Shodhshauryam, International Scientific Refereed Research Journal
© 2019 SHISRRJ | Volume 2 | Issue 3 | ISSN : 2581- 6306

Nuclear Energy : Pros and Cons of Safety and Security

Dr. Manju Giri & Ravindra Kumar
Department of Physics
D.S. College, Aligarh,U.P. India.

Abstract - Energy is a key input in economic growth of any country. There is a close link between availability of energy and future growth of a nation. Energy is consumed in a variety of forms and produced from variety of sources. Oil, Coal, Solar, wind and nuclear energy sources have become a permanent necessity of modern society. Nuclear energy has come to the forefront of these sources, because of its advantages. Nuclear energy is clean, safe, reliable, compact, competitive and practically inexhaustible. Nuclear energy is environmentally the most benign compared with other options for electricity generation. It is the only source of energy that can replace a significant part of the fossil fuels. Concerns about radiation effects, decommissioning, radwaste management and accident risks have been adequately addressed. Traditionally, safety receives the most intense attention of all aspects of nuclear technology. So Nuclear energy is a controversial topic. This paper is an attempt to study pros and cons of nuclear energy safety and security. Understanding the positive and negative aspects, a logical conclusion can be drawn in order to from an opinion on nuclear power that could change the world.

Keywords: Nuclear Power, Nuclear fission, Fossil fuels, Carbon emission.

Introduction- Nuclear energy is the energy in the nucleus or core of an atom, that is released in significant amount in processes that affect atomic nuclei, the dense core of atoms. One method of releasing nuclear energy is by controlled nuclear fission in devices called reactors. Huge amount of energy released in fission process provide power for society's benefit. The technology of using nuclear energy released by fission process have been in practice since 8 decaydes in all over the world. Today more than 425 power reactor are producing 1/6th of the world's electricity [1]. The energy released by the complete fission of 1 Kilogram of U^{235} is equal to the heat energy obtained by burning 4500 tons of high grade coal[2].

Nuclear power is a reliable form of energy that has proven itself at lowering carbon emission and helping countries become carbon neutral [3]. But a variety of baniers and risk of accidents exist there.

Although conventional nuclear power plants cannot explode like atomic bombs, accidents can happen in which dangerous levels of radiation might be released into the environment and result in human casualties. At high temperatures the metal encasing the uranium fuel melts, releasing radiation: this called a melt-down. Also, the water that is used in a nuclear reactor to transfer heat can boil away during an accident,

contaminating the atmosphere with radioactivity. Although various types of accidents are possible during the operation of a nuclear reactor, many safety devices are incorporated into reactor design and operation.

Three Mile Island

The most serious nuclear reactor accident in the United States occurred in 1979 at the Three Mile Island power plant in Pennsylvania, the result of human error after a valve failure [4]. A partial meltdown of the reactor core took place. Fortunately the containment building kept virtually all the radioactivity released by the core material from escaping. Although a small amount of radiation entered the environment. There were no substantial environmental damages and no inmmediate human casualties. A study conducted within a 10-mile radius around the plant ten year after the accident concluded that cancer rates were in the normal range and that there was no association between cancer rates and radiation emission from the accident [5]. In fact, Three Mile Island was a real success story for nuclear safety.

Chernobyl

The worst accident ever to occur at a nuclear power plant took place at the Chernobyl plant on April 26, 1986, when one or possibly two explosions ripped a nuclear reactor apart and expelled large quantities of radioactive material into the atmosphere. It is the worst nuclear disaster in history both in cost and causalities [6]. In the investigation after the accident, it became apparent that there had been two fundamental causes. First, the design of the nuclear reactor, the reactor was not housed in a containment building and was extremely unstable at low power. This second, human error contributed greatly to the disaster [7]. Many of the Chernobyl plant operators lacked scientific or technical understanding of the plant they were operating, and they made several major mistakes in response to the initial problem.

Fukushima

Fukushima was a large reactor located in the Futaba district of Japan. On March 11, 2011 a 9.0 magnitude earthquake shook Japan causing structural damage and loss of many lives. The reactor that was in working shut down immediately when the earthquake hit it. A high amount of radioactive release occurred in the following four to six days. It is important to understand the severity of what occurred at Fukushima reactor because it was a failure in the design of a reactor [8].

Radwaste

Radwaste management is an important issue in the nuclear program although radwaste quantities are very small, ~ $1m^3$ (~5t) of solid waste/TW(h). This can be compared to 1 million t of CO_2, 120 t of SO_2, 650 t of NO_x and 60,000 t of ash from an equivalent size coal fired power plant. Solar panels create 200 to 300 times more hazardous waste than nuclear radwaste [9]. Radwaste is isolated from the biosphere while the gases from fossil plants are entering the atmosphere. Technologies are available for nuclear waste disposal. A summary of the amount of radioactive waste and management approaches for most developed countries are present and reviewed periodically as a part of the IAEA's joint conventional on the safety of spent fuel management and on the safety of Radioactive waste management [10].

Advanced Technologies

In contrast, with the development of nuclear energy for 60 years, the technology is becoming more mature, and the probability of accidents is also declining. In every nuclear power plant a maximum credible accident is postulated by designers and suitable engineering safeguards built in their technologies are more developed and their safety is higher. The fourth Generation reactors, offering the potential of much higher energy recovery and reduced volumes of radioactive waste, are under study in the framework of the "Generation IV international Forum" (GIF)[11] and the "Molten salt reactors have been deemed the safest with the most

intrinsic safety features [12]. Molten salt reactors are a class of nuclear fission reactors. Molten salt reactors are also considered to be the most sustainable as they use molten salt as a reactor coolant instead of water. This also means that they do not operate under high pressure as there is no water to make steam, so the possibility of a steam explosion occurring is null.

Conclusion

Risks are the part of our daily life. Occasional air crashes, train collisions, industrial and automobile accidents, electrocution, earthquakes, house collapse, failure of dams, meltdown of nuclear reactor courses and bursting of LPG gas cylinders are some instances. Because of their benefits obtained, man has learnt to accept these risks, by adopting safety precautions.

France gets a total of 88% of its electricity from zero carbon emission with 72% of it coming from nuclear and 10% from hydro power [13]. Sweden gets 95% of its electricity from zero carbon sources with 42% from nuclear power 41% from hydro power [13]. These countries are proof that nuclear power is effective at lowering carbon emission as it has successfully done so in both these cases. Some of other countries are still planning to introduce nuclear power. In 2021 Iraq declared it plans to build 8 nuclear reactors by 2030 to supply up to 25% electric power [14].

The future of nuclear power is a bright one with great strides being made to make reactors more sustainable, cheaper to build, and safer to operate.

References

1. Nuclear share of electricity Generation in 2020, IAEA 24 June 2021
2. West's Encyclopedia of American Law 2008
3. The Editor of Encyclopedia Britannica.
4. https://www.britannica.com/science/nuclear-energy
5. U.S. Nuclear Regulatory Commission, 9 Mar 2021
6. Hatch Maureen C, American Journal of epidemiology 132 (3) 1995
7. Black Richard, B.B.C. News 16 Aug 2011
8. IAEA, 1992, Retrieved 1 Nov 2018
9. World Nuclear Asocial, Retrieved 13 Jan 2014
10. Desai. J. , & Nelson, M. 21 Jun 2017
11. http://enviromentalprogress.org/big-news/2017/6/21/are-we-headed-for-a-solar-waste-crisis.
12. The Joint convention IAEA archived on 28 March, 2010.
13. GenIV International forum: (http://www.gen-4.org/index.html)
14. Serp, J. , Allibert, M., Benes, O., Delpech, S., Feynberg, O., Ghetta, V., … Zhimin, Progress in Nuclear Energy, 77, 308-319, 2014
15. Shellenberger, M. 26 Mar 2019. We don't need solar wind to save the climate and It's a good thing, Too. Retrieved April 16, 2019, form
16. Iraq hopes to build 8 nuclear power reactors by 2030. Brecorder 15 June, 2021