India's - Civil Nuclear Technology

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Abstract

According to a report of Nationally Determined Contribution (NDC) to UNFCC India intends to increase its clean energy capacity. At the same time, India's energy poverty remains a major issue, and the country's development goal is dependent on providing electricity to the millions of people who are still unable to connect to the power grid. Nuclear energy has long been promoted as the solution to India's energy problems by major international actors, but actual performance has only flattered to deceive. In the last ten years, India has made some progress toward the conclusion of an Indo-US nuclear deal agreement, which has granted India a waiver from nuclear service. This paper aims are to study the reliability of nuclear energy as a solution is doubtful due to the possibility of nuclear accidents which may lead to environmental /physical/health problems among the marginalized communities.

Keywords: Nuclear Energy, Development, Marginalized communities, Accidents, Agreement.

1. Introduction

The developed and developing nations of the world are moving towards the development of civil nuclear reactors. Currently, coal accounts for 61% of India's electricity, followed by natural gas (7.6%), hydroelectricity (14%), other renewable energy sources (14%) and nuclear power. (3.5 per cent). By 2026, India planned to produce 9% more nuclear power as it is emerging as one of the important 'green source' for production of electricity. Since 1947, Homi Baba has stressed the importance of nuclear energy by stating

It was reasonable to believe that within the next couple of decades, atomic energy will play an important part in economy and industry of countries and that, if India did not wish to fall even further behind industrially advanced countries of the world, it would be necessary to take more energetic measures to develop this branch of suence and appropriate large sums for the purpose

Following this, India's goal is to increase nuclear power generation capacity from its current 6.8 gigawatts to 63 gigawatts by 2032. (Rosencranz and Vora, 2017). This increase is mainly due to two reasons. First, it depicts the sign of technological development in the country. Second, it is an important source of 'clean energy' which will help India to reduce carbon emissions and thereby playing its part in Global climate change.

In simple terms, we can define Civil nuclear technology as the controlled use of nuclear reactions for peaceful purposes, such as generating electricity, medical isotopes, or scientific research. Civil nuclear power plants are based on the same principle of nuclear fission as

nuclear weapons are. The only difference is that civil nuclear energy is used for peaceful purposes in a controlled manner. As a result of the issue of spent fuel containing radioactive elements, there may be risks to nuclear safety and nuclear theft Further, there have been risks due to possibility of cyberattacks, attacks during wartime or takeover of spent fuel during transit. As a result, the development and deployment of civil nuclear technology has been a topic of debate. Therefore, while nuclear power is a low-carbon energy source, there are risks associated with accidents, issues of nuclear security and the possibility of potential for the proliferation of nuclear weapons. To address these concerns, countries have developed safety regulations and protocols under the rubric of International Atomic Energy Agency (IAEA). One of the most important roles of the IAEA is to provide oversight and guidance on the peaceful use of nuclear technology.

Due to the risks involved in nuclear technology, it can be concluded that it is 'double edge sword. Nuclear energy, we can see how Marx turn to fetishism identified money as the mature expression of commodity fetishism as such, nuclear weapons function as the currency of power in the international system and in the "THEORY OF NUCLEAR FETISHISM" nuclear energy is often viewed as a valuable commodity, as it is a powerful source of energy that can be used for both civilian and military purposes. Nuclear power works as a currency of power in international However, the value of nuclear energy is not inherent to the technology itself, but rather a product of social and economic relations. The nuclear industry is heavily subsidized by governments, which allows for the creation and maintenance of nuclear power plants. The industry is also heavily regulated to ensure safety standards, which adds to the cost of nuclear energy. In addition, the potential for nuclear accidents or attacks creates a risk that must be factored into the cost of nuclear energy. Despite these costs, nuclear energy is often fetishized as a valuable and essential commodity, and countries that possess nuclear technology are often seen as more powerful in the international community. This can create a distorted view of the true value and costs of nuclear energy and can also lead to an unequal distribution of power based on possession of nuclear technology. (Santana,2009) So, despite nuclear security concerns, countries are developing these technologies. The most important fact which has often been missed is the problem of the marginalized people who are residing near the nuclear energy. This paper aims to address nuclear security issues, with reference to problems of marginalized groups in India.

2. India's Growth of Nuclear Energy

India's growth in civil nuclear technology can be traced back to the establishment of the Atomic Energy Commission (AEC) in 1948, which marked the beginning of India's nuclear energy program. Over the years, India has developed expertise in various aspects of nuclear technology, including nuclear power generation, nuclear medicine, nuclear waste management, and nuclear research. India's civil nuclear program has gone through several phases. In the first phase, which lasted until the 1970s, India's focus was on developing nuclear technology for peaceful purposes, including nuclear power generation. During this time, India developed its first nuclear power plant at Tarapur, Maharashtra, with the help of the United States.

The second phase lasted from the 1970s to the early 1990s, India faced international isolation due to its nuclear test in 1974 despite of the fact that these nuclear tests were termed as

'peaceful 'by Indian Ministry of External affair. As a result, India was forced to develop indigenous nuclear technology and become self-sufficient in this area. The nuclear landscape of India was changed due to the conclusion of Indo-US nuclear deal. The Indo-US nuclear deal, also known as the US-India Civil Nuclear Agreement, is a bilateral agreement between the United States and India signed in 2008. The deal aimed to allow India access to civilian nuclear technology and fuel in exchange for India opening its civilian nuclear facilities to inspection by the International Atomic Energy Agency (IAEA). Beside this, India entered into civil nuclear cooperation agreements with other countries, including Russia, France, and the United States in 1990s. These agreements helped India to gain access to advanced nuclear technology and equipment, which has enabled the country to expand its nuclear power program. India has also concluded civil nuclear agreements with Japan, a country which was reluctant to provide access to civil nuclear technology due to its experience of Hiroshima and Nagasaki India is using nuclear technology for medical isotopes, which are used for diagnosis and treatment of various diseases. The country has a well-established network of nuclear medicine centers that provide a range of diagnostic and therapeutic services to patients. Overall, India's growth in civil nuclear technology has been remarkable, and the country is expected to play an increasingly important role in the global nuclear energy market in the coming years.

As mentioned in an article India's Nuclear Energy Programme: Prospect and challenges.

Currently, India has 23 nuclear power reactors in operation, with a total installed capacity of 6,780 MW. In addition, India is also developing new nuclear power projects, including the 10,000 MW capacity Jaitapur Nuclear Power Project in Maharashtra, which is being built in collaboration with France.

"DAE (Department of Economic planners) have a history of making optimistic projections for the growth of nuclear power in India," the IPFM (Interantional panel for missile material) report from 2010 states. By 1987, India would have installed heavy-water and breeder reactor capacity of 20–25 GWe, according to Bhabha's 1962 prediction. The target of 43.5 GWe of nuclear capacity by 2000 has since taken its place. India's nuclear capacity, however, was only 4 GWe at the end of 2009, or about 3% of the nation's total electric-power generation capacity. The Nuclear Suppliers Group (NSG) lifted its ban on trade in uranium and nuclear technology with India in 2008, but the DAE had projected that India's nuclear-generating capacity would be 20 GWe by 2020 and 275 GWe by 2052(Gupta,2011).

According To 2011 Census Data Showing Total Energy and Electricity Generation **by Nuclear Plants in India:**

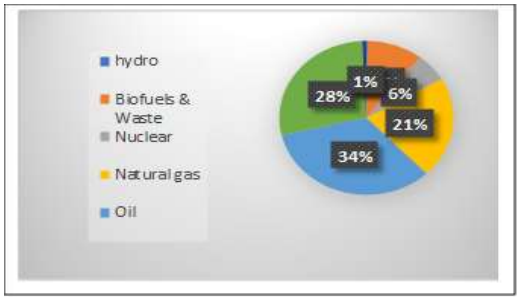

Fig1.Total Primary Energy Supply (IEA-2011)

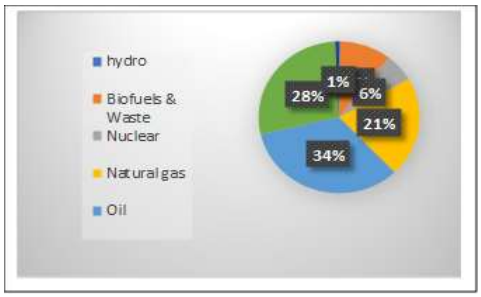

Fig.2 electricity generation in 2009 (IEA-2011)

To be self-sufficient in the nuclear energy, India has developed its civil nuclear reactors in different states as mentioned in Table 1(a).

Table 1: States that have Developed Civil Nuclear Technology in India

India has several civil nuclear facilities located in different parts of the country. Here are some of the major nuclear installations in India**...** **Power Plants in India – Operational**			
Name Of Nuclear Power Station	**Location**	**Operator**	**Capacity**
Kakrapar Atomic Power Station – 1993	Gujarat	NPCIL	440
(Kalpakkam) Madras Atomic Power Station – 1984	Tamil Nadu	NPCIL	440
Narora Atomic Power Station- 1991	Uttar Pradesh	NPCIL	440
Kaiga Nuclear Power Plant -2000	Karnataka	NPCIL	880
Rajasthan Atomic Power Station – 1973	Rajasthan	NPCIL	1,180
Tarapur Atomic Power Station – 1969	Maharashtra	NPCIL	1,400
Kudankulam Nuclear Power Plant – 2013	Tamil Nadu	NPCIL	2,000

Source: In March 2018, the Indian government designated 28 units with a capacity of 32 GWe as "in principle" approved. These figures are listed as "proposed" in WNA's reactor table.

These are some of the major civil nuclear facilities in India. There are also several other research reactors, nuclear fuel cycle facilities and nuclear medicine facilities located in various parts of the country.

3. India in Global Governance

In 1957, India became a founding member of the IAEA and actively participated in international discussions on safeguards for peaceful uses of nuclear energy. Given the current state of global security, India believes that nuclear security should be given top priority in the international community. As a responsible member of this community, India is emphasizing this aspect more than ever. In the more than five decades of India's nuclear weapons program, there has not been a single nuclear incident. Despite this, India has not shied away from acting against nuclear terrorism. Nuclear terrorism, according to India, is a serious threat in the twenty-first century, with potentially catastrophic consequences for international peace and security. India continues to render its vital support to global cooperation and diplomacy in building effective defenses against the threat of nuclear terrorism. (Kazi and Kolas,2019).

It is difficult to dismiss the possibility of risks arising from nuclear technology development because accidents have occurred in developed societies. Countries such as Russia and the United States claim to have better nuclear infrastructure. As a result, it is difficult to be certain about these technologies. Nuclear security issues include not only leakage issues, but also the impact of environmental disasters. The following section discusses various nuclear disasters that occurred on a global scale.

4. Historical Background of Nuclear Disaster

Chernobyl Disaster (1986): The Chernobyl disaster occurred in Ukraine in 1986 and was a catastrophic nuclear accident. The explosion and subsequent fire dispersed many radioactive particles into the air, which spread throughout the region and beyond. The long-term impact on the climate is still being investigated, but it is believed that the release of radioactive particles contributed to an increase in atmospheric pollution, which could have influenced global climate change. In terms of marginalized groups, the disaster had a devastating impact on the local population, forcing many to evacuate their homes and suffer health consequences because of radiation exposure.

More than 600,000 people (roughly half of Hawaii's population) were registered as emergency and recovery workers ("liquidators"), and 300,000 residents (roughly half of Wyoming's population) were relocated (Kinly III, 2006). The International Atomic Energy Agency classified the Chernobyl NPP accident as a level 7 "major accident" (Planer, R, 2013). Mental health effects were regarded as the most significant public health consequences in this case as well. (G. A.,2013)

The UN (United Nations) estimates that only 50 deaths can be directly attributed to the disaster, while the official, internationally recognized death toll indicates that only 31 people died as an immediate result of Chernobyl. It was predicted in 2005 that the radiation exposure would eventually cause 4,000 more people to pass away.

Fukushima Disaster (2011): The Fukushima disaster was caused by a massive earthquake and tsunami in Japan in 2011. The disaster caused the Fukushima nuclear power plant to melt down, releasing large amounts of radioactive particles into the environment. The impact on the climate is still being studied, but it is thought that the release of radioactive particles may have contributed to atmospheric pollution and thus to global climate change. In terms of marginalized groups, the disaster had a significant impact on local communities, forcing many to evacuate and suffering health consequences because of radiation exposure. In May 2012, 164,845 residents were evacuated. A total of 164,845 residents were evacuated in May 2012. This Nuclear Power Accident (NPP) was also registered as a level 7 by the International Nuclear and Radiological Event Scale (INES). (Terayama, T,2023)

There were no immediate fatalities because of the nuclear disaster. At least 16 workers were injured during the explosions, and dozens more were exposed to radiation while attempting to cool the reactors and stabilize the plant. According to a 2013 World Health Organization (WHO) report, the disaster will not result in an increase in cancer rates, and the risk of radiation is relatively low.

Three Mile Island Accident (1979): The Three Mile Island accident was a partial meltdown of a nuclear reactor in Pennsylvania in 1979. While the release of radioactive particles was limited, the incident had a significant impact on public perception of nuclear energy and safety. In terms of climate change, the incident did not have a significant impact. In terms of marginalized groups, the incident had a disproportionate impact on low-income and minority communities in the surrounding area, who were not properly informed about the potential risks and were not evacuated during the incident. According to the United Nations Regulatory Commission (UNRC), approximately 144,000 people within a 24km (about 14.91 mi) radius of the disaster left their homes for about a week. The accident appears to have had the

greatest impact on the mental health of the plant workers and the people living in the TMI region. .

Russia-Ukraine War (2022) till present: Russia and Ukraine went to war in February 2014, when disguised Russian troops invaded the Ukrainian autonomous republic of Crimea. Russia launched a full-scale invasion of Ukraine on February 24, 2022. Despite significant gains by Russian forces in the early days of the conflict, Ukrainian defenders rebuffed attempts to seize Kyiv and other major cities and were soon launching counterattacks on Russian positions.

When disguised Russian troops invaded the Ukrainian autonomous republic of Crimea in February 2014, Russia and Ukraine went to war. On February 24, 2022, Russia launched a full-scale invasion of Ukraine. Despite significant gains by Russian forces in the early days of the conflict, Ukrainian defenders rebuffed Russian attempts to seize Kyiv and other major cities, and counterattacks on Russian positions were soon launched. In all these cases, the marginalized groups were disproportionately affected by the disasters.

These communities often lack access to information about the risks associated with nuclear energy, and they may not have the resources to evacuate difficulties Faced by Marginalized Groups Due to Nuclear Accidents.

5. Who are marginalized groups and what is marginalization

According to Akshay Sharma's article "Access to Justice for the Marginalized Section in India," he defines the marginalized group as those Marginalization is defined as being forced to occupy the sides or margins of something. In a sociological sense, it refers to when a specific group of people is excluded from the normal course of life and forced to the outskirts of society because they speak a different language, adhere to different social customs, or do anything that contradicts the majority's views. Marginalization is a social phenomenon that occurs when a group of people is deemed unimportant and thus isolated from society's mainstream, such as Schedule castes, Scheduled tribes, women's groups, and so on.

Marginalization processes are recurring social mechanisms that prevent full and exclusive social integration and maintain existing social inequality, discrimination, and/or stigmatization (Mayntz 2004).

These Nuclear accidents have the potential to cause significant harm to people, particularly those who are already marginalized and vulnerable. The following are some of the difficulties faced by marginalized groups due to nuclear accidents:

Health Impacts: The health impacts of nuclear accidents can be severe, particularly for people living near the accident site. Marginalized groups such as children, pregnant women, and the elderly are particularly vulnerable to the health impacts of radiation exposure.

Displacement: Nuclear accidents often result in the displacement of people from their homes themselves from exposure to radiation. The long-term health consequences of exposure to radiation can also have a significant impact on these communities, particularly on children and pregnant women. Additionally, the loss of property and displacement can have a significant impact on the livelihoods of marginalized communities. munities. This displacement can have a disproportionate impact on marginalized groups who may not have the resources or support networks to cope with the loss of their homes and communities.

Economic Impacts: Nuclear accidents can also have significant economic impacts, particularly on the local communities and industries that are affected by the accident. Marginalized groups may be more likely to be employed in industries that are affected by the accident, such as agriculture or fishing, and may be more likely to suffer economic hardship as a result.

Social Stigma: Marginalized groups may also face social stigma and discrimination following a nuclear accident. This can make it more difficult for them to access support and resources and can exacerbate the other difficulties they are facing.

Civil nuclear technology has the potential to provide significant benefits, but the risks associated with nuclear accidents cannot be ignored. Marginalized groups are particularly vulnerable to the impacts of nuclear accidents, and it is important to ensure that they are adequately protected and supported in the event of such an accident.

6. Nuclear Technology Accidents Occur in India

Nuclear technology has led to many consequences for people and the environment. Below is the list of such nuclear disasters that have occurred in India.

March 1993: In NAPS unit 1, two turbine blades were slicing through other blades, causing an indirect raging fire. It absorbs the leaking oil and spreads it throughout the turbine building. The smoke detectors did not detect the fire. It caused a blackout in the plant, causing the secondary cooling systems to shut down, and power was not restored for 17 hours. As a result, the operators must manually engage the primary shutdown system. They also climbed to the roof to open valves that would slow the reaction. The incident received a level 3 rating on the international nuclear event scale, or INES.

Except theses there are many other nuclear accidents too that occurred in India and caused a lot of problems on environment and human life

March 1999: heavy water leaks from the pipes at madras atomic power station (MAPS) at kalpakkam, Tamil Nadu, during a test process. The pipes had a history of vibration problems and cracks. 42 people were reportedly involved in mopping up the radioactive liquid.

November 2009: 55 employees consumed radioactive material after tritiated water got into the drinking water cooler in Kaiga generating station. The NPCIL attributes the incident to "an insider's mischief"

Impacts of Such Nuclear Accidents on Environment and on Marganlized Section:

Although potentially disastrous, the environmental consequences of nuclear accidents are easily overlooked in policy debates. These include radioactive fallout, biological contamination, and even changes in species behavior, physiology, and morphology (Moller and Mousseau, 2006). As we all know, nuclear energy generates radioactive waste, which is a major environmental concern. Nuclear power plants impose These products, such as uranium mill tailings, spent reactor fuel, and other radioactive wastes, can be hazardous to human health for thousands of years.

Nuclear energy has both positive and negative effects on the environment. It is advantageous because it does not produce greenhouse gases, which contribute to global climate change. It is a renewable source of energy. While this is correct, it is also deceptive. Although nuclear power plants do not emit carbon dioxide during operation, they do emit a significant amount

of it during construction and operation. According to the Union of Concerned Scientists, even when operating normally, reactors pose risks to the environment and human health due to low levels of radioactive emissions from a variety of sources. Nuclear power plants use uranium as a fuel, which emits a significant amount of CO2 into the atmosphere. Radioactive plants continuously emit low levels of radiation into the environment, and various scientific studies have shown that this radiation can cause cancer in people who live nearby. Long-term exposure can also damage DNA. Furthermore, this radiation has the potential to harm wildlife, plants, and the ozone layer. Another significant issue is radioactive waste. This waste could be active for hundreds of thousands of years. Currently, there is no solution to this waste. Building more nuclear power plants, according to some scientists, is a bad idea.

These Nuclear Adversely Effect the Marganalized Section

We start by looking at distributive justice issues in US NPPs. In general, complex nuclear technologies pose potential health risks to people who live near nuclear power plants. Risks are divided into two categories: those caused by routine operations and those caused by catastrophic failures. Large areas near nuclear plants could be exposed to highly toxic radioactive releases, soil and water contamination, radiation from melted fuels, and large exclusion zones of uninhabitable land in the event of an acute failure (as in Chernobyl and Fukushima). The 2011 Fukushima Daiichi nuclear power plant disaster is the most recent example of how nuclear power plants can fail catastrophically, resulting in radiation-related diseases, the displacement of hundreds of thousands of people, and the contamination of vast areas. And, while these extreme events are rare, the environmental and health costs of these disasters will be borne by multiple generations, as Chernobyl demonstrated. (J.D.,2012)

Residents' perceived benefit and perceived risk of NPPs are important determinants of their nuclear acceptance as the most direct stakeholders and potential risk-takers, according to previous research (Guo and Wei, 2019; Zhu, 2018). Historically, nuclear waste has caused problems that have disproportionately impacted marginalized communities. The devastation caused by nuclear bombs, as well as the accidents that have forced marginalized people to flee their homes, cannot be overstated. As we saw during the covid-19 pandemic, poor management has resulted in the worst effects for this community. In addition, marginalized voices are being ignored in favor of nuclear development. Nuclear power plants are being planned and built in communities that oppose them and are concerned about their safety. Nonetheless, corporations continue to carry out their plans and silence the voices of the people. It has also been discovered that marginalized communities, such as those living below the poverty line or with higher populations of minority groups, tend to live closer to nuclear power plants. Chernobyl is famous for exemplifying what happens to marginalized communities when a nuclear disaster occurs. When the disaster struck, the city's many farmers found themselves suddenly without a way to make a living. This forced them to rely on government assistance to make ends meet and to relocate to a cheaper-housing region. Minorities and low-income communities are particularly vulnerable due to their proximity. Furthermore, while these communities have a higher proportion of women and children, nuclear power plants continue to be in such areas, demonstrating racist and classist discrimination.

7. Anti-Nuclear Protest Aganist Civil Nuclear Technology and what was the Government Response to It?

There have been several anti-nuclear protests in India against civil nuclear technology over the years. The most prominent of these protests were against the construction of the Kudankulam Nuclear Power Plant in Tamil Nadu, which was started in 2011. However, this achievement came after strong public opposition that was brought on by the Japanese Fukushima crisis. Following the Fukushima nuclear disaster, locals in Kudankulam besieged the plant for eight months out of grave concerns for the safety of the reactors. The protesters were primarily concerned about the potential risks associated with nuclear power plants, including radiation leaks, nuclear accidents, and the disposal of nuclear waste. They also expressed concerns about the impact of the power plant on the local environment and the livelihoods of the nearby fishing communities. The government responded to the protests by engaging with the protesters and addressing their concerns. The government set up a committee to investigate the safety of the Kudankulam plant and address the concerns of the local people. In addition, the government launched an information campaign to educate people about the safety features of nuclear power plants and the benefits of nuclear energy. The government also offered compensation and rehabilitation packages for those affected by the construction of the power plant. According to the report published by Institute for Defense Studies and Analyses (IDSA) on August 02, 2013, Despite the government's efforts, the protests continued, and there were allegations of police brutality and human rights violations. Because doubts are continued to be raised about the safety safety related concerns thus raises pertinent questions about 'how safe is safe enough' for the Kudankulam reactors and nuclear risk possibility in future. As the movement crushed when the Supreme Court of India ultimately ruled in favor of the construction of the Kudankulam power plant in 2013, stating that the plant had met all safety requirements and environmental regulations. Since then, there have been sporadic anti-nuclear protests in India, but they have not been as widespread or as intense as the Kudankulam protests.

The Indian government has continued to support the development of nuclear energy as a key part of the country's energy mix, but it has also taken steps to address the concerns of local communities and ensure the safety of nuclear power plants.

At present, The Lok Sabha was informed that the government intends to build nuclear power plants in north India, including one in each of Punjab and Uttarakhand.

Jitendra Singh, a minister of state in the prime minister's office, stated that nuclear plants are slated to be built in Uttarakhand, Punjab, Haryana, and Uttar Pradesh. He noted that the plants in north India have not been particularly noticeable up until this point.

8. A case study of the Mithivirdi Movement – the Story of a Struggle Against a Nuclear Power Plant in Gujarat

The Mithivirdi Movement was a grassroots campaign that took place in the Mithivirdi village in the Bhavnagar district of Gujarat, India. The movement began in 2010 and was aimed at opposing the construction of a nuclear power plant in the village by the Nuclear Power Corporation of India Limited (NPCIL).

The movement was spearheaded by local farmers, fisherfolk, and other villagers who were concerned about the potential environmental and health hazards posed by the nuclear power

plant. They argued that the plant would have a negative impact on the local ecology, including the marine life in the Gulf of Khambhat.

The villagers organized protests, rallies, and public meetings to voice their opposition to the plant. They also filed a petition in the Gujarat High Court, which led to a stay on the construction of the plant in 2013.

The Mithivirdi Movement gained national and international attention, with activists and organizations from across India and the world expressing solidarity with the villagers. The movement also highlighted the need for greater public participation and transparency in decision-making related to energy and environmental policy.

Ultimately, in 2016, the NPCIL announced that it was abandoning plans to construct the nuclear power plant in Mithivirdi, citing land acquisition issues and protests by local villagers. The Mithivirdi Movement thus succeeded in halting the construction of the plant and remains a significant example of people's power and grassroots activism in India.

Environmental activist and Paryavaran Sanrakshan Samiti member Krishnakant Chauhan recall one such incident, saying, "The movement has experienced many low moments; this was one such incident that occurred about six years ago. Villagers presented a charter of 18 demands to the Bhavnagar Collector, who received an assurance from NPCIL that they would be met.

9. The Government Safegaurds: Present And Future

In the future, the Indian government must prioritize the fair and adequate compensation of marginalized communities living near nuclear facilities. This will necessitate ongoing monitoring and evaluation of compensation policies and their implementation, as well as outreach to affected communities to learn about their needs and concerns. For safety concerns the government has already initiated various policies and programmes and taken the future into consideration to compensate the loss of marginalized groups affected by nuclear accidents.

To make the country's nuclear power plants sector more effective and safer, the government should lift the veil of secrecy surrounding its civilian program, with the first step being the establishment of an autonomous, transparent, and accountable regulatory institution. In this regard, the Atomic Energy Regulatory Board (AERB), which was established by gazette notification in 1983, is tasked with regulating the safety and security aspects of the country's civilian nuclear facilities. It is not, however, an autonomous body because it is entirely dependent on the Department of Atomic Energy (DAE) for all practical purposes. As a result, it has been unable to carry out its regulatory functions effectively. The establishment of a truly autonomous nuclear regulatory authority has long been advocated. The Raja Ramanna Committee report from 1997 recommended that the Atomic Energy Act (1962) be amended to improve the effectiveness of the country's nuclear regulatory system. Even though the Union government directed the DAE in 2000 to propose necessary amendments to the 1962 Act, nothing significant happened for nearly a decade. Finally, the DAE was jolted awake by the Mayapuri radiation accident in New Delhi in 2010 and the Fukushima disaster in Japan in 2011. HAPPYMON JACOB ,2014)

The Civil Liability for Nuclear Damage Bill, 2010 establishes (ACT NO. 38 OF 2010) specifies procedures for compensating victims and liability for nuclear damage. An Act to

provide for civil liability for nuclear damage and prompt compensation to victims of a nuclear incident through a no-fault liability regime, the appointment of a Claims Commissioner, the establishment of a Nuclear Damage Claims Commission, and other related or incidental matters.

Atomic Energy Regulatory Board to notify nuclear incident. – The Atomic Energy Act of 1962 (33 of 1962) established the Atomic Energy Regulatory Board. Nuclear facilities are supervised by regulatory bodies, which deal with incidents. The regulatory body is typically notified of a nuclear incident by the facility's operator or other sources such as emergency responders or the general public.

The Future of Nuclear Technology SMR TECHNOLOGY (SMRs) are advanced nuclear reactors with power capacities of up to 300 MW(e) per unit, or roughly one-third of the generating capacity of traditional nuclear power reactors. SMRs, which can generate a large amount of low-carbon electricity, are being developed. The benefit of SMR technology is

- SMRs will play an important role in the clean energy transition while also assisting countries in meeting the SDGs.
- SMR designs that have been proposed are generally simpler, and the safety concept for SMRs frequently relies on passive systems and inherent reactor safety characteristics such as low power and operating pressure.
- In some cases, these increased safety margins eliminate or significantly reduce the possibility of dangerous radioactive releases into the environment and the public in the event of an accident.

The amount of fuel required for SMRs has been reduced. The world's first floating nuclear power plant, Lomonosov, began commercial operations in May 2020 and is powered by two 35 MW(e) SMRs. Other SMRs are being built or licensed in Argentina, Canada, China, Russia, South Korea, and the United States.

According to a report by Union Minister of Atomic Energy (DAE) Dr. Jitendra Singh, India is also developing Small Modular Reactors (SMR) with capacities of up to 300 MW to meet its commitment to a clean energy transition. Dr.Jitendra Singh encourages the private sector and start-ups in India to look into the development of this critical technology.

CRITICISMS:

In India, civil nuclear technology has sparked debate and criticism from various segments of society. Some of the most serious criticisms leveled at civil nuclear technology in India are as follows:

Concerns about nuclear reactor safety and the disposal of radioactive waste are major concerns. The Fukushima disaster in Japan in 2011 highlighted the dangers of nuclear energy, and many in India are concerned that a similar disaster will occur.

- Environmental Impact: The construction and operation of nuclear power plants can have a significant environmental impact. Nuclear power plants use a lot of water, which can cause water scarcity in the surrounding areas. Concerns have also been raised about the effects of radiation on the environment and wildlife.
- Cost: Nuclear power plants are expensive to build and maintain, and many people believe that the cost of nuclear power is not justified when compared to the cost of renewable energy sources like solar and wind.Nuclear Weapons Proliferation: Some

critics argue that civil nuclear technology can be used to develop nuclear weapons, and thus the use of civil nuclear technology should be limited.

- Social Consequences: The construction of nuclear power plants can force people to leave their homes and livelihoods, causing social and economic disruption.

Overall, there are numerous concerns and criticisms about civil nuclear technology in India, and these issues must be carefully considered and addressed before any further development of nuclear power in the country.

10. Conclusion

The Indian government had announced an ambitious plan to increase atomic energy output sevenfold by 2022. However, a lot of unexpected grassroots movements have emerged to oppose these programs. Rather than focusing on fears of catastrophic events, it emphasizes citizen rights and government accountability. Although nuclear power has some significant advantages over coal and natural gas, those advantages vanish when compared to renewable energy technologies, and the potential for environmental disaster is enormous and long-term. We believe there is no reason to continue building new nuclear power plants and that investments should be made in wind, solar, hydro, wave, and other renewable and green energy resources that will not harm the environment. Although nuclear plants made significant impact on India energy resource but there is various impact on marginalized groups and environment, and with growth in India nuclear energy the concerns of others effect should be taken into consideration.

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