EIC
Together we innovate

CASE STUDY

HV Feeder Monitoring to Pre-empt Faults

Key Benefits/Themes

- Customer
- Health & Safety
- Financial

Project Partners

EIC Together we innovate
LORD CONSULTING
LORD POWER EQUIPMENT
northech
Scottish & Southern Electricity Networks
UK Power Networks Delivering your electricity

"The successful trial of the DFA solution has demonstrated that it is possible to pre-empt faults on the HV distribution network. Funding streams such as the NIA (and similar) are essential for identifying novel solutions to deliver continuous network improvements."

Chino Atako
Senior Asset Engineer
UK Power Networks

The Challenge

Distribution Network Operators (DNOs) are required to keep customer lights on safely at the lowest possible cost. However, occasional power cuts remain inevitable and the DNOs are committed to minimising their impact.

Any supply interruptions are tracked and measured using the Customer Interruptions (CIs) and Customer Minutes Lost (CMLs) metrics. Most CIs and CMLs occur on the High Voltage (HV) network. The DNOs implement a variety of measures to reduce these, most of which tackle faults that have already occurred. While operational teams are on standby to carry out repairs, this can be complex and time-consuming depending on the location of the fault.

The DNOs recognised that improvements could be made to network performance and costs by monitoring key network characteristics in real time and implementing proactive intervention strategies. This required having a better understanding of:

- Identifiable network characteristics before different faults occur.
- Operational processes to successfully pre-empt an emerging fault.
- Identifiable network characteristics before different types of faults occur.
- Methods for identifying the location of an emerging fault.
- Operational processes and steps to be followed to successfully pre-empt an emerging fault.

The Solution

In order to address this challenge, this project trialled Distribution Fault Anticipation (DFA) technology to help identify network faults, including in situations before customer power supplies were adversely interrupted .

DFA devices, which consist of an integrated smart disturbance recorder and data repository, deployed in tandem with a network analysis tool (ASPEN Distriview) for site location purposes, were installed in substations.

The DFA system works by monitoring voltage and current on electricity circuits to detect the smallest of network disturbances, which are often below the threshold of traditional network protection systems. The device then assesses both 'normal' and 'abnormal' waveforms via a sophisticated internal algorithm library, presenting the outcomes to DNOs in near real time for consideration to enable best course of action.

This is a Network Innovation Allowance funded project

The Project

The aim of the project was to test the DFA devices alongside other network monitoring equipment, such as fault passage indicators.

A trial was also undertaken at the Power Networks Demonstration Centre (PNDC) at Strathclyde University to determine the suitability of the hardware to be used on systems in the UK. This included a review of the installation process and tests to simulate selected fault scenarios, before committing to installations on the distribution networks.

The project has helped establish how the DFA technology can be used alongside other DNO operational software such as 'Power On' to provide an effective way to identify and locate network anomalies on HV and 33kV feeders, either before, or immediately after, faults materialise.

It has also enabled new learning in the following areas:

- Viability of this real-time method to consistently identify disturbances on the electricity network.
- Types of pre-fault conditions that could be detected by the device.
- Process to identify the source of disturbances.
- Process to effectively use outputs from the device to identify and repair the network before faults materialise.

Project Partners

New Zealand based Lord Consulting, along with partner company LORD Power Equipment, put forward the solution in response to a Call for Innovation that was launched by the EIC on behalf of UKPN in 2017.

UK based Nortech Innovation also contributed a fault passage indicator technology to the project.

The EIC guided the innovators through the innovation call process and supported the innovators with project plan development, legal contracting and project delivery which – thanks to Network Innovation Allowance (NIA) funding - included trials with UK Power Networks and Scottish and Southern Electricity Networks (SSEN).

Over the last 4 years, the trials have provided evidence that the DFA technology has the potential to deliver early warning and fault locations before - or immediately after - an abnormality occurs on the distribution network. This represents a significant step forward since it will help DNOs to undertake repairs before they result in an unplanned interruption of supply.

Impact

Customer

Reduction in power supply interruptions to customers.

Health & Safety

Potential safety improvements for operational staff or the public around distribution network assets.

Financial

Reduction in fault repair costs and a potential way to improve network performance such as reducing both the number of supply and duration of interruptions.

Next Steps

This project has now concluded but trials remain ongoing, providing additional learning to both UKPN and SSEN.

Once the trials have been completed, the DNOs plan to test the market for similar or complementary solutions, before potentially committing to a wider BAU roll-out.