

NIA ENWL015 Tap Changer Monitoring

Progress Report

31 July 2020



VERSION HISTORY

Version	Date	Author	Status	Comments
V1.0		Kieran Bailey		

REVIEW

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APPROVAL

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1 PROJECT FUNDAMENTALS

Title	Tap Changer Monitoring
Project reference	NIA_ENWL0015
Funding licensee(s)	Electricity North West Limited
Project start date	February 2022
Project duration	6 years
Nominated project contact(s)	Kieran Bailey (Kieran.bailey@enwl.co.uk)

2 PROJECT SCOPE

Following previous research into tap changer monitoring carried out under an Innovation Funding Incentive project, it has been determined that the technique utilised was not sufficiently robust and that further monitoring is required. Therefore we will work closely with Camlin Power to develop and produce a retrofitable tap changer monitoring system to accurately monitor the tap changer performance and consequently determine the intervention/trigger points.

For this project it was proposed to install the system on 10 x 132kV tap changers and 30 x 33kV tap changers and monitor and analyse the tap changer performance over a 24-month period to allow seasonal changes to be taken into account.

The project will allow Electricity North West to develop its understanding of the effects of tap changer failure modes and maintenance requirements and to identify the optimum window for monitoring in the life cycle of tap changers.

3 OBJECTIVES

This project is split into four distinct phases:

- **Phase 1** is to develop a retrofitable tap changer monitoring system. This phase was completed in December 2016.
- **Phase 2** is the onsite installation of 40 monitoring systems. This phase was completed by August 2018.
- **Phase 3** is the continuous data analysis and visualisation of the tap changer condition. This phase to be completed by August 2021.
- **Phase 4** is the implementation of identified trigger points into company policy and procedures. This phase to be completed by February 2022

4 SUCCESS CRITERIA

- Production and trial of a condition monitor for tap changers.

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

The project was due to be completed in four years, with development of prototype and installation of 40 systems in years one and two followed by a period of two years of continuous data monitoring and visual inspections of tap changers. Unfortunately, there have not been sufficient anomalous events or failures detected to provide enough data to develop, with a high-level of confidence, the algorithms for the anomaly warning system. Where events have occurred resource issues have prevented reactive invasive outages to investigate potential issues; This is a critical step in ensuring a “closed-loop system”, providing the feedback to Camlin to understand the cause of the warnings raised during the analysis period.

To develop this technology further it is necessary to extend the project for a further two years for data analysis and most importantly, where deemed necessary, carrying out non-planned maintenance outages of monitored tap changers which are indicating anomalies to correlate the data measurements with the physical issues, and thereby closing the loop.

The tap changers will be monitored for a further 18 months and a more rigorous regime will be implemented to take non-planned outages for invasive inspection and analysis. Following an anomaly detection, the results will be discussed at an internal TCM forum, allowing all parties to determine what action should be taken. Bringing more experience to the forum and availability of field resources will provide a much clearer and proactive approach enabling a “closed loop system” to exist.

Previously, following an anomaly report it, it was deemed that an outage was necessary. By adopting a forum it will be possible to review results as well as the data for the days following the initial reports and where possible carryout out a suite of tap change operations in both the de loaded and deenergised state.

As the learning develops, the response may need to be more reactive, especially if more or anomalies that are escalating in severity are occurring on the same unit. In these instances it will be necessary to take immediate action with a non-planned outage for further investigations.

Additional information, that would not normally be recorded during routine maintenance outages, will be captured and used to provide additional feedback of tap changer condition.

The final 6 months of the project will concentrate on implementation of the identified trigger points into company policy and procedures.

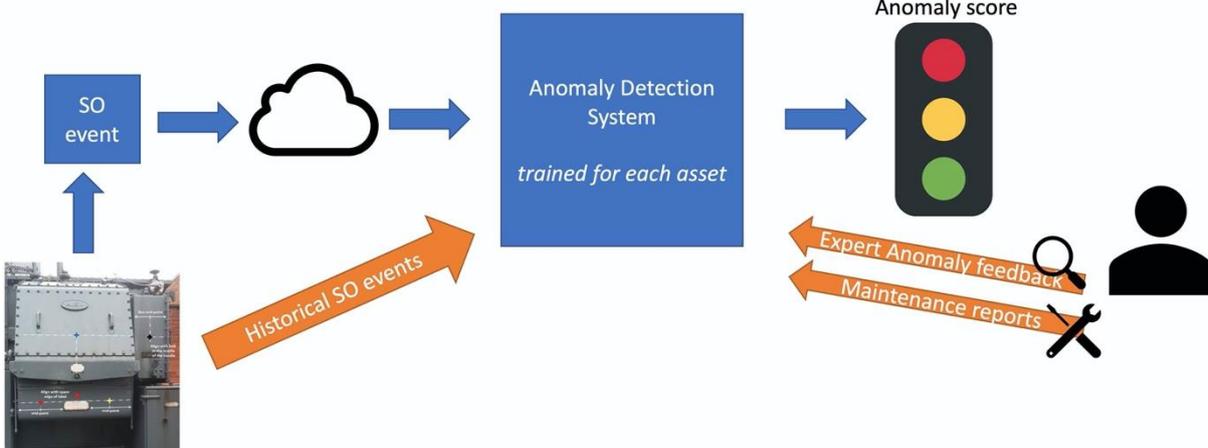


Figure 1 - Anomaly detection system

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

Not applicable – there are no modifications to the planned approach, but an extension to the data collection period, and more rigor applied to the feedback process in the analysis stage will significantly increase the useful learning.

7 LESSONS LEARNED FOR FUTURE PROJECTS

Not applicable.

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.

10 FOREGROUND IPR

The project will develop and bring to pre-production and trial a tap changer condition monitoring system. Camlin Power have developed and productionised the retrofitable tap changer monitoring system and own the IPR for the development of that system. The system will be made available for purchase from Camlin Power 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