RESEARCH PAPER | Political Science | Volume : 3 | Issue : 4 | April 2013 | ISSN - 2249-555X

Nuclear Energy: Will India be Able to Achieve Targets?

KEYWORDS: Electricity, Nuclear Energy, Energy Security.

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ABSTRACT *The electricity has emerged as important input for industrial development and for raising the standard of living of masses. In India,gap between demand and supply of electricity is growing.With the fast depletion of fossil fuels, the nuclear energy has emerged as a promising source of electric power that can play a very crucial role in ensuring energy security. This paper examines the nuclear energy scenario and discusses the past targets and achievements of nuclear energy generation in the country along with the targets being set for future. The paper analyses whether these targets are possible to be achieved, as the country has to confront changing political, economic, social circumstances and compulsions at domestic level while also dealing with the changes taking place at international level. India has to work on many fronts to realize the goal of energy security.*

Energy is an essential input for the sustained growth in development. With ascendant economy, a shift from the use of non-commercial energy sources to commercial energy sources, particularly electricity has resulted in surging demand outstripping the supply(Bucher, 2009). "The technology led growth has created a large demand for energy and as a result all nations are exploring every source of energy to ensure that they are able to meet growing energy requirements to spur economic growth and thereby further improve quality of life of their citizens" (Grover, 2009, p. 14). Every single step taken by country for progress comes with a more aggressive demand for energy. For economy to grow at faster pace and ensuring development for all energy is needed on continual and sustainable basis. Energy security ensures fulfilment of the country's energy needs and is closely linked to economic opportunity, empowerment, and security- both internal and external, apart from it, consumption and production of energy worldwide play a major role in several sustainability issues such as climate change, depletion of resources, and indoor and local air pollution (Reddy and Nathan, 2011). It is the dimension where energy security becomes inevitable and the most pressing challenge. Therefore, in the current scenario energy security is of paramount importance for not only national economic growth and development but also for national and global stability.

Energy Gap in India and case for nuclear energy

"Energy Independence has to be our nation's highest priority. Our target is to achieve Energy Security by 2020 leading to Energy Independence by 2030 and beyond" (Kalam, 2006, p. 2).As the economy grows, the energy sector of the country is also undergoing a massive revamp from policy changes to investment pattern and restructuring the preference for sources of power. The energy resources available in India are limited. In the coming decades, India has to face a challenge of a wide gap between its required level of energy supplies and the likely level of availability of energy supplies from both traditional fossil fuels and new renewable sources such as solar and wind (Report on US-India Dialogue on Energy Security, 2010). India is the sixth largest electricity producer in the world, but on per capita energy consumption basis India is ranked very low when compared with many developing countries. The electricity generated during the year 2000-2001 was about 500,000 million units. In absolute terms, this is a large figure, but when looked at on a per capita basis, this is far below the world average (The Indian Science Academy, 2001). Table 1 below clearly shows that India's installed generating capacity on per capita basis is just one third of the world average and OECD countries with per capita capacity of ~8000 kWhr per annum have more than eleven times higher than the India has. Similarly, in terms of per capita electricity availability India is far behind Canada, Italy, China and the USA. Thus, India has to take long strides on both counts to achieve its target of ensuring energy for all.

Table 1-Per Capita Electricity Generating Capacity and Availability

Per Capita Electricity Generating Capacity in kWh				Per capita Power Availability in kWh				
Location	India	World	OECD Countries	India	Canada	USA	Italy	China
Per capita capacity	~700	~2500	~8000	631	17179	1338	5644	1300

Source: Grover (2009) &Sethi (2010)

The quality and quantity of electricity has profound effect of living standards of people and overall economic development of the country. As Sethi (2010) argues, "India is severely energy deficient—more than half its rural households are resigned to darkness after sundown; cities suffer long and frequent power cuts. This has both a direct and indirect impact not only on the quality of life, but also on the overall economic growth potential and the national development index" (p. 223).

In this scenario, where in India the domestic deficit on fuel sources exists, the role of nuclear energy for ensuring energy security turns out to be promising on the grounds of both clean energy and cost benefit terms also. Nuclear power can significantly supplement electricity availability and hence ease the heavy dependence on fast depleting hydrocarbons. In France 80 %and in Japan 30 % of electricity is produced from nuclear energy. Japan had been able to reduce its oil imports remarkably to 56 per cent by the 1990s from the high level of 80 per cent during the 1970s. Japan has no domestically available sources of uranium (Sethi, 2010).Out of the to-

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tal installed electricity capacity of 168945 MW as on Dec 31, 2010, the nuclear energy had share of just 4560 MW (2.70 %). In India a half of power needs are satisfied by the electricity generated from coal fuel used in thermal power plants while hydro energy adds 37367 MW i.e. close to 22 per cent rest being contributed by gas and renewable sources (Ministry of New and Renewable Energy, 2011).

Nuclear Energy in India

The use of nuclear power as a source to generate electricity began in 1950s and in next ten years there were about 17 nuclear power reactors in operation in four countries namely France, the USSR, the UK and USA, which were generating around 12,000 MWe. The oil price crisis of the 1970s provided the much-needed boost to the nuclear power industry because after this incident industrialised countries started assigning a bigger role to nuclear energy. The expansion of nuclear energy generating capacity also brought with it the concerns of safety of nuclear power plants especially in the aftermath of Chernobyl disaster and disposal of nuclear waste. Due to the sudden proliferation of nuclear plants with inadequate safety measures, environmentalists and the anti-nuclear energy activists around the globe started rallying against nuclear energy because of the perils associated with it (Dadwal,1999).

In India, electricity production from nuclear power started in 1970s. The growth rate of nuclear energy supply was 7.95 per cent between 1970-80 that went down to 4.86 per cent in the following decade and rising upto 11.10 per cent in the decade of 1990-2000. Due to decline of uranium imports growth rate of nuclear supply plummeted to minus of 9.18, which made it clear that government's target of 19.13 per cent of growth rate domestic nuclear supply was not feasible (Government of India, 2008). The government launched a programme to establish 10,000 MWe of nuclear power by 2000, but lack of budgetary support, as well as lack of access to foreign sources of finance due to the US sanctions resulted in the non-achievement of target, despite a fairly good performance by the plants, which have completed about 140 reactor years of operation (Dadwal, 1999).

Table 3-Targets and Actual Generation of Nuclear Energy in Different Plan Periods

Five Year Plans	Targets of Nuclear Energy Generation in MW	Achievements of Nuclear Energy Generation in MW
VIII Plan	1100	400
IX Plan	880	880
X Plan	1300	1080
XI Plan	3380	3380*
XII Plan	11000#	-

Source: * Target to be achieved by the end of Eleventh Plan, # Target set for Twelfth Plan Adopted from Ninth and Eleventh Five Year Plans, Planning Commission of India.

India's achievement of nuclear energy generation against the targets set in different Five Year Plans have not been very encouraging as the table 3 above shows that against the target of 1100 MW in the Eight Five Year Plan country could generate only 400 MW which was just around 36 per cent of the target. Likewise, in the Tenth Plan India succeeded in generating 83 per cent i.e.1080 MW against the target of 1300 MW. However, India achieved full target in the Ninth Plan and according to Planning Commission, the target of the Eleventh Plan is likely to be achieved. Despite the fact that India has not achieved any significant success in nuclear energy targets, still very ambitious targets have been set for future. These targets seems difficult to be achieved keeping in view that till June 30, 2012 India has been successful to generate 4391 MW against the target of 7280 MW by 2012 (IAEA, 2012).

Obstacles to achievement of nuclear energy generation targets

India has always faceddifficulty in achieving the targets related to nuclear energy owing to various reasons. There are myriad of factors that would put hindrances in the way of achieving nuclear energy targets and by implications makes it difficult for India to realise its goal of ensuring energy for all and at the same time throwing in danger the plan of securing energy security. These factors operate at home front and are connected to international political, economic and diplomatic changes that will not only jeopardize India's energy security concerns.Following are the factors that will not let India to see its dreams come true about targeted generation of electricity from nuclear power.

1. NSG Restrictions on Nuclear Trade with non-NPT Countries and Uranium Supply Constraints-India's nuclear programme has always been under technological denials for decades from many countries (Kalam 2006, p. 4). Its power reactors in the mid-1990s had some of the world's lowest capacity factors, reflecting the technical difficulties of the country's isolation. However, capacity factors rose impressively from 60% in 1995 to 85% in 2001-02. Then in 2008-10, the load factors dropped due to shortage of uranium fuel (World Nuclear Association 2012, para. 8). The major reason for limited capacity in atomic energy has been the lack of availability of domestic uranium coupled with export restrictions imposed by the NSG. This scenario severely confines our capability to achieve desired targets from the first phase of our nuclear programme (Government of India, 2011). Already developing countries are facing daunting challenge of how to secure energy supplies and conflicting stand adopted by countries like Iran and North Korea may result in international nuclear trade turning more difficult for non-NPT counties like India.
2. Impact of Indian Defence Purchases-In January 2012, India decided to purchase advanced combat aircraft. Six companies including American F-16 and F-18, Russian MiG 35, Swedish Saab Gripen along with Euro fighter and Dassault Rafale were in the race in the beginning, butIndia decided to buy 126 French-made Rafale combat aircraft ("France's Dassault Rafale wins", 2012). It has important political implications for India as it may lead to losing opportunity to build a strategic partnership particularly in nuclear energy area. The reason behind Rafale decision may be that India does not want to become dependent on one particularly country for defence purchases.
3. Weak Indian Diplomacy- In a world of increasing interdependence, energy security will depend on how countries manage their relations with one another. Therefore, energy security will be the biggest challenge for Indian foreign policy in the coming times (Nachane, 2011). It is the clear sign of weak Indian diplomacy that the NSG issued fresh guidelines putting restrictions on nuclear trade with non-NPT countries thereby contravening the provisions of Indo-US Civil Nuclear Deal (Hussain, 2011). The lesson from the Bhopal disaster in 1984 has led India to the passage of a Nuclear Accident Liability Law. However, India could not convince the USA about the political necessity of enacting this Act. This issue perturbs more the United States than the other two nuclear suppliers i.e. Russia and France as the American suppliers were waiting anxiously to partake of the highly lucrative Indian nuclear market.The U.S. State department showed concern that this law may endanger the nuclear trade between two countries ("Liability law endangers US-Indian nuclear trade", 2012).They feel discouraged to invest in India as the law places the responsibility for paying compensation in case of a nuclear accident on both the operator and the supplier. Considering difficulty of passing of Indo-US Nuclear deal, it cannot be ruled out that in future nuclear deals with other countries will not have to undergo more aggressive protests from regional political

Volume : 3 | Issue : 4 | April 2013 | ISSN - 2249-555X

parties having considerable strength in the Parliament in general and Left Parties in particular (Report on US-India Dialogue on Energy Security 2010).

4. Safety Concerns on the Backdrop of Fukushima Accident-Even as the nuclear industry, nuclear operators associations, international nuclear safety organisation and nuclear regulatory bodies derive technical and operational lessons from the Fukushima disaster and apply them to enhance safety at all levels-site selection, design, construction, operation, emergency preparedness, etc. The immediate requirement is for reaching out to the public to restore its confidence in the safety of the nuclear power. The large-scale protests at Jaitapur in Maharashtra and later on at Kudankulam in Tamil Nadu indicate that the public opinion is swinging in favour of abandoning nuclear energy, though the need of the hour is to maintain a balanced approach by undertaking a calculated analysis of the risks and benefits involved and to distil and assimilate the right lessons from Fukushima (Laxman, 2011).
5. Acquisition of land for new nuclear plants and environmental concerns- The problems related to acquisition of land for setting up nuclear power plants cannot besolved without addressing socio-economic concerns of the farmers whose land in most cases is only source of livelihood. The farmers receive compensation far less than the prevailing market prices of land and they are mal-treated and threatened. The Centre and the State Governments do not take adequate measures for their settlement and rehabilitation. The forced confinement of villages in Sangrur in Punjab and continued protests at Kudankulam site in Tamil Nadu are the pointers. The most pressing challenge before the nuclear industry and national nuclear establishments is to arrest the mood of public opinion. Public should be properly educated about the high cost and carbon emissions (30 billion tonnes of CO2) related with use of fossil fuels and also their fast depleting reserves globally along with that country's development requirements. The IPCC estimates that 26 % of the emissions (about 7.6 billion tonnes) is a direct consequence of electricity generation requirements and pollution and the climate change directly or indirectly cause 481,000 deaths every year (Kalam& Singh 2011).
6. Problem of funding for Nuclear Technology and cost of high grade Uranium- India has limited Uranium reserves. Indian Uranium is of low-grade quality that generates very less amount of atomic energy than the high grade Uranium that is found in countries like Canada. The development of the nuclear programme beyond 10,000 MWe necessitates the increasing dependence on Uranium imports and it implies ever-increasing cost of importing high grade Uranium. India's uranium resources are modest, with 73,000 tonnes U as Reasonably Assured Resources (RAR) and 33,000 tonnes as inferred resources in situ (to $130/kgU) at January 2009. The DAE in May 2011 claimed 139,800 U (World Nuclear Association, 2012). Spending in India is very low on Research and Development. The Eleventh Plan states that India spends just around Rs 200–250 crore per annum on R&D efforts in the hydrocarbon sector against the annual turnover of Rs 4 lakh crore. This amount is substantially lower when compared with developed countries where it is 1% of industry turnover (Planning Commission, 2002-07, p. 1110). High cost of developing and importing nuclear technology coupled with restrictions on nuclear trade make nuclear electricity even costlier than the electricity generated from coal. The cost of nuclear electricity can only be reduced by decreasing the costof building the nuclear power plants (Jayaraman, 2013).

Conclusion

Above-mentioned factors should not be ignored while calculating the targets and associating hopes with their achievement. In the light of these factors it seems impractical for India to generate 11000 MW of nuclear power by the end of XIIth Five Year Plan and rather impossible to add nuclear energy capacity 20000 MW by 2020. The Government can take required steps to ameliorate the expected adverse effects of Nuclear Liability Act on nuclear technology and equipments industry suppliers' willingness to participate in projects. The Government should allow the entry of private investors into this area not only in setting up of power plants but also for enhancing advance research in fission technologies. India has to work on aggressive diplomacy if it wants to secure nuclear fuel to run its installed power plants as also importing advance nuclear technology and related equipments. All out efforts are needed to realize the goal of energy security.

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