Nuclear power and the Indo-US nuclear deal

Introduction

It is clear that nuclear power is essential to the future of the world. This is based on the high cost of oil, the limited resources of fossil fuels on the planet, and the dangerous effect of emissions from fossil fuels on our climate. For a large, fast-growing country like India, nuclear power is doubly important. The Indo-US nuclear deal is supposed to address our growing need for nuclear power. To decide whether or not this particular deal is truly beneficial for the country, we must naturally perform a detailed cost-benefit analysis. Since these are deeply technical matters, this cannot be done by politicians or diplomats alone– it has to involve the scientists.

It is a matter of regret that based on such an analysis one has to reject the Indo-US nuclear deal in its present form, for the simple reason that its benefits are outweighed by its costs in terms of the conditions imposed on our independence of action.

Need for a Deal

Two major types of benefits are advertised: access to the latest technology to strengthen the indigenous programme, and access to uranium and to reactors to augment our power production. Of these, the former is simply incorrect. Our indigenous programme is based on heavy-water reactors, fast-breeder reactors, and thorium utilization. The US programme is based on light-water reactors – and even these have not been built in the US for almost 25 years. In fast-breeder technology we are well advanced. Unlike us, the US and other Western countries have easy access to uranium and few resources of thorium, so they have no interest in thorium utilization. Finally, around 90% of the components in our reactors are indigenous. So what technology import are we talking about? It would be economically more fruitful for us to instead focus on the export of nuclear technology!

The latter, access to uranium and additional power-producing reactors, is also hyped-up. The deal does not involve selling us uranium at subsidized or fixed prices. It only allows us to buy uranium from the market. Similarly, the deal does not guarantee us a single new reactor. It only makes it possible for us to explore the international market, and negotiate to buy reactors at market prices. The price of uranium is presently $85 per pound, up from $20 per pound three years ago. If the demand from India and China goes up, the price can only

go up further. Overall, the cost of electricity from imported reactors will definitely be more than the cost from indigenous reactors. In addition, one can expect a host of legal wrangles, including the issue of government guarantees, in importing such expensive and sensitive items. Further, we have to submit to intrusive safeguards, the character of which have changed in the past and will continue to alter in the future. Being a non-weapon country we will be at the receiving end without any option for withdrawal.

The costs of the deal, on the other hand, are substantial. The most important one is that it will seriously impact national security. Further testing is essential for us to develop and maintain a credible nuclear deterrent. That will become impossible, in spite of the repeated assertions that the agreement does not infringe on our sovereign right to conduct nuclear tests. Imagine that the 123 Agreement is indeed ratified and operationalized, and we have imported some 5,000 MW of reactors. If then changed geopolitical circumstances make it desirable, even imperative, for us to conduct nuclear tests, no reasonable Indian government of the future would dare to do so, given the large dependence on power from the imported reactors. In other words, when we sign the 123 Agreement, we will also be signing away our ability to act independently in the strategic sphere. It is sometimes argued that it is not essential to test. This position is contradicted by the actions of the US itself. Even after sixty years of weapons development and over 2,000 tests, after the end of the Cold War and the emergence of a 'unipolar' world, the US want to start RRW project, to invent new nuclear weapons and to maintain their stockpiles in operating readiness. Further, the Russians announced the other day a new weapon called the 'father' of non-nuclear weapons. Does this presage a return to the 'Cold War' days, and if so, will we not need to be well prepared?

So, if we need more nuclear power, and if the Indo-US nuclear deal is not acceptable, then what are the alternatives? Let me address these alternatives in some detail.

Our reactor options

We have chosen the pressurized heavy-water reactor (PHWR) route to nuclear power. These reactors use natural (i.e. un-enriched) uranium as fuel, and heavy water as moderator. The technology for making the components for such a system, from developing exotic materials like zirconium, to the control electronics, to the turbo-generator, have all been developed in the country. Two 550 MW electrical power stations have been built and are operating at Tarapur, which were recently dedicated to the nation by the Prime Minister. Work is on hand to scale up the design to 700 MW in the new power stations to be built.

The economics of nuclear power based on an indigenous industry, has also been proven. The clamour for the import of light-water reactors of 1,000 MW capacity as an additionality, is therefore only like importing high-end cars like the Mercedes. It is not the work-horse for securing nuclear power for the future of the country.

Light-water reactors from the US are not the only option. Recently the head of AECL in Canada has issued a statement (published by PTI) which talks of modified Candu reactors which will use MOX fuel involving plutonium and thorium and thus introduce thorium in the fuel cycle earlier than fast breeder reactors – an old concept similar to our Advanced Heavy Water Reactor (AHWR) but utilizing the same hardware of CANDU which will make it most economical. He has also welcomed cooperation in introducing it in India since we have established reprocessing and MOX fuel making facilities long ago some fifteen years. We should grab such opportunities because we have demonstrated successful cooperation with them. It will also free us from the hold of enrichment cartels that can hold us to ransom in the future.

Another direction is to accelerate our fast-breeder programme. Breeder reactors make more fuel than they burn. Theoretical concepts which will allow in situ burning of fertile material like depleted uranium and thorium are also coming up, especially from BARC. Because of the high-temperature sodium that is used as the heat removal agent, they have higher efficiency in converting heat to electricity. The Prototype Fast Breeder Reactor (PFBR) project will establish our capability to be on our own in this area. To speed up large scale commercialization we should invest in one more PFBR as well as on reprocessing plants. Dedicated reprocessing plant with IAEA and US approval under additional protocol can be a non-starter if we go by previous experience. The dedicated reprocessing plant as envisaged in the 123 Agreement will at least take ten years to provide plutonium fuel for our fast reactors. Do we wait for another six yeas or more to reprocess the accumulated fuel from the light water reactors at Tarapur?

Problem of availability of uranium

It is true that there has been a mismatch between our mining and processing of natural uranium and our needs, which has produced a bottleneck in our operating PHWR reactors. This is because of several reasons: the high cost of production due to the low grade of the ore, diversion of uranium for enrichment for strategic purposes, lower burnup in the reactors for operational reasons etc. At one stage one did hope for import of yellow cake from the international market, which was prevented by our dearest friends even though

we offered to put them under safeguards. As the Australian PM recently declared, if we sign the 123 Agreement that country will consider supplying uranium to India, for we will then have effectively signed the NPT – something Indian governments have refused to do for years. Should we really panic at this stage? Does this not give us an opportunity to plan better, fuller utilization of the un-burnt fuel in our existing reactors, the Tarapur reactor in particular, and not be content with just burning less than one percent of the uranium that we have mined and utilized. The Canadian approach described earlier is one example of reducing our requirement of fresh natural uranium. The AHWR concept is again a feasible proposition, but has not proceeded fast enough. In any case, for the good of the world, when every uranium atom is fissionable we should try and make it possible rather than wasting most of it as the US has pioneered over the last 35 years. Special scientific committees in the US have advocated reprocessing of commercial fuel and utilization of the fissile material more effectively, but the insistence on the 'black box' non-proliferation regime advocated self-denial in that country. It is only Japan which has very strong interest in reprocessing light-water reactor fuel, to make it a richer energy source for the future.

Uranium ore was not considered a valuable material until the discovery of fission. It had very little practical use as a chemical substance. Therefore, there wasn't much interest in exploration for uranium deposits. It is only now that we find that the uranium is getting to be more important even compared to oil and gas. The resources must be more uniformly spread on the planet than we think it is. Research and Development in uranium exploration hasn't received enough attention. Since the discovery of rich ores in Africa, Canada and Australia, and their easy access to the US, it prevented commercial interests for exploration. In the Soviet Union, because of its connection with the defence needs, there was no question of costs and exploitation of even low-grade ore has gone on for years. If we prove greater percentage of burn-up of uranium, then the cost consideration may not apply.

What about the availability of uranium in non-NSG countries? There are several areas in Africa, South America that have uranium ore. They are not members of the NSG. Unfortunately, the commercial industries in advanced countries quickly grab control over these sources, and prevent free trade. The question may be asked, whether controlling trade in natural uranium is called for to implement the non-proliferation regime. But, it is they who make the rules.

Barter deals

In our experience, during the early years of our independence, Homi Bhabha complained to Pandit Nehru, that there was an attempt to internationally control even the mines of exotic materials in developing countries. The Atomic Energy Act in India, thanks to his efforts, described in detail the atomic minerals and prescribed that the ownership and control will rest with the government. Once, in Parliament, Panditji even talked of how we cannot agree to international control of mining operations. The export of beach sands was stopped and was taken over by the Department of Atomic Energy. Nobody had a right to export monozyte without approval of the DAE, which bought over that portion of the mineral sands for stockpile. There is a complaint that right now the beach sands are being illegally exported from the southern tip of the country, and there is even a court case in Madurai.

When necessary, Homi Bhabha also resorted to bartering strategic materials in return for equally important equipment. I remember a 6 MeV van de Graff accelerator, a state-of-the-art machine made by High Voltage Corp., then coming into vogue for nuclear research, was imported by bartering mineral sands to the US. The beryl ore, which contains beryllium, another strategic material, was bartered with France for sharing the technology of making beryllium oxide, as well as using it as a moderator in a reactor, under joint collaboration with Saclay, France. We have at present capability in nuclear technology, ranging from isotope production, research reactors, use of isotopes in health and industry, heavy water – a very sensitive material for reactors – zirconium and its alloys for components of nuclear reactors, as well as beryllium metal. At a crucial stage like this, when not market forces but international cartels control trade, it is necessary for us to think of bartering this material with non-NSG countries, who are not bound by NSG rules. Don't forget that there is more uranium dissolved in the ocean waters, and when researchers succeed in extracting that from sea-water, there could be no control over the uranium supply. For that effective R&D is required.

Separation plan

In the July 2005 statement India offered to provide a plan for separating its facilities into civilian and military. The option of putting the civilian facilities under IAEA safeguards, and at what time, was supposed to have been left to India. However, it took seven months, until March 2006, in lengthy discussions with the US, to arrive at an agreement coinciding with the visit of President Bush. Since the separation plan is applicable only to weapon states, it was presumed that the US had at last accepted India as possessing nuclear weapons

and having a strategic programme. However, the non-proliferation lobby in the US had argued that the separation plan violated the NPT requirement of full-scope safeguards, which means, all facilities should come under IAEA safeguards. The US Congress eventually passed the Hyde Act with the sole aim of restricting the availability of basic material for weaponisation, and putting many restrictions on our reprocessing facilities. This was to make it acceptable to the US Congress, and they in turn brought in the termination clause on the nuclear tests such that India doesn't make further progress in this field. Even though India protested, the US administration could not influence the decision of the Congress. In the 123 Agreement, we see no mention of an agreement with respect to the separation plan, which clearly shows that the US has now left the burden of agreeing to the details of the separation plan to the IAEA, under the India-specific safeguards agreement that is to be negotiated. It was not an easy task for DAE to agree to this separation plan, because the facilities weren't built like that. Now the IAEA can ask for a complete list of nuclear facilities and ask why only certain facilities are put under the civilian list, and question the timing. It can logically put restraints on the use of any of these facilities from one sector to another. When we signed an agreement with Pakistan on not attacking each other's nuclear facilities, we had to declare where and what are the nuclear facilities, which certainly revealed information which was not necessary in the public interest. In the same way the IAEA India-specific agreement may also be injurious to our strategic programme. It is surprising that the separation plan is neither an agreement nor a unilateral declaration by India. The Nuclear Suppliers Group will again have a chance to pick holes in our separation plan. Therefore the claim that the 123 Agreement solves all problems satisfactorily is not necessarily true.

Conclusion

The scientists have no fears about importing light-water reactors along with the fuel, to augment nuclear power sources. We have, for example, started off our nuclear power programme with the Tarapur light-water reactors, imported from the US. We have the Kudankulam project which has 1,000 MW reactors built in collaboration with Russia, which is an NSG country and has agreed to supply fuel for its lifetime. Other countries have bought light-water reactors, like Japan, South Korea, China. But what is questionable with the Indo-US deal, is their insistence on conditions extraneous to nuclear power, about which the media have elaborated. Even Supreme Court lawyers and judges have pointed out how amending the national law by the US, under the Hyde Act, is not sufficient to give us the freedom to pursue our strategic programme, and continue our three-phase power programme without strings attached. If the US trusts us as a strategic partner, which believes in their non-

proliferation regime and will not do anything to support attempts at making WMD in other countries, I don't see why they should not trust that our efforts in enhancing our abilities in reprocessing technology is purely for our fast-reactor programme and thorium utilization. We don't have to fall in line with their thinking on the next generation reactors or what their programme is to enhance nuclear power in their countries. On the other hand, competition in nuclear technology could lead to safer, more economic and cost-effective systems being developed, by India and China, taking into account the much lesser cost for R&D as well as manufacturing of components.

The growth of nuclear power in this country has to be based on expanding our indigenous capability, rather than importing the reactors as well as the fuel for its lifetime. To make a stock for a lifetime of 40 years of a nuclear power station, by investing in the fuel, is certainly not economical, considering the high interest rates obtained in India. It also speaks of a lack of confidence in our own ability to expand the enrichment capability in India, as well as making the MOX fuel, which also can be used in the light-water reactors. We must allow the future generation of scientists and engineers to innovate new systems, so that we demonstrate to the rest of the world that India is capable of leading the world in nuclear technology. The AHWR and the fast-breeders are examples of this type.

Nuclear science will progress, and new options will appear, as long as one is willing to think, experiment and innovate. The control on the thinking process is the worst thing that can happen to any country. Well established infrastructure can quickly decay if rational progress is not made. Even the US will find it difficult to get manpower if a sudden decision is made to climb back onto the nuclear bandwagon. Political decisions cannot create capability overnight. It has to be nurtured and grown in a systematic manner, without entanglements like in the proposed deal. That is where political decision of a type which goes beyond pure finances and economics, are called for. The debate is about not survival but progress. For example, if we hadn't expanded our agricultural production, won't we be importing food at enormous cost, upsetting our economy? If we hadn't built large-scale steel, cement etc. industries, would our industrial capacity and growth-rate have the present status? Mere foreign investment in terms of dollars is not enough to sustain a growth-rate, unless it is backed by productivity in agriculture, industry, and in education. We are reaping the benefits of a high level of education in the software industry, but this has to be backed by a sustained growth in technology. The satellite launching capability demonstrated by the GSLV is an example of how the future can be secured by a consistent policy which is based on self-reliance.

The scientists' opposition to the nuclear deal is not based on capitalism or socialism, but to allow indigenous growth in capability in nuclear technology, which will assure energy security in the long run. No economist has ever proved that out-sourcing nuclear technology for sustaining power growth in India is feasible or warranted. The sacrifices one has made in the past and that one is willing to make in the future, are testimony to a vision which originated with Nehru and Bhabha, and which was sustained for generations by a political will. One can change perceptions on non-alignment, global trade, etc., but it has to be realistic, taking into account the teeming population, the opportunity for jobs, and building up our capabilities in the industry, defence, and agriculture. A holistic view of progress is what is called for, and perhaps a rededication of what happened in space and atomic energy in the past, is the best way for growth in the future.

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