

Small reactors could figure into US energy future

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The Davis-Besse Nuclear Power Station at Oak Harbor, Ohio, on the shore of Lake Erie, is a megawatt-scale reactor. Small modular reactors may prove to be a feasible alternative to such reactors in the future, according to a new study released by the Energy Policy Institute at the University of Chicago (EPIC). Credit: Lloyd DeGrane

A newly released study from the Energy Policy Institute at the University of Chicago (EPIC) concludes that small modular reactors may hold the key to the future of U.S. nuclear power generation.



"Clearly, a robust commercial SMR industry is highly advantageous to many sectors in the <u>United States</u>," concluded the study, led by Robert Rosner, institute director and the William Wrather Distinguished Service Professor in Astronomy & Astrophysics.

"It would be a huge stimulus for high-valued job growth, restore U.S. leadership in nuclear reactor technology and, most importantly, strengthen U.S. leadership in a post-Fukushima world, on matters of nuclear safety, nuclear security, nonproliferation, and nuclear waste management," the report said.

The SMR report was one of two that Rosner rolled out this month at the Center for Strategic and International Studies in Washington, D.C. Through his work as former chief scientist and former director of Argonne National Laboratory, Rosner became involved in a variety of national policy issues, including nuclear and renewable energy technology development.

The reports assessed the economic feasibility of classical, gigawatt-scale <u>reactors</u> and the possible new generation of modular reactors. The latter would have a generating capacity of 600 megawatts or less, would be factory-built as modular components, and then shipped to their desired location for assembly.

The U.S. Department of Energy funded the reports through Argonne, which is operated by UChicago Argonne LLC. The principal authors of the report were Rosner and Stephen Goldberg, special assistant to Argonne's director.

The reports followed up a 2004 UChicago study on the economic future of nuclear energy. The 2004 study concluded that the nuclear energy industry would need financial incentives from the federal government in order to build new plants that could compete with coal- and gas-fired



plants.

The first report, "Analysis of GW-scale Overnight Costs," updates the overnight cost estimates of the 2004 report. Overnight costs are the estimated costs if you were to build a new large reactor 'overnight,' that is, using current input prices and excluding the cost of financing.

It would now cost \$4,210 per kilowatt to build a new gigawatt-scale reactor, according to the new report. This cost is approximately \$2,210 per kilowatt higher than the 2004 estimate because of commodity price changes and other factors.

Struggling restart

At the Center for Strategic and International Studies event on Dec. 1, CSIS president and CEO John Hamre said that economic issues have hindered the construction of new large-scale reactors in the United States. The key challenge facing the industry is the seven-to-nine-year gap between making a commitment to build a nuclear plant and revenue generation.

Few companies can afford to wait that long to see a return on the \$10 billion investment that a large-scale nuclear plant would require. "This is a real problem," Hamre said, but the advent of the small modular reactor "offers the promise of factory construction efficiencies and a much shorter timeline."

Natural gas would be the chief competitor of nuclear power generated by small modular reactors, but predicting the future of the energy market a decade from now is a risky proposition, Rosner said. "We're talking about natural-gas prices not today but 10, 15 years from now when these kinds of reactors could actually hit the market."



The economic viability of small modular reactors will depend partly on how quickly manufacturers can learn to build them efficiently. "The faster you learn, the better off you are in the long term because you get to the point where you actually start making money faster," Rosner noted.

Small modular reactors could be especially appealing for markets that could not easily accommodate gigawatt-scale plants, such as those currently served by aging, 200- to 400-megawatt coal plants, which are likely to be phased out during the next decade, Rosner said. An unknown factor that will affect the future of these plants would be the terms of any new clean-air regulations that might be enacted in the next year.

An important safety aspect of small modular reactors is that they are designed to eliminate the need for human intervention during an emergency. In some of the designs, Rosner explained, "the entire heat load at full power can be carried passively by thermal convection. There's no need for pumps."

Getting the first modular reactors built will probably require the federal government to step in as the first customer. That is a policy issue, though, that awaits further consideration. "It's a case that has to be argued out and thought carefully about," Rosner said. "There's a long distance between what we're doing right now and actually implementing national policy."

Provided by University of Chicago

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