Journal of Public Representative and Society Provision
Vol. 4, Issue 3, 2024
Page 201-211
Doi: https://doi.org/10.55885/jprsp.v4i3.650

Legal Aspects of Environmental Governance Related to Renewable Energy Development

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Abstract. *Renewable energy development is a cornerstone of global efforts to combat climate change and achieve sustainable development. This study, a comprehensive literature review, explores the legal and regulatory frameworks that govern renewable energy transitions at both international and national levels. The findings highlight the critical role of international agreements, such as the Paris Agreement and the United Nations Sustainable Development Goals, in setting the global agenda for renewable energy adoption. Additionally, national legal systems, including policies like feed-in tariffs, tax incentives, and priority grid access, are instrumental in translating international commitments into actionable strategies. Despite significant progress, the study identifies persistent challenges in legal and regulatory implementation, including policy inconsistency, insufficient harmonization of environmental and energy regulations, limited institutional capacity, and infrastructure deficiencies. These barriers are exacerbated in developing countries, where weak governance structures and socio-political resistance further hinder renewable energy deployment. The study underscores the need for stronger integration of environmental and renewable energy policies, capacity-building initiatives, and inclusive stakeholder engagement to overcome these challenges. By analyzing existing legal frameworks and their implementation challenges, this research contributes to the understanding of how governance systems can be optimized to accelerate renewable energy transitions. The findings provide valuable insights for policymakers, legal practitioners, and stakeholders aiming to enhance the effectiveness of renewable energy governance and achieve sustainable energy goals.*

Keywords: *Renewable Energy, Legal Frameworks, Policy Implementation, Environmental Governance*

Received: October 11, 2024 Revised: November 20, 2024 Accepted: December 30, 2024

INTRODUCTION

Renewable energy has become central to new global climate change mitigation and sustainable development initiatives and strategies (Elum, Z. A., & Momodu, 2017; Sarkar, 2010; Owusu & Asumadu-Sarkodie, 2016; Gan et al., 2023; Žičkienė et al., 2022). The rising energy demand together with negative effects of traditional energy sources on the environment calls for revolution in energy supply and management. Experts in the field have agreed that the utilization of renewable energy sources including solar, wind, hydro and geothermal power are sustainable sources of energy that also stand a chance of enhancing compliance with key global targets in environmental protection as outlined in the United Nations Framework Convention on Climate Change Paris Agreement, 2015.

However, the process of the development and deployment of renewable energy is not decoupled from the legal and institutional arrangements that determine the usage of environmental and energy resources (Wu et al., 2022; Spijkerboer et al., 2019; Liu et al., 2021; de, 2021; Leal-Arcas & Minas, 2016; Bringezu et al., 2016; Recalde, 2016; Christoforidis &

ISSN 2776-1266 (print), 2776-1266 (online)

Katrakilidis, 2021). Environmental governance is thus instrumental in defining renewable energy provision in countries. In its most general sense, governance involves the set of procedures that are used to arrive at the decisions that will guide the management of natural resources and the addressing of environmental issues. The legal regulation of environment has to involve aspects of politics, governance and sociology to suit issues of environmental concern like climate change and energy (Absori et al., 2021; Buttel & Taylor, 2013).

Based on the laws and regulations, the mechanism of introducing renewable energy, and supervising the compliance of the investment are established, and then the conflict of interest between different actors is being solved (Abdmouleh et al., 2015; Citelli et al., 2014; Ma et al., 2025). Such legal structures not only prescribe the roles and responsibilities of people of interest but also explain how they would be enforced and solved. Renewable energy governance is managed through numerous and diverse global, regional, national and international laws, conventions, policies, and strategies. UNFCCC has followed the Kyoto Protocol as the essential vehicles for driving international cooperation on renewable energy and climate change mitigation (Azam, 2021; Lau et al., 2012).

Likewise, the European Union's Renewable Energy Directive shows that regional cooperation speeds up the implementation of legal targets and cooperation instruments concerning the renewable energy sources. The authorities in Germany, China, and the United States have established a well-coordinated legal environment for the promotion of renewable energy and its development while taking into account the existing environmental problems (Abraham-Dukuma et al., 2022; Khamzina et al., 2025; Xin et al., 2022). Nevertheless, existing studies show that there remains a considerable gap in the procedural equity in the application of legal instruments in various regions and governance structures (Klein et al., 2021).

Among the key decisive factors of renewable energy governance, there is the problem of matching the laws with sustainability objectives. More than one third of the land-use regulations affect the establishment of renewable energy sources: they cause legal and administrative barriers. Realizing renewable energy policy also contains gaps in policy formulation and implementation that affect renewables mainly in the developing world. Furthermore, the absence of specific distinctive laws on other budding renewable technologies like energy storage and offshore wind makes policy governance dynamism essential. Solving these challenges needs coordinated approaches to the integration of laws, improvement of institutions, and engagement of the stakeholders.

Renewable energy governance is also an integral part of other socio-economic and political processes as well. Legal policies have to address factors for instance energy justice, ownership and engagements, and the fair distribution of resources (Jenkins et al., 2021). procedural in and of itself accommodates energy justice because it is designed to distribute energy benefits and burdens fairly as well as recognise important procedural and recognition injustices. Indigenous people may be locked out from participation in decisions relating to renewable energy investments even though they are Some of the most vulnerable groups affected by environmental degradation. The embedding of justice and equity principles within legal and governance frameworks might improve these three dimensions of renewable energy policies: public acceptance and social acceptance.

Another facet of governance of RE is cross cutting and that, is the link between environmental and energy policy. Traditionally, these two policy domains have worked independently, which produces inefficient and disjointed results. But the shift to the use of RE sources needs to consider the interrelationships between environmental and energy policies. Legal structures need to support the incorporation of renewable energy into broader environmental planning discipline, including species and habitat protection, water resource management and adaptation to climate change. The planning of renewable energy resources should not interfere with ecosystems and contribute to climate change objectives as much as possible (Olabi & Abdelkareem, 2022).

ISSN 2776-1266 (print), 2776-1266 (online)

The legal aspects of renewable energy governance are further complicated by the rapid pace of technological innovation. The emergence of decentralized energy systems, such as microgrids and distributed generation, challenges traditional legal and regulatory paradigms. These innovations require legal frameworks that are flexible, inclusive, and capable of accommodating diverse stakeholder interests. The digitalization of energy systems, including the use of smart grids and blockchain technology, raises new legal and ethical questions related to data privacy, cybersecurity, and consumer rights. Addressing these issues requires forward-looking governance strategies that anticipate and adapt to technological advancements.

METHODS

This study employed a literature review approach to analyze the legal aspects of environmental governance in the context of renewable energy development. The methodology focused on systematically collecting, evaluating, and synthesizing relevant academic literature, legal documents, and policy reports to address the research objectives. A comprehensive review of peer-reviewed journal articles, books, government publications, and international agreements was conducted to identify key themes, trends, and gaps in the existing literature. The selection process involved identifying and retrieving sources from reputable academic databases such as Scopus, Web of Science, and Google Scholar. Keywords and phrases such as "renewable energy governance," "environmental law," "climate policy," "legal frameworks for renewable energy," and "energy justice" were used to ensure the inclusion of a broad range of relevant studies. The inclusion criteria focused on sources published in English, primarily within the last 20 years, to ensure the relevance and timeliness of the findings. However, seminal works and foundational texts predating this period were also included where necessary to provide historical context. To enhance the rigor of the review, the study followed a systematic process of content analysis. Each source was reviewed to extract information related to the research topic, including legal frameworks, governance mechanisms, and their implications for renewable energy development. The extracted data were organized into thematic categories such as international legal agreements, national policy frameworks, challenges in implementation, and the role of energy justice. These categories formed the basis for analyzing patterns, comparing findings across studies, and synthesizing conclusions. Critical evaluation was applied to assess the reliability, validity, and applicability of the reviewed sources. Particular attention was given to identifying gaps and inconsistencies in the literature, as well as highlighting innovative approaches and best practices in renewable energy governance. Comparative analysis was also employed to examine how different legal systems and governance models addressed similar challenges in renewable energy development. This approach enabled the study to draw insights from diverse contexts while identifying universally applicable lessons.

RESULTS AND DISCUSSION

International Legal Frameworks for Renewable Energy Development

The findings of the literature review were synthesized into a comprehensive narrative that connected the legal aspects of environmental governance to the broader goals of renewable energy transitions. By integrating diverse perspectives and evidence, the methodology provided a robust foundation for understanding the complexities of legal and governance frameworks in advancing renewable energy development. The international legal systems have an important role to perform and it is towards augmenting world collaboration and supporting development of renewable energy. These frameworks set out agreed, as well as non-agreed obligations for states regarding common environmental problems, such as climate change and energy security. The Paris Agreement signed in 2015 under the United Nations Framework Convention on Climate Change (UNFCCC) is an international legally binding treaty, which aims at limiting global warming to below 2°C above pre-industrial levels, and pursue efforts to limit it to 1.5°C. Through NDCs the agreement's parties have been prompted to design renewable energy related projects and move away from reliance on fossil fuels. It also focuses on the role of funding and technological support from the developed states needed to help developing countries achieve them RE targets.

ISSN 2776-1266 (print), 2776-1266 (online)

The Paris Accord succeeded the Kyoto Protocol, currently containing specific rules for the regulation of renewable energy through legally binding emission reduction targets for developed nations (Mor et al., 2024). Though it was largely aimed at curbing greenhouse gases, the protocol encouraged the use of renewable power sources as a way of meeting these goals. That is why mechanisms like the Clean Development Mechanism (CDM) and others permitted developed countries to invest in renewable energy projects in the developing world and count carbon credits. While its scope and effectiveness lack brilliance, still, the Kyoto Protocol can be considered as the successful example of the international legal frameworks stimulating the further development of the initiatives in the field of renewable energy sources.

To focus on renewable energy development, regional legislation has also been identified as one more set of legal and institutional support crucial for REL. The European Union's Renewable Energy Directive is a good example, since it sets the legally binding targets to member states regarding share of renewable energy in total final consumption of energy (Strunz et al., 2021). It enshrines goals, which include feed in tariffs, renewable energy auctions and cross border co-operation to fulfill these objectives. Further, while addressing the deployment of renewable energy the directive focuses on the interaction of renewable electricity with the network, including, the technical and the regulatory challenges. This distribution of type of goals emphasizes the need of social synchrony in the legal and policy frameworks in order to promote RE in the similar manner.

Apart from the legally binding international treaties, legal and non-legal international commitments and resolutions have brought out a cardinal role in the dynamism of the renewable energy policy. The UN's SDGs with focus on the seventh goal aim at sustainable and clean energy for all the people. Despite not being legally binding the SDGs have fostered political commitment and financial support to renewable energy projects globally. Others which include International Renewable Energy Agency (IRENA) and Renewable Energy Policy Network for the twenty first century (REN21) are organisations that facilitate knowledge exchange, capacity development and policy harmonisation among countries in the promotion of renewable energy transitions.

Despite these advancements, challenges remain in the implementation and effectiveness of international legal frameworks for renewable energy development. The lack of enforceable mechanisms, disparities in national capacities, and competing interests among stakeholders often undermine the impact of these frameworks. Additionally, the absence of universally accepted legal standards for emerging renewable energy technologies, such as offshore wind and hydrogen, complicates efforts to integrate these technologies into global energy systems. Addressing these challenges requires strengthening international legal frameworks through enhanced enforcement mechanisms, increased financial support for developing nations, and the development of adaptive legal provisions for emerging technologies.

National Legal Systems and Policy Frameworks

The national legal systems and policies framework have the critical responsibility of transferring the international obligations on renewable energy to practical action plans. In order to foster deployment of RE technologies, attract RE investments and serve the purpose of sustainable environment across the nations, countries adopt several laws and policies. The United States launched the Renewable Portfolio Standard (RPS) at the state level providing regulations that utilities must obtain certain levels of electricity from renewable energy sources (Joshi, 2021). Likewise, Germany's Renewable ENERGY Sources Act (EEG) was set to raise tariffs of renewable energy wanted by producers and guaranteed electricity price for electricity from renewables. These legal instruments indicate how national policies can advance the use of renewable energy due to relative reductions in actual financial risks while offering certain political assurances to investors.

Promotion of renewable energy has attracted support through policy measures through granting tax incentives and subsidies. China and India and many others governments provide tax incentives and subsidies which lower the initial costs of renewable energy and make them cost-

ISSN 2776-1266 (print), 2776-1266 (online)

effective as those of recommended fossil fuels. The National Solar Mission of India offers funding to projects by means of capital subsidies and viability gap funding to large-scale solar projects (Ministry of New and Renewable Energy, 2019). Likewise, China also used feed-in tariff and direct subsidies for refining its wind and solar power technologies. These fiscal instruments allow the government to set the right conditions for investments in renewable energy which corrects market failures and costs.

In addition to financial incentives, countries have introduced regulatory mechanisms to ensure the integration of renewable energy into national energy systems (Matschoss et al., 2019; Zhang et al., 2024). Grid access regulations, for example, play a pivotal role in supporting renewable energy producers. In the European Union, priority grid access for renewable energy producers is mandated under the Renewable Energy Directive, ensuring that electricity generated from renewables is given preferential treatment. Similarly, countries like Australia and Brazil have established regulations to streamline grid connections for renewable energy projects, addressing technical and operational challenges. Such measures highlight the importance of legal frameworks in facilitating the transition to clean energy systems.

In recent years, there has been growing emphasis on public involvement and integration of stakeholders into renewable energy policies of most countries. Several countries have provided for people participation in renewable energy policies and expenditures. For instance, laws in Denmark open up opportunities for local charge and possession of renewable power project to foster investment in wind power plants by communities. Besides increasing demand, this approach also improves the stock of publicly acceptable RE sources and promotes social justice and equality in RE transitions. Likewise, South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) provides for community benefits, where communities will benefit from social economic opportunities from IPPs developing renewable energy projects (Davies, 2021).

Nevertheless, there is a great deal of evidence that national legal systems and policy frameworks encounter problems in terms of execution and realization. Lack of Renewable Energy Policy & Commercialization, Regulatory Hurdles &Reluctance and Institutional Capacity Constraints negatively impact the implementation of renewable energy. For example, in many developing countries, the absence of poles and the weakness of legal provisions puts uncertainties to investors and developers. Furthermore, some countries have heavily relied on subsidies this has consequently created distortions within the market and has triggered fear concerning the prospects of the policy in future. Solving these problems implies enhancing legal and institutional environment, optimizing the policy and ensuring international cooperation in sharing the best practices and resources.

Challenges in Legal and Regulatory Implementation

Concerns, challenges, problems and issues relating to the incorporation of legal and regulatory frameworks for the promotion of renewable energy development are also discussed below: The most challenging challenge is policy instability and regulatory risks that hamper the development of long-term funding solutions for renewable energy investment. The adoption of renewable energy policies is however known to evolve frequently in many countries in response to changing political or economic cycles (Zhou et al., 2019; Hassan et al., 2024). Temporary withdrawal of subsidies or the removal of incentives has stoked unsteadiness in renewable energy markets and left investors and developers considerably unsure about the viability of their investments. This lack of stability weakens any legal frameworks' potential for attracting the necessary capital for the development of renewable energies.

Further critical issue is that the environmental legislation and renewal, energy policy are not in tandem. Indeed, while both domains focus on sustainable development, environmental protection legislation and regulation harbours potential in terms of hindering renewable energy construction. The case of the wind or solar projects, highly guarded environmental impacts assessments may prolong projects' authorization and lead to higher expenses. At other times,

renewables are not welcomed due to disputes over use of land, conservation of species and fauna and flora or nơi ở of the people, meaning legal articulations of environmentalism in relation to renewables are required. Such conflicts show that environmental governance and strategies for renewable energy should be mutually inclusive to avoid negative synergies between them.

Insufficient institutional capacity and governance structures also pose significant challenges to the effective implementation of renewable energy policies. Developing countries, in particular, often lack the administrative resources, technical expertise, and financial capabilities needed to enforce renewable energy regulations. Regulatory agencies may struggle to monitor compliance with renewable energy targets or manage the complexities of grid integration for variable energy sources like wind and solar. Furthermore, the absence of clear accountability mechanisms within governance structures can lead to inefficiencies and corruption, further impeding progress. Strengthening institutional capacity through capacity-building initiatives and international support is crucial to overcoming these challenges.

The development of renewable energy regulations has been severely hampered by the slow speed of infrastructural expansion (Sen & Ganguly, 2017; he et al., 2016; Hoang et al., 2021; Walz, 2007). The systems connecting, storing, and transmitting renewable power to the grid are important in incorporating renewable energy into national energy systems, but they are frequently underdeveloped compared to policy goals. Tabula 3 summarizes some of the challenges that have been documented to affect renewable energy projects, especially in the developing world; these include; Underdeveloped grid systems in regions where renewable energy projects have been implemented may hinder the projects from achieving the designed impact, especially due to limited grid connectivity or low energy storage capacity, as observed in Grid codes and related technical standards in many countries are obsolete and hardly compatible with the variable nature of renewable power sources, calling for extensive changes in the legal and technical spectra.

Last but not the least, the existing socio-political culture may hinder effective implementation of the legal and/or regulatory framework for renewable energy projects. Sometimes it is mainly because of the short-sighted self-interested action of particular people centred on old non-renewable energy sources or because companies directly involved in the utilisation of fossil energies persuade people with false information. Furthermore, residents of a locale that has been earmarked for RE generation projects including; wind farm or large-scale solar power may reject the projects on the basis of the following perceived negative effects on; land use, visual appeal or employment. To the identified socio-political challenges, effective and efficient policy formulation should involve the door policy, labor worth standardization, and the public enlightenment to embrace the use of renewable energy.

Energy Justice and Legal Considerations

In this paper, energy justice is defined as equitable distribution of risks and benefits of energy systems such that all parties involved are protected especially in terms of cost, reliability and sustainability. As the focus in renewable energy sources increases in importance and prominence, there are numerous legal and ethical implications to consider for equity and access and inclusion. They cannot ignore the causes of those disparities such as regional and gender discrimination as well as impact on developing nations due to energy poverty. If not developed with an understanding for social justice, renewable energy initiatives wind up perpetuating inequality, minority oppression and environmental racism. Hence, it runs that energy justice principles should form the basis of legal and policy frameworks as a way of achieving a just transition to RE technologies (Upham et al., 2022; McCauley & Heffron, 2018; del & Cuesta, 2022; Jenkins et al., 2018; Healy & Barry, 2017).

Out of the energy justice for legal issues one can claim that the distribution of the resources for renewable energy should be fair. Larger renewable energy generation technologies such as utility scale solar and wind facilities demand large tracks of land which may be located in rural indigenous communities (Jacobson & Delucchi, 2011; Sánchez et al., 2015; Hunt et al., 2021). Local

ISSN 2776-1266 (print), 2776-1266 (online)

communities' legal needs and their right to own and control land tenure rights have to be respected to avoid their forceful eviction and loss of source of income. These human exceptions, seen in the circumstances in which construction of renewable energy infrastructure has involved standing on the poor's resources, have aroused social questions about the legitimacy of such projects. Governance systems should protect the rights of these communities and guarantee the reception of revenues from the RE investments took place in their territories, directly, in terms of money or through the formation of development programs.

Another aspect of energy justice is the affordability and accessibility of renewable energy. Legal measures, such as subsidies, tariffs, and financing mechanisms, must ensure that renewable energy is accessible to all income groups, particularly low-income households. In many countries, renewable energy technologies such as solar panels and wind turbines remain out of reach for poorer communities due to high upfront costs. Lam & Law (2018) and Madouri (2025) said that, legal instruments that provide financial incentives, such as grants, subsidies, or low-interest loans, can help bridge this gap and support the widespread adoption of renewable energy solutions. Additionally, regulations that prevent energy monopolies and promote competition can ensure that energy prices remain affordable and fair for all consumers.

Finally, energy justice includes understanding of the impacts of legal and regulatory mechanisms on distribution of positive and negative externalities. In any case, even though renewable energy projects as a rule are in some way associated with fewer negative environmental consequences than fossil fuel-based energy systems, the successful implementation of renewables is not without its drawbacks. For instance, wind power plants and solar power plants may harm wildlife and habitats; mining for raw material used in renewable energy technologies such as lithium for batteries also poses the same problem. Environmental regulations are required to manage the subject and ensure that renewable energy projects are not damaging the special sensitive areas or entities. This entails development of sound and coherent environmental impact assessment regulations that hold stakeholders accountable for the environmental cost realizing the deployment of renewable energy.

Last but not the least any legal approaches to energy justice should incorporate better provisions for the public to engage in the process (Heffron, 2022; Mundaca et al., 2018; Sovacool, 2016). The consideration of the above argument means that there is need to give communities especially those hosting renewable energy projects an opportunity to express themselves in the management and formulation of such power projects. Regulations that require public participation and engagement with regards to renewable energy development in the planning and approval phase can help avoid and this conflict and make future consideration of public concerns. Second, energy justice also entails the affected parties being able to seek redress whenever they have their rights violated, or whenever an energy project delivers an unjust outcome. Legal remedies for affected people as well as guaranteeing that communities suffer no adverse effects as the country shifts to clean energy are some of the pillars of energy justice.

CONCLUSION

The development of renewable energy is vital for addressing global environmental challenges and achieving sustainable energy systems, but it requires robust legal and regulatory frameworks at both international and national levels. While international agreements like the Paris Agreement and national policies such as feed-in tariffs and tax incentives have advanced renewable energy transitions, significant challenges remain. Issues such as policy inconsistency, conflicting regulations, limited institutional capacity, infrastructure deficits, and socio-political resistance continue to hinder effective implementation. Addressing these challenges demands stronger integration of environmental governance with renewable energy policies, enhanced institutional capacity, and inclusive stakeholder engagement. By refining legal frameworks and fostering international collaboration, nations can create the stability and support needed to accelerate the transition to renewable energy, ensuring long-term environmental and socio-economic benefits.

ISSN 2776-1266 (print), 2776-1266 (online)

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