Bringing energy to your door

NIA ENWL006 Sentinel

Progress Report

31 July 2022

VERSION HISTORY

Version	Date	Author	Status	Comments
V1.0		Kieran Bailey	Final	

REVIEW

Name	Role	Date
Lucy Eyquem	Innovation PMO Manager	29.07.22
Ben Ingham	Innovation Technical Lead	22.07.22
Victoria Turnham	Head of Innovation	25.07.22

APPROVAL

Name	Role	Date
Steve Cox	DSO Director	29.07.22

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GLOSSARY

Term	Description
HV	High voltage
LV	Low voltage
NIA	Network Innovation Allowance
OHL	Overhead line
PCB	Printed Circuit Board

1 PROJECT FUNDAMENTALS

Title	Sentinel
Project reference	NIA_ENWL006
Funding licensee(s)	Electricity North West Limited
Project start date	September 2015
Project duration	7 years 3 months
Nominated project contact(s)	Kieran Bailey (innovation@enwl.co.uk)

2 PROJECT SCOPE

The fault location equipment will be installed on approximately 10 – 20 high voltage (HV) networks, monitoring faults across the feeders. The precise numbers will be informed by the cost and the need to obtain data to support development. Networks will be chosen based on length of overhead line (OHL), earthing arrangement and network topology. Consideration will also be given to those circuits which have a higher incidence of faults. The fault sensing technologies will be integrated into a central dashboard which will display the results from all of the selected sites.

3 OBJECTIVES

- To install a range of fault location equipment expected to cover two main techniques ie impedance-based and travelling wave.
- To develop preferred methods for the installation of distance to fault systems including equipment at the primary substation and distributed devices such as sensors on OHLs etc. This will include an assessment of the preferred location of the sensors and where/how precisely these sensors will be connected to the system.
- To compare and contrast the performance of the different techniques and/or different manufacturers against the different network types. The results of these trials will be used to inform specification and engineering policy for the application of HV distance to fault on UK distribution networks.

4 SUCCESS CRITERIA

- Development of functional specifications for fault location technologies
- Successful deployment of fault location techniques
- Specification for the integration of results from trial equipment into a central dashboard
- Verification of the accuracy of the techniques by confirming the fault location
- Understanding of how each technique works for the different network types.

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

The project is on course to meet the original aims, objectives and criteria.

A revised programme of works was introduced to upgrade 5 trial circuits fully (65units) which was completed in Q2 2021. All modifications were carried out on these units and they have been performing as expected since.

A number of real faults have been detected on the operational trial circuits for which technical reports have been produced. The results have, overall, been very positive with fault locations detected within an acceptable range.

The analysis of these faults has allowed for further refinements providing improved accuracy and learning as to the capability of the Time Domain Reflectometry technology.

The project was extended to develop the following;

- Automatic algorithm for pole location selection
- Commissioning Tools for installation
- Integration into Electricity North West Network Management System (NMS)

Automatic Algorithm for pole location Selection

Initially the pole locations were manually selected based on a simplified set of criteria. As different network configuration and topologies were presented it became apparent that to identify the best locations a more complex and advanced set of criteria were required to provide an optimal cost solution while maximising line coverage. Work is progressing, and the first algorithm will be available in May 2022.

Commissioning tools for installation

To aid the installation process a number of tools are being developed to allow system health prechecks to be carried out prior to installation on the OHL as well as a website based application to check operating parameters once the unit has been energised. The application will be developed to work on both computers and phones, allowing the installation team to check that the system parameters such as voltage, current. comms, battery health and onboard CPU temperature are as expected prior to leaving site. These tools are in development and are planned to be available from July 2022.

Integration into Electricity North West Network Management System

In order to inform the Electricity North West control room of a fault detected by Sentinel in near real time it is necessary to integrate the Kelvatek Sentinel server, where all the calculations are performed following a fault trigger, to provide the necessary fault location information. For the sentinel system to identify fault locations it is necessary to provide the real time switch status of all switchable devices on the HV network. This functionality requires the development of a new Inter-Control Communication Protocol (ICCP) to serve switch status of telemetered and Non-telemetered switching devices from the Electricity North West NMS system to the Kelvatek Sentinel Server. The status of non-telemetered requires further software development by Schneider Electric (NMS provider) to provide an ICCP adapter to serve these points to Kelvatek. These works are in flight and are expected to be complete by October 2022.

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

Due to the voltage measurement issues and the need for upgrades a restoration plan has been implemented to change voltage measurement leads and to install the temporary solution to voltage sensors. Modifications have been deployed on 5 circuits to prove effectiveness and the voltage sensor design has been updated to incorporate improvements.

7 LESSONS LEARNED FOR FUTURE PROJECTS

The trial size of the project is ambitious. The work involved in planning outages on the HV system requires significant planning and coordination and involves various parties internal and external and to the main business

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 collected in the course of this project.

10 FOREGROUND IPR

The project will trial two different techniques for fault location: impedance based and voltage gradient. The fault sensing technology used is an HV application of Kelvatek's existing LV technology hence the IPR will be owned by them. The technology will be made available for purchase from Kelvatek and the method used for the trials will be made available via Electricity North West for others to replicate the project.

11 PLANNED IMPLEMENTATION

Not applicable.

12 OTHER COMMENTS

Not applicable.