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Time to Step Up India's Reliance on Nuclear Energy

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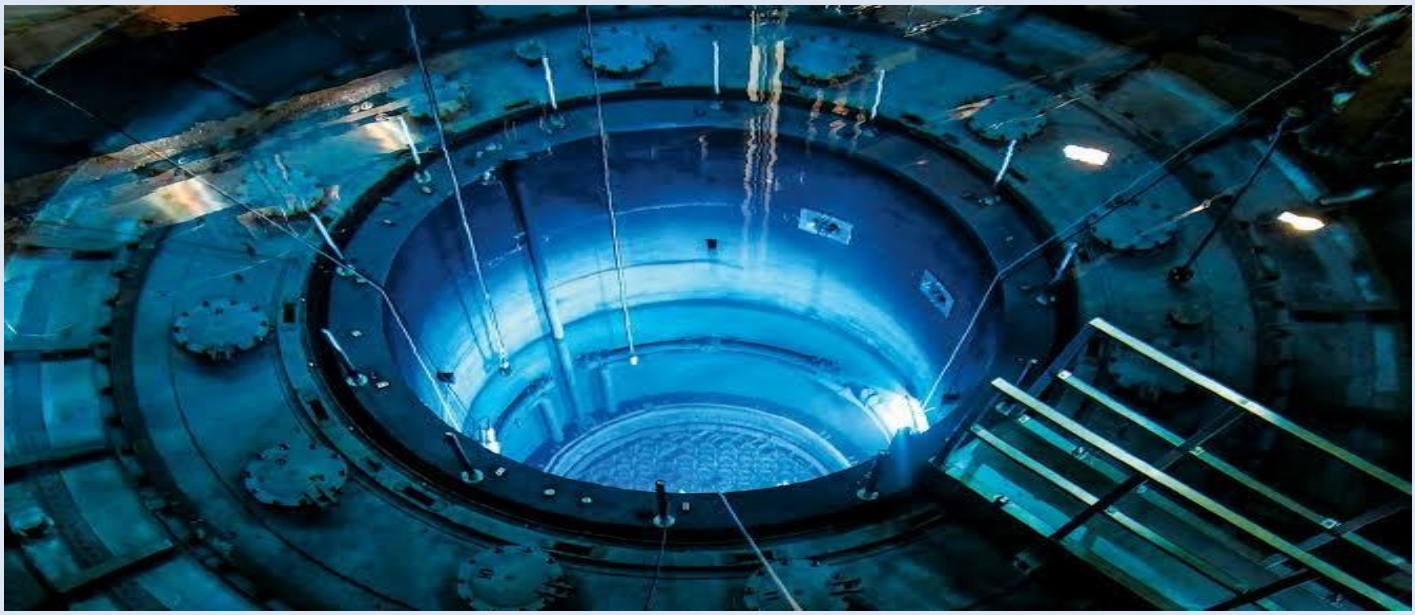

Image Source: American Chemical Society (https://cen.acs.org/energy/nuclear-power/Combating-corrosion-worlds-aging-nuclear/98/i36)

It is not the first time that an international crisis, such as the ongoing Russia-Ukraine war, has impacted the energy trade and the world economy at large. Economic and trade sanctions imposed on Russia have infused uncertainty into the global energy markets and led to a significant increase in energy prices. The tremendous pressure on India to reduce its already minimal oil imports – which is less than two per cent – from Russia, even as energy trade is technically exempt from US sanctions further lays bare the geopolitical nature of energy trade. There is little doubt that it would be in India's interest to reduce its import dependence on energy supplies and accelerate the adoption of alternative sources of energy such as nuclear energy.

As can be seen in the current crisis, global energy volatility has impacted almost all countries. However, it is especially troublesome for growing economies such as India that import a significant share of their energy requirements, as volatility in energy markets has a direct impact on inflation and their balance of payments situation. Around 86 per cent of India's crude oil requirements are met through imports. It is estimated that every USD 10 increase in price per barrel of crude oil adds USD 12.5 billion to India's deficit, which is roughly 0.43% of India's GDP.

As one of the faste[1]st-growing economies in the world with a much lower per capita energy consumption, India's demand for energy is expected to grow for decades to come. Additionally, India needs to remain mindful of its commitments under the Paris Climate Accords and pledge[2] to become a net-zero emitter by 2070. India has already embarked on an ambitious energy diversification program by accelerating the adoption of solar and wind power and promoting newer sources of energy such as hydrogen. However, the intermittent nature of these energy resources and the lack of reliable energy storage solutions coupled with India's large resource requirements make a strong case for increasing the reliance on nuclear energy.

Nuclear is one of the most energy-dense fuel sources available. One kilogram of natural uranium used in a standard light water reactor would produce energy equivalent[3] to burning around 14,000 kg of coal. Nuclear power plants also have a much higher capacity factor[4] because they require less maintenance and are designed to operate for longer stretches before refuelling. Further, nuclear power plants also require much less area[5] than solar parks or wind farms to produce equivalent energy. Unfortunately, the share of nuclear power in India's overall energy mix is just around 3%, in sharp contrast to the United States and France, with a share of 19% and 70% respectively.

India uses a mix of reactor types in its nuclear power program. Even though India started with US-imported 160 MW Boiling Water Reactors (BWRs) in 1969, by the 1980s it had developed an Indian Pressurized Heavy Water Reactor (IPHWRs) with the initial baseline design producing 220

MW which has since been upgraded to 540 MW and 700 MW capacity. Currently, 16 out of 22 operational nuclear reactors in India belong to the IPHWR family. In addition, two water-water energetic type reactors (VVER) with a 1000 MW capacity, built with Russian collaboration are operational in Tamil Nadu, while four more are under construction. India is also looking to build six reactors each of 1650 MW European Pressurised Reactor (EPR) at Jaitapur in Maharashtra and 1000 MW Westinghouse's AP1000 design at Kovvada in Andhra Pradesh.

Major impediments to accelerated adoption of nuclear energy in India include high initial cost and duration of construction, issues with Indian nuclear liability law, and domestic concerns about the safety of nuclear power plants. To overcome some of these challenges, India approved a comprehensive plan[6] in 2017 to undertake the construction of 10 IPHWR-type reactors of 700 MW each in 'fleet mode'. Under this plan, a nuclear power plant is expected to be built over five years from the first pour of concrete (FPC). The FPC under this plan will begin in 2023 at Kaiga Atomic Power Station in Karnataka. Furthermore, in 2016, to address the concerns raised by suppliers regarding the Civil Liability for Nuclear Damage Act (CLNDA) 2010, India created the Nuclear Liability Fund[7] with a corpus of ₹ 2,000 crores to cover damages resulting from a nuclear accident in case they exceeded the limit specified under the act. India also ratified the IAEA Convention on Supplementary Compensation[8], allowing access to additional funds from an international pool in case of a nuclear accident. Such developments are expected to provide impetus to the faster adoption of nuclear energy.

As India's nuclear infrastructure expands, so should its regulatory mechanisms. Currently, oversight of civil nuclear reactors is under the Atomic Energy Regulatory Board (AERB) which is an executive authority[9] constituted by the President of India with little parliamentary oversight. Furthermore, experts have highlighted[10] the conflict of interest in the mandate of the AERB that involves both promotion and regulation of the nuclear program. Therefore, there's a need[11] to establish an independent statutory body to oversee the safety and regulatory aspects of nuclear power plants. The Nuclear Safety Regulatory Authority[12] (NSRA) Bill that was first tabled in 2011 was a promising and forward-looking piece of legislation in this regard. The present government should reintroduce the bill in the parliament and ensure its speedy implementation.

Further, as India expands its production of nuclear energy, it should be mindful of not replacing one import dependence (i.e. oil and gas) with the other (i.e. uranium). Currently, India's domestic production of natural uranium is sourced from two mines in Jharkhand and Andhra Pradesh, but they haven't been able to meet requirements, leading to the import of natural uranium from Russia, Kazakhstan, Uzbekistan, France, and Canada. As more reactors come online, demand for uranium would increase. The government should invest to accelerate uranium prospecting within

the country to reduce import dependence. Recently, the Uranium Corporation of India Ltd. began uranium prospecting[13] and exploitation in Arunachal Pradesh. India should treat nuclear energy self-sufficiency, which includes using financially-viable local uranium resources and indigenous nuclear reactor technology, as an important part of its policy of 'Atmanirbhar Bharat'. India can take advantage of its vibrant start-up ecosystem. The Nuclear Power Corporation of India Limited (NPCIL) and the Department of Atomic Energy (DAE) should facilitate greater interaction between the government, students, and private companies on R&D of nuclear technology.

Lastly, there is a need to address misplaced fear and anxiety among the public about nuclear energy and technology. The Fukushima nuclear disaster of 2011 left an imprint on the Indian public psyche. This has manifested itself in protests against the Kudankulam Nuclear project[14] in Tamil Nadu and, more recently, the Jaitapur Power project[15] in Maharashtra. There is a need to put these fears to rest by engaging and educating the public about various aspects of nuclear energy.

One way could be by building museums that chronicle India's nuclear journey since independence and focus on nuclear technology and its applications in the spheres of health, energy, and agriculture. Furthermore, the government could encourage environmental groups, media persons, and politicians to visit the nuclear plants and see how they function. Internships or fellowship programs can be offered to students in related fields of nuclear physics and policy to familiarise future scientists, policymakers, and analysts with various aspects of nuclear energy and provide a hands-on experience.

NOTES

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