



# KNOW THYSELF

**Chris Armitage and  
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how asset reliability  
programmes help  
power plants keep the  
lights on.

**M**ost people only notice it when it is not there: the power to turn on a light with the flick of a switch, make coffee, charge a mobile device and keep a home warm. Among those that are aware of it all the time are the companies producing the power we use every day. For utility companies, ensuring customers have the power they need has its challenges.

#### **Ensuring reliable service**

According to last year's *Strategic Directions in the US Electric Utility Industry Report* from Black and Veatch, reliability and aging infrastructure are two of the industry's top issues. The report reflects the opinions of more than 600 qualified industry participants. The survey indicates that power plants are feeling the pressure to provide uninterrupted service and to comply with

regulations, while keeping costs to customers low. In addition, formerly baseload plants are increasingly being cycled, which is placing additional stresses on these assets.

The challenges faced by the power generation industry are not unique. Other industries must meet the need for reliability, compliance with complex regulations and rising CAPEX to replace old and obsolete equipment. What is unique to the power industry is the widespread impact caused when an issue arises. When disruption occurs, the result is highly visible and often extremely expensive.

### **Asset reliability**

Power companies are leveraging asset reliability strategies and technology to help them meet demands for consistent service. Traditionally, companies have not put much effort into asset management programmes, instead relying on preventive maintenance approaches to pre-empt unplanned outages. This approach can be expensive and not always effective. In order to achieve the consistent service their customers rely on, plants are now realising the need to understand how well their assets are performing, what physical condition they are in and when they need to be replaced.

As a result, power generating companies have begun building more robust reliability programmes. Key components of these programmes include performing asset criticality assessments, evaluating and adjusting current maintenance strategies for effectiveness based on actual operational experience, and implementing improved inspection criteria and monitoring technologies. In short, this means the right maintenance on the right assets at the right time.

The foundation for a successful reliability programme begins with an asset criticality assessment. Given the amount and breadth of equipment in a typical plant, it is crucial to understand which assets are most critical to their business and which are maintenance significant. Even before looking at the assets themselves, the plant needs to know what factors to consider in assessing criticality.

### **Case study: Springerville power plant**

The Springerville power plant, which is partially owned and operated by Tucson Electric Power (TEP), provides one example. TEP's predictive maintenance group monitors a variety of equipment, including conveyors, gearboxes, pumps, turbines, blowers, compressors, pulverisers, fans, and mills. They rate the criticality of the assets on safety, regulatory and environmental compliance, load reducing and single point of failure. They use the resulting ranking, as well as run-to-fail statistics, to develop and adjust the frequency of predictive monitoring for all of their critical assets.

The asset criticality assessment is not a stand-alone exercise. TEP uses asset trends and periodic asset criticality validation exercises to continuously refine its maintenance strategies, allowing actual asset health and performance, coupled with current and projected operational demands, to drive its decision making process. Reliable operations at the Springerville plant are vital for the company. The plant currently receives all of the output from Springerville Unit 1 through a 14% ownership and leases for the remainder. TEP also owns and receives all of the output from Unit 2. The two units represent slightly over a third of the company's owned generating capacity: approximately 800 MW. Springerville Unit 3 is owned by Tri-State Generation and Transmission Association and Unit 4 is owned by Salt River Project.

### **Knowing what to look for**

Once a company understands the criticality of its assets, it can apply the inspection tasks or technology to monitor the performance of those assets. TEP's predictive maintenance group relies on a variety of technology with high resolution, accurate data collection and advanced diagnostics capabilities. Their primary tools include vibration analysis, oil analysis, electrical motor testing, infrared thermography, ultrasonic testing and partial discharges testing. With the addition of a wireless network, they collect data and uses predictive analysis for critical equipment they were not previously able to monitor.

For example, they get predictive diagnostic data on the rail car positioner and dumper asset, which pulls an entire train loaded with coal. The asset rotates and dumps out the coal, one car at a time. If this equipment shuts down unexpectedly, TEP does not dump any coal – resulting in additional labour expense and delays to keep the plant operational. With five motors tied to five gearboxes, repairs can be costly. Due to the nature of its function, it is not safe for someone to be on the equipment while it is in motion. Now, with wireless vibration monitoring, TEP can identify deterioration in a safe manner before the asset fails.

Becoming proficient on both the equipment in the plant and the asset monitoring technology required is a daunting task. For plants to get the full benefit of an asset reliability programme, the maintenance staff must be able to identify issues and resolve them quickly. TEP has helped their staff gain proficiency by making training a high priority. Predictive maintenance members participate in multiple training sessions each year. The entire team has attained at least a minimum (Level 1) certification in all predictive technologies. This use of cross training enables the group to offer consistent service, even if a specific member is absent. It also enables the team to use multiple tools for diagnosis. Each member has additional areas of expertise. For example, if there is a problem with a motor, they can use vibration, as well as infrared thermography and ultrasonic testing to pinpoint the problem. This approach reduces time allocated for troubleshooting and yields robust results.

### **Real-time reporting**

In addition to meeting customer requirements for reliable service, power plants must comply with regulations. These regulations necessitate the use of cycling to achieve the proper mix of energy sources. The concept seems simple: vary the production of the plant to offset other energy sources. In reality, cycling the equipment on and off creates more stops and starts and increases costs in some unexpected ways.

Many plants still use equipment that was designed to run continuously, rather than cycle on and off. Cycling places additional thermal and mechanical stresses on that equipment. Premature replacement costs can be expensive and unplanned downtime can be severely detrimental.

In order to optimise operations, companies need to understand what their current approach is really costing them – both in incremental production loss (short-term consequence) and more rapid deterioration (longer-term consequence). Due to the changes in operating practice, they cannot rely on historical experience. Instead, they need to look at their asset criticality, failure rates based on actual conditions, as well as the projected impact. Armed with this new data, plants can better determine priority for which assets need to be replaced and timing for those replacements. The bottom line is that, based on the operational impact and high cost of replacing aging assets,

companies need advance warning and time to plan.

TEP's predictive maintenance group uses real-time reporting to document the impact and costs related to equipment issues. This detailed communication provides their leadership the opportunity to understand what is happening on the ground in the plant. They use that data to determine if any operational adjustment is required. The aggregate data also allows them to look at overall failure trends in the plant and make decisions accordingly. This improves their ability to plan and anticipate the assets that require repair work or replacement.

Real-time reporting can also result in real-time savings. For example, TEP identified an issue with a gear box that had been rebuilt within the last 18 months. Vibration data indicated looseness in the input bearings, so the team removed the gear box for repair before functional failure occurred. By leveraging this data, the team prevented a

shutdown and secondary equipment damage. During analysis of the components, they identified fretting corrosion due to the loose bearings, as well as abnormal wear on the gear teeth. Based on their findings, the US\$ 250,000 gear box was replaced without cost as part of their warranty.

## Conclusion

Companies in the coal-fired power industry are meeting the challenge to provide consistent service by establishing reliability programmes and using data driven strategies to address issues with equipment wear. For plants that are just beginning to tackle these challenges, starting with a formal asset criticality assessment is a good first step. With a clear picture of gaps and opportunities for improvement, plants can make progress toward meaningful asset strategies that optimise available staff and leverage the right technology to make an impact. <sup>W</sup>C