



# Utility Avoids Costly Misdiagnosis and Downtime with TOTUS

CASE STUDY





## CHALLENGE

Detecting Multiple Defects in a Single Transformer

A 150 MVA autotransformer, commissioned in 2003, was flagged for potential issues based on offline Dissolved Gas Analysis (DGA) results. Utilities face critical challenges when multiple anomalies appear simultaneously on a single asset:

- **Thermal faults** (elevated methane and ethylene) can indicate insulation overheating
- **Electrical faults** (high-energy partial discharges) may suggest bushing or winding defects
- **Misattributing failure modes** can lead to unnecessary downtime or improper interventions
- **Lead times for replacement transformers** can be long, making proactive planning essential

The utility needed **clear diagnostic separation** of the two phenomena to act confidently without taking the transformer offline prematurely.



## EVENT

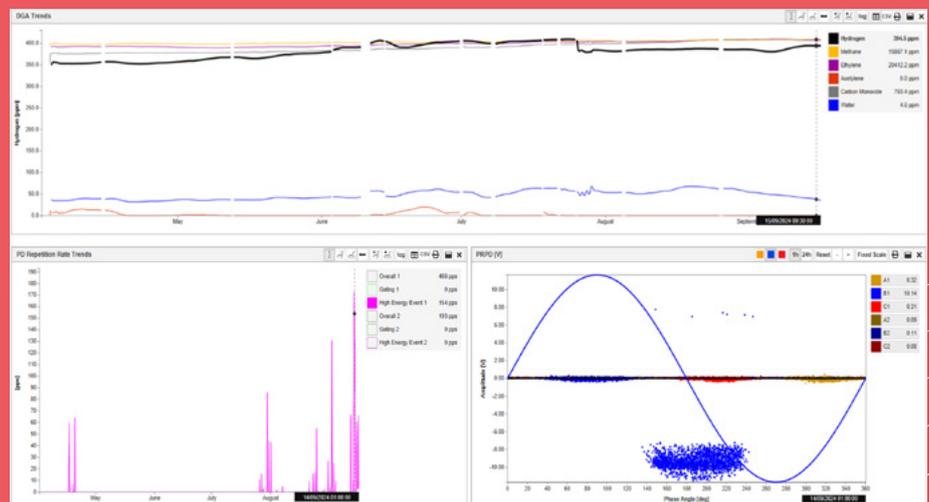
TOTUS Detects Concurrent Thermal and Electrical Anomalies

TOTUS transformer monitoring was installed in 2024 to provide continuous, realtime visibility of transformer health. Shortly after commissioning, the system detected exceptionally high concentrations of methane (15,867ppm) and ethylene (20,412ppm). At the same time, TOTUS recorded high-energy discharge activity within the primary winding, consistent with floatingelement partial discharge. Historical winding resistance measurements also showed elevated resistance in phase A, pointing to a localised hotspot that was contributing to the thermal fault.

Through combined DGA, PD assessment, and electrical diagnostic data, TOTUS was able to distinguish the two issues clearly. The methane and ethylene generation was driven by thermal degradation in the main tank, while the high-energy discharge activity originated from the bushings. This differentiation allowed the utility to address each problem independently and avoid the disruption and cost of treating them as a single, indistinct fault.

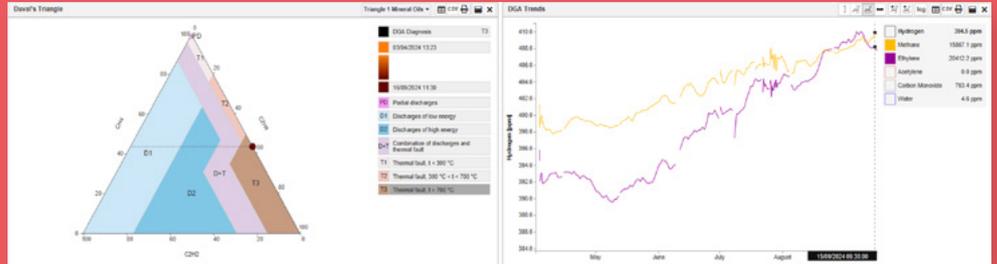
**Figure 1:**

DGA trends highlighting extremely high concentrations of gas



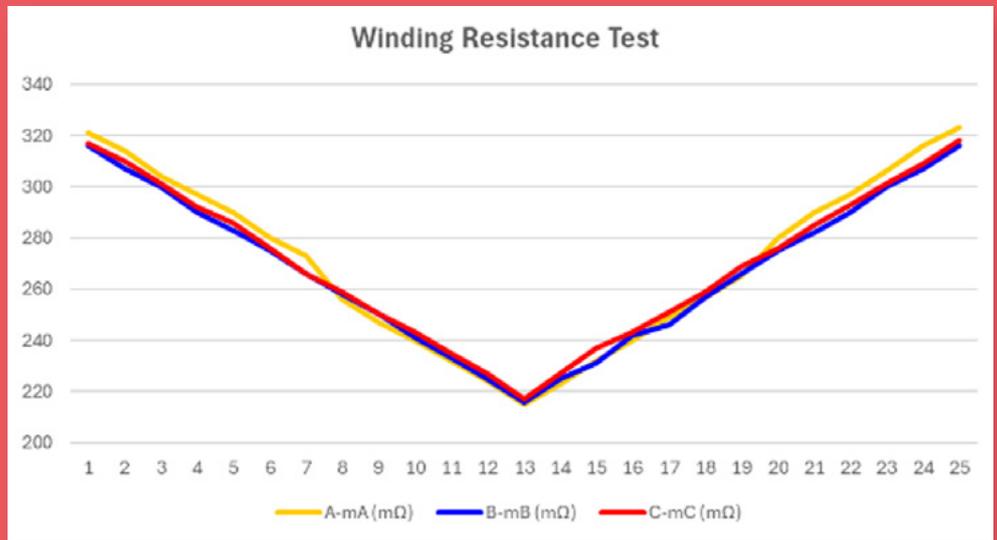
**Figure 2:**

Methane and Ethylene are attributed to thermal defects, and their generation is not due to electrical discharges



**Figure 3:**

Historical winding resistance results, revealing a deviation in phase A compared to phases B and C



**Figure 4:**

XXX

Положај регулатора	Струја мерења (A)	Температура (°C)	Измерени отпор (mΩ)		
			A - mA	B - mB	C - mC
1	10	40	321	316	317
2			314	307	310
3			304	300	301
4			297	290	292
5			290	283	286
6			280	275	276
7			273	266	266
8			256	258	259
9			247	250	250
10			240	241	243
11			232	233	235
12			224	225	227
13b			215	216	217
14			223	225	227
15			232	231	237
16			240	242	243
17			249	246	251
18			257	257	259
19			265	266	269
20			280	275	276
21			290	282	285
22			297	290	293
23			306	300	301
24			316	307	309
25			323	316	318
	10	40	202	203	204
	10	40	a - b	b - c	a - x
	10	40	4.5	4.5	4.6



## ACTION

### Targeted Diagnostics and Planning

With the defects clearly differentiated by TOTUS, the utility was able to carry out targeted investigations rather than broad, disruptive interventions. Oil samples were taken from the HV bushing for DGA analysis, and an infrared thermographic inspection was completed to verify the location of the suspected hotspot. These tests confirmed two distinct issues: a thermal fault within the transformer tank causing significant gas generation, and highenergy discharge activity originating from the bushings.

Armed with this evidence, the utility could proactively plan for transformer replacement, critical given extended manufacturing lead times, while managing the bushingrelated discharges separately. This crossdomain diagnostic approach enabled effective intervention planning without unnecessary shutdowns, maintaining operational continuity throughout.

# Two failures, one asset: a cross-domain diagnostic approach



## OUTCOME

### Prevented Failure with Measurable Business Impact

#### Technical outcome:

- ↓ Early detection and separation of thermal and electrical faults
- ↓ Accurate localisation of risks to either transformer tank or bushings
- ↓ Avoided emergency shutdowns and reactive interventions

#### Commercial & Operational Impact:

- ↓ Maintained **asset availability** while planning for replacement
- ↓ Minimised **unplanned outage costs** and operational disruption
- ↓ Reduced risk of **catastrophic failure** or collateral damage
- ↓ Enabled **evidence-based, targeted maintenance**, optimizing resource allocation
- ↓ Improved **confidence in decision-making** under complex multi-fault scenarios