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.

NIA Project Registration and PEA Document

Date of Submission

Dec 2024

Project Reference Number

NIA_ENWL_036

Project Registration

Project Title

LV Predict II

Project Reference Number

NIA_ENWL_036

Project Licensee(s)

Electricity North West

Project Start

May 2024

Project Duration

1 year and 8 months

Nominated Project Contact(s)

Del Ainsworth

Project Budget

£719,000.00

Summary

As we transition to net zero, the level and volatility of demands across the network will increase, with the greatest impact expected on the LV network particularly, underground cables. Without intervention, this increase in demand will increase the degradation rate of LV cables, causing higher failure rates.

LV Predict researched physical models for determining the temperature within LV cables, the stress cycles and physical damage cables sustained and constructed statistical modelling methods to predict this damage using commonly held LV data. LV Predict II will build on this work and will refine and extend the probabilistic framework by improving the skill and reliability of the model, expanding the model to other network assets, and applying the model in decision making.

Preceding Projects

NIA_ENWL_028 - LV Predict

Third Party Collaborators

Frazer-Nash Consultancy

Nominated Contact Email Address(es)

innovation@enwl.co.uk

Problem Being Solved

As energy systems evolve to meet net zero targets, it is widely expected that there will be greater electrification of energy (particularly heat and transport), which will have the effect of increasing both the level and volatility of demands across the network, with the greatest impacts expected on the LV system and in particular underground cables. It is expected that, without intervention, this increase in

demand on the LV system will increase the degradation rate of cables, causing higher failure rates.

Method(s)

This research project will build on the physical and statistical modelling framework developed in the first LV Predict NIA project, LV Predict researched physical models for determining the temperature within LV cables, the resulting stress cycles and physical damage the cables sustained and constructed statistical modelling methods to predict this damage using commonly held LV data (such as customer numbers and cable types). LV Predict II will refine and extend the probabilistic framework by improving the skill and reliability of the model, expanding the model to other network assets, and applying the model in decision making. This extended probabilistic framework is a necessary step to allow BAU tools to be developed in the future. Specifically the project will:

i. Improving and validating the skill and reliability of the model

ii. Integrating model outputs into decision making processes

Measurement Quality Statement:

There are no plans to take measurements as part of this project, the methodology will use already available measurements and data.

Data Quality Statement:

Data generated and/or processed in the course of this project will be reviewed to provide assurance that outputs meet the required standards. Data will be managed in line with the RIIO ED2 Data Best Practice Guidance and Data Assurance Guidance.

This project does not plan to undertake any processing of personal data.

Scope

Phase 1

Task 1.1:

Improve the predictive skill and reliability of the current framework by

- Using additional historic data to account for demand changes.
- Generating a larger set of physical model training data for use in training simulations.
- Including other sources of demand, such as non-domestic customer demand and electric heating.
- Demonstrating the use of monitoring data within the modelling framework, including quantification of the possible benefits of deploying this type of monitoring technology.
- Implementing new and innovative data sources (such as LV protection and monitoring devices) to test the validity and reliability of the model.
- Incorporating unstructured data such as fault reports.

Task 1.2:

Translate the complex modelling framework into a series of replicable steps that can be detailed within a report. This methodology will have defined inputs (such as cable type, estimated age, and number of households served), and a series of equations that can be used to establish the probability of failure. Sensitivity analysis will be undertaken to understand the prediction ability and define statistically significant thresholds for cable replacement. This will provide confidence that it is possible to use the modelling results in a replicable fashion, and the results are interpretable.

Phase 2

Task 2.1:

Using the outputs of Phase 1 generate a methodology report which details:

- Step by step guide to the methodology.
- Clear definition of the inputs and outputs required by a user of the methodology.
- Engineering justification for the validity of the methodology.
- Details of any underlying assumptions, limitations, dependencies, and latent conditions to be aware of in the use of the methodology.
- The analysis that underpins the methodology as an Annex to the report.

Task 2.2:

Generate a Cost Benefit Analysis to assess the merit of implementing a proactive LV cable replacement regime in the future. This CBA will use the research undertaken in Phase 1 to quantify the costs and benefits of utilising a proactive maintenance approach compared to the counterfactual of the current reactive approach.

Benefits of LV Predict II

The current asset management approach to LV underground mains cables is reactive sectional replacement upon failure and a proactive replacement of specific types of cable where a safety issue is identified. Spend profiles for LV cables are predominantly based on historic replacement rates, and there is currently no method of assessing LV cable condition, and no consideration of the potentially increased rate of degradation over time related to changing loading. Having a robust method of identifying the diminishing health of LV cables over time supports a new condition-based approach to the LV cable management and the justification of a new investment driver. It is expected, that without intervention, the increase in demand on the LV system will increase the degradation of rates of cables, causing higher failure rates. The project will produce a CBA to quantify the financial benefits of this new approach.

Objective(s)

The objectives are:

- Produce a methodology for deriving LV cable condition from available data sources.
- Produce a supporting CBA for the methodology.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

An assessment of distributional impacts (technical, financial and wellbeing related) for this project has been carried out using a bespoke assessment tool, which assesses the project as having a positive, negative or neutral effect on consumers in vulnerable situations. To help inform the assessment, this tool considers the categories of consumers identified in the Priority Services Register.

This project has been assessed as having an overall positive impact on consumers in vulnerable situations. The assessment has identified that this project will look to reduce the costs for households, improve the exchange of information between networks and customers. Other considerations including the projects impact on supply, immediate health and safety in the home have been made in carrying out this assessment.

Success Criteria

The project delivers a methodology that can be used to determine LV cable condition for asset management purposes.

Project Partners and External Funding

Frazer Nash

There is no external funding support.

Potential for New Learning

This project will deliver a first in the UK methodology for determining the condition of LV cables from available data sources. It will generate insights and knowledge that can be used by all electricity distribution licensees to enhance asset management practices.

Project outputs will be shared publicly on the Smarter Networks Portal, the Electricity North West website and at dissemination events such as the Energy Innovation Summit.

Scale of Project

Desktop modelling research project to develop a methodology to derive LV cable condition from available data sources along with a supporting CBA

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

North West of England.

Revenue Allowed for the RIIO Settlement

£0

Indicative Total NIA Project Expenditure

£647,100

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:

As we transition to net zero, the level and volatility of demands across the network will increase, with the greatest impact expected on the LV network particularly, underground cables. Without intervention, this increase in demand will increase the degradation rate of LV cables, causing higher failure rates. The LV Predict II model will allow networks to predict this degradation and respond in a more proactive manner ensuring that the network maintains reliability and resilience as demands change.

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)

N/A

Please provide a calculation of the expected benefits the Solution

The project will produce a CBA to quantify the financial benefits of the new approach to asset management of LV cables.

The LV Predict methodology would enable more efficient and better targeted investment in the LV cable network.

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

The developed methodology will use publicly available data sets where possible and any others would be provided by the DNO so this could easily be replicated across the UK.

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

The costs of applying the methodology GB wide should be negligible, unless additional LV monitoring is to be installed.

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

The methodology and data sets required will be disseminated as part of the project and can be applied to LV networks across GB.

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

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.

A review of the Smarter Networks Portal and conversations with other networks has not revealed any other project that addresses the modelling of LV Cable condition.

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

Due to their inaccessibility, determining the condition of LV cables once they have been installed has always been challenging to date DNOs have relied on historical failure rates, known problematic types and general engineering approximations. With the proliferation of LV Monitoring and other data sources, as well as advances in modelling techniques it should now be possible to accurately assess LV cable condition without direct inspection. This is a new approach, which requires investigation.

Relevant Foreground IPR

Expected Relevant foreground IPR to be generated is a methodology that can be used to determine LV cable condition for asset management purposes.

Background IPR is the initial model and learning developed in the LV Predict project.

Data Access Details

All data will be shared in line with the Electricity North West data sharing policy as published on our website. (https://www.enwl.co.uk/future-energy/innovation/our-innovation-strategy/our-innovation-data-sharing-policy/)

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

Whilst the ability to optimise the asset management of LV cables will bring benefits there is no direct financial push for networks to make the change in approach.

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

There is no direct financial incentive for networks to research and implement the LV Predict methodology. The unit cost of LV cable is around £100/m so it is clear that without precise targeting, it is difficult to justify pro-active investment to improve the overall reliability of LV underground networks.

Having a robust method of identifying the diminishing health of LV cables over time would support a new condition-based approach to LV cable management and the justification of a new investment driver.

This project has been approved by a senior member of staff

☑ Yes