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Nuclear Power Plants: The Pressing Priority for Clean and Green Energy

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Abstract:- The author in the present article has analysed whether the nuclear energy is really green and clean energy. Firstly, the author talks about the functioning involved in a nuclear power plant. Also, the author throws some light in the development and the advancement of nuclear energy globally. Indian perspective toward s nuclear energy has been taken into consideration too including how nuclear energy came to India and what is the process involved in setting up a nuclear power plant. At the end the author has discussed the advantages and disadvantages of the nuclear energy concluding with a hypothesis of conclusion.

I. INTRODUCTION

Indian sub-continent is a major growing economy on the globe at the present time. The needs and essentials of the citizens are increasing day by day, simultaneously the quality of the life of the people living is also getting improve every seeing day. An aspect od increased quality of life is the reach the reach of electricity or the power to each and every household. The major production of electricity in India is carried out through the coal-driven power sources. On one hand development is necessary to human race but on the other hand defacement of environment must not occur. To keep development and environment hand in hand We are having the concept of sustainable development, which has been adopted worldwide by countries either being super powers or being under developed.

For the production of energy and also the sustainable development follow-up, nuclear energy is the fathomable source fulfilling the need of the contemporaneous scenario. Nuclear power plants are the source that have been so efficient in the field of energy generation and it is quite necessary to switch to modern methods of energy generation, The nuclear disasters that have occurred are not destructible but it is said that they are the reason for development of cancer symptoms.

II. AN INSIGHT INTO NUCLEAR ENERGY

A small sugar cube to a gigantic machinery all are powered by atoms. They are present in every single entity. Atoms have a core part known as nucleus, all the energy of the atom is concentrated at that point and to liberate that energy it needs to go through process of fission. Uranium(U) is the only element present that can go through multiple chain fission reactions. However, Thorium (Th) powered plants are also there but, we mainly we Uranium in nuclear power plants to engender nuclear energy and this energy produced can be used in the form of electricity. For the process of fission, the apparatus required is a nuclear reactor. There are many types of nuclear reactors manufactured, but the safest reactor considered is the AP1000 nuclear reactor, as it is having an advancement in recent times to act as a self-coolant in case of any shutdown.[1] The working of these reactors involves the heating of the core of this reactor which in turn produces steam to run the turbine and production of electricity starts here. However, there are various steps involved after this, due to which electricity reaches our home.

The reaction for the nuclear has been described with the help of the figure below-

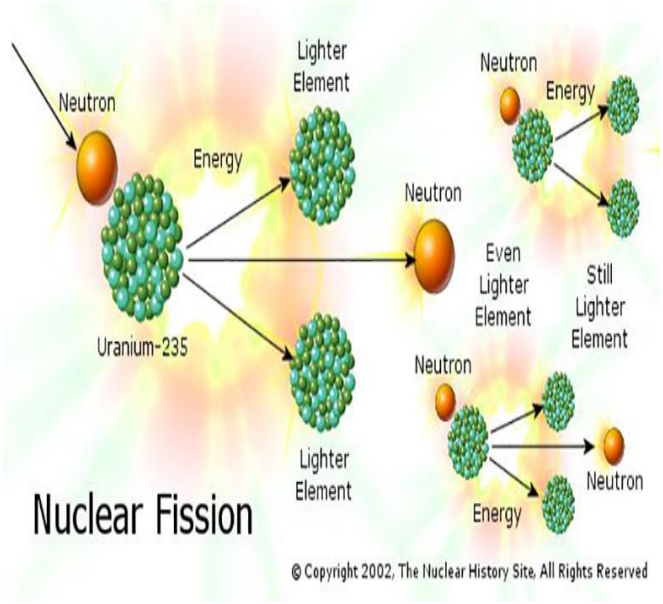

Fig. 1[2]

Looking down into the historical story of the nuclear energy, it gained currency in the late 1960's but it is not like that there were no nuclear reactors before this. Sir Enrico Fermi can be considered as father of nuclear reactors as on December 20, 1942 he, with her team in the University of,

[1] A Bittersweet Milestone for the World's Safest Nuclear Reactors - Peter Fairley (https://spectrum.ieee.org/a-bittersweet-milestone-for-the-worlds-safest-nuclear-reactors)

[2] Nuclear Reactor Laboratory, Massachusetts Institute of Technology (https://nrl.mit.edu/reactor/fission-process)

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designed the first nuclear reactor which came to be known as Chicago Pile. Talking about the first nuclear reactor to generate the electricity, it was EBR 1 developed by the U.S. scientists at the Idaho National Laboratory earlier known as the National Reactor Testing Station. Moreover, the first nuclear power station to get established was the Obninsk Nuclear Power Plant (Obninsk APS1) in the city of Obninsk in the Soviet Union on Seventeenth day of October, 1956. On one hand the output of electricity by this station was very less in comparison to today's nuclear power plant, as it was only capacitive to productive of just 5Mwe but this new step by the USSR gave birth to the new era- the Nuclear Era.

Fig. 2[3]

Now, there is such advancement in the field of the nuclear energy and it has gained so much currency that about 50 countries of across the globe and there are 440 nuclear reactors in total, mostly in the Europe and Southern and Eastern parts of the Asian continent. Superpowers like United States of America, Russia, France, etc. share a large part of their energy production to the Nuclear Power Plants with France being the winner in this race as it produces about 75% of share of the energy production to the nuclear driven energy with the help of the 56[4] working nuclear reactors.[5] A total sum of about 10% of the world's total energy is produced by the nuclear power plants. According to a recent report by the World Nuclear Association, the nuclear sector served about 2653 TWh of energy in the year of 2021.[6]

The figures below show-

1. Figure 3- The increasing growth of nuclear reactors (Operable) across the globe.
2. Figure 4- The increase in the production of energy by Nuclear Power plants in the years of 1970 to 2021.

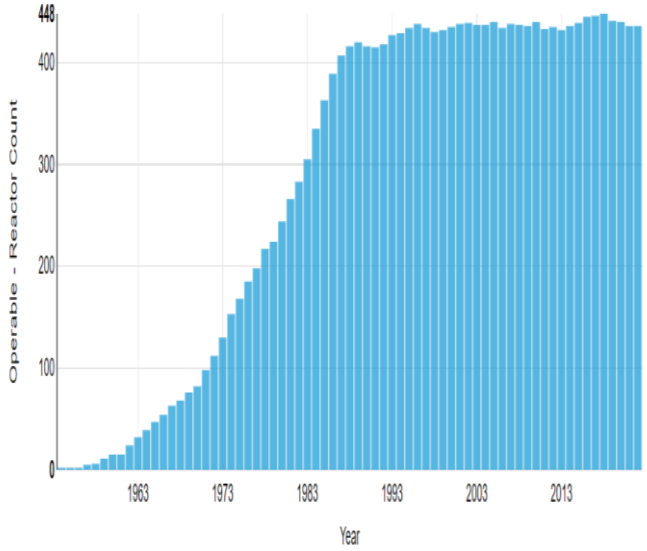

Fig 3[7]

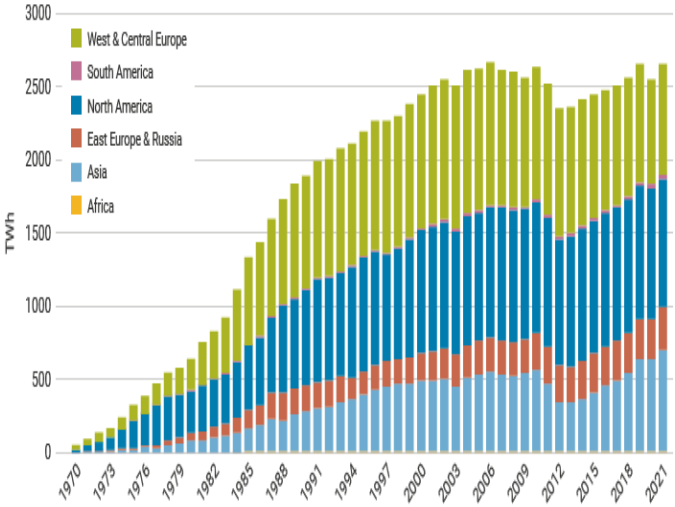

Fig. 4[8]

[3] OBNINSK NUCLEAR POWER STATION RECENT PHOTOGRAPH (https://www.iaea.org/newscenter/news/obninsk-beyond-nuclear-power-conference-looks-future)

[4] STATISTA OFFICIAL WEBSITE (https://www.statista.com/statistics/462256/number-of-nuclear-reactors-in-france/#:~:text=Nuclear%20power%20plants%20in%20France%201985%2D2021&text=As%20of%202021%20France%20had%2056%20active%20nuclear%20reactors.)

[5] WORLD NUCLEAR ASSOCIATION (https://world-nuclear.org/information-library/current-and-future-generation/nuclear-power-in-the-world-today.aspx)

[6] World Nuclear Association, IAEA PRIS

[7] World Nuclear Association, IAEA PRIS (https://world-nuclear.org/information-library/current-and-future-generation/nuclear-power-in-the-world-today.aspx)

[8] Nuclear Electricity Production, Report by IAEA

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III. STAND OF INDIA IN NUCLEAR ENERGY SECTOR

India is one of the fast-growing nations in the world. After getting independence in the year of 1947, and being independent for 75 years it has shown a great development to the world in every field. Moving to the sector of nuclear driven energy India is adapting towards the sustainable form of energy, which is also a necessary step taken as it is the rising demand on the international basis to protect our resources for the future generations also but not in a way to kill the present need, and this can be taken into action only by the way of the sustainable development. India being a member of the United Nations shows its respect to the 17 Sustainable Development Goals laid down in September 2015 in the United Nations general Assembly. It is also known as agenda 2030 as these goals are expected to be achieved by the nations across the globe by the year of 2030. By virtue of article 253[9] the parliament has authority to make legislations based on international treaties, agreements, etc. Also, the Article 51[10] enshrined in the Directive Principles of State Policy guides the state to foster respect to international treaties, agreements and also promote and respect international peace. As India is a signatory of the agenda 2030, and the goal 7 of the 17 Sustainable Development Goals in the Agenda 2030 is to "***Ensure access to affordable, reliable, sustainable and modern energy for all".*** So, by virtue of the Article 253 and 51 of the Constitution of India, the country is to an extent obliged to serve for affordable and clean energy.

The first step toward nuclear power in India was taken in the year of 1956 by the inaugural of the Apsara reactor by Pt. Jawaharlal Nehru (the Prime Minister of India then). Looking down to the history of the nuclear power station in India, the first nuclear Power Station was the Tarapur Atomic Power Station in Tarapur in the year of 1963, initially in lates 1960's it had 2 Boiling Water Reactors (BWR) capable of production 210 Mwe electricity. In the year of 2000 two more reactors, each Pressurised Heavy Water Reactor (PHWR-540) were constructed with an output of 540 Mwe. Now there are total 8 Nuclear Power Plants with 22 nuclear reactors installed with a capacitive output of 7380 Mwe of electricity.

There is a very complex process involves in setting up a nuclear power plant. A nuclear power plants needs to be set up near a water body, due to this they are predominantly set up in only coastal regions. The reasoning behind setting up a Nuclear Power Plant in coastal region only, near a water body is that it draws the water from that water body and uses it as a coolant. So, in India wee are having Coastal Regulation Zones, there are several notifications regarding these CRZs which are issues by the Ministry of Environment Forest and Climate Change and the latest notification is the CRZ Notification 2021 (Amendment of CRZ Notification 2019)[11]. So, there is a CRZ mapping and only in the specified zones in a coastal region, the nuclear power plants are allowed. The next step Involved is the commission of an EIA to a consultant which is accredited by the Quality Council of India for making EIA reports for their sector of expertise. After the EIA report is reviewed by the EAC (Expert Appraisal Committee) and then permission is granted to take under construction the nuclear power plant.

IV. NUCLEAR ENERGY IS BOON TO THE SOCIETY

Most of the time we have heard a term known as the climate change and we all the quite familiar to it. There is a strong connection between energy generation and climate change because in the process of energy generation from different sources there are various gases produced. The main source present across the globe for engendering electricity is the coal, which is used by about 80 countries and fulfils the demand of about 40% electricity of the globe which is quite impressive but, it is also a huge contributor to climate change because according to the Global Energy and CO_2 Report, 2019[12] by International Energy Atomic Agency; Coal fired energy generation alone contributed to 30% of the carbon emission across the globe which is about 10.1 GT CO_2. Nuclear energy tops the list of sources with less pollution contributing sources t the environment. The other alternates for producing electricity are the natural gas, wind driven energy production and the solar energy. According to a report by NEI, on the one hand nuclear facility powering 1000 megawatts in U.S. requires only 2.5 km^2 range while on the other hand solar driven power requires 75 times more land in comparison to a nuclear facility. Also, the wind driven energy requires 430 wind turbines to produces the same amount of energy, which in turn would increase the land use to 360 times in comparison to a nuclear facility.

Nuclear energy is the need of the hour, as it contributes negligently to the greenhouse gases and climate change. The amount of CO_2, CO, CH_3 produced by a nuclear power plant are completely negligible. Also, this is also not even the amount produced in energy generation through reactor but the amount of pollution contributed in setting up a nuclear power plant as it requires heavy machineries, use of fossil fuels, land use, etc. At all, shifting towards nuclear energy is quite fathomable as it is necessary for sustainable development because nuclear energy is recyclable due to the sustaining nature of uranium towards multiple chain reactions.

[9] COI, 1950
[10] COI. 1950

[11] http://environmentclearance.nic.in/writereaddata/S-O-4789-E-DATED%2018-11-2021.pdf
[12] https://www.iea.org/reports/global-energy-co2-status-report-2019/emissions

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V. NUCLEAR ENEERGY AFFECTING ENVIRONMNET

Everything in this world has advantages and disadvantages, so there are some disadvantages of nuclear energy too. The main disadvantage of nuclear energy is that there is a use of radioactive elements in the generation of electricity by the nuclear power plants, which in case of any security lag can cause huge damage to the biodiversity. The most ignored part of constructing a nuclear power plant is the fishing area, as discussed earlier we know that nuclear power plants are situated near a water body and it is quite obvious that there are fishing activities in a coastal area. If fishing activities in a coastal area are affected then consequently the livelihood of the fishermen in that particular area are affected. Another important impact on the marine life is that the water used by the nuclear power plant as coolant is heated and when it gets heated it is of no use to the power plant so that water is released back into the water body, but now this water is hot water and if it is released in to a water body definitely it is going to affect the marine life a lot.

The disasters which have occurred in the nuclear power plants like in the Chernobyl and the Fukushima are not so destructible, but the only point to worry about is that radioactive elements are very hazardous to human life. Also, it has been a problem in nuclear power plants in managing the nuclear waste as it can prevail to 1000s of years.

VI. CONCLUSION

We live in a constantly growing world and an accruing environment. Change is quite fathomable to happen to daily lives even with a slight alternative. Also, it is necessary for global development to adopt the most convenient method which is safe for the environment and the biodiversity. We all know that none of the sources for energy generation are perfect but it must be a criterion that the most efficient and convenient method must be chosen from all the alternatives, and in this scenario nuclear power plant are very forward out of all the other sources. They are the only source that minimize the use of land, maximize the power generation, subtract the pollution and add efficiency. Switching towards nuclear energy is very reasonable.