

CONNECTING DATA TO DECISIONS

Case Study 12
US Transmission Company

Linking Total Transformer Monitoring & Actionable Information
to Drive Business Value for Utilities

US TRANSMISSION COMPANY



Details

Correlation is the key for diagnosis.



Evidence

Multiple acetylene deviations recorded by TOTUS TTM. the correlation capabilities of the TTM provided a root cause analysis for the asset management strategy.

One of the 6 TOTUS TTM installed in the fleet recorded multiple Acetylene deviations: 3 step changes recorded over 1 year of monitoring data (Figure 1).

Figure 1: DGA results over the monitored period.

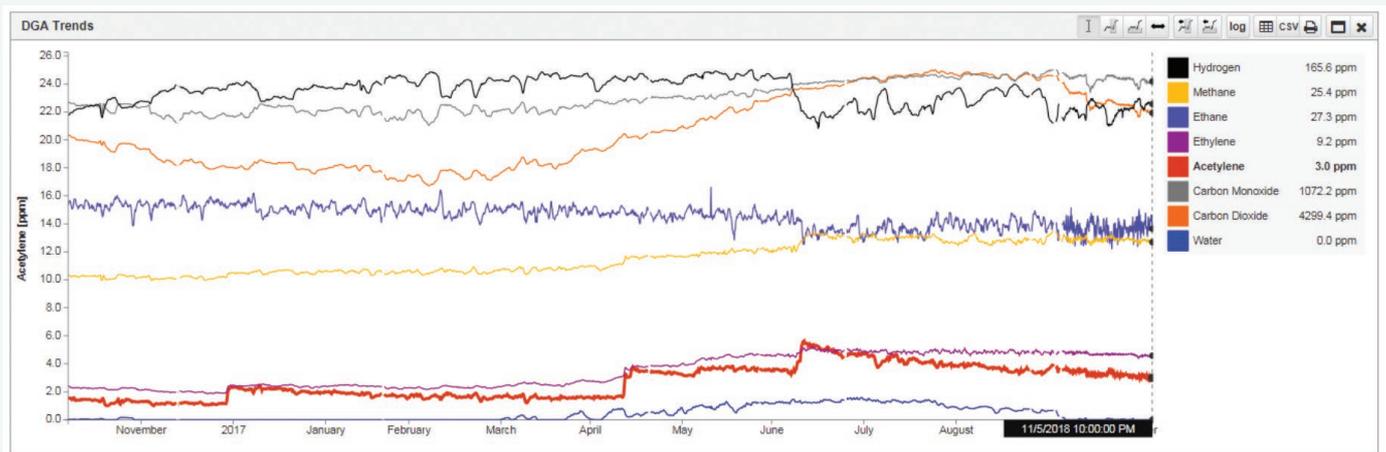


Figure 1 highlights Acetylene concentration increase up to a max of 5.6 ppm (July 2018). TOTUS TTM issued alarms and maintenance personnel conducted manual oil samples to be analyzed in laboratory (GC method used).

According to literature, C₂H₂ deviations occur as the consequence of arcing or discharges with high energy in the transformer tank. Although the ppm concentrations do not indicate an imminent failure, these events must not be neglected. Furthermore, it is essential to remark that several questions are un-answered in the current status:

- How many windings are affected?
- What is the affected phase? Only one or multiple?
- HV side or LV side?
- Is there anything sustaining the occurrence of arcing or discharges?

Answers to the above questions are the crucial step for an effective resolution plan.

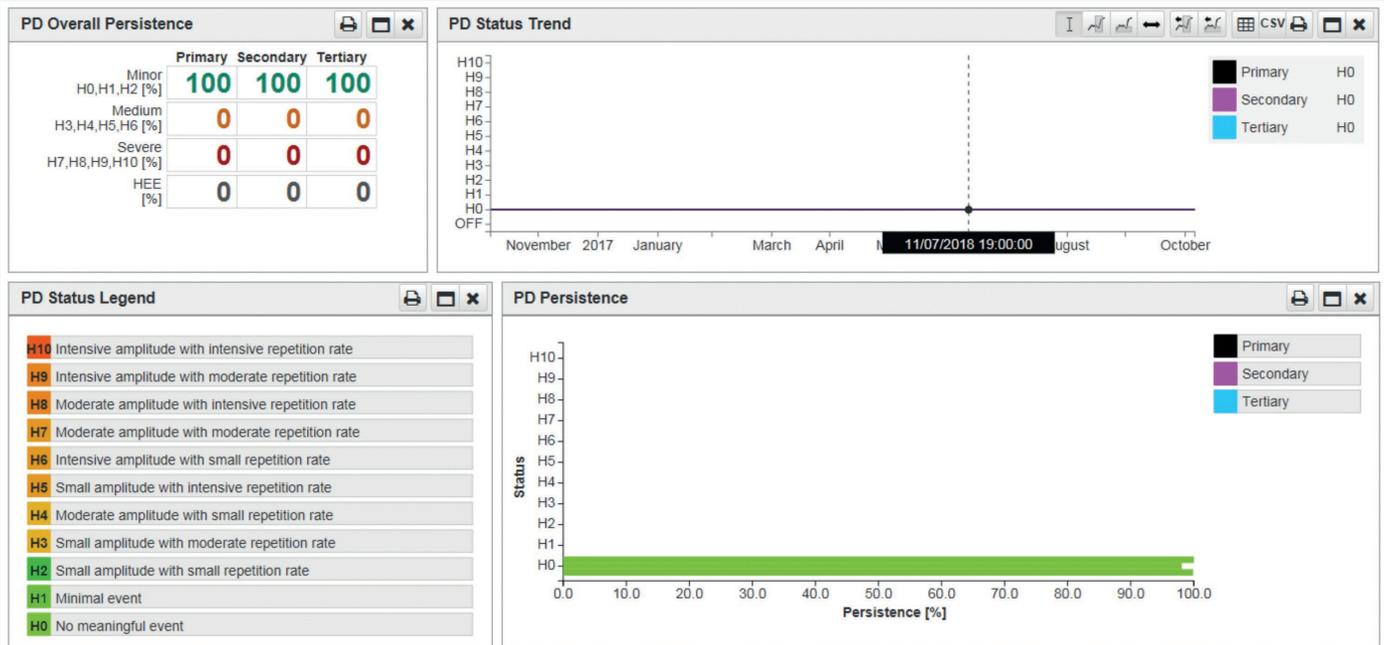
TOTUS TTM is designed to be an all in one monitoring system capable to combine DGA, Partial Discharge, High Energy Events and Bushing Monitoring within the same device together with environmental and operational parameters. The benefit of such a device is the unique capability to combine advanced detection of incipient failure mechanisms with embedded correlation tools.

While the laboratory results confirmed the increases they did add further details to the root cause analysis.

By looking at the data provided by the TOTUS TTM accurate conclusions were identified.

STEP 1: C2H2 increasing suggested the occurrence of arcing activity in the transformer tank, thus, PD and High Energy Events were evaluated.

Figure 2: PD summary over the monitored period.



No persistent PD activity was recorded within the monitored period. This means that the Acetylene increases were not the consequence of a stable and continuously active PD Phenomenon. The same conclusion can be taken for High Energy Events (in the following HEE).

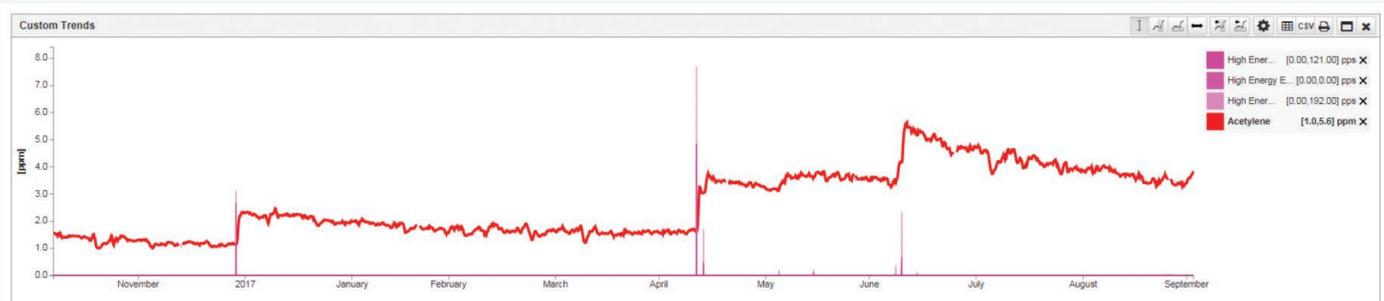
HEE are defined as PD events which have abnormally high amplitude (>10 Volts) and sporadic nature.

Following the investigation stage would be the occurrence of sporadic events to verify whether HEE or PD occurred concurrently with C2H2 step changes.

Figure 3: Custom Trend Chart - correlation between C2H2 and HEE.

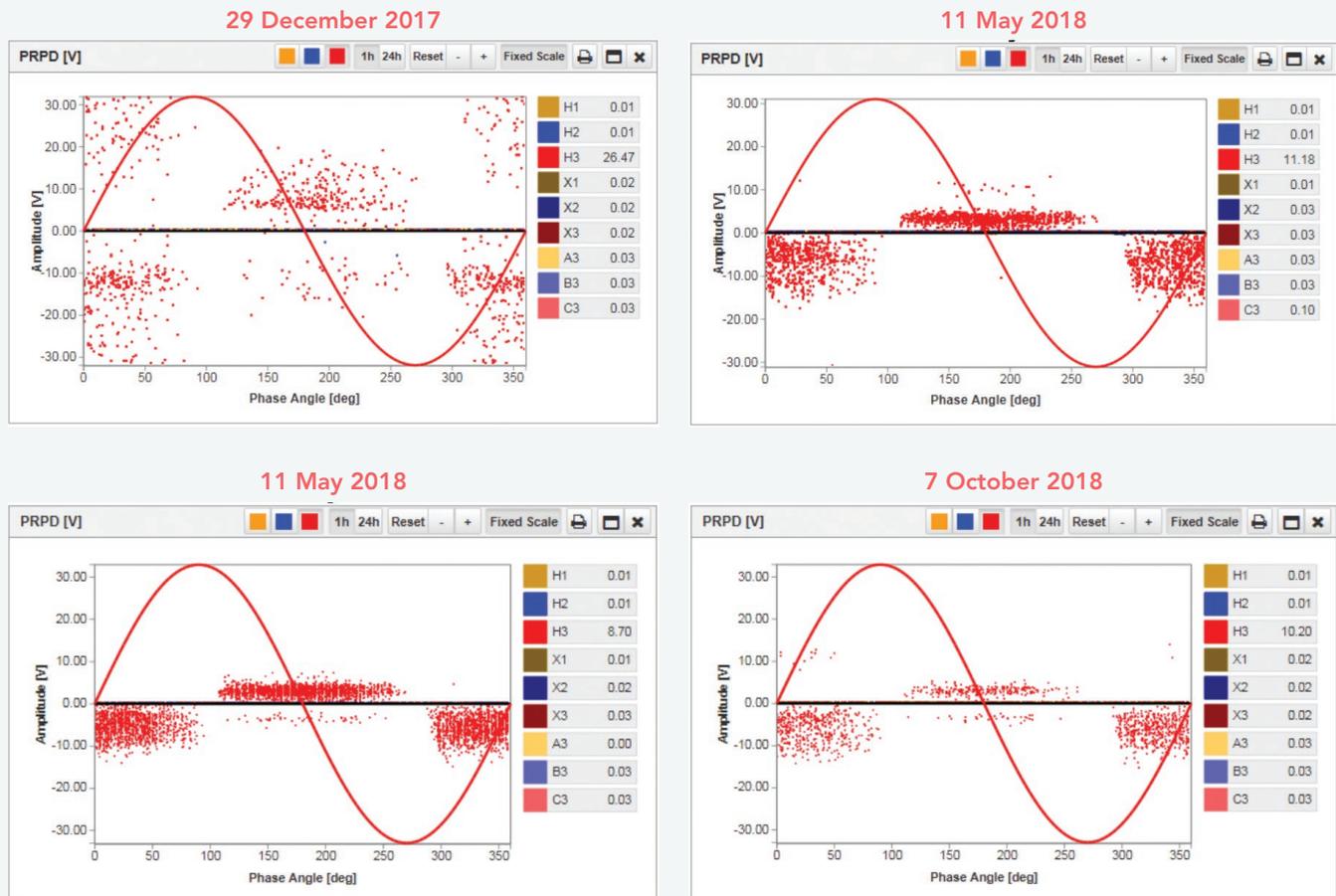
STEP 2: Cross correlation between C2H2 and HEE through Custom Trends.

Customized trending capability enabled by the TOTUS TTM, allowed for the Acetylene ppm concentrations to be plotted together with HEE from Primary, Secondary and Tertiary windings (Figure 3) showing concurrence between HEE and C2H2 step changes.



In this case further in-depth investigations must be addressed, Phase Resolved PD patterns can be also evaluated through TOTUS PRO Desktop in order to figure out which phase is the most affected between the three.

Figure 4: PRPD Patterns over the monitored period.



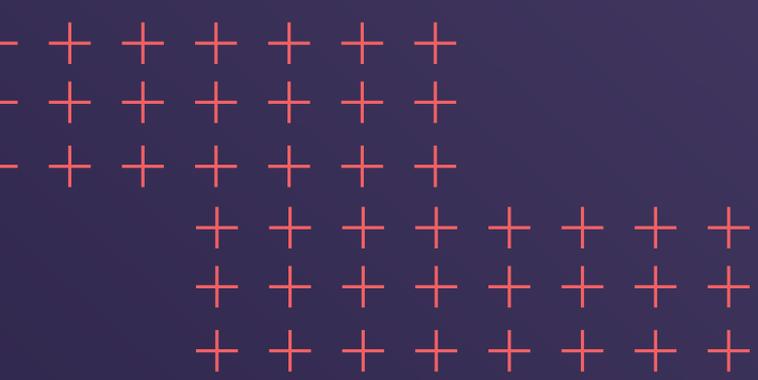
Conclusion is that in the instance of a suspicious sequence of events a step forward can be achieved on diagnosis.

Un-answered questions are now resolved:

- How many windings are affected?
 - One
- What is the affected phase?
 - H3 phase according to the transformer nameplate
- HV side or LV side?
 - HV side according to the wiring procedure and transformer nameplate

The Asset Management Team is now in a position to define the strategy plan in detail:

- A. Continue to monitor and properly react with specific and targeted actions (upon the Utility policy) in case of further Acetylene step changes or HEE occurrence.
- B. Electrical Tests planned anyway as soon as the transformer goes through the next outage to directly investigate the High Energy Event source in H3 phase.



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