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NIA ENWL028
LV Predict

Progress Report

31 July 2022

VERSION HISTORY

Version	Date	Author	Status	Comments
V1.0	29/07/2022	Ben Ingham	Final	

REVIEW

Name	Role	Date
Lucy Eyquem	Innovation PMO Manager	29.07.22
Victoria Turnham	Head of Innovation	29.07.22

APPROVAL

Name	Role	Date
Steve Cox	DSO Director	29.07.22

CONTENTS

GLOSSARY

Term	Description
LV	Low Voltage

1 PROJECT FUNDAMENTALS

Title	Interface
Project reference	NIA_ENWL028
Funding licensee(s)	Electricity North West Limited
Project start date	July 2021
Project duration	18 Months
Nominated project contact(s)	innovation@enwl.co.uk

2 PROJECT SCOPE

The project will develop a probabilistic framework which predicts the current state of the LV assets across a representative part of the network, most likely as a probability distribution of times to failure, or equivalently the probability of failure in a specific time interval. LV assets are those defined as operating at nominal voltages below 1kV and, for the purposes of this project, we will focus initially on the 400/230V cable network. The model aims to project the estimated degradation trajectory (likely manifesting as increasing failure probabilities) of the LV assets, based on a range of future operating scenarios. This will highlight the high-risk regions of the network that may require future investment to prepare for the increased demand on the network from the transition to Net Zero.

The probabilistic framework will likely be based on Bayesian statistical methods, allowing a precise model to be built using a combination of data and expert opinion, accounting for the varying quality across data sources, to output a probabilistic solution that fully accounts for all identified sources of uncertainty.

The framework will initially be constructed for one cable type and then expanded to cover other cable types and will consist of three internal models: a network demand model, a model of environmental conditions and a degradation model.

- The demand model will include a statistical characterisation of past and present demand patterns, as well as a representation of the way in which these would change if future developments were to follow a particular long-term and large-scale scenario. This will incorporate a wide range of possible data sources including different combinations of smart meters, annual consumption, novel LV monitors, and Maximum Demand Indicators.

- The environmental conditions model/ unit includes a probabilistic representation of the relevant environmental variables and conditions. This could include information on historical defects, ground conditions (e.g., soil chemistry, water table), road conditions and usage, weather, animal populations etc).

- The degradation model will be largely physics based, yet probabilistic in nature, representing the relationship between loading, environmental conditions, and rates of degradation.

The data will be presented visually, showing the effect of historical cable usage, environment and other factors on the LV assets' condition. These outputs will be presented in a Methods and Findings report.

The project shall identify gaps in data and the works required to take the framework to full scale implementation. These findings shall be presented in a business case which shall include cost benefit analysis of all aspects of the framework's functionality.

3 OBJECTIVES

Phase 1: Literature Review

To understand best practice, innovations, and methodologies for modelling the degradation of LV assets. This will include review into generic methods to model the degradation of the polymers used in the manufacture of LV cable insulation, as well as more 'random' events such as rodent damage and roadworks.

Phase 2: Framework Development

Develop a framework that is useful when testing a range of assumed model structures, and associated algorithms, to determine how accurately they can predict the current and future values of LV asset failure rates.

To conduct as much validation of the models being trialed as is possible, to judge and communicate exactly what can and cannot be concluded.

Identify gaps in both data and knowledge that could be populated at a later date.

Phase 3: Business Case Development and Data Visualisation

Understand the business case for implementation or further development of the framework.

Investigate data visualisation methods to present and interpret the results of the model.

4 SUCCESS CRITERIA

This project shall deliver success by developing the following key deliverables:

A Literature Review outlining best practice, innovations and methodologies for modelling the degradation of LV assets.

Delivery of a prototype analytical framework that enables testing of a range of assumed model structures, and associated algorithms, to provide and compare predictions of current and future values of LV asset failure rates.

Drawing from the literature review and the analytical framework development gaps in both data and knowledge will be identified that can be fed back into the models/algorithms as appropriate.

Preparation of data visualisation outputs to present and interpret the results of the model.

Delivery of the Business Case for implementing further development of the framework.

5 PERFORMANCE COMPARED TO THE ORIGINAL PROJECT AIMS, OBJECTIVES AND SUCCESS CRITERIA

The project is progressing well and has begun to collate the various data sets into a combined model. The progress to date is shown in detail in the LV Predict Interim progress report, copy attached). This details the various considerations that have been taken into

account in looking to model LV cable condition. These include load, soil type, thermal conductivity etc. There was also a slight change in focus to include examination of cable joints as the initial workshops identified these as a significant point of failure on the LV network.

6 REQUIRED MODIFICATIONS TO THE PLANNED APPROACH DURING THE COURSE OF THE PROJECT

There have been no modifications to the approach

7 LESSONS LEARNED FOR FUTURE PROJECTS

No notable lessons learned at this stage

8 THE OUTCOME OF THE PROJECT

Not applicable.

9 DATA ACCESS

Electricity North West's innovation data sharing policy can be found on our website.

There has been no data gathered so far during the project.

10 FOREGROUND IPR

None

11 PLANNED IMPLEMENTATION

Not applicable.

12 OTHER COMMENTS

Not applicable.