Scrap plans for fast breeder reactor

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The Indian nuclear power establishment seems to have a love affair with the uneconomic, polluting, obsolete, dangerous, and costly parts of nuclear technology. First, it was boiling water reactors (BWRs) at Tarapur, which emit far more routine radioactivity than pressurised water reactors (PWRs). India also went in for CANDU reactors, which emit far more radioactive hydrogen (tritium) in the form of water vapour than BWRs or PWRs. The human body cannot distinguish between radioactive and ordinary water. As a result, tritiated water can cross the placenta and affect fetuses. It can also affect sperm. As a result, it can cause miscarriages and birth defects. When India decided to buy PWRs, it settled on the obsolete Russian design, the VVER-1000, which is not up to international safety standards, according to the U.S. National Academy of Sciences. This design will no longer be built even in Russia. And now, the worst decision of all, the Department of Atomic Energy (DAE) wants to build a large, 500 MW-electrical, sodium-cooled Prototype Fast Breeder Reactor at Kalpakkam.

This general design of sodium-cooled fast breeder reactor was at the heart of the propaganda in the West during the 1950s that nuclear power would provide a “magical energy source” and end the world’s energy troubles. Like so many other nuclear promises, it hasn’t quite turned out that way. Let us examine the record.

More than $20 billion (all costs in constant 2000 year dollars or rupees) have been spent worldwide on building 11 plants bigger than 100 megawatts-thermal. One of these, the Kalkar reactor in Germany, completed in 1991, was never opened, because of concerns regarding accidental explosions. (Unlike water moderated reactors, sodium-cooled fast breeders can explode due to an accidental nuclear criticality.) Six of the other 10 are shut, including the latest one to come on line, the Japanese Monju reactor. It went critical in 1994. It was shut down in December 1995, when it had a secondary loop sodium fire. It remains shut. Two of the remaining four, Phenix in France, and BN-350 in Kazakhstan are due to be shut in the next few years. Of the other two, the Joyo reactor in Japan is more of a pilot plant, being only about 100 megawatts-thermal.

Only Russia has a large breeder reactor that it plans to operate into the next decade. But it uses medium-enriched uranium fuel and has used plutonium fuel only on an experimental basis.

Fueling a fast breeder reactor with plutonium would require routine operation of a reprocessing plant that could handle large amounts of spent fuel with high plutonium concentrations. The operation of reprocessing plants is a costly and dirty business, even when they have less than one per cent plutonium, as is typical of spent fuel from current commercial reactors. The only two large-scale commercial reprocessing plants now routinely operating are in Britain and France. Both are uneconomical. The plants are so polluting that several western European Union countries have called for their closure.

Finally, the question of cost of electricity. Overall, the operating record of these reactors is indifferent. A few have operated reliably. Most have operated at medium to low capacity factors. This means that even if the construction cost would be as low as the DAE’s estimate of Rs. 3,000 crores, the risk of electricity costs being in the Rs. 5 to 10 per kilowatt hour range is high. This is comparable to what Maharashtra

pays Enron from Phase I of that project.

The real costs could easily be higher, since the DAE's cost estimate is too low. The cheapest plant that has come on line since 1980 is the Russian BN-600, which is about one-third more costly per megawatt than the DAE's estimate for Kalpakkam. If the latest U.S. reactor, which went on line in 1980, is used as the benchmark, Kalpakkam would cost Rs. 22,000 crores. If the Japanese reactor Monju (1994) is used as the benchmark, the capital cost would shoot up to Rs. 46,000 crores. This enormous variation in capital cost is one sure sign of an immature, and hence an economically very risky technology. At the higher end of these costs, the wholesale electricity price could range from Rs. 9 to over Rs. 50 per unit, depending on whether plant performance was sound or poor.

India needs reliable electricity at reasonable cost. India has the technical capability to be at the leading edge of technology, which is in areas like distributed grids (which mix centralised and small scale plants in the same grid) and fuel cells. Even offshore wind power plants are now far cheaper than breeder reactors. When India has decided to innovate boldly, it has succeeded, as in the information technology sector. But in power, it continues to look to obsolete, costly, polluting, and/or dangerous technologies. The proposed Kalpakkam breeder reactor project should be scrapped without further ado.

The writer is president of the Institute for Energy and Environmental Research in Takoma Park, Maryland, U.S.