Interview: Phil Hildebrandt

A Practical High Temperature Reactor

Idaho National Laboratory has been designated by the U.S. Department of Energy as the project integrator for the Next-Generation Nuclear Plant, which will be built at the Laboratory. The project will incorporate a high-temperature reactor into a complex to produce electricity, synthetic fuels like hydrogen, and high-quality process heat for industry. Phil Hildebrandt is the Project Director for the plant. He has over 39 years of experience in the nuclear and power industries, including in the Naval Nuclear Propulsion Program. He is Special Assistant to the Laboratory Director for Prototype Reactors and Major Projects. He was interviewed by Marsha Freeman on Aug. 2.

EIR: In June, the House Approprations Committee increased the budget for the Next-Generation Nuclear Plant, and urged that it become a priority for the Department of Energy. One reason was to reduce the long time for its realization. On the current DOE timetable and budget profile, the plant would not be operational until 2021.

Idaho National Lab assembled the Independent Technology Review Group, which recommended that three years could be trimmed from the schedule. It concluded that to accelerate the program, rather than the $23 million requested for FY07, $100 million would be needed. How far does the $70 million the Appropriations Committee voted on go toward reducing the schedule?

Hildebrandt: I think it's a very important starting point. The amount of money in the budget that you'd like to have in FY08, to keep on the schedule that we'd like to stay on, would be considerably more than that—a factor of three to four more than the $70 million. However, the $70 million makes a very important first step in putting the Next Generation Nuclear Plant, and the demonstration plant for high temperature reactor gas technology, on the road. Let me give you the context for that.

The Next-Generation Nuclear Plant and the commercialization of the gas reactor is, in practical fact, going to be driven by private industry, not by government. We are putting together a commercial alliance. It will have members including

end-users and vendors, and will be a partnership with government to help share costs.

That commercial alliance is pressing very heavily toward completing, and making operational, the next-generation nuclear plant as a demonstration plant, by 2018. That is the press of the private sector. That is a different schedule than what comes out of the Energy Policy Act [passed by Congress in 2005].

EIR: Is the drive to get industry involved due to the fact that you don't see the government putting the level of funding into it that it requires?
Hildebrandt: That's correct. The government would start it off the ground, but as it's practically starting to occur, the private sector will be the driving force behind this.

EIR: What industries do you see participating in the commercial alliance?
Hildebrandt: The private sector membership for the commerical alliance has end users that are considerably different than the traditional nuclear industry. In this case, they are the broader energy industry—the petroleum industry, the petrochemical industry. This involves the use of process heat; process heat, and hydrogen being one of the energy carriers from that process heat, is the primary focus here. Industry wants the capability to exist as soon as possible, but no more than a decade out.

With what has been provided by the Congress, we still could achieve a 2018 start-up, with the House Appropriations Committee budget mark. It just means we're pushing a bow wave of funding ahead of us.

EIR: What level of contribution will be required from the private sector?
Hildebrandt: I would expect that by the end of the project, the government and industry would share it about equally. There would be 20/80 split early on, when we're in the developmental aspects of the program, and it flips around the other way as you get into construction of the demonstration unit.

EIR: What kind of interest have you had from industry?
Hildebrandt: The broader end-users in the petroleum and petrochemical industry are beginning to be interested, based on the prices of premium fuel, like natural gas and oil. In the petroleum industry, they use a large amount of hydrogen, and depending upon which company it is, they use a tremendous amount of natural gas. Natural gas is used as a source to make heat, and they're looking at what their options are.

There is some interest in the traditional nuclear industry in this technology. A couple of utilities are showing interest in the high-temperature gas reactor. Some of that interest is in producing hydrogen and selling it into the pipeline that exists along the Gulf coast. Other interest is in being the owner-operator of the nuclear facility that supplies process heat to industry. The company that has been most vocal about that is Entergy.

EIR: There is quite a bit of international interest in this technology—in South Africa, and General Atomics has worked with the Russians. It has been proposed that the U.S. program could advance more quickly by taking advantage of this work.
Hildebrandt: The Westinghouse interests and the South Africa Pebble Bed Modular Reactor (PBMR) people participate in this emerging commercial alliance. There's an ongoing conversation as to how we can achieve the benefits from the work that has already been done in South Africa. You have a competitive marketplace, and other vendors have interests in this. There are three teams: the Westinghouse team, which includes the PBMR group; an Areva team; and a General Atomics team. About 26 international companies are involved, and we are discussing how we use work that has already been done—by the South Africans and also the Russians, in their plutonium burner work with General Atomics—how we bring in the experience that goes back decades, and also the current work, that has been done.

EIR: One of the suggestions to accelerate the program was to start with a smaller reactor, at a lower temperature, which is not so challenging from a materials standpoint.
Hildebrandt: In fact, irrespective of the size, we will start at a lower temperature, because technically we need to step our way up. We are starting at a lower temperature than originally conceived of for the very-high-temperature reactor, which was in excess of 1,000°C. In the range of 950-1,000°, you get to the point where conventional metals will not work. The review group said to get below that temperature, and we have taken that step.

The second step in that discussion is, what temperature do we need for the process applications? The third step, is, at what temperature should we start the demonstration activity, so we are technologically successful, and to what extent can that reduce the time required? This is a very active conversation. I would not be surprised that when that is complete, in about a year, that we'll be lower than 950°C, in the range of 850-900°, which makes a big difference.

The three teams of companies will have their pre-conceptual design reports done in the September time frame, with opinions and recommendations. But temperature alone is not the only issue. The other is licensing time by the Nuclear Regulatory Commission, also being actively discussed.

EIR: As far back as the 1960s, Oak Ridge National Laboratory carried out design studies for what they called nuplexes, or Nuclear-Centered Agro-Industrial Complexes. Advanced nuclear technologies were to provide not only electricity for new cities, but also process heat for various industries. The artist's drawing of the concept for your Next-Generation Nuclear Plant [p. 55] is reminiscent of the nuplex concept.
Hildebrandt: That concept is not in my memory. At that time, I was in the Naval Nuclear Propulsion program in Washington. I would be very interested to see that.