



Digital Energy

Asset Performance Management

IMPROVE ASSET RELIABILITY AND AVAILABILITY WHILE REDUCING O&M COSTS

The power industry faces a complex set of market dynamics and disruptive forces to the operating environment — volatile fuel prices, growing renewables, changing workforce, and shrinking budgets. There's hope in data and analytics, but power operators face significant barriers that make it difficult to use this data to business advantage.

BUSINESS CHALLENGE

Unexpected disruptions cost **3-8%** of capacity, **\$10B** annual lost production cost

REAL RESULTS

€2.28MM cost avoidance in first year for 450 MW gas plant

\$35M+ savings on 2,600 MW generation capacity in five years

€6MM per year insurance savings on 7,300 MW thermal fleet

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OVERVIEW

Today's power operators face significant challenges

Information and people work in silos, and operator capacity is limited to analyze data that is collected. Traditional operations consist of multiple systems, each designed to measure and monitor singular machines or small groups of equipment. There has not been the ability to consolidate and provide that “single pane of glass” that operations management and staff need to see how operations are performing — holistically — across the plant and across multiple plants, resulting in:

- Disconnected and conflicting data across assets, sites, and regions
- A lack of asset level visibility — not knowing in advance when problems are about to occur
- Unplanned downtime with lost productivity and high cost of emergency repairs
- Costly and often unnecessary routine preventive maintenance that introduces risk and decreases availability
- High spare parts inventory levels for emergency repairs
- Loss of institutional knowledge as the existing workforce approaches retirement
- Delay in critical information reaching those that need to action — maintenance technicians, operators, etc.
- Over or under maintenance of assets with no tie to asset criticality and history

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Asset Performance Management

Asset Performance Management for Power and Utilities

Asset Performance Management (APM) is a software application designed to increase asset reliability and availability while reducing maintenance cost. APM connects disparate data sources and uses advanced analytics to turn that data into actionable insights while fostering collaboration and knowledge management across the organization. A commercial cloud solution, built on the Predix™ platform, APM also gives organizations the flexibility to develop new analytics and applications, making it adaptable to meet changing needs.

1600+
machine learning,
artificial intelligence,
physics-based and life
models, and statistical
software analytics

APM SOLUTIONS



APM Health

Anytime, anywhere, unified view of your assets' current state and health



APM Reliability

Achieve less unplanned downtime by predicting equipment issues before they occur



APM Strategy

Optimize across availability, reliability, risk, and cost through intelligent asset strategies

APM APPLICABILITY



LNG



Gas Fossil



Steam



Wind



Nuclear



Hydro



Solar



T&D



Battery

APM Health

Anytime, anywhere, unified view of your assets' current state and health.

- **Connectivity** gives users immediate visual reference of the status of various plants across geographical locations
- **Data management** visualizes and enables manipulation of asset data to create a unified view of enterprise systems
- **EAM integration** seamlessly connects APM Health data to third-party enterprise asset management solutions*
- **Condition monitoring** uses sensor analysis, anomaly detection & KPIs to present current operating state & health of assets
- **Data analysis and visualization** drills into underlying time series and other data to perform additional analyses in determining root cause
- **Criticality analysis** evaluates potential risks and their business impact
- **Event management** manages alerts, alarms, advisors, and resource assignments to aid in impact assessments and investigations
- **Recommendation management** manages alerts, alarms, advisors, and resource assignments to aid in impact assessments and investigations
- **Benchmarking** compares “like” assets and “digital twins” to identify opportunities for improved performance
- **Health manager** leverages data collected to determine and report the current health of the asset in its operating context and provides anomaly detection by calculating metrics and driving rule based exceptions
- **Rounds** allows workers to collect data in the field using mobile devices and receive alerts with real time instructions for how to react to situations
- **Calibration** streamlines and manages the calibration of instrumentation and critical plant devices

* available at additional cost

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APM Reliability

Achieve less unplanned downtime by predicting equipment issues before they occur.

- **Predictive analytics** provides early and actionable warnings of impending equipment and process problems
- **Case & collaboration management** manages actions from assignment through resolution and supports collaboration between analysts, engineers, plant personnel
- **Knowledge management** leverages historical asset conditions and case data to enhance future analysis, while enabling machine and operator learning detection updates, logging and event management, whitelisting and automated backup
- **Root cause analysis** uses a standard methodology for investigation of failures, provides better understanding and analysis of the underlying cause of failure
- **Reliability analysis** provides a comprehensive set of analytical tools to help understand causes of asset failure patterns and the true cost of failure
- **Digital twin blueprints** enable analysts to anticipate or identify failure of an asset with longer lead time to improve reliability and performance by modeling the asset's expected versus observed states

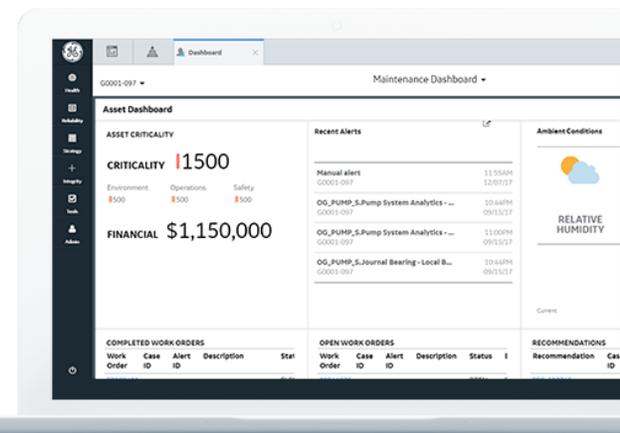
APM Strategy

Optimize across availability, reliability, risk, and costs through intelligent asset strategies.

- **Reliability centered maintenance** recommends modifications to preventative maintenance strategies for optimal utilization of assets based on budget and reliability risk constraints
- **Failure mode and effects analysis** identify failures and effects for each piece of equipment and then recommend actions to mitigate them
- **Strategy management** provides a common methodology to define actions and their mitigated risks for any asset, providing the ability to evaluate existing plans with basic qualitative risk analysis that is both straightforward and easy to use
- **Strategy library** provides professionally designed asset strategy templates that include likely risks and recommended mitigating actions for more than 600 common equipment categories
- **Lifecycle cost analysis** help asset owners understand “whole life” costs by capturing all relevant cost data associated with individual assets, groups of assets, or entire fleets
- **Financial and risk simulation** delivers insight into financial impact scenarios

“GE Asset Performance Solutions give us a heads up on potential problems coming down the pike. We use it to see anomalies before they become alarms; before they become critical issues”

— Mike Hartsig, Plant Manager
Griffith Energy



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Asset Performance Management

Customer Benefits

Overall APM Benefits

- Improve reliability — Advanced proprietary analytics that predict potential equipment failures with enough lead time to effectively plan maintenance
- Improve availability — Accurate diagnosis of equipment issues that enables faster repairs and shortens outage duration
- Maintain technical expertise — A unified and accurate view of assets that provides clear guidance to next occurrence as well as asset history, accessible through an intuitive user interface
- Create intelligent asset strategies — Combine real-time data with human experience, operating parameters, analytics, and connectivity to develop maintenance policies that meet strategic goals and reduce risk
- Reduce maintenance costs — Customized maintenance strategy that increases plant reliability while reducing the amount of maintenance activity performed overall
- Deliver continuous improvement — Build ecosystem that speeds the process by which new analytics are created, enabling operators to draw insights more quickly and drive action

APM Health delivers:

- Visibility of machine status and issues anytime, and all asset-related KPIs including cost, work orders, and history anywhere
- Better decision-making through a single source of truth that crosses organizational silos
- Wing-to-wing story that brings together real-time data, alarms, events, and other operational data to get a clear picture of asset performance

APM Reliability helps customers:

- Reduce unplanned downtime by predicting equipment issues before they occur
- Collaborate efficiently on issues while automatically capturing best practices

APM Strategy will help customers:

- Develop maintenance strategies that balance reliability, performance and costs
- Optimize maintenance tied to asset criticality, failure mode, cost targets, and risk of failure with inputs from advanced analytics
- Improve their ability to respond to market conditions as prices, demand and costs fluctuate in a SaaS/PaaS structure, enabling both use of and contribution to an analytics marketplace

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