ETOS® Asset Intelligence – Intelligent maintenance of power transformers

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ETOS® Asset Intelligence

New technologies can help compensate for the loss of personnel knowledge and the increased demands on operating equipment.
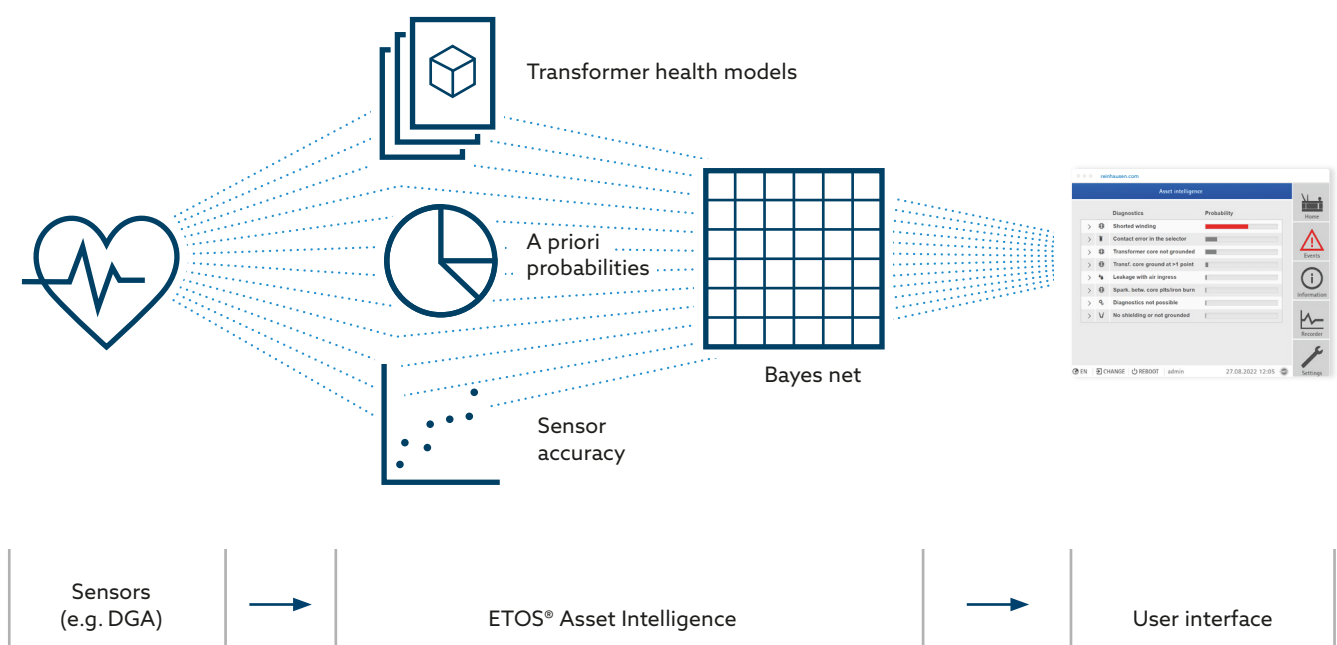
Monitoring and sensor systems on power transformers, such as DGA systems, are often installed on power transformers for early fault detection. These can detect operating states and send corresponding messages when limit values are exceeded. However, the mere attachment of various sensors has two decisive disadvantages. Firstly, the sensors generate a lot of data and messages which are not centrally monitored and evaluated, and multiple events per transformer cannot be easily monitored and interpreted. Secondly, sensor values are not used to comprehensively assess a problem. For example, if temperature, partial discharge and DGA sensors are all capable of detecting winding faults, their statements are not compared with each other. Thus, contradictory statements can occur, and a simple diagnosis is not possible.

With ETOS® Asset Intelligence, all sensors present on the power transformer are integrated and considered together. A Bayesian network checks which error patterns best match the warning messages that have occurred as well as those which have not occurred. In addition, the a priori probabilities for typical transformer faults (initial estimate of the likelihood of failure) and sensor accuracy (e.g., fault messages) are taken into account.
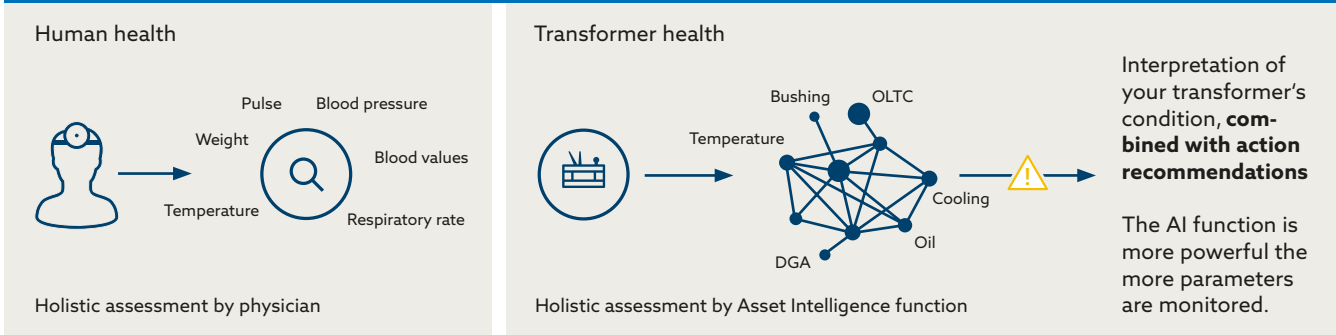
The result is a probability estimate for all known transformer problems, with the most likely problems being displayed to the customer, along with a list of reasons for the findings. This allows the specialist to interpret the diagnostic results in a simplified and efficient way.

> **"** *Asset Intelligence for power transformers provides a guide to minimize risks and take corrective action quickly."*
> Tobias Gruber | Product Manager ETOS®

Transformer health models

A priori probabilities

Sensor accuracy

Bayes net

| Sensors (e.g. DGA) | → | ETOS® Asset Intelligence | → | User interface |

ETOS® innovative AI function merges individual data into actionable insights

Human health

Pulse   Blood pressure

Weight

Blood values

Temperature   Respiratory rate

Holistic assessment by physician

Transformer health

Bushing   OLTC

Temperature

Cooling

DGA   Oil

Holistic assessment by Asset Intelligence function

Interpretation of your transformer's condition, **combined with action recommendations**

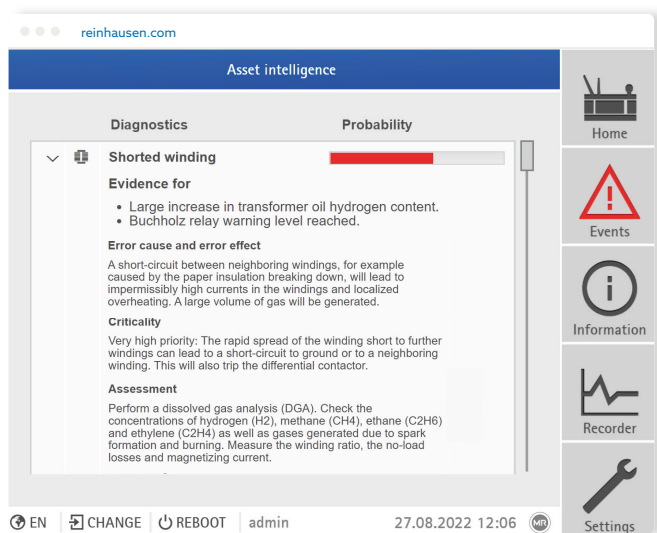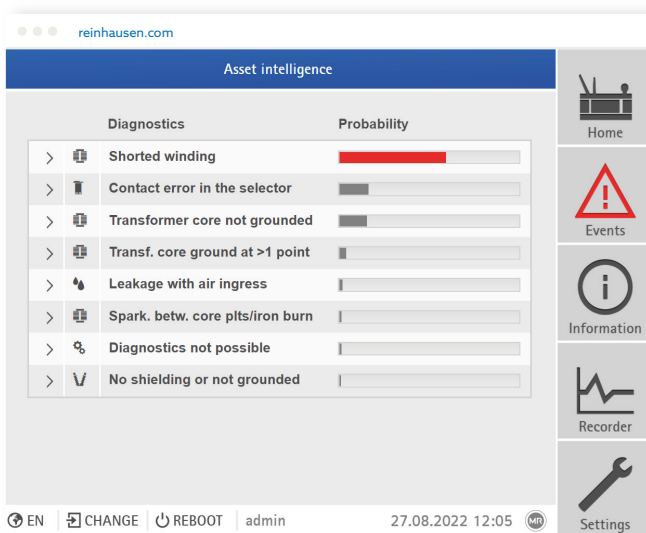The AI function is more powerful the more parameters are monitored.

Single outliers say little. Only the integrated evaluation over time allows the reliable detection of potentially critical conditions.

Due to the accurate fault description, the operator knows how to correctly classify the fault, assess its criticality, and initiate the next steps. Qualified fault diagnoses are provided based on the probability of the most common transformer failures as well as the actual measurements and results. The more sensor readings available in the process, the more powerful Asset Intelligence is. Like a human doctor who can diagnose through holistic assessment, Asset Intelligence for power transformers provides a guide to minimize risk and take corrective action quickly.

The following example serves as an illustration: The Buchholz relay has tripped, and the hydrogen level is greatly increased. Otherwise, there are no further limit violations. ETOS® Asset Intelligence provides the findings shown in the figure below.

By using ETOS® Asset Intelligence, the operator gets not only data but qualified support which provides competent recommendations for actions. This will help operators to compensate staffing bottlenecks, which might occur in context with complexity of tasks during energy transition.

$\longrightarrow$ **More information**

Your benefits

+ **Effective handling of uncertainty**

ETOS® Asset Intelligence is useful for modeling uncertain and complex transformer systems. It can handle incomplete and noisy data and provide probabilistic estimates of the likelihood of different diagnoses.

+ **Identification of causal relationships**

ETOS® Asset Intelligence can help identify causal relationships between different variables, which can be used to diagnose the root cause of the failure. By representing the causal relationships among variables, Asset Intelligence can provide insights into the mechanisms that lead to a failure.

+ **Improved accuracy**

ETOS® Asset Intelligence can improve the accuracy of failure diagnosis by combining multiple sources of information, including expert knowledge, sensor data, and historical data. This can help reduce false positives and false negatives in the diagnosis.

+ **Flexibility**

ETOS® Asset Intelligence is always updated as new information becomes available. This makes it particularly useful for online or real-time diagnosis where the data is constantly changing.

THE POWER BEHIND POWER.