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Reevaluating the impact and risks of nuclear energy

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Introduction

As of 2023, 32 countries worldwide are operating 413 nuclear reactors for electricity generation, and 58 new nuclear plants are under construction. By the end of 2022, 12 countries relied on nuclear energy to supply at least one-quarter of their total electricity. Nuclear energy is sometimes referred to as a clean energy technology as it produces nearly zero carbon dioxide or other greenhouse gas emissions. This makes it a great and favorable source of energy. Even though nuclear safety has made great strides in recent decades stemming from increased regulation and improved technologies and processes, concerns remain around what to do with spent fuel from reactors, as there's still no definitive way to dispose of it indefinitely without risk. The history of nuclear power generation includes several accidental releases of radioactive steam and raising reasons for concern, which should be taken into account while making future decisions about nuclear energy.

Definition of Key Terms

Accession

This is the act when a state accepts the offer or the opportunity to become a party to a treaty already negotiated and signed by the other states. It usually occurs after the treaty has entered into force.

Conflict

A state of discord between two or more parties that can be active or perceived. It is often caused by disagreement on a particular topic(s).

Nuclear Accidents

An event occurring in a nuclear power plant due to a failure of technical components, human errors, or natural disasters leads to the exposure of potentially dangerous radioactive material into the environment.

Nuclear Energy

Nuclear energy is the energy in the nucleus, or core, of an atom. It is the use of nuclear reactions to produce energy through the process of nuclear fission.

Nuclear Reactor

A nuclear reactor, or power plant, is a series of machines that can control nuclear fission to produce electricity.

Nuclear Safety

Nuclear safety is the achievement of proper operating conditions and the prevention or mitigation of accident consequences, resulting in the protection of workers, the public, and the environment from undue radiation hazards.

Radioactive material

Elements that have an unstable nuclear decay over time and release energy in the process. This energy can be in the form of alpha, beta, or gamma rays.

General Overview

Nuclear energy was first discovered in 1938 through nuclear fission, nuclear decay, and nuclear fission reactions, and the first nuclear reactor was built in the 1950s. In the current world, nuclear energy is used mainly for nuclear energy generation. About 9% of the world's electricity is generated from about 440 power reactors across 32 countries. Over 50 countries utilize this energy in about 220 reactors. But apart from energy generation, nuclear energy is also used for agriculture, medicine, space exploration, and weaponry.

Use of nuclear weapons

When it was discovered that nuclear fission could generate large amounts of energy, scientists started asking their countries to support them in their nuclear research to develop nuclear weapons. It was this eagerness of scientists and the race between countries to develop nuclear weapons that catalyzed the discovery of nuclear weaponry. USA led this research with its Manhattan Project in 1942 by creating the first nuclear reactor and the Trinity test. The Trinity test proved the existence of nuclear bombs, which were used a few months later on Hiroshima and Nagasaki. These

bombings killed 140,000 civilians in Hiroshima and 74,000 civilians in Nagasaki and caused the survivors to face side effects of exposure to nuclear radiation. To this date, these bombings remain the only use of nuclear weapons in an armed conflict. After these bombings, there was a strong opposition to nuclear energy and its devastating nature. There was also a debate about the safety of nuclear power and its sustainable use by generating cheap and endless energy. This portrayed nuclear energy as both a threat and a promise in the future.

Currently, there are nine countries in the world that possess nuclear weapons. They are Russia (with 5,889 warheads), USA (with 5,224 warheads), United Kingdom (with 225 warheads), Pakistan (with 170 warheads), India (with 164 warheads), Israel (with 164 warheads), and North Korea (with 30 warheads). The possession of weapons by these countries does not mean that they are all stored in the respective countries, and thus, they are stored in Nuclear weapon states. They are Belgium, Germany, Italy, The Netherlands and Turkey.

To put the devastating effects of nuclear weapons into perspective, one warhead detonated over a city like New York City would cause approximately 583,160 casualties. All the Nuclear weapon countries dominate about 90% of the nuclear world market. This shows that

Nuclear Power Plants

One of the main uses of Nuclear power plants is to generate electricity through nuclear fission. Today, about 9% of the world's electricity is generated through almost 440 nuclear power plants. Almost all the top electricity generating uses nuclear energy to generate electricity, for example, France uses more than 50 nuclear reactors to derive about 70% of its electricity. The US also has 100 nuclear reactors and leads the nuclear power industry. Nuclear fission is a very sustainable way to generate large amounts of electricity with zero carbon emissions. There are multiple factors that need to be taken into account while establishing a nuclear reactor, such as cost efficiency, surrounding safety, and disposal of nuclear waste material. The safety of nuclear reactors should be taken quite seriously, as even a slight leak can expose radioactive material to the surrounding environment and lead to serious consequences. Some of the most severe nuclear power accidents are the 1986 Chernobyl Plant Accident in Ukraine and the 2011 Fukushima Plant Accident in Japan. Both of these accidents will be discussed in further detail later in the report.

Chernobyl plant accident

The Chernobyl plant incident took place in 1989 in Ukraine, Russia. This incident was caused by the explosion of reactor No.4 and killed 2 engineers while severing and burning many others. This explosion released 5% of the radioactive material in the plant to be leaked into the environment. 28

people, all of whom were exposed to the radioactive material, showed symptoms of ARS (Acute Radiation Syndrome) and died. Along with this, The United Nations Scientific Committee on the Effects of Atomic Radiation estimates that 100 deaths were caused due to radiation exposure. Any such major accidents cause severe harm to the environment by polluting the area with radioactive material, and in turn, influence wildlife and the civilians living in that area. Some radioactive materials have a half-life of hundreds of years, which makes the surrounding area of the power plant completely inhabitable. A 2006 WHO study projected 9000 cancer-related fatalities in Ukraine, Belarus, and Russia. This nuclear accident remains one of the worst nuclear disasters in history, with an estimated financial impact of 700 billion USD.

To this day, it remains one of only two nuclear events on a scale of seven, according to the International Nuclear and Radiological Event Scale (INES). At the time of the incident, no provisions had been made for an accident this scale, and it took the government and the authorities by surprise. Because of this, the decisions made were often delayed, and the safety measures provided were incomplete and ineffective. The other factor that caused prolonged exposure of the civilians was that the nuclear power plant was run by the authorities in Moscow. This meant that the government of Ukraine did not receive accurate information about this accident until much later. This delay caused a delay in evacuation and greater exposure.

The areas of Belarus, Russia, and Ukraine were heavily contaminated with radioactive material. To handle the situation more effectively, The government of the USSR worked together with the IAEA to manage the contaminated areas.

In February 2003, the IAEA established the Chernobyl Forum under a group of UN Agencies to assess the environmental consequences of the Chernobyl accident. This also comprised the governments of Belarus, Russia, and Ukraine. The World Association of Nuclear Operators (WANO) was created as a direct outcome of the 1986 Chernobyl accident. This incident altered world's view on nuclear energy and emphasized on focusing on meeting international safety and regulations.

The Treaty on the Non- Non-Proliferation Treaty (NPT)

Even though all the countries mentioned above possess nuclear weapons, The Treaty of Non-Proliferation, or NPT, is an international treaty to prevent the use of nuclear weapons and advocate the safer use of nuclear energy. One of the main goals of this treaty is to further achieve nuclear disarmament to prevent incidents like Hiroshima and Nagasaki from happening again.

This treaty was signed in 1968 by 190 parties and came into force in 1968. These 190 parties include both the ratifier and acceders states. The four UN states that have never accepted this treaty are India, Israel, Pakistan, and South Sudan. Out of these, Israel, India, and Pakistan are in possession

of nuclear weapons. North Korea, which is also in possession of warheads, is an acceder that announced its withdrawal from NPT.

According to the treaty, all the non-nuclear weapon states that are part of the NPT have agreed to never acquire nuclear weapons, and the nuclear weapon states in the treaty have agreed to share the benefits of peaceful nuclear technology and pursue nuclear disarmament.

Intergovernmental organizations such as the International Atomic Energy Agency work with Member states of the United Nations and multiple partners such as EEAS to promote the safe, secure, and peaceful use of nuclear technology. IAEA, created in 1957 after the bombings in Hiroshima and Nagasaki, is the world's central intergovernmental forum for scientific and technical cooperation in the nuclear field. One of the main reasons for its creation was to address the growing international concern toward nuclear weapons in the 1980s. The Treaty of Non-proliferation of Nuclear weapons, signed in 1968, gives the IAEA the power to monitor nuclear programs and inspect nuclear facilities all over the world. Even though the IAEA provides a framework and guidelines, it does not have the mandate to enforce the application safety standards within a country. Multiple sub-organizations like the Department of Nuclear Safety and Security work along with the 180 member states, the only non-member state being North Korea, to monitor the nuclear energy in the world.

Fukushima plant accident

The largest civilian nuclear accident since Chernobyl took place in Fukushima-Dagaii in Japan. The accident, which took place in 2011, was caused by to failure of equipment after an earthquake of magnitude 9.0 and a subsequent tsunami. Radioactive material was released on a large scale, and tens and thousands of people had to be evacuated. Three months later, the IAEA hosted a Ministerial Conference on Nuclear Safety to promote the re-evaluation of nuclear safety and nuclear energy policy worldwide. One of the major outcomes of this part included Germany accepting to close all its nuclear reactors by 2022.

Following the disaster, Japan shut down all its nuclear power plants, some of them even permanently. In 2015, some of the reactors were restarted after carefully reviewing safety criteria based on revised operating criteria and public approval. Since 2015, 40 reactors have been restarted, and in 2022, 10 more nuclear reactors were planned to reopen under Prime Minister Fumio Kishida's leadership.

Safety

Safety should be the top priority while making a nuclear power plant, as any leakage can cause exposure to radiation and harm the surrounding environment. After the incidents of Fukushima and Chernobyl, nuclear safety standards have been higher, and more precautions have been taken. But it has to be kept in mind that even after all these safety standards, complete elimination of risk in a nuclear power plant is impossible. There is always a chance of an accident taking place, but the impact of the accident can be minimized by having substantial and thorough investigations related to safety and upgrades. Long-established power plants can be used as an inspiration to develop new and effective safety measures.

One other key priority should be the safety of the operating staff in the power plants. While safety measures such as shielding and PPE suits can minimize exposure to radiation, having remote handling equipment for tasks involving the reactor core will make sure there is no direct contamination. This will also be helpful in terms of that civilian deaths can be avoided if there is a failure in the nuclear reactor.

Timeline of Key Events

Date	Event
December, 1942	The first man-made nuclear reactor
July, 1945	The Manhattan Project, which included the Trinity Test, and the atomic bombing of Hiroshima and Nagasaki
July, 1957	Establishment of the International Atomic Energy Agency (IAEA)
July, 1968	Treaty of the Non-Proliferation of Nuclear Weapons
April, 1986	Chernobyl plant accident
March, 2011	Fukushima plant accident
2017	Treaty of the Prohibition of nuclear weapons adopted by the UN

Major Parties Involved

International Atomic Energy Agency (IAEA)

IAEA is an intergovernmental organization that promotes the safe and peaceful use of nuclear energy worldwide. It was established as a part of the United Nations system in 1957. Even though it is governed by its own treaty, it does report to the UN Security Council and the General Assembly. It has multiple programs that promote the peaceful applications of nuclear energy and provide international safeguards against the misuse of nuclear technology and nuclear material. According to the Treaty of the Non-Proliferation of Nuclear Weapons, all non-nuclear powers are required to negotiate a safeguards agreement with the IAEA, which gives the authority to monitor nuclear programs and nuclear facilities.

The United States of America

The USA has been leading in developing nuclear energy. It has played a key role in the development, starting with the Manhattan Project during WW1 and later the bombing of Hiroshima and Nagasaki. The United States has the largest nuclear power industry, with more than 100 reactors, and is the largest producer of nuclear energy in the world. 20% of the country's electricity is generated through nuclear power plants. It is a vital step taken by the government to reduce carbon emissions and combat climate change.

As a founding member of the IAEA, it plays a crucial role in promoting the peaceful use of nuclear energy while preventing nuclear weapon proliferation. The US Nuclear Regulatory Commission (NRC) has set internationally recognized standards for nuclear plant safety and environmental protection. National agencies such as the Department of Energy and Nuclear Regulatory Commission oversee the nuclear industry domestically.

The US has also been instrumental in creating international agreements like the Non-Proliferation Treaty (NPT) and spearheading efforts such as the Nuclear Security Summits.

It also collaborates with leading nuclear countries like Japan, South Korea, and France to develop and deploy next-generation reactors.

International Campaign to Abolish Nuclear Weapons (ICAN)

The International Campaign to Abolish Nuclear Weapons is a coalition of non-governmental organizations in one hundred countries promoting adherence to the United Nations Treaty on the Prohibition of Nuclear Weapons. This plays an important role in making sure this treaty is well implemented.

Japan

Japan is one of the most affected countries by nuclear energy, from the bombing of Hiroshima and Nagasaki in 1945 to the Fukushima plant accident in 2011. Both of these incidents changed the public sentiment on nuclear energy and opposition to nuclear power plants. The Fukushima accident led to a temporary shutdown of all nuclear reactors in Japan, which were then restarted in 2015. But as of 2024, 10 nuclear reactors are operational while others undergo safety inspections. The government has a revised plan to generate 20-30% of the country's electric power through nuclear reactors by 2030 to meet climate targets and reduce the environmental impact of fossil fuels.

Currently, Japan works closely with the IAEA and advocates nuclear safety. Along with that, it has developed some of the world's strictest nuclear safety standards after Fukushima.

Russia (Soviet Union)

Russia is, and has been, one of the leading countries in terms of nuclear energy and its development. Initially, the main cause for Russia to intensify its research was learning of the US Manhattan Project. So, in 1949, the Soviet Union successfully tested its first nuclear bomb and ended the US monopoly in the nuclear field. Russia was also the one to build the world's first nuclear reactor in Obninsk, Russia, in 1954. This opened the gates for the use of nuclear power for civilian and commercial use. However, these rapid technological advancements lacked the needed safety precautions, which led to the Chernobyl accident in 1986.

As of 2024, the country operates 38 nuclear power plants and remains the largest exporter of nuclear reactors, with power plants in Turkey, India, China, and Egypt. Russia uses these nuclear reactors to generate about 20.7% of the national electricity mix. This energy is essential for the development of other industries. With controlling 40% of the world's enriched market, Russia plans to grow the nuclear market steadily and expand the role of nuclear energy.

France

France derives 70% of its electricity from its 56 operating reactors. It has a long history with nuclear energy, starting with Henri Becquerel's discovery of radioactivity, followed by further research by scientists such as Pierre and Marrie Curie. It is one of the five nuclear-weapon states under the NPT treaty and is working to reduce its stockpile of nuclear weapons. It has reduced its stockpile from 540 to the current arsenal of 290.

North Korea

North Korea has been active in developing nuclear technology since the 1950s. Even though the country has no active nuclear reactors, it has developed nuclear weapons which have been tested. It remains the only country not part of the IAEA and restrains from accepting the NPT treaty by the UN.

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

The UNSCEAR has assessed and reported levels of radiation exposure in multiple accidents, such as the Fukushima accident in 2011. Multiple governments and organizations throughout the world rely on the reports passed by UNSCEAR to evaluate the risks of nuclear power plants and take safety precautions accordingly. The UNSCEAR was involved with the Chernobyl case from early on and participated in the Chernobyl forum.

Further Reading

https://pure.iiasa.ac.at/id/eprint/15756/1/IR_nuclear_draft_180712.pdf

This research paper by multiple environmental scientists (- Jessica Jewell, Marta Vetier, and Daniel Garcia Cabrera) outlines treaties about nuclear energy and mentions its pros and cons. It also provides a dataset and data analysis of the international technological nuclear cooperation landscape and mentions steps taken by various countries for the safety of nuclear technology. You could use this to understand your delegation's viewpoint and contribution to the nuclear field. You can also refer to Page 15 to see the list of all the international nuclear cooperation and their roles.

<https://digitallibrary.un.org/record/207456?ln=en&v=pdf>

This is an official document submitted and adopted by the United Nations General Assembly. This resolution was adopted during the 12th session on 14th December 1957 and is on the topic of "Agreement governing the relationship between United Nations and the International Atomic Energy Agency." This outlines the cooperation between the United Nations and the IAEA, which plays a key role in the development and assessment of nuclear energy. This can be useful to understand the terms agreed upon for nuclear energy. This document can also be helpful in terms of potential solutions and formal resolution writing.

https://energy.ec.europa.eu/topics/international-cooperation/international-organisations-and-initiatives/international-atomic-energy-agency_en

The European Union plays an important role in cooperating with the International Atomic Energy Agency to promote the peaceful use of nuclear energy. This sub-section on the official European Union website states the EU's previous involvement in terms of practical arrangements and key meetings between EU-IAEA senior officers. So, this source can be useful in understanding the relationship between the EU and the IAEA and how the international organization works.

<https://world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power>

The World Nuclear Association provides data about various countries and their role in nuclear energy in great detail. It gives statistics as well as additional information about countries' policies and actions regarding nuclear energy.

Bibliography

"Fukushima Ten Years Later: The Catastrophic Accident and Its Consequences." *BASE*, www.base.bund.de/EN/ns/accidents/fukushima/fukushima.html.

ICAN. "Hiroshima and Nagasaki Bombings." *ICAN*, ICAN, 2018, www.icanw.org/hiroshima_and_nagasaki_bombings.

"International Atomic Energy Agency." *Energy.ec.europa.eu*, https://energy.ec.europa.eu/topics/international-cooperation/international-organisations-and-initiatives/international-atomic-energy-agency_en

International Atomic Energy Agency. "International Nuclear and Radiological Event Scale (INES) | IAEA." *iaea.org*, IAEA, 31 May 2019, www.iaea.org/resources/databases/international-nuclear-and-radiological-event-scale

Jewell, Jessica, et al. "The International Technological Nuclear Cooperation Landscape: A New Dataset and Network Analysis." *Energy Policy*, vol. 128, May 2019, pp. 838–852, <https://doi.org/10.1016/j.enpol.2018.12.024>

Martin, William. "Nuclear Power." *Encyclopædia Britannica*, 25 Jan. 2019, www.britannica.com/technology/nuclear-power

National Grid. "What Is Nuclear Energy? | Why Is Nuclear Considered a Clean Energy? | National Grid Group." *Www.nationalgrid.com*, National Grid, 27 Mar. 2024, www.nationalgrid.com/stories/energy-explained/what-nuclear-energy-and-why-it-considered-clean-energy

“Nuclear Power.” *Wikipedia*, 15 Nov. 2022, en.wikipedia.org/wiki/Nuclear_power#History

“Nuclear Safety.” *Energy.ec.europa.eu*, [energy.ec.europa.eu, energy.ec.europa.eu/topics/nuclear-energy/nuclear-safety_en](https://energy.ec.europa.eu/topics/nuclear-energy/nuclear-safety_en)

United Nations. “Atomic Energy.” *United Nations*, 2022, www.un.org/en/global-issues/atomic-energy

“What Is Nuclear Safety ? | ENSREG.” *Www.ensreg.eu*, www.ensreg.eu/nuclear-safety

Wheatley, Spencer, et al. “Reassessing the Safety of Nuclear Power.” *Energy Research & Social Science*, vol. 15, no. 15, May 2016, pp. 96–100, <https://doi.org/10.1016/j.erss.2015.12.026>

Wikipedia Contributors. “International Atomic Energy Agency.” *Wikipedia*, Wikimedia Foundation, 27 May 2019, en.wikipedia.org/wiki/International_Atomic_Energy_Agency

World Nuclear Association. “Chernobyl Accident 1986.” *World-Nuclear.org*, World Nuclear Association, 26 Apr. 2024, world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident

