

NIA ENWL015 Tap Changer Monitoring

Progress Report

31 July 2018



VERSION HISTORY

Version	Date	Author	Status	Comments
V1.0	1 June 2018	Paul Marshall Project Manager	Final	Final version following internal review and comment

REVIEW

Name	Role	Date
Lucy Eyquem	Innovation PMO Manager	3 July 2018
Paul Turner	Innovation Manager	25 July 2018

APPROVAL

Name	Role	Date
Steve Cox	Engineering & Technical Director	31 July 2018

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PROJECT FUNDAMENTALS

Title	Tap Changer Monitoring
Project reference	NIA_ENWL0015
Funding licensee(s)	Electricity North West Limited
Project start date	February 2016
Project duration	4 years
Nominated project contact(s)	Paul Marshall (innovation@enwl.co.uk)

1 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.

2 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 to be 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 2020.
- **Phase 4** is the implementation of identified trigger points into company policy and procedures. This phase to be completed by January 2021.

3 SUCCESS CRITERIA

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

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

The challenge for the project was to design a system that is flexible enough to be installed across a range of tap changer and transformer types and ages. Once the project reaches the data gathering stage, the main challenge will be to ascertain whether data collected provides signs of tap changer mechanism condition and deterioration. It is also crucial to identify which methods are required to capture usable data to achieve an optimised ultimate solution.

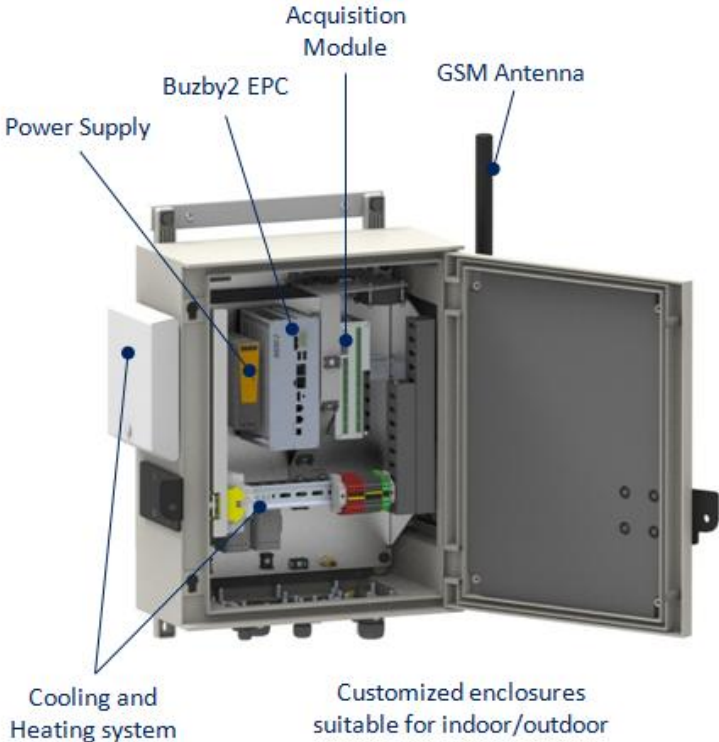
A prototype system was designed and installed at three sites in 2017 to collect data from the maximum number of sources across a wide spectrum bandwidth to allow for fine tuning of the data acquisition.

Prototype acquisition circuitry was designed, built and tested both in-house and in the field through a small number of 'Alpha' prototype installations. The acquisition circuitry has been used to collect, process and communicate high and low-speed data from a range of different sensors (such as accelerometers, temperature probes and current transformers), with data ultimately residing on a cloud-based server for long-term analysis.

Following the installation of these prototype systems onto different tap changer and transformer types, areas were identified where the installation could be streamlined to optimise efficiency. Data acquisition was seen to work effectively.

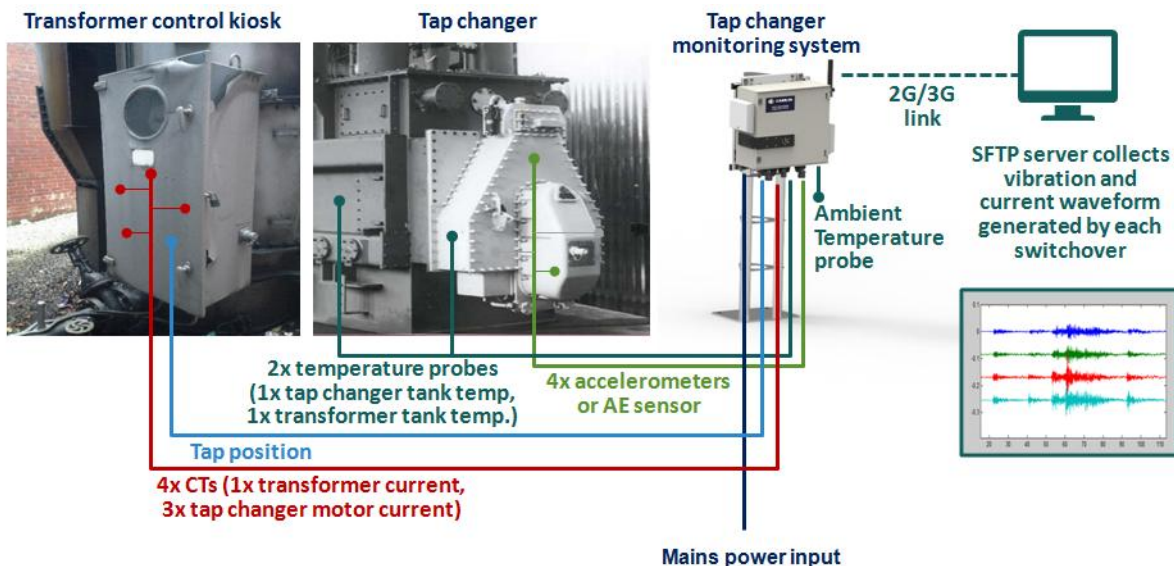
System components have been revised and built, as shown below, with the installation of 40 x 'Beta' systems currently programmed to be installed during the summer of 2018.

Figure 1: Revised system components



Additional development has taken place to enable the 'Beta' prototypes to capture tap position data by using new conversion modules. The 'Beta' unit system is shown below.

Figure 2: Beta unit system



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

No modification to the planned approach are required at this time.

6 LESSONS LEARNED FOR FUTURE PROJECTS

Not applicable.

7 THE OUTCOME OF THE PROJECT

Not applicable.

8 DATA ACCESS

Electricity North West's [innovation data sharing policy](#) can be found on our website.

9 FOREGROUND IPR

The project will develop and bring to pre-production and trial a tap changer condition monitoring system. Camlin Power will develop and productionise a retrofitable tap changer monitoring system and will therefore 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.

10 PLANNED IMPLEMENTATION

Not applicable.

11 OTHER COMMENTS