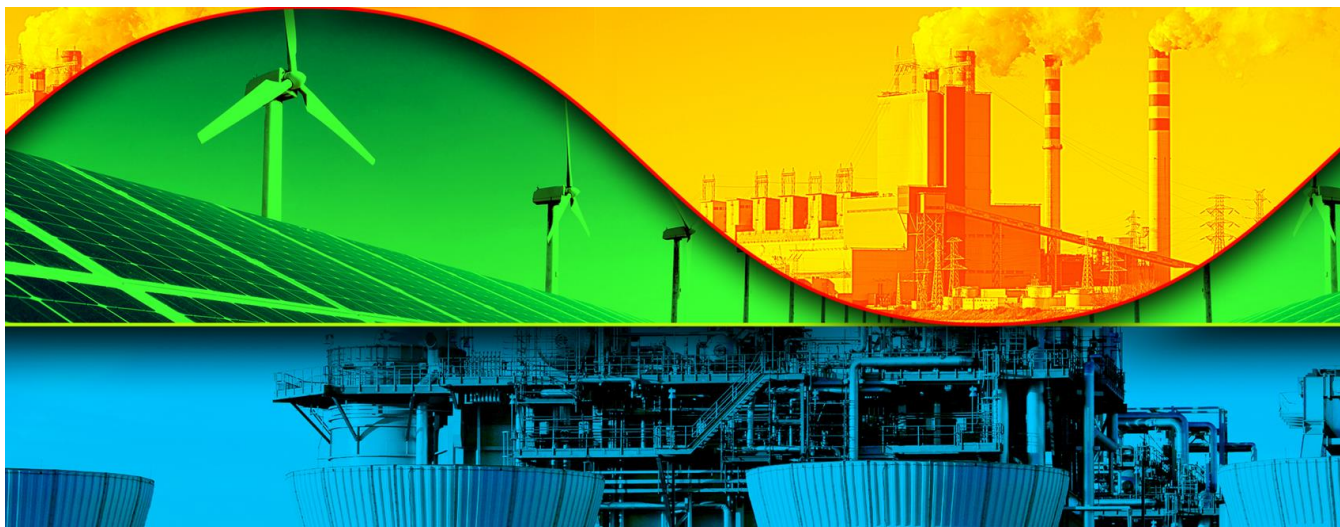


Feature—The New Normal



EPRI Helps Old Plants Take on New Missions

By Chris Warren

When the 1,880-megawatt Monticello Power Plant in eastern Texas started operating in 1974, it had a straightforward mission: burn lignite to generate baseload power. For decades, Monticello's three units have consistently met this mission, supplying electricity for nearly one million Texas residences during off-peak demand.

However, persistently low wholesale power prices resulting from inexpensive natural gas and the emergence of renewable energy dramatically changed the Texas electricity market, and along with it Monticello's traditional baseload mission. "We have the most wind generation of any state by a long margin, more is coming, and we're adding other renewables such as solar," said Dale Higginbotham, vice president, fossil engineering and support at Luminant, which owns Monticello.

These factors, along with higher fuel costs, increased regulatory burdens, and Monticello's operating costs, prompted Luminant to reexamine how the plant can best compete in the ERCOT competitive market. "We brought together our operations and dispatch people to look at ways to become more dispatchable and flexible, and we discovered that it's not easy to develop solutions," said Higginbotham.

In 2012, Luminant shifted two Monticello units to seasonal operations—available for summer dispatch, when power demand is higher and generation makes economic sense. In January 2014, Luminant brought the units out of seasonal operation as a result of cold weather and higher power demand. Another shift to seasonal operations followed later that year, and the units returned to year-round availability in October 2015.

"We will need to stay nimble," Higginbotham said. "Shifting market prices, power demand, and plant operating costs will determine when Monticello runs."

Role Reversal

Luminant is not alone in facing the pressure to alter operations at fossil generation facilities. "The industry is undergoing dramatic change," said EPRI Senior Technical Executive Norris Hirota. "More and more plants are being operated in a manner that is inconsistent with their original design."

The traditional missions of natural gas and coal plants have flipped. “Coal assets, designed for baseload operation, are increasingly being operated at low loads, in load-following mode, or are shut down because demand is not there,” said Hirota. “On the flip side, you have gas plants that were designed as peaker plants now providing baseload power.”

A confluence of factors has led to this reversal. With low natural gas prices, power companies increasingly rely on gas plants to meet baseload demand, resulting in extended layups for many coal plants. Increasing intermittent renewable generation is a principal driver of flexible coal plant operations, which include load-following mode, frequent ramping up and down, and minimum-load mode to help balance electricity supply and demand. Another driver is more demand management, which leads to fluctuating customer loads. Some units operate only a few months or weeks in a year.

This fundamental shift raises many questions: When a coal plant ramps up and down to meet changing demand, what is the impact on equipment originally designed to run continuously? How does this affect maintenance? What training is needed as decades-old job descriptions become obsolete? It is critical to find answers backed by solid research.

“Take a coal plant that may now be called upon for three weeks in the dead of summer and two weeks in the dead of winter,” said Tom Alley, EPRI’s vice president of Generation. “Its viability to remain in the generation mix might depend on having a high degree of availability during that time. Maintenance and staffing are critical for managing costs and supporting reliability.”

Plant Site Visits and Working Group

In 2014, EPRI launched its Changing Mission Profile initiative to provide wide-ranging expertise to plant operators and identify research needs. “We’re evaluating changing missions from a whole-plant perspective,” said Hirota. “It can’t just be the boiler or turbine program that does this.”

Central to this work is a pilot project consisting of seven visits to EPRI members’ plants to improve the common understanding of technical and organizational issues related to changing plant missions. In 2015 and early 2016, visits to Luminant, Salt River Project, FirstEnergy, Entergy, Duke Energy, and Ontario Power Generation (OPG) provided on-the-ground views of plant and personnel impacts at coal, hydropower, gas boiler, and combined-cycle units. “There’s no better way to understand the impacts of a changed mission than with a deep dive at the unit level,” said Revis James, a senior technical executive in EPRI’s Generation sector.

Each site visit included a workshop with EPRI technical staff and utility subject matter experts, examining topics such as materials, process chemistry, operations, and maintenance. Based on each unit’s design and its changed mission, the team reviewed, prioritized, and discussed the most important technical challenges along with solutions offering the most potential impact.

While the site visits highlighted a range of technical issues to guide future EPRI research and development, the focus on changing missions is not new. According to Hirota, as a result of feedback from member utilities over time, about 80% of the EPRI Generation sector’s current research portfolio addresses to some degree the needed improvements associated with flexible operations of fossil plants.

EPRI has launched its Mission Profiles Working Group to convene utility subject matter experts to identify key issues and share information. By 2017, EPRI will provide results from this effort, including an online database outlining technical challenges and possible solutions, applicable to various plant designs and missions. Hirota says that the database will be updated continually to reflect EPRI research findings and utility experiences and lessons.

“We are applying an approach from our colleagues in the nuclear industry,” said Hirota. “They have done a great job of sharing information about best practices, challenges, and experiences. If there is an event at one nuclear plant that’s relevant to other plants, they collect that information and share it so everyone benefits.”

Impacts on Maintenance, Environmental Controls, and Asset Management

Operating a power plant used to be straightforward and consistent. “Plant workers knew it was a good day if the plant was running and a bad day if it wasn’t,” said Alley. “That was the old story. The new story is that it might actually be bad if you’re running, because it may mean that another asset in your generation mix isn’t meeting its mission properly and your plant has to operate when it’s not scheduled to.”

A priority identified through the site visits and working group meetings is to increase the flexibility of plants that were not designed to respond to rising and falling demand. “We’ve talked with a lot of members who are interested in faster ramp rates,” said Alley. “They need to be able to bring these units up and down more quickly to respond to load changes.”

An important consideration for coal plants running at different loads is the impact on equipment. “When you shut down and start up a plant more frequently or increase and decrease the plant’s load, metal temperatures fluctuate. This can cause increased internal stresses and fatigue, which may lead to cracking and degradation,” said Hirota. “The maintenance staff needs to pay special attention to equipment undergoing thermal stresses beyond their original design. This may require changes to maintenance programs.”

Operating coal plants at lower loads and temperatures may reduce the performance of emissions control equipment needed for regulatory compliance. “This equipment is designed for full load,” said Hirota. “If you are running at lower loads, you might not be removing NOx or other pollutants as effectively, which may compromise your ability to comply.”

EPRI is investigating how to help enable a plant’s environmental controls to work effectively and in a sustained manner at low loads. “Given the staffing constraints that plants have, they can’t hire more people to monitor this,” said Hirota. “We are looking at better online monitoring of this equipment so that you might consider fewer, more centralized resources at a central location monitoring the entire fleet and better process controls to minimize the burden on plant operators.”

When a natural gas plant shifts from peaker to baseload operations, there typically are longer intervals between outages when equipment checks and maintenance can be done, forcing operators to make tradeoffs. “The strategy may become, ‘What maintenance can be put off while still maintaining the plant’s reliability?’” said James.

Changing plant missions may lead to the need for larger-than-expected investment in new equipment and maintenance, particularly in older plants. “We need to figure out how to build these long-term asset expenses into a utility’s planning process,” said James. “They will impact fleet management decisions and increase the complexity of long-term planning. Utilities will need to know the cost of flexible operations, when to make investments in maintenance, and when it’s best to retire a plant.”

Investigating Solutions

Luminant’s Higginbotham wasn’t expecting easy fixes when EPRI and FirstEnergy experts visited Monticello Power Plant last year. Instead, the purpose was to collect new perspectives and insights on how Monticello can effectively meet its new mission. For example, Monticello’s operators had been weighing whether to make certain equipment modifications to enable lower-load operations. “They weren’t comfortable moving forward until they got enough engineers together in a room saying, ‘We don’t see a problem making those changes,’”

said Higginbotham. “This meeting of the minds helped us to determine which issues were critical and which ones weren’t big enough to worry about.”

Sharing knowledge and exploring solutions will accelerate with the launch of research projects sparked by site visits and working group meetings. In 2016, EPRI will release a report based on the pilot project site visits. “The industry has embraced the working group,” said Hirota. “They’ve offered both funding and their most experienced subject matter experts for two years to help resolve priority issues.”

Key EPRI Technical Experts

Norris Hirota, Revis James