



## How to Modernize the Nuclear Fleet? EPRI Looks at Technology, Economics

For a machine to be designated a “workhorse,” it must do hard work, reliably, and over an extended period. Nuclear power plants have earned this designation by virtue of their reliable operation and sizeable contribution to baseload power generation around the world. A question emerges for these workhorse plants, most of which have operated for decades: Can they compete as modern machines, or will they prove uneconomical and uncompetitive?

The plants are getting a fresh look today from owners and operators, regulators, legislators, advocacy groups, financial institutions, and researchers such as EPRI. Many stakeholders are reappraising them as a foundation for sustained decarbonization—both on their own and in conjunction with renewables. They are also appraising plants’ economic contributions, local environmental footprint (quite compact), and many other societal benefits.

Economic forces shaping the future of these plants include:

- Natural gas prices and the cost of gas-fueled power generation (relatively low)
- Carbon reduction (not established as a priority at the federal U.S. level)
- The cost of solar, wind, and other renewable alternatives
- Technological options and economics of nuclear plant modernization



*Mike Howard, President and Chief Executive Officer, EPRI*

According to the World Nuclear Association, nuclear power provides more than 10% of the world's electricity.

*EPRI Journal* highlights our recent white paper, [The Economics of Nuclear Plant Modernization in U.S. Markets](#), which examines a range of data and assumptions regarding plant operations and economics. Its initial estimates suggest that many nuclear plants could justify investments of more than \$100 million to modernize and reduce non-fuel costs by 25%. In some regions, a cost reduction on that order—or higher—may be necessary to remain affordable. This suggests that it would be worthwhile for plant owners and operators to take a closer look and assess the economics of modernization to reduce non-fuel costs at their facilities.

*EPRI Journal* also reports on our [Nuclear Sector's Plant Modernization Initiative](#), which is examining how plant owners and operators could equip their facilities with updated technologies and improved processes to improve economics. The initiative has identified 12 areas with significant potential to reduce non-fuel costs at many plants. These include digitalization, wireless connectivity, analytics, automated work planning, risk-informed engineering and decisions, and continuous monitoring of structures and equipment.

One area of focus for plant modernization that can be appreciated by anyone who has ever had to put air in a car's tires is the concept of condition-based maintenance versus interval-based maintenance. The most familiar example I can offer is the difference between checking air pressure in all four of your car's tires every month (interval-based) in contrast with adding air only when your dashboard indicator tells you the pressure has dropped in one of your tires (condition-based). The latter takes less of your time, and time is money.

With sensors, data analytics, and communications networks, plant operators and maintenance technicians can focus on the right actions, in right priority, at the right time. Sensors and communications can give you direct readings of

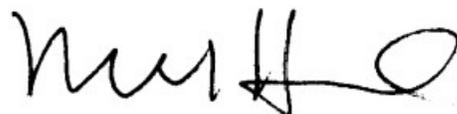
analyses can provide far-ranging insights for projecting and prioritizing needed actions. These add up to much more efficient, lower-cost operations.

One of the overarching challenges of our times is to understand as best we can—and as fast as we can—the interplay among rapid technological advancements and economic drivers. Some nuclear plants today face economic conditions that call into question their continued operation. The near-term closing of such plants could call into question society's prospects for decarbonizing energy production, delivery, and use.

This brings an urgency for determining how technology can enable an economically viable nuclear fleet for the near- and long-term benefit of society. Plant modernization may be an appropriate choice for some plants but may not work for others. Investments in certain plants may not be justified as a result of a particular market's economics. Nevertheless, modernization has much to offer in maintaining nuclear power as a safe, reliable, affordable generation option positioned to make a substantial contribution to decarbonization. It can also help provide a bridge to future nuclear power technologies for our electric system and the people who operate it.

The “modern” expectation of energy is that it be sustainable, affordable, reliable, and always available. There are important opportunities to make nuclear plants modern in the affordable sense and to continue their “workhorse” contribution to societies in every part of the world.

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