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Civil Nuclear Liability in the Age of Climate Change: India's Path to a Sustainable Future

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Abstract

Against the backdrop of heightened international climate commitments, nuclear power offers India a key window to sustain growth while minimizing carbon footprints. However, India's advances in upscaling its nuclear generation capacity continue to be hamstrung by the institutional and legal intricacies of its civil nuclear liability framework. This work critically analyses the Civil Liability for Nuclear Damage Act, 2010 (CLNDA) against the context of India's overall clean energy strategy. It further examines how the Act's rigorous provisions, especially those concerning supplier liability and insurance arrangements, have influenced investor confidence, Technology transfer, and long-term sustainability objectives. Based on recent policy trends and judicial interpretations, the article underscores the regulatory and economic hurdles of balancing accountability with practicality. It advocates re-tuning India's liability regimen to align with changing global nuclear practices without sacrificing victim protection or environmental protection. The research concludes with actionable policy suggestions, such as creating a supplier-specific insurance pool, greater legal certainty on risk-sharing, and harmonizing nuclear power policy with India's climate and sustainable development goals.

Keywords: *Civil Nuclear Liability; India; Nuclear Energy; Sustainable Development; Civil Liability for Nuclear Damage Act, 2010.*

I. Introduction

The imperative to decarbonize energy systems places nuclear power at the center of many national strategies for achieving climate goals. For a rapidly growing economy such as India, nuclear energy offers reliable baseload electricity with low direct greenhouse gas emissions and therefore figures prominently in pathways to limit warming and meet long-term targets for net-zero emissions. The Intergovernmental Panel on Climate Change (IPCC) and several

international energy authorities recognise that nuclear power, alongside renewables and storage, may be necessary in many mitigation scenarios to deliver deep decarbonisation while maintaining grid stability.[1]

Yet the adoption and expansion of civil nuclear capacity depend upon much more than technical feasibility. Legal frameworks governing liability for nuclear damage perform a central economic and policy function: they allocate the financial risks of catastrophic harm, determine incentives for safety and maintenance, shape insurance markets, and influence the willingness of domestic and foreign firms to supply technology and capital. In India, the Civil Liability for Nuclear Damage Act, 2010 (CLND Act) created a statutory structure for compensation and risk allocation that departs in important respects from prevailing international models by permitting a pathway for supplier recourse under certain conditions.[2]

India's CLND Act reflects both international and deeply domestic influences. Internationally, India's re-engagement with global civil nuclear commerce following the Indo–U.S. civil nuclear initiatives of the mid-2000s required an operative domestic liability regime acceptable to foreign partners and financiers.[3] Domestically, the jurisprudential and political legacy of the Bhopal Gas Tragedy and the resulting emphasis on stringent industrial accountability shaped legislative preferences for guaranteeing victim compensation and upstream accountability in hazardous industries. The CLND Act thus embodies a hybrid policy objective: to ensure rapid, victim-oriented compensation while enabling a commercial environment for nuclear deployment.[4]

The Act's principal features—strict operator liability with a capped quantum, a government backstop for amounts beyond the cap, a statutory timeframe for claims, and a conditional right of recourse against suppliers—drive both its normative appeal and its economic controversy. On one hand, strict no-fault liability for operators facilitates prompt compensation to victims

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[1] See IPCC, Climate Change 2022: Mitigation of Climate Change, Working Group III Contribution (AR6 WGI report, ch.6) (2022), available at https://www.ipcc.ch/report/ar6/wg3/; see also IAEA, Nuclear Energy in Mitigation Pathways to Net Zero (2021), available at https://www.iaea.org/publications/15558/nuclear-energy-in-mitigation-pathways-to-net-zero.

[2] Civil Liability for Nuclear Damage Act, No. 38 of 2010 (India).

[3] See Joint Statement on Civil Nuclear Cooperation, U.S.–India (July 18, 2005), and Agreement for Cooperation Between the Government of the United States of America and the Government of India Concerning Peaceful Uses of Nuclear Energy, text available at U.S. State Dep't archives, https://2001-2009.state.gov/p/sca/c17361.htm.

[4] For background on Bhopal's influence on Indian public and legal policy, see *M.C. Mehta v. Union of India*, AIR 1987 SC 965 (Oleum Gas Leak case) (establishing the principle of absolute liability), discussed in numerous commentaries on Indian environmental jurisprudence.

without protracted proof of negligence; on the other, Section 17(b)'s contractual pathway to supplier recourse has raised concerns among international suppliers and insurers about unpredictable exposure and the attendant consequences for technology transfer, project finance, and insurance pricing.[5] The Government of India and industry stakeholders have sought to mitigate such concerns through instruments such as the India Nuclear Insurance Pool (INIP), which was established to underwrite operator and supplier recourse exposures, but practical questions of premium, scope, and uptake persist.[6]

This paper situates India's liability regime within the twin policy objectives of advancing climate-relevant nuclear capacity and protecting public safety. Using an interdisciplinary law-and-economics approach, the analysis asks whether India's current legal allocation of nuclear risk promotes the efficient expansion of nuclear power in service of climate objectives, while ensuring adequate deterrence and compensation for harm. The inquiry proceeds in three parts. First, it sets out the legal architecture of the CLND Act and its implementing rules and insurance mechanisms. Second, it compares India's model with the principal international instruments and prominent national systems to identify divergences and their commercial implications. Third, it evaluates the costs and benefits of India's approach through an economic lens—assessing effects on incentives, transaction and insurance markets, and social welfare—and proposes calibrated reforms that can reconcile India's constitutional and distributive commitments with the pragmatic needs of rapid, climate-aligned nuclear deployment.

II. Climate Change, Energy Security, and the Role of Nuclear Power

India stands at the crossroads of an energy transition defined by the dual imperatives of climate mitigation and developmental equity. As one of the world's fastest-growing economies and the third-largest emitter of greenhouse gases, India's ability to meet its international climate commitments depends on reconfiguring its energy mix away from fossil fuels toward low-

[5] See Civil Liability for Nuclear Damage Act, No. 38 of 2010, Sections 4–6, 17; see also analysis of Section 17 and supplier recourse in Department of Atomic Energy, *FAQs on CLND Act* (Version 2.0), https://dae.gov.in/faqs-version-2-0-on-clnd-act-2010/.

[6] See GIC Re (India Nuclear Insurance Pool), *Nuclear Supplier's Insurance Policy (Right to Recourse)* (INIP launch materials, Aug. 12, 2016), available at https://www.gicre.in/images/pdf/INIPUnveilingAugust2016Web.pdf ; see also recent reporting on proposed legislative amendments and investment implications, e.g., India plans to ease nuclear liability laws to attract foreign firms, Reuters (Apr. 18, 2025), https://www.reuters.com/world/india/india-plans-ease-nuclear-liability-laws-attract-foreign-firms-sources-say-2025-04-18/.

carbon alternatives.[7] At the 26th Conference of the Parties (COP26), India pledged to achieve net-zero emissions by 2070 and reduce its GDP's carbon intensity by 45% by 2030 from 2005.[8] Achieving these targets necessitates expanding clean, reliable, and affordable energy sources — a goal for which nuclear power remains uniquely positioned.

Nuclear energy contributes to base-load electricity generation without the intermittency associated with renewables such as solar or wind.[9] The International Energy Agency (IEA) projects that in order to achieve global net-zero by 2050, nuclear power generation will need to double by mid-century, with emerging economies like India playing a pivotal role.[10] India's domestic plans reflect this trajectory. The Department of Atomic Energy (DAE) envisions an expansion of installed nuclear capacity from approximately 7.5 GW (2025) to 22.5 GW by 2031, primarily through the indigenous Pressurised Heavy Water Reactor (PHWR) fleet and prospective imported reactor projects.[11]

However, India's pursuit of nuclear energy is not merely technological but legal, financial, and geopolitical. The civil nuclear liability regime directly shapes foreign participation, supplier confidence, and insurance feasibility in reactor construction and fuel supply.[12] While nuclear energy promises climate and energy security dividends, these cannot be realized without a predictable and equitable liability structure that allocates risk efficiently across the state, operator, and supplier ecosystem. The Civil Liability for Nuclear Damage Act, 2010 (CLND Act), enacted in the wake of the Indo–U.S. nuclear agreement, serves as the legal cornerstone of this balancing act. Yet, its supplier liability provisions, particularly under Section 17(b), have generated persistent unease among foreign investors and insurers—potentially slowing India's low-carbon energy ambitions.[13]

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[7] Ministry of Environment, Forest and Climate Change, *India's Third Biennial Update Report to the UNFCCC* (2021), at 12–15, available at https://moef.gov.in/uploads/2024/01/INDIA_BUR-3.pdf.

[8] Ministry of Environmentt, Forest & Climate Change [MoEFCC], Gov't of India, *India's Long-Term Low-Carbon Development Strategy* (2022).

[9] International Atomic Energy Agency (IAEA), *Climate Change and Nuclear Power 2022* (Vienna: IAEA 2022) at 8–12.

[10] International Atomic Energy Agency [IEA], *Net Zero by 2050: A Roadmap for the Global Energy Sector* (2021), available at https://www.iea.org/reports/net-zero-by-2050.

[11] Priyansh Shukla, India's Nuclear Energy Ambitions: Challenges and Opportunities for a Cleaner Future, 5 International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) 77 (Feb. 2025), available at https://doi.org/10.48175/IJARSCT-23414.

[12] *Id.*

[13] Reuters, *supra* note 6.

In this context, nuclear liability ceases to be a narrow legal question and instead becomes a climate governance issue. Effective liability rules determine who bears the costs of potential accidents and how swiftly and equitably India can scale nuclear energy to meet its sustainability commitments. The challenge is to evolve a climate-compatible liability regime, ensuring high safety and compensation standards while maintaining the economic feasibility necessary for rapid decarbonisation.[14]

III. The Evolution and Framework of Civil Nuclear Liability in India

The legal architecture of India's civil nuclear liability regime reflects a convergence of three imperatives—technological self-reliance, victim compensation, and international alignment. The evolution of this framework is rooted in India's experience with industrial disasters and its desire to balance economic liberalization with social accountability.

A. Historical and Legislative Context

India's stance on nuclear liability is incomprehensible without considering the Bhopal Gas Tragedy of 1984, which highlighted the inadequacy of current tort systems in providing compensation to victims of industrial disasters.[15] The disaster prompted a jurisprudential transformation via the Supreme Court's establishment of the "absolute liability" doctrine in M.C. Mehta v. Union of India, wherein the Court determined that businesses involved in dangerous activities are strictly liable for any resulting harm, irrespective of fault.[16] This principle eventually made its way into environmental and industrial law, which is why there is a separate nuclear liability law.

The Civil Liability for Nuclear Damage Act, 2010 (CLND Act) emerged in the wake of the Indo–U.S. Civil Nuclear Agreement (2005), which sought to reintegrate India into global nuclear commerce after decades of isolation following its non-signatory status to the Nuclear Non-Proliferation Treaty (NPT).[17] To operationalize the agreement, India required a domestic liability framework that would both reassure foreign suppliers—particularly those from the

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[14] "Explained: What Are the Ambiguities in India's Nuclear Liability Law?" *The Hindu* (April, 2023), available at https://www.thehindu.com/news/national/explained-what-are-the-ambiguities-in-indias-nuclear-liability-law/article66782725.ece.

[15] *Union Carbide Corp. v. Union of India*, (1989) 2 S.C.C. 540.

[16] *M.C. Mehta v. Union of India*, (1987) 1 S.C.C. 395 ("Oleum Gas Leak Case").

[17] Priyansh, *supra* note 11.

United States, France, and Russia—and align with global conventions such as the Convention on Supplementary Compensation for Nuclear Damage (1997) (CSC).[18]

The CLND Act's preamble underscores its dual purpose: ensuring prompt compensation to victims of nuclear incidents while promoting the growth of nuclear energy in India.[19] The Act introduced a tiered structure comprising (1) strict and exclusive operator liability, (2) a sovereign guarantee for compensation beyond the operator's cap, and (3) conditional supplier recourse under specific circumstances.[20]

B. Key Structural Features of the CLND Act

Section 6 – Limitation on Operator Liability:

The operator's liability is capped at ₹ 1,500 crore, with any excess compensated by the Central Government up to 300 million SDR, reflecting India's obligations under the CSC.[21]

Section 17 – Right of Recourse:

The operator may seek recourse against suppliers in three situations: (a) where damage results from a supplier's intent to cause harm; (b) where a written contract expressly provides for such recourse; or (c) where the nuclear incident results from defective material or equipment supplied.[22]

Section 18 – Limitation Period:

Claims for compensation must be made within ten years of the nuclear incident.[23]

Rules 24–26 of the CLND Rules, 2011:

These rules cap the recoverable amount from suppliers at either the contract value or ₹ 1,500 crore, whichever is less, and require the right of recourse to be exercised within five years.[24]

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[18] International Atomic Energy Agency, Convention on Supplementary Compensation for Nuclear Damage (IAEA 1997), available at https://www.iaea.org/publications/documents/treaties/convention-supplementary-compensation-nuclear-damage.

[19] Civil Liability for Nuclear Damage Act, No. 38 of 2010, preamble (India).

[20] *Id.* Sections 6-8.

[21] *Id.* S 6; Convention on Supplementary Compensation for Nuclear Damage, *supra* note 18.

[22] CLND Act S 17.

[23] *Id.* S 18.

[24] Civil Liability for Nuclear Damage Rules, 2011, rr. 24–26 (India).

Collectively, these provisions create a hybrid model that merges tort-based liability and contractual recourse, distinguishing India's regime from the operator-exclusive systems predominant in international nuclear law.

C. India's Divergence from Global Conventions

Unlike the Paris (1960) and Vienna (1963, as amended 1997) Conventions, which channel all third-party liability to the operator to ensure swift compensation and to prevent litigation complexity, India's model allows for limited supplier liability under Section 17(b).[25] This deviation reflects domestic political and ethical imperatives rooted in post-Bhopal accountability narratives, wherein industrial actors are expected to share the moral and financial consequences of risk creation.[26]

While this design aligns with the principle of polluter-pays, it has generated friction in India's nuclear diplomacy. Supplier nations argue that ambiguous recourse provisions create legal and financial uncertainties, thereby raising insurance premiums and deterring foreign investment.[27] India, however, defends this departure as consistent with its constitutional obligation to protect citizens' right to life and a safe environment under Article 21 of the Constitution.[28]

Thus, India's nuclear liability framework embodies a sovereign assertion of social justice within a globalized energy economy—a model that prioritizes victim rights and ethical accountability even at the cost of commercial expediency.

IV. Nuclear Liability and Sustainable Development

The intersection of civil nuclear liability and sustainable development constitutes a significant paradox within India's energy policy. Some people say that nuclear power is an important part of India's move toward a low-carbon future. Others say that the liability framework, which is meant to ensure justice and accountability, has made it harder for people to invest and work together on new technologies. For sustainable development to happen, we need more nuclear power, but we also need a legal system that protects the environment, makes sure the economy is strong, and treats everyone fairly.

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[25] Priyansh, *supra* note 11.
[26] *Id.*
[27] Reuters, *supra* note 6.
[28] *Subhash Kumar v. State of Bihar*, (1991) 1 S.C.C. 598 (India).

India's nuclear liability framework, primarily governed by the Civil Liability for Nuclear Damage Act, 2010 (CLND Act), was conceived in the aftermath of the Bhopal Gas Tragedy, reflecting a strong commitment to victim compensation and corporate accountability. However, the strict and channelled liability imposed under Sections 4 and 6 of the Act has drawn concern from foreign suppliers who perceive India's framework as inconsistent with international conventions such as the Vienna Convention on Civil Liability for Nuclear Damage (1963) and the Convention on Supplementary Compensation for Nuclear Damage (CSC), 1997.[29] The resulting policy tension has constrained India's ability to attract global nuclear investments and diversify its low-carbon energy portfolio.

From a sustainability point of view, a balanced liability system should include the costs of the environment while also encouraging innovation and sharing of risks. Strict liability rules can keep advanced nuclear technology from coming in, especially in areas where safety is very important, like reactor design and waste management. This can slow down the shift to clean energy. On the other hand, a framework that is too lenient could hurt public trust and protections for the environment. So, India's problem is how to make the "polluter pays" and "common but differentiated responsibilities" principles work together in a way that also encourages technological collaboration.

Scholars argue that sustainable nuclear governance requires the integration of environmental economics and risk regulation within the liability framework. For instance, adopting a graded liability model—where liability caps are proportionate to the reactor's risk profile and capacity—could ensure both accountability and economic sustainability. India could also improve its nuclear insurance by adding supplier-specific risk coverage to the India Nuclear Insurance Pool (INIP). This would ease the worries of foreign partners while keeping domestic protection standards. This kind of action would be in line with India's duties under Article 51A(g) of the Constitution, which says that every citizen must protect the natural environment, and with the Directive Principles of State Policy, which stress the need for sustainable resource use.

In this way, the changes to India's civil nuclear liability law are very important for achieving energy justice, which is a system that balances access, affordability, and accountability in the energy sector. A liability system that protects the public and the environment while

[29] IAEA, *supra* note 18.

encouraging investment could make nuclear energy a key part of India's climate strategy. This would not only make energy more secure, but it would also promote fairness between generations.

V. Reconciling Liability, Innovation, and Climate Commitments

India's ambition to achieve net-zero emissions by 2070 and ensure energy security necessitates a re-evaluation of its nuclear liability architecture. While nuclear power offers a sustainable alternative to fossil fuels, the rigidity of India's Civil Liability for Nuclear Damage Act, 2010 (CLND Act) continues to constrain both domestic and international participation. Reconciling liability with innovation thus becomes imperative for realizing India's climate commitments.

A major problem is finding a balance between being responsible and making money. Section 17(b) of the Act's supplier liability clause goes against global norms by letting operators go after suppliers for material defects.[30] This provision was meant to make safety more accountable, but foreign investors have seen it as unpredictable and not insurable for business.[31] Because of this, suppliers like Westinghouse and Areva have been hesitant to sign reactor agreements, which has slowed down India's plans to expand its nuclear program.

To address this impasse, India must adopt a risk-sharing model grounded in the principles of economic efficiency and deterrence. A possible reform involves clarifying supplier liability through statutory amendments or executive rules—specifying that recourse would apply only in cases of proven gross negligence or intentional misconduct. This would align India's approach with the Convention on Supplementary Compensation for Nuclear Damage (CSC) framework, to which India is a party, ensuring compatibility with international practice while maintaining its sovereign right to protect public interest.[32]

It is just as important to encourage innovation and local manufacturing. India's "Make in India" and "Atmanirbhar Bharat" programs are meant to make important nuclear technologies available in India. But innovation can only happen in a legal and regulatory environment that is stable and easy to understand. The current lack of clarity about who is responsible for what in the nuclear supply chain makes smaller domestic businesses hesitant to get involved because they are afraid of being exposed to too much risk. Setting up a way for suppliers to pool their

[30] CLND, *supra* note 22, S 17(b).
[31] The Hindu, *supra* note 14.
[32] IAEA, *supra* note 18.

risks within the India Nuclear Insurance Pool (INIP) could help this problem by giving everyone financial security and lowering the risks for each person.[33]

From a climate governance standpoint, harmonizing nuclear liability with India's Nationally Determined Contributions (NDCs) under the Paris Agreement underscores the intersection of energy law and environmental justice. By reforming its liability framework, India would not only attract cleaner technology transfers but also strengthen its case for climate financing and international cooperation in sustainable energy infrastructure.

To balance liability, innovation, and climate goals, we need a three-part plan: (a) make it clear what suppliers are responsible for; (b) create strong, all-inclusive insurance systems; and (c) make sure that domestic laws follow international best practices. These kinds of changes would let India follow its low-carbon development path without giving up on accountability, openness, or public safety. This would make nuclear energy a legally and morally sound part of its climate policy.

VI. Conclusion and Policy Recommendations

The evolution of India's civil nuclear liability framework reveals a complex interplay between sovereign responsibility, public safety, and the pursuit of sustainable energy security. While the Civil Liability for Nuclear Damage Act, 2010 (CLND Act) was a necessary legislative response to historical industrial tragedies and international nuclear cooperation, its rigid structure has inadvertently constrained the growth of India's nuclear power sector. As the nation faces mounting pressure to decarbonize under its Paris Agreement commitments, a recalibration of liability norms is indispensable for reconciling environmental imperatives with economic realities.

A. Legislative Clarification and Targeted Amendments

India's liability system is still not clear, especially when it comes to Section 17(b), which lets operators go after suppliers under the terms of their contracts.[34] To build investor trust and protect accountability, Parliament should change the law to make it clear what "recourse" means. This change could limit a supplier's liability to cases of gross negligence, fraud, or intentional wrongdoing, in line with the Convention on Supplementary Compensation for

[33] Priyansh, *supra* note 11.
[34] CLND, *supra* note 22, S 17 (b).

Nuclear Damage (CSC) framework.[35] This level of accuracy would bring India's law in line with international standards while still upholding the strict operator responsibility principle in Section 4 of the CLND Act.[36]

Also, the government should think about using Section 46 to make interpretive rules or model contracts that make it clear what suppliers' responsibilities are and what indemnity clauses mean.[37] This would prevent excessive judicial discretion and promote contractual standardization across all reactor projects.

B. Creation of a Supplier Risk-Pooling and Insurance Framework

The India Nuclear Insurance Pool (INIP)—established in 2015—has effectively provided coverage for operator liability under Section 6, but it remains inadequate in addressing supplier-specific risks.[38] To bridge this gap, a Supplier Nuclear Risk Pool (SNRP) should be constituted within the INIP's structure. This pool, co-administered by the General Insurance Corporation (GIC) and the Nuclear Power Corporation of India Ltd. (NPCIL), could enable suppliers to contribute proportionally based on project value, component criticality, and risk exposure.[39]

This model would serve dual objectives:

a) ensuring supplier protection through collective risk absorption; and
b) reducing financial deterrence for small and medium enterprises participating in India's nuclear supply chain. The regulatory framework for this mechanism should be codified under the CLND Rules, 2011, through an amendment providing clear parameters for insurer liability, reinsurance, and state-backed guarantees.

C. Institutional and Regulatory Reforms

For the purpose of ensuring coherence and technical competence in the implementation of nuclear liability policy, India should establish an Independent Nuclear Liability Commission (INLC) under the aegis of the Department of Atomic Energy (DAE). This commission would:

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[35] IAEA, *supra* note 18.
[36] CLND, *supra* note 22, S 4.
[37] *Id.* S 46.
[38] The Hindu, *supra* note 14.
[39] General Insurance Corporation of India, *India Nuclear Insurance Pool Overview* (GIC Re, 2022), https://www.gicre.in.

- Serve as a quasi-regulatory body to interpret liability provisions;
- Facilitate mediation in supplier-operator disputes;
- Recommend periodic revisions to liability caps based on inflation and project complexity; and
- Oversee capacity-building initiatives related to nuclear insurance and compliance training.

Such institutionalization would align India's liability governance with global best practices exemplified by the Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF) in Japan and the Price–Anderson Nuclear Industries Indemnity Act framework in the United States.[40]

D. Integration with Climate and Energy Policy

Finally, India's nuclear liability reform should not exist in isolation but as part of a climate-integrated energy strategy. The government should:

1. Include nuclear power explicitly within the Nationally Determined Contributions (NDCs) under the Paris Agreement's implementation plan;
2. Develop a Green Financing and Risk Mitigation Facility for nuclear projects, allowing domestic and foreign lenders to underwrite nuclear investments under predictable liability conditions; and
3. Encourage public-private partnerships (PPPs) in next-generation small modular reactors (SMRs) and thorium-based technologies, subject to safety and liability guarantees.[41]

By embedding liability reform within the broader sustainable development agenda, India can project nuclear energy not merely as a technological pursuit but as a cornerstone of climate justice, energy equity, and intergenerational responsibility.

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[40] Price–Anderson Nuclear Industries Indemnity Act, 42 U.S.C. SS 2210–2286 (1957); Nuclear Damage Compensation and Decommissioning Facilitation Corporation Act, Act No. 94 of 2011 (Japan).

[41] International Atomic Energy Agency, *Climate Change and Nuclear Power 2022* (IAEA 2022), available at https://www.iaea.org/topics/nuclear-power-and-climate-change/climate-change-and-nuclear-power-2022.

Conclusion

India's path in the nuclear liability system must balance accountability, affordability, and flexibility. Clear laws, innovative insurance, changes in institutions, and climate considerations create a solid plan for a strong and responsible nuclear future. This reform process is based on the country's values of human dignity, environmental protection, and technological growth. It also aligns with India's global climate goals and its desire for sustainable energy independence.

If implemented well, these steps can change India from a hesitant player to a leader in global nuclear governance. It can promote sustainable growth while maintaining public safety, legal clarity, and fairness for future generations.