Nuclear Power: Is it the 'Energy Miracle' in the post fossil fuel era?

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All energy experts worldwide are aware that there is no future for fossil oil and coal because of the high rate of depletion of resources and the prevalent challenges to control climate change. The pertinent question against this backdrop is “what are the alternatives for fossil oil and coal?” Nuclear power which was considered the most promising alternative in the early 1970's lost its momentum drastically in 1980's. However, it is enjoying resurgence in the minds of policy makers as a cheap power option.

Though the last U.S. commercial nuclear reactor to go on-line was way back in February 7, 1996 the current US President Barak Obama recently declared that the US will pay attention to reviving its nuclear power program as an alternative to fossil fuels. In July 2009, the Italian Parliament passed a law that cancelled the results of an earlier referendum of facing out nuclear power and allowed the immediate start of the Italian nuclear program. The Sri Lankan government took the initiative of exploring the possibilities of nuclear options last year despite the fact that CEB has ruled out nuclear power as a candidate option for its long-term generation expansion strategy. As the climate negotiations reached its climax the energy community worldwide has become excited over the development plans of fourth-generation reactor technology that can use spent uranium fuel as its feed-stock. Bill Gates has been advocating one version of that technology, the “travelling wave reactor”, and has invested in a company developing it.

The wind that has shifted in the nuclear industry’s favour is the desire of governments to be less reliant upon increasingly pricey oil imports and concern over the fossil-fuelled climate catastrophe. Many governments look set to fail to meet their meagre greenhouse-gas reduction commitments set out under the Kyoto Protocol. This shines a new and more flattering light on the nuclear power industry. Every pro-nuclear organization now touts the technology’s carbon-free credentials.

The nuclear power industry so far has gone through three generations. The first generation from the mid 1940's to the mid 1960's was dominated by early prototype reactors which were retired some time ago. The second generation (which is called the generation of commercial power reactors) started in mid 1960's and came to an end in the mid 1990's. Second generation reactor safety systems are 'active' and led to accidents in the event of malfunction. Third-generation reactors which had passive safety features were less vulnerable to operational upsets, and had a higher availability and longer operating life - typically 60 years. Further it reduced the possibility of core melt accidents, resistance to serious damage that would allow radiological release from an aircraft impact, higher burn-up to reduce fuel use and the amount of waste, and burnable absorbers to extend fuel life. Current reactors in operation around the world are generally considered second or third generation systems. In 2007, there were 439 nuclear power reactors in operation in the world, operating in 31 countries. Still in 2009, only 15% of the world's electricity came from nuclear power.

Despite the current popularity of nuclear technology amongst decision makers, we must take a sober look at the dangers that they pose. The Chernobyl catastrophe was 400 times more potent than the Hiroshima bomb. Today, children are still being born with genetic defects and higher incidences of thyroid cancer and leukaemia. The Chernobyl threat is far from over and stands as a stark reminder of the dangers of this "arrogant” technology. Since the Chernobyl disaster in 1986, there have been at least 22 major accidents at nuclear power stations of which 15 involved radiological releases. Of these, 2 came close to meltdown. The huge cost, and delays and budget over-runs in construction of third generation reactors, along with concerns about their safety, has inspired a search for new, smaller designs, including some that are only the size of a garden shed.

Generation IV reactors are a set of theoretical nuclear reactor designs currently being researched. The primary goal of Generation IV is to improve nuclear safety, improve proliferation resistance, minimize waste and natural resource utilization, and to decrease the cost of building and running such plants. However most of these designs are generally not expected to be available for commercial construction before 2030 and solutions to the climate catastrophe are an immediate requirement and there is no time for further research.

Nuclear fusion reactions which are safer and generate less radioactive waste than fission, is another option currently under consideration. Fusion power advocates commonly propose the use of deuterium, or tritium, both isotopes of hydrogen, as fuel. Many experts and civilians alike believe fusion to be a promising future energy source due to the short lived radioactivity of the produced waste, its low carbon emissions, and its prospective power output. These reactions appear potentially viable, though technically quite difficult and have yet to be created on a scale that could be used in a functional power plant. Fusion power has been under intense theoretical and experimental investigation since the 1950s; it is however not going to be a reality for decades to come.

The European Commission estimates that there may be only 2-3 million tonnes of exploitable uranium sources globally. The global nuclear industry requires approximately 68,000 tonnes of uranium ore a year to operate. At current projections of nuclear capacity, uranium mining operations will need to increase output by 100% within 10-20 years to meet demand. It is estimated that global exploitable reserves of uranium will likely be depleted within 30-40 years. The UN's Intergovernmental Panel on Climate Change outlines a scenario whereby 3,000 nuclear reactors would be needed by the year 2100. This would mean an average of 75 new nuclear reactor-builds each year for 100 years. If all the world's existing fossil fuel based power stations were replaced by nuclear, there would only be enough uranium for 3-4 years. Hence it is clear that Nuclear Power is not a sustainable replacement for fossil fuels.

Another alternative currently under discussion is to breed uranium from thorium as fission fuel in the thorium fuel cycle. Thorium is about 3.5 times as common as uranium in the Earth's crust, and has different geographic characteristics. India has looked into this technology, as it has abundant thorium reserves but little uranium. India has also done a great amount of work in the development of a Thorium centred fuel cycle. A prototype reactor that would burn Uranium-Plutonium fuel while irradiating a Thorium blanket is under construction at the Madras/Kalpakkam Atomic Power Station. This would extend the total practical fissionable resource base by 450% but still, there is a long way to go on this front. We should keep in mind that without uranium, conventional reactors stop reacting and it is by no means a replacement for fossil fuel.

As of 2010, India has 19 nuclear power plants in operation generating 4,560 MW out of total plant capacity of 140,000 MW which is just 4.2% of the total power requirement of India. India; the sleeping giant which is about to be awakened can by no means rely on nuclear power. A new nuclear renaissance, such as that already being seen in India, only introduces more risks of future accidents.

Is nuclear power really a solution to climate change? Unfortunately it is not. Nuclear power plants may not directly emit climate-damaging carbon dioxide, but if you look at the whole lifecycle of a nuclear power station (uranium mining, enrichment and transport across the globe; the construction and decommissioning of facilities; and the processing, transport and storage of radioactive wastes) it produces 20-40% of the CO_2 of a typical gas fired power plant.

France has long been seen as the model nuclear nation – deriving over 70 per cent of its electricity supply from nearly 60 nuclear power reactors. However, in the past few years, heat-waves have

brought a number of stations near to closure. The French Government has temporarily allowed the plants to breach safety rules rather than force costly closures. The irony is that with global warming expected to bring hotter summers and more prolonged droughts, the nuclear industry seems unlikely to be able to cope in such overheated conditions.

In 2009, estimates for the cost of a new plant in the U.S. ranged from $6 to $10 billion. In 2008, new nuclear power plant construction costs were rising faster than the costs of other types of power plants. Sri Lanka by no means can afford such high capital costs for power generation at present.

The promise is great. However, cheap nuclear power without underlying waste problems is yet been solved. There are also some nuclear experts who warn that the promise is a snare and a delusion. The arguments against nuclear power are as valid today, as they were 20 years ago. The technology is still extremely dangerous; relies on dwindling supplies of uranium; and remains so costly that massive government subsidies are required. It is also vulnerable to terrorism; can feed weapons proliferation; and produces volumes of toxic waste with no satisfactory storage solution. It's not that something new and important and good has happened with nuclear, it's that something new and important and bad has happened with climate change. Nuclear power is neither a short term solution nor a medium-term solution to the power crisis. Further it is unlikely to be a long-term solution as well.

Nuclear power is only a straw for the drowning human civilization and the more fundamental questions about the way we live, the nature of our economic system, and how we build meaningful movements for change still remain.