NUCLEAR ENERGY; SWANSONG OF ENERGY SECURITY OR SAGA OF UNIMAGINABLE MISERY

Two billion people worldwide and almost half of the Indian population have no access to electricity today. However, the choices of energy generation being made need to take into account the future of the earth, lives and livelihoods of billions of people, and safety to present as well as future generations. The recent nuclear plant Fukushima, Japan meltdown has not only raised the issues of nuclear safety but also questioned the rationale of nuclear energy. As a response to the horrific accident, China froze further approvals to nuclear power plants, until the safety conditions are reviewed, Italy called for one year moratorium, Germany shut down its oldest power plants and plans top switch off all its 17 plants by 2030. While US remain tightlipped (Obama having sanctioned USD 32 billion subsidy to nuclear energy programme) India called to review the safety standards of all its plants. Public opinion against nuclear energy roared all over the world where people met to mourn the dead in Japan and extend support and solidarity to the surviving many of them would come to believe what Nikita Khrushchev said long back "living would envy the dead." Closer home thousands of people have been protesting against the proposed nuclear power plant at Jaitapur in Ratnagiri in Maharshtra. Since 2009, when they started protesting little did they know that it was more than acquisition of their land and remote radiation threats.

Whether nuclear energy is at all an alternative?

Today's governments find it convenient to say that nuclear energy is the cheapest source of energy. In fact, even on paper, nuclear energy is twice as costly as electricity from coal and gas. Its actual cost is much more than this. All over the world nuclear power generation is hugely subsidized. These subsidies include: research costs, costs associated with transporting and storing the radioactive waste, operational costs including security against terrorist attacks, the huge costs of decommissioning the reactors once their operating life ends. All these are not included while calculating cost of nuclear power. Further, all liabilities in case of major accidents too are assumed by governments. And finally, the health costs associated with the radiation emitted routinely at each stage of the nuclear cycle are not even taken into consideration; they are not even admitted by governments.

The economic performance of nuclear power is heavily dependent on the construction costs, and delays in construction have had a significant impact on the economics of nuclear power, interest on the capital borrowed to build the plant will increase with construction time. These economic problems can be seen in different regions around the world. In country after country nuclear construction programmes have gone considerably over-budget. In the United States, an assessment of 75 of the country's reactors showed predicted costs to have been USD 45 billion (€34bn) but the actual costs were USD145 billion (€110bn). In India, the country with the most recent and current construction experience, completion costs of the last 10 reactors have averaged at least 300% over budget.

Nuclear power is not cheap. Costs associated with safety and security, insurance and liability in case of accident or attack, waste management, construction and decommissioning are rising substantially for nuclear power. The economics of nuclear power have always been bad, and the industry only really got off the ground as a mask for nuclear weapons programmes. The fact that consumers or governments have traditionally borne the risk of investment in nuclear power plants meant that utilities were insulated from these risks and were able to borrow money at rates reflecting a reduced risk.

Nuclear energy is clean and climate friendly

Besides the argument of being cheap, governments and nuclear power industry also claims that nuclear energy helps to contain climate change. The Massachusetts Institute of Technology (MIT) and other studies estimate that for nuclear power to have any effect on global warming, we would need to build a minimum of 1,000 reactors worldwide. This is a wildly unrealistic scenario, given that the current growth in nuclear electricity is at about 4%, and investors refuse to buy into nuclear power's dubious economics. It is true that nuclear energy dies not produce CO2, however, it is highly energy intensive and use fossil fuel at each stage from uranium mining to waste storage. Research carried out for the European Union concluded that when looking at the whole cycle of nuclear generation, from mining the uranium to decommissioning the plants, nuclear power stations would produce around 50% more greenhouse gas emissions than wind power. Besides, reactors routinely release radioactivity. Even if it were climate-friendly, nuclear power could do little or nothing in the fight against global warming. Nuclear power is used only to generate electricity. It represents a mere 16% of the world's electricity. Electricity itself only accounts for approximately one third of greenhouse gases.

Nuclear energy is deadly

Nuclear energy is generated in a nuclear reactor when nuclear fuel (uranium 235) kept in the reactor core is split up, releasing huge amounts of heat. This heat is used to produce steam, which in turn is used to drive a turbine to generate electricity. During this fission process it creates more than 200 types of highly radioactive elements, which did not exist till the uranium atom was fissioned by man. The resulting uranium fuel in the reactor core is intensely radioactive: a 1000 MW nuclear power plant contains an amount of long lived radiation equivalent to that released by 1000 Hiroshima bombs! Many of these radioactive elements will continue to emit radiation for thousands of years. Impact of this radiation on the human body is deathly. It mutates the genes in the cells, causing cancer; it also mutates the reproductive genes, causing all kinds of diseases and birth deformities in future generations.

On April 26, 1986, Unit Four of the Chernobyl Nuclear Power Plant exploded. Almost all the deadly radioactive fission products in the reactor core were spewed into the environment. Its consequences have been horrendous. More than 100,000 square miles around Chernobyl – an area slightly less than the size of Maharashtra – is heavily contaminated, and will remain so for thousands of years. Tens of thousands have died from radiation induced diseases. The seven million still alive and living in this region know that they are forever contaminated, that they could develop cancer anytime, that their children and grand children and great grand children could be born with severe birth defects. Radiation released into the atmosphere has contaminated almost all countries in the Northern Hemisphere. Food in many parts of Europe will continue to be radioactive for hundreds of years. Sharp rise in cancer has been recorded in countries as far away as Sweden and France.

In March of 1979 equipment failures and human error contributed to an accident at the Three Miles Island nuclear reactor at Harrisburg, Pennsylvania, the worst such accident in U.S. history. Consequences of the incident include radiation contamination of surrounding areas, increased cases of thyroid cancer, and plant mutations. According to the US House of Representatives, Subcommittee on Oversight & Investigations, "Calculation of Reactor Accident Consequences (CRAC2) for US Nuclear Power Plants" (1982, 1997), stated that an accident at a US nuclear power plant could kill more people than were killed by the atomic bomb dropped on Nagasaki. An accident of this kind can be repeated by any one of the world's 400 or so nuclear reactors, of which 104 are located in the US.

Besides being deadly, nuclear energy production is extremely hazardous to the environment and bio-diversity. All the steps in the complex process of creating nuclear energy entail environmental hazards. The mining of uranium, as well as its refining and enrichment, and the production of plutonium produce radioactive isotopes that contaminate the surrounding area, including the groundwater, air, land, plants, and equipment. As a result, humans and the entire ecosystem are adversely and profoundly affected.

No solution to radioactive waste and threat of nuclear proliferation

Each 1000 MW nuclear power plant generates 30 tons of extremely potent radioactive waste annually. There is no way known to safely dispose this deadly material, which remains radioactive for tens of thousands of years. The half life of degeneration of plutonium is 2400 years. Its active life having potential to cause cancers is many times more. At present this waste is stored near the reactors in huge cooling pools. Were an accident to happen in one of these fuel pools, it would make Chernobyl look benign!

Nuclear power provides the basic ingredients for nuclear weapons, dirty bombs and provides an obvious target for terrorists. Nuclear technology, such as uranium enrichment is also used in nuclear weapons production, and therefore a proliferation risk. There are now more than 40 countries civil nuclear power programmes giving them the tools for nuclear weapons. Nuclear technology will always carry the risk that it will be used to construct weapons of mass destruction. In the year 2000, an estimated 310 tons (620,000 pounds) of civilian, weapons-usable plutonium had been produced. Less than 8 kilograms (about 18 pounds) of plutonium is enough for one Nagasaki-type bomb. Thus, in the year 2000 alone, enough plutonium was created to make more than 34,000 nuclear weapons.

Nuclear energy is outdated. There are 438 nuclear power plants located in 33 countries around the world. No new nuclear power plants have been set up in the US since 1973. Many countries in Western Europe have stopped building nuclear power plants and Germany has decided to shut down all of its 17 nuclear power plants by 2030. The American nuclear industry giant Westinghouse has received only one order in the past 25 years. Tragically, many other countries, including China, East Asia and India, are continuing to set up new plants.

Viable alternatives

There is no energy shortage. More energy falls on the Earth each day than its 5.9 billion inhabitants would use in 27 years. Solar generated power could provide the current world energy use 10,000 times over. Renewable energies could cover the global energy demand six times over with today's engineering – sustainably, peacefully, cleanly and infinitely. Every dollar invested in electricity efficiency displaces up to seven times as much carbon dioxide as a dollar invested in nuclear power.

To install renewable energy generators is faster, cheaper and more reliable that the installation of nuclear power plants. Construction time e.g. for wind turbines is approx 2 weeks, plus an average planning time of 1 to 2 years. Wind farms can "follow" growing demands from developing countries such as India and China easier than very low and uncertain nuclear projects. The German wind industry alone installed and generated more power within one decade than the nuclear industry did within a decade when they forced nuclear power onto the market. Most renewable energy technologies will be competitive against conventional fuels within the next 10 to 15 years – despite the massive subsidies still going to these conventional industries. Wind will be competitive within the next 5 to 7 years – based

on current fossil fuel prices. Oil, coal and gas prices have been rising for years and will continue to do so, as growing economies will crease their energy demand.

Nuclear energy in India

Electricity demand in India is increasing rapidly, and the 830 billion kilowatt hours produced in 2008 was triple the 1990 output, though still represented only some 700 kWh per capita for the year. With huge transmission losses, this resulted in only 591 billion kWh consumption. Coal provides 68% of the electricity at present, but reserves are limited. Gas provides 8%, hydro 14%. The per capita electricity consumption figure is expected to double by 2020, with 6.3% annual growth, and reach 5000-6000 kWh by 2050. India nuclear energy programme contributes only 3% of the total production from its 14 nuclear power plants. The government hopes to increase this contribution to 25% by 2050 with an investment of USD175 billion over next two decades.

The government of India has begun embracing nuclear power in a big way. The foremost reason for going ahead with the Indo-US nuclear deal is that *it could enable the country to generate 40,000 MW of nuclear power by 2020, from 3700 MW at present*. Proclaiming the need for ushering in a 'nuclear renaissance', the Prime Minister has stated that to meet India's growth needs, the country needs huge amounts of energy; since the proven reserves of coal, oil, gas and hydropower were limited, India's energy needs could be met through nuclear power which was affordable "*not only in terms of its financial cost but also in terms of the cost to our environment*."

India has a huge potential of producing energy from alternate sources of energy like wind, hydro, solar, tidal, wave, biomass and these cause little global warming. The entire future target set by the government of India for nuclear energy of 40,000 MW, and much more than this, can easily be produced from these renewable energy sources. The potential of producing energy from wind power is estimated at 45,000 MW, from small hydro power projects at 10,000 MW, from tidal power at 15,000 MW. The estimated potential of meeting rural energy needs through biogas plants and urban electricity needs through production of electricity from wastes is more than 20,000 MW. And then, the total potential of saving energy through energy conservation is estimated to be nearly 25,000 MW in the country.

Issues related to safety and regulation in India

The nuclear reactors in India are most rickety in the world and a serious threat to public and environmental safety. The two boiling water reactors at Tarapur are of 1969 vintage American design and all similar reactors all over the world have been already shut down for reasons of safety. Many parts of it are uninspectable and after 1974 no spare parts or assistance has been coming from the US. The two steam generators in each of the unit are totally disabled and therefore Tarapur Atomic Power Station (TAPS) was de-rated from 200 MW to 160 Mw. Rawatbhata Atomic Power Station (RAPS) was also de-rated from 200 MW to 100 MW after an end shield showed cracks and consequent leakages. RAPS and MAPS pressure tubes have also worn out and while many pressure tubes at RAPS, Maharshtra Atomic Power Station (MAPS) and Kalpakkam Atomic Power Station (KAPS) have been retubed, many units remain to be retubed. While the government of India maintains complete silence on accidents at its nuclear power plants, according to experts at least 300 accidents of serious nature have so far taken place, causing radiation leaks and physical damages to workers and nearby residents. Some of these, like the accident at Narora in UP in 1993, nearly caused a Chernobyl like meltdown.

The current state of affairs raises serious questions regarding safety and regulation in India. The Atomic Energy Regulation Board (AERB), the regulatory body is entrusted with ensuring safety in the country. The AERB is subordinate entity of the Department of Atomic Energy (DAE). The AERB is answerable to the Atomic Energy Commission (AEC) whose Chairman is also the secretary of the DAE. Two other members of the AEC are the Director of the Bhabha Atomic Research Council (BARC) and Managing Director of Nuclear Power Corporation of India Limited (NPCIL). There could not have been a more subservient body. AERB reports to those whom it is supposed to regulate and control in the public interest. 95% of the AERB staff are scientists and technicians on the payrolls of the DAE. The interference has manifested itself in toning down the seriousness of safety concerns agreeing to the postponement of essential repairs to suit to DAE's time schedule and allowing continued operation of installations when public safety consideration warrant their immediate shut down and repair. Post Chernobyl investigations found that lack of independence of the regulatory body was major contribution to the accident. The US regulatory mechanism was substantially strengthened after Three Miles accident. A 1996 proposal to make AERB functionally independent and autonomous gathers dust. Do people of India need to suffer in order to wake up the government to work on ominous signs and improve regulatory mechanism? Both the civilian and nuclear programme under DAE, it is in an excellent position to obstruct any effort to an autonomous regulatory body. Atomic Energy Act, 1962 which recognizes only peaceful deployment of nuclear energy has become redundant after 1998 weapons test, which was carried in violation of the Act. The AERB is also woefully understaffed and has only about 200 scientists and technicians to monitor 17 nuclear power plants, 5000 medical, industrial and research units, 5 uranium mines, and 50,000 radiographhy units. In addition, they are also supposed to take care of more than 80,000 permits annually for transportation of radioactive material throughout the country.

Issues of Nuclear liability

India's 1962 Atomic Energy Act says nothing about liability or compensation in the event of an accident. Also, India is not a party to the relevant international nuclear liability conventions (the IAEA's 1997 Amended Vienna Convention and has recently signed 1997 Convention on Supplementary Compensation for Nuclear Damage - CSC). Since all civil nuclear facilities are owned and must be majority-owned by the Central Government (NPCIL and BHAVNI, both public sector enterprises), the liability issues arising from these installations are its responsibility. On 10 September 2008 the government assured the USA that India "shall take all steps necessary to adhere to the Convention on Supplementary Compensation (CSC)". Under existing Indian legislation, foreign suppliers may face unlimited liability, which prevents them from taking insurance cover, though contracts for Kudankulam 1&2 exclude this supplier liability.

A bill related to third party liability has been passed by both houses of parliament. This is framed and was debated in the context of strong national awareness of the Bhopal disaster in 1984, probably the world's worst industrial accident. A Union Carbide (51% US-owned) chemical plant in the central Madhya Pradesh state released a deadly mix of methyl isocyanate and other gases due to operator error and poor plant design, killing some 15,000 people and badly affecting some 100,000 others. The company paid out some US$ 1 billion in compensation - widely considered inadequate.

The new bill places responsibility for any nuclear accident with the operator, as is standard internationally, and limits total liability to 300 million SDR (about US$ 450 million) "or such higher amount that the Central Government may specify by notification". Operator liability is capped at Rs 1500 crore (about US$ 330 million) or such higher amount that the Central Government may notify, beyond which the Central Government is liable.

The bill does not make any mention of India ratifying the Convention on Supplementary Compensation for Nuclear Damage (CSC), and any international treaty or framework governing nuclear liability under which the supplier cannot be sued in their home country. The CSC is not yet in force internationally, but Indian ratification would bring it closer to being so, and was part of the September 2008 agreement with USA. In October 2010 India signed the CSC. In October 2010 it was reported that NPCIL proposed to set up a fund of Rs 1500 crore ($336 million) for nuclear liability "with the Centre addressing anything over this level".

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