Monitoring and diagnostics

Analyze the past, monitor the present, and predict the future!

Asset Services/Monitoring and Diagnostics

www.siemens.com/td-services
We leverage the power of data

A reliable energy supply is the key to success for every enterprise in a globalized industrial world. It goes without saying that qualified online condition monitoring helps grid owners and utilities face their numerous challenges, including expenditure cuts and the loss of knowledge and expertise through retirement or downsizing.

In addition, operating aging equipment at higher performance levels affects its life span and reliability – and yet utilities are expected to maintain the same level of service.

Asset data management is realized with:
- Your expertise as a grid operator, plus
- Siemens’ unique OEM knowledge, plus
- Decades of experience in condition monitoring
Our portfolio covers the entire value chain of monitoring and diagnostics: Assess – Address – Act!

Assess: condition monitoring, collecting data
Online condition monitoring of primary substation equipment like high-voltage gas-insulated switchgear and transformers reveals the current condition of your assets. We offer condition monitoring as a stand-alone product or integrated into an entire monitoring system.

Address: asset data management, processing data
Our substation or central monitoring system based on ISCM technology serves to integrate all monitored assets – or even the entire substation. The collected data are processed for extended analysis and diagnostics and provide recommendations for the operator's daily business. A single screen displays the assets' condition and clearly indicates where action is required. No more alarms will be overlooked.

Act: asset performance management, predicting future condition
Processed online condition monitoring data lay the foundation for further risk analysis. To obtain reliable recommendations for your asset performance management, we use dynamic software that was designed as a decision support tool (Reliability Centered Asset Management, or RCAM) for asset managers.

The ability to assess and quantify your asset's future condition creates a valuable basis for designing an optimized asset management strategy – and enhancing your asset's performance as well.

Remote services
As an enhanced service for our customers, you can have Siemens Remote Diagnostic Centers monitor your assets or substations remotely, 24 hours a day, 365 days a year.

All available products and services are based on ISCM technology.

The goals of condition monitoring are straightforward: extended component life, meaning reduced lifecycle costs (OPEX and CAPEX); avoidance of dangerous or environmentally hazardous conditions; and avoidance of penalties by predicting and preventing equipment failures.

As Siemens' research has revealed, the majority of forced outages are predictable, and this presents network operators with a tremendous opportunity.

But while online condition monitoring has great potential, collecting data is not an end in itself. The crucial factor is using the data for higher-level analyses. Siemens leverages the "power of data" by capturing, processing, and analyzing them, providing a sound basis for action, for both daily operations and long-term planning of asset performance management.

Your benefits
• Reduced lifecycle costs
• Avoidance of faults and penalties
• Increased and secure energy supply
• Optimized asset performance
Condition monitoring focuses on essential predetermined objectives, including the avoidance of penalties and compliance with PAS55/ISO55000. We offer condition monitoring tailored to your individual priorities for the improved operation of your primary substation equipment.

Switchgear and transformers play a key role in every power network, and they are often in operation for decades at a time. These assets in particular must meet the requirements of the steadily increasing demand for electrical energy. The unavoidable effects of aging and wear can significantly impair your asset's functioning, even though equipment manufacturers have met the highest quality standards.

Siemens online condition monitoring helps avoid the inevitable costly failures. Our products and services are available as stand-alone products, or can be integrated into substation monitoring projects (see page 6, Asset data management).

Online condition monitoring for high-voltage gas-insulated switchgear (GDM SF₆ and PDM (UHF))<br>Grounded in more than 25 years of experience, UHF partial-discharge monitoring (PDM) and gas density monitoring (GDM) offer significant insights into the condition of high-voltage gas-insulated switchgear.

Gas density monitoring with Assetguard GDM<br>Assetguard GDM provides highly accurate measurements for gas inventory purposes. It enables you to minimize insulation gas emissions, which is important with respect to bonus and penalty regulations. Assetguard GDM was designed to allow the user a greater degree of flexibility in measurements and alarms than is currently provided by gauges with contacts. The system uses SF₆ density transducers. The result is a full SF₆ inventory management system capable of providing advance warning of SF₆ leaks with high accuracy. Transducers can be mounted directly on the GIS chamber using an industry-standard gas “top-up” connection.

Where easy access is required, they can also be retrofitted to gas monitoring boxes that house SF₆ gas-pressure gauges.

Partial-discharge monitoring with Assetguard PDM<br>Siemens UHF partial-discharge monitoring Assetguard PDM was developed for gas-insulated switchgear (GIS). Assetguard PDM facilitates measurements using internal or external UHF sensors. It supports compliance with the IEC requirements for high-voltage onsite testing using partial-discharge monitoring. The UHF transducer comprises:
- UHF sensor with UHF cable
- UHF signal filtering and optical processor

The specially designed optical-signal conditioning modules provide the data input to the data acquisition system in the node unit.

This typically allows one node unit to concentrate and process data for up to four high-voltage gas-insulated switchgear bays. It is also possible to perform partial-discharge localization with the application of a Siemens portable DiaLoc system.
Online condition monitoring for transformers

Siemens’ offering for online transformer condition monitoring is based on our in-depth knowledge as a manufacturer of power and distribution transformers with decades of experience in engineering, manufacturing, and maintenance.

Our portfolio covers a powerful monitoring solution for each transformer type, revealing the majority of faults easily and economically. The robust Assetguard TXM is available as a stand-alone product with an integrated Web server, and it can also be integrated into the ISCM substation monitoring system, where it will benefit from advanced data management. Customer-specific solutions are available with the monitoring packages provided by Sitram CM as part of the TLM (Transformer Lifecycle Management) solution. With both solutions, we can detect failures like dissolved gas in transformer oil, bushings, and tap changers. In addition, we can monitor the cooling system and partial discharges.

Assetguard TXM

Siemens online transformer monitoring convinces with its robust design, user-friendly handling, cost-effectiveness, and the high quality of the raw data it provides. It provides an optimal balance between failure prevention and investment.

Assetguard TXM is mounted close to the transformer to minimize interference with existing IT infrastructures. Recorded data are stored locally or forwarded over protocol, and a Web HMI is provided for access using any standard Web browser.

The power supply, data acquisition, Ethernet switch, and all other electronics required for operation are concentrated in one piece of hardware. The hardware used for Assetguard TXM is rugged and specially developed to withstand harsh transformer environments, including electromagnetic and thermal stress and mechanical wear due to vibration. All communication is transmitted via fiber-optic cables.

Assetguard TXM is the central component. It collects all data from the connected sensors, stores them, and also performs calculations and alarming. In addition, Assetguard TXM can be integrated into a substation or a central monitoring system like ISCM (see page 6, Asset data management) as well as into existing SCADA networks.

Sitram Condition Monitor (CM)

Siemens has developed a modular monitoring system that allows operators to oversee all types of sensors, protocols, and parameters, with the goal of meeting cost-specific requirements.

Like Assetguard TXM, the Sitram CM can be used on all your transformers, regardless of manufacturer and age. Customer-specific solutions can be built on a basic version, and existing sensors can also be integrated: for example, as part of a retrofit solution.

The individual measured values are combined with a data acquisition unit in the monitoring system’s switch cabinet. Thanks to standardized interfaces, it’s easy to integrate the Sitram CM Guards or other equipment. The Sitram CM can be easily extended, offering a secure investment even if standards change or additional requirements arise.

Siemens’ online condition monitoring solutions deliver top-quality data ready for enhanced processing.

The next step on the path toward optimized asset performance management is the integration of the online condition monitoring data. We call this asset data management, and it’s based on our ISCM technology.
Asset data management for substations and enterprises helps operators translate collected online condition monitoring data into useful knowledge for their daily operations. This is achieved by integrating the monitoring solutions in a system called Integrated Substation Condition Monitoring (ISCM). This integration can occur in the substation, centrally for more than one substation, or a combination of the two.

The ISCM substation or central system functions as a host for all monitored substation equipment – from one asset to entire substations. The incoming data are processed for further analysis and diagnostics.

Finally, ISCM provides each user with the data they need, for example, through a user interface. Regardless of the operator’s condition monitoring expertise, the user interface offers a clear understanding of what may be wrong. This is a key benefit of the ISCM system: Starting with a complete substation view, a problem is indicated and then assigned to the relevant asset. Experts can use the expert interface to validate the automated diagnosis or to perform a more thorough investigation.

ISCM avoids overloading SCADA data networks by hosting all the data acquisition and processing via knowledge modules. This means that it will not affect your SCADA system while diagnosing your assets. In order to share useful information between the two systems, integration in SCADA is available upon demand.

Asset condition software solutions provide additional functions to ISCM-based monitoring systems. Typical functions like automated reporting (monitoring reporting tool) or Icons Intelligence are available as add-ons to each system.

The Siemens ISCM system provides an alignment of alarm functionalities, user administration, and Web access. It contains plug-in facilities to central condition monitoring systems for obtaining remote expert advice on condition data diagnostics. In addition, an extensive set of protocols is available for further integration.

Asset data management, or online condition monitoring revealing the current asset status, enables unplanned outage avoidance, the early detection of impending failure, fewer repair costs, improved availability, and a more efficient, cost-effective maintenance strategy.

Asset data management forms a bridge to the final step: asset performance management.

Address: asset data management

Analyze present and past events to predict future asset performance.
Asset performance management takes you to the next level, providing recommendations for asset management and operation (O&M). It predicts the future behavior of your assets based on dynamic online condition data combined with our renowned offering of Reliability Centered Asset Management (RCAM).

RCAM Dynamic is a decision support software tool for asset managers and operators. It combines asset data, subject-matter expertise, and several years of experience in asset behavior with a cutting-edge methodology. The extremely reliable prediction of an asset's future condition allows for an optimized asset management strategy – and enhanced asset performance. With RCAM Dynamic, Siemens offers a new tool that aims to extend and maximize asset life, while at the same reducing lifecycle costs, as is often required by regulatory obligations.

RCAM Dynamic combines online condition data showing the assets' current status, offline condition data from measurements, and static data relating to the assets' past performance – like general OEM information – in dynamic models for forecasting and risk assessment. RCAM Dynamic models the impact of aging according to a set of varying condition parameters, predicting both an asset's future health and its remaining service life in an Asset Health Index calculated for every asset in a power grid. An Asset Health Index considers both online and offline condition information, and is graded and weighted according to the asset group. With it, risks based on current and future failure probability rates for each individual asset can be calculated. Relevant reports can be generated from all these calculations, e.g., a future risk report showing upcoming risks (probability x consequence of failure) across five dimensions: CAPEX and OPEX risks, and environmental, safety, and network performance risks.

The resulting asset management approach is truly comprehensive and covers the entire energy conversion chain, from generation through transmission and distribution networks to energy-intensive industries. Assets no longer need to be automatically replaced at the end of a predefined period, and the remaining service life can be calculated years ahead of time. Asset managers can use RCAM Dynamic to schedule future maintenance, prevent defects from developing into serious failures, and extend the service life of their equipment. In addition, they can base their strategic planning and their optimization of capital investments on RCAM Dynamic.

The key features of RCAM Dynamic are:

- Risk forecast based on Health Index (HI) forecasting
- HI calculation based on condition parameters
- HI forecast based on aging functions per condition parameter
- Present risk calculation with HI-related outage probability
- Calculation of next maintenance, based on HI development scenarios
- Calculation of best intervention timing (replacement, refurbishment) using risk-based present-value-scenario analysis

**Act! asset performance management**

**Step three: Act with tailored maintenance**

- Predict future asset performance
- Budget planning