Nuclear Energy; its place in future energy mix

The fukushima nightmare brought about a new look at nuclear energy and the entire energy industry. The public perception about nuclear energy went from bad to worse, but the big question remains “can we do without nuclear power”? Doubts surround nuclear energy as a safe future energy source and after the recent fukushima incidence, Japan has shut down completely all its 55 nuclear power plant and this has led to a huge drop in Japanese nuclear power generation by 44.3%.While it is true that Germany adopted the same idea and shut down its nuclear power units with the adverse effect being a drop in German nuclear power output by 23.2%, and the world total nuclear energy output dropped by 4.3% [1]. The irony remains that even after Germany successfully shut down its nuclear reactors due to post fukushima incidence, they’re still seriously importing nuclear electricity from Holland, Czech Republic and France to make up for their home soil drop in nuclear power output [2].

Inspite of all these, the need to decarbonise electricity generation, tackle climate change and the ever increasing cost of fossil fuel, have revived the interest in nuclear power option to the extent that currently,there are more nuclear reactors under construction than they were before the fukushima incidence. Several countries have looked at the huge price to pay if they’re to drop the use of nuclear power. Countries like Russia, China, India, South Korea, etc have re-affirmed their interest in pursuing stable and secured future energy sources through the use of nuclear power [1] and are undergoing researches to discover ways of making nuclear power plant projects more profitable maybe by increasing the level of uranium exploration. China and its government have confirmed that their main aim remains to set up a 40GW of nuclear power output by 2015 and about 80GW by 2020 [2]. In 2010, there were 441 nuclear reactors generating 13.4% of the global electricity, 67 new reactors are currently under construction in about 15 countries and this shows the position of nuclear energy in future energy mix [3].

Recently, the US Nuclear Regulatory Commission has given an order for a new nuclear reactor to be constructed in the country and its Department of Energy has endorsed a research programme aimed at promoting the life of exisiting American nuclear reactors beyond 60 years [1] and the US government have brought back to life a nuclear plant that was shut down and this plant has the capacity of generating 60GWe [3]. France generated 78% of its total electricity in 2011 via nuclear power and plans are still ongoing by the country to construct

new nuclear plants. Poland, Lithuania, Estonia and Latvia all have new nuclear power plants currently under construction [1].
From record, nuclear power generated 17% of world electricity in 2002 and forecasts have been made that only 5% increase in nuclear power generation could help meet the energy demand in 2020 [4]. This 5% increase entails few more nuclear power plant would be constructed and for this to be succesful, an optimal and viable means must be deviced to make sure the benefits of nuclear matches its safety and security challenges and this would be one of the feasible ways to change the present public perception of nuclear energy [5].

At the moment it's looking like nuclear energy has no future due to some reasons like;

- **Cost:** looking at the overall life cycle of nuclear power plant, its cost is much higher when compared with other power plants like coal.
- **Safety:** the unsafe issues of health and environment associated with nuclear has been of great concern to potential users. The transporting of nuclear materials haven't been proved totally safe so far.
- **Proliferation:** the potential abuse and misuse of nuclear mterials and facilities is a factor that must be taken seriously if the use of nuclear energy must be proved worthwhile.
- **Waste management:** a good method for long term processing of radioactive nuclear waste is another big challenge.
- **Uranium availability and supply:** some researchers have said that uranium may be in short supply after 50years.

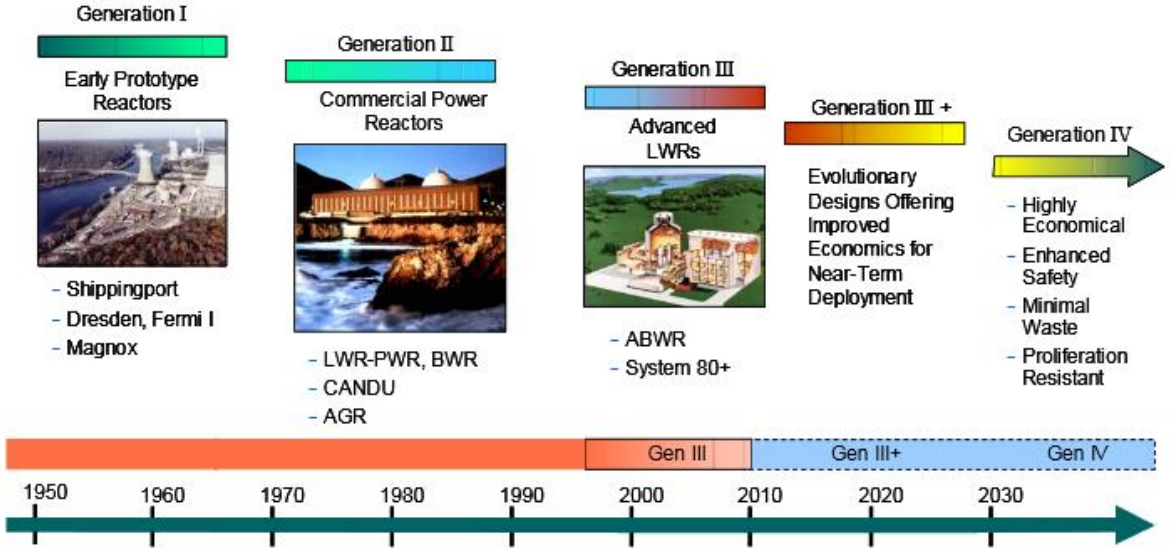
To keep nuclear power option alive, the above challenges and issues must be addressed properly and addressing these issues looks a bit uneconomical, thereby raising the need for government involvement in order to subsidize the cost of overcoming the challenges [4].
However, the good news is that there are huge hopes that despite the current issues with nuclear power, the "nuclear renaissance" agenda will be a dream come true and these hopes come from the facts that;

- Nuclear power will help contribute to meet the future energy need as the energy released by uranium fission is about 2million times greater than that from C-H bond splitting in fossil fuels and nuclear has about 2million times more energy than gasoline. One tonne of uranium gives an energy level equal to that several million tonnes of fossil fuels would give [2].

- While it is true that the cost of installation of nuclear power plants is high, the same can also be said of other power plants (solar, coal, etc.) [2].
- One pound of uranium yellow cake (U308) has an energy equal to 35 barrels of oil and just 7g of uranium fuel pellet produces electricity equal to that produced by; 17,000ft^3 of natural gas, 564 litres of oil and 1780 pounds of coal [2].
- Nuclear power will help address the need to reduce carbon in energy supply and this will in turn reduce global warming. Burning the cleanest of coal "lignite" in one year in a country like Germany will still produce CO_2 million times more than what the entire fleet of nuclear plants in Germany would generate in over 20years [2], the use of nuclear power produces no ash,no gases, no smokes and there's little or no need for detailed engineering to control air flows and no need for expensive elecricity storage facilities. Infact, due to its compactness, nuclear energy technology is the first main industrial technology that has made it possible for wastes to be completely isolated from the biosphere [2]. So no doubts that one of the few practical and viable options for controlling CO_2 when considering electricity generation is the use of nuclear power [4].
- Nuclear energy technology currently stands as the only proven technology that can deliver 24/7 electricity on a large scale irrespective of the prevailing weather conditions [2].
- The prospects of reducing global warming is a good factor justifying the need for the government of various countries to invest on nuclear expansion and address the challenges associated with it.
- The next generation reactor design technologies has promised to address almost all the current challenges associated with the use of nuclear power. 50 years experience of nuclear power plant use have offered the technical and technological improvements in the newest designs on nuclear power reactors [9]. The technology has aimed its advancement at; optimal and long lasting waste management, optimal use of nuclear resources, high safety and reliability of plants, proliferation resistance and an improved reactor containment design to shield and give the maximum physical protection possible to the reactors [6].
- In 2010 G8 Summit in Canada, the proliferation issue was discussed extensively [5]. All efforts are being put in place to mitigate nuclear weapons proliferation. United Kingdom, France, Russia and China are

coordinating effectively with US government to control nuclear weapon proliferation [7].

- With the short in supply of uranium recorded by US in 2011, some countries have taken proactive measures already to make sure this problem doesn't hinder the smooth running of nuclear power plants in their countries in the future. China Nuclear Power Corps have acquired upfront a 2.2 billion dollars worth of uranium from Australia. Canada has agreed to partner with india so that a lot of Canadian uranium will be going to India. India is also in talks with Australian government to tie up an agreement for uranium importation to India [2] and France has endorsed a huge sum of 3 billion dollars worth of uranium from UAE to cover for running of its nuclear power plants for seven years [2].
- The need to invest in nuclear energy will not just help meet the future energy demand but will also help maintain and sustain economic growth and standard of living [8].
- The current problem of matching thebenefits of nuclear energy with its safety and security challenges [5] has been resolved extensively for its future use more especially in the aspect of its reactor designs.



A Technology Roadmap for Generation IV Nuclear Energy Systems

The IAEA has predicted that nuclear power generation would double to 807GWe in 2030 [8]. The EIA also predicted that the generation capacity of nuclear in 2030 will be 489GWe. This means about 124 reactors of 1000MW capacity each would be in place. In 2030, the total energy capacity from nuclear power plants will be around 400-450GW and energy consumption is expected to rise to about 60% in 2030 [1]. In 2050, nuclear power capacity have been predicted to hit 1200GW and this will represent 24% of the world total

electricity generation. This means that by 2050, nuclear power would be the single largest source of electricity [9].
Having looked at the prospects, potentials, technological advancements, technical improvements and all other things the next generation reactor designs have in place to securely and safely generate energy in the future, there's an increasing need for schools and government to keep researching on nuclear energy and its optimal usage [9].
I see huge hopes of nuclear energy being the major solution to future energy supply and security.

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