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Success Story

Duke Implements Equipment Reliability Process and Smart M&D Technologies

Duke Energy, working with EPRI, is implementing a new, comprehensive Equipment Reliability (ER) process across its fleet. The system, modeled after a similar methodology developed in the U.S. nuclear industry, captures industry experience and best practices to provide a single common standard for integrating and administering fossil power plant programs for maintenance optimization, condition monitoring, asset management, and other related activities. Duke is also participating in an EPRI project to apply new smart monitoring and diagnostic (M&D) technologies for real-time, automated tracking and analysis of equipment condition.



Duke Energy's Central M&D Center in Charlotte, NC uses SmartM&D technology to remotely monitor and assess plant equipment condition.

Coordinating Efforts to Improve Reliability

In the current marketplace, fossil generating plants need to provide highly reliable power at low cost and find innovative methods to increase availability with reduced manpower. Over the past three decades, the industry has embraced a number of proven maintenance practices, such as Reliability Centered Maintenance (RCM) and Maintenance Basis Optimization (MBO). What is needed is a comprehensive system for integrating these tools.

In 2001, the U.S. nuclear industry developed an equipment reliability process description (INPO AP-913) that effectively captured industry good practices and provided a structure that was used as the standard for U.S. nuclear plants. This ER approach has been deployed across the nuclear fleet and has contributed to industry improvement in lowering forced outage rates, raising generation capacity factors, and reducing costs.

EPRI is currently developing a new ER process that would provide a similar common standard for fossil power generation plants. The new technique represents the integration and coordination of a broad range of equipment reliability activities into one system for plant personnel to establish the optimum preventive maintenance tasks, monitor and communicate the performance and health of important station equipment, develop and implement long-term equipment health plans, and make continuing adjustments to maintenance strategies based on equipment operating experience and maintenance feedback.

The merger between Duke Energy and Progress Energy created an opportunity for the new utility to gather good ER practices from the fleet and integrate industry guidelines to support high performance levels. In 2013, Duke began implementing a fleetwide ER program, utilizing EPRI research, to support equipment reliability through consistency and standardization of plant O&M routines and technology. The utility developed a "Master ER Implementation & Change Management Plan" for the fleet and is deploying it, along with site-specific plans, at all its plants. The Master Plan is designed to be adapted to many different plant configurations while still maintaining an overall structure and purpose.

"In today's energy environment, operational efficiency is more important than ever before. Our new Equipment Reliability process coupled with the growing capabilities of our Monitoring and Diagnostics Center support that mission and our commitment to continue delivering customer value at a competitive price."

~ Charlie Gates
Senior Vice President, Power Generation Operations, Duke Energy

The new ER process offers significant benefits for Duke. Failures are identified for critical equipment, and measures established to prevent them. Equipment aging is managed using preventive maintenance techniques. The approach also provides the structure to integrate and uniformly access equipment condition/health data and information from a variety of sources. This integrated information can then be used for decision-making to most effectively optimize O&M and capital expenditures for sustaining and improving plant reliability.

Continuous, Automated Monitoring and Diagnostics

Utilities today face challenges in monitoring plant equipment. Technology specialists are spread too thin, and many predictive maintenance (PdM) programs spend the majority of time on data collection, not analytics. In recent years, some organizations have implemented centralized fleet centers that remotely monitor equipment parameters. However, a need still exists to develop innovative approaches that lessen the burden on personnel and increase the ability to do automated, real-time diagnostics on critical equipment.

Duke's M&D Center currently monitors process information (PI) data from its fossil and combustion turbine plants. The Center utilizes PRISM Advanced Pattern Recognition software and EtaPRO software for thermal efficiency monitoring. These tools enable the Center to detect small changes and notify plant specialists and system owners. However, the Center is limited to distributed control system (DCS) data and needs more instrumentation to expand its capabilities.

EPRI has initiated several projects to investigate and demonstrate the concept of a Smart M&D system that provides the intelligence and infrastructure to continuously monitor equipment and integrate diagnostic and prognostic models. Working with Duke and other utilities and vendors, EPRI is creating a specifications document for the input/output system architecture of a Smart M&D system and is developing improved sensor technology for power plant electrical equipment. What makes this vision of Smart M&D system possible are advances in several areas, including wireless networks, new devices for automated operator checks, expanded instrumentation and low-cost sensors for vibration and temperature, and leading-edge software for automated diagnostics and data integration.

Duke is collaborating with EPRI and National Instruments to develop and install the next generation of advanced M&D technologies, including remote plant M&D sensors and network, advanced diagnostics, and data integration and visualization. As part of this effort, Duke is installing more than 30,000 process sensors on over 10,000 pieces of equipment for vibration, temperature, and oil-level monitoring. This deployment will eliminate 50,000 monthly manual equipment readings and disparate reports, and will shift Duke's PdM technology from manual data collection to 24/7 remote analytics.

In the future, the Duke M&D Center will provide a real-time, integrated equipment health assessment that includes risk and the basis for that risk. Engineers, managers, and condition-based monitoring specialists can speak from a common understanding when they share information between plants. A common workflow and platform allow resources to be deployed as efficiently as possible. Lessons learned can be shared quickly and efficiently across the fleet.

"In today's energy environment, operational efficiency is more important than ever before. Our new Equipment Reliability process coupled with the growing capabilities of our Monitoring and Diagnostics Center support that mission and our commitment to continue delivering customer value at a competitive price," said Charlie Gates, Senior Vice President, Power Generation Operations, Duke Energy.

Related EPRI Work

Developing an Equipment Reliability Program Model for Fossil Power Plants. EPRI. Palo Alto, CA: November 2013. 3002001348.

Smart Monitoring & Diagnostics—Input/Output Architecture. EPRI. Palo Alto, CA: September 2013. 3002002180.

Smart Monitoring & Diagnostics—Electrical Equipment Sensor System. EPRI. Palo Alto: September 2013. 3002002175.

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3002002573 February 2014

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