



NUCLEAR POWER IN INDIA

DR.R.VENKATAPATHY*; MS.D.ANBUGEETHA**

*Director,
BSMED, Bharathiar University, Coimbatore – 46.
**Senior Doctoral Scholar,
Bharathiar University, Coimbatore – 46.

ABSTRACT

With a growing economy, an increasing population, mounting energy demand, limited availability of conventional sources India is in the position to resort to unconventional methods of energy generation ranging from jatropha biodiesel to atomic power. But the Fukushima Daiichi disaster has brought back the nuclear energy debate in India. Environmentalists and non-governmental organisations (NGOs) alike have raised their concerns on India's nuclear path. This article gives an overview about the economics of nuclear power in India, addresses the environmental issues that has been raised regarding the construction of nuclear plants in the country and aims to emphasize the importance of nuclear energy in India's energy mix.

INTRODUCTION

Efficient, reliable and environmentally sustainable energy supplied to each household at the minimum possible cost is a dream of India's government. Successive governments of India are working to bring in energy security for India at the earliest. They are also planning and acting in the direction of achieving energy independence. Energy independence is now India's first and highest priority. To address this essential challenge, the base of the country's energy supply system has steadily shifted from non-renewable to renewable sources as well as towards development of nuclear energy sources.

India being a highly populated country ranks sixth in the world in terms of energy production. Though commercial primary energy consumption in India has grown by about 700 percent in the last four decades, India's present level of energy consumption, by world standards, remains very low (Eco world, 2011). Experts believe demand for energy will soon increase as India's economy continues to grow at an average of 8 percent per year. With a growing economy, an increasing

population, mounting energy demand, limited availability of conventional sources India is in the position to resort to unconventional methods of energy generation ranging from jatropha biodiesel to atomic power.

As of now, nuclear power is the fourth-largest source of electricity in India after thermal, hydroelectric and renewable sources of electricity. Currently, India has 20 nuclear reactors in operation in six nuclear power plants, generating 4,780 MW while seven other reactors are under construction (The Hindu Survey of Indian Industries, 2008).

India now plans to increase the contribution of nuclear power to overall electricity generation capacity from 2.8% to 9% within 25 years (The Hindu Survey of Indian Industries, 2008). As of now, India stands 9th in the world in terms of number of operational nuclear power reactors. Indigenous atomic reactors include TAPS-3, and -4, both of which are 540 MW reactor. India's US\$717 million fast breeder reactor project is expected to be operational by 2012-13.

The U.S.-India Civil Nuclear Agreement will allow India to carry out trade of nuclear fuel and technologies with other countries and significantly enhance its power generation capacity. When the agreement goes through, India is expected to generate an additional 25,000 MW of nuclear power by 2020, bringing total estimated nuclear power generation to 45,000 MW (NPCIL, 2011). On the other hand the Fukushima Daiichi disaster has brought back the nuclear energy debate in India. Environmentalists and non-governmental organisations (NGOs) alike have raised their concerns on India's nuclear path. This article gives an overview about the economics of nuclear power in India, addresses the environmental issues that has been raised regarding the construction of nuclear plants in the country and aims to emphasize the importance of nuclear energy in India's energy mix.

THE ECONOMICS OF NUCLEAR POWER IN INDIA

A country should choose an optimal mix between thermal, hydro, nuclear, renewable and non-conventional energy sources. Actually there is no standard prescription to choose this optimal mix, but it should be studied in detail specifically for each country as solutions differ for every country. Thus, India has to choose its own mix and proceed accordingly. Considering the projected demand for electricity in the medium and long terms in the country, it is essential to utilise all possible sources of energy.

At present, among available energy, apart from coal and hydro, nuclear energy is the only attractive alternative which can fill the increasing gap between demand and supply. It is necessary to develop nuclear power, independent of short term economic considerations, also for the following reasons,

- Long-term need to develop alternative energy systems;
- Utilisations of Uranium resources and large amounts of Thorium the country is endowed with.

- The necessity to diversify the energy resources for energy security and energy independence;
- Saturation effects that may throttle other technologies like constraints in transport and infrastructure;
- To limit green house gases such as carbon dioxide from thermal stations;
- To limit long term energy needs which cannot be met by the limited fossil resources which are also required for consumption in sectors other than the power industry;
- Keeping abreast with nuclear power technology among the developed and developing countries, especially in Asia;
- The nuclear power industry is almost totally indigenous for the entire nuclear fuel cycle. Thus, installation of nuclear power plants can give a fillip to other Indian industries.

In addition to these reasons it is important to note that countries which have larger resources of coal than India are also keen in developing nuclear power at a rapid pace. In the long run, nuclear option will be called upon to play an increasing role for enhancing the power generation in the country. Further the economics of nuclear power in India depends on the cost of electricity generated by a nuclear power plant in comparison with the cost of generation of electricity from thermal power plant.

The coal deposits in India are concentrated mostly in the eastern regions of the country. Hence setting up of a thermal power plant in other parts of India involves high transportation costs favouring the economics of nuclear power. However it can be argued that nuclear power is more capital intensive and requires a large amount of imported components. If one considers the total investment in a power plant, and all associated facilities such as fuel cycle facilities including coal mine development and investment needed to transport coal, the difference between the two options may not be significant at all.

Further, economists argue that analysis of total system cost is the best method to compare the thermal and nuclear plants as it includes the costs associated with environmental degradation due to coal-fired thermal power plants. Hence according to the total cost-benefit analysis experts in economics are of the opinion that nuclear plants are favourable to India. Energy experts also favour nuclear plants because they feel that the prices of oil in the international market are likely to build up. With the rise in the prices of oil, nuclear power will turn out to be cheaper than coal. Additionally it has to be understood that excessive dependence on coal for generation of electricity also makes the country dependent on labour who are engaged in the mining of coal and transportation of coal. Therefore, for the security of the electricity supply system, it is necessary to have diversity in the installed capacity and reduced dependence on the coal based production system.

RISING ENVIRONMENTAL ISSUES

Though nuclear power in India has been established as a safe, environment friendly and economically viable source of power generation, Fukushima Daiichi disaster has brought back the nuclear energy debate in India. Environmentalists and non-governmental organisations (NGOs) alike have raised their concerns on India's nuclear path.

Following the Fukushima disaster, many environmentalists are questioning the safety of nuclear plants. The proposed projects are under serious protests. The massive Jaitapur Nuclear Power Project is the focus of concern. The planned six-reactor nuclear power complex on the plains of Jaitapur, 420 km south of Mumbai, if built, would be one of the world's largest nuclear power complexes. Environmentalists, local farmers and fishermen have been protesting for months. Protestors say that 931 hectares of farmland will be needed to build the reactors. They argue that the land that is now home to 10,000 people, their mango orchards, cashew trees and rice fields. Fishermen in the region say their livelihoods will be wiped out.

Similarly, thousands of protesters and villagers living around the Russian-built Koodankulam nuclear plant in the southern Tamil Nadu province, are blocking highways and staging hunger strikes, preventing further construction work, and demanding its closure as they distrust federal government assurances regarding safety. They fear there will be a nuclear accident similar to the radiation leak in March at Japan's Fukushima nuclear disaster.

A Public Interest Litigation (PIL) has also been filed against the government's civil nuclear program at the apex Supreme Court. The PIL specifically asks for the staying of all proposed nuclear power plants till satisfactory safety measures and cost-benefit analyses are completed by independent agencies.

NECESSITY FOR NUCLEAR POWER IN INDIA

All these environmental and safety issues have raised the question whether India requires nuclear power? To answer this question a practical evaluation of some future scenarios is needed. India currently is the ne of the fastest growing economy in the world and the GoI plans to maintain this growth rate of 8 percent annually, for the next few years. The demand for electricity during this period will grow at a consistent rate annually. India therefore will have to diversify energy sources and the associated infrastructure development because even with tremendous progress since independence, India still ranks low in per capita electricity consumption in the world. In addition to this GoI wants to reduce the dependence on carbon and wants to increase the proportion of renewables in the energy mix. It is because dependence on fossil fuels will also place India at the mercy of international price fluctuations as almost 90 percent of the oil has to be imported. India has to increase the generation of electricity from water, air and solar energy as well. India is also doing good and is ranked as the third most favoured destination as far as investment in the renewable energy sector is concerned. Renewables are an important source of energy for India and without doubt the magnitude will increase, but it will be some decades before its full potential can be exploited in form of commercial viability. Considering the above explained scenarios, the nuclear energy option stands out as an important component in India's energy mix. It will surely improve the self dependency of the country while proving to be a

major source of energy security. The Indo-U.S. Nuclear Deal has provided a valuable opening for India to trade internationally. India has 30 percent of known thorium deposits in the world. India will be a major beneficiary if Prototype Fast Breeder Reactor (PFBR) technology turns out to be successful and widespread. It is because PFBR is capable of running on thorium fuel cycle. Another advantage of the thorium based fuel cycle is production of less plutonium and other transuranic waste as well. Reversal of the nuclear program at this critical juncture when new discoveries are unfolding is disadvantageous to the development of the country. In addition to this, improved designs and safety measures have made nuclear energy safer. It can be understood by the fact that of the four hundred and forty-one total plants in operation worldwide, only three accidents have occurred so far, namely, the Three Mile Island (1979), The Chernobyl (1986) and the most recent Fukushima (2011). This is a relatively good record for such industry. The underlining argument is that all forms of energy have to be developed and used by India, including nuclear.

CONCLUSION

To attain energy security it becomes important to resort to nuclear energy. Further the protestors have to note that other Asian-Pacific countries pursue their nuclear energy programs without being discouraged by the Fukushima incident. India's need for energy security has made the nuclear option a very attractive one. Since renewable source of energy will take a few more years to become commercially feasible, dependence on fossil fuel will increase so as to satisfy the need of India's developing economy. Considering India's present and future rise, nuclear energy does become an important aspect in India's need for energy security. Besides improved designs and safety measures have made nuclear energy safer.

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