alterative to using open cut lays in replacing EHV cables.
- Review and assess the emerging techniques highlighted by the suppliers and select the techniques to be tested. Run a tender process to identify the Supplier for the replacement technique (only if it is found that several providers can provide the solution otherwise single source against the supplier initially identified)
- Development of an evaluation pro forma to assess the performance of each trialled replacement technique.
- Assessment of each replacement technique employed. This assessment is proposed to cover costs, time at site, limitations of the technique and impacts on adjacent circuits.
- Peer review undertaken of results with other DNOs.

This project will be carried out in two phases:

- **Phase 1 – Trial on electrically isolated cables**

The purpose of this phase will be to test the new technology in real ground conditions – in close proximity to other non-UK Power Networks assets and in close proximity to other (inactive) circuits. During this trial other UK Power Networks circuits in close proximity will be closely monitored to confirm the impact of the new technology on them and to identify if risk of damage to adjacent assets can be minimised.

- **Phase 2 – Trial on temporarily electrically isolated power cables**

This second phase will only be carried out subject to successful outcome of the first phase of each technology. In the event that one technology is successful and the second is not, only the successful technology will be brought forward to this phase.

In this phase the technology will be tested on electrically active cables. These will be cables which have been temporarily isolated due to faults, leaks or ongoing repairs. The technology will be trialled on sample routes where each technology will be trialled on a different section where practicable.

Scope

The project aims to demonstrate alternative techniques to the traditional replacement approach for EHV cables employed by GB DNOs. The project will trial identified techniques at a number of sites where there are circuits of small bore cable. The main objectives are to:

- Conduct a market assessment (nationally and internationally) of the available techniques and suppliers that use offer alternative approaches when replacing fluid filled cables to the traditional open cut lay approach.
- Select a number of replacement techniques to be tested and the sites within each licence area for them to be trialled. At the moment, only two replacement techniques have been scoped for inclusion.
- Undertake trial cable replacements at the identified circuits for each identified technique.
- Assessment of each replacement technique and collation of trial results.
- Peer review undertaken of trial results with other DNOs.

Objective(s)

The Small Bore Cable Replacement Technology project intends to demonstrate emerging techniques for the replacement of EHV cable as an alternative to traditional open cut lay techniques currently used.

Technologies have been trialled on large cross section area cables in rural locations for the replacement of fluid filled cables. These however have not yet been proven on small bore cables in urban environments that may be in close proximity to other circuits or services. Therefore this project plans to trial these emerging techniques at small bore cable routes in urban environments that are close to other circuits and cables. Demonstrating that such cable replacement techniques can be employed may provide the ability for the reduction of: EHV cable replacement costs; cable leakages (fluid and gas); Customer Interruptions; and Customer Minutes Lost. Therefore facilitating a cost-effective cable replacement programme.

The main risks for the project will be impact on customers whilst carrying out the trials due to failure of the new methods being tested. For this reason initial trials will be carried out on inactive sections first.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The following will be considered when assessing whether the project has been successful:

- A list of suppliers and their contact details that provide services for the replacement of fluid filled cables, along with the techniques (tested and untested) they are able to offer as an alternative to the traditional open cut lay approach.
- Alternative replacement techniques have been undertaken and tested at the trial sites and replacement circuit is commissioned.
- An understanding through demonstration whether there are effective alternative solutions to the current open cut technique for EHV cable replacement.
- The dissemination of trial results with other GB DNOs.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The project trials are planned to involve the replacement of four cable sections.

These circuits of small bore cable routes would be representative of typical cable installations other DNO areas and how the trials could be repeated at other sites following successful testing of the replacement technology.

Technology Readiness at Start

TRL6 Large Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

Work will be carried out to review and select appropriate trial sites. We currently expect to proceed with the trial in areas with the following characteristics, subject to detailed design:

- Small bore cable routes that sit in parallel with another circuit route
- Cable routes that are electrically isolated
- Cable routes that are electrically active

Revenue Allowed for the RIIO Settlement

Circuits selected for trial will not have been those identified as part of the RIIO-ED1 settlement

Indicative Total NIA Project Expenditure

£1,114,650 is the total expenditure which we expect will be incurred during the duration of the project. This estimate is based on the replacement of four sections.

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 reducing the cost of replacing EHV cable it is anticipated there will be significant savings in reduced cost of replacement of cable in RIIO-ED1 for all DNOs. This will result in savings to customers across GB DNOs.

In UK Power Networks business plan there is £200.10m investment programmed in RIIO-ED1 for the replacement of fluid filled cables, if this project could result in 10% savings this would represent a saving of £4.83m (Net Present Value in 8 year period). It is anticipated this new method of replacement would reduce the cost of cable replacement by 10%, due to the reduced requirement for excavation.

When considering a full scale deployment, it is estimated that the benefits could be approximately £4.83m for ED1 period. However this can only be confirmed after sites are identified and the trials are completed. Looking at annual savings from 10% efficiency being realised it is estimated to be on average £2.5m over 2016 to 2023.

Please provide a calculation of the expected benefits the Solution

Base Cost: £1.04m

Based on ED1 unit costs for the replacement of 132kV cable is £1.3m per kilometre of cable and assuming the trial will be looking at two sections totalling 800m. To replace 800m of 132kV cable would cost UK Power Networks £1.04m

Method Cost: £0.445m

This is the cost of deploying the solution, assuming £355k for contractors, £20k for new cables, £60k for transition joints and £30k for jointing.

Benefits: **£0.05m**

Benefits over the RIIO ED1 period based on realising cable replacement efficiencies at 10% .

Financial Benefits: £0.645m

(Base Cost – (Method Cost – Benefits)

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

All DNOs within Great Britain that operate oil cable networks at EHV or above. This process would be replicable to all DNOs who operate this type of cable.

There are approximately 24,275km of cable at EHV level throughout Great Britain where this technology can potentially be deployed.

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

Based on the following assumptions, it is estimated the cost of the roll out would be £216.05m:

- The cost of deploying the solution for 800m of FFC cable is approximately £445k.
- 2% of the 24,275 km of EHV cables need replacement and can be targeted for the developed solution.

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

If successful, the learning could be used by relevant network licensees to significantly reduce the cost of replacing EHV cables, providing improved value to customers.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

Innovation strategy capability themes addressed:

- Understand the condition of our assets, and;
- Managing asset risk and improving fault performance.

☑ 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