Energy Networks Innovation Process

Annual Project Progress Report Document

The voice of the networks

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Notes on Completion: Please refer to the NIA Governance Document to assist in the completion of this form. Please use the default font (Calibri font size 10) in your submission. Please ensure all content is contained within the boundaries of the text areas.

Project Title (*This cannot be changed once registered*)
Synaps 2 – Fault Detection, Classification & Location Solution

Project Reference
NIA_SSEN_0051

Funding Licensee(s)
Scottish Hydro Electric Power Distribution
Southern Electric Power Distribution
Eastern Power Networks
London Power Networks
South Eastern Power Networks
UK Power Networks

Project Start Date
December 2020

Project Duration
19 months

Year
2021

Nominated Project Contact(s)
Kevin Dennis - Scottish and Southern Electricity Networks (SSEN)
Chino Atako - UK Power Networks (UKPN)

1. Scope

The Project will be organised into two trial stages:

- Basic Fault Location (3-4 months duration) will be trialled on two sets (four units) of the existing generation of prototype sensors to collect more data to improve the algorithm model for the advanced fault location stage

- Advanced Fault Location (8-9 months duration) will be trialled on ten sets of next generation sensors to continue collecting the data while improving the algorithms on different cable architectures and fault scenarios.

There will be a project review after 6 months.

2. Objective(s)

Basic Fault Location

This will continue from the previous SYNAPS 1 project — the installation of the current sensors on LV feeders with known faults to determine their location. This work will focus on optimising the network calibration procedure and tuning the location technology to improve accuracy of the fault information and minimise the time required to generate it. Once a fault is identified the equipment will be moved between feeder locations at regular intervals after liaison with UKPN. This will allow continued collection of fault data in multiple cable type environments. Fault location information will be communicated to asset teams for investigation and validation.

DNO Operational IT System Connection Specification

Development of a specification for an interface between the SYNAPS cloud server and DNO operational IT systems to enable DNO operational staff to be informed in real time when LV faults are detected on specific feeders and to provide fault location information when this is available. The target system will be determined through mutual discussion between the NIA partners and could include iHost or similar platform.

Advanced Fault Location

This will be based on around ten sets of the next generation SYNAPS sensors. These will be divided between SSEN and UKPN and the installation of the sensors will be on LV feeders with known faults and/or fault history. In addition to increasing the number of data collection sites, this work package will also aim to test and validate the technology in support of the following use cases:

- Low voltage networks that run in parallel known in the industry as fully meshed networks
- Long Term Fault Evolution. Investigation of the network disturbances noted in SYNAPS 1 project. to determine which are early faults, to follow their evolution into permanent faults, to seek to determine at what stage they can be located and to ascertain the scope for predicting the time before they become critical.
- Investigate if faults can be identified as either cable or joint faults.

Prototype DNO Operational IT System Connection

Based on the "DNO Operational IT System Connection specification" developed above, implementation and testing of a working interface between the SYNAPS system and the DNO Operational IT system.

Business as Usual Demonstration

A demonstration of the final TRL8 commercial prototype will be carried out on the distribution network with the intent to demonstrate the solution in a network environment and to evaluate the data connectivity.

3. Success Criteria

The new project will aim to achieve the following Success Criteria:

- Demonstrate that the SYNAPS system locates faults on an LV network with a precision similar to or better than existing technologies.
- Improve the accuracy of the fault position estimate with specific emphasis on calibration procedures
- Improve the speed with which the location can be determined.
- Validate the technology on a wider range of feeders and cable types, including fully meshed networks
- Identify if the fault is either cable (main cable or spur) or a joint fault.
- Specify and demonstrate a basic interface between the SYNAPS system and DNO IT systems.
- Investigate long term fault evolution on faulty cables (asset management).
- Improve deployment procedures and expose more operational staff to the technology.
- Demonstrate installation on an operational meshed LV network.
- Implement a pilot trial, with limited documentation, in an operational environment taking the SYNAPS solution from TRL6 to TRL7.
- Demonstration of data connectivity of the final TRL8 commercial prototype with the DNO network.
- Document network trials, DNO Operational IT System Connection specification and learnings.

4. Performance compared to the original project aims, objectives and success criteria

Details of how the Project is investigating/solving the issue described in the NIA Project Registration Pro-forma. Details of how the Project is performing/performed relative to its aims, objectives and success criteria.

Project background

The SYNAPS 1 (NIA_UKPN0037) project was successful in trialling a solution which predicted fault locations from waveforms gathered prior to any noticeable LV activity, detecting transient or "pecking" fault events of short duration and low energy that did not rupture a fuse or trigger an LV network circuit breaker. Whilst not yet ready for a wider roll-out, this technology was certainly of interest and this project is aimed at increasing the technical readiness level (TRL) to a commercially ready solution.

Project progress

SYNAPS 2 started in December 2020, so far, the procurement and legal activities have been completed regarding the contract with the Energy Innovation Centre (EIC), who will co-ordinate the project on behalf of the Distribution Network Operators (DNOs).

Over the duration of this project the associated ten sets of next generation sensors, which follow on from SYNAPS 1, will be developed by PowerLine Technologies. The existing first generation of prototype sensors from the SYNAPS 1 NIA project have been installed onto the distribution network to collect further data to improve the algorithm model. The information collect will help info and develop second-generation sensors.

5. Required modifications to the planned approach during the course of the project

The Network Licensee should state any changes to its planned methodology and describe why the planned approach proved to be inappropriate. Please confirm if no changes are required.

The project has just started, therefore no modifications have been made as yet.

6. Lessons learnt for future projects

Recommendations on how the learning from the Project could be exploited further. This may include recommendations on what form of trialling will be required to move the Method to the next TRL. The Network Licensee should also state if the Project discovered significant problems with the trialled Methods. The Network Licensee should comment on the likelihood that the Method will be deployed on a large scale in future. The Network Licensee should discuss the effectiveness of any Research, Development or Demonstration undertaken.

This project is in its early stages and at present there is no significant learning to report upon.

7. The outcomes of the project

When available, comprehensive details of the Project's outcomes are to be reported. Where quantitative data is available to describe these outcomes it should be included in the report. Wherever possible, the performance improvement attributable to the Project should be described. If the TRL of the Method has changed as a result of the Project this should be reported. The Network Licensee should highlight any opportunities for future Projects to develop learning further.

This project is in its early stages and at present there is no significant learning to report upon.

8. Data Access & Quality Details

A description of how any network or consumption data (anonymised where necessary) gathered in the course of the Project can be requested by interested parties. This requirement may be met by including a link to the publicly available data sharing policy.

For information on how to request data gathered as part of this project please see Network Innovation Competition (NIC) and Network Innovation Allowance (NIA) Data Sharing Procedure at https://www.ssen.co.uk/InnovationLibrary/Distribution/

9. Foreground IPR

A description of any foreground IPR that have been developed by the project and how this will be owned.

This project is in its early stages no foreground IPR has been developed as yet.