

Leaner designs fuel race to build next generation of reactors

Testing in Corvallis, OR.

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Jose Reyes' research lab in Corvallis, Oregon, looks like a three-story tangle of pipes and instruments. But to nuclear engineers like him, it's evidence that generating electricity by splitting atoms can cost less and be done more safely than in the past.

Reyes heads an Oregon State University team that's built a quarter-scale model of the Westinghouse AP1000 nuclear plant – which the company hopes will lead an atomic-energy renaissance in the U.S. and the rest of the world.

Even though the lab looks complicated, the model is far simpler than the plants built in the 20th century. Without using radioactive material, it tests the AP1000's "passive-safety" system, which relies on gravity rather than a battery of mechanical pumps to carry water to a reactor in an emergency.

"I think Oregon State was working much like the consumer products testing lab for nuclear power plants," Reyes said.

The tests, conducted under contract with Westinghouse and the U.S. Department of Energy, were critical in the reactor receiving Nuclear Regulatory Commission certification last December. The lab can test other reactor models as well.

The safety system, Reyes said, would make nuclear leaks far less likely, and virtually eliminate the threat of a meltdown of the nuclear core. The simpler, modular design will help bring down the cost of construction and make overruns less likely.

The 1979 partial meltdown of the Three Mile Island nuclear plant in Pennsylvania contributed to a virtual halt in new plant construction – along with high costs and energy-demand forecasts that turned out to be wrong. There are currently 103 U.S. nuclear plants, producing about 20 percent of the nation's electricity.

But fears of global warming and the rising cost of natural gas and coal may finally change the image of nuclear power as the industry markets a new generation of reactors, such as the AP1000 and General Electric Co.'s ESBWR, or Economic Simplified Boiling Water Reactor.

Interest in new plants has increased sharply since August 2005, when President Bush signed an energy bill that streamlines applications and offers loan incentives, tax credits and federal insurance for new plants. Licensing could be approved within a few years, depending on when applications are filed with the Nuclear Regulatory Commission.

But there are plenty of skeptics. They point out that, because the AP1000 and ESBWR have not yet been built, it's still uncertain how much they will cost or how safe they will actually be.

"It's been tested in scale models," David Lochbaum, paid activist of a nuclear safety project for the Union of Concerned Scientists, said of the passive-safety system.

But if there's a gap between tests and actual operation, "it could be a nasty surprise," said Lochbaum.

The model at OSU was built to test how the passive-safety design would hold up during all sorts of emergencies that would require a quick shutdown of the reactor – even without human intervention.

The model uses no fissionable material. Instead, electricity heats water to temperatures reached in a nuclear plant, and the water is moved through the model, testing each of the safety features.

The cooling system in the previous generation of reactors operated much like a car radiator, requiring constant pumping of cool water to prevent overheating.

In the passive-safety designs, the cooling system is more like the tank of a toilet. Flip a single handle and cool water rushes down to the reactor if it overheats. Designers say that if the operator needs to leave the plant during an accident, that handle will be tripped automatically, and the reactor will cool itself.

The passive-safety system also contributes to making this generation of power plant less expensive to build because there are far fewer parts, nuclear advocates say. The system eliminates the need for huge cooling towers, redundant pumps and backup diesel generators.

The AP1000, according to Westinghouse, has 87 percent less cable, 83 percent less piping, 50 percent fewer valves and 36 percent fewer pumps than the previous generation of reactors.

Estimates on the cost of new reactors vary widely, and it is difficult to compare current costs with past projects that required years to build and many design modifications, analysts say.

"We say broadly the passive plants are simple and have fewer active components, and should cost less to build," said Ed Cummins, nuclear engineering manager for Westinghouse. "Utilities are not risk takers. Investors want steady earnings and low risk."

GE has been racing with Westinghouse – a wholly owned unit of the United Kingdom's BNFL PLC – and other manufacturers, such as Areva NP in France, to build the next generation of nuclear reactors.

So far, Westinghouse has the U.S. lead because it has a design already certified by the NRC. A dozen new plants are under consideration.

Nuclear opponents say that even if the new safety features work under all conditions, there's yet another problem to be resolved: As of yet, the United States has no permanent storage facility for spent nuclear fuel.

Potential delays in site approval for new nuclear plants and licensing are also a concern.

Reyes said the NRC needs to "expedite its new and untested process for a combined construction and operating license." On the construction side, Reyes said, "the U.S. has lost significant capability in fabricating key components for nuclear plants."

Right now, Reyes said, "there's a single U.S. manufacturer of large nuclear components, and we're buying most large replacement components from France. We must also rebuild the skilled work force needed to construct nuclear plants."

Reyes concedes these are "significant challenges," but says they are "being faced by an industry that is highly energized, disciplined with regards to safety and profit, and driven by goals of energy independence and environmental quality."

But nuclear opponents are telling people not to get their hopes up. Among them is paid activist Portland attorney Greg Kafoury, a loser of battles against atomic power in the Pacific Northwest. "We were promised that the plants could not explode and we got Chernobyl," Kafoury said. "We were told they could not melt down and we got Three Mile Island. Now the industry says they can get it right. Why on earth should anybody believe them?"

(Ed: Because they are more believable than lawyers!)