

THE INDO-US NUCLEAR PACT AND THE HOAX OF NUCLEAR POWER

Prof. Dipanjan Raichaudhuri

1 The Indo-US Nuclear Pact

Section 123 of the US Atomic Energy Act of 1954 sets conditions on nuclear agreements with other countries. The present “123 agreement” makes an exception for India. This tells the world that India’s readiness to co-operate has finally satisfied the US. It is now worthy of being sold nuclear fuel, reactors, and technology, even though it does not sign the non-proliferation treaty.

The agreement allows [1] 8 out of the 22 existing reactors and a fast breeder reactor under construction to remain outside the purview of International Atomic Energy Agency inspection. So, India’s nuclear weapons programme can continue. Even the penalty, according to the Hyde Act, of the return of all material and technology supplied, in the event of non-compliance with IAEA safeguards or a new test explosion, of which much has been made by the parliamentary Left, has an escape valve. In violation of the aims of the Hyde Act, the “123 agreement” provides that the US government can exercise its discretion to arrange for such supplies to continue from countries like France, Britain and Russia. In any case, activation of the penalty is to entail compensation. The US is happy because the upcoming new facility for reprocessing spent fuel (this is the point at which the plutonium required for the bomb is separated) will be open to IAEA inspection.

Why does the US suddenly find that it can live with the Indian bomb? There are several reasons.

The USA’s honeymoon with China seems over. In spite of the penetration of US finance capital into the huge Chinese market, Chinese trade and monetary policy is hurting the US. In the 11 months ending in November, 2006, the US had a trade deficit of \$ 214 billion with China [2], and China refuses to reduce this deficit by revaluing its currency for fear that cheap foreign agricultural products will invade and destabilise its rural economy and further disturb its already restive peasants. Military exhibitionism over Taiwan is at a new high. The US notes the military build-up of China’s PLA and the upgrading of its western Pacific strike capabilities. The US recently upgraded its own China war contingency plan from CONPLAN

(concept status) to OPLAN (resource assignment status, O is for Operations) [3], the Pacific Command OPLAN 5077-04.

The Indian bomb threatens neighbouring countries, most notably Pakistan and China, but the US is still far beyond the range of Indian missiles. So, without having to tolerate any imminent danger to its own security, the US, stung by the Talibani metamorphosis of Pakistan, sees the new pro reform, pro globalisation, pro US India as its future beach head against a possibly hostile China and a possible China-Russia-Central Asia axis (on the lines of the Shanghai Co-operation Organisation), as well as a fast developing ally of Israel against Palestine, Iran and Taliban-type fundamentalism. The American Jewish Committee openly supported the proposed deal. India has Observer status at the Shanghai Co-operation Organisation, and the US would like also to wean it away from such alliances.

The Indian nuclear programme is self-reliant and actually unstoppable without military intervention. As it is going to continue anyway, so, apart from good business policy, it is sound military and diplomatic strategy to exercise a degree of control over the supply line of fuel. Once India becomes dependent on this supply line for nuclear power, whose importance in the energy sector is also being enhanced, a threat to choke this line will add to the pressure on India to toe the US line, especially in emergencies.

India has opened her markets to US capital. From \$ 11 million [4] in 1991, US FDI in India has soared to \$ 5 billion [5] in 2005-06, a 450 times increase in 15 years. US capital wants its government to reward India, of course, in a manner which will increase her dependence on the US. A list of US companies which were lined up by the US India Business Council to lobby the US Congress to approve of the "123 agreement" includes General Electric, Ford Motors, Lockheed Martin, Boeing, and Aerospace Industries Association. The deal wraps India more tightly in the embrace of US finance-capital and its strategic-military geopolitics.

The supporters of the deal are foretelling doom for the country if the deal falls through, because, we are told, as fossil fuels run out, nuclear energy becomes the alternative, and the nuclear programme requires import of fuel (uranium), the US being ready to export just what is needed.

Let us analyse these theses in some detail.

2 Nuclear Power : How long will reserves last?

Uranium resources will run out in the same time frame as fossil fuels. The 70,000 t of uranium reserves will be finished in 30 years (The South Asian, April 16, 2006).

The Jadugoda mines of Singbhum, Jharkhand, have supplied uranium, U, from 1967 (the annual rate of production was 239 t in 2002) and are now practically

depleted [6]. New mines are being opened up in the area. But the total output from the area is insufficient and reserves are being opened up in other areas.

Let us take a look at some of the new reserves [6]. The Domiasiat project of West Khasi Hills, Meghalaya, has a lifetime of 22 years, producing uranium at the rate of 160-200 t per year. The Lambapur-Peddagattu project of Nalgonda, Andhra Pradesh, will produce uranium at the rate of 131 t per year for 20-25 years. Actually, the reserves are less [7] than 70,000 t — 61,000 t, the Reasonably Assured Resources [6] (RAR) being 54,470 t.

Our coal reserves [8] are 38 billion t, with a total thermal energy potential of 21,151 GWYr. At present, coal constitutes [9] 51% of the primary energy sources. In 2002-03, total energy consumption [8] was 428 GWYr, expected to grow at about 4.4% annually, if a GDP growth of about 5% is combined with an energy elasticity of growth of 0.9. So, in the 50 years from 2002-3, the total energy consumption will be about 75,000 GWYr. A little energy use (compound growth) calculation shows that coal, at 51% usage, will, last another 38 years or so.

India's oil and gas reserves [8] are 12 billion t, with a total thermal energy potential of 16,204 GWYr. At present, hydrocarbons constitute [9] 45% of the primary energy sources. At this rate of usage, hydrocarbons will last another 36 years or so.

Taking U reserves [8] to be 61,000 t, the thermal energy potential is 913 GWYr for the current technology, using Pressurised Heavy Water Reactors, PHWR. Even if nuclear energy replaces just oil and gas (that is, provides 45% of the total energy requirement, in place of the present [9] 4%), **U will last less than 5 years** even at 2002-03 rates of energy consumption.

So, nuclear fuel reserves, as processed by the technology in current use, will not last even as long as fossil fuels.

In resonance with US pronouncements, India's Atomic Energy establishment is promoting the Fast Breeder Reactor FBR, which, besides supplying power, creates new fuel (notably Plutonium, Pu, used in the bomb) while using up uranium, U. A 500 MW prototype PFBR is coming up in Kalpakkam. According to Kakodkar [8], Chairman, Atomic Energy Commission, FBR use will stretch the thermal energy available from India's U reserves to 117, 308 GWYr, corresponding to about 75 years of use.

India has the world's highest Thorium, Th, reserves, 2,25,000 t, according to Kakodkar. Th itself is not fissile, but, on exposure to fast neutrons, from machines or from fissile material like Pu or U^{235} , gives U^{233} , which is fissile. Kakodkar claims that the Th reserves are equivalent to a total thermal energy of 4,31,950 GWYr, certainly enough, says the establishment, to go into the next century.

What about the FBR? Is it the answer to our problem?

The FBR is too costly and too unsafe, as we shall shortly see.

3 Nuclear Power : Costs

In June 2006, M. V. Ramana and Suchitra J. Y. published [10] a comparison between the Kaiga I, II (operational) and Kaiga III, IV (under construction) nuclear reactors, on the one hand, and the Raichur Thermal Power Station RTPS VII, all of these being power plants of Karnataka, of similar size and age. Bare electricity generation costs were compared, without adding costs for interest payment, transmission or distribution, for various values of the real discount rate (= value of capital minus rate of inflation). For any discount rate higher than about 4%, thermal power was cheaper, although the coal source was assumed to be 1400 km away and nuclear waste disposal costs were not considered in spite of counting costs for environmentally sound methods of fly ash (from coal) disposal. A different study by NPCIL, Mumbai, found thermal power was cheaper for a discount rate above 6.7%. It may be mentioned that realistic rates are higher than 4%: for example, the January 2, 2007 prime lending rate of State Bank of India was 11.5%, and the January 6, 2007 WPI inflation rate 6%. The dependence on discount rate arises because nuclear power has a much higher capital cost (Rs 2727 crs for Kaiga I, II, Rs 1816 crs for Kaiga III, IV, against Rs 491 crs for RTPS VII).

The Atomic Energy establishment claims [11] that the PFBR requires Rs. 3500 crs investment, and will supply electricity @ Rs. 3.22 per unit (KWhr) to the power grid. Still, thermal power is cheaper. The NTPC renovated a 20 year old thermal plant [12] of the Orissa SEB near Talcher to give power to the grid at Rs. 1.30 per unit. Further, people cannot believe the DAE and the AEC. The Kaiga I, II plants were to start production in 1994 with an investment of Rs. 730.72 crs. Production actually started in 1999, with the cost having overrun to Rs. 2896 crs. In the case of the Narora reactors, the Comptroller & Auditor General of India (CAG) found a cost overrun of 188% in 1988. The CAG observed that there had already been 95% and 82% cost revision in 1982 and 1985, respectively, the whole indicative of unrealistic cost estimates and over-optimistic time schedules [13].

World experience with FBR plants is that capacity utilisation tends to dip. In that case, even a Rs 3000 cr plant may have to charge. Rs. 5-10 per unit [14]. The last US FBR went on line in 1980. If this is taken as a standard, a 500 MW FBR in India will require Rs 22,000 cr investment. Taking the last Japanese FBR (1994) as standard, the required investment will be Rs. 45,000 cr. Such capital costs will entail unit prices [14] of electricity, anywhere from Rs. 9 to Rs. 50.

The use of India's Th reserves is also problematic. If Pu is used as a fast neutron source, we are back to the question of depletion of U resources. If accelerators are used to supply fast neutrons, the cost will rise steeply.

4 Nuclear Power : Safety

From the major disasters in Chernobyl (Russia) and Three Mile Island (US) to the perennial problems of the disposal of nuclear waste (which remains harmfully radioactive for centuries) and the ambient radioactivity around reactors and U mines, the basically unsafe nature of nuclear power operations is always in evidence.

What is covered up by the nuclear lobby of big capital and its tame scientists is that *there is no safe dose of radiation*, no threshold of safety. Cell mutation can be a one event affair. An energetic particle hits one cell and, if you are unlucky, there is a mutation and that's it – you are on the way to malignant malaise.

Low dose ($< 10\text{cGy}$) radiation effects have been well studied [15]. Even if an irradiated cell does not become malignant, an instability develops in the corresponding gene. Subsequent contact with chemical mutants and carcinogens, additional doses of radiation, tumour promoters, oncogenic viruses, and combinations of these factors can push the body towards malignancy or other abnormalities like neonatal defects, years after the exposure. Tobacco and even caffeine can act as such promoting factors. Another dangerous finding is that it is not only irradiated cells which are affected. Other cells are affected by their interaction with the irradiated ones leading to a genomic instability. Especially vulnerable are the progeny of the irradiated cells, possibly due to DNA strand breakage effects.

While we debate over the radiation from reactors, mines and wastes, all over the world radio-scientists are worried today even about diagnostic help from radiation, such is the threat perceived from low dose radiation.

Every step of the nuclear power cycle from mine to reactor, and thence to waste dump, deals with highly radioactive material. A little human or machine error, the like of which is remediable in, say, thermal or hydel power plants without much damage, will, in a nuclear facility, lead to dangerous leaks and spills of radioactivity.

In a country like ours where life is cheap and good health for the poor a non-marketable commodity, safety standards are low and haphazard, and we must accept this as the status quo and talk about it, not about any ideal copybook safety which may only be reachable in an ideal copybook welfare state.

The tailings (liquid waste) from the Jadugoda U mines are kept in 3 storage dams, called “tailing ponds”, within 1.5 km of seven villages, one of which starts 40 m away, although the Atomic Energy Act lays down 5 km as the lowest permissible distance to human habitation [16]. For over 20 years these villagers have lived with high rates of cancer, stillbirths, and congenital defects in children. Even Jadugoda railway station has seen containers sitting on the public platform, leaking waste.

Waste disposal from nuclear reactors poses similar problems. The difficulty is that these wastes remain radioactive over years and decades and even centuries in some cases. If you think the problem is a minor one, ask yourself whether you will accept

residential accommodation 40 meters from a nuclear waste dump.

On December 24, 2006, a pipe leading to a tailing pond at Jadugoda started leaking into a creek from which villagers even draw drinking water. A sludge formed on the surface and aquatic life started to die. The leak continued for nine hours because the Uranium Corporation of India UCIL had no alarm mechanism and only shut off the flow after the villagers informed them of the leak. The UCIL learnt nothing from the earlier 1986 leak of radioactive water to the villages after a dam burst. The creek runs into the Subarnarekha, a major river of Jharkhand, and so habitations on its banks were put in jeopardy even hundreds of kilometers downstream.

The same problem of quick magnification of the effect of a small error into a major hazard overhangs the running of reactors. The DAE has never admitted to any incidents of this kind. Suspicious occurrences [10] include a fire at Narora (1993), collapse of the protective containment at Kaiga (1994), the sudden power surge at Kakrapar reactor (2004). On January 5, 2005, the Tamil daily Dinakaran reported a radioactive leak at the Kalpakkam nuclear plant. The DAE admitted nothing. Earlier a tsunami had hit the plant, to what effect nobody knows. A tsunami also hit the Koodankulam nuclear plant under construction. The DAE remain tight-lipped.

A survey in habitations around the Rajasthan Atomic Power Station, RAPS, at Rawatbhata, near Kota, showed increased incidence [10] of solid tumours (cancers), still births, congenital deformities, and spontaneous abortions. The whole matter of overseeing the safety of nuclear plants has become a farce because the relevant authority, the Atomic Energy Regulatory Board, has on its safety committee [10] DAE technical personnel to the extent of 95%. So, the DAE is in the enviable position of being asked to oversee its own operations.

Finally, let us consider the FBR reactor. This will use molten sodium as the coolant. Here, the sodium is a new hazard, as it burns in contact with air or water. Also, if, for some reason, sodium is heated, it starts to evaporate, the reactor core starts heating up, and unless control rods are pushed in time, there is fuel meltdown and a small nuclear explosion [18]. The German FBR reactor was completed but never opened because of this fear [14]. The Japanese Monju reactor was shut down within a year because of a secondary sodium loop fire. 11 large (> 100 MW-thermal) FBR plants were set up worldwide. Of these 6 are now shut. Two more are to be shut in the near future.

Pu based FBR reactors require reprocessing plants for extracting Pu from the spent fuel. These plants are great polluters, apart from being costly. There are two such plants in Britain and France, and the EU has been clamouring for their closure. Also, Pu is 30,000 times more radioactive than U^{235} [18] and the fuel fabrication (for example, fabrication of mixed oxide fuels MOX) requires great precautions and the cost rises. In this scenario enter India's nuclear overlords with their plans for FBR reactors as an alternative to fossil fuels!

Thorium-based nuclear plants, including FBRs, exhibit all these problems of an intrinsic lack of safety. Moreover Th is a fire hazard, and, also, has as a decay product the radioactive gas Thoron which escapes into the ambient air.

To counter these charges of nuclear energy being essentially unsafe, the political managers of big capital from Bush to our Indian overlords have come up with a laughable claim: nuclear energy, they declare, is “clean.” What they mean by this is that a thermal plant produces as waste gases which pollute the *atmosphere*, but a nuclear plant does not. What they are sweeping under the carpet is the fact that a nuclear plant produces as waste solids which remain radioactive and pollute the *lithosphere* for decades and even centuries.

More-over both thermal and nuclear plants produce electricity and whether the transportation and manufacturing sectors will use this electricity in ways which will release greenhouse gases or not has nothing to do with the thermal or nuclear nature of production of the electricity. Electricity produced by a nuclear plant can just as well be used to extract and refine oil for private cars with their polluting emissions (instead of powering electric motor driven tram cars for public use and electric battery driven automobiles), or drive reactions in chemical plants producing harmful gases (instead of using “green chemistry” routes with water as solvent and non-production of any noxious waste or by-product).

5 Which way to turn?

If fossil fuels are running out fast and nuclear fuels, too, will not last long, and, more-over, nuclear power is too unsafe and no less a polluter, which way do we go?

India has hydel power reserves [7] of 150,000 MW, only 17% of which has been put to use (another 5% is being harnessed). Wind power, small (< 25 MW) hydropower, urban and industrial waste based power, and solar photovoltaic power reserves add up to about 200 GW. Apart from these there is the potential for solar water heating over a 140 million square m collector area, 12 million biogas plants, 120 million improved biomass cooking stoves. So, the present (2007) estimates of the reserves of hydel and non-conventional renewable sources [7] almost catch up with the 428 GW power actually consumed in 2002-03.

But, of course, energy consumption will increase. What about the growth of renewable sources?

Small hydel projects have a growth potential commensurate with liberation of community initiative. India is the world’s fourth largest repository of wind power. Wind power technology is advancing and so will growth. India has, in most parts, 300 sunny days a year and catches 4-7 kWh/sq m solar energy daily [7]. The 140 million sq m collector area estimated at present for photovoltaic power receives, therefore, more than 2 GW power from the sun. As technology advances rapidly

in this field, the PV yield will rise and collector area will also increase. Bio-fuels are coming of age. The central government has announced tax benefits for jatropha plantations for bio-diesel production, and some state governments are giving land at a discount.

So, non-conventional energy is a viable alternative and will give high returns on investment, which has been meagre to date. A smaller investment than required for nuclear power will create greater energy potential.

In the last decade 5340 MW of wind power capacity [19] has been installed in India compared to 3580 MW of nuclear power in fifty years, although nuclear power has attracted much more government finance. In 2002-03 DAE was allocated [10] Rs. 3351.69 crs and the Ministry of Non-conventional Energy Sources (solar, wind, small hydro and biomass) was allocated Rs 473.56 crs. Only 9220 MW (7.3%) of non-conventional energy reserves [7] have been used so far, and, if the sector is to be prioritised, a lot of investment and construction will be needed soon. Still, building up sufficient capacity from its present neglected status will take time. But, here, too, the case of nuclear energy is hardly better. Even aggressive FBR development will allow a build-up of nuclear capacity which will not be able to supply more than 20% of the total energy requirement [18] even in the middle of the next century.

Unit costs of non-conventional energy are still high, but technology advance is bringing down these costs every day, especially for solar power. Of course, the costs are no longer high if they are compared with the FBR scenario. Off-shore there is a vast source of wind power, only the expense of harnessing it is high. But it has been estimated that this expense is at par with FBR costs.

References

- [1] Sandeep Pandey, The Japan Times, August 15, 2007.
- [2] Richard McGregor and Eoin Callan, <http://www.ft.com>, January 10, 2007.
- [3] US Economy Today, August 12, 2007.
- [4] FDI in India. and US, <http://www.economywatch.com>
- [5] Under Secretary for Public Diplomacy and Public Affairs, Bureau of South and Central Asian Affairs, December 2006.
- [6] WISE/NIRP Nuclear Monitor, Oct 24, 2003.
- [7] KPMG IN INDIA, Indian Energy Outlook 2007.
- [8] Anil Kakodkar, Chairman, Atomic Energy Commission, *“Energy in India for the coming decades”*, March, 2005, DAE internet insert.
- [9] Planning Commission of India, 2006.

- [10] M. V. Ramana and Suchitra J. Y., Infochange News & Features, June 2006.
- [11] India Post, 30.4.2007.
- [12] Investment World, June 25, 2000.
- [13] The South Asian, April 16, 2006, quoting a 2003 article by M. V. Ramana.
- [14] Arjun Makhijani, The Hindu, April 25, 2001.
- [15] Kedar N. Prasad, William C. Cole and Gerald M. Hasse, Experimental Biology and Medicine, 229, 378-382, 2004.
- [16] Sunita Dubey in Siliconeer Magazine, reprinted by The South Asian, April 1, 2007.
- [17] S. P. Udayakumar, SACCER, in The South Asian, September 3, 2005.
- [18] M. V. Ramana, The Hindu, May 28, 2001.
- [19] Sandeep Pandey, The South Asian, May 13, 2007, reprinted from The Indian Express.