

# AI.EPRI

## Data: From Fuel to Function—Equipment Reliability in Power Generation

### Introduction

EPRI is leading a cross-sector collaborative effort across multiple projects taking raw data into action by plant staff. Insights from advanced data analytics can be used to enhance models like those in the PM Basis Database (PMBD) that have already been integrated into frameworks like the Equipment Reliability Process. As the volume of data collected through the Value Based Maintenance and Equipment Reliability Analytics, challenges with how to convert both structured and unstructured data into valuable insights will continue.

### Delivering the Nuclear Promise Through Value Based Maintenance

Historically, the nuclear power industry emphasized “reliability at any cost,” which could result in cases in which more money than necessary was spent on component maintenance for an appropriate level of reliability. Given today’s challenging market, the industry is focused on developing maintenance strategies to achieve “the right reliability for the right cost.” For example, less frequent inspections of a non-critical heating, ventilation, and air conditioning (HVAC) unit may result in slightly more failures of that component, but with no consequence to safe, reliable plant operations.

The U.S. nuclear industry recently developed a strategic plan called Delivering the Nuclear Promise to drive greater operational efficiency and affordability for customers, while continuing to prioritize safety and environmental protection.

To help nuclear plant operators identify savings opportunities for plant systems and components, EPRI worked with utility members to develop the Work Order Data Visualization Tool. This web application enables utilities to view and track historical maintenance costs (including ancillary costs such as construction of scaffolding) and draw insights about where money is being spent.

Examples of where nuclear sites have already seen savings from applying analysis of historical work order data:

- Quad Cities decreased the frequency of some tasks for non-safety-related HVAC equipment, realizing \$30,000 in annual savings. Plant staff also determined that certain motor inspections were more frequent than necessary. Using a less frequent, more consistent schedule resulted in annual savings of \$75,000. For some systems they addressed unexpected component failures by increasing inspection frequency.<sup>1</sup>
- Exelon used the tool along with another application to examine its maintenance strategy for several non-critical components, using 11 years of historical data spanning its nuclear fleet. The company identified its 10 costliest, non-critical components and streamlined unnecessary maintenance for an estimated \$80 million in annual savings across its fleet by the end of 2025.<sup>2</sup>

1. *New Epri Tool Enables Nuclear Plants To Save Millions In Maintenance Costs.* Epri Journal. Epri, Palo Alto, Ca: January 23, 2019

2. *Success Story: Exelon Uses Epri Work Order Data Visualization App To Look At Maintenance Costs and Implement Value-Based Maintenance Strategies.* EPRI, Palo Alto, CA: 2018. 3002012287

# Collaborating Across the Fleet: Leveraging Learnings into Action

In non-nuclear generation, market forces have forced much of that fleet into a limited preventive maintenance regime. However, opportunities exist to leverage the same tools proven in nuclear to gain different insights.

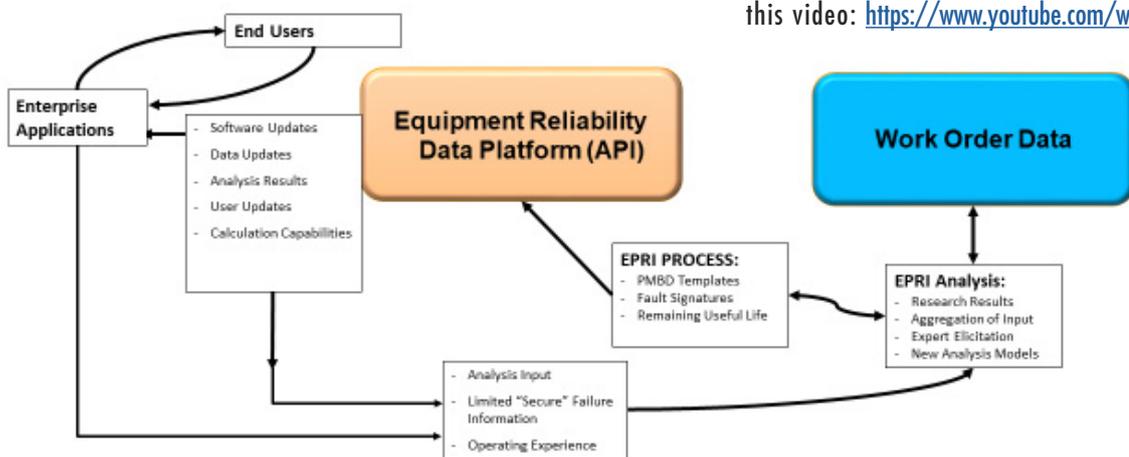
The first example of this collaboration is a tool that's been in development for two decades across the Institute: the Preventive Maintenance Basis Database (PMBD). The PMBD software outlines the relationships between a component's degradation mechanism and the factors that influence them; the time scale of progression-to-failure; and the opportunities to discover and prevent degraded conditions, so utilities can adapt PM programs to plant conditions. To date, EPRI has compiled detailed information on degradation modes for more than 325 plant component types from industry and component experts. This compilation has resulted in more than 25,000 degradation modes, with task-effectiveness data for more than 2,000 tasks, making PMBD the most comprehensive resource in the industry.

To upgrade its maintenance process, Korea Western Power Company (KOWEPO) used the PMBD in conjunction with their WP-PM (Western Power Preventive Maintenance Model) tool. This implementation—along with related initiatives—reduced equipment failures at the utility's combined-cycle Seoincheon Plant by 40% and resulted in a total annual cost savings of \$2.12 million in 2016. KOWEPO's future goal is to take the learnings from the integration of the WP-PM at the Seoincheon Plant and produce the same results across its fleet and to share those learning with other utilities.<sup>3</sup>

During this engagement, EPRI and KOWEPO identified the opportunities to enhance the models in both PMBD and WP-PM applications, but recognized more data would be needed. That realization resulted in the Equipment Reliability Analytics Collaborative—which kicked off at the beginning of this year with nine members from four different countries. This collaborative project will apply the same work order analysis model as the Value Based Maintenance project and will develop an API-based platform that will allow project members to integrate the resulting models directly into their own enterprise systems.

Learn more about the results of EPRI's PMBD Platform by watching this video: <https://www.youtube.com/watch?v=qEoFD31CThU>

## Equipment Reliability Data Platform



Future State: Greater Automation and Real-Time Updates

## The Challenges Ahead

The data science challenge presented by this effort is a familiar one: massive amounts of data that requires various strategies for insight. The Value Based Maintenance project has already collected 15 million work orders from more than 20 sites. The Equipment Reliability Analytics Collaborative will result in similar order of magnitude of data in addition to that collected through the API.

The three major challenges moving forward are already recognized:

1. Deploying reliable and secure methods to connect across enterprise systems

2. Developing efficient data ingestion and effective data governance
3. Applying models in a cost-effective manner to lead to actionable results

Addressing these issues will be a major research task for the Equipment Reliability Analytics Collaborative.

To find out more about all of the related projects, contact one of the EPRI resources.

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3. Success Story: Korea Western Power (Kowepo) Establishes Maintenance Standardization Process. EPRI, Palo Alto, CA: 2018. 3002012230