camlin energy

CASE STUDY

TOTUS prevents new transformer failure

Discover how Camlin Energy's online transformer monitoring solution TOTUS supports a Chinese Transmission company detect malfunctions in two young transformers, avoiding premature failure.

CHINESE TRANSMISSION COMPANY

Transformers are vital for power distribution and should typically boast long lifespans, but they can and do fail. In June 2017, Camlin Energy partnered with a leading Chinese transmission company on a project for 10 single phase transformer. This included an overall installation of 30 TOTUS transformer monitors. On this particular project, two young transformers showed signs of malfunction within an 18-month period, emphasizing the need for continuous monitoring and condition-based maintenance to ensure uninterrupted electricity supply.

The utilization of TOTUS transformer monitoring proved instrumental in the detection of an increase in Acetylene within the two young transformers. Acetylene is a highly combustible gas. If Acetylene concentrations continued to rise in the transformer without maintenance intervention to correct the issue, the risk of permanent failure is increased. Worse yet, such failures can be explosive, posing a risk of damage to adjacent substation equipment and a safety risk to workers or the public in proximity.

This detection was determined by the recorded deviation noted by TOTUS, and further validated through laboratory Gas Chromatography (GC) analysis. The strategic placement and functionality of monitoring devices played a pivotal role in identifying and addressing issues pertaining to converter transformers, showcasing the efficacy of integrated monitoring solutions in industrial settings.

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Example 1 (October 2017)

In October 2017, one of the TOTUS transformer monitors recorded an Acetylene deviation. As a result, several manual oil samples for lab analysis were conducted. Lab analysis used a Gas Chromatography method.

The level of Acetylene in the manual samples showed an increase over time, the Operations & Maintenace (O&M) team decided to replace the single-phase transformer tank in April 2018. Within this time frame it was possible to record stabilization of the Acetylene from the monitoring system up to 5.2 ppm (Figure 1).

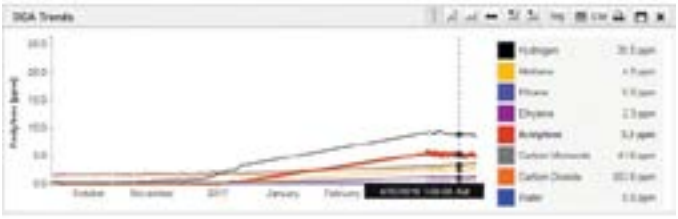

Figure 1: DGA Behavior from Installation date to April 2018

Acetylene is highly combustible at high concentrations within the transformer putting it at risk of in-service failure. This compromises asset availability, increases risk of collateral damage including public safety and significantly impacts revenue due to prolonged periods of downtime.

As each project is different, the financial impact varies, but the costs would potentially include replacement of the assets, collateral damage in the substation, and contractual penalties for prolonged outage due to the failing equipment.

Even if this problem would not have led to a short-term failure, there are also potential benefits from a warranty perspective for identifying issues such as this at the earliest opportunity. The utility is able to observe that the transformer is not meeting the level of quality expected for a transformer in a new condition. And this defect would likely shorten its serviceable life.

After the replacement took place, the monitoring system was recommissioned and left in operation to track future further changes. No further changes were recorded as reported in Figure 2.

Figure 2: DGA behavior following the O&M intervention.

Implementing corrective maintenance strategies significantly mitigates downtime and the associated costs, thereby offering substantial benefits to operational efficiency and financial savings. The sudden deviation in Acetylene levels, detected by the TOTUS Dissolved Gas Analysis (DGA) system and corroborated by laboratory Gas Chromatography (GC) results, underscores the critical role of transformer monitoring devices.

The presence of Acetylene is often an indication of electrical arcing inside the transformer. This is not expected for a transformer in brand new condition. If the transformer was to continue operation with a high concentration of Acetylene, it would ultimately lead to failure of the transformer.

By swiftly recognising and addressing issues such as those affecting the converter transformer, corrective actions can be promptly initiated, minimizing downtime, and preventing potential damages. This proactive approach not only reduces repair expenses but also prevents contractual penalties due to service disruptions.

Example 2 (October 2018)

In October 2018, one of the TOTUS transformer monitors started to record an Acetylene deviation in another transformer on the same project. In this instance it was not just Acetylene that had increased, increases in other gases (Methane, Hydrogen and Ethylene) were also detected.

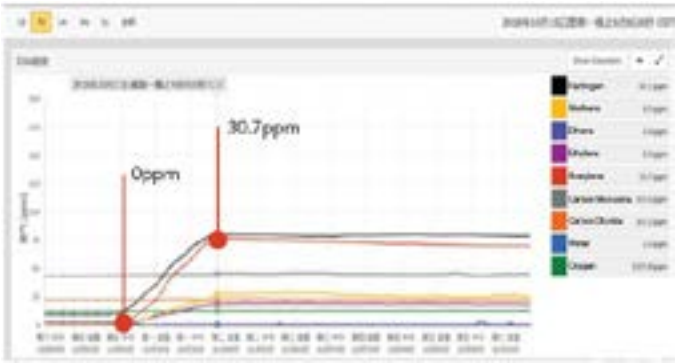

Figure 1. Offline results before and after the online alarm.

Within Figure 1, it must be pointed out that the Acetylene concentration rose from 0 ppm (recorded at 12:00 on 14th of October) to 30.7 ppm (recorded at 21:00 on the 15th of October) within approximately 36 hours.

The TOTUS transformer monitor issued an alarm resulting in maintenance personnel taking manual oil samples for laboratory testing (GC method used). Several manual oil samples were taken for lab analysis.

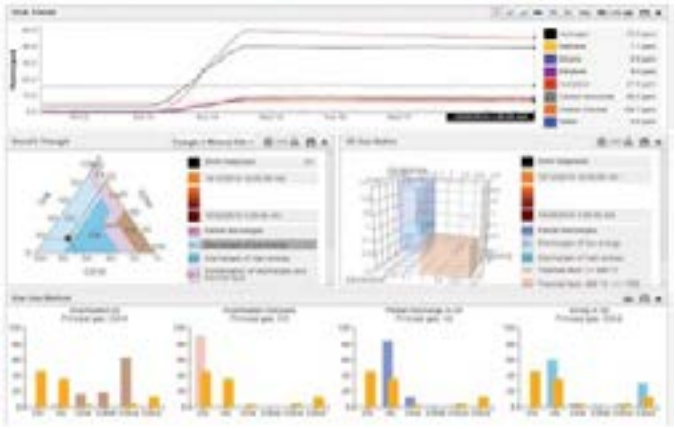

Figure 2. DGA Diagnostic results

The level of Acetylene in the manual samples showed a high level of Acetylene confirming the findings of the TOTUS transformer monitor.

The transformer was temporarily shut down, while root cause analysis was completed. With the decision from O&M being to replace the converter transformer.

Implementing proactive maintenance strategies is crucial for reducing downtime and costs, offering significant benefits for operational efficiency and financial protection. The detection of elevated Acetylene levels, confirmed by both the TOTUS DGA system and laboratory tests, highlights the importance of a digital transformer monitoring solution. Elevated Acetylene indicates electrical arcing, uncommon in new transformers, which can lead to failure if left unaddressed. Swift action to rectify issues like those affecting converter transformers minimizes downtime and prevents potential damages, cutting repair expenses and avoiding contractual penalties for service disruptions.

About Camlin Energy

For over 30 years, Camlin Energy has grown their global presence and been at the forefront of key innovations that have changed the face of the global energy industry.

We work collaboratively with global energy companies and our partners to deliver cutting-edge technology, technical expertise, and focused service and support. We are working hard to deliver unparalleled visibility of networks and critical assets, enabling targeted interventions to be made at the right time.

Our capabilities are end-to-end right across the grid. Our suite of smart sensors, advanced software and expert services enable energy operators to optimize the performance of assets, enhance network performance and reliability and help us on our journey to Net Zero.

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Camlin Energy

31 Ferguson Drive
Knockmore Hill Industrial Park
Lisburn BT28 2EX
Northern Ireland

Camlin Energy (US)

5085 Avalon Ridge Parkway
Suite 200 Norcross
Peachtree Corners
GA, 30071, Atlanta

T: +44 (0)28 9262 6989 | T: (+1) 773-598-4126
E: mail@camlingroup.com | W: camlinenergy.com

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