

Nuclear Power : A Treacherous Choice

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Nuclear Power is undergoing a renaissance on a global scale, say some energy pundits.

By the late 1990s there were clear signs of decline in the nuclear energy industry. The United States which had, and still has, the highest number of nuclear power plants, was no longer showing any keen interest in pursuing the nuclear path. No new reactors were being ordered and licenses of 17 nuclear power plants were about to expire. And in general, public opinion in the industrially advanced nation states was against building any new reactors.

Whether there is or not an actual global resurgence of nuclear power is something one shall look into. But there is indeed no doubt that suddenly, in the early years of this millennium, nuclear power has received an ideological shot in the arm. The source of this boost was the worldwide alarm with global warming.

Scientists and environmentalists all round the world were expressing deep concern with the production of greenhouse gases, and international consensus highlighted the need to cut down on fossil fuel use. On the other hand any and every global energy forecast predicted the dramatic rise in energy consumption in the near future with the global energy demand predicted to double by 2050. If a large proportion of the escalating energy demand were to be fueled by fossil fuels then this would spell the doom for the earth's environment and global economy. Deeply worried environmentalists argued the need for research and use of renewable energy sources on a war footing.

It was this acute alarm that provided the window of opportunity for an ailing nuclear energy industry.

During the last five years an entire planetary team of nuclear exponents has been assembled, and nuclear power is receiving a more favourable press than at anytime during the last two decades. What have been particularly beneficial to the pro-nuclear camp are the votes that nuclear power has received from leading Green theoreticians. The famous James Lovelock has stated that the nuclear option is the only viable one in the face of climate change. Stewart Brand, another Green theoretician writing about the problem of addressing escalating energy demands on the one hand and that of Greenhouse Gases emission on the other says, 'The only technology ready to fill the gap and stop the carbon dioxide loading of the atmosphere is nuclear power.'

Similar support has been extended by Hugh Montefiore (formerly with Friends of the Earth, UK) and Patrick Moore (formerly with Greenpeace).

The support for nuclear energy from some leading Greens rests upon a simple reasoning. The reasoning, with all its steps spelled out, may be presented as follows:

1. The greatest threat to the biosphere and human civilization is climate change.
2. Climate change is the result of tremendous amounts of greenhouse gases let loose into the atmosphere from anthropo-genic sources.

3. Amongst all the greenhouse gases the major culprit is carbon dioxide. For, although per unit mass its greenhouse effect is less than that of many other greenhouse gases, e.g. methane, it takes the cake in terms of the sheer volume emitted into the atmosphere, making it the chief climate villain.
4. Fossil fuels constitute the main source of Carbon dioxide.
5. Therefore they should be replaced by alternative non-CO₂ emitting energy sources which are viable.
6. The question of viability is of key importance here. Given the fact that the world is looking ahead to tremendous spurt in energy use in the coming decades the alternative to fossil fuel must be a source that can provide energy on a large scale.
7. Nuclear, which is already providing around 16% of the world's electricity, is the most promising and viable alternative to fossil fuels.

Environmentalists and environmental activists recognise that the issue of climate change is the most crucial issue confronting humankind today. Therefore most of them will have little objection to the sequence of steps from 1 through 5, and even to 1 through 6. The main point of contention is the proposition itemised as 7, which, according to most environmental activists, does not follow from the earlier propositions. The author of this article also shares the same view, and in what follows it will be argued that proposition 7 is not only not a logical consequence of earlier propositions but that as a statement it is devastatingly misleading in what it implies and suggests.

The proposition consists of two parts :

1. Nuclear energy is already providing around 16% of the world's electricity.
2. Nuclear energy promises to be the only serious alternative to fossil fuels.

This is uncontested as of now (January 2007). But a statement may be correct yet convey misleading suggestions. For example, 16% is a very respectable proportion. But electricity is only one form of energy that the world uses. What might be nuclear's share in total energy scenario? Nuclear's share in this energy pie is around 6%. This distinction is important. Not because 6 is a less respectable figure than 16 but because nuclear, unlike diesel, coal or kerosene, or wind power, is unsuited to multiple modes of energy production. Coal can be used in the kitchen as well as in a thermal power plant; wind may be used to turn a grinding mill as well as an electric turbine. Not so nuclear. This can be used only to produce electricity, which in turn may become a source of other energy forms. As of today or in the foreseeable future nuclear power does not show any promise of being used in car engines or kitchen stoves. This has tremendous implications as regards energy choice.

Moreover, the question needs to be asked as to how nuclear came to emerge as a significant energy source. Did it emerge in a climate of free competition where it fought for and secured its place in the energy market by competing with fossil fuels and subsequently other energy sources? It did not. It succeeded in securing a place for itself purely on the strength of massive state initiative and patronage.

Now for the second part of the proposition : Nuclear energy is the most promising and viable alternative to fossil fuels.

This is an empirical statement that should be susceptible to factual corroboration. And logically the burden of proof should be on those who make the pronouncement. However, no arguments are clearly advanced on the basis of actual facts. Therefore it is necessary to take up the issue by first examining whether nuclear power does appear

to show any prospect of developing into a major power source on a global scale and whether it has any prospects of making a real dent in global warming, leaving aside for the moment the question of its being a desirable alternative.

In 2004, there was a close analytical study about the prospects of Nuclear Energy by Mycle Schneider and Antony Froggatt :

'In order to evaluate the status of the world nuclear industry, it is helpful to estimate the number of units that would have to be replaced over the coming decades in order to maintain the current number of operating plants. We have considered an average lifetime of 40 years per reactor— with the exception of the remaining 18 German nuclear plants that, according to German legislation, will be shut down at an average age of about 32 years - which is optimistic as the average age of reactors closed to date is 21 years, but which seems possible given the progress that has been achieved on the current generation of plants compared to the previous one... Over the next 10 years, 82 new reactors would have to start up operation. The calculation takes into account 18 reactors with a firm start-up date of the 27 units listed as under construction by the IAEA as of June 2004. In other words, another 73 reactors would have to be planned, built and started up until 2015. This is virtually impossible given the long lead times for nuclear power projects. One EPR in Finland and one more in France won't change that picture. Further more, over the next 20 years a total of 280 units would have to be replaced in order to maintain the same number of plants operating today. China is said to have plans for up to 32 new nuclear plants until 2020. A prospect that seems highly unlikely but not impossible. But even such an extraordinary undertaking in terms of capital investment, technical and organizational challenge would cover hardly more than 10 of the number of units that reach age forty. The number of nuclear power plants operating in the world will most likely decline over the next two decades with a rather sharper decline to be expected after 2020.'

Since Schneider and Froggatt's analysis is based on 2003 data, it is better to test their analysis by present data—culled from the most respectable pro-nuclear sources, the International Atomic Energy Agency (IAEA) and the World Nuclear Association (WNA)!

Although large numbers of reactors close down at an age of 21 to 24 years, the average lifetime of reactors is about 40 years. The IAEA's PRIS database tells us that the number of nuclear reactors, the world over, which are of 30 years of age or above (as on January 2007) add up to 114. Thus, all such reactors will be 40 years old or older after January 2017. So it is abundantly safe to assume that about 114 existing reactors will close down by or soon after January 2017. As on January 2007 the total number of reactors in the world that are under construction add up to 29. If all goes well for them, they will be up and running by 2017. The PRIS database does not provide data for reactors planned. The WNA, in its information portal (29 January 2007), states that 64 new reactors are planned. No one knows exactly when their construction will actually start and when they will come into operation. Since time taken to construct a new reactor takes anything from 5 to 10 years, one can, by hoping the best for all the reactor plans, assume that about half of them, i.e. 32, will take off in time so as to be completed by December 2017. Therefore by December 2017 the world will have a total of 61 new reactors. Hence there is a shortfall of 114 minus 61 i.e. 53 reactors. The same PRIS data says that the 114 that are likely to be shut down have a combined net installed capacity of 74,024 MW. The combined net capacity of the 29 reactors under construction, as per PRIS data, is 23,641 MW. The combined capacity of the 64 planned reactors is 68,861 MW. Though in the best-case scenario, 32 of the reactors planned will come into operation by 2017, but people have no idea about

which 32 they will be. But one can proceed again to take the best-case scenario and assume that 32 of the most powerful reactors will come into operation by 2017. Calculating the WNA data one finds that the combined capacity of 32 of the largest reactors happens to be 41,707.43 MW. Now adding this figure to the combined capacity of the reactors under construction one gets the value of 65,348 MW. But the total shortfall due to shutdown of old reactors is 74,024 MW as shown earlier. Therefore, even in an extremely favourable scenario there is likely to be a significant shortfall in nuclear output by 2017.

And what about the next ten years after 2011? In that period another 213 reactors, of installed capacity of 195,372 MW, will have reached the age of 40 years or more and will be closed down. Let us assume however that all of today's planned reactors (64 in number) are up and running by this time. The combined capacity of the remaining 32 happens to be 27,153.57 MW. Now the aforesaid WNA data also gives a long list of proposed reactors. No one knows how many such proposed reactors, will advance from the 'proposed' to the 'planned' stage, and having reached the latter stage will advance to the 'under construction' stage in the next 20 years. Let us assume that all will. How many reactors are proposed? 158. What is their proposed installed capacity? It is 124,225 MW. Therefore, there is a total of 124,225 plus 27,153.57 MW, i.e. about 145,379 MW. So even if there are all the new reactors that are proposed operational by 2027, there will have a massive shortfall as compared to existing installed capacity.

Why do actual facts and trends tend to point to bleak picture of nuclear energy future? Is it entirely the fault of the green activists who have kept up a propaganda crusade against nuclear power? No. The pains of nuclear industry have deeper, albeit more prosaic origins as Schneider and Froggatt suggest :

Many analysts consider that the key problems with nuclear power have not been overcome and will continue to constitute a severe disadvantage in global market competition. Ken Silverstein, Director of the US based consultancy *Energy Industry Analysis* states : "As a result of deregulation of power and other market -and policy-based uncertainties, no nuclear power company can afford to take the financial risk of building new nuclear plants. A report published by Standard & Poor's identifies the barriers. The financial costs for construction delays, for example, could add untold sums to any future project. That, it says, would also increase the threats to any lender. To attract new capital, future developers will have to demonstrate that the perils no longer exist or that energy legislation could successfully mitigate them." Peter Rigby, a Standard & Poor's analyst and author of the report says: "The industry's legacy of cost growth, technological problems, cumbersome political and regulatory oversight, and the newer risks brought about by competition and terrorism concerns may keep credit risk too high for even (federal legislation that provides loan guarantees) to overcome.'

The above analysis is overwhelmingly borne out if one looks at the WNA database. Of the 38 states listed there, consisting of actual users of or supposed aspirants to nuclear power, one can see that 26 have no reactors under construction. 21 have no plans for new reactors, and 16 have no proposals whatsoever for nuclear reactors. Germany, which has 17 reactors in operation, and 19 in state of permanent shutdown, has no reactor that is either being constructed or planned or even proposed. This gives substance to the claim that Germany is determined to phase out its nuclear power. France, the state that derives about 79% of its electricity from nuclear power has 59 reactors in operation and 11 in state of permanent shutdown. But, it has only 1 that is planned and only 1 that has been proposed. Yet, by 2020, 7 of its operational reactors will have reached the age of 40 or more and will have been, in all probability, shut down; and in the next 8 years another 45 of its then existing reactors will have reached the age of 40 or more, with predictable results.

In fact notwithstanding all the talk of 'nuclear renaissance' the situation indeed seems bleak for the nuclear industry. The only serious nuclear ambition seems to emanate from China, which has 13 reactors planned and 50 proposed. Russia, another erstwhile socialist power, has 8 planned and 18 proposed. India, which has recently decided to ape China in various respects, has 7 planned and 15 proposed. But notwithstanding all their heroic ambitions and efforts to lead the 'renaissance' none else seem equally inspired, and hence their efforts do not add up to whatever is needful to stem the tide of nuclear decline.

So, given the facts there does not seem any way that, twenty years hence the industry will not be able to maintain its present nuclear capacity, let alone increase it. Given this predicament it is difficult to understand how nuclear can be taken as a serious fossil fuel alternative.

Nuclear's share in the total pie of marketed fuels was around 6% in 2003. Forecasts for world energy increase project a 70% increase in energy production by 2030, with fossil fuels still dominating the energy scene. Therefore even in a scenario of 31 % increase in nuclear capacity, nuclear's share in total energy will have fallen (to less than 5%) while production of greenhouse gases will have increased by leaps and bounds. Thus, at the end of the day, nuclear energy does not at all show promise as a serious or viable candidate that can lead to any significant reduction in global warming. ❄❄❄

[Courtesy : Society for Direct Initiative for Social and Health Action.]