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Why the Nuclear Energy Path is Suicidal

- Homepage - Background papers -

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Dr Manmohan Singh, our Prime Minister, was at his compromising worst when he clubbed nuclear energy with the solar as the necessary energy path. At the Indian Science Congress' inaugural session on January 3 this year, he declared that the nuclear, the solar and clean coal technologies, would have important contributions to make to the country's energy security. This is a stock phrase, riven by inner contradictions, taught by the US power elite. It is fraught with confusion and a potential for misdirection.

Nuclear energy is the poorest yielder in terms of investments and is also the unsafest. Its every step bristles with radioactive hazards while the solar and other forms of renewable energy are abundant producers, non-polluting, free from hazards, and are far cheaper in costs.

The following are the reasons why the nuclear path must not be trodden at all.

(i) Given a determined political will, all energy needs can be met by renewable forms of energy plus clean coal-and the emerging hydrogen production-cum-use technologies-within the next two and a half decades, by which time natural gas will tend to decline in availability. Investments in nuclear plants will pre-empt the resources and starve the renewable energy projects.

(ii) France's claim about the sustainability of nuclear power production is wearing thin. No private company in any part of the world is now willing to construct a nuclear power plant because of its high cost and prospect of heavy loss. At the cost of the public exchequer, governments can try to build it up, as France did. But people's resistance will make the setting up of this plant extremely difficult. It is now public knowledge that Electricite de France had to raise 33,000 million dollars as loans in the international market and that it has not so far been able to repay anything except the interest, despite its large income from arms sales.

(iii) It is immoral to build new nuclear power plants when humanity does not as yet know how to dispose of the accumulated radioactive wastes of the last few decades, which are becoming grave health hazards. In certain cases, these wastes have been flowing to the rivers and seas for years. Some are contaminating groundwater.

(iv) An approach that accepts mega plants in general, and the most capital-intensive and most complex nuclear power plants in particular (which are also non-adaptable to "step-up" and "step-down" measures), is headed for centralist development. It promotes centralisation of economic and political power and spurs the growth of dictatorial tendencies, even within the structure of formal democracy. As against this, reliance on renewable energy sources and clean coal

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technologies can open up a vista of durable prosperity and genuine democracy.

(v) Contrary to popular belief, nuclear power plants' net output of electricity is unimpressive. When the total output of power over 30 years of the plant's life is weighed against the total expenditure of energy during the different stages of its fuel preparation and operation and surveillance of the decommissioned plant over thousands of years thereafter, the net outcome appears small, not worth the risks involved.

(vi) Even though the quantities of energy embedded in the atom are massive, as explained by Einstein's equation, E=mc2 (that is, the energy content is equal to the mass lost in the fission of heavy atom multiplied by the square of the speed of light), these are not suitable for any benign use. On the basis of evidences, we can say that if these are sought to be harnessed by man, these will only lead to destruction, including self-destruction of man.

Of the six points listed above, the fist needs substantiation by a wealth of data which are best left for a separate, full-length article in a forthcoming issue. Points two and three are self-explanatory and need no elaboration.

On-Site Integration of Renewable Forms of Energy For Every Home

POINT number four is supported by the premise which most people now accept (but the state authorities wobble over) that decentralised development brings out the best and most durable development and universally shared prosperity.

In the sphere of energy, the agencies of the state give priority to national electric grid, super-thermal power plants, mega dams etc. despite their eco-destructive effects. Politicians have a liking for glamorous mega projects which give them pride and also feed their party funds. Empirical evidence shows that this approach keeps the poorer people starved of the types of energy they need. The alternative approach ought to be: on-site integration of all forms of energy for energy sufficiency of every home in every village, under the leadership of the gram sabha. The gram sabha's attention will naturally be towards renewable forms of energy-that is, direct solar energy, wind energy, micro-hydels, biofuels etc. The responsibility for coastal wind farms can be taken by zila parishads or State governments. National authorities have to take the responsibility for promoting all sophisticated technologies including the solar and exploring the possibilities of harnessing power from the sea tides and ocean currents.

Manufacture and use of solar cookers, solar collectors and

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photovoltaics have not made much headway even though these have been discussed for decades. Responsibility on, and power to, the people for their own energy sufficiency will lead to a nationwide animated campaign to harness the energy sources which have hitherto remained largely untapped. Village-wise competitive cooperation will bring a burst of creativity in both manufacture of the required instruments and generation of energy.

The nuclear energy path blinds us to the need for on-site integration of all forms of renewable energy.

Heightened Expectations but Poor Gains

NOW to point number five. Generations which have been reared on the concept that the nuclear energy output is immeasurable will be aghast at the statement that its outcome is unimpressive. Yet, that is the finding of experts who undertook to apply the test. About thirty years back, the present writer, along with Dr P.N. Tiwari, then the Director of Nuclear Research Laboratory of the Indian Agricultural Research Institute, and Prof R. Misra, India's doyen of ecology, happened to participate in a discussion with Dr Howard Oddum, an internationally acclaimed energy expert from the University of Florida. Prof Oddum said that, according to his team's analysis, the total expenditure of energy on uranium ore mining, purification, enrichment, pelletisation, transportation of fuel rods, nuclear plant operation, spent fuel reprocessing, and storage of wastes in the yard, consumes three-seventh of the total energy output of 30 years of the nuclear plant's life. To this we will have to add the energy that will need to be spent on surveillance of the decommissioned plant and its surroundings and safe containment over thousands of years.

He felt that this could as well consume the remaining four-sevenths of the plant's energy output. Of course, no country is providing for surveillance for more than a couple of hundred years.

When Prof Oddum was saying this, another idea flashed across my mind. If this is the situation in energy calculation, what about the losses from the land spaces that will have to be given up for the cemeteries of serial nuclear plants? There will be numerous cemeteries, considering that a nuclear plant's average life span is around 30 years!

Even if we suppose that in Oddum's analysis, there was some exaggeration of the amount of energy expenditure and considerable underestimation of the cumulative output of, say, 45 years (which is now considered possible as the plant's life span), the outcome would still be unimpressive.

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In any case, available literature suggests that less than a mere one per cent of the energy content of the fuel can be used before it has to be removed from the reactor.

Considering that only one-thousandth part of the ores could be used as material for the fuel preparation and that less than one per cent of the energy content of the loaded fuel can be tapped, it must be considered a very inefficient way of using resources.

Massive Quantities Alright but Not for Man's Tapping

THIS is not exactly a novel plea. Lord Ernest Rutherford, the great scientist who had made the basic studies for understanding the structure of atom, had virtually come to saying this. He passionately believed that these energies were safely contained in the innermost part of the atom protected by strong electric repulsion between positively charged nuclei: hence, those who believed that these could be put to any practical use were just day-dreamers.

His contemporaries thought that he considered it impossible for man to get over the barrier. But his objection seems to have been more fundamental.

Edward Teller narrates an episode. Leo Szilard in the mid-1930s came to persuade him to give up his opposition to exploiting atom for energy purposes on the ground that science could some day find a way to force the positively charged particles to meet each other by crossing the barrier. Rutherford was so incensed that he threw Szilard out of his office.

In the mid-1940s, interactive efforts by scientists of different countries discovered that one building block of these very nuclei, namely, neutron, could be separated from the nucleus and then made to hit the nucleus. When a neutron hits the nucleus, more energy is released than a million chemical reactions could produce. This led to the making of the atom bomb, the weapon of mss destruction. Szilard and men of his way of thinking might have rejoiced at this use of the energy of the atom.

But experiences of the last six decades have proved that Lord Rutherford would have been hundred per cent right if he had added only one word, to say that these energies could not be put to any use, benignly. Philosophically inclined scientists could even now hail Lord Rutherford as the seer. Just as men came to realise in recent times that Nature protests against man using the hydrocarbons (coal and oil) stored underground in her deep vaults-this she does by emitting pollutants in the atmosphere-scientist-philosophers like Lord Rutherford could perceive quite early that Nature would protest with greater vehemence when energies stored under greater protection

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in the innermost recesses of atom are sought to be exploited by man. Nature's protest here is by way of spreading radioactivity all over and poisoning the lives of plants and animals.

Since philosophy is no substitute for hard facts, we need to see how the spread of radioactivity begins from the mining stage and occurs at every step of the transactions with atom. Uranium, till recently considered the heaviest element (and its uranium-235 isotope being the most fissile, and u-238 being fertile), was the first element to be tried for nuclear power generation.

Danger at the Mining and Milling Stage

URANIUM is usually found in low concentrations. One tonne of ore usually produces only one kg of uranium, leaving 999 kg. as wastes. These huge wastes from the ores spread radioactivity through the air and downstream into the rivers, lakes and ground water. In the mill (adjoining the mine) where the ores are pulverised, and mixed with water and chemicals to make a kind of "yellow cakes", the wastes-called "mill tailings"-present a huge nuclear waste problem. In quantity, the wastes at the source are the largest; in terms of routine and accidental radioactive releases, too, these are deadly. Even though these are rejects, these retain about 85 per cent of uranium's radioactivity. Because of these tailings' long-lived radioactivity, these get morphed into isotopes of various other elements-cum-radioactive metals which keep disintegrating. Of these, thorium, again, disintegrates into radium-226 which breaks further into radon-222. Thus, various channels for the spread of radioactivity open up. Radon needs special mention. It being a gas, drifts far away and gets inhaled into animals' lungs to cause lung cancer far and wide. No wonder that in Jadugoda (Jharkhand) and its neighbouring areas, there is a high incidence of incurable diseases among men and women of all age groups. Besides, there are high rates of infertility, miscarriages, stillbirths and deformities of various types.

Radioactivity Spread at Enrichment Stage

THE next stage is uranium enrichment. Although India has not built any enrichment plant and does the enrichment on laboratory scale, pressure may build up for setting up some such plants if several new nuclear power plants are going to be launched.

It is a highly energy-intensive and expensive process. The uranium enrichment centre at Oak Ridge consumes the entire output of two atomic power plants of 1000 MW each. The enrichment process emits greater radioactivity than the milling process and is harmful to the populace of a wider area. During this process, a certain percentage of uranium itself escapes into the atmosphere either as liquid or

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gaseous substance. Particles of uranium, mixed with dust solubles, polychlorinated biphenyles, heavy metals and other pollutants become lethal on ingestion into human and other animal bodies. The "enrichment tailings", too, are more radioactive than "milling tailings" and need to be preserved with greater protective cover.

Peril at Post-enrichment Stage

AT the post-enrichment stage, uranium becomes the source of another peril. It becomes the coveted object of the forces of terrorism. By stealing some amounts of enriched uranium (to make bombs), by direct attack on nuclear power plants, or by attacks on the cooling tanks of the superheated fuel rods, the terrorists can create havoc. In today's condition, this is a distinct possibility. According to a study by Brookehaven Laboratory, one such attack can cause the death of 28,000 persons and destruction of 59,000 million dollar worth of properties.

Then, the spread of reactivity from even a normally operating reactor (furnace) is considerable. In order to prevent the reactor from getting overheated, one-third of fuel rods has to be taken out of the furnace every year and kept immersed in cool water. Since these rods are extremely hot, the pool becomes the niche of transmuted elements like Strontium-90, Iodine-131, Caesium-137 and Plutonium-239. These are all deadly radioactive substances, Plutonium-239 topping all in radioactivity and toxicity. Plutonium's half-life is 24,000 years. Its each milligram that escapes into the atmosphere keeps causing death for thousands of years.

Dangers from Meltdown

AND if there is a meltdown of the reactor core, then, it means a universal dissolution-like cataclysm in a large part of the world. Despite many attempts at underestimating the Chernobyl (in Ukraine) casualties, a report published in April 2006 by the World Information Service on Energy revealed that it resulted in the death of 93,000 persons. The Vice-President of Ukraine's National Commission for Radioactive Protection has revealed that five lakh people have been victims of radioactivity in his country alone. Among those who participated in the clean-up operation, as many as 34,499 persons died, and thyroid cancer and leukemia have become endemic. And the rate of infant mortality went up to 30 per cent (from 20 per cent). Reports from many countries of Europe revealed that their butter, foods and fodder became contaminated.

The casualty figures from the USA's Three-Mile Island meltdown remain suppressed. Despite greater fortifications following these meltdowns, it can be said that there can be no fail-safe arrangements against human errors and/or technical faults. Accidents will happen if

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nuclear power plants continue to be constructed. The horrors of accidents in Breeder Reactors cannot even be imagined. The UK and the USA and Japan abandoned their Breeder Reactors earlier. France, too, has closed them. In the USA, there is now no commercial unit for reprocessing of the spent fuel. The Department of Energy Studies, Jadavpur University has information that a nuclear power plant in the USA, built at the cost of 12 billion dollars, has been sold out for just one dollar. Since 1978, there has been no order in the USA for any new nuclear power plant. Even though the Bush Administration is now trying to revive the order on the plea that it does not emit greenhouse gases, no non-government company will undertake it nor will people allow it. The journal, Forbes, says that the US industries incurred a loss of 145,000 million dollars by their nuclear plant ventures.

Conclusion

DESPITE all these evidences, there are people in our country who continue to argue that with greater progress in technology, nuclear power plants may one day be safe and that to bar them will be against progress. They need to examine themselves what their stance will be if a nuclear plant is going to be sited in their area. To the lobbyists for nuclear power, we can just offer Lord Rutherford's implied version: the massive energies stored in the atom can be used only to cause destruction. Nature designed it to maintain the earth's background radiation. By trying to exploit the minute atom in a mega way, mankind can only destroy itself.

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