

NUCLEAR ENERGY

Proposed DOE test reactor sparks controversy

Congress favors the Versatile Fast Neutron Source but some scientists see little need

By Adrian Cho

Plans for a controversial multibillion-dollar U.S. nuclear research reactor are coming together at lightning speed—much too fast, say some nuclear policy experts. With a push from Congress, the Department of Energy (DOE) has begun designing the Versatile Fast Neutron Source, which would be the first DOE-built reactor since the 1970s. It would generate high-energy neutrons for testing materials and fuels for so-called fast reactors. But U.S. utilities have no plans to deploy such reactors, which some nuclear proliferation analysts say pose a risk because they use plutonium, the stuff of atomic bombs.

Researchers are divided on whether the reactor, which would likely be built at Idaho National Laboratory (INL) near Idaho Falls, is badly needed or a boondoggle. “Definitely, there is a lack of capability in the U.S. and a shortage of such facilities worldwide,” says Massimiliano Fratoni, a nuclear engineer at the University of California, Berkeley. But Frank von Hippel, a nuclear physicist at Princeton University, says, “It’s a pork-barrel project.”

The reactor does enjoy extraordinary congressional support. In March, Congress gave the project \$35 million for this year, although DOE only requested \$10 million. The House of Representatives and the Senate have passed separate bills that call for completing the facility by 2025, with the House bill authorizing DOE to spend \$2 billion. Von Hippel speculates that the cost could end up reaching \$10 billion.

Nuclear reactors come in two broad types: thermal and fast. A thermal reactor “burns” a fuel typically containing a few percent of the isotope uranium-235, which releases energy and neutrons in a chain reaction. To maximize the chances that each neutron will split another atom in the dilute fuel, a “moderator” must slow them. It is often the same cooling water that conveys heat energy out of the core. Nearly all commercial power reactors are water-cooled thermal reactors.

In contrast, fast reactors split atoms with the raw high-energy neutrons. They must

burn fuels that are enriched with more uranium-235 or that contain plutonium-239, and their coolant, often molten sodium or molten lead, does not slow the neutrons. They also come with a bonus: The fast neutrons can efficiently transmute inert uranium-238 into plutonium-239 to breed more fuel. That was attractive decades ago, when experts expected nuclear energy to supply all the world’s electricity and feared running out of uranium. Today, with no shortage of uranium, the more complex fast reactors can’t compete economically with thermal reactors—although some nuclear

come online too late to help companies now developing novel fast-reactor designs, such as Oklo Inc., of Sunnyvale, California. Oklo Co-Founder Caroline Cochran agrees that the reactor won’t be ready in time to help the company, but says, “It will be a national resource in the decade to come.”

Edwin Lyman, a physicist with the Union of Concerned Scientists in Washington, D.C., argues that INL’s real goal is reviving its fast-reactor program. INL’s sodium-cooled Experimental Breeder Reactor-II shut down in 1994. Pasamehmetoglu acknowledges that one reason to build the neutron source is to maintain expertise.

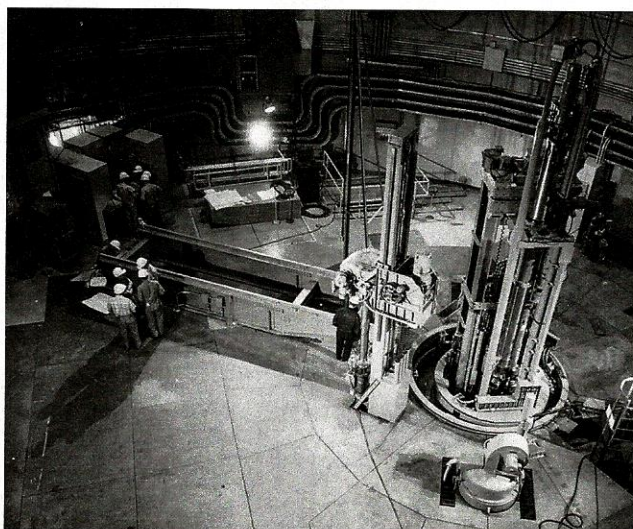
The debate over the test reactor mirrors a larger one over the future of nuclear energy, says Mark Hibbs, policy analyst with the Carnegie Institution for International Peace in Berlin. If nuclear energy provides a bridge to other carbon-free sources such as wind and solar, fast reactors won’t be needed, he says. But if nuclear energy will be needed for centuries—as China anticipates—then utilities must eventually switch to fuel-breeding fast reactors, Hibbs says. The debate, he says, “is dominated by theology and lobbyists.”

In Congress, the reactor has bipartisan support, especially from the House science committee, where Representatives Randy Weber (R-TX) and Eddie Bernice Johnson (D-TX) both sponsored

the House bill. “We felt that there is a very clear need and it’s timely,” says one committee aide. “If we wait too long, all these companies will go to Russia.”

The project is already taking an usual trajectory at DOE. According to agency rules, a major project must pass a review that certifies the need for the facility before moving on to designs. But in this case, Pasamehmetoglu says his team will develop the design and costing first, and present it to DOE for a yes or no decision in 2020.

That is a problem, Lyman says. “Clearly, they haven’t done their due diligence to show that this facility is needed,” he says. Before going further, Von Hippel says, DOE should ask the National Academies of Sciences, Engineering, and Medicine to study the need for the reactor. ■



A new “fast” nuclear reactor would work a bit like the Experimental Breeder Reactor-II, which ran until 1994 at what is now Idaho National Laboratory.

experts say breeders will one day be needed.

In April, INL invited industry to help design a modest 300 megawatt sodium-cooled fast reactor that would burn a plutonium-based fuel made from retired nuclear weapons. The need for a research fast reactor to study materials and fuels emerged in 2015, when DOE’s Office of Nuclear Energy reviewed its facilities, says Kemal Pasamehmetoglu, a nuclear engineer at INL who leads the project. “The one glaring gap was a lack of access to fast neutrons.” Russia has the world’s only fast-neutron test reactor.

Others are skeptical. “I don’t see a compelling need for this facility,” says Jacopo Buongiorno, a nuclear engineer at the Massachusetts Institute of Technology in Cambridge. He says the test reactor would