"Core loading" of India's first indigenous 500MWe FBR at Kalpakkam marks a high-point in the effort put in by DAE's scientists, engineers and other employees towards promoting self-reliance

At the same time, is the country's original Nehru-Bhabha vision getting blurred?

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Nehru and Bhabha – an extraordinary partnership of two visionaries

The Prime Minister (PM) is reported to have witnessed in person the core-loading of India's first indigenous 500MWe Prototype Fast Breeder Reactor (PFBR) at Kalpakkam on the 4th of March, 2024. The event marked a high point in the continuing effort put in by the scientists, engineers, technicians and other employees of the Department of Atomic Energy (DAE) towards promoting self-reliance in the field of atomic science. Operationalisation of

the upscaled FBR technology forms part of the 2nd stage of the 3-stage Nehru-Bhabha strategy towards making India a global leader in atomic science.

The Nehru-Bhabha 3-stage nuclear power development strategy:

The 1st stage of the strategy envisaged the use of Pressurised Heavy Water Reactors (PHWRs) using natural uranium available in limited quantities in India. PHWRs also produce fissile plutonium-239. The 2nd stage visualised reprocessing of the spent fuel from PHWRs for efficient use of plutonium inventory by using FBRs and also to convert fertile thorium into uranium-233. The 3rd stage based on uranium-233 will use advanced thermal reactors and FBRs. In addition, it will also produce fissile isotopes by using accelerator-driven sub-critical reactor (ADR) systems (https://dae.gov.in/saga-of-atomic-energy-in-india/)

Recognising that beach sands in some parts of the east and the west coasts of India contain large quantities of monazite, the raw material from which thorium can be extracted as a fuel for sustaining the above strategy, at the instance of Bhabha, the then Prime Minister Nehru lost no time in establishing public control over beach sand mining and imposing a total ban on the export of monazite.

The speed, alacrity and the timeliness with which Bhabha put in place a long-term vision for nuclear development in India can be gauged by the fact that he formulated his plan within 5 years after the first discovery of nuclear fission reaction in the world and within 2 years after the first successful demonstration of a controlled fission reaction in 1942. Within one year after India's independence, in August 1948, at the instance of Bhabha, Prime Minister Nehru moved equally fast to establish the Atomic Energy Commission (AEC). The Indian Rare Earths Ltd (IREL) was set up in the public sector in August, 1950 for extracting rare earths, including monazite. India soon became a world leader in the field of atomic science, which in turn generated spin-off outcomes in the field of electronics, in medicine and a host of other important fields of science and technology.

While the latest 500 MWe FBR at Kalpakkam has undergone inordinate time and cost overruns in reaching its goal, it should be recognised that it is the price one necessarily pays for building self-reliance through a predominantly indigenous effort. The scientists, the

engineers and the technicians of the nuclear establishment in India deserve the nation's kudos for it.

Safety of nuclear facilities:

It is reported that when the PM visited the Kalpakkam FBR facility on the 4th of March, 2024, the State Chief Minister "consciously" skipped the event as the reactor would be "harmful" to people who are living in and around the atomic power station near Chennai (https://www.deccanherald.com/india/tamil-nadu/pm-modi-witnesses-first-step-towards-operationalisation-of-long-awaited-fast-breeder-reactor-2921619#). One can readily understand the State Chief Minister's concern keeping in view the toxic contamination spewed around by Sterlite's copper smelter at Tuticorin, found fault with by no less than the apex court of India, the ammonia gas leak that caused widespread havoc in December, 2023 at the fertiliser unit of Coromandel International Ltd (CIL) located at Ennore and, emission of toxic pollutants and accidents occurring in several industrial establishments in and outside Tamil Nadu that adversely impacted the health and the lives of the people. Corporate social irresponsibility has become more a rule than an exception in India. While economic development is desirable and necessary, unless it converges with an improvement of the overall welfare of the people at large, it will have no relevance.

Those familiar with the intricacies of nuclear reactions will appreciate the fact that however low may be the probability of occurrence of a nuclear accident, if it ever occurs, its consequences can be disastrous. When a nuclear complex has multiple reactors set up at one location, the compound probability of an accident and its consequences can be far higher.

The accident at the Three-Mile Island nuclear power plant way back in 1979 reminded the world of this for the first time, forcing many States in the USA to put a stop to their ambitious nuclear power development plans.The 1986 accident at Chernobyl in Russia was far more disastrous resulting in a huge financial liability imposed on Russia for decommissioning the accident-stricken plant. A massive steel/concrete dome, otherwise known as a "*sarcophagus*" had to be built over the accident-stricken reactors to prevent spread of radioactive contamination. A far more disastrous accident occurred at the Fukushima nuclear power plant in Japan in 2011. It may take decades for Japan to decommission the plant and clean up the surroundings. The cost of decommissioning has

already reached a mind-boggling figure of $70 billion and it continues to escalate every day. More than one million tonnes of water contaminated with radioactive isotopes are being released into the sea from the accident-stricken reactors and the problem posed by contaminated water continues to get accentuated further and further.

If a Fukushima-like accident were ever to take place in India, it is doubtful whether either the Central government's budget or the concerned State's budget would be able to bear the consequent open-ended liability.

Though the existing Atomic Energy Regulatory Board (AERB) set up under the Atomic Energy Act exercises oversight on India's nuclear facilities, despite the fact that it has the necessary professional competence and experience, since it operates under the administrative control of the DAE itself, it lacks the autonomy needed for enforcing safety. Immediately after the Fukushima accident, prompted by a world-wide expression of concern for safety, the DAE introduced a Bill to set up an independent nuclear regulatory authority for enactment by the Parliament. A standing committee of the Parliament examined the Bill in depth and recommended a number of far reaching amendments to it to empower the regulatory body adequately. Unfortunately, DAE failed to incorporate the necessary safeguards and get the Bill enacted by the Parliament. Post-Fukushima, there is greater public awareness of the potential risks of nuclear power and one can understand the Tamil Nadu Chief Minister's concern about the FBR project at Kalpakkam.

Imported light water reactors based on imported fuel pose an affront to self-reliance:

The bilateral agreements that India had entered into with Russia in 2002 and the USA in 2005 for expanding nuclear power generation capacity based on imported light water reactors and imported uranium fuel marked the first major departure from the 3-stage strategy, marking a set-back to DAE's indigenisation effort and posing a serious threat to India's self-reliance in nuclear power development. Importing reactors, depending on overseas sources for fuel, and depending on them for spares and maintenance indirectly acts as a dampener of indigenisation effort. Such agreements involve non-transparent procurement procedures that make it difficult to discover the market price and therefore tend

to hike up the costs.

The fact that India had to agree to adopt a civil liability legislation under global pressure that limits the liability to be borne by the reactor suppliers to an unconscionably low amount points to the potential risks involved. In other words, while India would import reactors from from foreign MNCs, in the event of a serious accident, the latter would not be required to bear the liability except to a highly restricted extent, leaving the rest to be borne by the Indian tax-payers.

The ambitious nuclear power capacity expansion plans of the DAE based on imported reactors appear to be far more attuned to promoting the commercial interests of the MNCs rather than providing inexpensive electricity to domestic consumers in India. While such nuclear power projects cause displacement of thousands of households and disrupt their lives in India, they help the overseas reactor suppliers, who were about to face bankruptcy due to lack of adequate business opportunities, in reviving their business activity and provide employment opportunities in their respective parent countries.

Neither Bhabha nor Nehru would ever have visualised a situation such as this, which runs diametrically opposite to their vision, increasing dependence on foreign agencies for enhancing nuclear power generation capacity in India, that too allowing them to go scot-free, exempted from the bulk of the liability that may arise from an accident in the future!

The twists and turns in the policy on beach sands mining:

As already pointed out, considering that beach sands contain several scarce, highly strategic atomic minerals such as monazite, titanium etc., it was at the instance of Bhabha that the DAE under the then PM Nehru restricted beach sands mining exclusively to the public sector and imposed a total ban on monazite export. This situation continued till the UPA era when the then government caved in to external pressure and opened up the sector to private mining companies. Restrictions on the export of atomic minerals were progressively relaxed. A certification procedure that existed then to ensure that export consignments involving atomic minerals such as ilmenite do not contain monazite in excess of a low threshold had been done away with. As a result, the private miners, driven exclusively by the profit motive started adopting unscientific, environmentally damaging mining practices

and smuggling out monazite in significantly large quantities. When the civil society supported by knowledgeable scientists exposed this, the Madras High Court took cognisance of it and ordered a thorough investigation which corroborated the fears expressed by the civil society. Cases were filed before the apex court and elsewhere, culminating in the Central government prohibiting private beach sands mining in March, 2019.

However, unable to resist external pressure, the Central government made a volte-face in 2022 by introducing amendments to the Mines and Minerals (Development & Regulation) Act to permit the entry of private mining companies to undertake beach sands mining once again, unmindful of its long-term adverse national interest implications (https://countercurrents.org/2023/05/allowing-fdi-in-nuclear-power-development-an-imprudent-step-it-will-adversely-impact-the-national-security/)

Allowing private miners to undertake beach sands mining and creating an environment that allows indigenously available monazite resources to be smuggled out amounts to thwarting the strategy so prudently designed and put in place by Nehru and Bhabha more than seven decades ago to safeguard national security. Since private mining companies will operate to maximise their profits, neither the government is likely to impose limits on annual extraction rates to ensure the optimal use of the critical atomic mineral resources nor is it likely to impose restrictions on exports. Considering that India's political parties have of late fallen prey to large-scale corporate funding of elections, the present trend seems to be in favour of diluting the rule of law in all its dimensions to suit the interests of private corporate entities.

FDI in nuclear power development?

In view of the strategic nature of nuclear power, there is presently a restriction on foreign direct investment in setting up nuclear power plants. In the guise of giving a push to expansion of nuclear power generation capacity to reduce carbon emissions, a panel of Niti Ayog, the government's premier think-tank, is reported to have recommended overturning the ban on foreign investment in the sector and allowing greater participation by domestic private firms ((https://economictimes.indiatimes.com/industry/energy/power/india-considering-allowing-foreign-investment-in-nuclear-power/articleshow/100015038.cms?

utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst).

If this recommendation of Niti Ayog were to be accepted, as it is to be expected, it would amount to a complete reversal of the Nehru-Bhabha strategy for self-reliance in nuclear power development. India may then become an easy playground for overseas MNCs, profiteering at the cost of the people of India, insensitive to the damage they cause to the environment and indifferent to the welfare of the nation.

Let us hope that the people of India will resist such a trend.