

Going nuclear

For a growing economy like India, leveraging nuclear energy is crucial to address climate change challenges and attain its net-zero goal



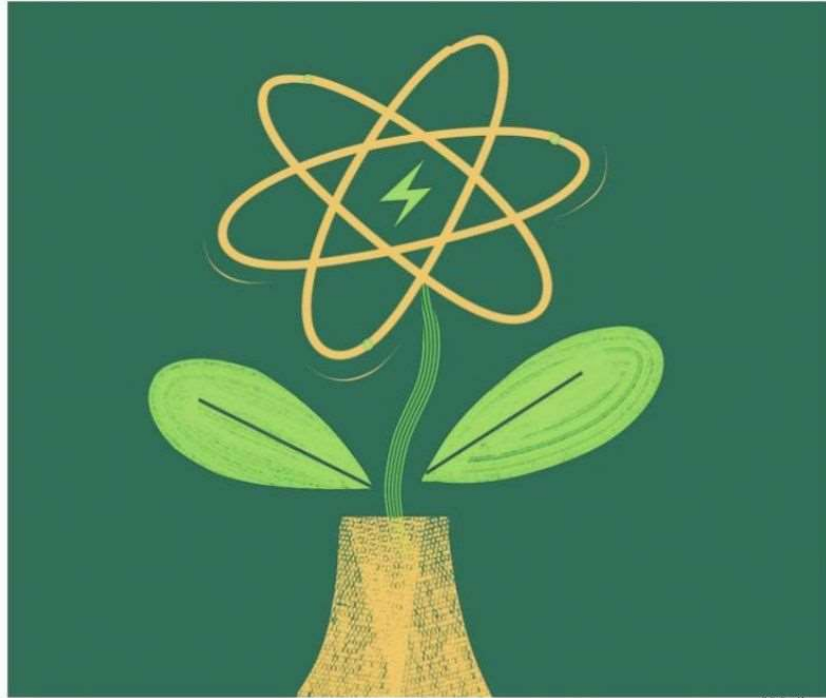
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INDIA'S ECONOMY IS growing rapidly. It is expected to surpass Germany and Japan and move up from number five to number three position before the end of this decade. Economic growth triggers demand for energy. One would thus expect significant growth in our primary energy consumption which is already the third-highest globally. Most of this is based on fossil energy.

Fossil fuel consumption is a major contributor to global warming, which has now become an existential crisis for humanity. Deep and immediate emission cuts, leading to net zero, have become unavoidable. There is now a global consensus to reach this goal before a 2045–2070 time frame. Transition to net zero involves massive transformation of energy systems, involving new technologies, restructuring of energy systems at supply- and demand ends and large costs. For a large and developing country like India, the challenge of reaching net zero is much bigger. Our developmental aspirations require a manifold increase in per-capita energy use even as we transition to net-zero GHG emission. Our inability to meet this dual challenge would mean either compromising on development or failing to realise the net-zero target timeframe or both.

We all aspire to reach a Human Development Index (HDI) comparable to advanced countries of the world. For this, as per prevailing correlations, we need a minimum of 2,400 kilogram oil equivalent (kgoe) energy consumption per capita per year. This threshold could improve to around 1,400 kgoe, as a result of expected improvements in energy use efficiency. Even after considering this, the total clean energy requirement to support a developed India would work out to around 25,000–30,000 TWh/yr. This is more than four times our present energy consumption. While we are rightfully making rapid strides in deployment of renewable energy including hydro, would this alone enable us to become an advanced country? The answer is no.

Hypothetically, even if the entire barren uncultivable land in India is used up for setting up solar plants (which, clearly, is not possible), it would still fall way short of the target. The potential of wind energy is even smaller. The only way out then is a rapid scale-up of nuclear energy. For this, we need to shed the unfounded phobia around nuclear energy. Today, nuclear energy has emerged as one of the cleanest and safest of energies capable of effectively countering climate change. Since we pursue a closed nuclear fuel cycle, waste issue is also reduced to a negligible level. Based on a study done by Vivekananda International Foundation, with due analytical back-up from IIT-Bombay, it appears that nuclear energy would need to be scaled up to a couple of thousand GWe for an optimum solution to reach net-zero in a developed India. This is a major implementation challenge and the country must brace up to meet it. Luckily, on the technology front, we are capable of self-reliance. What is missing is the



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determination and requisite policy/management framework. Without nuclear energy playing its due role, the country will not be able to reach the status of a developed nation. We need to be guided by our own *sui generis* strategy and not be driven by foreign vendors.

In this context, it would be worthwhile to pursue a six-pronged national strategy for a rapid scale up of nuclear energy.

Indigenous 700 MWe PHWR, the first unit of which is already in commercial operation, should be the prime workhorse for base load electrical capacity addition. Fifteen more such units are already under construction in fleet mode. One should take up many such fleets for implementation leveraging multiple PSUs in addition to NPCIL.

Secondly, build indigenous SMRs at a large number of sites that would be vacated by retiring coal plants in the coming decades. As the experience with large PWRs has shown, importing these units would make electricity production unaffordable. NTPC, being the owner of the largest number of coal plants in the country, is a natural partner in this process. More industrial partners could be involved.

Thirdly, well-proven 220 MWe PHWR units can be offered as partially owned captive units for electricity and hydrogen for energy-intensive industries such as metals, chemicals, and fertilisers. AHW300-LEU developed by BARC can also be offered for this role after demonstrating a prototype.

Fourthly, develop a high temperature reactor for direct hydrogen production without resorting to electrolysis. This would enable cheaper green hydrogen production and

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reduce pressure on excessive electrification of the energy system in the country, which otherwise appears inevitable. Bhabha Atomic Research Centre has the requisite capability. Speed up second and third stage nuclear-power programme development to unleash thorium energy potential in accordance with the pre-existing plans for long-term sustainable energy supply.

Finally, emerging-economy countries, where one expects maximum net growth in energy consumption, should see rapid deployment of new nuclear-energy capacity to credibly address the climate-change challenge at the global level. Our PHWRs are globally competitive both in terms of performance and capital cost and are a good fit for meeting these requirements. Thorium-HALEU fuel in PHWR can make these reactors even more attractive in terms of economics, safety, waste management and proliferation resistance. India should encash this opportunity through piloting a major international co-operation for global efforts to address climate change challenges.

Reaching 25,000–30,000 TWh per year from where we are today by the year 2070 corresponds to a CAGR of around 4.8 percent. While this should clearly be feasible, leveraging nuclear energy in a significant way is inevitable. A large and growing economy like India can certainly implement this, provided it is driven as a national programme guided by a bold policy support that provides a level playing field for nuclear energy on par with renewable energy.

The writer, a nuclear scientist, was director of Bhabha Atomic Research Centre

