Date of Submission

October 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
Cable Health Assessment - Low Voltage	ENWL009

Project Licensee(s)	Project Start Date	Project Duration
Electricity North West Limited	Nov 2015	3 Years

Nominated Project Contact(s)	Project Budget
Geraldine Bryson (geraldine.bryson@enwl.co.uk)	£2,750,000

Problem(s)

Low Voltage cables represent a significant proportion of the Electricity North West asset base, yet there is little availability of data to permit asset condition assessment (a corner stone of our long term asset intervention strategy) and hence asset risk to the Company. Electricity North West uses the Condition Based Risk Management (CBRM) system to assess the condition of many of our assets. This assessment is based on an assessment of the likely condition from the age, environment and duty of an asset and then modifies this through use of various data sets to provide an estimate of the probability of failure. In order for an asset to be assessed in this manner there needs to be a collection of appropriate input data which reflects the asset's current condition and the trend or movement in that condition over the medium long term.

In the case of solidly insulated cables in general and Low Voltage cables specifically, data is not presently widely available. Existing methods require the destructive testing of the cable (generally through cable sampling) and analysis of the condition of the cable's components to determine if a level of degradation can be determined. This results in disruption to customers and stakeholders alike and is often costly owing to the excavation of footways and roads. An alternative to intrusive destructive testing of cables would be to develop a measuring device to collect measurements from in service cables over a long time period and use this data to determine condition. This device will need to provide results which accurately assess the comparative condition of the cable and its movement over time in comparison to similar assets.

As most new connections are provided in some manner from existing low voltage cable networks the ability to determine the relative health of the asset prior to connection will provide network operators with improved measures of the cable reliability under higher loading conditions and hence will permit targeted intervention on the associated asset. This assessment of the cable condition will therefore replace the current process of "fix on fail" and hence provide improved customer service to all customers.

Method(s)

The project will be split into six phases:

Phase 1 – Develop additional knowledge of cable degradation using LV cable test facilities at Kelvatek and will be used to ultimately develop a monitoring device with sufficient bandwidth to detect and measure cable condition. This R&D product development phase will result in a specification for a sensor (and trial units) which can be fitted to the busbar without the need for a shutdown. The monitoring device will consist of 4 voltage probes (L1, L2, L3 and N, and 3 current sensors) and sampling rates will likely > 1M samples per second per channel.

The monitoring device will enable network operators to begin to develop an understanding of the condition of the LV network. Subject to the information recorded and the post processing the network operator may decide to install the next layer of data capture devices

in the form of fault management technology which provide much higher bandwidth such as the Weezaps on each of the LV feeders in order to capture specific waveforms with a view to developing a proactive response.
Phase 2 – Develop the necessary backend data processing and modelling required allowing LV cable condition data to be used within the current CBRM framework. This will allow network operators to assign Health Indices to its low voltage cables and associated networks. The analysis algorithms will be used to provide a health assessment and relative ranking between monitored cables.
Phase 3a – This phase will deploy and collect data from the hardware at approximately 500 substations ensuring that the sites selected cover a variety of factors including cable type, age, environment and load. The project will look to include areas with new Low Carbon Technology loads.
Phase 3b – Development of additional support services and business processes for cable system management. This phase will build upon earlier work with the existing Fault Support Centre model to allow for the inclusion of the intelligence obtained, combined with GIS cable data and other DNO sources of cable history, to provide services to analyse data returned from field devices, and to convert this data into actionable information that provides business value. These services enable rapid scaling to business as usual.
Phase 4 – This phase will be a six month live trial of the assessment tool within the business supported via the additional support services developed in phase 3b.
Phase 5 – This phase will produce all the documentation required to facilitate adoption within other DNOs and transfer to Business as Usual including the new CBRM HI methodology for cables, data requirements and specifications.

Scope

This project will develop the technology, data processing, support services, BAU operating model and CBRM based asset health modelling required allowing LV cable condition data to be included in the Condition Based Risk Model giving Network Operators the ability to assign Health Indices to its low voltage cables and associated networks.

Objective(s)

- Develop low cost technology which can be used to define the condition of the low voltage cable network.
- Develop BAU support services to allow wide scale deployment.
- Develop the data processing and modelling necessary to allow inclusion in the CBRM framework.
- Installation of hardware at a number of distribution substations (expected to be up to 500).
- Run a live trial of the new models and associated support services.
- Produce all the necessary documentation (specs and models) to allow adoption by other Network Operators.

Success Criteria

1. Production of hardware and backend data processing technologies.
2. Production of the relevant processes and models to allow LV cable condition to be included in the CBRM framework.
3. Development of a BAU operating model to allow wide scale deployment.
4. Production of the CBRM methodology, specifications and codes of practice to permit replication.

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

Project Partners and External Funding

Kelvatek

Potential for New Learning

The current CBRM framework does not include any methodology for low voltage cables. The successful outcome of this project will allow Network Operators to close this gap and will provide the ability to target the replacement of low voltage cables.

Scale of Project

The cable health system will be deployed to monitor the health of 500 substations across the Electricity Network area. This scale of deployment should allow us to cover different cable types, ages and environments as well as the different load types experienced on the network.

Geographical Area

North West of England

Revenue Allowed for in the RIIO Settlement

None

Indicative Total NIA Project Expenditure

2750000

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.

The outputs of this project can be used by other Network Operators to further enhance their CBRM framework in order to assign Health Indices to low voltage cables and enable a targeted asset replacement programme.

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

In Electricity North West's innovation strategy we have a theme of affordable reliability and part of this is improving service reliability through better understanding of asset performance and investment timing. This project will give us increased understanding of the low voltage cable network allowing us to invest appropriately before faults occur thereby increasing the service reliability to customers.

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.

Using the CBRM framework for low voltage cables will have two effects:
• Allow better targeting of the asset replacement requirements associated with Low Voltage cables by creating a longer term investment plan to be implemented over a number of regulatory periods.
• A reduction in the number of incidents which require a reactive response by identifying cable sections at or near their end of life and implementing a short term programme of asset replacement.

This initiative will result in a 25% reduction in faults on the low voltage network resulting in a saving of £3.5M to Electricity North West

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).

The total financial benefit can be calculated as the annual cost of low voltage faults x 25%.

The successful implementation of this project will close a gap which currently exists in the CBRM framework which will allow Network Operators to produce a much improved and better targeted investment programme.

A Societal benefit of this project will be the provision of an improved service to customers as well as reducing the impact any works has on the customer.

As we will be conducting more targeted replacement programmes it will result in less unplanned disruptive work in the street. This can result in Environmental (and possibly Carbon) benefits due to the reduction in machinery and materials used.

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.

This methodology could be applied to any substation from which a low voltage underground network is supplied. In Electricity North West we estimate that approximately 16,670 sites could be equipped with the technology. Assuming the Electricity North West System is typical of all GB DNO's then potentially the technology could be applied at over 233,380 sites.

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

For the software developments this would be a one off cost per DNO of approximately £10k giving a GB cost of £60k.

We do not believe that the technology would be deployed simultaneously at every site but that the network operators would enter into a programme of monitoring and would cover their entire network over a number of years. If we assume the entire network will be covered in 8 years we would look to deploy 12.5% per year which is approximately 29,000 sites over GB. It is anticipated that the technology deployment could cost £1000 per site. Therefore for technology deployment the total cost to GB could be £29M.

At a much smaller number of sites we anticipate the need to install fault management technology which will provide much higher bandwidth and more detailed data. We anticipate that network operators will use their current stock of devices but do realise that the stock level may need to be increased and have assumed a figure of £5M to cover this.

This results in a total cost to GB of £34.06M.

2d. Does Not Lead to Unnecessary Duplication 

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

There have been many projects looking at the CBRM framework but to date they have concentrated on switchgear and transformers. This will be the first project that will consider extending this model to cover the low voltage network allowing network operators to make better informed strategic decisions.

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