



Monitoring & Diagnostics Service

Remote Technical Support for Industrial Steam Shaft Lines

GE's Monitoring & Diagnostics (M&D) Service leverages operational data and infrastructure to provide early and actionable warnings of potential equipment and process problems for your industrial steam turbine-generator sets. This allows your workforce to turn reactive maintenance into proactive action; transitioning from waiting for problems or unplanned outages to occur, to anticipating and mitigating them. In addition, experienced GE M&D engineers are available through a technical support line to collaborate with your staff to get equipment back online as quickly as possible. GE's M&D service can help you improve the availability and longevity of your equipment.

Background

Production is the fundamental driver of industrial processes and the steam turbine plays a key role in the success of meeting plant production targets. The steam turbine is often playing a dual role in an industrial plant by not only providing process steam at the required pressure, temperature, and output, but also driving a generator which powers areas of the plant. Therefore, availability and reliability of the shaft line is the priority. Even with the best maintenance plans, there is a remaining risk for unplanned events. The impact of such events may be minimized through advanced warning and rapid access to knowledgeable resources with both GE OEM and oOEM expertise.

Asset Protection

There are several ways in which GE's M&D offering helps you protect your assets and improve their performance.

Early warning analytics

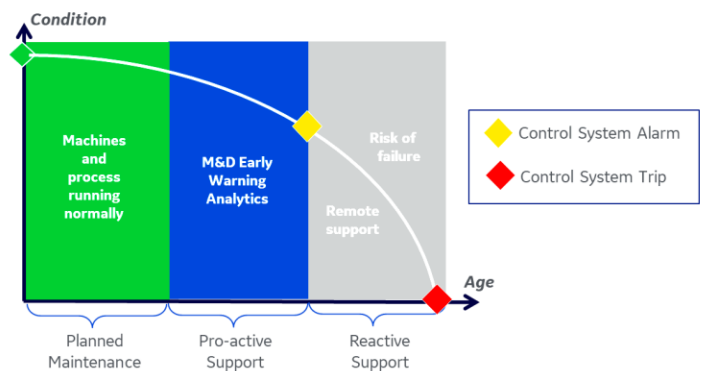
- Continuous analysis of operational data, using a combination of different analytics, allow fault signature detection before they turn into failures
- Unlike control system alarms, early warning analytics track deviations from expected values rather than violations of absolute thresholds. The expected values are generated by models derived from physical algorithms or historic experience
- Analytics are continuously improved by leveraging the knowledge gained from monitoring over 400 steam turbines

Remote technical support

- Access to a dedicated technical support desk helps to shorten the troubleshooting time and speed up return to service cycle
- Specialized GE domain experts helps to define a solution for the more complex issues

Leading indicators and KPI tracking

- Periodic reports provide insights through long term trends of leading indicators; monitoring changes in boundary conditions that can affect ageing rates
- Leading indicators and KPI's help to effectively set priorities for the planning of the next outage
- Reporting and case tracking help to manage continuous improvement



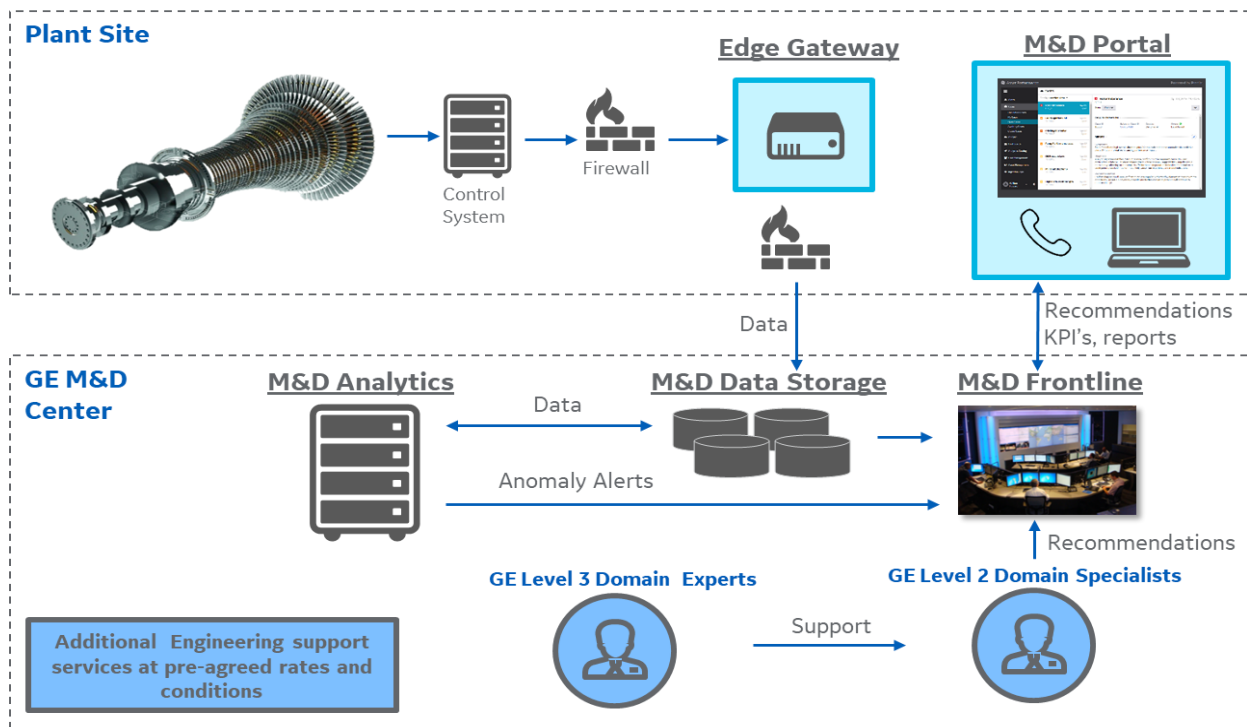
Features of M&D Service Offering

Data acquisition and cyber security

- Data acquisition is carried out by an on-premise industrial Edge Gateway, directly connected to the asset control system
- The M&D Edge Gateway is a read only device, compatible with the most popular industrial protocols, such as Mark VIe, OPC-UA, Modbus, GE Historian and OSI-PI
- No additional sensors are required
- Data transfer to the cloud is based on modern cyber security standards

Real-time data analysis and support

- Continuous data processing and analysis through advanced early warning analytics
- Main machine parameters and subsystem monitoring (e.g. vibrations, bearing metal temperatures, gland seals, oil system, generator cooling)
- Diagnostics to pinpoint the cause of the detected anomaly
- Data scientists dedicated to support the continuous development of analytics based on OEM and oOEM expertise and incorporating of fleet experience
- Engineers available to validate early warnings and help with troubleshooting in case of unexpected events



Benefits

- Risk Mitigation and reduction of unplanned outage cycle
- Improved budget management enabled through fast and effective data driven decisions
- Reduced outage cost through improved planning based on predictive maintenance analysis
- Improved asset lifecycle management through enhanced asset remaining life prediction

Applicability

The base offering is available for all types of industrial steam turbine generator sets with one of the supported data interfaces and a reliable internet connection. Optionally, the offering can be extended to include other plant components, such as the boiler.

GE Experience

GE Power has been providing M&D services for power generation assets for several decades. Every day, GE collects more than 50,000 operating hours of data from more than 2,500 globally installed assets, supplementing a 600-terabyte database representing more than 220 million fleet operating hours.

Complementary Offerings

GE's Industrial M&D Service can be combined with the following offerings:

TEAMS Inspection

Turbine Evaluation, Analysis and Maintenance Scheduling program that can be performed when the unit is on-line.

- **Check-up (1 day):** visual inspection and operational data collection to baseline the equipment
- **Lite (2 days):** primarily mechanical evaluations to mitigate unplanned outages and improve reliability
- **Base (3 days):** mechanical and thermal evaluations to optimize asset performance
- **Max (4 days):** mechanical and thermal evaluations plus maintenance planning

Generator Health Monitoring

Generator monitoring system (additional sensors required)

- Partial discharge
- Rotor flux
- Rotor shaft voltage
- End winding vibration
- Collector health*

Generator Health Advisor

Generator data analysis (no additional sensors)

- Utilizes DCS data to detect developing issues and obtain the equipment "fingerprint"
- Early identification of developing risks and faults, based on normalization procedures

For more information please contact your local GE representative

Visit us at www.ge.com