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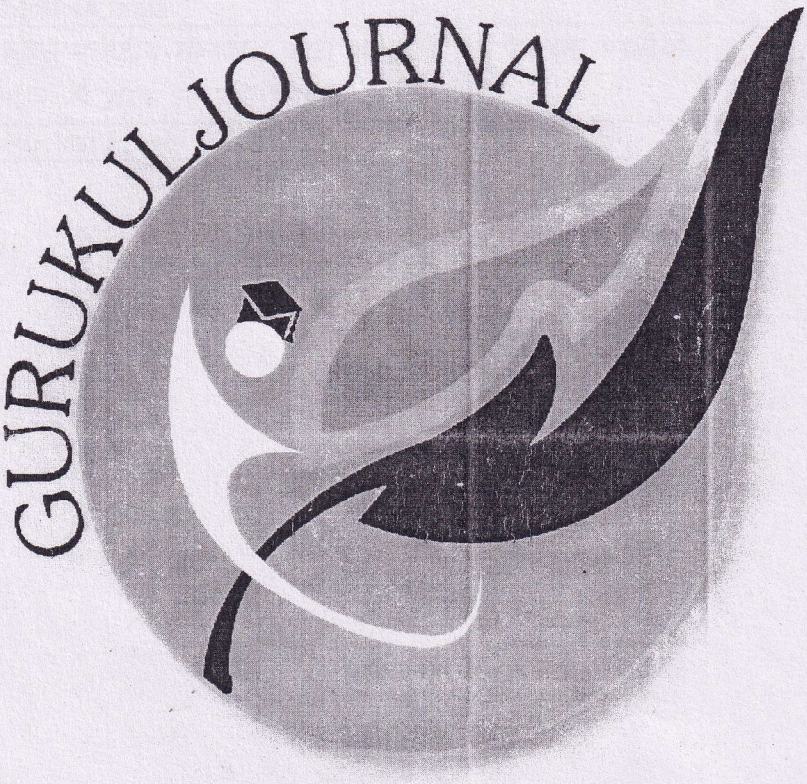

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Nuclear Power in India

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India has a largely indigenous nuclear power program. The Indian government is committed to growing its nuclear power capacity as part of its massive infrastructure development program. The government has set ambitious targets to grow nuclear capacity. At the start of 2018 six reactors were under construction in India, with a combined capacity of 4.4 GWe. Because India is outside the Nuclear Non-Proliferation Treaty due to its weapons program, it was for 34 years largely excluded from trade in nuclear plant and materials, which hampered its development of civil nuclear energy until 2009. Due to earlier trade bans and lack of indigenous uranium, India has uniquely been developing a nuclear fuel cycle to exploit its reserves of thorium. Since 2010, a fundamental incompatibility between India's civil liability law and international conventions limits foreign technology provision.

"Nuclear energy, in terms of an overall safety record, is better than other energy".

-Bill Gates

Nuclear energy is one of the cheapest, highly efficient and environment-friendly sources of energy of the current generation. Of late, there has been a newly found enthusiasm in the generation and use of nuclear energy because of its importance in varied sectors. The nuclear energy pioneers of the world include the US, France, Germany, Russia amongst others. The importance of nuclear energy in India too is on the rise.

Basically, nuclear energy is the energy in the nucleus of an atom that holds the neutrons and protons. Nuclear reactions (the reactions that change the number of protons and neutrons) release nuclear energy. The best example of nuclear energy or energy from nuclear reactions is the inexhaustible energy of the Sun. The fundamental processes of nuclear energy production include-Fission and Fusion.

Nuclear fission is a nuclear reaction that splits the nucleus of an atom into smaller parts and often leads to the production of free neutrons and gamma photons and releases a very large amount of energy. Almost all the operative commercial nuclear power plants in the world today

use nuclear fission to generate heat that produces electricity. On the other hand, nuclear fusion is a nuclear reaction in which two or more atomic nuclei come close enough to form one or more different atomic nuclei or subatomic particles. These reactions can release more energy than fission, without producing as many radioactive by-products, but have not been successfully and commercially developed yet.

When we discuss the issue of use or abuse of nuclear energy, the most evident instance that instantaneously comes to our mind is its use in nuclear warfare and nuclear weaponry that can cause immense destruction in a short period of time and have everlasting effects and can also lead to nuclear winter that can last up to several centuries. Thus, nuclear weapons and nuclear energy abuse threaten the world with a nuclear holocaust. There is no doubt that weapons of mass destruction can release vast amounts of energy-around millions of tons of trinitrotoluene. However, it is important to note that humanity can derive benefits, too, through peaceful application of nuclear energy in different fields.

Nuclear power is the fourth-largest source of electricity in India after thermal, hydroelectric and other renewable sources of electricity and India expects to have 20 GW of nuclear capacity by 2020. The Indo-US nuclear deal is also expected to facilitate India in meeting its goal of 25,000 MW of nuclear power capacity through imports of nuclear reactors and fuel by 2020.

'Nuclear medicine' is a medical speciality involving the application of radioactive substances in the early diagnosis and treatment of diseases in a safe and painless way, provided it is used in the correct prescribed dose. It is worth mentioning that elements can be made radioactive by bombarding them with neutrons. The atoms of the elements so bombarded, capture these neutrons, thus forming a different nuclei called radioisotope, which dissipate excess energy in the form of gamma and other rays. In nuclear medicine, medical professionals inject a tiny amount of radioisotope into the patient's body and a specific organ picks up the radioisotope, enabling a special camera to take a detailed picture of how that organ is functioning. For example, bone scans can detect the spread of cancer 6-18 months earlier than X-rays do. According to the cancer registry released by the Indian Council of Medical Research (ICMR), cancer cases and its incidence in India are estimated to grow by 25% by 2020, with more than 1300 Indians succumbing to the dreaded disease everyday. In this context, nuclear medicine is an easy way forward for early detection and treatment of cancer of all types. Moreover, given the

pathetic and deplorable conditions of hospitals and nursing homes in India, radiations can also be used to sterilize medical equipments to prevent the further spread of diseases.

Radioisotope Thermal Generators (RTGs) power space missions. Voyager Space Probes,; the Galileo mission to Jupiter and the latest Mars rover, Curiosity are best examples of RTGs powering space missions. The heat generated by the decay of a radioactive source, often Plutonium-238, is used to generate electricity. RTGs could be a stepping stone to ISRO's future extraterrestrial explorations like Mangalyaan-2, Venus exploration, Jupiter and solar exploration programmes.

Nuclear energy can also help in ameliorating global safe drinking water woes, given the dwindling supply of fresh water and climate change concerns. Currently, the use of nuclear energy is being explored for some desalination efforts that can also help to cut down the use of the commonly used fossil-fuel-based desalination, which is quite expensive because processing saline water into fresh water is extremely energy-intensive. The Nuclear Desalination Demonstration Plant (NDDP) located at Kalpakkam, Tamil Nadu, is the world's largest hybrid seawater desalination plant, couple to an existing nuclear power plant, Madras Atomic Power Station and it deploys both multi-stage flash (MSF) evaporation and reverse osmosis (RO) membrane separation technology. The total capacity of NDDP is around 6.3 million litres per day.

Nuclear technology can also help in preventing food spoilage, caused by microbes and pests, through food irradiation which involves raw foods being exposed to high levels of gamma radiation that would kill the microbes and bacteria pathogens, without affecting the nutritional value of the food and facilitate storage for a long time. In Mali, irradiation of Sorghum and rice seeds has produced more productive and marketable varieties which are more resistant to pests and adaptable to harsh climatic conditions as prevalent in India.

Apsara Research Reactor, designed and built in India with assistance and fuel from UK, was India's as well as Asia's first nuclear reactor. The second nuclear reactor was Canadian Indian Reactor Uranium System (CIRUS), supplied by Canada. It was a 40 MW reactor that used natural uranium as fuel and heavy water as moderator. Pokhran I (codenamed as Smiling Buddha by the Government of India) was India's first successful nuclear bomb test, detonated on an army base, Pokhran Test Range, Rajasthan by the Indian Army and India became the first country, after the five permanent UNSC members, to carry out such a test.

The Atomic Energy Act of 1948 focussed on peaceful development of nuclear programmes. India is not a member of NPT and has to develop its technology and fuel sources domestically and India has been making considerable advances in the field of thorium-based fuels and developing fast breeder reactors which maximize plutonium production. India's inclusion in NSG would not only provide India with a better market to export and import nuclear-related products and access to clean nuclear energy source but will also put India on a firm footing to propose the idea of plutonium trade for its thorium programme.

As a December 2016, India has signed civil nuclear agreements with 14 countries of the world. Post the 123 Agreement, the US approached the NSG to grant a waive. to India to commence civilian nuclear trade and India became the first non-signatory of NPT to carry out nuclear commerce with the rest of the world, with France being the first country to sign a civilian nuclear agreement with India in 2008. This has also eased India's uranium imports as India's uranium reserves are infinitesimal.

However, it is undeniable that nuclear energy has its fair share of risks and dangers-catastrophic accidental consequences, unauthorized and illegal access that we cannot afford to overlook. Over the past three decades, the risks have escalated. The nuclear bombing of Hiroshima and Nagasaki of Japan during the final stage of World War II is the only use of nuclear weapons for warfare in the human history till date. Currently, as North Korea has speeded up its nuclear programme, the West, particularly the US has also escalated its efforts, with the former claiming to have successfully miniaturized nuclear warhead, the credentials of which have not been independently verified. Under such circumstances, the apprehension of another world war looming large cannot be ruled out a nuclear world war.

The Chernobyl disaster and the Fukushima Daiichi nuclear disaster are perfect examples of catastrophic nuclear accidents and are classified as level 7 event (the maximum classification) on the International Nuclear Event Scale. Every country, particularly India needs to pay heed to the safety measures to prevent the loss of human and animal lives and property; we cannot even imagine a Bhopal Gas Tragedy-like event in our wildest dream.

Undoubtedly, the peaceful application of nuclear energy benefits the society but humanity cannot co-exist alongside the abuse of nuclear weaponry and only the safe and authorised use of nuclear energy for peaceful civilian purposes holds the key to a brighter tomorrow.

References :

1) Subramanian, T.S. (20 March 2011). "Massive uranium deposits found in Andhra Pradesh". news. Chennai, India: The Hindu. Retrieved 8 August 2016.

2) Bedi, Rahul (19 July 2011). "Largest uranium reserves found in India". The Telegraph. New Delhi, India.

3) http://www-pub.iaea.org/MTCD/publications/PDF/TE 1450 web.pdf

4) "Nuclear Power in India". world-nuclear.org. Retrieved 4 May

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