‘Civil’ nuclear programme – serving the dual objectives of retaining the state’s hegemony on citizens’ basic energy needs and assuring supply of weapon grade ingredients: a case study on India

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Abstract: Political leaders of ambitious emerging economies of India and China, where the state has not yet reached the maturity stage, prefer nuclear power to other alternative energy sources, as it serves the dual purpose of retaining the state’s hegemony on citizens’ basic energy needs and assures supply of weapon grade ingredients. In contrast to North America and most of Western Europe, where growth of nuclear power has levelled out for many years, the ‘greatest growth in nuclear generation’ in the near future is expected in China, Japan, South Korea and India.

It would be naïve to believe that the political establishments are not aware of the negative consequences of nuclear power. The question may then arise as to why have the emerging economies of India, China, Brazil, etc., aligned themselves with the nuclear establishment without fully exploiting other alternative energy sources? Taking India as a case, this paper analyses secondary data and findings of various previous studies to explore an answer to this question.

Keywords: climate change; energy policy; state hegemony; Non-proliferation Treaty; NPT; political economy; nuclear weapon; renewable energy; fossil fuel; nuclear power; India.

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1 Part I

In July, 2008, the Lower House of the Indian Parliament, for the first time in its long history, had debated on an issue which, among others, was also linked to energy supplies. Though there is no dearth of experts in the country on 'poverty' alleviation strategies, Indians usually do not show much enthusiasm in any debate on 'energy'. Politicians in general and development economists in particular have failed miserably to highlight the links between 'poverty and lack of energy supply'. However, an analysis of the last few weeks' political events would indicate to a growing sense of urgency among the leaders of the ruling coalition to ensure supply of nuclear energy, for the development of the country.[1] A section of the mainstream media – both electronic and print, have praised very highly of the Prime Minister of India for taking the 'risk' of seeking a 'confidence vote' in the Parliament, which he owned on July 22, 2008 amid allegation of resorting to all unfair means to 'buy votes'.

It is an irony that during the debate on 'confidence vote', most of the Members preferred to discuss various issues (from bribery to poetry) except energy. No one has spoken of the need for a comprehensive long term energy policy which the country has failed to develop even after six decades of independence[2]. This lack of proper energy policy has prompted the government to take short term initiatives at different periods to address the energy needs of the elite groups – mainly the upper and middle class citizens. This recent euphoria about nuclear energy is a case in point.

The World Watch Institute, in one of their latest reports has informed that the future prospect of nuclear power is 'uncertain' (Chandrashekhar, 2008). According to the figures released (in June 2008) by the World Nuclear Association[3], in 2007 the global production of nuclear energy declined to 2,608 TWh from 2,658 TWh in 2006 (The actual figure after summing up the country-wise figure adds up to 2,661.3 TWh in 2006. Please refer to the Appendix for details). Compared to this, in this period, the growth of wind and other renewable form of energy across the globe was much higher. But defying all economic logic, the government of India has preferred to patronise the former. The figures in Table 1 highlight the priority the government has accorded to different forms of energy during last one and half decades. Between 1990 and 2005, the share of nuclear energy in the total primary energy supply (TPES) has gone up while the shares of the renewable energy sources have declined. In contrast, the global trends in the growth of renewable and nuclear energy were just the opposite.

On March 2, 2006, India and USA had entered into a civilian nuclear deal (commonly known as '123 nuclear agreement') where India promised to separate its civilian and military installations in return for uninterrupted supply of uranium and access to advanced nuclear technology. Though US law prohibits any nuclear cooperation between USA and India as the latter has not signed the Non-proliferation Treaty (NPT), the present agreement grants a 'waiver' from that law to enable the US firms to participate in the massive nuclear programme of India (Iyenger, 2008). It is claimed that in the long run, the said agreement would help the country to fuel its growing energy needs (*The Businesses Standard*, 2006).

Table 1 Energy sources (India)

Total primary energy supply (Mt. of oil equiv.)		*Share of TPES*											
		Fossil fuels						*Renewable energy*				*Other*	
		Coal (%)		*Oil (%)*		*Natural gas (%)*		*Hydro, solar, wind and geo-thermal (%)*		*Biomass and waste (%)*		*Nuclear (%)*	
1990	2005	1990	2005	1990	2005	1990	2005	1990	2005	1990	2005	1990	2005
319.9	537.3	33.2	38.7	19.6	23.9	3.1	5.4	1.9	1.7	41.7	29.4	0.5	0.8

Source: UNDP, Human Development Report (HDR) (2007/2008)

1.1 Shift of the epicenter

The epicenter of nuclear power has shifted in recent past to East and South-East Asia. In January 2006, USA along with Australia and Japan has formed the Asia Pacific Partnership on Clean Development and Climate (APPCDC). APPCDC is an agreement between six Asia – Pacific nations namely Australia, Japan, China, India, South Korea and USA. The spoke person of APPCDC, after its first meeting at Sidney in January 2006, commented: "You have to accept that nuclear power plants, civil nuclear power plants are greenhouse friendly" (CAN-Talk, 2006). And after attending the meeting, the Indian Environment Minister suggested that "nuclear power should be used in India to promote our emission reduction" (ibid). It has been reported that in contrast to North America and major parts of Western Europe, where growth of nuclear power have levelled out for many years, the 'greatest growth in nuclear generation' in near future is expected in China, Japan, South Korea and India (World Nuclear Association, 2007).

Various reports suggest that India could import up to 40 nuclear reactors in the next decade. As per the estimates of the US-India Business Council, India might spend up to $175 billion to expand its nuclear sector in the next twenty five years. According to a October 2008 reports, in the next five years, India would construct 21 nuclear power facilities, including six French reactors (1,600 MW each), four Russian reactors (1,000 MW each), and four US reactors (1,500 MW each). In February 2009, the Nuclear Power Corporation of India Limited (NPCIL) and the Areva (a French company) concluded an agreement for the supply of two European Pressurised Reactors (EPR) of 1650MW each.[4] Mainland China has 12 nuclear power reactors in operation, 24 under construction, and more about to start construction soon. Additional reactors are planned, including some of the world's most advanced, to give more than a tenfold increase in nuclear capacity to 80 GWe by 2020, 200 GWe by 2030, and 400 GWe by 2050 (World Nuclear Association, 2010).

Resistance against nuclear power in the developed western countries, especially after the Chernobyl nuclear disaster in 1986, did not allow nuclear lobby to regain its lost position. Research findings released by different competent authorities like UK's Sustainable Development Commission (SDC) have established that nuclear power is a problem, not a solution to global warming. SDC gave a unanimous 'no' to the question, "is nuclear the answer to tackling climate change or energy security?". Their reasons, among others, included 'long-term waste, cost, inflexibility, undermining energy efficiency and international security issues, including accidents, terrorism and nuclear proliferation' (Greenpeace, 2006). Figures in the Appendix on the declining importance of nuclear power in most of the developed countries including France which is often cited as an example of the most successful country in achieving energy security through nuclear energy, would strengthen SDC's observations.

1.2 Why nuclear power

It would be naïve to believe that the political establishments are not aware of the negative consequences of nuclear power. Question may be raised then why have the emerging economies of India, China, Brazil, etc., aligned themselves with the nuclear establishment without fully exploiting other alternative energy sources? Taking India as a case, this paper analyses secondary data and findings of various previous studies to explore an answer to this question.

2 Part II

2.1 Petroleum a dominant energy source: emergence of a symbiotic relationship between the state and transnational energy utilities

Conventional energy sources namely coal; petroleum, natural gas and electricity from large hydro electric projects have dominated the world economy during the last century. Technology was one of the strategic tools through which energy utilities maintained their dominance over the production and distribution of different energy sources. Major oil companies could retain control on world petroleum market over a fairly long period mainly due to their technical edge over others. However, constant support from their 'home' state was also essential to maintain their dominance. Though coal was found abundantly throughout the world, after the World War II, most of the countries shifted to oil, by then, the technique of coal production became known to almost all the countries but the technique of oil production remained unknown to most of them. Since 1950s, thanks to Marshall Plan (Tanzer, 1974), the 'US oil majors' who had established their dominance in the global petroleum market by then, played the crucial role in this shift from coal to oil, especially in Europe[5]. Subsequently, India, with a huge coal reserve capable to meet her energy demands for few hundred years, has also followed the global trend of switching over to petroleum, though till date, as the Table 1 indicates, coal has remained as a major source of energy in India (Dey, 1999).

2.2 State and large energy utilities: a symbiotic relationship

The 'green revolution' of 1950s had opened an opportunity before the nation states to exercise control on the basic necessities (food and energy) of its citizens. A symbiotic relationship between the states and major transnational firms supplying new agricultural inputs (say fertiliser, seeds, pesticides, water pumps, diesel, electricity, etc.) was established. Usually, in such arrangements, the state provided with the financial assistance – subsidies, tax rebate, etc., and the corporate supplied the required technology.

A World Bank study in 1992 estimated that globally, around US $230 billion per year was provided by the states towards consumption subsidy of fossil fuel. In a subsequent study in 1997, they estimated the annual fossil fuel subsidy in the OECD countries and twenty largest countries outside the OECD, at US $10 billion and US $48 billion respectively. The International Energy Agency (IEA) in 1999 had estimated the total value of energy subsidies in eight of the largest developing countries at around US $95 billion. It also revealed that the annual energy consumption subsidies in non-OECD countries were as high as $250 billion [as mentioned in Chakraborty and Govind (2008)]. And in 2006, the Indian government provided a yearly subsidy of Rs 26,604 crores (nearly $6 billion) to the consumers of LPG and kerosene. While the subsidies ensured political loyalty of the beneficiaries to the state, the energy utilities enjoyed higher market share, earned more profit and remained competitive vis-à-vis other alternative forms of energy. Thus, during last century, a win-win relationship had existed between the states and the major energy utilities, dominated mainly by petroleum firms.

The major exception to this trend was France which is cited repeatedly by the nuclear lobby and ambitious emerging states, as an example to emulate. After the oil shock of 1973, to retain its control on energy supplies, the French government made a

conscious decision to establish massive nuclear plants. Now the state run France Electricité de France (EdF) operates 59 nuclear reactors with total capacity of over 63 GWe. Around 75% of electricity in France is generated from nuclear sources. In 2003, 70% of the French citizens had identified themselves as being poorly informed on energy questions.[6] Lack of information to the citizens (may be due to different barriers imposed by the state on accessing information) on energy options and their socio economic consequences definitely helped the ambitious French government (which always wanted to be at par with its hefty neighbours) to pursue with its massive nuclear programme.

2.3 Decline in state power in the 21st century: breaking down of the alliance between the state and major corporations

In 21st century, which is likely to be dominated by knowledge-based industries (unlike the resource-based industries of the last century), corporations will not require the backing of the state to the extent it needed during the previous decades[7]. In future, the nation states will be increasingly subjected to the regulations of multilateral and regional bodies like WTO, European Union (EU), etc. The transnational corporations will play a dominant role in formulating rules and regulations of those bodies (Dey, 2006). In such an environment, the nation states are likely to lose their sovereign power and a less powerful state will not be left with enough funds to subsidise large energy projects, the way it used to subsidise earlier. Tax-incentives, cross subsidies, military support to ensure supply of raw materials like crude, etc., will be discouraged. But subsidies (may be at a much lower amount) for new and renewable energy sources might continue for few more years. The process has been started already. The US House of Representatives has passed legislation in January 2007, seeking a cut of US $14 bn in oil and gas subsidies in next ten years. The legislation proposed to pass on the said amount to the companies engaged in the development of renewable energy and technology (opt cit Chakraborty and Govind, 2008).

Anticipating dwindling support from the states in future, the energy utilities have started to look for an alternative strategy to retain their control on energy supplies. They have realised that the century old symbiotic relationship that existed between the state and energy utilities is unlikely to be continued for a long period in future. In this new century, the transnational corporations engaged in energy and food business, are putting pressure on the 'nation states' to loosen latter's control on both 'food' and 'energy' supplies (Dey, 2009). Currently; there is a move to develop smaller units, which may be built independently or as modules in a larger complex, with capacity added incrementally as required. The driving forces for small nuclear power plants are the reduction of the financial risk and the need for integration into smaller grids in many developing countries (Frogatt, 2005).

Keeping in line with this, the government of India has promulgated a new Electricity Act in June 2003. As per the provisions of this Act, the generation has been totally deregulated, transmission partly regulated and distribution fully regulated. It was claimed that, deregulation of generation would bring in many small private generators to industry. This is inline with the recent trend in developing small size 'next generation' nuclear reactors suitable for the developing countries.

2.4 Energy options before India

Against the backdrop of soaring crude oil price and climate change debate, the relative importance of different energy sources in the energy mix of a nation are changing. The 'Renewables 2007: global status report' as released by REN21 (http://www.ren21.net) has claimed that multilateral agencies and private investors "have been 'mainstreaming' renewable energy in their portfolios and many renewable technologies have captured the interest of the largest global companies". In 2006, the share of renewable energy in the global final energy consumption amounted to 18%. The share of nuclear energy was 3% and rest 79% was the share of fossil fuels (including coal). The corresponding shares of renewable sources, nuclear and fossil fuel in the generation of global electricity were: 18.4%, 14% and 67% respectively.

Interestingly, two groups of nations are patronising different forms of energy sources. While the US led group are trying to push nuclear energy to the fast growing economies of India, China, Brazil, etc., the EU is seriously aiming towards a low CO_2 fossil fuel future through the development of green energy including 'clean coal technologies' so that after 2020 'near zero emission' power generation could be systematically used in the EU and in the world.[8] In addition to the renewable energy sources like solar and wind energy the EU has envisaged an integrated technological solution combining efficiency improvement of the conversion cycle with the mechanism of 'carbon-dioxide capture and storage (CCS). This 'sustainable coal technologies' will enable European firms to become the 'global leaders in this energy form' (CEC, 2007).

In 2005, the Planning Commission of India had appointed a very high power committee the 'Expert Committee on Integrated Energy Policy' (Expert Committee) to recommend on the future of India's energy policy. The Committee has submitted its final report in August 2006 (Planning Commission, 2006). Assuming an 8% GDP growth per annum, the report predicted a very high share of coal in the energy mix in the year 2031–32. In that year, the share of coal in the energy mix in India was projected to range between 54.1% and 32% and the share of oil and gas would vary between 41.1% and 31.2%. The projected share of nuclear in 2031–32 ranged between 6.4% and 4%.

Before releasing their final report in August 2006, the Expert Committee had submitted a 'draft report' in December 2005 (Planning Commission, 2005). A comparative assessment of different composition of fuel mix in 2031–32 (assuming 8% GDP growth rate) as projected in the 'draft' and 'final' reports convey enough indication about the external pressure which might have influenced the policy recommendations of the Expert Committee while preparing the final report. The changes in the 'fuel mix' composition projecting the maximum and minimum range of the coal and nuclear energy's share in 2031–32 as documented in the 'draft' and 'final' report of the Expert Committee, is a case in point (refer to Table 2).

Table 2 indicates two major changes in the 'final report' released in August 2006, compared to the 'draft report' released in December, 2005.

1 The 'draft report' projected a much higher share of coal in the future energy mix. The range was between 65% and 42.0%, and this was much higher as compared to the range between 54.1% and 41.1% in the 'final report'.

2 In the 'draft report', the share of nuclear power in the projected energy mix of 2031–2032 ranged between 0% and 6%. But in the 'final report', this projected range has been increased to 4% and 6% respectively.

Table 2 Projected fuel mix (%) scenario in 2031–2032

Fuel mix	*Draft report (Dec. 2005)*		*Final report (Aug. 2006)*	
Oil	28.0	29.0	25.7	22.8
Natural gas	7.0	12.0	5.5	9.8
Coal	65.0	42.0	54.1	41.1
Hydro	0	4.0	0.7	2.2
Nuclear	0 (min)	6.0 (max)	4.0 (min)	6.4 (max)
Renewable	0	2.7	0.1	5.6
Non-commercial	0	5.0	9.8	12.0
Total	100.0	100.0	100.0	100.0

Source: Planning Commission (2005, 2006)

This clearly indicates, energy experts appointed by the Planning Commission, believed (at least till December 2005) that for the next two and half decades the energy needs of India with a projected GDP growth rate of 8% per annum, could be managed without any contribution of nuclear energy. But in the 'final report', nuclear energy became an important contributor to the energy options projected by the same group of experts. The minimum share of nuclear energy in the fuel mix' in 2031–32 as per different alternative projections made by them, was increased to 4% from 0%, as projected earlier in the 'draft report'.

The question naturally arises; what factors did compel these changes in the major policy recommendations within a span of eight months? The reasons could be the following:

- The 'draft report' was prepared when Mani Shankar Aiyar was the Minister of Petroleum, Oil and Natural Gas. He initiated key negotiations with China, Iran and Pakistan to form trans-Asian energy cooperation. Analysts claimed that due to his independent attitude, he earned the wrath of few western energy lobbies. A plan to pipe gas from Iran to India via Pakistan had particularly worried US policymakers. The Prime Minister of India acted promptly to allay their concerns by replacing this high profile and independent-minded petroleum minister, in January 2006, with a right wing politician. His sudden removal from the Ministry of Petroleum had raised suspicions in India about the Prime Minister's willingness to align his economic and foreign policy more closely with US interests.[9] As if to substantiate this, India, had voted against Iran in the general assembly.
- In the revised and final report, relatively more emphasis was laid on nuclear power though the country has enough non-nuclear energy options to meet the energy demands of its growing economy. Moreover the Expert Committee itself had mentioned in its report that India was poorly endowed with uranium. Available uranium supply could fuel only 10,000 MW of the pressurised heavy water reactors (PHWR) – a second-generation CANDU reactor. Further, India was extracting uranium from extremely low-grade ores (as low of 0.1% uranium) compared to ores with up to 12% to 14% uranium in certain resources abroad. This made Indian nuclear fuel two to three times costlier than the international supplies (Planning Commission, 2006). Different studies on the cost of atomic energy in India concluded that production cost of nuclear power significantly exceeded the price

charged to the consumers. Nuclear energy was made to look competitive by extending huge subsidies to the production of 'heavy water' (see Ramana, 2007). India has substantial reserve of thorium. To use it as nuclear fuel, the fertile thorium has to be converted to fissile material. For this, the Indian government had envisaged a three-stage nuclear power programme (Planning Commission, 2006). But the new nuclear programme seems to have discarded these plans to indigenise India's nuclear programme by relying more on imported fuel (Dey, 2008).

- India is probably the only nation where the concerned ministry (*Ministry of New and Renewable Energy Sources*), solely responsible for development of renewable energy sources, could project a lesser share of it while preparing plans for the future fuel-mix of the country. For the year 2021–22, the projected share of renewable, (refer to Table 3), was reduced to 30.9% from the actual share of 33.52% in 2001–02. In 2002–03, electricity generated from different renewable energy sources amounted to 0.330 million tone of oil equivalent (MTOE). This was equivalent to only 0.10% of the total primary energy consumption of India in that year. Against a total generation of 536.8 billion kwh unit of electricity in 2002–03, the contribution of renewable sources were only 4.1 billion kwh.

Table 3 Fuel-mix in 2001–2002 and Scenario for 2021–2022

Fuel type	*2001–02, MMTOE*(%)*	*2021–22, MMTOE*(%)*
Fossil fuel-total	285.81 (65.30%)	595 (66.85%)
Non-fossil fuel-total	151.88 (34.70%)	295 (33.15%)
Renewable-total	146.73 (*33.52%*)	275 (*30.90%*)
Grand total	437.69 (100.00%)	890 (100.00%)

Note: *Million metric tone of oil equivalent

Source: MNRES (2005)

In the absence of any concrete road map, the nation had to wait for the Greenpeace report 'Energy revolution: a sustainable energy outlook for India', released in April 2007, to assess its true potential. Commissioned by the European Renewable Energy Council, the report also provided a practical blueprint for reducing India's carbon dioxide emissions by 4% in the next 43 years while "providing for a secure, affordable energy supply, maintaining steady economic development and without relying on hazardous nuclear technologies" (*The Statesman*, 2007).

Table 4 India's energy scenario

Energy source	*2007*	*2050**
Total installed capacity, GW	120	880
Oil, gas, coal	67%	34%
Large hydro	26%	11%
Renewable energy	4%	51%
Nuclear energy	2%	0.2%

Note: *As projected in the Greenpeace study

Source: *The Telegraph* (2007)

The energy scenario predicted in the Greenpeace report (refer to Table 4) is very encouraging. By 2050, the share of renewable energy is expected to reach to 51% in 2050 from 4% in 2007[10] and the share of nuclear is likely to decline to 0.2% from the current (2007) share of 2%.

On June 30, 2008 the Prime Minister of India has released the National Action Plan on Climate Change. The 'action plan' focuses on eight national missions which will be pursued as key components of India's strategy for sustainable development. The National Missions on Solar Energy is one of such missions.[11] In November 2009, few weeks before the crucial UN meet on climate change at Copenhagen, the government has approved a new policy on development of solar energy. And on 11th January, 2010 the Indian Prime Minister formally has launched the Jawaharlal Nehru National Solar Mission, under the brand name 'Solar India'. To achieve this ambitious target, the mission aims[12] to create an enabling policy framework for the deployment of 20,000 MW of solar power by 2022.

The government policy looks miserable inconsistent when it remains non-committal to other viable forms of renewable energy sources like wind energy. In wind energy sector few Indian companies have already achieved reasonable recognition in the global market[13]. Among all the renewable energy sources, achievement of wind energy sector was remarkable. And even for the 11th plan period (2007–12), of the total physical target of 150,000 MW of renewable energy, target for wind energy was as high as 105,000 MW which in relative term constituted 70% of the total. Compared to this, the target for solar energy was only 50 MW.

It may be noted that Indian Government has taken this enormous initiative towards solar energy at a time when the ruling coalition, ministry had been desperately trying to complete the procedural issues related to 123 Nuclear Agreement with USA. By announcing the solar mission, the government of India has tried a balancing act to satisfy both the super powers (Dey, 2010).

2.5 Importance of India to the global nuclear industry

The Indo-US Nuclear Agreement will allow India to enter into global nuclear trade. In addition to the vast market it offers, India will act as a facilitator to the major players in expanding the market to smaller developing nations with the limited capacity of installing smaller nuclear reactors. Globally, major developers of nuclear reactors in France and North America have moved into large reactor sizes of 1,000 MWe and above. India is still using 220 MWe reactors in running its nuclear programme. 12 such reactors are in operation now.

It is reported that India is exploring the possibility of exporting indigenous 220 MWe reactors to the developing countries which are constrained by small sized electricity grids to support large reactors of say 1,000 MWe. To enhance their global competitiveness, the French and US firms[14] have already expressed interest for long term cooperation with Indian nuclear establishment. While the French firms are keen establishing their production base in the manufacture of pressurised water reactor (PWR) equipment, the US firm Thorium Power is interested in generating license-driven revenue through deployment of thorium technology (*The Hindu Business Line*, 2008).

India has acquired global leadership in research involving PHWR; fast breeder reactors and thorium cycle. In case of thorium research, India stands at the top, ahead of Japan, France, Germany and the USA. By entering into different collaborative

agreements with existing major manufactures of the industry, India plans to leverage its edge in these areas to tap the export potential of the global market. Countries like Vietnam, Philippines, Thailand and Indonesia which have announced their intention to go nuclear are the possible targets (ibid).

2.6 Nuclear energy and proliferation of nuclear weapon

A document, dated August, 1981, from the Los Alamos National Laboratory, USA stated: "There is no technical demarcation between the military and civilian reactor and there never was one. What has persisted over the decades is just the misconception that such a linkage does not exist". As early as 1951, the Atomic Energy Commission (AEC) concluded that commercial nuclear reactors would not be economically feasible if they were used solely to produce electricity; they would be, however, if they also produced plutonium which could be sold (Nuclear Energy Information Service, 2010).

In 1953, President Dwight Eisenhower announced his 'atoms for peace' programme, by which the force of the atom was to be harnessed for 'peaceful' purposes. It was also at this time that the USA began offering nuclear technology and training to the rest of the world. In 1954, utilities which were to operate commercial nuclear reactors were given further incentive when congress amended the Atomic Energy Act so that utilities would receive uranium fuel for their reactors from the government in exchange for the plutonium produced in those reactors (ibid).

Nuclear power generation programme in India began in 1969 with the help of US-supplied boiling water reactors. It was one of the earliest and largest nuclear programmes initiated among the developing countries. The CANDU type reactor supplied by Canada went into operation in 1973 and in May 1974, India announced its first nuclear explosion.[15]

The Nuclear Non-proliferation Treaty (NPT), in its present form, which allows some countries to retain their nuclear weapons while others are to make commitment of non-proliferation of nuclear weapon, has lost its relevance. The Indo-US nuclear deal has further exposed the basic flaws of the NPT. Though India, a declared nuclear weapon state, is not a signatory to the NPT, it has received all the necessary support and encouragement from International Atomic Energy Agency (IAEA) and other regulators in its endeavour for massive nuclear programme. The preferred treatment which India has received in recent past from IAEA and other nuclear states was reserved, for those who signed the NPT and vowed to abide by the non-proliferation regulations.

Sheer ban on nuclear weapons would not be effective unless supply of weapon grade materials, produced in such civilian programmes, could be stopped. This ban could be made effective only by putting a world wide ban[16] on nuclear energy generation programmes.

2.7 New initiatives to make the world nuclear free

For the first time, the issue of the complete elimination of nuclear weapons was being addressed, in the USA, by politicians like George Schultz, Henry Kissinger, Bill Perry and Sam Nunn, who represent the mainstream of US strategic policy. Recently, these four US statesmen have proposed a total elimination of nuclear weapons. They argued that unless the nuclear-weapon states (now there are eight of them) – and especially the two main ones, USA and Russia, take the lead in launching a process aimed at their total

elimination, it would become increasingly difficult to prevent other countries from acquiring them, with the risk that sooner or later these weapons may be used, and that would have catastrophic consequences for the world.

The civil society organisations (CSOs), across the globe, have raised demand for a total moratorium on nuclear energy programmes and phased decommissioning of all existing reactors. This is the only approach through which further proliferation of nuclear weapons could be stopped. Even after six decades of Hiroshima and Nagasaki massacre, political leaders have failed to find a suitable mechanism to make this world free of nuclear weapons. Now the onus is on the civil society to achieve that objective.

2.8 Conclusions

In this new century when the sovereign power of the nation states are being increasingly challenged due to proliferation of multilateral agreements, the nation states, specially the ambitious states of emerging economies which have not yet reached the maturity level of Western European States, are trying desperately to retain their hegemony over the basic needs of their subjects. The symbiotic relationship between the state and energy utilities suits effectively with energy sources like petroleum and nuclear power which need large scale operation with huge initial capital investments.

Transnational energy utilities have always preferred mega exploration projects; large refineries and power plants with modern technology. For producing electricity, micro or mini turbines with decentralised power production facilities have been consciously discarded paving way to mega thermal/hydro/nuclear complex with centralised control on production and distribution. Since the 1950s, the size of reactor units has grown from 60 MW to more than 1300 MW, with corresponding economies of scale in operation (see Frogatt, 2005). To run such a large nuclear plant, the utilities will require the support of the state in a wide range of functional areas starting from the procumbent of raw materials; safe disposal of wastes and arranging subsidy for marketing the electricity it produces, to the protection of the plant against disruptive forces.

In the absence of organised public opinion against such blatant exercise of power, these states will construct new nuclear power plants knowing fully well that the safety[17] and economic cost[18] of nuclear energy are much more than the cheaper options already available in other energy sources. This hunger for ‘absolute power’ is pushing the ambitious states like India, China, Brazil and South Korea towards nuclear power projects.

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Notes

1 As per 2001 Census, only 55.8% of Indian household had access to electricity.

2 The Integrated Energy Policy, 2006, has already been made a toothless document.

3 See the website of the World Nuclear Association (2008).

4 Available at http://www.nti.org/e_research/profiles/India/Nuclear/index.html (accessed on 7 August 2010).

5 Europe is planning to reverse the trend by regaining their dominance on coal through 'sustainable coal technology'.

6 France's first national energy debate was announced in 2003, in response to a "strong demand from the French people", 70% of whom had identified themselves as being poorly informed on energy questions (http://www.world-nuclear.org/info/inf40.html).

7 The present financial crisis and economic recession are cyclical phenomenon and should not be considered as an indication of resurgence of state power as witnessed during last century.

8 In February 2008, The Polish Platform for Clean Coal Technologies was initiated by the Vattenfall Polska Company and the National Contact Point for EU Research Programmes. Poland which is dependent on coal for 96% of its energy, considers the EU's flagship programme for producing clean energy from coal as 'the future' of their economy (see *The Warsaw Voice*, 2008).

9 'EIU views wire via Thomson dialog news edge country briefing', available at http://www.tmcnet.com/usubmit/2006/02/27/1412052.htm.

10 This is in line with the figure quoted by President of India in his Independence Day (August 14, 2005) speech where he mentioned about the share of renewable in the total primary energy as 5% (see *The Economist*, 2005).

11 The eight missions include National Missions on Solar Energy; on Enhanced Energy Efficiency; on Sustainable Habitat; on Conserving Water; on Sustaining the Himalayan Ecosystem; on creating a 'Green India'; on Sustainable Agriculture; and on establishing a Strategic Knowledge Platform for Climate Change.

12 Available at http://mnre.gov.in/annualreport/2009-10EN/Chapter%203/chapter%203_1.htm (accessed on 21 May 2010).

13 One of such firm is Suzlon Energy Limited; Asia's largest fully integrated wind power company was founded in 1995.

14 Between 1996 and 2007, the share of nuclear in the generation of electricity has decreased both in France and USA (see the Appendix).

15 For details see Dhirendra (1983b). Also see the book review (Dhirendra, 1983a).

16 May be in a phased manner allowing sufficient time to switch to alternative energy sources.

17 The cost becomes prohibitive if we include the safety cost of managing the nuclear waste. It has been reported that since the inception of the Nuclear Waste Policy Act in 1983, the USA nuclear establishment had to spend around $9 billion to store the waste. But this amount would reach to $58.5 billion, if the 'total system life-cycle cost' method were used for the cost estimates (see FORTUNE, 2007).

18 For a detailed discussion on how 'the prohibitive cost of reactors is making nuclear energy unviable across the world', see Latha (2008).

Appendix

Nuclear share (%) in electricity generation (1996–2007)

Country or area	*%*			*Nuclear electricity production (TWh)*	
	1996	*2002*	*2007*	*2006*	*2007*
A Countries exhibiting increasing trend (share)					
Armenia	36.7	40.5	43.5	2.4	2.4
Brazil	0.7	4	2.8	13.8	11.7
China – Mainland	1.3	1.4	1.9	54.8	59.3
Czech Rep.	20	24.5	30.3	24.5	24.6
Finland	28.1	29.8	28.9	22	22.5
India	2.2	3.7	2.5	15.6	15.8
Pakistan	0.6	2.5	2.3	2.5	2.3
Romania	1.8	10.3	13	5.2	7.1
Russia	13.1	16	16	144.3	148
Slovakia	44.5	65.4	54.3	16.6	14.2
Slovenia	37.9	40.7	41.6	5.3	5.4
Ukraine	43.8	45.7	48.1	84.8	87.2
Total (A)				*391.8*	*400.5*

Source: World Nuclear Association (2008)

Nuclear share (%) in electricity generation (1996–2007) (continued)

Country or area	*%*			*Nuclear electricity production (TWh)*	
	1996	*2002*	*2007*	*2006*	*2007*
B Countries exhibiting decreasing trend (share)					
Argentina	11.4	7.2	6.2	7.1	6.2
Belgium	57.2	57.3	54.1	44.3	45.9
Bulgaria	42.2	47.3	32.1	18.1	13.7
Canada	16	12.3	14.7	92.4	88.2
China – Taiwan	29	22.9	19.3	38.3	39
France	77.4	78	76.9	428.7	420.1
Germany	30.3	29.9	25.9	158.7	133.2
Hungary	40.8	36.1	36.8	12.5	13.9
Japan	33.4	34.5	27.5	291.5	267.3
Korea, S.	36.3	38.6	35.3	141.2	136.6
Lithuania	83.4	80.1	64.4	7.9	9.1
Mexico	5.1	4.1	4.6	10.4	10
Netherlands	4.8	4	4.1	3.3	4
South Africa	6.3	5.9	5.5	10.1	12.6
Spain	32	25.8	17.4	57.4	52.7
Sweden	52.4	45.7	46.1	65	64.3
Switzerland	44.5	39.5	40	26.4	26.5
UK	26	23.7	15.1	69.2	57.5
USA	21.9	20.3	19.4	787.2	807
Total (B)				*2,269.7*	*2,207.8*
Grand total (A) + (B)				2,661.5	2,608.3

Source: World Nuclear Association (2008)