

Network Innovation Allowance Progress 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 Progress

Project Title

Prognostics and Health Monitoring of Grid Connected Assets

Project Reference

NIA_SHET_0002

Project Licensee(s)

Scottish Hydro Electric Transmission

Project Start Date

Dec 2012

Project Duration

3 Years 6 Months

Nominated Project Contact(s)

Robert Hopkins

Scope

To conduct a research study of the science of PHM, build a small scale system for use on relays and utilise the results to develop a cost-effective online transformer oil condition monitoring and prognostics system prototype for field testing on a decommissioned SHE Transmission grid transformer.

Objective(s)

- Conduct a literature review of PHM, gain understanding of the various tools used and identify optimal tools for use with this project
- Undertake a small initial relay based project using knowledge from the literature review to consolidate project researchers' experience in the concepts of PHM

- 1 · Develop and optimise an online oil condition monitoring and prognostics system prototype

Test the prototype on a decommissioned SHE Transmission grid transformer and evaluate its cost-effectiveness

Success Criteria

The success criterion for this project is to deliver sufficient data to enable evaluation of the PHM-based monitoring system's suitability to meet the requirements of TOs and its cost-effectiveness.

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

Objective: Conduct a literature review of Prognostics and Health Management (PHM), gain an understanding of the various tools used and identify optimal tools for use with this project

A literature review was conducted as part of PhD studies to identify current optimal tools and methods applied around the world for asset health diagnosis and prognosis. The review provided an understanding of the tools available for prognostics and health

management (PHM). Fusion prognostics – which combine the Physics of Failure (PoF) technique with data-driven techniques, have now been used to trial the establishment of a prognostic system for a Barnbrook BV416 electromechanical relay. This objective has been met.

Objective: Undertake a small initial relay based project using knowledge from the literature review to consolidate project researchers' experience in the concepts of PHM

This involved setting up a small scale lab-based prognostic prototype test bed using the principles established through the literature review conducted. The test bed was used to test the contacts of 6 small Barnbrook BV416 relays with the aim of obtaining data that could then be used to establish their remaining useful life (RUL).

The results of tests that were performed demonstrate that fusion prognostics using PoF and data-driven techniques have good potential in PHM. The results also demonstrated that the failure precursors for all the different possible failure mechanisms could be established for the relays under test.

The chosen experimental architecture of the test bed has enabled prototyping for a working hardware implementation of a prognostic system for the Barnbrook BV416 relays.

Objective: Develop and optimise an online oil condition monitoring and prognostics system prototype

The learning obtained from the preceding objective will form the basis for carrying out this objective.

Objective: Test the prototype on a decommissioned SHE Transmission grid transformer and evaluate its cost-effectiveness

Same as above

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

No modifications required as of 31 March 2014.

Lessons Learnt for Future Projects

The literature review done at the onset of this project provided insight into work by others outside GB. Ongoing review of progress by such outside parties will help in consolidating understanding of PHM by GB stakeholders and potentially expedite progression of the method to higher Technology Readiness Levels (TRL).

The methodology for the PHM prototype set up to test electromechanical relays in this project could provide good reference for the establishment of similar experiments to establish PoF for other systems which require failure mechanisms and failure precursors to be identified.