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CORRELATIVE ANALYSES FOR TRANSFORMER HEALTH ASSESSMENT

Emilio Morales, Thomas Linn
Qualitrol Company LLC

CURRENT INDUSTRY TRENDS

DEREGULATION CHANGED THE FACE OF THE ENERGY MARKET

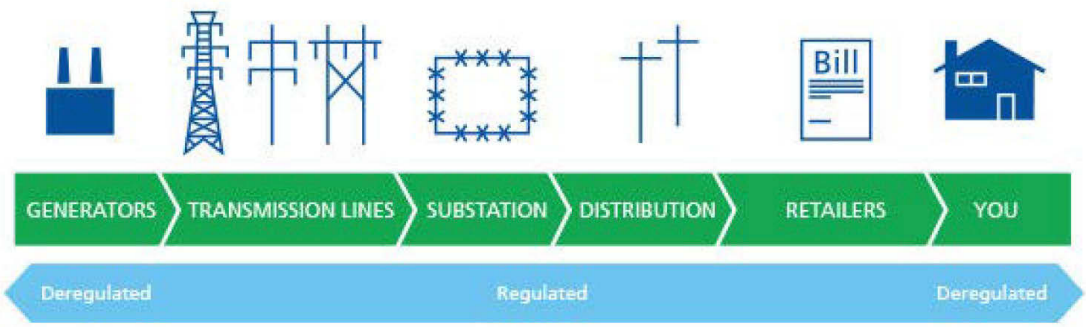
GENERATION, TRANSMISSION AND DISTRIBUTION WERE DIVIDED

MORE PROFIT ORIENTED ENTERPRISES

OUTSOURCE MAINTENANCE AND OTHER TECHNICAL SERVICES

CAREFUL INVESTMENTS IN NEW OR RENEWAL OF EQUIPMENT

SOMETIMES LIMITED TO REPLACEMENT



CURRENT INDUSTRY TRENDS

INCREASE

Transformer Utilization Rates
- Higher transformer loading
- Need to extend useful asset life
- Higher performance expectations

Maintenance Costs
- Higher crew costs
- Increased safety regulations
- Aging asset infrastructure

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DECREASE

Operation and Maintenance Budgets
- Fewer resources
- Limited time constraints

Industry Expertise
- Retirement of industry veterans
- Loss of key asset knowledge

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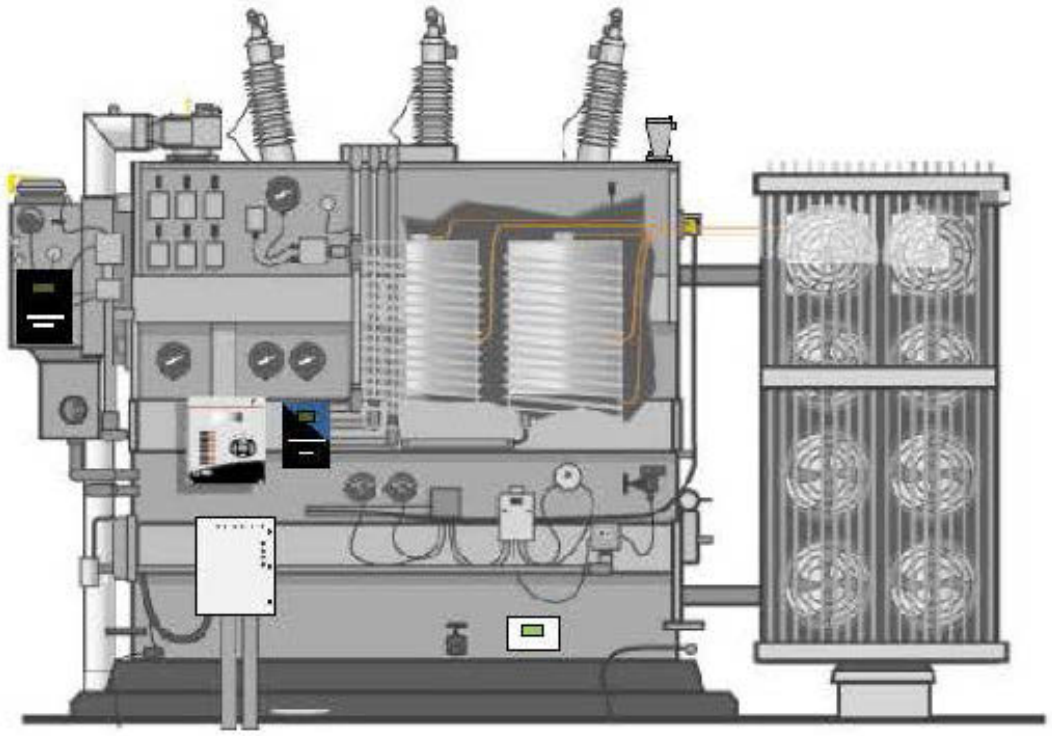
NEED FOR CONDITION MONITORING

- Extension of useful asset life
- Constant window on asset health
- Avoid unnecessary maintenance
- Automated data collection

CURRENT INDUSTRY TRENDS

- Reliable transformers are essential
- Condition knowledge is extremely important
- Offline condition assessment methods:
  - Screenshot of the asset
  - Health condition can only be estimated
  - Incipient faults can be missed



CURRENT INDUSTRY TRENDS

- Online monitoring was limited to some parameters
- Users struggled accessing the true overall condition of an asset
- Confusions prevailed over clear decisions

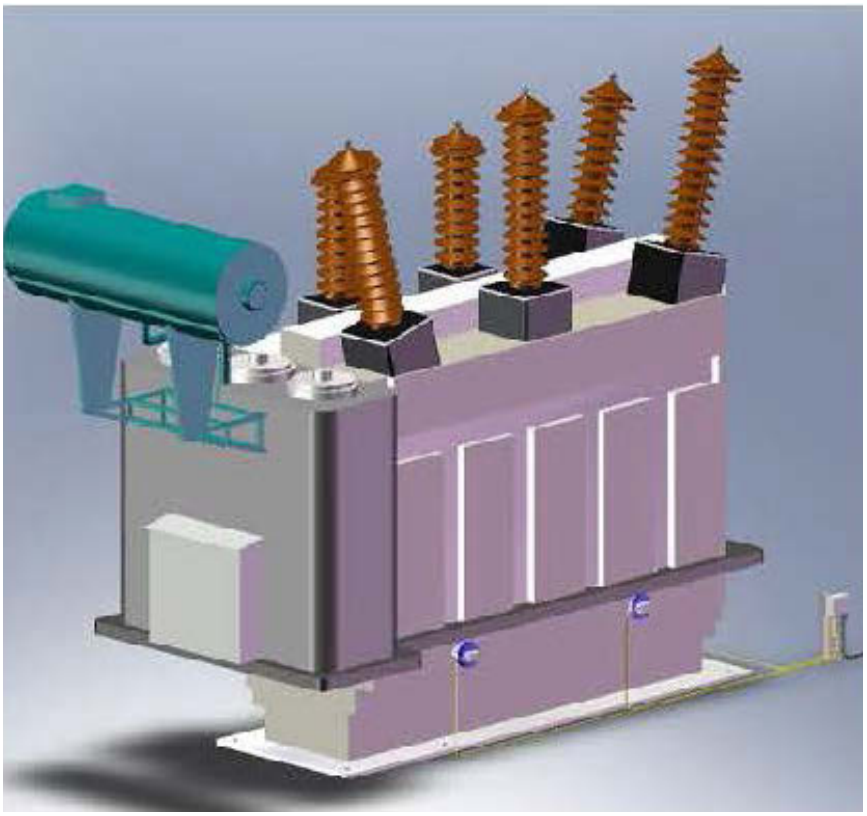
“FALSE ALARMS” LEADED AND LEAD IN NOT TRUSTING INSTALLED MONITORING SOLUTIONS

A COMMON OPINION STILL IS THAT ALWAYS THE HELP OF EXPERTS IN THAT FIELD IS NEEDED

CURRENT INDUSTRY TRENDS

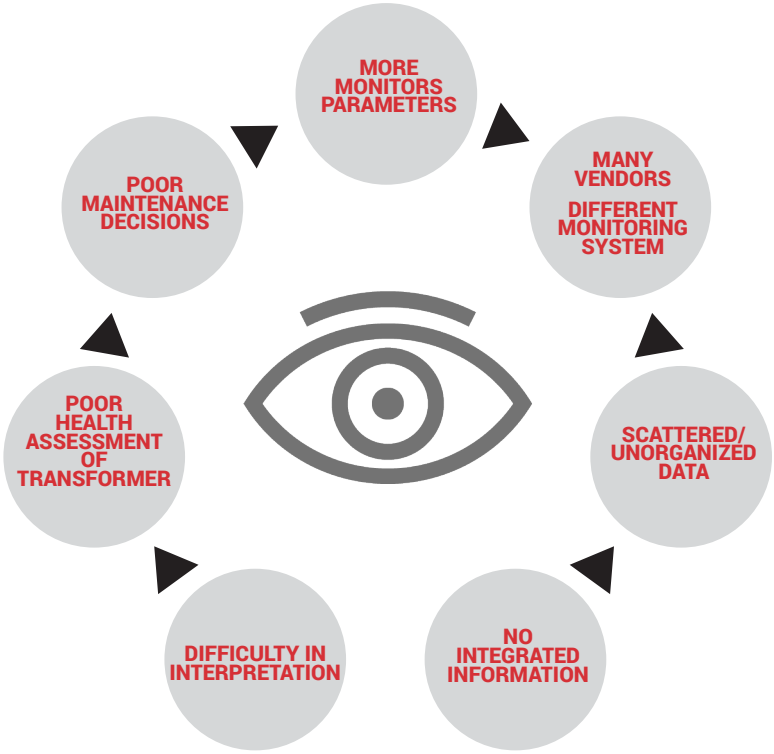
Important drivers for the development of innovative condition monitoring:

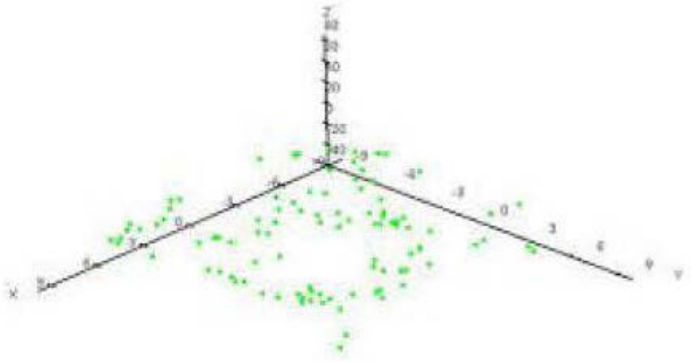
- Operating the assets
- Assessing the condition of major network components to maintain the ability to deliver electrical energy
- Use the equipment till its real end of live



THE CHALLENGE

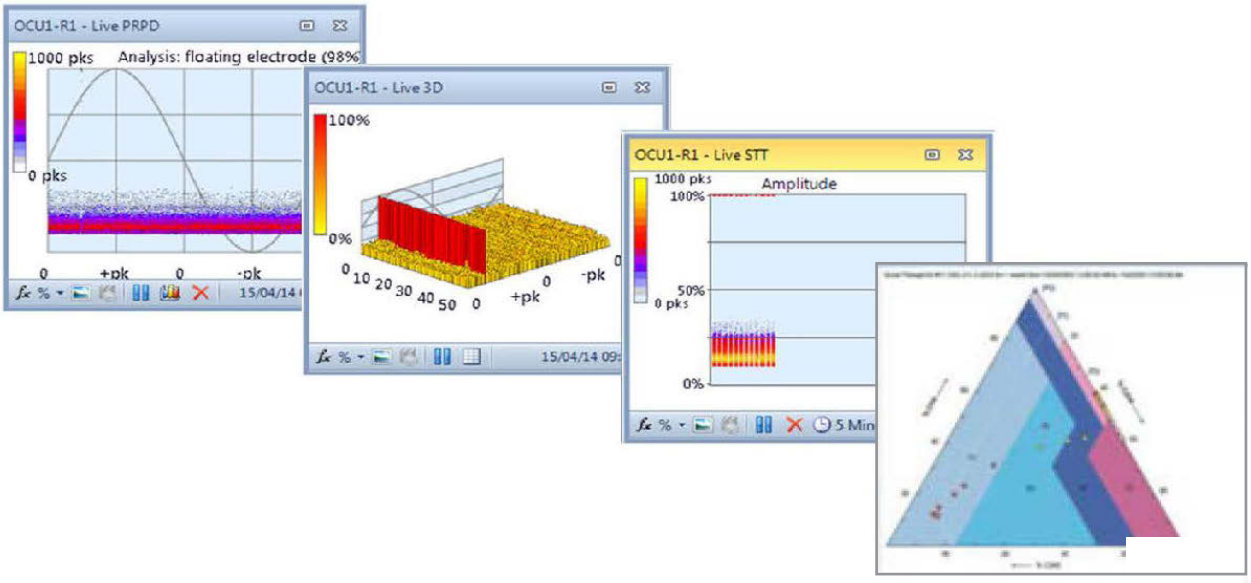
- Presenting “only” data can mislead to:
  - Poor maintenance/ operational decisions
  - Unnecessary interventions
  - Potential to introduce new risks
- Often it is difficult to analyze the scattered data
- Data are analyzed separately in disregards of the possible relationship to other parameters or even legacy data





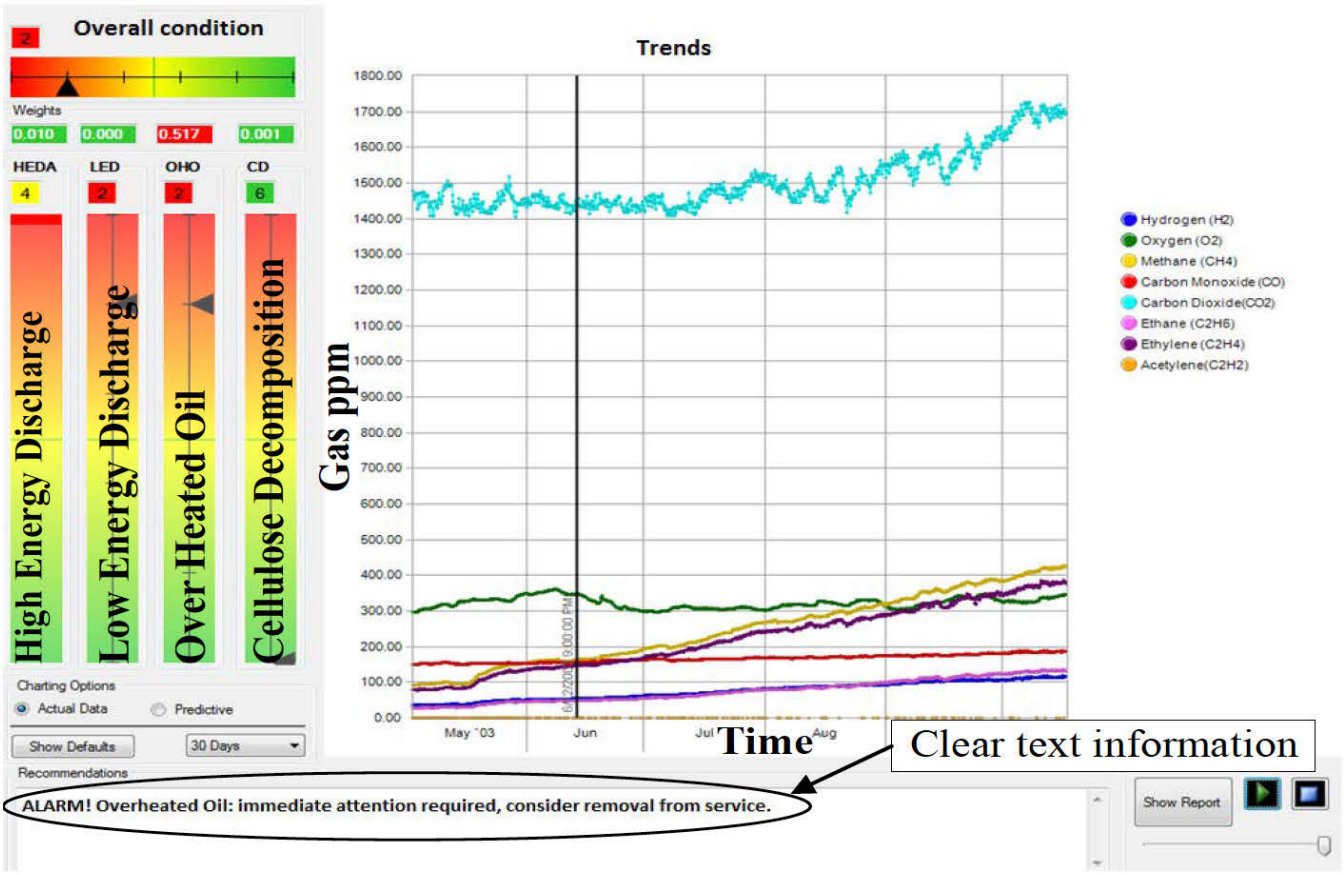
ANALYTICS VS. DIAGNOSTICS

Diagnostics are used to find for example the root cause/ location etc. for a certain abnormality.



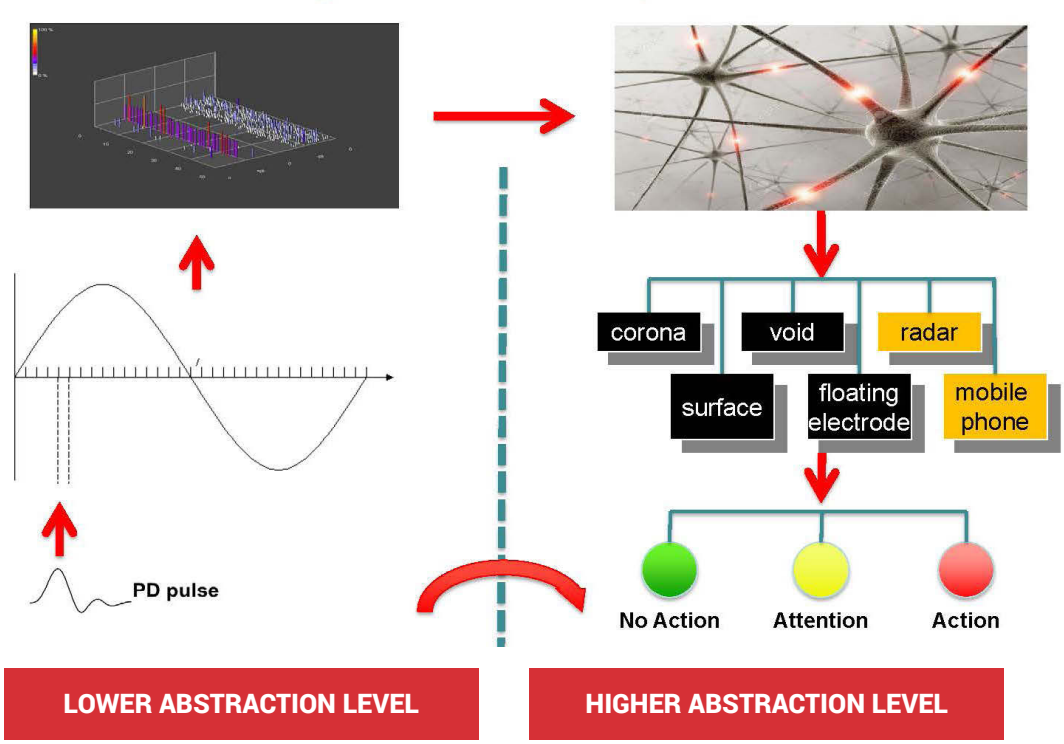
ANALYTICS VS. DIAGNOSTICS

Analytics describes the condition of an asset based on a certain input parameters (provides the inside of the asset). To determine often neuronal networks, simple and fuzzy logic etc. will be used.

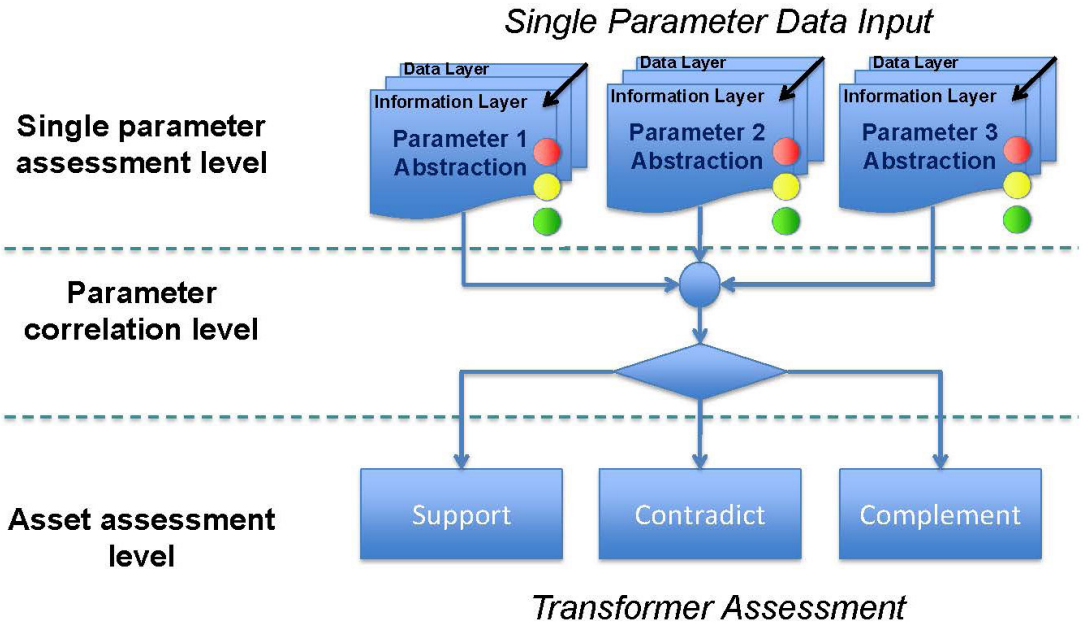


Gas in oil analytics with clear text information/ recommendations

DATA ANALYTICS EXAMPLE

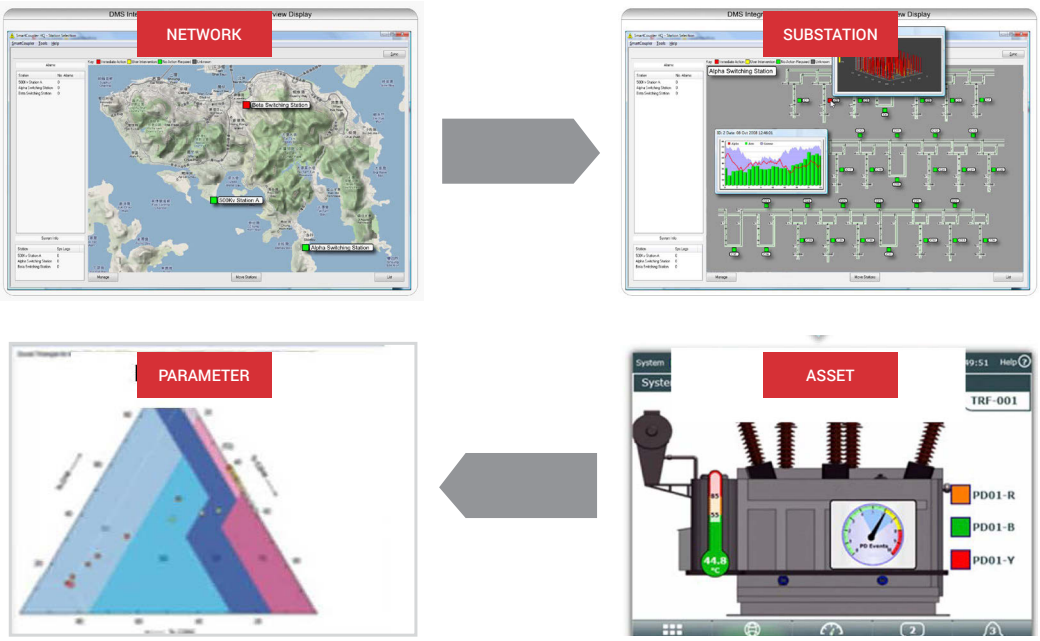


CORRELATIVE INFORMATION ANALYZES



USER ABSTRACTION LEVELS

Applying the abstraction levels to a utility user the user



APPLICATION OF DIFFERENT PARAMETERS FOR ONE PHENOMENON

Applying the abstraction levels to a utility user the user

PHENOMENON LEADING TO FAILURE	MEASURED SIGNALS	DIAGNOSTIC MODELS	CONFIRMATION	DETECTION TIME
Loss of core ground	Hydrogen or multi-gas	DGA	1	Hours
Unintentional core and shields grounds	Core ground current	Core Ground Current	2	Real time
	Gas accumulation relay	Gas Accumulation Rate	3	Hours
	PD	PD	4	Real Time Hours
	Core hotspot (Fiber)	Thermal	5	
	Temperature			

CONCLUSION

1. Comparing different parameters/analytical models is essential in order to achieve a complete transformer condition view.
2. Increase the confidence in the result of the risk assessment.
3. Will support Condition Monitoring Principles.
4. Helps to avoid false alarms.

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