A Strong Case for Expanding the Role of Nuclear Energy

Manpreet Sethi*

India had just about negotiated its inclusion into international nuclear commerce, and signed Memoranda of Understanding with a dozen odd nuclear supplier countries, when the unfortunate nuclear accident at Fukushima happened on 11 March 2011. While no fatalities have been attributed to the nuclear accident, it nevertheless shook up public faith and has led to several questions being raised on the need to pursue nuclear power. In fact, according to the IAEA Annual Report of 2015, the number of countries that were actively considering or planning a nuclear power programme fell by half from a total number of nearly 60 nations that had expressed interest in nuclear power, only six years earlier.

* **The author** is Senior Fellow and Project Leader, Nuclear Security, Centre for Air Power Studies, New Delhi.

Nevertheless, there are still two countries in Asia that remain steadfast on their nuclear programmes. Indeed, most of the new nuclear construction is happening in China and India. Both have stayed on the nuclear course and are going ahead with ambitious expansion plans. This paper examines why India continues to consider nuclear energy as an important contributor to its future electricity needs. What are the contributing compulsive factors compelling India to do so and what are the challenges it will have to overcome to make nuclear energy a feasible and worthwhile component of the national electricity basket? While the primary focus of the paper is on nuclear energy, it nevertheless is premised in the belief that there is need for growth and development of *all* energy sources in India, both existing and potential, to power its socio-economic growth and development. The country's energy requirements are so huge that it cannot afford the luxury of banking on only one or two fuel sources to power its future. Therefore, nuclear energy will be one component amongst the diverse electricity sources that India must per force exploit for its benefit.

The Current Electricity Scenario in India

Despite the rapid growth of its power generation capacity (hundred fold since independence), and despite being the third largest producer of electricity in the world, India is still an electricity deficient country. The per capita power availability is at about a dismal 1000 kilo watt an hour (kWh), which is way below the world average of about 2800 kWh. It compares poorly with global statistics of 17179 kWh in Canada, 13338 kWh in USA, and even 1300 kWh in China. At the moment, India draws the bulk of its electricity, nearly 69% of its total energy generation, from thermal sources. Of this, 55% is met from coal and the rest largely from gas and only a very miniscule amount is from oil-fired plants. The worrisome part of this share of thermal electricity generation is that, India imports these traditional fossil fuels in large quantities. This increases national vulnerability to global fossil fuel supply mood swings. For a large and rapidly developing country like India, bulk imports of fuel are neither affordable nor strategically prudent. India has reasonable coal reserves, and is the fourth largest producer of coal and lignite in the world (after the United States, China, and Australia). However, India's coal reserves are of low quality with high ash content and low calorific value. Also, these are concentrated in select pockets of the country. This necessitates haulage of coal over long distances which not only raises cost but also strains the transportation network. In fact, transport costs raise the cost of coal three times from when it comes out of the mine. Nevertheless, at present, coal remains the dominant fuel. Oil is primarily being used by the transportation sector. So, the other significant source of thermal power generation is natural gas. But, given the limited domestic availability of

natural gas vis-a-vis the demand, it will also have to be sourced from outside through elaborate and long distance pipelines and LNG shipments. These suffer from the risks of terrorism, piracy and environmental spills. While "peace pipelines" is politically a commendable concept, it has enormous economic and security implications, especially when the pipelines have to pass through politically unstable nations that harbour open hostility towards India.

The major bulk of generation of electricity is from thermal sources, followed by the distant second in the form of hydropower which is at a measly 14% of the total generation. This number, however, changes to 30% if all the renewable sources are clubbed together. Indeed, efforts to harness viable renewable energy resources, such as wind, biomass, solar energy, etc continue to increase the share from such sources in the total electricity generation portfolio. Research and development efforts are being encouraged in renewable energy technologies, which include such sources as tidal and geothermal energy too. However, except for hydro power in the few places where it is plentiful, other sources are yet to present themselves as suitable for large scale power generation where continuous, reliable power supply is needed. Storage technologies are yet to improve to the extent of making these sources available for base load electricity.

Finally, nuclear reactors provided just about 2% of the total electricity generation at 6.78 GWe in 2017. Despite its rather meagre contribution, nuclear energy holds substantial promise from the perspective of meeting India's humongous energy needs in a secure and sustainable, low carbon way. In fact, if the growing Indian economy continues to rely on traditional thermal energy sources, carbon emissions would significantly rise and environmental consequences like greenhouse effect, global warming and climate change would progressively become a serious cause for concern. At present, India's per capita carbon emissions stand at 1-1.2 tons compared to 20 tons per capita in the US. With continued urbanization, a shift from non-commercial to commercial fuels, increased use of motorized vehicles, and prolonged use of older and inefficient coal-fired power plants, India's emissions are expected to increase and nearly triple by 2030. In fact, according to the US Department of Energy, between 2001 and 2025, India's carbon emissions will grow by 3 per cent annually, twice the predicted emissions growth in the US, making India the third largest air polluter after the US and China by 2015 itself. If India is to avoid this dubious distinction, then a conscious decision must be taken to switch to more environmentally sustainable energy technologies, such as nuclear power.

Evidently then, India has a strong case for exploiting and expanding the role of nuclear energy in the future electricity mix. Demographic growth, rising

aspirations of a young and aspiring populace, lack of indigenous fuel resources, mounting proof of climate change are all challenges that call for a long-term vision and commitment to safe generation of nuclear power.

The Current Nuclear Energy Scenario in India

Presently, India has 22 operational nuclear reactors that produce about 6 GWe electricity. The government plans to quadruple this nuclear power generation capacity to 20 GW by 2020. While this looks ambitious, given the previous record of the nuclear establishment, it must be noted that several pieces of the programme are already in place. The upsurge is expected from rapid expansion of the indigenous programme besides the import of larger capacity reactors from established nuclear suppliers. Indeed, several significant developments have taken place for the Indian nuclear power programme over the last 5 years, to once again raise hopes on the nuclear programme.

In 2016, India imported a record amount of 3000 metric tonnes of uranium from Russia, Canada and Kazakhstan. The availability of imported uranium for its safeguarded reactors has enabled a jump in the capacity factors of the operational nuclear power plants. While the Uranium Corporation of India Ltd too has re-started uranium prospecting and exploitation within the country, the availability of imported uranium will be a big help as new indigenous nuclear reactors begin coming on line from 2018 onwards; seven of which are currently under construction, and ten more have been approved for construction.

In March 2017, the start of commercial electricity production by Kudankulam 2 led to a straight jump of 1000 MW. Awaited next is the start of operation of the first of the 700 MWe reactors at Kakrapar. After the 540 MWe reactors at Tarapur, these are the biggest capacity reactors being built indigenously in India and are expected to become the standard reactors in the future. In fact, in May 2017, the government approved 10 more such reactors. Another much awaited development is the attainment of criticality by the Prototype Fast Breeder Reactor (PFBR) at Kalpakkam. Given that nearly all countries working on fast reactor technology have given it up (Japan being the latest to put its Monju reactor to rest in December 2016), the eyes of the rest of the world are on India to gauge the success of PFBR technology. Once the PFBR becomes operational, it will provide a major breakthrough for India to progress towards its long-developed but slow-moving three stage nuclear programme which will culminate with the large scale utilisation of thorium available within the country. Given that the country is trudging a lonely path in this direction, it is natural that every step is being taken cautiously with adequate safety measures in place, since any mishap at this stage could mar the future of the nuclear programme.

Challenges on the Road to Indian Nuclear Expansion

Many challenges to nuclear power expansion in India can be identified. Public Acceptance may be counted as one of the biggest challenges to nuclear power expansion in most countries of Asia. The pressing challenge before the nuclear industry and national nuclear establishments is to arrest the general mood of public opinion that appears to be swinging in favour of choosing the easy option of abandoning nuclear energy. And the need of the hour is to maintain a balanced approach towards nuclear energy by undertaking a calculated analysis of its risks and benefits and to distil and assimilate the right lessons from the nuclear accident at Fukushima.

The battle of restoring public confidence has to be won on two counts: one, to make people understand the need for nuclear power; and secondly, to explain the safety aspects of nuclear electricity generation. This calls for a more proactive approach from the nuclear establishment. Until now, such programmes have worked in a closed manner with no public debate or participation. But in the changed environment after Fukushima, the only way to win public support for nuclear energy will have to include a far greater interaction with the people to explain to them the reasons for selection of a particular site, the basics of the reactor technology, the safety redundancies built into operations etc.

In fact, it would be a good idea to invite the public – school and college students, organized groups of women's associations, the corporate sector, the media, and generally the common man — to visit the plants and to see and feel for themselves. A special effort must also be made to engage with NGOs and local community groups, including religious heads, at plant sites since they have the advantage of directly interacting with the local populace as also a huge capacity for mobilizing public opinion. The more approachable the nuclear plants seem, the greater will be the confidence that will be instilled over time.

Secondly, India still needs to be paying attention to **Nuclear Liability Issues.** However, before coming to the situation in India, it is important to understand the general sensitivity of this issue. It is a recognised fact that safety is most critical for the nuclear industry since it deals with materials that are radioactive and hence potentially dangerous, and with systems and technologies that are extremely complex. Nuclear accidents have widespread implications. In no other industry does an accident in one plant have comparable impact on the international industry as a whole. In fact, after each untoward incident, new technical processes and design changes have been incorporated into nuclear reactors and modern power plants are the result of refinement of several decades of reactor operating experience. Over time, all the processes involved in reactor

siting, design, construction, and operation have evolved into best practices under the watchful eye of national and international regulatory agencies. Several new design features such as double containment for the reactor, core catcher in case of meltdown, passive safety features, etc have been derived from past accidents.

Similarly, better emergency planning, and conduct of independent peer reviews also help operators share information, and aid in further building a safety culture. Yet, achieving unimpeachable safety standards is a continuous journey and not the final destination. Given the widespread impact that safety can have on the fate of nuclear power worldwide, as is evident in Asia, relevant procedures and their regular improvements needs to be imbibed as an organisational culture so that safety is not imposed but inborn. Only such measures will help to change public perception and raise confidence in favour of nuclear power again. However, stringency on safety has far reaching implications for the nuclear industry and also affects the cost of nuclear power.

The period immediately following Fukushima and the passing of the stringent Civil Liability for Nuclear Damages Act (CLNDA) in India saw a lull as the nuclear industry expressed concerns about its investments. The general impression was that the law was placing an inordinate level of burden on the nuclear supplier by holding him responsible for any nuclear accident and subject to liability compensation. In order to assuage the mood, the government took several steps. It provided clarifications on the liability issues, which were of main concern to the nuclear industry in 2015. In 2016, it set up an insurance pool to further facilitate confidence by covering the risk of the suppliers. This was through the creation of a Nuclear Liability Fund of Rs 2000 crore meant to cover damages resulting from a nuclear accident in case they exceeded the limit specified at Rs 1500 crore for nuclear power operators under the CLNDA. Soon after the setting up of the pool, NPCIL bought the first Operators and Suppliers insurance policy at Rs 100 crore premium from the consortium of General Insurance Corporation of India and the Nuclear Risk Insurers of the UK. India also ratified the IAEA Convention on Supplementary Compensation in February 2016. This enables the availability of additional funds from an international pool in the unfortunate case of an accident. The indigenous construction of the new reactors will prove the viability of this model and inspire confidence in the foreign nuclear suppliers.

Thirdly**, Stringent Regulatory Oversight** is critical to have and for its existence to be seen and recognised. The role of independent and effective regulation of national nuclear programme cannot be overstated. Given the risks involved in the technology, it is only natural that a special organisation be tasked

to perform diligent supervision with utmost objectivity and rigour based on a set of clearly established guidelines. The IAEA has also evolved such benchmark guidelines for the creation and functioning of regulatory organisations. Post-Fukushima, regulatory oversight mechanisms in all countries came into question with the surfacing of the phenomenon of 'regulatory capture' – a situation in which a regulatory agency created to act in public interest, instead starts advancing commercial or political concerns of special interest groups dominating the sector it is supposed to be regulating. The conflict of interest involved in having the same set of people engaged in promotion and regulation of nuclear programmes was identified as a major drawback of existing regulatory systems in many countries. After the Fukushima experience, many countries have worked towards clearing this mess. It must be remembered that public confidence can only be restored if the regulatory organisations prove their independence in functioning and do so with effectiveness and transparency. India too embarked on the process of creating a statutory body passed by Parliament with the drafting of the Nuclear Safety Regulatory Authority (NSRA) bill in 2011. This envisaged the dissolution of the existing Atomic Energy Regulatory Board and its replacement with NSRA. However, owing to political reasons, the passage of the bill has been pending in Parliament for the last six years. Since the bill could not be taken up for consideration before the dissolution of the 15th Lok Sabha, it has since expired and a fresh Bill is under processing.

Lastly**, Nuclear Waste Management** is another key public concern in relation to nuclear power since the nature of nuclear waste is radioactive with very long life. Environmental and public interest groups have whipped up opposition to nuclear power by highlighting the difficulties involved in dealing with spent fuel and its safe storage. Aspects of safety and security are both involved in this dimension. Fortunately, the nuclear industry is well aware of this challenge and has been managing waste disposal successfully for more than half a century. Dozens of facilities for low-level and intermediate-level nuclear waste are in operation throughout the world. As far as the long-term management of high-level radioactive waste and spent fuel is concerned, nations are experimenting with the ideas of construction of deep geological repositories. While search for such a site is on also in India, the country has also introduced the technology for reduction of high level waste through separation of actinides and disposal of each dependent on their chemical nature and composition. Given technological advancement and human ingenuity, it is quite possible that adequate solutions to the challenge of radioactive waste disposal will be found sooner rather than later.

Conclusion

It can be said, and may be with some certainty, that nuclear power will remain a major contributor to the Indian electricity basket for at least two reasons. The first of these is that, as a developing economy, India will be compelled to use all electricity generating options to meet the rising demand for electricity. Given India's electricity deficit, the absolute amount of electricity generated by India would have to at least double by 2020, double again over the next ten years, and be close to ten times the figure today by 2050. Even with a relative economic slowdown in the last few years, the fundamentals of the country remain strong enough to merit substantive growth in electricity supply. The second reason is that India will also be obliged to move towards environmentally sustainable sources in order to meet the international emission reduction targets. These two driving points will provide the basic rationale for national efforts towards nuclear energy and underpin the choice that the country makes. Both these compulsions will require India to cultivate a prudent mix of diverse energy sources that pragmatically balances considerations of cost, uninterrupted availability of fuel and environmental impacts, all at the same time.

Lastly, it needs to be reiterated that it is important that every potential source of electricity generation be optimally used and the menu of options be as varied as possible so as to minimise risks of disruption arising from shortages, price fluctuations or political manipulations. This is the only possible strategy that 'rising' India can afford to power its future.