GE APM Reliability Management for Wind

Your Challenge: How do you reduce maintenance costs and increase the availability of your renewables assets?

Each time a turbine trips or a component unexpectedly fails, operators face asset downtime and costly repairs. Each time an unplanned fault occurs, a wind technician needs to embark on a time consuming, costly turbine climb. Gearboxes, blades, and generators have a high cost of repair or replacement, so asset owners should want as much insight into the status of these components as possible, especially the existence of any impending issues and the component’s remaining useful life. It takes a combination of advanced analytics with a way to ensure clear communication to the field to enable technicians to resolve issues with the right tools and right parts at the right time. Operators want to track the entire case lifecycle—detection, communication, and resolution—to improve accountability of field technicians to fix issues.

Our Solution: Data-driven tools to accurately detect, predict, and diagnose issues to enable timely responses before they impact asset performance.

GE’s Asset Performance Management (APM) Reliability Management provides the insights required to efficiently resolve issues with your renewable assets. Reliability Management leverages machine sensor data, sophisticated analytics, and software to gain greater reliability, flexibility, and productivity. This application allows customers to optimize maintenance from a financial perspective, increase asset availability, reduce unplanned O&M costs, and reduce the risk of maintenance plan spikes.
**Key Benefits**

APM Reliability Management allows customers to:

- Reduce operational maintenance costs and boost revenue through reduced unplanned maintenance. Lower the risk of high-cost, catastrophic unplanned events such as gearbox, blade, or generator failures.
- Document symptoms, diagnosis and recommendations, collaborate across the organization, and track action completion; Track the entire case lifecycle to improve accountability and ensure cases are being resolved in a timely manner.
- Integrate and automate workflows to improve field execution efficiency.
- Automated retrieval of past events/cases with same anomaly type. Evaluate past failure modes for the same issue, and revisit asset history to view prior work.

**Measureable Results**

- 13,500+ assets monitored
- $80 million+ annual O&M savings and increased performance
- 2,000+ anomalies resolved yearly
- 460+ physics-based and statistical software analytics

**Product Overview and Features**

Information flows from core data collection systems through our analytics platform, is translated from information into insights and then converted into business-critical actions through case management and digital worker integrations.

APM Reliability Management has six key feature sets that differentiate it from any other solution on the market today.

- **Asset Model**
- **Analytics and Analytics Orchestration**
- **Case Management**
- **Data Analysis Tools**
- **Dashboards**
- **Administrative Tools**
1. Asset Model
A unified repository for asset-related data. All Digital Wind Farm applications are linked to the asset model, so apps communicate with each other to establish a unified DWF. Customers can define any kind of asset in the model and manage its associated information. With standardized asset mapping and tag naming methodologies, applications work for any asset and data type.

Bring together diverse data sets to be stored in and analyzed by APM, such as:

- **Operational data:** Turbine, Farm, and BOP data. All available data tags collected and stored with IEC61400-25-2 compliant tags mapping.
- **High-frequency data:** vibration data from accelerometers on gearbox, generator, and main bearing
- **Configuration data:** Site layout, component configuration, contract management
- **Maintenance data:** Oil Samples, Borescope Reports, Visual Inspections, etc
- **External Data:** Weather forecasts, lightning alerts, power pricing information

2. Analytics and Analytics Orchestration

**Analytics**
APM Reliability Management analytics detect operational anomalies using advanced analytics and automatically processes them into an alert and case management system to simplify traceability and enable clear communication across your organization. Some examples of the advanced analytics in APM Reliability Management include:

- **Similarity-Based Analytics:** GE Renewables’ patented analytics to compare an asset’s operational performance to neighboring assets.
- **Digital Twin Analytics:** Comparison of an asset’s performance to a model for that specific asset.
- **Site + Fleet-Based Digital Twin Analytics:** Comparison of an asset’s performance to a model for that turbine type, created using your site and/or GE fleet’s data.

The analytics offered by GE cover failure modes that provide coverage for defects on all major turbine components:

- **Performance:** underperforming turbines, blade and yaw misalignments, parameter errors, de-rates, wind vane and anemometer defects
- **Gearbox:** bearing and gear defects, cooling system defects, thermal control valve failures, Oil pump circulation issues, oil quality
- **Generator:** bearing defects, bearing grease degradation, failing/failed cooling fans, slip ring grounding, cooling duct issues, phase imbalance
- **Nacelle:** disconnected cooling ducts, clogged air filters, cooling fan failures, yaw motor defects, main bearing defects, main bearing grease degradation
- **Pitch system:** pitch bearing degradation, pitch motor and encoder defects, pitch battery charging issues, axis/battery cabinet temperature issues
- **Blade:** Aerodynamic and mass imbalance detection, lightning strike detection
- **Converter:** cooling fan failures, clogged air filters, low coolant levels, IGBT issues
- **Communication issues, defective sensors**
Analytics Orchestration
APM Reliability management includes tools so customers can easily write and deploy their own analytics above and beyond those provided:

- **Analytic Catalog**: Organize your analytics in one place and store details such as asset applicability, analytic revision control, and developer notes.
- **Deployment**: Analytics can be deployed to the entire fleet or selectively to a certain asset type, wind farm, or even specific assets.
- **Scheduling**: Ability to schedule the analytic to run time based (hourly, daily, weekly, etc.), event-based (ex. on turbine trip), or continuously on new data feeds.
- **Tracking**: Track the success of these analytics—when they last ran successfully or failed—to verify that the analytics are running properly.

3. Case Management
Whether cases are automatically created by APM Reliability Management analytics, manually entered, or created through 3rd party application integrations, APM Case Management allows for easy collaboration across your organization.

- **Case Templates**: Cases can be created blank or with a case templates in order to provide pre-defined prioritization, troubleshooting recommendations, relevant data visualization, and other case details to those resolving the cases. Case Templates allow for a consistent way of resolving the same anomaly to enable you to scale more easily across your fleet.
- **Knowledge management**: Case closure and resolution notes are saved and easily accessible to enable continuous improvement of best practices throughout the life of monitoring your assets. When working on an open case, all similar past closed cases are conveniently accessible to investigate past failure modes.

4. Analysis
APM Reliability Management provides data visualization tools to perform ad-hoc investigations or to troubleshoot cases by viewing related real-time or historical trends of applicable data.

- Create time-series, X-Y, and other chart types of applicable tags.
  - Select from a list of tags related to the asset.
  - Compare data across assets.
- Save charts as templates and share across your organization to enable faster analysis for repetitive investigations.
  - Analysis templates can be linked to Case Templates for easy access to applicable tags for troubleshooting cases.
  - Easily update and add templates to future cases
  - Provide consistent reporting and documentation.
- Review historical trends and make cross-tag relationships.
5. **Dashboards**
Customizable screens to show at-a-glance information about the fleet, farm, or asset
- Dashboards configurable at each layer of the asset model
- Set to display and track specific variables and KPI's
- New widgets are added regularly, and users can create their own. Some examples include:
  - Summarize open APM cases by site across the fleet and sort by severity.
  - Summarize open cases by severity across a site
  - Compare Gearbox temperature across all turbines at a site.

6. **Administration**
Configure the APM system, including asset provisioning and user administration. Manage user accounts and application access from a simple interface. Customers can use their own SSO system for quick login and added security.

**The GE Advantage**
Single pane of glass for asset maintenance strategy optimization
- Proven analytic solutions for both SCADA based and drivetrain vibration based systems
- Access to GE experts through managed services
- Unified experience—from Data Ingestion to Action-focused Analytics to Digital Worker Enablement
- Best-in-class analytics successfully utilized at scale across the GE fleet
About GE Renewable Energy

GE Renewable Energy is a global leader in advanced technology focusing on wind, hydro, and solar power generation services for a cleaner, more productive world. Combining onshore and offshore wind, hydro and innovative technologies such as concentrated solar power, GE Renewable Energy has installed more than 400 GW capacity globally to make the world work better and cleaner. Our tailored solutions range from single component to full turnkey power plants.