Energy Security – A Strategic Imperative for India

Colonel GG Pamidi*

Introduction

The 9-point magnitude earthquake that struck the northeastern Sendai region of Japan on 11 March 2011 and the subsequent tsunami that it triggered have caused incalculable devastation. Apart from the widespread loss of life and property, the natural disaster also damaged six reactors of the Daichi Nuclear plant at Fukushima. By March 16, the earthquake and tsunami-stricken Fukushima Daichi nuclear station had been the site of two fires, three explosions and significant radiation releases. Japan's nuclear disaster that heightened fears of a possible nuclear meltdown has stirred the Indian nuclear debate again. Japan's worst nuclear accident in at least 33 years has compelled both China and India to review plans for atomic energy. A review of all nuclear reactors in the country has been ordered by the Prime Minister, Manmohan Singh in a bid to check the levels to which these are equipped to deal with natural disasters. At the timing of writing, while it is too early to fully comprehend the extent of the damage as well as the radiation dangers that may happen, there are already calls in India to rethink about the approach to nuclear power. This article attempts to seek answers to some of these questions and explore the possibility of using nuclear power to augment other sources of electricity in the country, without forsaking the valid concerns of safety, economic viability and environmental degradation.

Energy Needs of the Asian Giants

The 21st century has been termed as the Asian century and both China and India are the two rising giants of Asia. While it is indisputable that both these countries are galloping ahead, it is also a reality that (among other reasons) future economic growth will depend on the long-term availability of energy, particularly electricity. Growth in economy is made possible by several inputs, the two most important being energy and human resource. Studies by several academics and consultants forecast continued high growth rate for the next several decades.1 If energy does not meet demand, these optimistic growth projections will receive a rude jolt and plummet. Both the rising giants of Asia, India as well as China have been scouting for energy resources across the world with missionary zeal.**2** For a country of India's size, population and economy which is targeting ambitious growth rates of eight to ten per cent over the next two decades, safeguarding energy is a strategic priority.**3** Both these countries are eyeing nuclear energy as a viable option.

As is well known, India is a severely energy deficient nation. Not only are the rural areas in our country still resigned to darkness after sunset but several urban areas and even metros are subjected to long hours of power cuts. Both, the industry as well as agriculture, suffer and this affects the overall national development. The nation owes each citizen a good quality of life, and regular uninterrupted power is one important facet of this. To ensure this, the country needs to tap the entire range of available fuel sources after a careful examination of issues related to sustainability, security of supplies, self sufficiency, and security of energy infrastructure as well as their effect on local, regional and global environments. While the environmental burden needs to be factored in, in the words of Dr Anil Kakodkar, it needs to be reiterated that *"poverty is the biggest polluter"* and is the source of several conflicts. Currently, the per capita consumption of electricity in India is only about 566Wh per year. In comparison, the USA has 13,647 kWh per year and China 2,453 kWh per year**4**.

India's energy situation demands that all energy resources, including nuclear, be developed to meet the long-term energy needs in a sustainable manner. However, there is no dearth of sceptics and cynics of nuclear power. The doubts and misperceptions of nuclear energy range from safety aspects to availability of skilled manpower to radioactive waste management to the economics and viability of nuclear power generation itself. The recent Japanese tragedy has further heightened theses fears and hence the need for a dispassionate analysis.

Current Energy Generation and Source Position

Currently, India draws the bulk of its electricity from thermal sources, especially coal. In terms of percentages, almost 70 per cent of power generation is from coal. India's requirements for coking coal are almost entirely met by imports. Even the non-coking coal is increasingly imported to blend it with Indian high-ash coal for power generation at some coastal locations. Increasing dependence on imports has caused serious concerns about the country's vulnerability to the international market. "For a large country like India, long term energy security, mainly based on indigenous resources, is an important and inevitable need, from economic as well as strategic considerations," according to the Indian Department of Atomic Energy. The quality of coal available in India is poor, with ash content in the range of 35 to 50 per cent. As a result of exploration carried out up to the depth of 1200m, a cumulative total of 267.21 billion tonnes of Geological Resources of Coal have so far been estimated in the country as on 1st April 2009.**5** Despite its poor quality, with this much estimated reserves, coal is likely to continue to be the mainstay of power generation in India for a long time. Hydropower comes a distant second and produces approximately 15 per cent of the output. However, India has a large hydro potential and this needs to be exploited fully. This traditionally involves construction of large dams and, with it, arises the major problem of displacement of people. Hence, while hydropower is clean, it is not always green because large dams can destroy our natural habitat as well as displace people. Renewable sources provide the next share and several areas have good potential. Unfortunately, at the present level of technology, renewables cannot be used for central power stations and remain very expensive due to high capital costs and low availability factor. They also have the additional challenges of seasonal variations. Nuclear reactors supply about three per cent of electricity. India's energy requirements are so huge that it cannot afford the luxury of banking only on a few energy sources or neglecting any source.

The importance of nuclear power will grow significantly in the coming years as the concern of resource extinction prevails in the world. While the premise that all available energy sources need to be fully tapped is well understood, this article focuses on nuclear energy per se.

Nuclear Energy: Past and Present

The vision of harnessing energy from the atom is not new. It dates back to the independence days. India's first Prime Minister, Pandit Jawaharlal Nehru recognised early that nuclear technology offered a tremendous potential for economic development, especially for a developing country aspiring to leapfrog technology gaps brought about by long years of colonial exploitation**6.** However, the process of development of nuclear energy has been far from smooth. Under the "Atoms for Peace" programme which was aimed at facilitating the civil use of nuclear technology, India acquired a Cirus 40MW heavy-water-moderated research reactor from Canada and the USA provided the heavy water. The peaceful nuclear explosion of 1974 changed the way the western world looked at the Indian nuclear programme and sanctions were imposed on India. Being a non-signatory to the Nuclear Non-Proliferation Treaty (NPT), India was subjected to a de-facto embargo from members of the Nuclear Suppliers Group (NSG). This has prevented India from obtaining commercial fuel, nuclear power plants and services from the international market. The positive outcome has been that India has been compelled to develop its own fuel, components and services for nuclear power generation. This has resulted in innovations in the areas of Fast Breeder Reactors, Thermal Breeder Reactors, the Thorium fuel cycle, nuclear fuel reprocessing and Tritium extraction and production.

India's domestic uranium reserves are relatively small and the country is dependent on imports to fuel the nuclear industry. Russia has been a major supplier of nuclear fuel to India since the early 1990s. Due to lack of uranium, the electricity generation had gone down. However, the India-US Civil Nuclear Agreement led to the end of India's nuclear isolation. A waiver from the Nuclear Suppliers Group was given in September 2008 which allows India to commence international nuclear trade. As a result, India will now be able to import Light Water Reactor (LWR) technology as well as high grade uranium to enhance nuclear power production.**7** As of 2010, India has 19 Nuclear Power Plants in operation, while four others are under construction. India has a vision of becoming a world leader in nuclear technology having made good progress in technology for fast reactors and Thorium fuel cycle.

India now has a largely indigenous nuclear power programme and expects to have 20,000 MW nuclear capacity by 2020 and 63,000 MW by 2032.

Nuclear Cooperation with Foreign Countries

India has designated two sites for nuclear power plants to be established in cooperation with the USA. However, there still appear to be certain niggling doubts over the Civil Liability for Nuclear Damages Bill, a domestic legislation of India. This has been followed by the signing of Convention on Supplementary Compensation (CSC) for Nuclear Damage at the International Atomic Energy Agency headquarters in Vienna, Austria on 27 October 2010. To date, four nations – Argentina, Morocco, Romania and the USA have ratified the CSC pact. With India's action, 14 countries have signed the convention, according to an IAEA release. In order to enter into force, the pact must be ratified by a minimum of five nations with at least 400,000 units of "installed nuclear capacity," the release states.**8**

India and France have been working closely in the field of nuclear power plants. During the recent visit of the French President Nicholas Sarkozy to India, the two countries signed a general framework agreement and four other pacts for deepening bilateral cooperation in the nuclear energy sector. The location has also been identified and it is proposed at Jaitapur in Maharashtra. A general framework agreement has also been signed between the Nuclear Power Corporation of India Limited (NPCIL) and the French company, Areva.

Russia and India have a long relationship in the nuclear field. In December 2009, India and Russia signed a bilateral agreement on cooperation in civil nuclear energy. This was followed by an important agreement signed during the visit of the Russian Prime Minister Vladimir Putin during March 2010. Russia has agreed to build 16 nuclear reactors in India and six of these are to be built by 2017.

Australia has declined to supply uranium to India. Though the previous government of John Howard had given in principle support to the sale of uranium, the present government under Julia Gillard has so far not reversed the previous government's decision not to sell Uranium to India.

NPCIL has signed an agreement with Kazakhstan in 2009 for supply of uranium. India has also signed Uranium supply agreements with Namibia and Mongolia. The future of nuclear cooperation for India with various countries appears fairly optimistic.

Major Critiques of Nuclear Energy: Safety

One of the biggest opposition to nuclear energy is on the issue of safety. While nuclear energy reduces the extent of carbon emissions, it poses serious threats to the environment and human beings in case of an accident. The horrific accident of Chernobyl is a grim reminder of the danger. The former UN General Secretary Kofi Annan had said, "…….. the exact number of victims may never be known, but three million children require treatment and…. many will die prematurely…not until 2016, at the earliest, will be known the full number of those likely to develop serious medical conditions…because of delayed reactions to radiation exposure…".**9**

Let us examine the recent Japanese disaster at the Daichi Nuclear Plant. The Japanese media have reported that underlying the meltdown of reactors which forced the government to declare a "nuclear emergency situation" was the failure of diesel generators to supply power to an Emergency Core Cooling System of the nuclear reactor10. The generators stopped functioning after they were flooded by the tsunami. Commenting on the situation, a *Japan Times* editorial blamed the government for not implementing necessary safeguards and asked "why were the back-up diesel generators at 1F placed in a location where they would be vulnerable in the event of a tsunami, and why wasn't a policy of double-redundancy enforced in which a reliable back-up power-generation system existed for the back-up diesel generators?" The daily has urged the government to review its nuclear power generation policy and "ensure multiple redundancies in safety systems" in all the 54 power reactors in Japan11. Another editorial in the *Yomiuri Daily* opined: "Nuclear power generation has become the fundamental source of energy in this country. However, the

shock wave of the explosion may shake that position to its foundation." It went on to suggest that the Japanese government "must reinforce its system for preventing accidents at nuclear power plants. If the government makes mistakes in handling such accidents, the utilisation of nuclear power stations at home and abroad will be jeopardised."12

Public safety is an emotive issue in India since the ill-effects of Bhopal gas tragedy are still being felt by lakhs of victims. Even the Bhopal gas tragedy would pale into insignificance if a nuclear accident, akin to the Japanese incident happens in India. Its repercussions would have to be endured. This brings us to the moot question: Does this mean that we must not pursue nuclear energy at all? There is absolutely no doubt that the best practices in the world need to be observed in the nuclear plant construction as well as maintenance. All the safety norms must be adhered to diligently and people responsible for safety and maintenance must be held accountable. Let us analyse the recent Japanese experience. Amazingly, a 40-year-old power plant built to withstand a 7.9 magnitude earthquake on the Richter scale shut down automatically as designed when the earth began shaking. In fact, it stood up to an earthquake that released more than 40 times the amount of energy the plant was designed to survive.13 The tsunami wave that hit the plant is said to have measured at least seven metres in height, compared to the maximum 6.5 metres high wave the plant was designed to cope with.14 The twin effects of the earthquake as well as the tsunami seem to be responsible for the plants cooling generators to collapse. It is also a matter of surprise that the Japanese who have a well developed robotics technology do not seem to have incorporated robots in their reactor operations for just such an eventuality. The correct lesson to imbibe is not the simplistic and fatalistic one of abandoning nuclear energy but to build reactors capable of withstanding such pressures and to have redundancies built-in.

In this regard, the path set by Spain is revealing. The Spanish government has recently ratified a law removing a statutory 40 year limit on nuclear power plant operating life. Specifically, the nuclear energy amendment states that the government will determine nuclear energy's share in Spanish generation and also the lifetimes of existing nuclear plants based on a variety of considerations including regulatory requirements for nuclear safety and radiological protection as advised by the Spanish nuclear regulator, plus trends in demand, the development of new technologies, security of supply, costs of electricity production and greenhouse gas emissions.15 This serves to show that with technology the legitimate safety concerns can and have been addressed adequately in other parts of the world. There is no reason that India cannot use the same safe practices and technology, and if possible, even surpass those.

Economic Viability of Nuclear Energy

Another widely propagated idea is that nuclear energy in India would be more expensive than fossil fuel based electricity.**16** Although nuclear energy is not as cheap to harness as coal or oil, importing uranium will certainly make nuclear energy a viable long-term option since importing fuel from abroad would help in reducing costs. Both the opponents and proponents of nuclear power generally agree that nuclear power plants have a decisive advantage over coal-fired plants in the area of fuel costs, and this advantage should continue as long as uranium supplies remain abundant.17 Another important factor determining the economic viability of nuclear power, apart from capital costs, is the actual number of hours a nuclear power plant operates. With an assured supply of nuclear fuel, the plant utilisation will definitely go up and this will help in reducing overall costs. The excellent commercial performance of Nuclear Power Corporation, a triple A-rated company is testimony to the economic viability of nuclear energy.

Availability of Skilled Manpower

The positive aspect of decades of nuclear apartheid that India had to face since the time sanctions were imposed on India was that India was compelled to develop technology on her own. This in turn has resulted in a huge pool of trained manpower in India who are competent. In this connection the testimony of Seigfried S Hecker, former director of Los Alamos National Laboratory to the US Senate Committee on appropriations, Subcommittee on energy and water development on 28 April 2008 is noteworthy. He said, "I found that whereas sanctions slowed progress in nuclear energy, they made India self-sufficient and world leaders in fast reactor technology……".18

Radioactive Waste Management in India

Radioactive wastes from the nuclear reactors and reprocessing plants are treated and stored at each site. Waste immobilisation plants are in operation at Tarapur and Trombay and another is being constructed at Kalpakkam. Notwithstanding this, research on the final disposal of high-level and long-lived wastes in a geological repository is in progress at BARC. Disposal as a final step in the management of radioactive waste involves confinement or isolation of these wastes from biosphere in the repositories. Based on the longevity and concentration of the radionuclide present in the waste, the repository could be either near-surface or in deep geological formation. India has extensive and varied experience in the operation of near surface disposal facilities (NSDFs) in widely different geo-hydrological and climatological conditions. Over the years, considerable expertise has gone in refining and improving the design and construction of these NSDFs. A system of multiple barriers employed in these NSDFs ensures isolation and release of radio nuclides below permissible limits to the environment. This is ensured by regular monitoring and periodic performance assessment of NSDFs.19 Overall, the system is efficient and has stood the test of time and there is every reason to believe that India will continue to do so.

Conclusion

India needs to sustain its current high growth rate for several years to realise her long cherished dream of banishing hunger and poverty and finally becoming a 'developed' nation. In order to convert this dream into reality, affordable and uninterrupted energy is critical. Access to traditional global energy sources such as oil and gas will become increasingly difficult and expensive as time progresses. India has to adopt a holistic approach in energy generation and tap all sources, including nuclear, to bridge the huge gap between demand and supply. One hopeful possibility is that the Japanese crisis will spark the development and deployment of new and even safer nuclear power plants. India too has to quickly learn its lessons from Japan's failures and lay more emphasis on making its nuclear plants with such inbuilt mechanisms that can withstand even mega quakes and attendant fallouts.

***Colonel GG Pamidi** belongs to 5th Battalion, the Mechanised Infantry Regiment. Presently, he is a Senior Research Fellow at the Centre for Strategic Studies and Simulation, United Service Institution of India, New Delhi.

Journal of the United Service Institution of India, Vol. CXLI, No. 583, January-March 2011.