

INTERNATIONAL JOURNAL OF LAW MANAGEMENT & HUMANITIES

[ISSN 2581-5369]

Volume 6 | Issue 5

2023

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Harnessing the IP and Technologies for the Advancement of Clean Energy

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ABSTRACT

As the world grapples with the pressing need for sustainable energy solutions, the role of intellectual property (IP) and sophisticated technologies in driving innovation and advancement in the clean energy industry has become increasingly important. Innovations in technology, ranging from improved solar materials to enhanced grid management systems, hold the key to increasing the efficiency, scalability, and affordability of sustainable energy solutions. IP is a vital facilitator in this process, providing the framework required to protect and commercialize these technical innovations.

Robust intellectual property regimes ensure exclusivity and return on investment for inventors, researchers, and organizations, stimulating the development of breakthrough technologies in fields such as solar, wind, hydro, and energy storage systems. Strategic use of intellectual property promotes collaboration and knowledge-sharing throughout the clean energy ecosystem. Licensing and collaborations enable technology diffusion by enabling for the exchange of ideas and skills among industrial participants, researchers, and policymakers. This collaborative spirit accelerates discovery and broadens the worldwide effect of renewable energy solutions.

Keywords: Intellectual Property, Patent, Clean Energy, economic growth.

I. INTRODUCTION

With the escalation of environmental concerns at the global level, there is a need of the hour for transition in our life system and we must have to adopt such resources which are sustainable in nature and protects the green earth and safeguard it for the upcoming generation. The Stockholm Conference of 1972 was the first International Conference wherein the idea of protecting the earth was put before the world and lot of efforts were made which also led to frequent clashes over economic growth or environmental concerns. However, in 2015, the United Nations recognized the 17 goals that must be achieved by 2030, and among all of these goals, access to clean and renewable energy consumption is one of the most important.

Having the entire world's population have access to green and clean energy is not a pipe dream in this era of global digitalization, where everything is made possible by technology and IP-

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driven tools. Technology and intellectual property integration could help green technology transition to the development of clean energy and a sustainable future. The most prestigious universities and industries in the world are investigating the crucial role that technology and intellectual property (IP) may play in the creation and spread of renewable energy.

II. INNOVATION AND TECHNOLOGICAL ADVANCEMENT

Intellectual Property Rights (IPR) including Patent, Copyright, trademark etc is the legal framework for the providing protection to the innovators and creators for their invention. Intellectual property protection gives creative people peace of mind that their R&D investments and efforts won't be lost. By granting them exclusive rights to their findings, intellectual property (IP) encourages people and organizations to invest considerable sums of money in the creation of novel clean energy technology. The competitive nature of IP motivates businesses and inventors to constantly improve and advance their clean energy solutions. Because they are certain that their inventions are protected, they are more willing to share their ideas, which creates a competitive environment that pushes the boundaries of what is practical. Clean energy technologies usually need significant financial resources for their development and commercialization.

The Energy generation by Solar PV is 1300 terra-watt hours (TWH) in 2022, which is 26% higher than 2021.² IP assets can help turn innovative ideas into market-ready goods by attracting funding from investors, venture capitalists, and governmental institutions. Intellectual property is the cornerstone of innovation in the clean energy sector. In addition to promoting the use and application of green energy solutions, it also defends innovators' rights. As we face the pressing concerns of climate change and environmental sustainability, IP serves as a catalyst for the development of cutting-edge technologies that offer a cleaner and more sustainable future for all. Businesses can establish strong brand identities on the market by using trademarks and other branding elements protected by IP. Consumer trust and recognition are key factors in determining whether consumers will accept renewable energy products and services. In order to gain a presence in various places, it offers a basis for discussions and partnerships with regional or global players.

III. PATENTS AND CLEAN ENERGY TECHNOLOGIES

The creation of renewable and clean energy technology is necessary for all nations to advance

² IEA. (2023, JULY 12). *RAPID PROGRESS OF KEY CLEAN ENERGY TECHNOLOGIES SHOWS THE NEW ENERGY ECONOMY IS EMERGING FASTER THAN MANY THINK* (OCT. 03, 2023, 10.09 AM) [HTTPS://WWW.IEA.ORG/NEWS/RAPID-PROGRESS-OF-KEY-CLEAN-ENERGY-TECHNOLOGIES-SHOWS-THE-NEW-ENERGY-ECONOMY-IS-EMERGING-FASTER-THAN-MANY-THINK](https://www.iea.org/news/rapid-progress-of-key-clean-energy-technologies-shows-the-new-energy-economy-is-emerging-faster-than-many-think)

toward an economy with minimal carbon emissions. Because of this, intellectual property rights, especially patents, can facilitate such a transition. These inventions include the development of solar power plants, biomass fuels, and geothermal energy. Patent rights offer protection and encourage the inventor to enjoy the benefits of his invention for a set amount of time. However, the advancement of current technologies promotes the invention of new ones. Inventors may safeguard their ideas on a global scale thanks to the reach of patents. This gives them the ability to break into new markets and increase the use of their clean energy technology, advancing development on a global scale. The Patent Cooperation Treaty (PCT) launched by the World Intellectual Property Organisation (WIPO) is heavily used by the inventors at the global level as by filing the single application, one can apply for the patent protection in more than 150 countries simultaneously that are signatories to the pact. From 2002 to 2012, the number of patent applications particularly in renewable energy sector has been increased however in from 2013 onwards this number declined but then from 2019 applications started increasing in this field.³

Patents are physical assets that give innovators significant negotiating power when they look for funding from venture capitalists, investors, and government grants. The advancement of sustainable energy technologies depends on this monetary backing. Some of the industries for renewable energy have benefited from patent protection, such as Photovoltaic (PV) technology, which uses silicon plates to transform solar radiation into electricity. This sector is booming globally as well as at national level, as developing economies like India has set an aim to become a substantial Player in global market in PV sector.⁴ Also in Biofuel technology wherein, the sugarcane, rice are converted into ethanol and used as a fuel. Most recently, Toyota has developed world's first flex-fueled-ethanol driven car which has the potential to generate electric power and can run in EV mode.⁵

Patents play a critical role in advancing the creation and application of renewable energy technology. They are essential players in the innovation ecosystem because they offer incentives, legal protection, and chances for collaboration. It is impossible to overestimate the importance of patents in improving clean energy technologies as the entire globe works toward

³Nurton,J, *Patenting trends in renewable energy* (Sept.09, 2023, 01.09 PM) https://www.wipo.int/wipo_magazine/en/2020/01/article_0008.html

⁴Kiran,S, *Solar Shift: How India is silently becoming a next major PV player.* (Sept. 11, 2023, 11.53 AM) <https://energy.economictimes.indiatimes.com/news/renewable/solar-shift-how-india-is-silently-becoming-the-next-major-pv-player/102137650>

⁵Business Today Desk. (2023, August 29) *World's first flex-fuel ethanol-powered car, Toyota Innova Hycross unveiled in India unveiled in India by Nitin Gadkari: All you need to know* (Sept.10, 2023, 02.15 PM) <https://www.businesstoday.in/auto/story/worlds-first-flex-fuel-ethanol-powered-car-toyota-innova-hycross-unveiled-in-india-by-nitin-gadkari-all-you-need-to-know-396113-2023-08-29>

a more sustainable future. We create the foundation for a greener, more sustainable future through this mutually beneficial connection.

IV. LICENSING AND COLLABORATION FOR CLEAN ENERGY

Technology transfers and licensing agreements are essential distribution channels for renewable energy innovations. They are essential in making sure that cutting-edge solutions reach the market, are available to a larger audience, and support the development of a more sustainable energy future. Companies and organizations can use licensing agreements to gain access to the resources, experience, and knowledge of the technology's original developer. This is especially crucial in the intricate and quickly developing sector of sustainable energy. Transfers of technology hasten the commercialization of clean energy solutions.

Companies can purchase known technologies rather than creating new ones, drastically lowering the time and resources needed for development. Technology transfers allow businesses to take advantage of existing manufacturing and infrastructure resources. When production is scaled up for wider use of renewable energy technology, this can be extremely advantageous. The expense of research and development can be greatly decreased through licensing agreements. Businesses can build on current inventions rather than beginning from scratch, which will save them time and money. Clean energy innovations can be distributed through licensing to new sectors and areas that the original inventor may not have been present in. This facilitates having a greater worldwide impact. In some circumstances, businesses may be experts in implementation, marketing, or distribution yet fall short when it comes to technical development. They can collaborate with subject matter authorities thanks to licensing arrangements. Collaboration between the original inventor and the acquiring company is common in technology transfers. Sharing information is encouraged, and the technology may advance and improve as a result. Technologies for clean energy might need to be modified to meet certain regional or local needs. This modification can be made easier by licensing agreements, which will help to make sure the technology is appropriate for the intended audience. Transfers of technology can aid businesses in navigating difficult regulatory environments. Regulatory needs may have previously been addressed by the original inventor, who can offer insightful information. A company can stand out from its rivals and establish itself as a leader in the renewable energy industry by having access to cutting-edge technologies. They fill knowledge gaps, quicken time to market, cut costs, and make it easier to customize and deploy new solutions. We can hasten the shift to a cleaner and more sustainable energy future by making use of these processes.

As in September 2021, the United States of America (USA) and India had collaborated on green energy.⁶

The aim of this collaboration is to put efforts to advance energy security, clean energy innovation and decarbonization efforts for transitioning towards the renewable source of energy. To combat with the global energy crisis, the UN in May 2022, had initiated a UN-Energy plan in collaboration with 30 other international organisation.⁷

Technology can be modified through collaboration and licensing to satisfy unique regional or local requirements. This makes sure that sustainable energy solutions are adapted to the particular difficulties and chances presented by various markets. Collaboration and licensing enable the joining of entities with complimentary qualities. To create and improve sustainable energy solutions, research institutes, commercial enterprises, and governmental organizations can combine their resources. Knowledge transfer from organizations with particular expertise in renewable energy technology is frequently a part of collaborative efforts. Through the avoidance of the necessity for considerable internal research and development, this can significantly speed up the development process. Collaboration can give stakeholders a forum to interact with regulators and policymakers as a group. This may result in the creation of guidelines and regulations that encourage the use and integration of clean energy technologies. Increasing the production and use of sustainable energy technology can benefit from licensing agreements. Licensing can assist satisfy the rising demand for sustainable energy solutions by enabling numerous parties to produce and sell a technology.

V. MARKET COMPETITIVENESS AND ECONOMIC GROWTH

A competitive environment in the renewable energy industry depends on a strong Intellectual Property (IP) framework. It offers a legal framework that protects the rights of creators and inventors, enticing them to spend money on the R&D of fresh renewable energy solutions. Innovative thinkers are reassured that their concepts and creations will be safeguarded by a solid IP framework. This guarantee motivates them to devote more time, energy, and money to the creation of sustainable energy solutions. Inventors are more likely to take chances and push the limits of what is technologically achievable when they are confident that their ideas are protected. When they see a solid IP portfolio, investors and venture capitalists are more likely

⁶Department of Energy, *US and India advance Partnership on clean energy* (Sept. 12, 2023, 11.20 AM) <https://www.energy.gov/articles/us-and-india-advance-partnership-clean-energy#:~:text=The%20sides%20welcomed%20cooperation%20between,to%20the%20transition%20to%20a>

⁷Department of Economic and Social Affairs of United Nations. (n.d.). *United Nation Organisations launch plan to Catalyze action by 2025 on energy commitments* (Sept. 13, 2023, 02.15 PM) <https://www.un.org/en/desa/un-organizations-launch-plan-catalyze-action-2025-energy-commitments>

to back renewable energy projects.

It gives them comfort in knowing that their investments will be safeguarded and that the technology has a commercial edge. Companies are more likely to spend money on R&D to advance and perfect their technology when they are confident that their discoveries are protected. The dynamic climate fostered by this rivalry encourages ongoing technological development in the renewable energy industry. Businesses with robust IP portfolios can increase their presence in foreign markets. Their technologies develop into important exportable assets and support domestic and international economic progress.

A culture of innovation is supported by a strong IP framework. Inventors and businesses are more inclined to invest in clean energy technology when they are confident that their efforts will be rewarded and protected, fostering a never-ending cycle of invention. In order to achieve sustainable development objectives relating to climate action and affordable, clean energy availability, clean energy technologies are essential. In order to achieve these global goals, a vibrant renewable energy sector underpinned by a strong IP framework is essential. We foster the growth and distribution of game-changing clean energy innovations by defending the rights of innovators.

VI. IP CHALLENGES FOR CLEAN ENERGY

While intellectual property (IP) gives a number of opportunities for innovation and growth in the clean energy industry, it also has a number of drawbacks. Due to the complexity and quick evolution of clean energy technologies, these problems can be complicated. Some of the key IP challenges faced in the clean energy sector:

- The fast-paced technological development in the renewable energy industry might result in patents that overlap and clash with one another. This may lead to legal battles, which would impede innovation.
- A wide range of technologies, including solar, wind, energy storage, and grid management, are included in the clean energy sector. It can be challenging to navigate the complex patent landscape, particularly for startups and small businesses with little resources.
- A "patent thicket," or the accumulation of several patents in one field of technology, might make it difficult for new competitors to enter the market. This might inhibit innovation and stifle competitiveness.

- Complex engineering and scientific principles are frequently used in clean energy technology. Because of this intricacy, certain organizations known as "patent trolls" or patent assertion corporations may seek to obtain patents only for the purpose of enforcing them against businesses, even if they have no intention of ever developing the technology.
- As clean energy technologies are adopted globally, it might be difficult to ensure compatibility and adherence to multiple international standards. When technology do not adhere to established standards, IP issues may occur.
- Open-source technologies, which promote teamwork and knowledge sharing, are becoming more popular in the sustainable energy sector. It can be difficult to strike a balance between open-source and proprietary models since businesses want to safeguard their intellectual property while also fostering collaboration.
- Regulatory frameworks for renewable energy technology can change, causing uncertainty about the enforcement and protection of intellectual property rights.
- This includes issues for responsible component sourcing, manufacture, and disposal, which might have an impact on IP strategy.
- Maintaining access to and affordability of sustainable energy technology for everybody, particularly in resource-constrained places, while maintaining intellectual property rights is a complex balancing act.
- Many diverse stakeholders from many nations are frequently involved in clean energy technology. This might result in jurisdictional issues in patent disputes, necessitating a complex knowledge of international IP law.

A planned and knowledgeable approach to intellectual property in the renewable energy business is necessary to navigate these difficulties. In order to stimulate innovation while preserving intellectual property rights, stakeholders must actively interact with legal and IP experts and take such models into consideration.

VII. ROLE OF GOVERNMENT POLICIES AND REGULATIONS

Government rules and policies have a significant impact on how sustainable energy is developed. They offer the structure, incentives, and guidance required to hasten the shift to renewable and sustainable energy sources. The adoption and integration of renewable energy sources, such as wind, solar, and hydroelectric power, can be the subject of ambitious government goals. These goals provide the energy industry a defined direction and promote

investment in green technology. A fixed price for energy produced from renewable sources is offered via feed-in tariffs and PPAs. As a result, it is more appealing for developers of clean energy projects to invest in them since they are guaranteed a consistent cash stream. Net metering laws, which enable people to sell extra electricity produced by their renewable energy systems back to the grid, can be implemented by governments. This encourages grid integration and provides incentives for people and companies to invest in sustainable energy solutions.

In September 2022, the Prime Minister of India Shri Narendra Modi had declared that by 2030, 60% of energy consumption shall be through renewable source of energy.⁸ The utilization of sustainable energy sources and emission reductions are only two examples of the environmental criteria that businesses and industries must comply with. This promotes the use of clean energy methods and technology. The electrical grid may be updated by governments to better support renewable energy sources. This covers energy storage options, smart grid technology, and grid infrastructure enhancements. To advance renewable energy technology on a global scale, governments might participate in international partnerships and agreements. This can involve collaboration on projects to mitigate climate change, research sharing, and technology transfer.

VIII. FUTURE OUTLOOK FOR CLEAN ENERGY

With technological developments, favorable legislation, and a rising global commitment to combating climate change, the future of renewable energy appears bright. Not only will these technologies promote economic growth, but they will also make a major contribution to a more resilient and sustainable energy future for everybody.

It is anticipated that renewable energy technologies including solar, wind, energy storage, and grid management would continue to advance. The adoption of renewable energy will be greatly aided by advances in materials science, increased efficiency, and lower costs. Emissions from the transportation industry will be significantly reduced by the electrification of transportation, including electric cars (EVs) and charging infrastructure. Widespread adoption is anticipated to be sparked by improvements in battery technology and supportive regulations. Energy-efficient technology and green building techniques will advance, lowering building energy use and supporting sustainable building practices. As a result, emissions will be reduced and the built environment will be more sustainable. Clean energy technology will be made available to all

⁸ET Energy World.com. (2022, July 22). *Clean energy capacity: India to have 60 per cent renewable energy by 2030, says power minister* (Sept.15, 2023, 01.07 PM) <https://energy.economictimes.indiatimes.com/news/renewable/clean-energy-capacity-india-to-have-60-per-cent-renewable-energy-by-2030-says-power-minister/77098718>

communities, particularly those in underserved or rural places. This will support social and economic growth and help combat energy poverty.

IX. CONCLUSION

The availability of clean and green energy is urgently needed, and efforts are being made both globally and locally to produce the necessary intellectual property and technology. Since goal 7 of the Sustainable Development Goals (SDGs) has created some challenges that need to be addressed by 2030, such as lowering the population's dependence on traditional cooking fuels like burning fire wood by making clean energy and fuel accessible to them, the IPR is transforming the digital arena and encouraging innovators and creators to develop new technologies to propel the clean energy consumption. The renewable energy revolution is being led by the symbiotic link between intellectual property and technology. IP rights serve as a potent stimulus for the creation and spread of sustainable energy solutions by giving creators the tools to safeguard and benefit from their discoveries. We can all work together to create a greener, more sustainable future via cooperative efforts, encouraging policies, and creative ideas.

Integrating intellectual property and technology is not just a question of choice but also a must in the quest for sustainable energy. The fact that we are able to confront the most important issues of our day and open the door to a better, more sustainable future is a credit to human creativity and tenacity.
