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**CONTENTS**

# LEGAL DIMENSIONS OF RENEWABLE ENERGY IN INDIA: NAVIGATING REGULATION, INVESTMENT AND ENVIRONMENTAL SUSTAINABILITY

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***Abstract***

*India's transition to renewable energy is not merely a technological shift but a legal and policy challenge that requires a strong and coherent governance framework. This article critically examines the legal dimensions that shape India's renewable energy sector, focusing on four key areas: regulatory frameworks, investment challenges, intellectual property rights (IPR) and technology transfer, and the intersection of environmental law with renewable energy. he regulatory framework for renewable energy in India has evolved through instruments such as the Electricity Act, 2003, Renewable Purchase Obligations (RPOs), and the National Electricity Plan (NEP). However, regulatory fragmentation between the Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commissions (SERCs), inconsistent tariff-setting and weak enforcement of Power Purchase Agreements (PPAs) have created uncertainty for investors and developers. Land acquisition, governed by the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013, further complicates project execution due to procedural delays, conflicts with local communities, and overlapping clearance requirements under environmental and forest laws. The role of IPR in renewable energy is equally critical.*

*The article argues for a balanced approach that promotes open-access licensing, public-private partnerships, and capacity-building initiatives, while also considering compulsory licensing for critical green technologies in line with global sustainability imperatives. The paper concludes that India's renewable energy ambitions can be realized only through a comprehensive legal framework that harmonizes federal and state policies, strengthens contract enforcement, secures investments, balances IPR with technology access, and integrates environmental safeguards.*

***Key words:*** *Renewable Energy, Electricity Act, 2003, IPR, Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.*

## I

## Introduction

The global transition to renewable energy is essential for both sustainable development and climate change mitigation. In addition to being a technological change, the switch from fossil fuels to renewable energy presents a legal and policy dilemma that calls for strong governance frameworks. The renewable energy landscape is shaped by a number of factors, including regulatory uncertainty, investment hurdles, intellectual property rights (IPR) concerns, and environmental legal difficulties. The effectiveness, viability, and long-term sustainability of the widespread use of renewable energy are determined by these criteria. The legal aspects of the renewable energy sector are critically examined in this paper, with a focus on four main areas: (i) Indian renewable energy regulatory frameworks; (ii) legal concerns related to investments in renewable energy; (iii) technology transfer and intellectual property rights (IPR); and (iv) the connection between environmental law and renewable energy.

India has implemented major legislative and policy measures to assist the spread of clean energy, making it one of the world's fastest-growing markets for renewable energy[1]. While national initiatives like the Renewable Energy Purchase Obligation (RPO) and the National Electricity Plan (NEP) seek to expedite adoption, the Electricity Act of 2003 and its amendments have made market-based renewable energy generation easier. Legal issues still exist, nevertheless, because of uneven state laws, intricate tariff-setting procedures, and poor grid infrastructure. Energy developers and investors are uncertain as a result of these regulatory obstacles. To ensure a seamless and legally sound energy transition, a more standardized and flexible policy framework is essential.

Legislative frameworks also have a significant impact on investments in renewable energy. Though legal ambiguities surrounding land acquisition, Power Purchase Agreements (PPAs), and dispute resolution procedures have deterred long-term commitments, India has been successful in luring FDI in renewable energy. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 governs land acquisition; yet, because of bureaucratic hold-ups and inconsistent state-by-state implementation, land acquisition continues to be a major obstacle. State governments' attempts to renegotiate or terminate PPAs due to contractual

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[1]Hanspal, Manindra. *Impact of Indian Energy Policy on Environment and Climate Change: Legal and Policy Insights*. 3 56-78SSRN ELECTRONIC JOURNAL(2025)*available at* 10.2139/ssrn.5095182 (last visited 20/08/2025).

problems further discourage investors. Further complicating funding for renewable energy are regulatory concerns related to green bonds, tax incentives, and approvals of carbon credits. Resolving these legal issues is crucial to creating a secure and alluring investment environment for renewable energy initiatives.

An important legal aspect of renewable energy innovation is the function of Intellectual property rights (IPR). Patents can limit access to vital renewable energy technology even though they encourage technological development. Concerns over fair access to innovation have been highlighted by India's observance of the TRIPS Agreement and the sparse application of Compulsory licensing for green technologies. India's transition to renewable energy will be accelerated by technology transfer through international alliances and legal frameworks that strike a balance between open-access technology sharing and commercial innovation[2].

Lastly, a critical topic of legal discussion is the relationship between environmental legislation and renewable energy. Although most people agree that renewable energy projects are good for the environment, there are issues with waste management, biodiversity preservation, and land use conflicts. Large-scale renewable energy projects must undergo impact assessments in accordance with the Environmental Protection Act of 1986's Environmental Impact Assessment (EIA) Notification of 2006; however, enforcement of this requirement is inconsistent. The lack of a thorough legislative framework for handling trash from renewable energy sources makes it increasingly difficult to dispose of solar panel and wind turbine e-waste[3]. Sustainable development will require bolstering environmental regulations to conform to renewable energy policy.

This article attempts to give a thorough grasp of the legal environment surrounding India's renewable energy business by looking at these four legal dimensions: regulatory frameworks, investment problems, intellectual property concerns, and environmental law intersections[4]. Ensuring environmental sustainability, investment confidence, and energy security all depend on a stronger legal and regulatory framework. In order to improve India's governance of renewable energy, this study will thoroughly examine these factors with an emphasis on workable legal solutions.

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[2] Shankar, U., & Basu, A. CHRONICLING ENERGY LAW IN INDIA IN THE ERA OF LOW-CARBON TRANSITION 413-34 (2023).

[3] Srinivasan, B. *Energy Law as an Area of Law in India*. *RGNUL , 9* (1) STUDENT RESEARCH REVIEW, 50-93 (2023).

[4] Sokołowski, M. M. *When black meets green: A review of the four pillars of India's energy policy, 130*, ENERGY POLICY, 60-68 (2019).

## II

## Regulatory Framework for Renewable Energy in India

Numerous legal and contractual systems, particularly those pertaining to land acquisition, power purchase agreements (PPAs), dispute resolution procedures, and regulatory clearances, have a substantial impact on investment in India's renewable energy sector. Even though India has become a global leader in luring FDI into renewable energy, investors are uneasy due to legal issues regarding tariff structures, contract enforcement, and policy reversals. Building trust and guaranteeing the sustained expansion of investments in renewable energy require a clear legal framework[5].

PPAs are the cornerstone of renewable energy projects because they provide long-term contracts with electricity distribution companies (DISCOMs), providing energy producers with financial assurance. However, a number of legal challenges have resulted from state governments' policy changes and contract renegotiations. Citing high rates or DISCOM financial instability, a number of governments have tried to amend or terminate current PPAs. Prolonged litigation as a result of this practice has damaged investor confidence in the industry.

(i) *Regulatory commissions*

These are empowered to supervise rate determination and contractual disputes under the Electricity Act of 2003. Nonetheless, legal difficulties are produced by discrepancies between the State Electricity Regulatory Commissions (SERCs) and the Central Electricity Regulatory Commission (CERC). Regulatory uncertainty is exacerbated by the lack of a standardized legal framework governing PPAs. Although the Supreme Court of India and the Appellate Tribunal for Electricity (APTEL) have recently upheld the legally enforceable nature of PPAs, state-by-state enforcement of these agreements is still uneven[6].

(ii) *Land acquisition*

It is a significant legal barrier to renewable energy projects, especially for large-scale wind and solar farms. Although the 2013 Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation, and Resettlement Act was created to safeguard landowners' rights, its intricate procedures frequently cause major hold-ups and legal issues. As required by the Forest (Conservation) Act of 1980, the approval procedure necessitates adherence to a number of regulatory standards, such as environmental

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[5] Naik, A., & Bhakare, J. RENEWABLE ENERGY SECTOR IN INDIA: LEGAL PERSPECTIVES, ISSUES AND CHALLENGES (2023).

[6] Sinha, S. K., Srikanth, R., & Mahalingam, S. Regulatory framework for India's Energy Security and sustainability 162ENERGY POLICY (2022).

clearances, land-use conversion approvals, and forest clearances[7]. Land ownership conflicts, insufficient compensation claims, and laws prohibiting the conversion of agricultural land for non-agricultural uses are the main causes of delays in many renewable energy projects. Furthermore, the approval process is made more difficult and investor anxiety is increased by contradictory land-use restrictions between state and federal agencies.

Legal problems relating to Land acquisition, PPAs, and altering policy mandates frequently result in extended litigation, increasing financial risks for investors. Presently, India lacks a formal dispute resolution process for renewable energy projects. Traditional judicial forums including the Supreme Court, High Courts, and the National Company Law Tribunal (NCLT) are frequently used to resolve legal disputes, but they can be expensive and time-consuming. A more effective dispute settlement procedure and increased investor trust might result from the establishment of a dedicated Renewable Energy Dispute settlement Tribunal, modeled after the Electricity Dispute Resolution Mechanism under the Electricity Act[8].

(iii) *Investments in renewable energy*

These are greatly aided by financing tools such as carbon credit trading and green bonds. Although the Securities and Exchange Board of India (SEBI) has set rules for green bonds, there is still a concern about the absence of a thorough legal framework controlling their issue and adherence. Investors in renewable energy have also been impacted by tax concerns under the Goods and Services Tax (GST) regime. At first, lower tax rates were advantageous for wind and solar power projects; but, recent changes to GST categories have resulted in higher expenses and regulatory conflicts. Promoting long-term investment in the renewable energy sector requires a stable tax system and unambiguous regulatory requirements.

Even though India has made significant progress in creating a strong regulatory framework for renewable energy, issues with finance rules, land acquisition, contract enforcement, and dispute resolution still hinder sectors expansion. To ensure a sustainable and investor-friendly renewable energy landscape, it is imperative to strengthen the legal framework through regulatory clarity, expedited approval procedures, policy stability, and

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[7] Leal-Arcas, R., & Minas, S. The micro level: Insights from specific policy areas: Mapping the international and European governance of renewable energy. , *35*(1),YEARBOOK OF EUROPEAN LAW 621-666 (2016).

[8] Benecke, E. *Networking for Climate Change: agency in the context of Renewable Energy Governance in Ind*ia. , 11(1), INTERNATIONAL ENVIRONMENTAL AGREEMENTS: POLITICS, LAW AND ECONOMICS23-42 (2011).

effective dispute resolution. India can improve its energy security and fulfill its international obligations under the Paris Agreement and the Sustainable Development Goals (SDGs) by removing these obstacles.

## III

## Legal Challenges in Renewable Energy Investments

The legal and contractual frameworks controlling land acquisition, power purchase agreements (PPAs), dispute resolution procedures, and financial restrictions have a big impact on investment in India's renewable energy sector. Even though India has been successful in luring FDI into the renewable energy sector, the sector's expansion is nevertheless hampered by regulatory ambiguities, inconsistent policies, and enforcement problems. Determining tariffs, contract enforcement, retroactive policy changes, land acquisition issues, and financial regulatory obstacles are some of the main obstacles. Resolving these legal issues is essential to maintaining investor trust and guaranteeing the sustainability of India's shift to renewable energy in the long run.

(i) *Power Purchase Agreements (PPAs) & Tariff Determination Issues*

PPAs are essential to investments in renewable energy since they guarantee developers' financial stability by negotiating long-term contracts with power distribution companies (DISCOMs). However, alleging high tariffs or financial difficulties, a number of Indian governments have tried to renegotiate or cancel current PPAs. Investors have been deterred by this technique because it has resulted in extensive litigation and uncertainty in the industry[9].

Regulatory commissions have the power to supervise rate determination and contract disputes under the Electricity Act of 2003. However, inconsistent enforcement has been caused by the Central Electricity Regulatory Commission's (CERC) and several State Electricity Regulatory Commissions' (SERCs') divergent interpretations. Although the Supreme Court of India and the Appellate Tribunal for Electricity (APTEL) have made decisions supporting the preservation of PPA sanctity, inconsistent state-by-state implementation remains a major legal obstacle.

Retrospective price policy changes and tariff determination present further challenges. Certain states have attempted to reduce tariffs that were previously agreed upon, which has resulted in contractual conflicts and financial losses

[9] Debnath, R., Mittal, V., & Jindal, A. *A review of challenges from increasing renewable generation in the Indian Power Sector: Way forward for Electricity (Amendment) Bill 2020. , 33*(1), ENERGY & ENVIRONMENT3-40.(2022).

for investors. These difficulties are made worse by the lack of a uniform legal framework across the country to safeguard PPA agreements, which erode investor confidence[10].

(ii) *Land Acquisition & Regulatory Barriers*

One of the most difficult legal problems facing India's renewable energy industry is acquiring land for massive wind and solar projects. To guarantee just compensation and safeguard landowners' rights, the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation, and Resettlement Act, 2013 was created. However, renewable energy projects have been severely delayed by its drawn-out clearance procedures, administrative roadblocks, and uneven enforcement.

State-specific land-use policies, which differ greatly in terms of zoning laws, environmental impact assessments, and limitations on non-agricultural land use, further exacerbate the legal difficulties. Strict land conversion laws in some jurisdictions make it challenging for developers to get land for renewable energy projects[11]. Project execution is further slowed down by several governmental licenses, such as environmental and forest clearances, which raises the legal risks for investors.

Additionally, local people frequently oppose land acquisition for wind and solar projects, which can result in drawn-out legal disputes. Environmental issues, like community uprooting and agricultural land damage, have led to several lawsuits and have an impact on a project's overall viability. To accelerate the implementation of renewable energy in India, land acquisition regulations must be strengthened by streamlining legal processes, guaranteeing standard land-use rules, and accelerating dispute resolution procedures.

(iii) *Dispute Resolution Mechanisms & Investment Protection*

Investors face serious risks as a result of the protracted legal actions that usually follow disputes over land acquisition, PPAs, and regulatory clearances. Reliance on conventional judicial forums including High Courts, the Supreme Court, and the National Company Law Tribunal (NCLT) has resulted from the absence of a specialized conflict resolution process for

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[10] Gentry, B. S., & Ronk, J. J. *International Investment Agreements and Investments in Renewable Energy, 45* (2007).

[11] Lam, P. T., & Law, A. O. *Financing for renewable energy projects: A decision guide by developmental stages with Case Studies*, *90*,RENEWABLE AND SUSTAINABLE ENERGY REVIEWS 937-944 (2018).

investments in renewable energy. These forums frequently have an excessive number of cases, which causes delays in dispute resolution[12].

An expert entity to effectively resolve conflicts and give investors legal certainty may be a Renewable Energy Dispute Resolution Tribunal. Existing sectoral dispute resolution organizations, such the Electricity Dispute Resolution Mechanism under the Electricity Act, could serve as the blueprint for the tribunal. India can lower the risks associated with investments and guarantee the prompt settlement of contractual disputes by creating a specific legal framework for resolving disputes involving renewable energy.

(iv) *Regulatory Challenges in Renewable Energy Financing*

The funding of renewable energy projects is also impacted by legal obstacles, especially when it comes to green bonds, tax breaks, and the trading of carbon credits. Green bond regulations have been implemented by the Securities and Exchange Board of India (SEBI), but there is still a lack of a clear legislative framework that governs their issuance, compliance, and investor protection.

Additionally, developers of renewable energy are facing financial uncertainty as a result of Goods and Services Tax (GST) legislation. Although reduced tax rates were initially advantageous for solar and wind energy projects, modifications to GST categories have raised project developers' expenses and sparked legal conflicts. Businesses have found it challenging to plan long-term investments in the sector due to a lack of uniform tax laws and investment incentives[13].

Moreover, India's carbon credit trading laws are still in their infancy. Investors have been unable to take full advantage of financial opportunities in climate markets due to the absence of legal certainty surrounding the ownership, transferability, and market processes of carbon credits. The industry would have financial stability if a clear legal framework for carbon credits, emissions trading, and green financing methods were established.

(v) *Legal Uncertainty in Foreign Direct Investment (FDI) Policies*

To increase its infrastructure for renewable energy, India has aggressively pursued foreign direct investment (FDI). Under the automatic method, the government has approved 100% FDI in renewable energy, enabling foreign investors to join the market without first obtaining government approval.

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[12] Majid, M. (2020). Renewable energy for sustainable development in India: current status, future prospects, challenges, employment, and investment opportunities. *Energy, Sustainability and Society*, *10*(1), 1-36.

[13] Firger, D. M., & Gerrard, M. Harmonizing climate change policy and international investment law: Threats, challenges and opportunities. *Yearbook on international investment law & policy*, 11(2010).

However, the sector's FDI inflows have been impacted by regulatory uncertainty, retroactive taxation, and policy reversals[14].

For instance, significant foreign investors have refrained from making long-term financial commitments to India's renewable energy sector due to retroactive tax demands and abrupt legislative changes. Attracting long-term FDI requires bolstering investment protection legislation and maintaining regulatory stability. Long-term commitments could be encouraged by offering foreign investors legal protections through a bilateral investment treaty framework for renewable energy ventures.

(vi) *Ensuring Legal Certainty for Renewable Energy Growth*

Even though India has made great strides in developing a legislative framework for renewable energy, investors are still faced with obstacles due to legal ambiguities surrounding PPAs, land acquisition, dispute resolution, financing methods, and FDI laws[15]. Harmonizing legislative frameworks, maintaining policy stability, and fortifying regulatory institutions are required to meet these problems.

India can establish a legal climate that is conducive to investment by putting in place more robust contract enforcement procedures, specialized dispute resolution forums, streamlined property acquisition legislation, and transparent finance rules. In addition to drawing in foreign investment, removing these legislative obstacles is essential to ensuring that India fulfills its sustainable energy obligations under the Paris Agreement and the Sustainable Development Goals (SDGs).

## IV

## Compulsory Licensing and Intellectual Property Rights

(i) *Compulsory Licensing for Green Technologies: Legal Framework and Challenges*

The impetus behind the demand for 'Compulsory Licencing of Green Technologies' is the urgency associated with imminent global crisis consequent of climate change is. Article 31 of the Trade-Related Aspects of Intellectual Property Rights[16] (henceforth, TRIPS) Agreement of 1995 allows

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[14] Vasani, S. Z., & Allen, N. *No green without more green: the importance of protecting FDI through international investment law to meet the climate change challenge 5*(1) EUROPEAN INVESTMENT LAW AND ARBITRATION REVIEW ONLINE 1-39 (2020). .

[15] Chaisse, J. *Renewables re-energized? The internationalisation of green energy investment rules and disputes* 9(4)THE JOURNAL OF WORLD ENERGY LAW & BUSINESS,269-281(2016).

[16]Agreement on Trade-Related Aspects of Intellectual Property Rights, 1995, Art. 31

compulsory licencing and government use of patented technologies without authorisation from the patent holder in situations of National Emergency or other contingencies of Extreme Nature. However, the interpretation of the term 'Other Contingencies of Extreme Nature' is upto the political will of the state imposing compulsory licencing in context of any such patented technologies.

Previously, any context of such compulsory licencing have been particularly granted for 'health emergencies' such as the AIDS epidemic, treatment for malignant cancers, COVID-19 pandemic, etc… Although, it can be argued that climate change similarly impacts human population on large scale like any other health epidemic would but, consequently it is also true that the spontaneous and sporadic nature of health epidemics is distinct form the gradual and continuous nature of the climate change. Therefore, unlike health emergency which requires an immediate action to supress and control the outbreak, the solution to climate change is not as simple as seizing and preventing such activities which affect climate change; because, the value generated by such activities is ultimately essential for the functioning of the world. However, such non-transient nature itself does not disqualify the climate change from being categorised as 'emergency'.

Although, climate change cannot be equated proportionally to a health emergency but, increased lethality during any such outbreak of any epidemic could be attributed to aspects of climate change such as increase in temperature and pollution. Therefore, an argument can be raised that impact of climate change presents themselves as 'Another form of Health Emergency' although, the genesis of climate change can only be attributed to non-pathological elements.

(ii) *Balancing Intellectual Property Rights and Sustainable Innovation*

Considering the potential advantages and legal arguments in favour of compulsory listening such schemes have however not been adopted because: *one*, Green Technology innovations unlike the pharmaceutical innovations face internal competition from existing alternatives both, conventional or otherwise; *two*, Compulsory Licencing will not enhance the 'rate of technological innovation' but, could in fact impede it because, innovations are built upon existing technologies but, out of necessity. Therefore, dissemination of such critical knowledge would eliminate the necessity essential to steer innovation; *three*, Compulsory Licensing would discourage the private players from investing into green technologies because, compulsory licensing would shrink their 'return on investment' and dilute the dilute the IP rights; *four*, Parents Law protections are not the factor hindering

the dissemination of technologies because it was witnessed during the aftermath of COVID-19 breakdown that, 'manufacturing and distribution' are more critical in emergency situations; *five*, Compulsory Licencing provision is inherently time-barred and, ceases its operation when situation is mitigated but, in context of climate change scientific analysis have failed determine a sufficient time-frame.

Conversely, it can also be argued that dissemination of critical knowledge about existing green technology can also steer technological innovation within field because of sharing of ideas and information. Similarly, climate change unlike a 'temporary health emergency', is a continuous problem which would require cumulated efforts both, national as well as, international character therefore, 'capacity building' is critical than manufacturing and distribution. Moreover, the 'indeterminable nature' of time frame in calculating the amount of time needed for mitigation in climate change levels also, doesn't change the imminent aspect of climate change. Moreover, there is no scientifically qualified standard of measure to measure such achieved mitigation in climate status. To counter climate change capacity building is imperative which, is only possible if there is sufficient sharing of knowledge and technology.

While patents incentivise technological innovation, they also grant exclusive rights and ultimately restrict access to critical technologies. Therefore, there is a need to strike a balance between open-access to technologies and commercial interests. Adoption of open-source models for green technologies is essential to ensure transition in industrial sector. The minor objective of economic returns should be balanced with larger common objective of global sustainability. Therefore, multiple jurisdictions have acknowledged the imminent nature of climate change and have introduced policies to expedite the registration of patent applications thereby, reducing the delay in creation and subsequent market adoption of green technologies. International accords such as Paris Agreement incentivise technology transfer for sustainable practices and, organisations such as World Intellectual Property Organisation (WIPO) help ease creation of cross-licensing agreements through its green initiatives.

The government can help in ensuring equitable access to green technologies by providing for compulsory licencing in critical technologies and, by offering subsidies and tax incentives to the patent holders of such compulsorily licenced green technologies. Also, the patents that specifically align with the objectives of sustainable development could be provided with an extension of patent protection if their patents are compulsorily licenced.

(iii) *Environmental laws Impacting*

**Renewable Infrastructures and Circular Economy Approach**

(i) *Legal Framework Governing Renewable Energy Infrastructure*

In India, the Environment Protection Act of 1986, The Biodiversity Act of 2002, Land Acquisition Act of 2013 and Forest Rights Act of 2006 regulate the procedure of construction of large-scale renewable energy in fracture.

The section 8 of the Biodiversity Act, 2002[17] mandates for the establishment of National Biodiversity Authority (NBA) and State Biodiversity Authority (SBA). The NBA is empowered to advise the central government on matters of conservation of biodiversity, sustainable use and equitable sharing of benefits of such lands, advising the state governments on establishing biodiversity hotspots as 'heritage sites' and perform any such function necessary for the application of the act. Under section 36 of the act the central government is empowered to undertake such strategies and programmed required for the conservation and sustainable development of biodiversity. Section 24(2) empowers the SBA to prohibit any violation of the act within its jurisdiction.

The establishment of renewable energy projects acquisition of large scale of land is a prerequisite if the location of the project is not on a land already owned by the government. The Land Acquisition Act of 2013 imposes strict requirements on the government to take over the private land of the respective property owners to ensure the Right of Fair Compensation and ensure Transparency of the procedure. Section 4[18] of the act imposes the obligation to conduct a Social Impact Assessment within a temporal limit of six months from the commencement of such land acquisition process and present its findings to a multidisciplinary expert group for evaluation.

The objective of Forest Act, 2006 is redressal of adverse condition of living of tribal families' endemic to forests. Section 3(2)(ii)[19] vests power with the Gram Panchayat to make any diversion to the lands of the forest. This provision ensures that members of Gram Panchayat who have knowledge of their rights arrive at an informed decision, because the prevalent levels of literacy in such communities tend to be very low.

(ii) *Impact of Renewable Energy Projects on Biodiversity and Land Use*

The 2006 notification of Environmental Impact Assessment (EIA) under the Environment Protection Act, 1986 establishes rules for obtaining

[17] The Biological Diversity Act, 2002, § 8.

[18] The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013, § 4.

[19] The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006, § 3(2)(ii).

environmental clearances. Section 7[20] of the said notification establishes four stages to obtain Prior Environmental Clearance for all relevant projects. The first stage 'screening' distinguishes projects that will require an EIA. The second stage 'scoping' stage establishes detailed and specific Terms of Reference (TOR) which includes all pertinent environmental issues in order to prepare an EIA Report. The third stage is 'public consultation' involving members of the community who would be directly impacted by the project. The fourth stage is 'appraisal' where an expert committee reviews and passed the project if it fulfils all essential conditions and make recommendations to be fulfilled for the grant of such clearance.

India has put forth an ambitious stance in COP26 of achieving 50% of its energy consumption from renewable sources. To accomplish such an objectives India needs to rapidly developpe its renewable energy infrastructure. Because renewable energy infrastructures are established at locations with highest resource potential, it also makes it incumbent upon the authorities that such projects do result in inevitable sacrifice the biodiversity in name of development as, such zones are biodiversity hotspots. Studies have theorised that unhinged and carelessly planned renewable energy infrastructure would result in loss of about 11,900 Km of forests and 55,700 Km of agricultural land. Large scale land acquisition for the establishment of renewable energy infrastructure is recovered from wastelands which majorly include marshes and wetland which are necessary for the recharging of ground water table or; grasslands or pasturelands which sustain pastoral communities and the grazing of their livestock[21].

(iii) *Circular Economy and Sustainable Waste Management in Renewable Energy*

Moreover, E-waste generated during the establishment and maintenance and of renewable infrastructure could itself jeopardise the ecosystems of the surrounding areas. The solar park in Pavagada, Karnataka was envisioned to become largest of such structures in India. Established with aim to provide in the backword region of Pavagada but, the poor execution of the project caused the of pollinators like bees to disappear which adversely impacted the local

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[20] Ministry of Environment, Forest and Climate Change, S.O. 1533 (E) (Notified on September 14, 2006).

[21] Ecoverva. .*Circular Economy and E-Waste Management: India's Path to Sustainability*. ECOVERVA, (11 July 2023) available at- https://ecoverva.com/circular-economy-and-e-waste-management-indias-path-to-sustainability/#:~:text=In%20contrast%2C%20the%20circular%20economy,create%20a%20closed%2Dloop%20system.

agriculture. Furthermore, the project caused the population of bears, jackals and leopards to migrate from the vicinity of the project. Furthermore, bird population in the surrounding region has been in decline ever since the establishment of the park in 2015. A scientific analysis revealed that poor disposal of the Photo Voltic cells at the end of their life duration which, are used in the construction of solar cells, have polluted the surrounding environment because of the toxic elements used in their construction.

In *M K Ranjitsingh* v. *Union of India* a PIL was filed by two environmentalists contending since a part in western Rajasthan where, population of two endangered species of birds reside, was exempted from EIA as it a major solar and wind energy zone prior to the establishment of such large-scale projects. Powerlines connect both the projects together however, these power lines that connect the projects pass through the area inhabited by such bird population and, these birds are getting killed in collisions with the said power lines. The SC held bird diverters of certain standards to be established along the entirety of the length of such power line.

The government needs to amend the existing laws and policies to align themselves with not only, the objective of mitigating climate change but also, the process implemented in achieving such objectives especially for large scale renewable energy projects.

Developing a robust legal and regulatory framework for renewable energy is critical to ensuring investment security, environmental sustainability, and efficient energy governance. The following policy recommendations aim to address the four legal dimensions outlined in this study: (i) regulatory frameworks for renewable energy in India, (ii) legal challenges in renewable energy investments, (iii) intellectual property rights and technology transfer, and

(iv) ) *The intersection of renewable energy with environmental law*

Addressing disparities in tariff structures, land acquisition regulations, and grid connectivity standards requires a unified regulatory framework between the federal and state governments. Conflicts between the Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commissions (SERCs) can be lessened with a uniform legal framework. Consistency in the implementation of renewable energy legislation can be ensured by establishing a Renewable Energy Law Commission to coordinate policies across states.

Accelerating renewable energy projects requires streamlining land acquisition processes. Despite offering a legal framework, the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation, and Resettlement Act, 2013 has complicated the process. The acquisition process can be streamlined

by designating certain areas for renewable energy, especially in states with abundant solar and wind. Delays can also be avoided with the aid of more transparent compensation plans, standardized land-use regulations, and accelerated clearance procedures provided under the Forest (Conservation) Act of 1980.

Strengthening the legal protections for Power Purchase Agreements (PPAs) is necessary to stop state governments from arbitrarily renegotiating and terminating them. To ensure the sanctity and binding nature of PPAs, the Electricity Act of 2003 should be revised to incorporate stronger enforcement measures. By offering a specialized legal structure for effectively resolving contractual issues, the creation of a Renewable Energy Dispute Resolution Tribunal can further boost investor trust.

To encourage investment in renewable energy, green financing options must be expanded. Financial viability can be increased by enacting tax incentives under the Goods and Services Tax (GST), simplifying carbon credit trading procedures, and fortifying green bond rules. To draw in long-term investments, the Securities and Exchange Board of India (SEBI) ought to establish more precise legislative requirements for green bonds and financial disclosures pertaining to climate change.

For effective integration of renewable energy, a modernized grid infrastructure with legislative clarity on net metering laws, decentralized energy generation, and cross-border energy trade is essential. Energy security and distribution efficiency will be enhanced by modernizing legal rules under the National Smart Grid Mission (NSGM) and guaranteeing open regulatory procedures for open-access renewable energy trading.

Innovation in renewable energy can be aided by fortifying technology-sharing arrangements and intellectual property rights (IPR) laws. India should investigate the possibility of mandatory licensing for essential green technologies, even though the TRIPS Agreement safeguards patent rights. The implementation of renewable energy can be accelerated without monopolizing innovation by promoting open-access licensing for sustainable technology and public-private collaborations for research and development.

The circular economy's objective is to optimise value from resources while minimising waste and adverse environmental impacts by extending their productive lives. It places focus on reduction, reusing, recycling, and recovery of materials thereby, establishing a closed-loop system. This system saves the resources spent in surveying, extraction and processing of the new resources thereby, ultimately mitigating factors contributing to climate change.

India currently does not possess a recycling system for specific types of e-waste and treats them as general e-waste. However, provided that such type of

e-waste is distinct in the economic value of its components India needs to implement one such policy. Currently India does not have a module recycling policy and can learn from modules adopted by other countries to ensure reduce waste and also, creating self-sufficiency in terms of raw material.

The European Union regulations work on the extended principle of Extended Producer Responsibility (EPR). The EPR places the responsibility of the entire life-cycle of the electronic gadget on the producer including its collection, recycling and safe disposal. The EU's directive makes the producer lay financing schemes for such disposal and requires the producer to report their sales, collect damage or discarded products free of cost and update target status.

Since the recycling marketing is capital intensive the availability of finance is crucial. India can choose to follow any financial model, such as pay-as you-go, pay-as-you-put, or collective producers responsibility scheme. In pay-as-you-go model the producer pays at the time of waste generation. This model works with a 'last-man standing insurance'; in case the producer goes out of business, the insures takes the responsibility for the recycling of the waste. In pay-as-you-put the producer pre-allocates a fixed sum for the future collection and recycling of the waste. In collective producers' responsibility scheme the producers in the market jointly designate financial guarantee with a last man standing insurance as a stopgap. This scheme is also called joint and several liability scheme because producers jointly contribute to this financial guarantee according to their specific market share. Indian producers can learn from Solar Energy Industries Association (SEIA) in the United States and New Energy and Industrial Technology Development Organization (NEDO) of Japan to invest in recycling technologies, finance routes, and feasibility examination by pilot projects. In India the Ministry of New and Renewable Energy along with, relevant industries and associations can spearhead such development akin to SEIA and NEDO.

India can develop a robust renewable energy sector that strikes a balance between environmental stewardship and economic prosperity by putting these legislative and policy recommendations into practice. In addition to streamlining investments, a thorough regulatory framework will promote innovation and fair access to sustainable technologies. India will fulfill its commitments under the Paris Agreement and the Sustainable Development Goals (SDGs) while establishing itself as a global leader in the transition to renewable energy by modernizing infrastructure, bolstering financial incentives, and guaranteeing legal clarity in contracts.

## VI

## Conclusion

Technological developments, a dedication to global sustainability goals, and ambitious governmental goals are driving India's shift to renewable energy. However, a complicated legal and regulatory framework that affects policy execution, investment, innovation, and environmental sustainability shapes this shift. Even though India has made great strides in creating laws and policies that are helpful, there are still issues with ensuring that federal and state regulations are seamlessly coordinated, contracts are enforceable, investor interests are safeguarded, intellectual property issues are addressed, and environmental sustainability is incorporated into the legal framework surrounding renewable energy.

The development of clean energy has been greatly aided by the regulatory framework for renewable energy. The sector has been guided by laws like the Electricity Act of 2003 and programs like the National Electricity Plan (NEP). However, regulatory fragmentation brought about by discrepancies between the Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commissions (SERCs) has raised doubts about power purchase agreements (PPAs), pricing structures, and project approvals. To guarantee uniformity, cut down on delays, and give developers and investors a clear process, a unified legal framework is required.

The development of large-scale renewable energy projects is still hampered by legal issues. Due to legal uncertainties brought on by problems with land acquisition, PPA disputes, and financing arrangements, investors are reluctant to make long-term financial commitments to the industry. Foreign direct investment (FDI) has been welcomed in India; but, investor trust has been affected by policy reversals, tariff issues, and delays in dispute resolution procedures. In order to reduce investment risks, it will be essential to set up a Renewable Energy Dispute Resolution Tribunal and guarantee that contracts may be enforced in accordance with national and international legal norms. Financial sustainability in the renewable energy industry will also be strengthened by legislative clarity about tax incentives, carbon credit trading, and green bond compliance.

Technology transfer and intellectual property rights (IPR) are essential for boosting innovation in renewable energy. India's patent rules and adherence to the TRIPS Agreement must strike a balance between fair access to green technologies and economic innovation. Important renewable energy technologies can be made more widely available while encouraging domestic R&D by requiring licensing. Technology transfer won't be a hindrance to the growth of renewable energy if public-private partnerships are promoted and open-access licensing models are incorporated for sustainable energy solutions.

The confluence of environmental law and renewable energy is another urgent legal issue. Large-scale renewable energy projects have an impact on waste management, biodiversity, and land use, despite the fact that they are generally viewed as an environmentally friendly substitute for fossil fuels. To incorporate thorough evaluations for battery storage sustainability, wind turbine decommissioning, and solar panel waste disposal, the Environmental Impact Assessment (EIA) Notification, 2006, needs to be substantially improved. To achieve long-term environmental sustainability, renewable energy waste management should embrace a circular economy strategy and incorporate Extended Producer Responsibility (EPR) legislation.

A well-organized legal system can not only hasten India's adoption of clean energy but also guarantee that access to technology, investment, and environmental responsibility are not hampered by legal restrictions. India will become a global leader in the shift to renewable energy if it improves contract enforcement procedures, simplifies dispute resolution, updates grid regulations, and incorporates environmental sustainability measures into legal frameworks.