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GREEN PATENTS AND CLIMATE TECHNOLOGY: BALANCING INNOVATION, ACCESS AND SUSTAINABLE DEVELOPMENT

(Nikky Singh)

I. INTRODUCTION

Climate change has transformed the relationship between technological innovation and public policy. The transition to a low-carbon and climate-resilient economy depends not only on environmental regulation and public finance, but also on the creation, protection, transfer and deployment of new technologies. Solar photovoltaic systems, advanced batteries, electric mobility, green hydrogen, carbon capture, smart grids, low-emission industrial processes and climate-resilient agricultural technologies are examples of innovations that can reduce emissions or strengthen adaptation. Intellectual property, particularly patents, is therefore an important part of the climate-technology ecosystem.

A patent gives an inventor a time-limited legal right to prevent specified acts concerning an invention in exchange for public disclosure of the invention. In the climate context, this bargain has a distinctive significance. Disclosure can enrich the technological knowledge base, while exclusivity can help innovators recover research and development costs and attract investment. At the same time, climate technologies generate a public interest that extends beyond the commercial interests of individual right holders. If a technology capable of reducing emissions or protecting communities from climate impacts remains inaccessible because of cost, licensing restrictions, inadequate infrastructure or lack of technical capacity, the social value of the innovation may not be fully realized.

Recent patent evidence shows the scale of the technological transformation. WIPO's 2026 analysis reports that global green-technology patent families increased from approximately 111,400 in 2003 to 412,300 in 2023, while their share of global patenting rose from 13.7% to

18.2%. The leading areas include smart energy, grids and transmission, battery storage, and air-pollution control. These figures indicate substantial inventive activity, but patenting itself does not establish whether a technology is affordable, commercially viable, or actually deployed at the scale required for climate action.

The central legal and policy question is consequently not whether patents are good or bad for climate technology. It is how the patent system can preserve incentives for risky and expensive innovation while preventing intellectual property from becoming an unnecessary barrier to diffusion. This article examines that balance through the international framework and the Indian patent regime, and considers how green patents can contribute to climate objectives while remaining connected to access, technology transfer and sustainable development.[1]

II. GREEN PATENTS AND THE CLIMATE-INNOVATION ECOSYSTEM

The expression “green patent” is generally used to describe patents relating to technologies that provide an environmental benefit, including mitigation of greenhouse-gas emissions, improved energy efficiency, renewable-energy generation, pollution control, sustainable transport, resource conservation and climate adaptation. There is no universal legal category called a “green patent.” Instead, green technologies are identified through patent classifications, technology concordances and analytical methodologies. This matters because environmental functions cut across conventional technical classifications: a battery, for example, can serve electric mobility, grid storage and consumer electronics, while the climate relevance of each application may differ.[2]

Patents can contribute to climate innovation in at least three ways. First, exclusivity can reduce investment risk. Climate technologies frequently require substantial research expenditure, testing, manufacturing capacity and infrastructure before commercial returns become predictable. Patent protection can make licensing, assignment and investment arrangements easier to structure because the legal asset is identifiable. Second, patent disclosure creates a public source of technical information. Researchers can study patent

[1]World Intell. Prop. Org., Climate Change and Intellectual Property, WIPO, https://www.wipo.int/en/web/climate-change.
[2]World Intell. Prop. Org., Mapping Green Innovation: An Overview of the New WIPO IPC–Green Technology Concordance, WIPO (2026), https://www.wipo.int/web-publications/mapping-green-innovation-an-overview-of-the-new-wipo-ipc-green-technology-concordance/en/background.html.

documents, identify existing solutions, avoid unnecessary duplication and build further inventions around expired or non-protected technologies. Third, patents can facilitate markets for technology through licensing and partnerships. WIPO's WIPO GREEN platform, for example, is designed to connect technology providers with parties seeking environmentally friendly solutions.

However, patent counts should not be treated as a direct measure of climate impact. A patent may never reach commercial production; an invention may be protected in one jurisdiction but not another; and many important innovations are not patented. Deployment also depends on complementary factors such as electricity networks, manufacturing capacity, skilled labour, public procurement, standards, financing and consumer demand. Patent policy should therefore be understood as one component of a broader innovation system rather than as a substitute for climate policy.

The distinction between invention and diffusion is especially important for developing countries. A country may possess strong demand for clean technologies but have limited domestic research capacity or manufacturing infrastructure. Conversely, an economy may produce many patents without achieving corresponding deployment. Climate policy therefore requires attention to both sides of the innovation cycle: creating knowledge and moving knowledge into practical use.[3]

III. INTERNATIONAL LAW: INNOVATION VERSUS ACCESS

The international intellectual-property framework already contains language relevant to this balance. Article 7 of the TRIPS Agreement states that intellectual-property protection and enforcement should contribute to technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users, in a manner conducive to social and economic welfare and a balance of rights and obligations. Article 8 further recognizes the ability of Members to adopt measures to promote public interests of vital importance to their socio-economic and technological development, subject to consistency with the Agreement.[4]

These provisions do not create a general “climate exception” to patent rights. Nevertheless, they provide an important policy framework: patent protection is connected to broader

[3]World Intell. Prop. Org., WIPO GREEN, https://www.wipo.int/en/web/wipo-green.
[4]Agreement on Trade-Related Aspects of Intellectual Property Rights arts. 7–8, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 401.

objectives of innovation, dissemination and welfare. The challenge is to use the flexibilities already available in national systems without undermining legitimate incentives for investment.

The Paris Agreement also places technology at the centre of climate action. Article 10 recognizes the importance of fully realizing technology development and transfer to improve resilience and reduce greenhouse-gas emissions, and calls for strengthened cooperative action on technology development and transfer. Climate technology policy therefore operates across two related but distinct legal fields: international intellectual property and international climate governance. Neither field alone resolves the practical question of how a particular technology should be financed, licensed, manufactured and deployed.

Technology transfer is often discussed as if it simply means transferring a patented product from one country to another. In practice, effective transfer may require know-how, training, local adaptation, maintenance capability, supply chains and finance. A licence without technical capacity may have limited value. Similarly, a patent pool or open licence cannot by itself create factories, grid infrastructure or skilled personnel. Green patent policy should therefore be integrated with public investment, development finance, research collaboration and capacity building.

An additional issue is geographic concentration. WIPO's recent patent analysis shows a sharp concentration of green patent families in particular jurisdictions. Such concentration does not by itself demonstrate unfairness, because patenting reflects differences in research capacity, market size and filing strategies. It does, however, illustrate why technology diffusion mechanisms are important for countries that need climate technologies but have smaller domestic innovation systems.[5]

IV. THE INDIAN PATENT FRAMEWORK AND CLIMATE TECHNOLOGY

India's patent regime contains several principles that are relevant to the climate-technology debate. Section 83 of the Patents Act, 1970 sets out general principles governing the working of patents. It recognizes that patents are granted to encourage inventions and to secure that inventions are worked in India on a commercial scale to the fullest extent reasonably

[5]Paris Agreement art. 10, Dec. 12, 2015, T.I.A.S. No. 16-1104; U.N. Framework Convention on Climate Change, Technology Development and Transfer, https://unfccc.int/topics/climate-technology/what-is-technology-development-and-transfer.

practicable without undue delay. It also links patent protection with technological innovation, technology transfer, public interest and reasonably affordable access. These principles are particularly significant when patented technologies have major environmental or developmental implications.[6]

Section 84 provides for compulsory licences after three years from the grant of a patent on specified grounds, including failure to satisfy the reasonable requirements of the public, lack of availability at a reasonably affordable price, or non-working of the invention in India. A compulsory licence does not automatically apply to every socially important technology. It is a statutory mechanism subject to legal conditions and procedural safeguards. Nevertheless, its existence demonstrates that Indian patent law does not treat exclusivity as absolute.

Section 92 provides a separate mechanism where the Central Government is satisfied that compulsory licensing is necessary in circumstances of national emergency, extreme urgency or public non-commercial use. Climate-related circumstances could raise difficult questions about the application of such provisions, particularly where a technology becomes critical to protecting life, infrastructure or public resources. Any such application would depend on the statutory requirements and the facts of the particular situation; climate relevance alone does not automatically trigger a compulsory licence.

India also provides expedited examination routes for specified categories of applicants, including startups, small entities and certain government applicants. Faster examination can reduce uncertainty for innovators, although speed of grant should remain consistent with rigorous examination of novelty, inventive step and other patentability requirements. For climate technologies, a predictable and efficient patent process may be useful because investment decisions can depend upon the clarity of intellectual-property rights.

The Indian framework therefore already contains tools for balancing private rights and public interests. The policy challenge is to apply them in a way that encourages domestic green innovation while enabling responsible licensing, collaboration and deployment. Public authorities can also support climate innovation through research grants, procurement, demonstration projects, incubators, standards and infrastructure, reducing the pressure on patent rights to perform functions that properly belong to broader innovation policy.[7]

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[6]The Patents Act, 1970, No. 39 of 1970, § 83 (India), https://ipindia.gov.in/acts/patent-act-1970/section-83.
[7]The Patents Act, 1970, No. 39 of 1970, §§ 84, 92 (India), https://ipindia.gov.in/acts/patent-act-1970/section-84; https://ipindia.gov.in/acts/patent-act-1970/section-92.

V. REFORMING THE GREEN-PATENT ECOSYSTEM

A climate-responsive patent ecosystem should focus on diffusion as well as invention. The first priority should be better identification of climate-relevant technologies. WIPO's standardized green-technology concordance is useful because it creates a more consistent basis for analysing patent activity across jurisdictions. Indian policymakers, universities and industry bodies can use comparable classification methods when assessing technology gaps and domestic innovation strengths.[8]

Second, voluntary licensing and collaborative models deserve greater attention. Patent owners may license climate technologies on differentiated terms for research, humanitarian or development-oriented applications, while retaining commercial rights in other markets. Patent pools, cross-licensing and technology platforms can also reduce transaction costs where multiple patents are needed to produce a single technology. Such mechanisms are not substitutes for compulsory licensing, but they can create cooperative pathways before more coercive legal tools become relevant.

Third, public funding should be linked to access conditions where public money substantially supports research and development. Government-funded climate research can include contractual provisions concerning licensing, publication, local manufacturing or reasonable access, while respecting legitimate commercial interests. This approach can help ensure that public investment produces public value without eliminating incentives for private participation.

Fourth, India can strengthen the connection between patent information and technology-transfer programmes. Patent databases contain technical information that can reveal emerging fields, expired rights, potential licensing opportunities and areas where domestic research may be directed. Universities and research institutions should develop greater capacity to conduct patent landscaping and freedom-to-operate analysis for clean-energy, mobility, waste, water and adaptation technologies.

Fifth, climate technology policy should recognize the difference between mitigation and adaptation. Mitigation technologies, such as renewable generation and low-carbon transport, often operate in commercial markets. Adaptation technologies may serve communities facing floods, heat, drought and other risks, where commercial demand may be weaker. Public

[8]The Patents Act, 1970, No. 39 of 1970, § 84 (India); see also World Trade Organization, TRIPS: Technology Transfer, https://www.wto.org/english/tratop_e/trips_e/techtransfer_e.htm.

procurement, grants and open-innovation programmes may therefore be especially important for adaptation.

Finally, any reform should preserve the basic logic of the patent bargain. Weakening patent protection indiscriminately could reduce incentives for research-intensive technologies. Conversely, treating patent rights as an end in themselves could overlook the public purpose of innovation policy. A balanced approach should ask whether a particular rule increases useful innovation, facilitates responsible diffusion, or creates an avoidable barrier to climate action.[9]

VI. CONCLUSION

Green patents occupy an increasingly important position at the intersection of intellectual property, climate policy and sustainable development. The rapid growth of patent activity in areas such as batteries, smart grids, pollution control and other climate technologies demonstrates that inventive effort is responding to environmental challenges. Yet the existence of patents does not guarantee deployment. The ultimate climate value of an invention depends upon whether it can move from laboratory to market and, where appropriate, from advanced markets to countries and communities that need the technology.[10]

The legal framework should therefore pursue a dual objective: incentivize the creation of new technologies and facilitate their diffusion. International instruments already recognize both objectives. TRIPS connects intellectual-property protection with innovation, technology transfer and social welfare, while the Paris Agreement emphasizes technology development and transfer for mitigation and adaptation. India's Patents Act similarly combines exclusive rights with principles concerning working, public interest, affordability and compulsory licensing.

The future of green patent policy should not be framed as a choice between patents and access. A more productive approach is to design institutions that allow both to operate. Efficient examination, strong research ecosystems, voluntary licensing, patent pools, public procurement, technology platforms, capacity building and carefully targeted statutory flexibilities can work together. The objective is not merely to increase the number of green

[9]The Patents (Amendment) Rules, 2019, r. 24C (India), as reflected in Intellectual Property India, Expedited Examination of Applications, https://www.ipindia.gov.in/acts/patent-rules-2003/rule-24c.

[10]World Intell. Prop. Org., Green Technology Book: Solutions for Confronting Climate Disasters (2025), https://www.wipo.int/web-publications/green-technology-book-solutions-for-confronting-climate-disasters/en/foreword-by-wipo.html.

patents, but to create conditions under which useful inventions are developed, financed, transferred and deployed.

Climate technology is ultimately valuable when it produces real environmental and social outcomes. Patents can be an important instrument in that process, but they are one part of a larger system. A climate-responsive intellectual-property policy should therefore measure success not only by patent filings, but also by technological diffusion, affordability, domestic capability, collaboration and measurable contribution to climate mitigation and adaptation. Such an approach can preserve the incentive structure of patent law while aligning innovation more closely with the urgent and shared objectives of sustainable development.[11]

[11]World Trade Organization, Intellectual Property and the Public Interest, https://www.wto.org/english/tratop_e/trips_e/trips_and_public_interest_e.htm.