The breeder reactor

"In 1945, Enrico Fermi stated that 'the country that first develops a breeder reactor will have a competitive advantage in atomic energy,'" the ERAB subpanel notes. "Six years later in 1951, the U.S. was the first country to demonstrate the technical feasibility of breeding at Arco, Idaho, in the experimental breeder reactor EBR-I. This reactor not only demonstrated breeding but was the first reactor in the world to produce electric power from fission."

Despite continued progress, however, the U.S. breeder program came to a halt in 1984 when the Reagan administration cut its budget and relegated breeder development to "private enterprise." Now, France, West Germany, Britain, Japan, India, and the Soviet Union are moving ahead with breeder technology, leaving the United States 10 to 15 years behind. As the ERAB report spells out the details:

> The breeder budget has been cut back approximately $100 million each year for the past four years, from approximately $600 million to $200 million in fiscal year 1986, with a recommended cut by OMB to $129 million in fiscal year 1987. If the current program is not maintained, the U.S. will not only fall further behind the rest of the world, but will not be able to capitalize on its investment to date and will have so decimated the infrastructure that it will take years to reestablish the capability that will have been lost.

The ERAB subpanel, however, makes the best of these setbacks, reasoning that breeders will not really be economically essential until well into the 21st century, when uranium reaches the price of $100 per pound, thus driving up the cost of fueling light-water reactors. For this reason, the subpanel recommends that government R&D focus on improving the economics of the breeder by developing innovative reactor designs, a metal-alloy-fueled reactor with pyrometallurgical reprocessing, and an ultra-long-life oxide-fueled reactor core. In this way, the subpanel says, the end-product will be a "design concept that could far exceed any current projections of breeder plant economics either in the U.S. or in foreign breeder programs."

Research advances

While this go-slow approach of the subpanel is disappointing in its acceptance of budget constraints as a necessity, all of the advances and ongoing research discussed in the report could of course be speeded up and come on-line not only faster but in greater numbers. Most exciting of the advances reported on are the conceptual designs by General Electric and Atomics International (part of Rockwell International) for a small, modular breeder reactor in the 100 to 300 megawatt-electric (MWe) range. These would be standardized nuclear designs that could be mass-produced in a factory and transported by barge or rail to a site where the rest of the plant would be conventionally constructed. Chief among the advantages—such as shorter lead times, ability to group several reactors together depending on need, and reduced financial risk—is the reduced cost, which promises to overcome the traditional economies of scale associated with nuclear power plants (see **Figure 2**).

The DOE facilities involved in testing innovations for the breeder program, such as passive safety features and fuel configurations, are the Fast Flux Test Facility (FFTF) in Hanford, Washington, and the Experimental Breeder Reactor II in Idaho. The FFTF is working on an advanced fuel design with an operating lifetime three to four times longer than earlier fuel systems, a capability the subpanel says is unmatched in the rest of the world and one that will help make the new breeders competitive with today's light-water reactors. Such an extended-life fuel system, which can stay in the reactor core three to five years, uses new materials that are resistant to radiation damage.

The savings from such a long-life core are considerable. Westinghouse estimated that the fuel cost would decrease from about 13.5 mills per kilowatt/hour (kWh) to less than 7 mills.

The FFTF is also testing new safety features, including passive systems that ensure reactor shutdown and core cooling if a problem arises. These systems give the plant operators additional time to correct a problem.

Also at Hanford is a Westinghouse plant, Secure Auto-

The Chernobyl bogey: for export only

Chernobyl has become the new environmentalist bogeyman, the very mention of which is used to imply that nuclear power is not safe, that existing plants should shut down, and that new plants should not open. Yet while the Soviet-supported Greenies in Europe and the United States were escalating their fight against the nuclear industry, moving to riots and sabotage in Europe, the Soviets were busy putting two of the four damaged Chernobyl reactors back on-line, one at 50% power and the other at 90%. And as U.S. political figures like New York Governor Mario Cuomo and Massachusetts legislators Sen. Ted Kennedy and Rep. Edward Markey have waved the bloody Chernobyl banner in their fight to keep closed the already completed Shoreham plant on Long Island, N.Y. and Seabrook plant in New Hampshire, the Soviets announced that they plan for a fivefold increase in nuclear capacity by the year 2000.