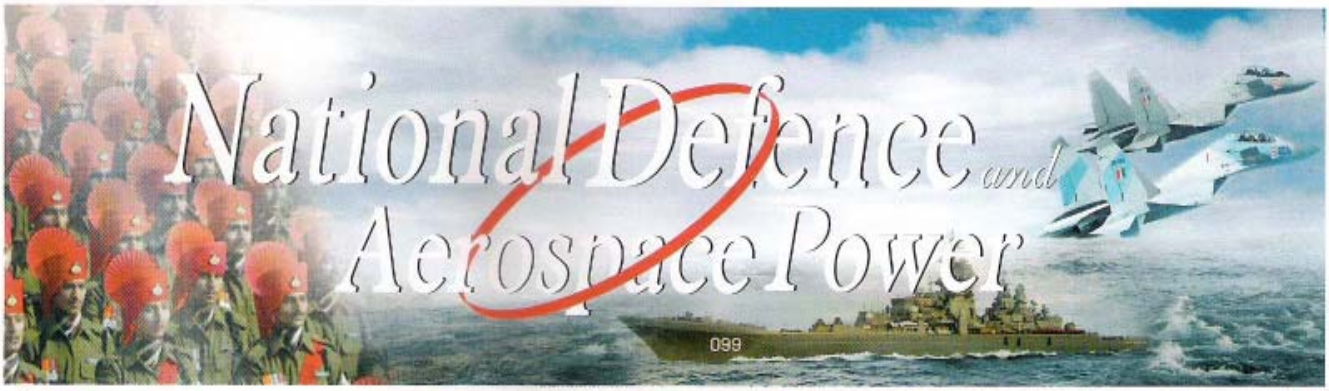

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THE FRENCH NUCLEAR ENERGY EXPERIENCE: DRAWING LESSONS FOR INDIA

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On November 26, 2010, the twentieth nuclear power plant of India, an indigenously built 220 MWe pressurized heavy water reactor (PHWR) and Unit 4 of Kaiga Atomic Power Station attained criticality. Two days later, the Ministry of Environment and Forests granted permission to the Nuclear Power Corporation of India Ltd. (NPCIL) to set up the nuclear park at Jaitapur in Maharashtra. Almost a week later, during the visit of President Sarkozy to India, the French nuclear company AREVA and the Indian Nuclear Power Corporation of India Ltd concluded the agreement for the construction of two French designed nuclear reactors at the Jaitapur site.

Ever since the conclusion of the various formalities on India's entry into international nuclear commerce, the country's power progrmame has been abuzz with activity. As the pace and momentum of the programme picks up, it is imperative that adequate thought be devoted to the contribution envisaged from nuclear power in the national energy mix over the next few decades.

It is in this context that this issue brief examines the nuclear power programme of a country – France – that today gets nearly 80% of its electricity from nuclear energy. France has 59 operational nuclear power plants that have a total capacity of 63 GWe that cater for the bulk of the electricity needs of the country. The pursuit of a resolute and consistent energy policy has enabled France to emerge as a leader in nuclear electricity production. It has not only managed to satisfy its domestic electricity needs but also exports nuclear energy. Besides, with an overall expertise of the entire nuclear fuel cycle, France is well placed to exploit the possibility of a global nuclear renaissance.

Of course, the growth of the nuclear sector in France has not been without its challenges and share of criticism. As opined by a scholar, "France has demonstrated that nations can successfully address their energy vulnerabilities, but its example also demonstrates that no energy option will be the cheapest, cleanest, and safest".[1] Aspersions have been cast on the economics of nuclear power and its claims at being environmentally friendly. Several have even questioned the manner in which the programme has been pursued without any meaningful public scrutiny. Both, for its successes and criticisms, the French nuclear energy experience holds several lessons for nuclear power programmes elsewhere. This paper derives some of them for India.

Lessons for India

Perhaps the most important lesson to be drawn from the French nuclear energy experience pertains to the importance of energy security for a nation. The oil shock in the early 1970s awakened France to its energy vulnerability owing to the large scale dependence on fuel imports. The government was then jolted into finding ways of securing energy independence and turned to nuclear power. For India, a country that faces a huge energy deficit and low domestic availability of fuel, but which has nearly 300 reactor years of operating experience in nuclear power, the option of nuclear electricity is particularly relevant. While nuclear power cannot be expected to completely bridge the energy shortfall, it can make a substantive contribution towards overall energy production and do so in an environmentally sustainable manner. Energy security is essential for overall national security and India cannot afford to be lax on this front. It must learn the pitfalls of energy vulnerability from the French experience of the 1970s and build adequate safeguards for itself.

Second, it is almost ironical that France, which turned to nuclear energy as a solution for securing its energy independence after the experience of the oil crisis that had exposed its energy vulnerabilities, has today nearly 80% dependency on nuclear energy. With such a high level of dependence on only one energy

source, the country seems to have fallen into the same trap once again. This makes it overly vulnerable to the shutdown of reactors since the loss of generation from one or more high capacity reactors threatens major loss of energy production. For instance, in the summer of 2009, an unprecedented heat wave, a strike by power workers, and ongoing repairs at some units put a third of French nuclear power stations out of action, and the country was forced to import electricity from the UK.[2] The lesson here for India is that it must develop as diversified an energy mix as it can. Given the huge energy demand of the rapidly developing nation, the country cannot afford the luxury of depending on only one source of energy. It needs to tap every fuel including placing a heavy emphasis on energy efficiency and conservation. Only then can the country assure itself of true energy security.

Third, quite like the case in India, nuclear decision-making in France has largely been conducted without any major public scrutiny. While on the one hand this has allowed a greater degree of constancy in French nuclear policy, it has also led to allegations of nuclear power being made viable in the country only through government subsidies. As the Indian nuclear programme undertakes rapid expansion, it must open itself to greater amount of transparency so that it can operate in a more democratic/transparent fashion to avert potential allegations of commercial non-viability. This is important for reinforcing public support for the nuclear programme. To its credit, it must be mentioned that the annual reports of the Nuclear Power Corporation of India Ltd (NPCIL) are in the public domain.

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The fourth lesson to be derived from the French experience is the need for high public support for the nuclear programme so that it acquires the character of a national venture. Only then can issues such as land acquisition, environment impact assessments which have the potential to become contentious be carried out smoothly. In France, for instance, through the period 1970s-90s, the nation perceived its nuclear programme as symbol of national pride and contributor to energy independence. The French were able to bring about this mindset not only by the safe, consistent and cheap production of nuclear electricity but also through a conscious and well planned education campaign that included encouraging the common man to visit nuclear plants and related industrial facilities. This helped alleviate public fears about nuclear power and reduced the distance between 'high technology' and common man. In order to address the somewhat reduced support for nuclear power in recent times, particularly over the issue of long term radioactive waste management, it has been recommended that the government should launch a "national programme for energy education" at the school level as well as "to open again to the public nearby power plants and industrial facilities."[3]

In India, the nuclear establishment and decision making has been largely removed from the general public. Taking a leaf out of the French experience it would be worthwhile for the government to encourage conducted tours of nuclear stations for school and college students, the general public and most importantly for the media, which can prove to be a powerful tool for educating and influencing public opinion on the relevance and importance of nuclear power in India's energy scenario.

Fifth, there is no escaping the fact that governments that desire a high nuclear contribution to national electricity supply must themselves provide clear and sustained policy support and an appropriate environment to nuclear industry for investment through an effective framework for insurance and liability and the establishment of an efficient and effective regulatory system. It hardly needs to be said that investments in the nuclear domain require huge sunk costs several years before starting a plant, and hence the utilities need to be secure about the long term policies of the government, including the sensitivity of the regulatory mechanisms to ease the processes of licensing etc. While strict and fair regulatory processes are important, lengthy procedures do increase capital costs of the plant by delaying the start of operations and increasing the interest charges on investment loans. Inordinate procedural delays imposed by interest groups through public interest litigation can reduce the investment prospects for nuclear plants. As the nuclear activity and infrastructure expands in the country, anti-nuclear groups who enjoy a fair amount of freedom in the democratic system can play upon an active media and judiciary to sway public perceptions on nuclear power.

In order to avoid such pitfalls, it is necessary to provide opportunities for involvement of experts (not just from the government) in the decision making process so that different perspectives and apprehensions get a fair airing. This would help build public support for nuclear power in

the long run. Therefore, the role of the government is absolutely critical. It needs to work with transparency, fairness and strictly by the rules of the game. In contemporary times, when the media maintains a close watch over the government, nuclear policy will not be the domain of only the government. Public perceptions about risks to public health and environment will have to be accounted for and the government would be well advised to launch public awareness campaigns to undertake perception management. Efforts must be made to disseminate facts on the Indian energy situation in general, its linkages with economic and social development, and the specific advantages of nuclear energy in the Indian energy mix. The existential risks in the nuclear sector must be addressed by explaining how the government and the nuclear industry seek to mitigate them.

Sixth, the government certainly has a role in ensuring the safety of the entire nuclear chain from uranium mining to management of radioactive waste. The ability of the French nuclear programme to avoid any major mishap generated continued support for itself from the government and the public. In India, until now, the government has managed the entire nuclear programme, including operation of nuclear power plants. With the entry of private players envisaged in the future, adequate terms of reference will have to be drawn for optimum public – private partnership with an apt level of investment risk being borne by private sector investors. Therefore, efficient and responsive nuclear governance will be critical for an expanding nuclear programme in India. The country must demand and the nuclear industry must provide the highest standards of nuclear safety in case the promise of large scale generation of nuclear electricity is to be realized.

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Seventh, France gained immensely from its decision to standardize its nuclear units. This resulted in a substantive reduction of construction time, increased efficiency of plant management and easy rectification of faults if detected in any unit. The monopolistic situation in France with one utility, one vendor of nuclear steam supply system, and of turbine generators led to better organization of work across many plants and facilitated easy transmission of lessons learnt. This is not an advantage that the Indian nuclear programme can enjoy given that it has reactors of different capacities, even if a majority of them are PHWRs. In fact, given that the Indian nuclear power programme is envisaged along the three phase route, different type of reactors – technology and fuel composition – is in nay case a reality for the nation.

In the future, as the country imports from many suppliers, no standardization, at least of the kind that the French have, would be possible. Rather, working with different partners who may have different approaches to business, different specifications and differing licensing requirements will bring its own difficulties. A multiplicity of players, architects, designs, and vendors will also lead to greater challenges for procurement of spares and maintenance and also result in poor assimilation of lessons from one plant or experience to another. The country will have to cope with this situation. However, some limited benefit of standardization can be achieved if India builds 700 MWe PHWRs as part of its indigenous programme, as has been planned. Also, given that large parks are envisaged for each imported technology, it might be worthwhile considering the desirability of establishing separate organizations to deal with individual technologies of which there would be a large number of identical units per site. Such a strategy could lead to reaping the benefits of standardization at the micro level while gaining from the redundancy provided by non-dependence on one source at the macro level.

Eighth, investment in nuclear R&D is imperative independent of the ongoing construction and operation of nuclear plants. Despite the successful running of its nuclear stations, the French nuclear industry never gave up the focus on R&D in all domains of nuclear activity including in pure sciences such as nuclear physics, materials, chemistry etc as also in the engineering processes involving use of heavy equipment, hot labs and sophisticated measuring devices, safe reprocessing and waste management etc. For India, this aspect is of particular significance. At the time of the negotiations over the Indo-US civilian nuclear cooperation agreement, several had opined that with the availability of imported reactors, the Indian nuclear establishment might lose its momentum on indigenous R&D. This, however, cannot be afforded and must not be allowed to happen. If India is to graduate to the third stage of the thorium cycle, then the necessary budgetary and human resource investment in relevant R & D cannot be allowed to be diluted.

Ninth, consistent availability of skilled and trained manpower is essential for the nuclear sector. As generations of technicians, engineers and researchers retire, replacements have to be systematically planned to

preserve the knowledge base. In the case of the French nuclear industry, a recent report cautions, "The management, maintenance and development of skills of all employees of the French nuclear industry are critical to meet the challenges and ambitions of France in the nuclear field. The efforts made by the French education system are not yet up to the challenge. This statement refers both to the number of people trained and the range of courses covered." This is equally true for India. As the country embarks on a rapid expansion of its nuclear power programme, more skilled and trained manpower will be needed at every level. Given the specialized nature of this industry, the pool of skilled workmen can only be built over a period of time and through a conscious effort in that direction. Hence there is a case for a coordinated action plan that involves all stakeholders – the government, industry and the education system — to meet this challenge.

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Tenth, an effort is required to deal with the problem of nuclear waste. France confronted this problem after twenty years of large-scale energy generation. But, it has become an issue important enough to cause concern and a dip in public support for nuclear power. If India is to avoid this, serious thinking on the selection of site and construction of geological repository to house high level, long term waste must begin now in order to reassure the public on this important matter. And public support will depend upon transparency and education in this field.

Lastly, it needs to be said that every nation has to address its energy vulnerabilities by finding its own answers and optimal trade-offs. While coal is cheap and easy to use, it is environmentally the most unfriendly; solar and wind are expensive and intermittent but clean; nuclear power is capable of large scale use, relatively cheap and carbon-free but waste management as also proliferation risks have to be taken into account. A coherent energy policy must take all these aspects into the picture to craft a holistic approach towards assuring energy security.

For India, which requires nothing less than an energy revolution to meet the projected electricity demand in the next couple of decades, there is a strong case for careful planning in the determination of the future energy mix. A continued demographic growth, rising aspirations of a young and demanding populace, lack of indigenous fuel resources, mounting proof of climate change requiring GHG reductions are challenges that call for a long-term vision and commitment. Five decades ago Homi Bhabha had stated "No power is costlier than no power". This is more true today than ever before since an electricity shortfall that hamstrings the economic growth and development of the country would indeed prove to be extremely costly — not just in economic but also in social developmental goals. Energy security therefore must be ensured through intelligent understanding of similar exercises elsewhere and their wise adaptation to suit the distinct requirements of this nation.

Notes

1 Kurt Zenz House, "In Praise and Fear of France's Energy Policy", *Bulletin of Atomic Scientists*, 29 July 2008.

2 Robin Pagnamenta, "France Imports UK Electricity as Plants Shut", *Times Online*, 3 July 2009.

3 Roussely Report, as translated by Nuclear Engineering International,available at http:www.neimagazine.com, downloaded on 4 Aug 2010, p. 11.

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