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Promoting Green Technologies Through Patent Law: Advancing SDGs Under The TRIPS Framework

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Abstract

Patent law in India serves two closely related purposes. At the same time, rights that are too broad, too expensive to license, or too difficult to interpret may delay the spread of technologies that have clear environmental value. Patents relating to renewable energy, energy efficiency, cleaner manufacturing, waste treatment, low-carbon transport, and climate adaptation may contribute directly to SDG 7 and SDG 13, while also supporting industrial and infrastructure goals. The law does not provide a clear statutory meaning of a green patent, so applicants and examiners may apply different assumptions when deciding whether an invention deserves special treatment. Questions arise about affordability, local working, access to technical know-how, and the circumstances in which an environmental emergency may justify stronger state intervention. Section 3(d) creates an additional interpretative difficulty because many green technologies improve through small but valuable gains in efficiency, durability, storage capacity, material use, or emissions reduction. Such advances may be environmentally important even when they do not appear revolutionary. The present study therefore examines whether Indian patent law promotes the creation, transfer, and commercial use of green technologies in a consistent manner. It focuses on legal uncertainty, administrative discretion, weak policy coordination, and barriers that separate patent ownership from real-world deployment. Although India's regime is broadly aligned with its international obligations, its practical operation does not yet offer a fully predictable route from invention to sustainable use. Two recurring concerns remain visible in practice: the uneven implementation of Article 66.2 in relation to technology transfer and weak security of trade secrets. Besides, the creation of discrepancies in the expansion of Section 3(d) prompts the question of whether patents amicably serve green products. Lack of an elaborate policy framework further makes things difficult. Thus, the author analyses the impact of the patent system in India on the creation of green technologies with an emphasis on the legal and regulatory uncertainties that decrease innovation, transfer of knowledge and commercialisation. Although in principle the patent regime in India is consistent with its international commitments, the implications of the operationalized system are somewhat negative due to the lack of clarity in its legal framework and uneven

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policies. To turn patents into a useful tool of climate innovation and achievement of SDGs, legislative clarification, careful exercising of TRIPS flexibilities, and building stronger institutional cooperation are recommended to address these issues.

Keywords: Green Patents, TRIPS Agreement, Sustainable Development Goals, Compulsory licensing, Section 3(d)

1. Introduction

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

~Gro Harlem Brundtland, Brundtland Report (1987)

Green Technology innovation refers to the birth and development of environmentally friendly innovations that have a significant aim in protecting the natural environment and its attributes by limiting and reducing the adverse effects of humans. The term "green technology" is used in a wide and practical sense. It can include a physical product, a specialised service, an improved manufacturing technique, a digital control system, or an operating practice that reduces pressure on the environment. Some inventions lower the quantity of fuel or raw material needed for a particular task. Others control pollution before it enters the air, water, or soil. A further group replaces hazardous substances with safer inputs, makes recycling easier, extends the useful life of equipment, or allows natural resources to be managed with greater care. The environmental value of a technology may therefore appear at different stages of its life cycle. It may arise while materials are extracted, during production, when the product is used, or when it is repaired, reused, and finally discarded. Renewable-energy devices are an obvious example, yet the category is not limited to solar panels or wind turbines. Energy-storage systems, efficient motors, water-saving processes, low-emission transport, waste-recovery methods, pollution-monitoring tools, climate-resilient agricultural techniques, and cleaner industrial controls may also perform a green function. The result need not be the complete removal of environmental harm. A measurable reduction in emissions, resource consumption, waste generation, or ecological risk may itself be important, particularly when the technology is used on a large scale.

Developing states can then face a double burden: they are expected to meet climate commitments, but they may lack affordable access to the protected tools required for implementation. The public, however, requires timely, reasonably priced, and geographically fair access to technologies that protect shared environmental resources and make climate obligations practically achievable.

India plays a visible role in international debates on development, climate responsibility, technological capacity, and equitable innovation. As a party to the Paris Agreement, the country has accepted commitments connected with lower emission intensity, cleaner growth, and a continuing expansion of renewable-energy capacity. Indian law does not expressly define the term "green patent," and no single statutory route determines which climate-related inventions should receive special examination, incentives, or policy support. Questions also remain about the use of compulsory licensing for essential climate technologies, especially where high prices or limited local working restrict access. TRIPS recognises technology-transfer objectives, but practical movement of patented knowledge, manufacturing skill, and confidential know-how is often limited. The article uses a doctrinal and comparative methodology to examine how India's patent law affects climate-responsive innovation and the fulfilment of the Sustainable Development Goals (SDGs) 2030, with an emphasis on structural shortcomings within India's green patent landscape.

2. TRIPS Framework and Global Governance of Green Technology

The expansion of intellectual property (IP) under the TRIPS Agreement has altered the relationship between innovation, commerce, and public welfare. Before TRIPS, which went into force in 1994, intellectual property varied widely, allowing poorer countries to have more freedom in their patent regimes. TRIPS standardised minimal patent protection, raising conflicts regarding access to essential technologies, especially regarding public health and environmental sustainability.[3]

The agreement requires patent availability for innovative inventions and forbids discrimination against certain industries. For a minimum term of twenty years, patent owners receive the legal power to stop others from making, using, selling, or importing the protected invention without authorisation. However, the same exclusivity can create serious access concerns when the protected subject matter is environmentally essential. A patent may cover an invention needed for clean electricity, efficient storage, low-emission transport, water treatment, or climate adaptation, yet a developing country may be unable to obtain it on workable financial or technical terms. Proprietary restrictions can therefore limit not only copying but also local production, repair, improvement, and large-scale deployment. TRIPS contains safeguards that permit member states to respond to public-interest needs. Compulsory licensing is one such flexibility, allowing authorised third parties to use a patent under specified legal conditions and with appropriate remuneration. Although this mechanism is most familiar in public-health disputes, its language may also be relevant where renewable-energy or climate-resilience technologies become urgently necessary. Articles 7 and 8 provide broader interpretative guidance by connecting intellectual property protection with social welfare, development, and measures needed to protect legitimate public interests. Article 66.2 separately seeks to encourage technology transfer to least-developed countries. Its practical effect has nevertheless been questioned because formal reporting and voluntary incentives do not always produce meaningful transfer of equipment, skills, manufacturing experience, or usable technical knowledge.[4]

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[3] *EPLP-041.Pdf*, https://portals.iucn.org/library/sites/library/files/documents/EPLP-041.pdf (last visited May 15, 2026).
[4] *Innovation and Intellectual Property*, IPDAY, https://www.wipo.int/en/web/ipday/2017/innovation_and_intellectual_property (last visited May 15, 2026).

Climate justice remains contested because countries enter the green transition with unequal wealth, infrastructure, bargaining power, and technological capacity. Developing states argue that strong patent control may deepen inequality when essential low-carbon technologies are unaffordable or licensed on restrictive terms. Developed countries and technology-owning firms respond that weaker protection could reduce investment in expensive and uncertain research. Different policy models have therefore emerged. The European Union links intellectual property with climate regulation, public funding, and industrial planning, whereas China uses state finance, procurement, and manufacturing incentives to expand green industries. These approaches show that patents do not operate alone; their practical effect depends on licensing rules, investment, competition, industrial policy, and technology-transfer support.

Developing countries, especially India, continue to struggle with their roles in a system where IP governance interacts with global equity and environmental duties, aiming for a patent regime that is both TRIPS-compliant and supportive of sustainable development.

3. India’s Patent Regime and the Emerging Green Patent Framework

The Patents Act of 1970 constitutes the fundamental legal framework for patents in India, which has been updated to align with India's commitments under the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). This Act specifies substantive and procedural conditions for patentability, issuing, and enforcing patent rights, with the intention of balancing innovation and public interest. To qualify for a patent, innovations must meet three fundamental criteria:

1) Novelty: The invention must not have been made known to the public before the patent application is submitted.
2) Inventive Step: It should not be clear to someone with expertise in the topic.
3) Industrial Applicability: The invention must be useful in fields such as technology, healthcare, or agriculture.

Furthermore, intellectual property rights (IPRs) offer sole authority to inventions, but green intellectual property (Green IPR) expressly protects environmentally beneficial technology.[5] The TRIPS agreement emphasises the significance of Green IPR by promoting the creation and sharing of technology that benefits both producers and society as a whole. Within its 2030 Sustainable Development Agenda, the World Intellectual Property Organisation (WIPO) emphasised the link between intellectual property rights, innovation, and sustainable development. It demonstrates how IP frameworks may boost a country's intellectual capabilities, attract foreign direct investment, and promote environmentally friendly commercial products and services across the world. In addition, WIPO’s International Patent Classification tools make technical information easier to identify by grouping published patent documents connected with environmentally sound technologies. Public disclosure allows researchers, firms, and policymakers to study earlier inventions, avoid

[5] Z. A. Khan & Shireen Singh, *Intellectual Property Rights Regime in Green Technology: Way Forward to Sustainability*, 22 Nat. Env. Poll. Tech 2145 (2023).

unnecessary duplication, locate possible partners, and develop further improvements from knowledge already placed in the patent record.[6]

3.1. Green technology categories recognized by the Indian Patent Office

Even so, India does not have a separate statutory regime that clearly identifies green technologies or links patent examination with climate policy. The absence of a common legal definition, uniform eligibility standards, and coordinated policy guidance creates uncertainty for inventors, examiners, investors, and public authorities. This uncertainty may delay protection, produce inconsistent classification, and weaken the commercial pathway for inventions that could support national sustainability objectives.[7]

In India, the label green technology is generally applied to inventions that prevent environmental harm, reduce pollution, improve energy or material efficiency, conserve limited resources, support adaptation, or lower the climate impact of existing economic activity. International classification makes published patent material easier to locate.

As a result, the categorisation of green innovations is heavily dependent on administrative interpretations and the judgement of patent examiners.

The implementation of faster review procedures for specified forms of innovations is a significant move forward in India's green patent system. The Patent Rules permit accelerated examination for several classes of applicants. Recognised start-ups and small entities may qualify because early legal certainty can be especially important for organisations with limited capital. Applications involving eligible female applicants can also receive the benefit, while government departments, institutions established by legislation, government companies, and certain publicly financed bodies may use the procedure when the prescribed conditions are satisfied. Other categories may become eligible through arrangements recognised under the Rules. The practical effect is significant: an application placed on an expedited track can move more quickly toward examination, response, amendment, and final decision. Quicker processing may help an applicant approach investors, negotiate a licence, plan production, or decide whether further development is commercially sensible. The present mechanism, however, is applicant-centred rather than technology-centred. Eligibility normally follows the legal identity, institutional status, or other prescribed characteristic of the person filing the application. Consequently, a climate-beneficial application submitted by a non-qualifying individual or company may continue through the normal examination sequence, with the same possibility of delay that applies to other technologies.

Environmental innovation often depends on decisions that must be taken before the commercial value of an invention is fully known. A faster and more predictable examination process can reduce this uncertainty. Investors usually want to understand the likely scope of protection before committing funds to prototypes,

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[6] Sonja Alexandra Rapcanova, Patent Law and Green Technology: The Role of Patent Law Mechanisms in the Development and Diffusion of "Green Technologies" (Master's thesis, Lund University 2022) <https://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=9086289&fileOId=9086293 > accessed 15 May 2025

[7] SpicyIP, *Green Patents and Climate Governance: What India Can Learn from Global Leaders in Climate-Tech IP*, SpicyIP (Mar. 5, 2026), https://spicyip.com/2026/03/green-patents-and-climate-governance-what-india-can-learn-from-global-leaders-in-climate-tech-ip.html.

testing, certification, or large-scale manufacture. Potential licensees may also postpone negotiations until they know which claims will survive examination. When a decision remains pending for a long period, firms can hesitate to construct facilities, order specialised equipment, enter supply agreements, or train workers. Public authorities may face comparable difficulty when considering procurement or demonstration projects. By combining quality with reasonable certainty, the patent office can reduce avoidable delay and help environmentally useful technology reach users at the stage when its contribution is most valuable.

Indian patent law presently contains no express statutory category called a "green patent." This omission produces uncertainty at the most basic level because applicants, examiners, investors, researchers, and public agencies may use the same expression in different ways. Clear language would make the Indian regime easier to administer, compare, and evaluate. Neither the Patents Act, 1970 nor the Patent Rules clearly explains what qualifies as a green invention, an environmentally sound technology, or a climate-responsive patent. A further question concerns the kind and degree of environmental benefit that should be sufficient. Some inventions produce an immediate and visible ecological result. A pollution-control device may capture harmful discharge, or a renewable-energy system may replace electricity generated from fossil fuel. Other inventions work indirectly.

3.2.Legislative Gaps

The absence of a dedicated mechanism for multidimensional technologies can make patent examination lengthy.

Examination of green-technology applications is technically demanding for several reasons. The relevant industries develop quickly, terminology changes, and inventions often combine knowledge from fields that have traditionally been examined separately. Patentability must still be assessed through the ordinary requirements of novelty, inventive step, and industrial applicability. The examiner must search earlier patents and non-patent literature, construe the claims, identify the actual technical contribution, and decide whether the disclosure enables the invention to be performed. Environmental assertions add another layer to this work. An applicant may state that a process saves energy, lowers emissions, conserves water, improves recyclability, reduces toxic inputs, or strengthens climate resilience. Those statements cannot simply be accepted as labels. The examiner may need to determine whether the claimed advantage follows from the technical features, whether comparative evidence is credible, and whether the effect is relevant to inventive step or only to commercial utility. Different approaches can lead to inconsistent outcomes. One examiner might regard an efficiency improvement as the central inventive effect because it changes the operation of the system. Another might treat the same improvement as an incidental benefit that does not distinguish the claims from earlier technology. A third may lack access to the specialised literature needed to test the assertion. Interdisciplinary applications make the risk greater. A claim involving software-controlled energy equipment may require expertise in computing, electrical engineering, and system design, while a cleaner chemical process can demand knowledge of chemistry, industrial scale-up, and environmental measurement. Clear criteria and

interdisciplinary support would ensure that ordinary patentability standards are applied with sufficient technical understanding and reasonable consistency.

4. Compulsory Licensing and Climate Emergencies

Compulsory licensing allows authorised use of a patent without the owner's consent, subject to legal conditions and remuneration.

Climate technologies often involve multiple complementary rights. A battery can depend on patented materials, cell design, control software, safety systems, and manufacturing methods. Water-treatment equipment may require replacement parts, specialised membranes, operating data, and continuous maintenance. These differences make it harder to identify the precise patent barrier and to determine whether a licence will provide an effective remedy. The legal position is also unsettled because international and national provisions do not always refer expressly to climate emergencies. Decision-makers must interpret general concepts such as public interest, national emergency, extreme urgency, reasonable requirements, and affordability. The scope of any licence would need careful limits so that it addresses the demonstrated need without extending further than necessary. Remuneration must be determined, and the proposed licensee must possess genuine technical capacity. These unresolved issues explain why the legitimacy, scope, and practical design of climate-related compulsory licensing continue to be contested within international intellectual property law.

4.1. Concept and rationale of compulsory licensing

The Patents Act of 1970 (Chapter XVI) presents a three-party compulsory licensing system that seeks to increase the use of green technology in India. Section 84(1) also gives an interested party a right to take a compulsory licence in three years period following the issue of a patent whereby on three independent grounds such as: (a) failure to meet reasonable requirements with regards to the use of the invention by lots (b) inaccessibility of the patented invention at an acceptable price and (c) whenever the invention is not used within India. Such standards often suggest continuing lapses within the green technology field, especially those of foreign patent holders who do not offer cheap access or local production.

Moreover, the Central Government has a faster mechanism set in Section 92 to grant compulsory licenses where it deems it necessary in the best interest of the people. This provision gives the Controller the authority to issue licenses immediately without prior discussions with the owner of the patent about emergencies or exceptionally urgent situations. Although the application of national emergency or conditions of extraordinary urgency under Section 92 has not been settled before in a climatic context, the persuasion for its use is high. Climate change nowadays is considered a matter in various government regimes, and in the Paris Agreement, it is mentioned as an urgent and even irreversible menace. In addition, should a state of public health crisis, as established under the Doha Declaration on TRIPS and Public Health, it should be of great necessity, then any imminent disaster that takes away the pillars of civilization should also fit into that category.

Provision	**Ground**	**Green Technology Application**

S. 84(1)(a)	Public requirements are not satisfied	Inadequate supply of solar/wind technology
S. 84(1)(b)	Not available at an affordable price	High-cost renewable energy patents
S. 84(1)(c)	Not worked in India	Foreign-held green tech is not manufactured domestically
S. 92(1)	National emergency / extreme urgency	Climate emergency expedited, no prior negotiation needed

4.2. Compulsory licensing jurisprudence in India

Within India, compulsory-licensing law has developed mainly through disputes concerning public welfare and access to medicines. The framework shows that patent exclusivity is subject to statutory conditions and cannot be separated from affordability, supply, and the reasonable requirements of the public. India demonstrated its willingness to use TRIPS flexibilities in Natco Pharma Ltd. v. Bayer Corporation, where a compulsory licence was granted for Sorafenib Tosylate, an anti-cancer medicine. The decision examined whether the patented product was available in sufficient quantity, whether its price was reasonably affordable, and whether the invention was adequately worked in India. These factors placed social need at the centre of the analysis rather than treating the patent owner's commercial preference as decisive. The case also confirmed that an exclusive right remains regulated by the objectives of the Patents Act. Patent protection rewards innovation, but it does not create an absolute privilege that can operate without regard to statutory public-interest safeguards. The resulting doctrine, although developed in a pharmaceutical dispute, now provides useful interpretative guidance for other fields. Its reasoning can inform analysis of green technologies where limited supply, unaffordable licensing, or failure to establish local working prevents the public from receiving an environmentally important invention. The factual inquiry would necessarily differ because climate technologies are technically diverse, yet the underlying principle remains relevant: the scope and exercise of a patent monopoly must be considered alongside the broader welfare objectives recognised by Indian law.

Natco- Bayer Case Study

Natco Pharma Ltd. v. Bayer Corporation (2012) remains India's leading compulsory-licensing decision and offers an important reference point for considering how Section 84 might operate beyond pharmaceuticals. The dispute concerned Sorafenib Tosylate, a patented anti-cancer medicine. When examining the application, the Controller considered the actual number of patients served, the availability of the product in India, the extent of local working, and the price charged by the patent holder. Bayer's supply was found to meet only a very small share of patient demand, and the Controller considered the price of Rs. 2.8 lakh per month unreasonable. The IPAB emphasised that "reasonable public requirements" should be based on society's needs rather than patent-holder interests, a notion that applies to green technology. Renewable energy cannot fulfil societal demands if it only impacts a tiny proportion of energy-deficient homes. The 6% royalty rate serves as a

standard for future compulsory licensing in green technology, meeting TRIPS regulations. Furthermore, Section 84(1)(c) demands a functioning condition that might be used to support a compulsory licence, particularly for international patents in essential climate technologies that have not yet been licensed in India.[8]

4.3. Public health Vs. environmental emergencies

Considering today's legislative framework, public health emergencies and environmental disasters occur. Public health emergencies have gained legal and humanitarian recognition in international intellectual property discourse, particularly following the Doha Declaration on the TRIPS Agreement and Public Health, which reaffirmed member states' rights to protect public health and promote access to medicines. Despite the grave concerns posed by climate change, environmental crises are under-recognised within compulsory licensing legislation. This raises serious questions about whether climate change may legitimately be classified as a "national emergency" or a situation of *"extreme urgency under Sections 84 and 92 of the Indian Patents Act and Article 31 of TRIPS."*

4.4. Why hasn't a compulsory green technology licence been issued? Examining the barriers

The lack of global mandatory licences on green technology is a political and institutional challenge, and not due to legal challenges. This disparity is due to three significant challenges:

1. Diplomatic Deterrence: Countries considering a compulsory licence may face pressure that extends beyond the formal requirements of patent law. The United States Special 301 process examines the intellectual property practices of trading partners and can place states on watch lists when their laws or enforcement policies are viewed as inadequate. Governments may fear that an assertive use of TRIPS flexibilities will attract negative reporting, bilateral criticism, reduced investor confidence, or the threat of trade consequences. Earlier controversies involving Brazil and Thailand have contributed to this perception, particularly where compulsory licensing was used or proposed for important medicines. The legal right to grant a licence may therefore exist, yet political officials can remain cautious about exercising it. Political influence, uncertainty about international reactions, and the bargaining power of major technology owners can make a lawful public-interest measure appear institutionally risky.
2. Technical complexity: Reproducing an environmentally sound technology can require much more than reading the claims of a single patent. Some pharmaceutical inventions centre on a defined compound and a manufacturing process that a technically capable producer may be able to reproduce after obtaining lawful access. Green technologies are often organised as complete systems. A modern wind installation, energy-storage facility, electric-vehicle platform, water-treatment plant, or carbon-management process may contain many patented components owned by different entities. Successful operation can depend on specialised materials, precision machinery, embedded software, control algorithms, engineering standards, safety testing, grid or network compatibility, installation experience, and regular maintenance. Without these additional elements, a compulsory licence can be legally valid but commercially or technically ineffective.

[8] Mansi Sood, *NATCO PHARMA LTD. V. BAYER CORPORATION AND THE COMPULSORY LICENSING REGIME IN INDIA* (2013).

3. Administrative uncertainty: India does not presently maintain a specialised body with a clear and continuing mandate to examine green-patent landscapes and evaluate climate-related compulsory-licensing requests. An ordinary licensing application can already require legal, economic, and technical analysis. Environmental technologies add questions involving climate urgency, public need, system compatibility, alternative solutions, and measurable ecological benefit. A coordinated unit would first need to identify all patents relevant to the proposed use, not merely the most visible patent. It would then examine whether reasonable public requirements are unmet, whether supply is sufficient, whether the offered price or licence terms are workable, and whether the invention is adequately worked in India. The authority must also assess the technical capacity of the proposed licensee. In the absence of such coordination, officials may hesitate to initiate or approve a licence because they cannot confidently identify the blocking rights, establish the statutory grounds, calculate remuneration, or determine whether local working is realistically achievable.

Developing countries, including India, need timely and workable access to environmentally sound technologies if international climate commitments are to be translated into domestic action. The Paris Agreement and the Sustainable Development Goals create expectations relating to clean energy, resilient infrastructure, lower emissions, sustainable production, and adaptation. Progress in these areas depends on equipment and knowledge that may be protected, expensive, technically complex, or concentrated in a small number of firms. Access cannot therefore be measured only by the availability of a finished imported product. A country may need authority to manufacture components locally, adjust a design to climatic and infrastructural conditions, connect equipment with domestic systems, repair it without repeated foreign assistance, and improve it as operating experience develops. Workers must be trained, replacement parts must be secured, and technical standards must be understood. Local production can also support affordability, supply security, employment, and the ability to respond when international supply chains are interrupted. Voluntary licensing is normally the preferred route because the parties can negotiate patents, know-how, technical assistance, quality control, and continuing support as one package. Negotiation, however, may fail. A rights holder might refuse to license, offer only a narrow field of use, demand a price that makes deployment impractical, restrict local manufacture, or supply quantities that do not satisfy public need. In those circumstances, compulsory licensing has been proposed as a public-interest safeguard. It could authorise use of the necessary patent while preserving remuneration for the owner. Its value lies in creating a lawful option when reasonable voluntary arrangements do not produce adequate supply, affordable terms, meaningful local use, or the capacity to adapt technology over time. Opponents raise different concerns. Frequent or unpredictable compulsory licences could reduce investor confidence, weaken incentives for private research, or encourage firms to protect valuable knowledge as trade secrets instead of disclosing it through patents. Because the sector is diverse, law and policy must identify the particular public need, the relevant patent barriers, and the realistic capacity of a licensee rather than assuming that every protected climate invention can be transferred in the same manner.

4.5. Implementation of TRIPS flexibilities to renewable energy and climate technologies

The existing leading global debates on climate compulsory licensing have shown that it is more hypothetical and less explored.

5. Section 3(d): Technology Transfer and Barriers to Commercialisation

The successful distribution, adaptation, and commercialisation of the environmentally beneficial innovations is also an important aspect of the effective use of the patent law in facilitating sustainable development in the country, since the provider of the technology gets a unique right. Laws on intellectual protection should be part of a wider policy that fosters the transfer of knowledge, development of industries and resilient infrastructural development in the context of green innovation. Although there has been an increased patent activity in the area of renewable energy and the sustainability fields of work, there exists an institutional set of challenges that bar the efficient adoption of green innovations in India. These issues are especially noticeable in the barrier to knowledge transfer, the interpretation problem in relation to Section 3(d) of the Patents Act of 1970, and the decentralization of India commercialization ecosystem.

a) Technology Transfer Challenges

The transfer of climate technology is a practice whereby a country shares its green technologies, expertise, and innovations with another country, which plays a crucial role in transforming emerging economies to adopt renewable energy systems and sustainable operations. It is verified by international frameworks like the Paris Agreement and Article 66.2 of the TRIPS Agreement, which highlight its applicability, although it is frequently inefficient, with mere cosmetic efforts to implement it being undertaken. Limited licensing agreements, high transactional costs and widespread patent thickets all hinder access to important green technology. In addition, there is the trade secret protection that discourages efficient reproduction of technology. This structure primarily contributes to the North-South inequality in technologies and the inefficacy of climate justice, as the underdeveloped countries have massive obstacles to the innovation of essential technologies, and the richer countries occupy the markets of innovation.

b) Patentability of Incremental Innovation Vis-À-Vis § 3(D) Of The Indian Patents Act

The second critical issue in the Indian green patent regime is the interpretation of Section 3(d) of the Patents Act, which does not allow simple modifications of the existing chemicals to be patented unless they display greater efficacy. Despite this provision being aimed at discouraging evergreening in medicines, its applicability to green technology poses an interpretative challenge. The decision made by the Supreme Court in the case of Novartis AG v. Union of India emphasized that higher efficacy should be considered as a material improvement, and this will affect the consideration of patentability within the industry.

Section 3(d) is particularly tricky in relation to environmental technology because green developments are often a series of incremental improvements as opposed to game changers. Progressive efficiencies are advantageous to technologies like solar panels and battery systems, but it is unspecified whether it meets the requirement of enhanced efficacy.

The confusion creates problems in fields that have had to be innovated by incremental improvements, such as in the areas of solar energy and battery technology, in which long-term innovation is crucial. If these innovative developments are not patented due to narrow interpretations of Section 3(d), the sustainable technology can be negatively impacted. On the other hand, excessively large patents on relatively minor modifications can derail competition. Achieving balance in India's green patent framework is thus an essential issue.

c) Commercialization and Policy Disintegration

In addition to patentability and technology-transfer issues, India’s green innovation ecosystem faces economic problems and fragmented laws.

6. Recommendations

The close relationship among climate governance, technological innovation, and intellectual property law makes a careful review of India’s patent regime necessary for sustainable development. Patent rules influence which inventions attract investment, how technical knowledge is disclosed, who may manufacture a protected product, and the terms on which a technology can be licensed. These effects are especially important for clean energy, efficient production, environmental protection, and climate adaptation. India has expanded renewable-energy capacity and supported several forms of clean technology, yet the patent environment remains fragmented. Green inventions are not defined by one legal standard, administrative practice is not fully integrated with climate policy, and the path from protection to commercial deployment remains uncertain. A development-oriented system must therefore become more coherent, predictable, and responsive to environmental need. Reforms will include the creation of a legislative definition of what is meant by a green patent to give it a legal status and a climate-sensitive interpretation of compulsory licensing to enhance access to vital green technology:-

a. India is also in a position to enhance technology transfer practices and joint licensing conditions to avail sustainable technologies. Section 3(d) should be changed to acknowledge biannual green breakthroughs, and patent law should be aligned with industrial strategy and climate finance so that green technology can be commercialized effectively. The collaboration between the government and the industry can accelerate the creation of low-cost green technology, not to mention that it can promote competition locally.
b. Second, the Parliament will need to amend the Patents Act of 1990, in particular, Section 92, to provide a clear reference to climate change prevention and adaptation as being considered by the emergency compulsory licensing. It should include a condition that any type of climate emergency declaration by the Central Government, along with the current commitments of India in the Paris Agreement and the National Action Plan on Climate Change, is viewed as a circumstance of extreme urgency under Section 92. This explains the legal collaboration behind expedited license issuance, abolishing the three-year wait.
c. Third, the Ministry of Commerce and Industry should come up with a National Green Technology Compulsory Licensing Policy that emphasises qualified technology categories (e.g., solar PV, offshore

wind, battery storage, and carbon capture), uniform payment methodologies that adhere to the 6% Natco benchmark, compulsory responsibilities on expertise transfer required to patenting licenses, and expedited processing of Section 92 applications.

7. Conclusion

The clash between intellectual property protection and environmental sustainability has posed significant challenges to global governance, particularly in view of climate change, which is intensifying the demand for sustainable development in the world. Green technology is a source of economic interest and environmental safeguard, which requires a re-evaluation of patent regimes within the TRIPS Agreement to balance proprietary rights with good and fair access. In India, the green patent ecosystem is full of legal uncertainties, namely, the lack of a definition of green patents in the Indian legal system leads to differences and misunderstandings in the management. The mandatory application of a license and the transfer of technology by TRIPS are inadequately addressed, which contributes to the further increase of imbalances between the advanced and developing states. Climate transitions cannot succeed with restrictive licensing and high costs, as access to sustainable technology would be hindered. This paper has shown that the innovation system in India is grant-based and does not relate to the incorporation of necessary industrial policy measures to curtail the economic viability of green innovations.

Technology transfer must be understood as a practical process rather than a paper permission. Skills, manufacturing experience, maintenance capability, testing facilities, standards, replacement parts, finance, and continuing institutional cooperation are often necessary before a protected invention can be used reliably. Policy should also examine outcomes. These principles should ultimately guide the design, interpretation, and administration of green-patent law and policy.