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Nuclear Energy in India: From Self-Reliance To Import Dependence



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E A S Sarma

India was an early entrant in the field of nuclear energy. It was Dr Homi J Bhabha who initiated nuclear science research in India by setting up the Tata Institute of Fundamental Research (TIFR) in 1945 and later the Atomic Energy Establishment at Trombay (now known as Bhabha Atomic Research Centre or BARC) in 1954 to intensify effort to deploy nuclear technology for generating electricity. The Department of Atomic Energy (DAE) headed by the prime minister started functioning since then.

As a part of an agreement with the USA, India set up its first nuclear power station (410MW) in 1963 at Tarapore in Maharashtra. It was based on Boiling Water Reactors (BWRs) using enriched Uranium fuel supplied by the USA. This project started commercial operation in 1969. Tarapore marked the beginning of India's nuclear power development effort.

Initially, it was the DAE that implemented the nuclear power development programme till the creation of the Nuclear Power Corporation of India Ltd. (NPCIL) as a central PSU in 1987.

It was Dr Bhabha's vision that India should become self-reliant in the field of nuclear energy. Accordingly, India adopted a three-stage nuclear power development programme based on indigenously made reactors and fuel processed from domestic resources.

The first stage was based on indigenously manufactured Pressurised Heavy Water Reactors (PHWRs) that used natural Uranium from domestic sources as fuel and indigenously produced Heavy Water as both the moderator and the coolant. In the second stage, Plutonium-239, separated from the spent fuel in the first stage, was to be used in indigenously developed Fast Breeder Reactors (FBRs) for generating electricity. In the futuristic third stage, it was envisaged to use the indigenously available Thorium raw material from the sea sands along the coast and produce Uranium 233 which in turn would be the fuel for electricity generation.

During the last five decades since its inception, with a heavy emphasis on indigenous effort, DAE has installed around 5,780 MW of nuclear power generation capacity. As on date, nuclear power constitutes only 1.83 percent of the total installed electricity generation capacity in the country and, in terms of the total electricity generation, its contribution is only 3.23 percent.

It was in 1988 that India started deviating from the path of self-reliance in the field of nuclear energy when it signed an agreement with the then Soviet Union for setting up a 2x1000MW capacity power project based on Soviet manufactured pressurised water reactors at Kudankulam in Tamil Nadu. Actual work on the project started in 2002.

The signing of the Indo-US nuclear deal in 2005 marked the beginning of a series of bilateral inter-country agreements that India signed for importing on a very large scale both nuclear reactors and fuel from overseas sources. Such bilateral agreements lack transparency in price fixation in respect of both the reactors and the fuel. Such bilateral agreements make it difficult for the country to demand the highest standards of safety in the design of the reactors. Compounding this is the fact that the nuclear MNCs are reluctant to assume full liability for a Fukushima-like disaster as and when it occurs as a result of deficiencies in reactor design.

Safety of nuclear power technology

During the last six decades, there have been a very large number of nuclear accidents, both minor and major. As a result of the overall cover of secrecy that surrounds the nuclear industry, many of them have gone unreported.

As per the list of the accidents disclosed to the international agencies, more than 30 major nuclear accidents occurred globally, involving multiple fatalities and property damages exceeding \$100 million. Out of these, nine were very serious accidents and three of them, the first at Three Mile Island in USA (1979), the second at Chernobyl in the erstwhile Soviet Union (1986) and the latest at Fukushima in Japan (2011) were of a devastating nature. While the Three Mile Island accident forced at least fifteen states in the USA to impose formal restrictions on the setting up of new nuclear power projects and drastically slowed down nuclear power development in that country, in the case of Chernobyl, the stricken plant had to be encased in a

high-cost “sarcophagus” or a tomb as it could not be cleaned up fully.

The disaster-affected Fukushima reactors are releasing, even today, more than 200 tonnes of radioactive water daily into the Pacific Ocean. The local ground water aquifers stand contaminated. Japan may not be able to clean up these reactors for decades and may ultimately have to encompass the stricken reactors in an expensive metal casing to insulate the surrounding community from radioactive exposure. Some estimates place the liability arising from the Fukushima accident to touch seven lakh forty thousand crores of rupees. The Western MNCs supplying reactors to India are unwilling to assume responsibility for such a huge liability! If a Fukushima-like accident were to occur in India at one of the projects being set up, the government will find it difficult to meet the liability of that order from its limited budgetary resources.

When the parliament enacted the Civil Liability for Nuclear Damage Act in 2010, it was on the insistence of the Left parties that the ceiling on liability on account of an accident was raised to 300 million SDRs (roughly Rs 2830 crores at today's exchange rate). Keeping in view the magnitude of the Fukushima liability referred above, this statutory ceiling implies a near 100 percent exemption from liability for the MNCs supplying reactors to India, which will not only cost the public exchequer dearly but also incentivise the reactor suppliers to cut corners in the safety features of reactor design.

Human lapses, mechanical failures and natural calamities could lead to both radioactive leaks and major accidents at the nuclear power project sites. In addition to radioactive leaks from the power station, transportation of fuel to the power plant and the movement of the spent fuel from the power plant for storage elsewhere could also expose the local communities to radiation risks. Low-intensity radioactive exposure can have long-term health impacts on the people. Major accidents can impact large areas around the accident stricken plant. The zoning norms adopted in the USA suggest that such impacts could extend upto 80km around the plant site, depending on the wind velocity and the wind direction. According to news reports, radioactive material from the Fukushima accident could be traced as far as near the west coast of the USA!

Looking at the risks associated with the nuclear power technology, private insurers are reluctant to insure nuclear power plants and the international financial institutions like the World Bank are unwilling to provide loan assistance.

Atomic energy regulatory board(AERB) subordinate to the DAE

The Atomic Energy Regulatory Board (AERB) in its present form is subordinate to the DAE whose activities it is expected to oversee and regulate.

Post-Fukushima, as a result of the global concerns about the safety of nuclear power technology and the need to introduce independent regulation, the government introduced the Nuclear Safety Regulatory Authority (NSRA) Bill in the parliament. The concerned Parliamentary Standing Committee considered the Bill in 2012 and made several far reaching recommendations to make

sure that the proposed NSRA turns out to be truly independent. Neither the then UPA government nor the present NDA government has cared to enact the new law. As things stand today, the regulatory authority is not in an unfettered position to question the DAE on the safety aspects of either the existing plants or the new ones being set up. The Atomic Energy Act in its present form unduly restricts the citizen's right to have information on the activities of NPCIL. This compounds the public fears about the safety of the nuclear power projects.

In the recent times, the European and the US regulators have detected large scale use of substandard components in the nuclear power projects being set up in different parts of the world. False quality certification and fraud seem to have become a rule rather than an exception these days. This is far too serious a matter to be ignored by the government, as it potentially enhances the probability of major accidents taking place.

COST OF NUCLEAR POWER

There are certain elements of the cost of nuclear power that cannot be easily quantified. For example, there is no known technology as yet that can satisfactorily process the radioactive waste generated by nuclear power plants and the costs associated with waste management are anybody's guess. The cost of decommissioning an aged nuclear power plant is difficult to estimate as the global experience in decommissioning such plants is woefully negligible.

Globally, most nuclear power projects are known to have undergone enormous time and cost overruns in their implementation. For example, in the case of the Olkiluoto reactor being set up in Finland by Areva, the French company, the construction period has gone up from 5 years to 13 years and the cost has trebled. There is no guarantee that the project will not undergo further delays. Both Areva and the other French company, EDF, as well as the US-Japan companies, Westinghouse and Toshiba, which are setting up nuclear power projects in Maharashtra (Jaitapur) and Andhra Pradesh (Kovvada) respectively are financially stressed and it is doubtful if they can ever stick to their time schedules or cost estimates. Since India is planning to depend heavily on such foreign reactor suppliers, the future trajectory of nuclear development in the country is going to be uncertain and highly expensive.

In the name of inter-country bilateral agreements, the DAE has chosen a highly non-transparent procedure for negotiating the price of the reactors and that of the Uranium fuel required for operating the reactors. In other words, India will be at the mercy of the MNCs supplying the reactors and will have to accede to the prices quoted by them which need not necessarily be competitive. In the case of the fuel, there has been a global trend towards mergers/acquisitions among the fuel companies that tend to create monopolies which in turn will dictate the fuel price. Considering that such high fuel prices will also be dollar-denominated, the price of electricity from nuclear power plants will be several times higher than the average electricity tariffs that the domestic consumers pay today.

Nuclear power projects generate steady power that is needed to cater to the base loads in grid operation. The Indian power system has excess base load generation capacity and additions to

nuclear power generation will only accentuate the imbalance that will in turn add to the overall unit cost of electricity. This assumes importance since nuclear power plants cannot be easily backed down and, as a result, their operation may force other less expensive generating stations to back down, at the cost of the electricity consumer.

ENERGY SECURITY IMPLICATIONS

Importing both the nuclear reactors and the Uranium fuel on a large scale from external sources, as is presently planned, will erode the energy security of the country. Such imports will also have indirect implications for India's foreign policy options. Moreover, some western MNCs having fuel fabrication facilities have come under an intense financial stress and, as a result, have sold those facilities to other foreign companies. In the context of such uncertainty surrounding the fuel sources, India should feel concerned about the strategic implications arising from it.

KOVVADA NUCLEAR POWER PROJECT

NPCIL had originally proposed to set up a 6X1000 MW capacity nuclear power project at Mithi Viridi in Gujarat. The Westinghouse-Toshiba group was expected to supply reactors for the project. However, as a result of intense public opposition to the project in view of the serious risks involved, the DAE has since decided to ask Westinghouse-Toshiba to set up their reactors at Kovvada, implying that the concerns of the people of Mithi Viridi are far more pressing compared to the concerns of the people living around Kovvada. Even in the case of the nuclear power project originally proposed to be set up near Haripur in West Bengal, in view of the public opposition, the centre, hand-in-glove with the Andhra Pradesh (AP) government, seems to have shifted the project to a coastal site in AP. Such decisions show the insensitive attitude of the centre and the state to the concerns of the people living in the vicinity of Kovvada and the other locations along the coast in AP.

Though the Site Selection Committee (SSC) constituted in the case of Kovvada had recommended a comprehensive seismic study to be undertaken over a region extending upto 300km around Kovvada, no such study seems to have been conducted. There have been multiple tremors in this region over the last few years. The DAE and NPCIL, if they are genuinely concerned about the safety of the people living in and around Kovvada, should have conducted a detailed seismic evaluation of the region and taken the public into confidence.

The Kovvada project will displace farmers and traditional fisherfolk and artisans over 1,916 acres, and disrupt agriculture and fishing activity.

In addition, there are five villages within a radius of 1.5 km around the project, designated as the "Exclusion Zone" where people are not allowed to reside. Within a radius of 5 km, designated as the "Sterilised Zone", there are 42 villages where, as a result of the project, there will be no development activity undertaken. Finally, within a radius of 30 km comprising of "Emergency Planning Zone" and "Impact Assessment Zone", more than a lakh of population will face potential radiation hazards and possible evacuation in times of emergency. Those living outside

the project site, though subject to such potential hazards, may not get any compensation. The Kovvada project will thus cause an irreparable human trauma that the rulers of the day do not seem to care for. It is doubtful whether the meagre benefits, if any, of the project will ever accrue to the local people.

Such projects will perhaps benefit the western MNCs by creating a profitable market for them in India and employment opportunities for those in their parent countries, more than in India! The irony of the Kovvada project is that the government will forcibly acquire land from the people in advance, disturbing the food security of the region, whereas the project itself may not fructify for decades to come!

CONCLUSION

Considering that the electricity supply system in India has several inherent inefficiencies, it will be prudent for the government to invest on cost-effective efficiency improvements as the first step towards balancing the electricity demand vis-a-vis the existing supplies. In the recent times, the unit costs of renewable sources of energy, especially, solar PV modules, have come down significantly and it should be possible for the government to align its policies to encourage roof-top solar generation systems etc, on a large scale. The social benefits of such policies far outweigh the cost of nuclear and other conventional sources of energy.

The writer is a former Union Power Secretary

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Editorial Desk : pd.cpim@gmail.com

Managerial office: pdpbln@gmail.com

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