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Nuclear Power's Core of Support Gains Strength

By ERIC BERGER
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After a decades-long winter of discontent, a confluence of favorable events during the last 10 years has provided a spark to America's nuclear industry.

With no major U.S. accidents during that period, public opinion has slowly swung in favor of splitting atoms to meet the country's voracious power demands. The cost of natural gas — a competitor to nuclear — spiked to $13 per thousand cubic feet last year, although it has since fallen. And in a world worried about carbon dioxide, nuclear energy stands out, because it produces virtually no greenhouse gases.

Finally, during a Bush administration friendly to nuclear power, the federal government has begun providing generous loan guarantees for new reactor construction.

Because of these trends, the Nuclear Regulatory Commission during the last two years has received 17 applications for 26 new nuclear reactors, most of them at existing facilities. And during this year something will likely happen that hasn't in three decades: A U.S. power provider is expected to receive a license to begin clearing land for a new reactor.

"There's clearly momentum building in favor of nuclear energy," said Sean McDeavitt, a Texas A&M University assistant professor of nuclear engineering.

Among the first to apply for a license was NRG Texas, which seeks to expand its existing South Texas Project near Bay City. The two proposed units, which the company expects would begin operations by 2016, would produce an additional 2,660 megawatts, enough electricity to supply 2.1 million homes.

"We think nuclear energy plays an important role in the near future," said Kevin Howell, president of NRG Texas.

Two other power providers also submitted license applications last year. Exelon wants to build two reactors in Victoria County, and Luminant wants to add two reactors to its Comanche Peak facility near Glen Rose in North Texas. Amarillo Power is expected to apply this year to license a two-reactor plant in the Panhandle, according to the Nuclear Regulatory Commission.

Even most advocates of nuclear energy worry, however, that the present nuclear resurgence is transitory.

As part of a 2005 energy law, billions of dollars in subsidies were offered to the first few energy companies that built plants. It's possible that after a few reactors are constructed and exhaust these benefits, new construction will cease.

[The latter is highly unlikely. Apart from the fact that upcoming greenhouse gas-limiting legislation will make nuclear power more popular, the U.S. will hopefully learn from the French example of developing a few reactor types and then building them again and again, as needed. The U.S. nuclear power plants of the 1970's were all unique. Cost savings in nuclear power will be realized by not having to re-engineer every power plant. Like other forms of technology, the first one built is the most expensive. If every power plant is unique, each one will be the most expensive one.]

President-elect Barack Obama, too, has signaled a more cautious approach than President George W. Bush, saying the technology should proceed only if proved "safe and clean."

[The nuclear power industry hasn't had a serious incident or accident since Three Mile Island, and even that one resulted in not one death or serious injury or exposure. How much safer do we need to make an industry? How many car accidents or plane crashes have occurred since Three Mile Island? Nuclear power doesn't produce greenhouse gases. The amount of nuclear waste produced since the first nuclear power plant would fill a football field to a depth of about 14 feet. The amount of waste material is far less than other forms of energy production.]

The Waste Issue

And the issue of nuclear waste disposal remains a quagmire, with no imminent agreement to move forward on building a waste repository at Yucca Mountain in Nevada, where the project is widely opposed. Obama's choice for energy secretary, Steven Chu, has previously expressed doubts about Yucca Mountain.

"I just don't think there will be a big renaissance," said Peter Hartley, an energy expert at Rice University. "I believe the new administration will be much tougher on nuclear energy. Even if they implement carbon dioxide controls, I think the result will be primarily more natural gas plants, rather than wind."

[Dr. Hartley appears to be showing a bias here. Dr. Chu was recently quoted as saying that nuclear power will play a major role in future energy production in the U.S. because while it produces 20 % of the U.S. electricity, it accounts for 70 % of its carbon-free electricity.]

Coal Dominates

Nuclear energy and natural gas now provide about 20 percent each of the country's electricity needs. Coal, by far the dirtiest energy source in terms of carbon dioxide, generates almost half the nation's electricity. In Texas, natural gas is the leading generation fuel at about 45 percent.

Carbon dioxide emission from natural gas is about half that of coal.

But as consumers discovered last summer, the price of natural gas generally is tied to the price of oil and can rise quickly. Also, there remains a wide range of uncertainty about the total amount of recoverable natural gas in the world, and whether these reserves could sustain a natural gas economy for more than a few decades.

[President-Elect Obama has said that he plans on making coal-generated electricity prohibitively expensive. He also plans on instituting a carbon tax. If that occurs, nuclear power will be the only form of power production that will be able to immediately replace all of that lost power generation. Solar doesn't work at night and wind doesn't work when the wind doesn't blow or is above 40 miles per hour (the blades would over-rev the generator).]

Uranium Aplenty

So here's where nuclear energy has key advantages: There's enough uranium to power much of the world for decades, and the price is more stable than for fossil fuels. Once nuclear plants are built, operating costs are considerably cheaper than for any fossil fuel, including coal.

But nuclear plants are expensive to build, costing billions, and prone to overruns, delays and environmental lawsuits.

Add in capital costs, Rice's Hartley said, and nuclear energy becomes more expensive than coal or natural gas.

[Again, Dr. Hartley is showing bias. His statement assumes that every nuclear plant will be unique. However, if the U.S. adopts several designs, and only uses those, the cost per power plant will become less with each plant because new engineering will not be required.]

Critics Point to Price

This is a point seized upon by environmental groups — many of which haven't rallied behind nuclear energy despite its near-zero greenhouse gas emissions.

"Nuclear power is the most expensive way anybody has ever figured out how to boil water," Josh Dorner of the Sierra Club said. "Ignoring the waste problem, you just can't justify the costs."

[This is typical Domer bias. There are methods for handling the waste problem, but public opinion and Congress (especially the senior Nevada Senator) have prevented their use. Eventually, reprocessing of the waste will become cost-effective and will be instituted. Only 5% of the fissionable material is actually used before the fuel becomes too contaminated to continue to be used. Reprocessing the fuel will not only allow a more efficient use of the fissionable material, but will also reduce the amount of waste that needs to be disposed.]

Two Paths

All this leads to a question: At this moment of opportunity for nuclear energy, when the outlook is more favorable than at any time since the 1960s, is there a path by which the United States might significantly increase its reliance on nuclear energy, address its waste issues and increase energy security?

Experts see two paths: One comes through policy, the other new technologies.

The policy path is straightforward, though not easy, energy experts say: Further simplify regulatory approval for plants; pick a design like Japan and France have done to standardize the construction of plants; develop legislation to dissuade environmental lawsuits; and, finally, solve the nuclear waste issue.

"It would certainly take a Manhattan Project-type commitment to get that done," said McDeavitt, the A&M nuclear engineer, referring to the effort during World War II to develop the atomic bomb.

[The energy crisis is that serious so we need a major commitment]

Technological Solutions

A recognition of these policy hurdles has led to numerous technological approaches that circumvent some of the existing problems with nuclear energy and that one day may lead to a wider adoption of fission power.

The broadest is an international effort by more than a dozen nations, including the U.S., to develop a new generation of reactors, called the Generation IV International Forum.

One goal of this new reactor design is to use nearly all of the available natural uranium in a reaction. Most of today's reactors can use only a small fraction of the uranium fuel in nuclear reactions, typically less than 1 percent. Using a larger fraction and developing reprocessing techniques would greatly extend the lifetime of the world's supply of uranium and significantly cut waste.

Those involved in the initiative hope to deliver a design for commercial construction by 2030.

A second technological approach is to develop reactors that use thorium, a radioactive element that can be transformed into a uranium-based fuel. The reason for the interest in thorium is simple: There are enough thorium reserves to power the world for centuries.

The United States has generally not supported research of thorium, because it transforms into uranium-233, which has the potential to be used for weapons. However, some countries with abundant thorium reserves but low amounts of uranium, such as India, have pushed the technology forward.

[U^{233} would be a good bomb material, if it were not for the fact that the thorium reactor also produces a small amount of U^{232}, which is unstable (70 year half-life), and starts a sequence of radioactive decays that emit enough high-energy gamma rays to necessitate expensive and difficult remote handling of the U^{233}. In addition, U^{233} and U^{232} are chemically indistinguishable, so removing U^{232} from U^{233} would necessitate a centrifuge or other mechanical process, which would not be practical because of the radioactivity.]

Now, the United States' position on thorium may be softening. In October, Sens. Orrin Hatch, R-Utah, and Harry Reid, D-Nev., sponsored legislation that would provide $250 million over five years to spur the development of thorium reactors.

"All I can do is put forward a technically feasible way to create all of the energy this planet needs for the next thousand years," said Peter McIntyre, a Texas A&M physicist who has worked on thorium reactors. "To move forward, it's up to the government to change its policy toward thorium power."

'Backyard' Reactors

Another new approach involves making small "backyard" reactors. The most aggressive proponent is Santa Fe, N.M.-based Hyperion Power, which seeks to build hot-tub-size reactors that can generate 25 megawatts of electricity, or enough juice to power 20,000 homes.

The company is already negotiating with several entities for the sale of 200 reactors, each at a cost of about $30 million. The idea is to deliver power at a cost of less than 10 cents a kilowatt-hour to locations — say remote areas of Alaska, military installations or industrial locations in Canada's tar sands — where it's difficult to obtain conventional power, said John Deal, Hyperion's chief executive officer.

Hyperion is still finishing its manufacturing design and hopes to obtain federal licensing from the Nuclear Regulatory Commission and other bodies within a few years. Deal expects to deliver the first units to customers in less than five years.

Much of the demand has come from overseas. The United States, where much antipathy remains toward nuclear energy despite public surveys showing falling opposition, will have to wait.

“Honestly,” Deal said, “right now, I’m not really interested in fighting American ignorance about nuclear power.”

[**Unfortunately, Americans do have the misguided belief that if the U.S. doesn’t use nuclear power, the rest of the world won’t be able to use it either. What they don’t understand is that we are actually behind the rest of the world, not leading it, in this matter. We do not hold the technological edge at present.**]

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