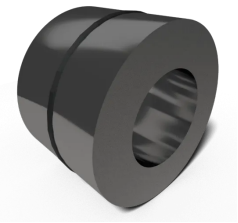
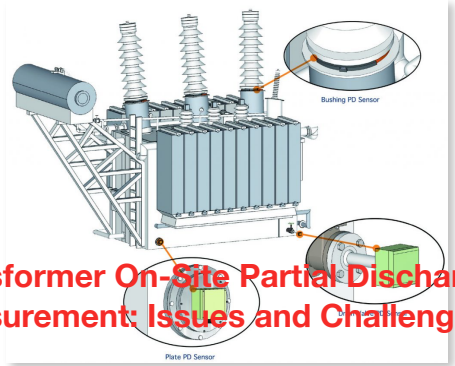
Quick Info

Cold Rolled Grain Oriented (CRGO) magnetic steel of transformer was invented by N.P. Gross in 1933. It has significantly improved the magnetic permeability and reduction in magnetostrsiction of silicon steel.



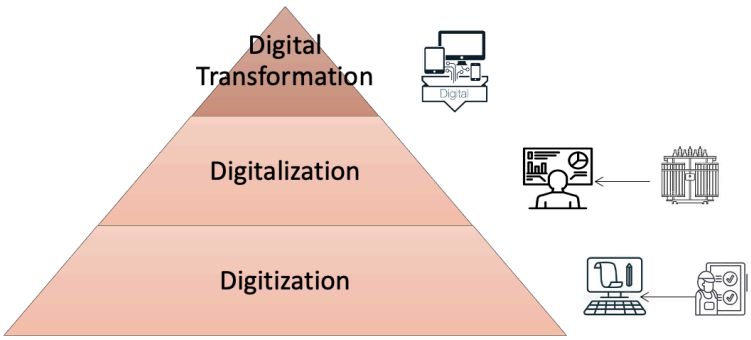
Next Issue



DIGITALIZATION OF TRANSFORMER MAINTENANCE: SHAPING THE FUTURE

Condition based maintenance has allows the utilities to predict the health condition of in-service power transformer and allow maintenance actions to be taken at an early stages to prevent any potential failures. It collects condition data that reveals failure mechanisms and deterioration patterns either through online or offline monitoring systems. In today modern world, the implementation of advanced technologies such as big data, industrial internet of things, and analytics has bring improvements to existing processes and business models. Similarly, we have seen significant improvement in digitisation and digitalization of maintenance and management of power transformer over the last ten years.

The digital transformation in asset management was started by digitisation and later digitalization. Digitization can be refer as creating a digital representation of physical objects or attributes. In other words, digitization is about converting something non-digital into a digital representation, in which the computerized systems can then use it for various applications. An example in asset management would be when an inspection or measurement is converted from a manual reading to an electronic one.



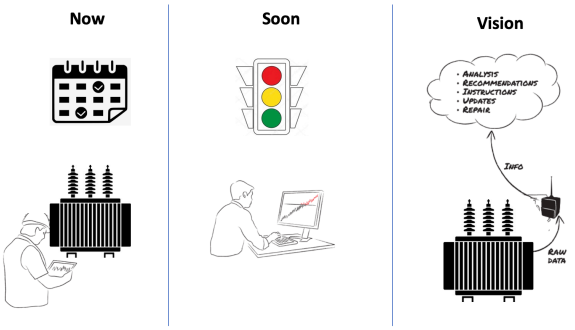
Digital Transformation Pyramid

On the other hand, digitalization refers to enabling or improving processes by leveraging digital technologies and digitized data. Examples of this could be a sensors or microprocessor-based system for online data monitoring and analysis. Digitalization increases productivity and efficiency while optimised the operation and maintenance costs. In our industry, digitalization is to ensure reliability and maximum lifetime – the transformer condition is monitored continuously and evaluated for appropriate asset management decisions. Asset

management needs to be both cost-effective and reliable, sensing solutions that provide asset managers with actionable intelligent data.

SMART TRANSFORMER MANAGEMENT

As a critical asset in electrical network, transformers normally received a special attention regarding condition and risk assessment. For a decades, offline condition assessment methods are established and successful. Nevertheless, the measurement require an outage and thus only give a momentary screenshot of the asset at the time of the measurements, so the development of incipient faults can be missed between outages.

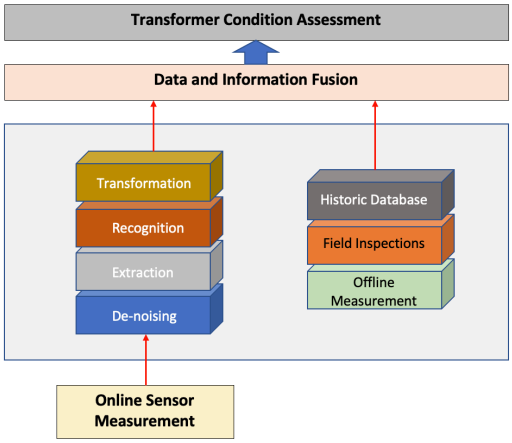


Phases of Digitalization in Transformer Management

The digitalization initiatives and introducing of online condition monitoring has shown significant improvement in the management of transformer fleet and now increasing used by major power utilities. The real-time data by means of connected sensors and algorithms, which enables the maintenance manager to make informed decisions and take corrective action has lead to a marginally lower maintenance costs, lower downtime of assets, and fewer critical breakdowns. A long term vision could incorporated Artificial Intelligence (AI) for automatic data analysis and interpretation and perhaps automatic maintenances.

Online Sensor for Smart Monitoring

The incipient faults in power transformer will somehow result in the creation of detectable signs; could be chemical, electrical, optical, or acoustic in nature, but often they will be a combination of these. Detection of these parameters are important for digitalization process in transformer life management. A framework for transformer asset management with a focus on monitoring and detecting transformer status may incorporated offline and online measurement. Deploying of sensors or Internet of Thing (IoT) are valuable in monitoring real time condition of power transformer which can prevent outage and extend the life span of in-service transformers.



Framework for Smart Transformer Management

A comprehensive and interactive of on-line monitoring system integrates all relevant main components of the power transformer. Temperature monitoring device such as current transformer based winding temperature indicator (WTI) and a PT100 fitted in a pocket to monitor top oil temperature together ambient temperature can forecast possible overloading and thus overheatin. Other devices like the Bucholz-relay data, oil level, pressure relief device and, if fitted, DGA data should be available to see the whole picture. All of these indicator's data should be taken into consideration to ensure a

healthy operating system. This data should be available online to get a real time indication of the situation and to build a picture of what the data should look like when everything is normal. As soon as any deviations are noted, they should be evaluated and a decision should be made, either to monitor the situation if not critical, or to take immediate action if need be to save cost on downtime and maintenance.

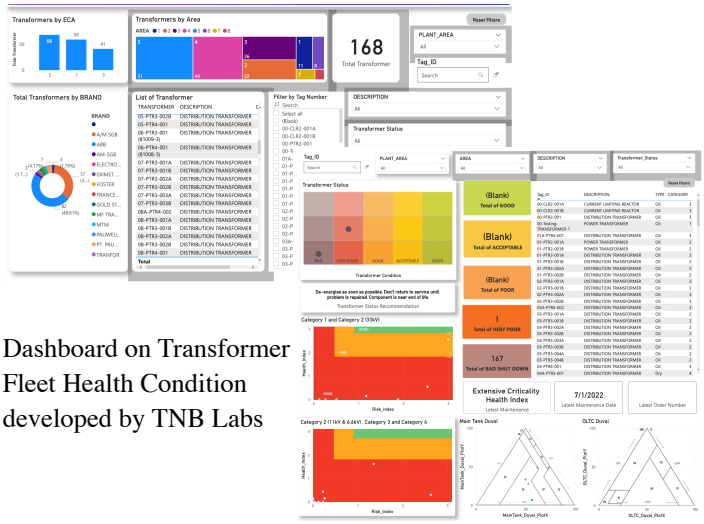
Installation of DGA online monitoring system at TNB substation

Online physical and infrared thermal inspection

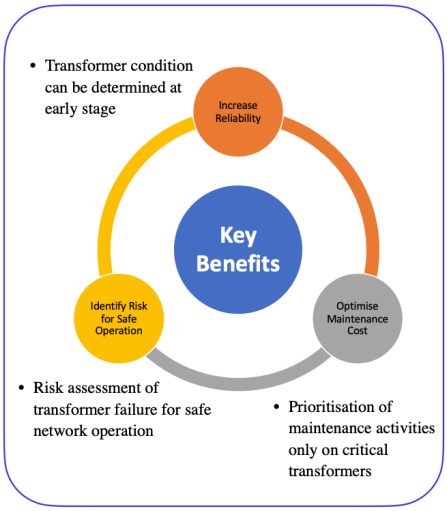
Data Analytic and Correlative Analysis

Data analytics are the key acceleration in digital transformation. It concerned with finding meaningful patterns based on input data and converting it to a useful output or valuable information on transformer health condition. Correlative analyses can be part of the analytics or in a simpler way a standalone technique, combining information based on different parameters and from different sources. The knowledge of failure statistics, problems and failures of a particular transformer fleet, and an understanding of failure mechanisms combined with criticality analysis are essential to choosing the right parameter for an assessment and building up analytic models.

By combining these capabilities into one Transformer Management System, we have a better tool as required for managing power transformers for maximized output; data is continuously captured, formatted and analysed from all the devices linked to the system which makes interpretation and decision making much easier.



Dashboard on Transformer Fleet Health Condition developed by TNB Labs



CONCLUSIONS

Major power utilities and plant operators have a very real need to move from “just monitoring” to the point of being able to have the full and continuous knowledge of the operating condition and state of the transformer fleet. When things begin to go wrong, diagnosis of the problem should be promptly made available and provide a recommended proactive course of action to reduce the risk of unexpected outages and damage to transformers and other associated equipment. The digitalisation in transformer management which include online condition monitoring, expert rule systems and artificial intelligence systems are now becoming important and has improve on operational reliability and safety of maintenance personnel and, no less importantly, help to protect the environment.

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