



## NUCLEAR ENERGY IN A CARBON-CONSTRAINED WORLD.

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### ABSTRACT

*Climate change is generally acknowledged as a serious challenge to mankind and much of nature. Nuclear power is a clean, zero-emission energy source. Fission, the process of separating uranium atoms to produce energy, is how it produces power. Without the harmful by-products emitted by fossil fuels, the heat generated by fission is used to produce steam, which spins a turbine to generate electricity. Nuclear power, when combined with renewables, energy efficiency, and other cutting-edge technologies, will help achieve long-term energy goals while also improving energy security.*

**KEYWORDS:** NUCLEAR ENERGY, CARBON, CLIMATE CHANGE, CLEAN ENERGY, CIVIL NUCLEAR LIABILITY, RADIOACTIVE WASTES, URANIUM.

### LIST OF ABBREVIATIONS

- WNA: WORLD NUCLEAR ASSOCIATION
- UN: UNITED NATION
- US: UNITED STATES
- DOE: DEPARTMENT OF ENERGY
- LWRS: LIGHT WATER REACTOR SUSTAINABILITY
- IAEA: INTERNATIONAL ATOMIC ENERGY AGENCY

- NPT: NUCLEAR NON-PROLIFERATION TREATY
- AERB: ATOMIC ENERGY REGULATORY BOARD
- PV: PHOTOVOLTAICS
- CO2: CARBON DIOXIDE
- NEI: NUCLEAR ENERGY INSTITUTE
- NRC: NUCLEAR REGULATORY COMMISSION

### INTRODUCTION

Many countries have faced the challenge of generating more energy to satisfy rising energy demand while also addressing the problem of reducing greenhouse gas emissions in recent years. It is widely accepted that the planet will face an environmental disaster unless drastic measures are taken to reduce global warming.

Present patterns in energy supply and use, according to the International Energy Agency, are clearly unsustainable — economically, environmentally, and socially. Energy-related CO<sub>2</sub> emissions will more than double by 2050 if no action is taken, and increased oil demand will raise questions about supply security. Since energy is at the heart of the issue, it must also be at the heart of the solution.”<sup>1</sup> As a result, the current research indicates that continuing on today's energy path without a change in government policy in the major energy-consuming countries will result in rapidly growing reliance on fossil fuels, with worrying climate-change implications.

Energy-importing countries are also confronted with a serious energy security problem. Many countries face risks in terms

<sup>1</sup> INTERNATIONAL ENERGY AGENCY, 2009b



of energy supply stability as a result of the concentration of energy sources in the unpredictable Middle East region. Oil-importing countries face a similar challenge in terms of energy supply. Many countries face risks in terms of energy supply stability due to the concentration of energy sources in the unpredictable Middle East region.

Many countries are being forced to find energy alternatives to fossil fuels due to energy protection and environmental concerns. Renewable and nuclear energy sources are thought to provide some solutions to energy protection and environmental degradation problems. As a result, many countries have invested in nuclear and renewable energy to reduce their reliance on imported oil, increase the availability of reliable energy, reduce the price instability, reduce greenhouse gas emissions associated with imported fossil fuels. Many people agree that nuclear and renewable energy, as carbon-free energy sources, will help to solve global warming and energy security problems. And countries that were previously wary of nuclear power are now showing an interest in developing it to diversify energy sources, boost energy efficiency, and provide a low-carbon alternative to fossil fuels.

Although the growing threat of global warming and climate change has focused attention on the connection between economic growth and pollution, research into the effect of nuclear and renewable energy as a potential panacea for emission reductions has been conspicuously absent.

- *What are the major challenges to the expanded use of nuclear energy, and how will the legal system address them?*

### **WHAT IS NUCLEAR ENERGY AND HOW IS IT SEEN AS A CLEAN ENERGY SOURCE?**

Nuclear energy is produced by the fission of atoms, which produces heat. Steam is used in all power plants to transform heat to electricity. At nuclear power plants, heat is produced by atoms splitting apart, a process known as fission. Heat and neutrons are released as a result of fission. The released neutrons then collide with other neutrons, repeating the process and creating more heat in the process. Uranium is the most popular fuel for nuclear fission.

#### **1. NUCLEAR ENERGY IS BENEFICIAL FOR THE EARTH.**

Nuclear power is a renewable, zero-emission energy source.

Fission, the process of splitting uranium atoms to create energy, is how it produces electricity. Without the toxic by-products generated by fossil fuels, the heat produced by fission is used to produce steam, which spins a turbine to generate electricity.

In 2019, the United States avoided more than 476 million metric tonnes of carbon dioxide emissions, according to the Nuclear Energy Institute (NEI). That's more than all other renewable energy sources combined, and it's the equivalent of eliminating 100 million cars from the road.

It also cleans the air by eliminating thousands of tonnes of toxic air pollutants each year that cause acid rain, smog, lung cancer, and cardiovascular disease.



## **2. NUCLEAR POWER HAS A MINIMAL ENVIRONMENTAL FOOTPRINT.**

Nuclear energy generates more electricity on less land than any other clean-air source, despite producing large quantities of carbon-free energy.

In the United States, a single 1,000-megawatt nuclear power plant needs a little more than 1 square mile to operate. According to the National Energy Institute, solar photovoltaic plants need 75 times more space to generate the same amount of electricity.

To put that into perspective, more than 3 million solar panels or more than 430 wind turbines will be needed to generate the same amount of energy as a typical commercial reactor.

## **3. NUCLEAR POWER GENERATES HARDLY ANY WASTE.**

The density of the fuel is exceptionally high. It's a couple of million times larger than alternative standard energy sources, however, the degree of fuel used is not as massive as you'd suppose. All of the used fuel generated by the energy business within us over the last sixty years might work on a playing area with a depth of but ten yards.

While the United States does not currently do so, the waste can also be reprocessed and recycled. Some advanced reactor designs in development, on the other hand, could run on used fuel. The NICE Future Initiative is a global campaign led by the Clean Energy Ministerial to ensure that nuclear power is taken into account while implementing future advanced clean energy systems.

## **IMPORTANCE OF NUCLEAR ENERGY:**

**NUCLEAR POWER HAS THE POTENTIAL TO PLAY A SIGNIFICANT ROLE IN THE TRANSITION TO RENEWABLE ENERGY.**

- **NUCLEAR POWER NOW CONTRIBUTES SIGNIFICANTLY TO ENERGY PRODUCTION, ACCOUNTING FOR 10% OF GLOBAL ELECTRICITY SUPPLY IN 2018.**

Nuclear power is the main low-carbon source of energy in industrialised economies, accounting for 18% of total production. However, in recent years, its share of global electricity supply has decreased. Advanced economies have guided this trend, as nuclear fleets have aged, new capacity additions have slowed to a trickle, and some plants constructed in the 1970s and 1980s have been withdrawn. The move to a renewable electricity system has been slowed as a result of this. Because of the decline in nuclear power, despite the impressive growth of solar and wind power, the overall share of renewable energy sources in total electricity supply in 2018 was the same as it was 20 years ago, at 36 percent. Stopping the slide would be critical to accelerating the decarbonisation of electricity supply.

- **FOR RENEWABLE ENERGY TRANSITIONS AROUND THE WORLD, A VARIETY OF TECHNOLOGIES, INCLUDING NUCLEAR POWER, WILL BE NEEDED.**



Electricity is becoming a more important source of global energy. That is to say, the secret to making energy systems clean is to transform the electricity sector from the largest source of CO<sub>2</sub> emissions into a low-carbon source that reduces fossil fuel emissions in areas such as transportation, heating, and industry. Although renewables are expected to continue to lead, nuclear power, in combination with fossil fuels, will play an important role in carbon capture, use, and storage. Countries that see nuclear as having a potential position account for the majority of global energy demand and CO<sub>2</sub> emissions. However, to stay on track with environmental priorities – like international climate goals – renewable energy growth will have to be three times faster than it is now. By 2040, 85 percent of global energy will have to come from renewable sources, compared to just 36 percent today. The trajectory will require an 80 percent increase in global nuclear power output by 2040, in addition to substantial investments in efficiency and renewable.

- **NUCLEAR POWER PLANTS HELP TO ENSURE ENERGY SECURITY IN A VARIETY OF WAYS.**

Nuclear power plants contribute to the stability of power grids. They may adapt their operations to some degree in response to demand and supply changes. The demand for such services will grow as the share of variable renewables like wind and solar photovoltaics (PV) grows. Nuclear power plants will help to mitigate the effects of seasonal fluctuations in renewable energy production while also improving energy stability by reducing reliance on imported fuels.

***CASE EXAMPLE WITH RESPECT TO THE WORLD NUCLEAR ASSOCIATION:***

For years, the nuclear power industry was reviled because of the risk of disasters like Chernobyl and leaks like Three-Mile Island, but it is now regarded as one of the cleanest of all energy technologies. Nuclear power plants produce no carbon dioxide, nitrogen oxides, or sulphur dioxides at all. In a 2009 paper, the Nuclear Energy Institute (NEI) noted, "In 2008, nuclear plants in the United States prevented the emissions of nearly 689 million metric tonnes of carbon dioxide." This is almost the same amount of CO<sub>2</sub> as all passenger vehicles in the United States." According to the World Nuclear Association, "for every 22 tonnes of uranium used, one million tonnes of CO<sub>2</sub> emissions are avoided". Nuclear power is seen as a more stable energy source, in addition to having clean air benefits. Nuclear power plants require very little fuel and are therefore less vulnerable to shortages; additionally, since nuclear power plants use uranium, which is abundant in the world, foreign affairs have no effect on the fuel supply. Although safety is still a concern when it comes to nuclear power, the safeguards in place now are sufficient to prevent incidents from happening in the first place, making nuclear power one of the safest ways to generate energy available today. The industry has learned from past mistakes, and safety precautions are now in place to reduce the risk of mishaps, such as a reactor accident or human radiation exposure. "In all countries using nuclear energy, there are well defined protocols for storing, handling, and transporting such wastes, financed from electricity users," the WNA says when it



comes to nuclear waste. Waste is contained and treated rather than being published. Storage is safe and stable, and plans for eventual disposal are well underway.” For years, many countries have successfully used nuclear power, and more countries are planning to build more nuclear power plants. Around 436 commercial nuclear power plants are currently operational in 30 countries around the world. According to the WNA, “more reactors are being built, and over 200 more are planned or firmly proposed.” France, for example, produces 75 percent of its electricity from nuclear power and has a long-standing nuclear energy strategy. Nuclear power has not always been viewed positively by the UK government. However, in recent years, there has been a change in this mindset; only last year, a ban on nuclear plant construction was lifted. The government of England and Wales approved the construction of ten new nuclear power stations in 2009. Nuclear power, according to Energy Secretary Ed Miliband, is a safe and tested energy source. The United States has also recently announced plans to advance nuclear power plant production. Nuclear energy is America's primary source of clean air, according to the NEI. There's no denying that the nuclear power industry has seen some disastrous events. The 1986 Chernobyl accident is an excellent example of the devastating consequences of a nuclear power plant meltdown. The Chernobyl nuclear power plant meltdown in Ukraine resulted in a fire that sprayed radioactive fallout over a wide area, making it one of the worst nuclear power plant incidents in history. People in those areas experienced both short- and long-term health consequences. Another historic nuclear power accident occurred in the United States in 1979 with the Three-Mile Island disaster. The worst commercial

nuclear power plant accident in United States history prompted the Nuclear Regulatory Commission (NRC) to tighten safety regulations. According to the NRC, the plant experienced a serious core failure, which is the "most dangerous form of nuclear power accident." Despite these accidents in the past, the nuclear power industry has maintained a high level of protection. Nuclear power has been efficient and appears to be increasing in the future, according to the WNA, with nearly 12,000 cumulative reactor years of service spanning five decades.

### MAJOR CHALLENGES POSED BY NUCLEAR ENERGY

The nuclear industry faces many major challenges, including ensuring power plant protection, shielding reactors from natural disasters and external aggression, and developing successful long-term waste management solutions. The role of nuclear power in a decarbonized energy mix that can help limit global warming will be determined by how these obstacles are overcome. The international community is currently working on Generation IV reactors, which are part of the solution.

#### a) GROWING PUBLIC AWARENESS

The general public often perceives commercial nuclear power as a dangerous or unreliable operation. This impression is frequently focused on three global nuclear incidents, a false connection with nuclear weapons, and how it is depicted in mainstream television shows and films.



DOE and its national laboratories are collaborating with industry to develop new reactors and fuels that will improve the overall efficiency of these technologies while also reducing nuclear waste production.

DOE's social media and STEM outreach programmes to educate the public about the benefits of nuclear energy also work to provide reliable, fact-based facts about nuclear energy.

**b) TRANSPORTATION, STORAGE, AND DISPOSAL OF USED FUEL**

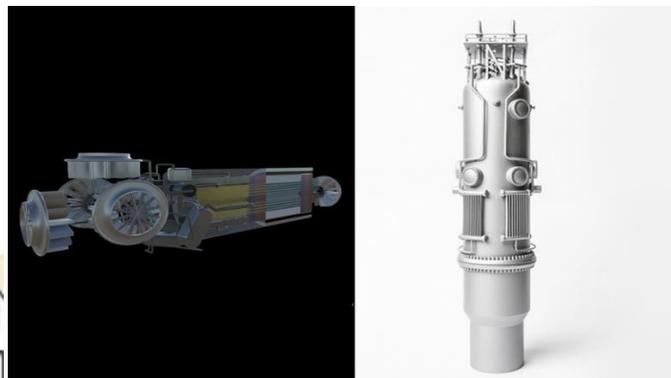
Many people see used fuel as a growing issue and are concerned about how it will be transported, stored, and disposed of. All commercial used fuel is currently safely stored at 76 reactor or storage sites in 34 states, and DOE is responsible for its eventual disposal and related transportation. For the time being, this fuel can be securely stored at these facilities until Congress determines a permanent disposal solution.

The Department of Energy is currently assessing nuclear power plant sites and surrounding transportation systems in order to facilitate the potential transportation of spent fuel away from these facilities. It's also working on new, specially built railcars to enable potential large-scale transportation of used fuel.

**c) BUILDING NEW POWER PLANTS**

Stakeholders may be discouraged by the prospect of constructing a nuclear power plant. Multibillion-dollar infrastructure programmes are multibillion-dollar reactor

designs. Public interest has also been stifled by high capital costs, licencing and regulation approvals, as well as lengthy lead times and development delays.



**TINY MODULAR REACTOR (LEFT) - MICROREACTOR (RIGHT)**

The Department of Energy is funding the construction of two new reactors at Plant Vogtle in Waynesboro, Georgia, in order to restore its nuclear workforce. The reactors will be the first new reactors built in the United States in over 30 years. When the new units start operating in 2021 and 2022, the expansion project will employ up to 9,000 employees during peak construction and create 800 permanent jobs at the plant.

DOE is also promoting the production of smaller reactor designs, such as microreactors and small modular reactors, which would provide customers with even more size and power capacity flexibility. These factory-built systems are expected to cut construction time in half and make nuclear power more cost-effective to instal and run.



#### d) OPERATING COSTS ARE EXORBITANT

The nuclear industry is struggling to compete due to difficult market conditions. Strict controls on maintenance, staffing levels, operator preparation, and plant inspections have cost the industry a lot of money.

The Light Water Reactor Sustainability (LWRS) programme of the Department of Energy is working to address these financial issues by modernising plant systems to lower operating and maintenance costs while improving efficiency. The programme is also looking to diversify plant products through non-electric applications such as water desalination and hydrogen production, in addition to materials research that supports the long-term operation of the nation's reactor fleet.

To will running costs even further. DOE is also collaborating with industry to improve accident-tolerant fuels and cladding. These new fuels have the potential to improve plant efficiency, allowing for longer response times and less waste. By 2025, accident-tolerant fuels will be widely used.

- *What is Nuclear Power's Importance and Challenges in India, and how is the civil nuclear liability regime enforced?*

<sup>2</sup> Anil Kakodar, 'Energy in India for the Next Decades,' paper presented at the International Atomic Energy Agency's Inter-Ministerial Conference on 'Nuclear Power for the 21st Century,' Paris, March 21-22, 2005.

#### INDIA'S STAND ON NUCLEAR ENERGY

Nuclear power accounts for just a small percentage of India's overall commercial primary energy consumption. Nuclear power is used to produce electricity, but it accounts for a very small percentage of the total electricity produced in India. Nuclear power, despite its limited current contribution, has the ability to provide India with "energy independence" beyond 2050, and hence its production is seen as critical.<sup>2</sup> India, on the other hand, has a low concentration of low-quality uranium ores but a significant quantity of thorium ores. As a result, India's nuclear-generation programme is organised into three stages: (i) Pressurized Heavy Water Reactors, (ii) Fast Breeder Reactors, and (iii) Reactors based on the Uranium 233-Thorium 232 cycles, all of which are aimed at eventually exploiting the country's large thorium reserves. However, since India is a non-signatory to the Nuclear Non-Proliferation Treaty (NPT) and has conducted nuclear tests in 1974 and 1998, it has been subject to foreign sanctions preventing it from obtaining nuclear materials and technologies from other countries.<sup>3</sup> India's potential nuclear power production is reliant on civilian nuclear trade with the international community. The International Atomic Energy Agency (IAEA) was established in 1956 with the primary goal of promoting and facilitating nuclear power's spread.<sup>4</sup> It was assumed that atomic energy would lead to global 'peace, health, and prosperity.' According to the IAEA's goals,

<sup>3</sup> 'Evolution of the Indian Nuclear Programme,' Annual Study of Energy and the Environment 369-95, A. Gopalakrishnan (2002)

<sup>4</sup> Articles III (1) – (3) of the Statute of the International Atomic Energy Agency (IAEA) (4).



health and environmental risks will be handled by different legal structures, which will formulate rules and regulations based on IAEA-established safety guidelines.

### **CHALLENGES AND IMPORTANCE OF NUCLEAR ENERGY IN RESPECT WITH INDIA**

In the last 10-15 years, a new chapter on nuclear power has been published. Many legal structures have shifted to nuclear energy as a result of increased rivalry for fossil fuels and global concerns about climate change. Indeed, according to the World Nuclear Industry Status Report 2010–2011, more nuclear reactors were under construction in 2010 than in any year since 1988.<sup>5</sup> While the number of operating reactors in the world fell by 39 percent in 2014, from 427 in July 2013 to 388 in July 2014, there are now 50 fewer than in 2002.<sup>6</sup> The transition to nuclear energy is especially strong in China, India, and South Korea, which are all energy-starved yet fast-growing economies. In reality, India has devised a bold plan to achieve a nuclear power capacity of 63,000 MW by 2032, and the Indian government has repeatedly stated that nuclear energy would play an important role in the

country's search for a clean and environmentally friendly energy source. Even as the global nuclear energy industry and Asian countries prepared for this revival, the Fukushima disaster in 2011 served as a grim reminder of nuclear power's ability to cause devastating harm and the need for stricter safety standards.<sup>7</sup> Scholars and experts have paid close attention to the design of effective safety regulations for civil nuclear facilities, which is unsurprising.<sup>8</sup>

India's economy is growing at a healthy pace of 8% per year.<sup>9</sup> To maintain this pace of growth, the country must prioritise infrastructure development and increased input supply (such as energy).<sup>10</sup> In the next thirty years, India's total commercial energy demand is expected to rise by 7.5 times, but the current growth rate is only 3.29 percent. Given the imminent threat of climate change and environmental degradation, it is also important that the energy generated does not pollute the atmosphere. This can be accomplished using both renewable and nuclear energy sources. The following are India's current energy generation sources.

### *SUMMARIZATION OF INDIA'S ENERGY SECTOR<sup>11</sup>*

<sup>5</sup> 'Ensuring Energy Security,' Foreign Affairs 65:2 (March/April 2006), p.69.

<sup>6</sup> D R Sardesai Ahomas (ed.) Nuclear India in the Twenty-First Century, 282-87. Raju G C Thomas, 'India's Energy Policy and Nuclear Weapons Program,' 2002).

<sup>7</sup> The Hindu, March 30, 2006, Sudha Mahalingam, 'Diversification and Energy Protection.'

<sup>8</sup> The Convention on Nuclear Safety was signed in 1994, followed by the Convention on the Safety of Spent Fuel and Radioactive Waste Management in 1997, and the Convention on Nuclear Emergency Assistance in 1986.

<sup>9</sup> Trading Economics, India GDP Growth Rate, <http://www.tradingeconomics.com/india/gdp-growth>

<sup>10</sup> In the Eleventh Five Year Plan (2007-12), the Indian government aimed to achieve a GDP growth rate of 10% and sustain an annual growth rate of about 8% for the next 15 years.

<sup>11</sup> 'India's First Airpower Doctrine Takes Shape,' Jane's International Defence Review, 30(6), 33-38. Pravin Sawhney, 'India's First Airpower Doctrine Takes Shape,' Jane's International Defence Review, 30(6), 33-38. (1997).



Fuel	MW	Percentage (%)
Total Thermal	188,898	70.6
• Coal	164,636	61.5
• Gas	23,062	8.6
• Oil	1,200	0.4
Hydro (Renewable)	41,267	15.4
Nuclear	5,780	2.2
Renewable Energy Sources	31,692	11.8
Total	2,67,637	

Energy	Improved/Declined	Percentage (%)
Thermal	Improved by	4.18
Hydro (Renewable)	Improved by	18.58
Nuclear	Improved by	4.14
Overall growth rate	Improved by	6.04

Hydropower stations combined with thermal power stations have provided the majority of India's electricity over the years. At the same time, energy output from nuclear power plants has decreased, despite the fact that the National Electricity Policy of 2005 calls for a substantial increase in the share of nuclear power through increased public sector investments. The total growth rate of energy in the thermal, hydro, and nuclear sectors was 6.04 percent in 2013-14, and it was 8.4 percent in 2014-15 (provisional). The following is the generation output by category:

*INDIA'S POWER GENERATION OVERVIEW<sup>12</sup>*

Nuclear power accounts for around 16% of global electricity output<sup>13</sup>. Nuclear power produced more than 15% of the world's electricity in 2009<sup>14</sup>. Aside from that, more than 150 nuclear-powered naval vessels have been constructed around the world. India currently has nineteen nuclear power plants in operation, producing 4,560 MW of electricity, with four more under construction, with a total capacity of 2,720 MW<sup>15</sup>. India also plans to raise nuclear power's contribution to total electricity production capacity from 4.2 percent to 9 percent in the next 25 years. India has an ambitious plan to achieve a nuclear power capacity of 63,000 MW by 2032, according to the official report.<sup>16</sup> However, recent public demonstrations against the construction of new nuclear power plants have put this goal in jeopardy. For example, public opposition to a 9900 MW nuclear power plant in Jaitapur, Maharashtra, and a 2000 MW nuclear power plant in Koodankulam, Tamil Nadu, India, has been unprecedented. Similarly, the West Bengal

<sup>12</sup> Source: <http://www.powermin.nic.in/Overview-0>  
<sup>13</sup> 'Price of Failure,' Daily News & Analysis, November 13, 2007. Nicolas Blarel and Manjeet S. Pardesi  
<sup>14</sup> Id at 4

<sup>15</sup> *ibid*  
<sup>16</sup> India as a New Global Power: An Action Agenda for the United States, by Ashley J. Tellis, pp. 19-54. (Carnegie Endowment for International Peace, Washington, D.C., 2005)



state government has denied permission for a planned 6000 MW power plant in Haripur, citing safety concerns.

In the context of the lifting of global sanctions, the country's increasing energy needs, and a rise in nuclear trade, The Civil Liability for Nuclear Damage Act, 2010, was passed by the Indian Parliament in 2010 to provide a specific framework for dealing with compensation claims resulting from nuclear accidents. Prime Minister Manmohan Singh said after the bill was passed in the Lok Sabha that it marked the "end of a journey to end the apartheid against India in the area of atomic power."<sup>17</sup> However, the question is not only how much liability should be charged in the case of an accident, but who should foot the bill, the operators or the vendors, and to what degree.

- *Why nuclear power is both environmentally friendly and long-term. What is the legal safety regulation?*

### **REGIME GOVERNING CIVIL NUCLEAR LIABILITY**

#### **THE 2010 ACT ON CIVIL LIABILITY FOR NUCLEAR DAMAGE**

Operators of nuclear power plants are legally responsible for any harm they cause. Operator liability is founded on the principle of no fault or strict liability, regardless of fault, rather than the fault principle. This

<sup>17</sup> 'Safety Last,' Frontline, 2010, p.28. John Cherian.

<sup>18</sup> Details at: <http://www.world-nuclear.org/info/inf67.html>

<sup>19</sup> The (Paris) Convention on Third Party Liability in the field of Nuclear Energy, 1960.

damage will have an effect not only in the disaster's own country, but also in neighbouring countries. Normally, the owners of the plants/nuclear establishments are held responsible for the damage to a certain extent, which they may cover by insurance. Beyond that, states assume liability as the insurer of last resort, according to international law and practise.<sup>18</sup>

The international system of nuclear liability currently consists of three major international agreements. They are as follows:

- (a) The Paris Convention of 1960<sup>19</sup>.
- (b) The Vienna Convention of 1963<sup>20</sup> along with the 1997 Protocol to Change the Vienna Convention.
- (c) The 1997 Supplementary Compensation Convention for Nuclear Damage.

Only the Convention on Supplementary Compensation for Nuclear Damage<sup>21</sup>, has been ratified by India, but she has signed a number of bilateral agreements with other nations, including the United States, the United Kingdom, Russia, France, and Canada, for cooperation in the use of nuclear energy for civilian purposes. The bilateral agreement between India and France expressly notes that India must establish a civil nuclear liability system to compensate for damage caused by accidents involving nuclear material and facilities.

Despite the fact that there are over 400 nuclear reactors in service around the

<sup>20</sup> The (Vienna) Convention on Civil Liability for Nuclear Damages, 1963.

<sup>21</sup> Information at: <http://www.iaea.org/newscenter/news/2010/indiaconvention.html>



world<sup>22</sup>, there have only been three major nuclear reactor incidents in which human lives have been lost<sup>23</sup>. However, the consequences of a major nuclear disaster, such as Chernobyl, is catastrophic.<sup>24</sup> The Civil Liability for Nuclear Damage Act of 2010 was enacted with the aim of providing swift coverage in the event of a nuclear disaster. To resolve this problem, international agreements have certain common features:

- a. Removing operators' no-fault responsibility and forcing them to purchase insurance or have financial protection.<sup>25</sup>
- b. Time and monetary limits on no-fault responsibility.
- c. There is a procedure in place to ensure that victims receive their compensation as quickly as possible by determining which court or authority has jurisdiction.

On September 21, 2010, the president signed the Civil Liability for Nuclear Harm Act of 2010. The primary goal of this law is to establish civil liability for nuclear harm and provide timely coverage to victims of nuclear accidents through a no-fault liability regime that assigns responsibility to both the operator and the state. This Act also intends to create a Nuclear Damage Claims Commission and appoint a Claims Commissioner. It is also claimed that it is being enacted to compensate for liability in the event of a nuclear incident, as well as the

"need to enter an international liability regime."

The Act covers nuclear damage that occurs outside India's territorial waters, in or over the exclusive economic zone, on board or by a ship registered in India, or on or by an artificial island, construction, or structure that is subject to Indian jurisdiction. At the same time, it only applies to nuclear installations owned or operated by the Central Government, either directly or through any authority or entity it or a government company has created.

#### **NUCLEAR DAMAGE LIABILITY:**

The law and procedures on responsibility for nuclear harm are laid out in Chapter II of the Act (sections 3 to 8). If the Atomic Energy Regulatory Board (AERB) believes the seriousness of the hazard and danger involved is not negligible, it must report a nuclear incident within 15 days of its occurrence. After being informed, the Board will make the incident widely known so that people can be vigilant and take all appropriate precautions. However, the term "insignificant" used in this section appears to be perplexing. It allows the AERB to decide what is and is not important since there are no pre-determined parameters. If a nuclear incident occurs while the Operator is in charge of a "nuclear installation" or "nuclear materials," the Operator is responsible for the resulting "Nuclear Damage." Because there are several operators and the harm due to

<sup>22</sup> World Nuclear Power Reactors & Uranium Requirements, <http://www.world-nuclear.org/info/reactors.html>

<sup>23</sup> Appendix 2: Serious Nuclear Reactor Accidents, Safety of Nuclear Power Reactors, <http://www.world-nuclear.org/info/inf06app.html>

<sup>24</sup> Backgrounder on Chernobyl Accident, available at: <http://www.nrc.gov/reading-rm/doc-collections/factsheets/chernobyl-bg.html>.

<sup>25</sup> Civil Liability for Nuclear Damage Act, 2010 preamble



each is not separable, each operator's liability is "Joint and Many."<sup>26</sup> And if there are mutual and multiple liabilities, the overall liability of the operator must be as set out in section 6(2). In the event that many nuclear installations owned by the same operator are involved in a nuclear incident, the operator is individually responsible to the degree set forth in section 6(2) for each nuclear installation.

**BASED ON THE PRINCIPLE OF "NO-FAULT LIABILITY," AN OPERATOR'S LIABILITY IS DESCRIBED AS "STRICT LIABILITY."**

The 'absolute liability' principle, which governs strict liability in India, states that "where an organisation is engaged in a hazardous or inherently dangerous activity and harm is caused to someone as a result of an accident in the conduct of such hazardous or inherently dangerous activity. For example, if poisonous gas escapes, the company is solely and entirely liable to compensate all those that are harmed as a result of the accident, and this responsibility is not subject to any of the exceptions that apply to the tortious concept of strict liability under the Rylands v. Fletcher rule."<sup>27</sup> To put it another way, total responsibility means that there are no exceptions to the law. The Indian Supreme Court established this liability standard in *M.C. Mehta v. Union of India (Oleum Gas Leak Case)*<sup>28</sup>.

The extent of liability in the event of a nuclear disaster in India, however, is not specified. The Act expressly states that an

operator is not liable under such special circumstances (however, even under these circumstances the victim will get compensation as the liability is transferred to the Central Government).

The following are the circumstances:

(a) A severe natural disaster of extraordinary proportions. The term "exceptional character," on the other hand, is not described in the Act. The authorities have a lot of choice in this situation.

(b) Armed conflict, hostility, civil war, insurgency or terrorism are both examples of terrorism.

If these events directly cause nuclear harm, the government takes responsibility instead of the operator<sup>30</sup>. In addition, any nuclear damage to the following is included on the list:

1. The nuclear facility itself, as well as all other nuclear installations on the site where the incident occurred, whether completely or partially built.
2. Any land on the same site that is being used or will be used in conjunction with the installation.
3. To the mode of transportation used to transport the radioactive materials involved at the time of the nuclear incident.<sup>31</sup>

These rules, although intended to prevent the operator from receiving compensation for a nuclear incident he caused, which work against the interests of another party whose

<sup>26</sup> Id section 4(2)

<sup>27</sup> *Rylands v. Fletcher* (1868) LR 3HL 330

<sup>28</sup> *M.C. Mehta v. Union of India*, AIR 1987 SC 1086

<sup>29</sup> Id S.5

<sup>30</sup> Id S.7

<sup>31</sup> Id S. 5



property was on the same site at the time of the nuclear incident.

### **CONCLUSION**

Nuclear technology has exploded in popularity over the last few decades, due largely to the international community's increasing concern about global warming. All international liability regimes for nuclear harm have two features in common: channelling liability to the operator, capping that liability, and passing ultimate obligation to the government to compensate victims. Relieving the supplier of all responsibility in the event of a nuclear accident entails significant risks, reducing the supplier's motivation to design safer nuclear plants.

Apart from channelling liability to the operator, capping that liability, and assigning final responsibility for compensating victims to the government under the Indian civil nuclear liability regime, the operator has been granted a right of action against the supplier if the nuclear incident was caused by equipment or material with patent or latent defects or subsisting defects by the supplier. It is a significant deviation from international best practises, but it is well justified because it holds suppliers accountable in nuclear commerce and reduces the risks of releasing suppliers from all liabilities.

### **RECOMMENDATIONS**

Several elements can support the transition to a reliable, low-carbon energy system in liberalised markets, including a firm political

commitment to full decarbonization in the long run:

- (a) effective dispatch through competitive short-term electricity markets;
- (b) frameworks for the adequate provision of capacity, flexibility and infrastructure for transmission and distribution;
- (c) measures to foster long term investment in low carbon technologies; (d) internalization of system costs; and
- (e) carbon pricing.

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