Scottish & Southern Electricity Networks

Date of Submission

July 2017

Network Innovation Allowance Closedown Report

Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form.

Network Licensees must publish the required Project Progress information on the Smarter Networks Portal by 31st July 2014 and each year thereafter. The Network Licensee(s) must publish Project Progress information for each NIA Project that has developed new learning in the preceding relevant year.

Project Closedown

Project Title	**Project Reference**
Parade (Polemounted Auto-Recloser Automated Distribution Evaluation)	NIA_SSEPD_0008

Project Licensee(s)	**Project Start Date**	**Project Duration**
Scottish Hydro Electric Power Distribution, Southern Electric Power Distribution	Apr 2015	2 Years 4 Months

Nominated Project Contact(s)

SSEPD R&D Manager - David MacLeman

Scope

The scope of the project is to evaluate the technical operation of, and business case for, the Intelliteam distribution automation technology in the SEPD and SHEPD regions.

The main delivery plan will work as follows:

- The new type of radios will be installed progressively on further lines, over the first six months of the project, with each line being commissioned and its functioning evaluated before proceeding to the next
- Once all feeder lines have been commissioned and are relying on Intellirupters for protection, the long term performance will be independently evaluated to quantify the operational aspects and business benefits of the Intellirupter/Intelliteam system
- The project will also examine the combination of the Intellirupter/Intelliteam system with existing pole-mounted switchgear

Objective(s)

The learning objectives are:

1. To evaluate the year-round performance of this distribution automation technology, in terms of communications performance; behavior during faults; and impact on CI/CMLs
2. To consider the suitability of the communications technology for any other applications of high data rate digital radio communications in the utility sector, at the frequencies allowed in the UK
3. To quantify the commercial benefits of Intelliteam technology for the distribution business and so provide the information needed to determine whether it is advantageous to deploy it elsewhere on the network

Success Criteria

The project will succeed if:

1. The suitability of the new radios for providing protection functionality can be determined
2. The performance of the technology over a 12 month period of operation can be measured and evaluated

3. An analysis can be made of the performance of the communications sufficient to inform an assessment of their suitability for general utility applications
4. An evaluation can be made of the benefits in terms of CI/CMLs

Performance Compared to the Original Project Aims, Objectives and Success Criteria

The project is being terminated early for the following reasons:
1) The implementation of largely equivalent functionality through SEPD's Power-On Fusion SCADA system has made the Intelliteam functionality redundant
2) The deployment of fewer than 30 Intellirupters is not economically viable in the long term and a decision has been made to retire them from service
The deployment of new radios has been completed and the performance of the network observed, however without the Intelliteam functionality in operation, it cannot be stated definitively whether the network supports the intended protection functionality.
The Intelliteam functionality was not operated over the complete system at any time and was operated locally only for short test periods. It has therefore not been possible to assess the performance of this technology.
The communications system is complete and some learning objectives have been achieved. No evaluation has been possible in terms of CI/CMLs.

Required Modifications to the Planned Approach During the Course of the Project

The early termination of the project, prior to the achievement of the majority of learning objectives, was necessary because the Intelliteam functionality is almost completely duplicated by the action of tele-controllable switchgear operating under the automated control of Power-On Fusion. The high-level business decision to adopt the SCADA implementation has therefore removed the fundamental justification for the project's primary objectives.

Lessons Learnt for Future Projects

A number of issues were encountered:
• The new radio had to be CE marked before it could be deployed within the UK. Although ultimately successful, this process required more third-party laboratory testing than anticipated and took several months, delaying the deployment
• Many of the Intellirupters were mounted on poles located in agricultural fields, which are inaccessible for heavy vehicles when the ground is waterlogged (most of the winter) and when crops are standing. Some of the necessary work required mobile elevated work platform (MEWP) access or the use of lifting gear, and the window for carrying out this work was smaller than anticipated
• Commissioning and protection-setting procedures had to be re-written and authorised and the full fleet of Intellirupters re-commissioned

An extension to the original schedule was requested in September 2016. A few months after this, a decision was made to terminate the trial of Intelliteam, and subsequently, to retire the fleet of Intellirupters completely. These decisions necessitated the closure of the project.

Learning obtained from the deployment and iterative improvement of the radio network has been captured and is the principal output of the project. The radios have demonstrated the ability to operate under UK conditions (on the applicable frequencies and with low output power). There is a possibility that similar meshed radio networks could be used in other applications, for smart grid technologies.

Note: The following sections are only required for those projects which have been completed since 1st April 2013, or since the previous Project Progress information was reported.

The Outcomes of the Project

Learning outcomes relate primarily to the radio network.

The previous projects based on the Isle of Wight 11kV network both encountered substantial difficulties with the communications infrastructure. There is a low output power limit on radios in this application of 0.1W, and in the bands approved for the project by the Joint Radio Company, there is significant noise in this region, suspected as being overspill from the 400kW digital TV broadcasting antenna located at Rowridge in the centre of the island. The new radios are entirely digital, and their operating characteristics are set by software. These radios, once approved for use under UK and EU regulations, proved to be able to discriminate very well between signals and noise, and to form an effective network in which IP data packets could be passed by the most effective route available at any given time.

Each Intellirupter was fitted with a radio operating on a single frequency, and able to pass data packets to its nearest neighbours operating on the same frequency. A series of repeater stations, mostly sited on high ground, and fitted with radios operating on two frequencies, linked the areas to each other and back to their substations.

Whatever the performance of the radio hardware, it will never be possible to install a mesh radio network quickly and easily, and a period of tuning will always be required. Desk research can identify candidate stations and repeater sites, followed by a radio survey to measure actual signal strengths achievable. An area such as the Isle of Wight, with significantly undulating topography, and on which many distribution lines follow valleys, will always present a challenge in this respect, since the strength of a link in the mesh depends on whether a direct line of sight exists and the nature of the land and obstacles in between.

The installation of pole-mounted distribution automation is also an area requiring planning and on-the-ground research. If vehicle access is required for any particular maintenance operations, this will be a significant limiting factor in selecting the individual poles to be equipped with switchgear. At SSEN’s request, the Intellirupters were fitted with Wi-Fi antennae so that routine operations could be accomplished by walking to within about 20m of the base of the pole concerned. While this has certain advantages, staff in the depot expressed a preference for a more conventional control panel approach, not requiring software tools.

Planned Implementation

The installation of further Intellirupters is unlikely given that the equivalent functionality is largely obtainable from simple tele-controllable switchgear and SCADA automation, to which approach this company has committed.

Other Comments

N/A