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LEGAL IMPLICATIONS OF RENEWABLE ENERGY TECHNOLOGIES: A Comparative Legal Analysis

Jamshid Kazimi
Ph.D. in Law, University Institute of Legal Studies, Chandigarh University, Punjab, India
jamshidkazimi@gmail.com

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ABSTRACT

The paper will discuss legal aspects of renewable energy technologies by comparing India, the United States, and Germany. It integrates both case law analysis and a framework of Policy evaluation to identify three determinative factors in the outcome of renewable energy: regulatory certainty, institutional capacity, and market integration. The results indicate that investors are confident in predictable and enforceable regulations, as seen in Germany, through stable feed-in tariffs, in contrast to the uncertainty of the U.S. tax incentives and the poor enforcement of Renewable Purchase Obligations in India. Institutional strength is highly connected to project acceleration, and delays in the U.S and Indian cases as compared to a relatively consistent regulatory framework in Germany. Reduction of cost comes with competition mechanisms like auctions, but their efficiency depends on an open and enforceable legal framework. The paper concludes that cost-effective, socially legitimate, and investor-friendly renewable energy transitions cannot be attained without the presence of adaptive and coherent legal frameworks that are based on the principles of enforceability, institutional robustness, and policy coherence.

INTRODUCTION

Renewable energy technologies are also leading the struggle to reach sustainable energy systems in the world. They provide very high benefits to the environment and economy as greenhouse gas (GHG) emissions abatement and offset expenditure in the long term.[1] Nevertheless, transition is not only technically feasible, but it is institutionalized in the complex law, institutional, and policy frameworks, and differs across jurisdictions. The global shift to sustainable energy systems would not be possible without renewable energy technologies. They have significant environmental, economic, and social advantages, thus requiring to reduction in the emission of GHG and addressing climate change.[2] The global energy transition involves wind and solar PV technologies as renewable energy technologies that can provide two-thirds of the global energy needs, and emissions of GHG can be reduced to a significant degree.[3] Renewable energy offers great economic and environmental rewards, such as savings in cost, decreased cost of lifecycle, and decreased GHG emissions.[4] The energy transition requires the development of renewable resources technologies, i.e., solar, wind, biogas, and biomass. Moreover, these technologies have to be effectively incorporated into the energy systems to make the most of them.[5] Besides, facilitating regulation systems is invaluable in accelerating the development of renewable energy technologies. A change in the following structures can trigger the necessary pace of moving towards renewable energy.[6] Although these are the advantages, there are drawbacks to widespread adoption of renewable resources technologies, such as technological, economic, and social obstacles.[7] The current reaction to the dynamic inverters that operate the Renewable Energy Sources (RES) in the power grid creates potential legal issues in trying to integrate renewable energy technologies into the power grid, since the inverters and protection systems' design has to respond to the dynamic nature of the RES.[8] There are also difficulties in the asynchronous ability to tie converter-based RES, such as wind and solar, to the grid that result in low delivery of vital power system functions, such as inertia and strength, and require viable approaches to assessment and definite requirements to achieve safe integration.[9] Tax subsidies, regulatory limits, and energy storage are also important policy factors in overcoming the challenges relating to incorporating renewable resources, especially in the optimal

1 Sharma, A. (2024). Current Trends and Future Directions in Renewable Energy Systems. International Journal for Research Publication and Seminar, 15(2), 186-198. https://doi.org/10.36676/jrps.v15.i2.1408.

2 Adefarati, T., Bansal, R. C. (2019). Reliability, economic and environmental analysis of a microgrid system in the presence of renewable energy resources. Applied Energy, 236, 1089-1114. https://doi.org/10.1016/j.apenergy.2018.12.050.

3 Gielen, D., Boshell, F., Saygin, D., Bazilian, M. D., Wagner, N., Gorini, R. (2019). The role of renewable energy in the global energy transformation. Energy Strategy Reviews, 24, 38-50. https://doi.org/10.1016/j.esr.2019.01.006.

4 Weschenfelder, F., de Novaes Pires Leite, G., Araújo da Costa, A. C., de Castro Vilela, O., Ribeiro, C. M., Villa Ochoa, A. A., Araújo, A. M. (2020). A review on the complementarity between grid-connected solar and wind power systems. Journal of Cleaner Production, 257, 120617. https://doi.org/10.1016/j.jclepro.2020.120617.

5 Ostergaard, P. A., Duic, N., Noorollahi, Y., Mikulcic, H., Kalogirou, S. (2020). Sustainable development using renewable energy technology. Renewable Energy, 146, 2430-2437. https://doi.org/10.1016/j.renene.2019.08.094.

6 Heptonstall, P. J., Gross, R. J. K. (2020). A systematic review of the costs and impacts of integrating variable renewables into power grids. Nature Energy, 6(1), 72-83. https://doi.org/10.1038/s41560-020-00695-4.

7 Ganiyu, S. O., Martínez-Huitle, C. A. (2020). The use of renewable energies driving electrochemical technologies for environmental applications. Current Opinion in Electrochemistry, 22, 211-220. https://doi.org/10.1016/j.coelec.2020.07.007.

8 Shah, H., Chakravorty, J., Chothani, N. G. (2023). Protection challenges and mitigation techniques of power grid integrated to renewable energy sources: A review. Energy Sources, Part A: Recovery, Utilization, and Environmental Effects, 45(2), 4195-4210. https://doi.org/10.1080/15567036.2023.2203111.

9 El Wejhani, S., Elleuch, M., Tnani, S., Ben Kilani, K., Ennine, G. (2022, October 26). Renewable energy integration in power system: Clarification on stability indices. 2022 IEEE International Conference on Electrical Sciences and Technologies in Maghreb (CISTEM). https://doi.org/10.1109/cistem55808.2022.10044066.

exploitation of solar and wind energy resources in the existing grid infrastructure.[10]

The legal framework surrounding the adoption of renewable energy is very fragmented and uneven across jurisdictions, even though this energy source has become central to the sustainability of the globe. The literature on the subject often gives us descriptive explanations of treaties, incentives, and policies, but seldom offers a comparative systematic assessment of their efficacy. Regulatory certainty, institutional capacity, and market integration are also critical issues that have not been adequately researched yet despite their decisive influence on determining the confidence of the investments, the timing of projects, as well as cost effectiveness. The existence of weak enforcement in India, fragmentation in the United States of America, and competition restrictions to competition dynamics within the European Union in Germany highlight institutional gaps, indicating that comparative legal analysis and evidence-based policy suggestions are necessary. The paper will critically examine the legal issues surrounding renewable energy technologies by conducting a comparative analysis of India, the United States, and Germany by applying the case law analysis and policy evaluation frameworks to determine the best practices, gaps in the institutions, and policy recommendations that enhance sustainable, cost-effective, and investor-friendly transitions in the energy system. To achieve this goal, the paper will focus on the following research questions (RQ):

RQ 1. What is the relationship between regulatory certainty, institutional capacity, and market integration, and the effectiveness of renewable energy laws in India, the United States, and Germany?

RQ 2. What are the similarities and differences between comparative case law and policy regimes in these jurisdictions, and what are their implications on investor confidence, project acceleration, and reduction in costs?

RQ 3. What evidence-based legal and policy actions can be advocated to reinforce the governance of renewable energy uses and promote sustainable, socially acceptable, and investor-friendly transitions?

The paper is organized as follows: Section 1 describes the international and national frameworks; Section 2 discuss intellectual property rights in renewable energy; Section 3 take into account the environmental regulation and compliance; Section 4 discuss contractual and commercial consideration; Section 5 case studies; Section 6 take into consideration a discussion.

METHODOLOGY

The study adopts a comparative legal framework and discusses the legal implications as regards renewable energy technologies. This framework is a combination of the doctrinal analysis of the law and the courts and policy appraisal model; therefore, there is a need to have a unified and thorough process of appraisal of the law in various jurisdictions. Amicus Solar Pvt. Ltd. v. State of Maharashtra in India, the litigation over the Cape Wind Project in the United States, and litigation in the Energiewende system of Germany are high-profile cases. These cases show the similarities, such as the judicial emphasis in conducting an environmental impact analysis, and differences, such as the enforceability of renewable purchase requirements in India and the conflict of federal and state competencies in the U.S.

The policy evaluation framework compares the legal and institutional background to three criteria: regulatory certainty, institutional capacity, and market integration. The comparative evidence suggests that the U.S. is characterized as being very incentive-based and has consistency issues. India has high statutory goals and an inability to execute them the same way. Germany has a subsidy-to-auction transi-

10 Tietje, C., Brouder, A., Nowrot, K. (2006). Philip C. Jessup's Transnational Law Revisited, 55; Utama, M., Irsan, I. (2018). General overview on selecting and drafting construction contract disputes resolution. Sriwijaya Law Review, 2(2), 152. https://doi.org/10.28946/slrev.vol2.iss2.129.pp152-169.

tion that is firmly founded on EU competition legal principles. Utilizing a fusion of judicial reasoning and policy examination, the research will offer a systematic inter-jurisdictional examination, best practices, common traps, and remedies to be repatriated to share renewable energy across the globe.

1. INTERNATIONAL AND NATIONAL LEGAL FRAMEWORKS

1.1. International level

The international legal framework of renewable energy technology is a complex of rules established by agreements and protocols to stimulate the technology related to renewable energy. In 1992, the UN Framework Convention on Climate Change (UNFCCC) highlighted the need to stabilize GHG in the atmosphere as well as sustainable development.[11] The Energy Charter Treaty (ECT)1994 was signed in order to promote global cooperation in the field of energy.[12] It aims at establishing a legal framework of energy commerce, protection of investment, and dispute resolution among the member states. The ECT gives the investors in fossil fuels the opportunity to challenge the environmental and climate policies, and thus stall massive climate action.[13] The uniform interpretation and application of the provisions of the ECT by the arbitral tribunals and domestic courts have not been consistent, thus leading to the absence of legal clarity in the settlements of investor-state disputes.[14] In 2009, the law of the International Renewable Energy Agency (IRENA) was passed to make greater use of all the renewable resources in a sustainable manner. The IRENA assists the states to move to renewable energy and is used as a platform of international cooperation and storage of knowledge regarding renewable energy.[15] IRENA helped to access renewable data, policy, capacity-building, and technology transfer (TT).[16] In the year 2009, the Kyoto Protocol was imposed on the industrialized countries to cut GHG emissions.[17] In 2015, the SDGs emphasized the significance of renewable energy in SDG7.[18] In accordance with the SDGs, the Paris Agreement of 2015 aims at reducing global warming to levels that are lower than the pre-industrial levels,[19] and in addition to this, it suggests that countries should contribute, financially assist developing countries, TT, and capacity-building.[20] All these treaties and agreements are aimed at promoting cooperation between countries and ensuring the implementation of renewable energy technologies.

1.2. National legal framework

Implementation of renewable energy is facilitated by a complicated system of national laws and regulations in different nations. The legal frameworks for the adoption of renewable energy are varied and vary in various countries, as there are different social, political, and economic backgrounds.

11 United Nations. (1992). *United Nations Framework Convention on Climate Change*.

12 Energy Charter Secretariat. (1994). *Energy Charter Treaty*.

13 Verbeek, B.-J. (2023). The Modernization of the Energy Charter Treaty: Fulfilled or Broken Promises? Business and Human Rights Journal, 8(1), 97-102. https://doi.org/10.1017/bhj.2022.39.

14 Verburg, C. (2019). Modernising the Energy Charter Treaty: An opportunity to enhance legal certainty in investor-state dispute settlement. The Journal of World Investment & Trade, 20(2–3), 425-454. https://doi.org/10.1163/22119000-12340144.

15 International Renewable Energy Agency. (2009). *Statute of the International Renewable Energy Agency (IRENA)*.

16 Prysiazhniuk, Y. Y. (2023). Legal activity of the international renewable energy agency. Uzhhorod National University Herald. Series: Law, 2(76), 251-256. https://doi.org/10.24144/2307-322.2022.76.2.40.

17 United Nations. (1997). *Kyoto Protocol to the United Nations Framework Convention on Climate Change.*

18 Fonseca, L. M., Domingues, J. P., Dima, A. M. (2020). Mapping the sustainable development goals relationships. Sustainability, 12(8), 3359. https://doi.org/10.3390/su12083359.

19 United Nations. (2015). *Paris Agreement.*

20 Michaelowa, A., Shishlov, I., Brescia, D. (2019). Evolution of international carbon markets: Lessons for the Paris Agreement. WIREs Climate Change, 10(6). https://doi.org/10.1002/wcc.613.

1.2.1. United States (US)

The policy of renewable energy in the US is constituted by both federal and state policies.[21] At the federal level, there is the Energy Policy Act of 2005 that provides loan guarantees and tax credits to facilitate energy production among the different sectors, which include renewable energy.[22] It facilitates the development of clean energy technologies, including the Investment Tax Credit and the Production Tax Credit. The credits can be used together to lower the initial cost of installing and keeping up the new RES operational, which makes the clean energy projects more cost-effective and promotes investment in renewable energy infrastructure.[23] The unpredictability in the US renewable energy investment climate is caused by the absence of long-term power purchase agreements and dependency on the changing tax incentives, which leads to uncertainty in investment. This may be stabilized by a national renewable portfolio standard, which would require long-term contracts for renewable energy projects.[24] Offshore renewable energy development in the US is managed by federal policies that differ from state policies. These policies are aimed at the permission, research, and innovation to facilitate technologies such as offshore wind energy.[25] Also, the Progressive energy storage technologies, including the electrochemical batteries, are important in order to incorporate the renewable energy into the grid. The federal rules (especially FERC Order 841)[26] are supposed to enable a structure of participation in the energy storage market, yet further detailed design changes are required to achieve efficient integration.[27] In addition to this, the solar energy policies in the US comprise federal incentives and several state-based initiatives. The challenges are permission procedures, funding processes, and interconnection standards, which differ greatly among states.[28] Renewable energy is greatly affected by the state's politics, policies, and prices. Policies on renewable energy are influenced by factors like professionalism of the legislature and political affiliations of the governor and the legislators.[29]

1.2.2. India

The legal system in India has developed a renewable energy system to address the challenges and facilitate the normal development of renewable energy. The Electricity Act 2003[30] transformed the power sector by offering reforms, but failed to mention renewables specifically, which slowed down the goal of achieving 175 GW of installed capacity by 2022 in India.[31]

21 Saurer, J., Monast, J. (2020). Renewable energy federalism in Germany and the United States. Transnational Environmental Law, 1-28. https://doi.org/10.1017/s2047102520000345.

22 Energy Policy Act of 2005, Pub. L. No. 109–58, 119 Stat. 594 (2005). [in United States]

23 Weschenfelder, F., de Novaes Pires Leite, G., Araújo da Costa, A. C., de Castro Vilela, O., Ribeiro, C. M., Villa Ochoa, A. A., Araújo, A. M. (2020). A review on the complementarity between grid-connected solar and wind power systems. Journal of Cleaner Production, 257, 120617. https://doi.org/10.1016/j.jclepro.2020.120617.

24 Mendicino, L., Menniti, D., Pinnarelli, A., Sorrentino, N. (2019). Corporate power purchase agreement: Formulation of the related levelized cost of energy and its application to a real life case study. Applied Energy, 253, 113577. https://doi.org/10.1016/j.apenergy.2019.113577.

25 Portman, M. (2010). Marine renewable energy policy: Some US and international perspectives compared. Oceanography, 23(2), 98-105. https://doi.org/10.5670/oceanog.2010.49.

26 Federal Energy Regulatory Commission. (2018). Order No. 841: Electric storage participation in markets operated by regional transmission organizations and independent system operators. [in United States]

27 Sakti, A., Botterud, A., O'Sullivan, F. (2018). Review of wholesale markets and regulations for advanced energy storage services in the United States: Current status and path forward. Energy Policy, 120, 569-579. https://doi.org/10.1016/j.enpol.2018.06.001.

28 Weismantle, K. (2014). Building a better solar energy framework. St. Thomas Law Review, 26. https://api.semanticscholar.org/CorpusID:166715796.

29 Yi, H., Feiock, R. C. (2014). Renewable energy politics: Policy typologies, policy tools, and state deployment of renewables. Policy Studies Journal, 42(3), 391-415. https://doi.org/10.1111/psj.12066.

30 Electricity Act, No. 36 of 2003 (India).

31 Dubey, B., Agrawal, S., Sharma, A. K. (2023). India's renewable energy portfolio: An investigation of the untapped potential of RE, policies, and incentives favoring energy security in the country. Energies, 16(14), 5491. https://doi.org/10.3390/en16145491.

Renewable energy is another important player in the energy economy development of the country, as it aims to utilize technologies such as blockchain to achieve transparent energy transitions and peer-to-peer trading to empower prosumers.[32] The Indian government has also put in place a number of policies and frameworks that facilitate the integration of renewable resources, including the Renewable Purchase Obligation and Renewable Energy Certificate.[33] These policies provide incentives to generate RES and also to conform to the regulations of the state and central policymaking.[34] Proper regulation is essential in incorporating renewable energy into the electricity market. The framework should enable the forecasting, planning, and managing of imbalances to provide grid stability and access to renewable sources in the market.[35] In spite of the development, a number of obstacles hinder the wide adoption of renewable resources technologies. These are technical, economic, market-related and institutional challenges. It is necessary to solve these obstacles with the help of policy interventions and improvements of the current legal framework.[36] India has achieved a lot with regard to renewable energy and especially solar and wind energy industries have been very successful in the country. These efforts are still supported by the government which provides the financial, institutional, and educational assistance to ensure the energy security and economic prosperity of the country.[37] The policies of the renewable energy in India match the international sustainability and mitigation of climate change. Presence in international regimes like the UNFCCC will boost the country in the development of renewable energy technologies in addition to responding to world environmental issues.[38]

2. INTELLECTUAL PROPERTY RIGHTS (IPR) IN RENEWABLE ENERGY

IPRs are important in the encouragement of innovativeness in the renewable energy industry. They offer a framework of the law that secures investments of companies and people in new technologies, knowing that inventors can enjoy the fruits of their labor. This insurance encourages additional R&D, and it is essential to improve the technologies of renewable energy. The renewable energy has been affected by the IPR. Firstly, the high IPR protection is a great stimulus to the procurement of renewable energy since it encourages companies to invest in renewable energy technologies. The higher the protection rights, the more renewable energy production will be resulted in, which will enhance sustainability.[39] Moreover, IPR affects the

32 Gupta, H., Singh, N. K. (2023). Climate Change and Biodiversity Synergies: A Scientometric Analysis in the Context of UNFCCC and CBD. Anthropocene Science, 2(1), 5-18. https://doi.org/10.1007/s44177-023-00046-4.

33 Central Electricity Regulatory Commission. (2022). *Renewable Purchase Obligation (RPO) and Renewable Energy Certificate (REC) Regulations.* [in India]

34 Goyal, M., Jha, R. (2009). Introduction of Renewable Energy Certificate in the Indian scenario. Renewable and Sustainable Energy Reviews, 13(6–7), 1395-1405. https://doi.org/10.1016/j.rser.2008.09.018.

35 Barpanda, S. S., Saxena, S. C., Rathour, H., Dey, K., Pawan Kumar, K. V. N. (2015, November). Renewable energy integration in Indian electricity market. 2015 IEEE PES Asia-Pacific Power and Energy Engineering Conference (APPEEC). https://doi.org/10.1109/appeec.2015.7381034.

36 Ghosh, D., Shukla, P. R., Garg, A., Ramana, P. V. (2002). Renewable energy technologies for the Indian power sector: Mitigation potential and operational strategies. Renewable and Sustainable Energy Reviews, 6(6), 481-512. https://doi.org/10.1016/s1364-0321(02)00015-1.

37 Shyam, B., Kanakasabapathy, P. (2017, December). Renewable energy utilization in India—Policies, opportunities and challenges. 2017 International Conference on Technological Advancements in Power and Energy (TAP Energy). https://doi.org/10.1109/tapenergy.2017.8397311.

38 Chaudhary, A., Krishna, C., Sagar, A. (2014). Policy making for renewable energy in India: Lessons from wind and solar power sectors. Climate Policy, 15(1), 58-87. https://doi.org/10.1080/14693062.2014.941318.

39 Tee, W.-S., Chin, L., Abdul-Rahim, A. S. (2021). Determinants of renewable energy production: Do intellectual property rights matter? Energies, 14(18), 5707.

performance of innovation; an example of this is in China where it was shown that government subsidies in combination with strong IP protection increase the performance of renewable energy enterprises in creative performance. This will aid in R&D as well as increase the ability of companies to innovate.[40] Moreover, the IP protection is a significant aspect of the economic growth, especially in the open economies. It promotes and implements new technologies because it is a secure investment environment.[41] In addition to this, IPRs introduce certain barriers and facilitators; even though IPRs tend to enhance innovation, they may have certain barriers particularly in the use of renewable energy in the developing countries. IRPs are also reliant on the efficiency of R&D and other economic aspects such as the trade openness.[42] Moreover, just like renewable energy, IPRs in agriculture have been observed to maintain innovation and change in technology. They give economic stimulus that promotes R&D and facilitates the innovation of new technologies, including the plant breeder rights in Canada.[43] Later, IPRs also play a vital role in manufacturing industries as far as sustainable innovation is concerned. They assist in unlocking sustainable innovations but occasionally can postpone their dissemination.[44] The main types of IPRs are the following: patents, copyrights, trademarks and trade secrets. Patents protect the novelty by providing the inventor with what is known as an exclusive right which is the right to prevent any other party to produce, use, or sell the invention during a specified period, normally twenty years. Patents in the renewable energy industry provide a high patronage value to companies. Firms that have good patent portfolios, meaning that they have strong patents protection capabilities, are more likely to be overvalued in the market.[45] One of the indicators of technological innovation in renewable energy is patents. Renewable energy technologies have a positively affecting rate of innovation due to the supportive policies of public policies favoring R&D and patenting activities.[46] Other than patenting, software and digital innovations in renewable energy technologies can be safeguarded by copyright. They assist in ensuring that the financial worth of these innovations is guaranteed by avoiding unauthorized reproduction and distribution.[47] The trademarks assist the companies dealing with renewable energy to distinguish their products and to establish brand loyalty. The successful trademark can strengthen market share and consumer trust on renewable energy products.[48]

https://doi.org/10.3390/en14185707.

40 Xu, X., Chen, X., Xu, Y., Wang, T., Zhang, Y. (2022). Improving the innovative performance of renewable energy enterprises in China: Effects of subsidy policy and intellectual property legislation. Sustainability, 14(13), 8169. https://doi.org/10.3390/su14138169.

41 Gould, D. M., Gruben, W. C. (1996). The role of intellectual property rights in economic growth. Journal of Development Economics, 48(2), 323-350. https://doi.org/10.1016/0304-3878(95)00039-9.

42 Li, J., Omoju, O. E., Zhang, J., Ikhide, E. E., Lu, G., Lawal, A. I., Ozue, V. A. (2020). Does Intellectual Property Rights Protection Constitute A Barrier To Renewable Energy? An Econometric Analysis. National Institute Economic Review, 251, R37-R46. https://doi.org/10.1017/nie.2020.5.

43 Horbulyk, T. M. (1993). Intellectual property rights and technological innovation in agriculture. Technological Forecasting and Social Change, 43(3–4), 259-270. https://doi.org/10.1016/0040-1625(93)90055-c.

44 Eppinger, E., Jain, A., Vimalnath, P., Gurtoo, A., Tietze, F., Hernandez Chea, R. (2021). Sustainability transitions in manufacturing: The role of intellectual property. Current Opinion in Environmental Sustainability, 49, 118-126. https://doi.org/10.1016/j.cosust.2021.03.018.

45 Kim, D., Kim, N., Kim, W. (2018). The effect of patent protection on firms' market value: The case of the renewable energy sector. Renewable and Sustainable Energy Reviews, 82, 4309-4319. https://doi.org/10.1016/j.rser.2017.08.001.

46 Johnstone, N., Haščič, I., Popp, D. (2009). Renewable energy policies and technological innovation: Evidence based on patent counts. Environmental and Resource Economics, 45(1), 133-155. https://doi.org/10.1007/s10640-009-9309-1.

47 Graham, S. J. H. (2008). Chapter 5 Beyond patents: The role of copyrights, trademarks, and trade secrets in technology commercialization. In Advances in the Study of Entrepreneurship, Innovation & Economic Growth (pp. 149-170). Emerald (MCB UP). https://doi.org/10.1016/s1048-4736(07)00005-7.

48 Amernick, B. A. (1991). Basic distinctions between patents, copyrights, trade secrets, and trademarks. In Patent Law for the Nonlawyer (pp. 5-10). Springer US.

3. ENVIRONMENTAL REGULATIONS AND COMPLIANCE

The environmental laws contribute significantly to the development of renewable resources projects. These laws strive to create some form of balance between the need to have clean energy and the need to save the environment. Offshore Renewable Energy Projects in the US had environmental and regulatory obstacles, especially in the offshore industry, such as the requirement of detailed Environmental Impact Statements (EIS) and the lack of certainty in determining the ecological impact of new technologies. Regulatory frameworks also engage several agencies and involve much participation by the masses and stakeholders to deal with the physical and biological effects of such projects.[49] The scientific uncertainty and complexity of EIA have prompted delays and opposition among the citizens in Spain. Regulatory improvements should be made to improve the ease of EIAs, increase the participation of the people, preserve the marine biodiversity, and promote the development of renewable energy.[50] In Japan and the EU, the EIA process has been cited as a hindrance to large-scale renewable energy projects, and reforms have been called to bring a balance between protecting the environment and developing the projects. These processes are important in reduction of climate change by ensuring they are streamlined to help with socio-economic problems.[51] The environmental laws of the EU have made a positive impact in embracing and embracing renewable energy technologies. Nevertheless, such regulations should be tangibly combined with environmentally-friendly technologies to make the most of the use of renewable energy. Large-scale renewable projects should have sufficient environmental and social impact evaluation. Such evaluations should take into account ecosystem services and climate resilience to achieve the sustainable potential of renewable energy.[52] An increase in renewable energy infrastructure results in land use alteration, which has the potential to cause harmful effects to ecosystems.[53] The importance of ecosystem services in China has been recognized in a multi-level legal system with both centralized and decentralized structures. These are lawful instruments, such as land use differentiation, payment of ecosystem services, and litigation on the part of the public interest, which are designed to both protect the ecosystems and encourage renewable resources.[54] The EU has had legal problems in the integration of renewable energy objectives with conservation directives, e.g., the Habitats and Birds Directives.[55,56] The absence of coordination between these instructions may slow down the implementation of renewable energy projects. The solution to these

https://doi.org/10.1007/978-1-4684-7829-7_2.

49 Daughdrill, W. H. (2009). Assessing the role of environmental and regulatory issues on offshore renewable energy projects in the United States. Volume 4: Ocean Engineering; Ocean Renewable Energy; Ocean Space Utilization, Parts A and B. https://doi.org/10.1115/omae2009-79097.

50 Salvador, S., Gimeno, L., Sanz Larruga, F. J. (2018). The influence of regulatory framework on environmental impact assessment in the development of offshore wind farms in Spain: Issues, challenges and solutions. Ocean & Coastal Management, 161, 165-176. https://doi.org/10.1016/j.ocecoaman.2018.05.010.

51 Schumacher, K. (2017). Large-scale renewable energy project barriers: Environmental impact assessment streamlining efforts in Japan and the EU. Environmental Impact Assessment Review, 65, 100-110. https://doi.org/10.1016/j.eiar.2017.05.001.

52 Rastegar, H., Eweje, G., Sajjad, A. (2024). The impact of environmental policy on renewable energy innovation: A systematic literature review and research directions. Sustainable Development, 32(4), 3859-3876. https://doi.org/10.1002/sd.2884.

53 Kim, J. Y., Koide, D., Ishihama, F., Kadoya, T., Nishihiro, J. (2021). Current site planning of medium to large solar power systems accelerates the loss of the remaining semi-natural and agricultural habitats. Science of The Total Environment, 779, 146475. https://doi.org/10.1016/j.scitotenv.2021.146475.

54 You, M. (2016). Withdrawn: Assessment of multi-level legal mechanisms for the protection of ecosystem services in China. Ecosystem Services, 100348. https://doi.org/10.1016/j.ecoser.2016.02.009.

55 European Union. (1992). *Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive).*

56 European Union. (2009). *Directive 2009/147/EC on the conservation of wild birds (Birds Directive).*

goals is the proposal of adaptive management strategies and detailed plans for renewable energy.[57] The rapid development of RES, especially in such regions as the western US, has been associated with great ecological problems. These are habitat-breaking and the displacement of species. These challenges need to be tackled with effective legal strategies and mitigation activities in order to proceed with the development of sustainable energy.[58]

4. CONTRACTUAL AND COMMERCIAL CONSIDERATIONS

A number of contractual agreements and commercial arrangements are involved in the renewable energy industry to make the projects successful and to be developed successfully. It is necessary to have a number of contractual agreements and commercial arrangements. These contracts provide clarity among the parties, risk reduction, and easy investment. Firstly, PPAs are the long-term agreements between producers and consumers of renewable energy, where the former usually sell the electricity to utilities or big corporations at a fixed rate. Such deals play a vital role in getting the funding and a stable flow of revenue to the renewable energy projects. To give an example, in the US, PPAs are becoming increasingly popular among privately owned companies to purchase the renewable power. Such agreements are useful in ensuring that companies attain the objectives of sustainability and offer financial stability to the developers of the project.[59] The Corporate PPAs are becoming more popular as corporations strive to decrease their impact on the environment. They enable companies to gain access to renewable energy at a competitive cost and balance between cost and long-term sustainability objectives.[60] Moreover, other ownership structures and financing provisions are employed in the renewable energy sector, such as project finance, limited partnerships, and sale/ leaseback. These are the structures that assist in the management of risk and investment.

Moreover, utility proprietors occasionally directly possess and fund renewable energy undertakings, which have the advantage of saving expenses and being able to operate undertakings compared to acquiring influence of power produced by independent generators.[61] In addition, consumer co-ownership will also be necessary, in which the consumer (co-)ownership models include community investment in renewable energy projects, where local participation and acceptance are encouraged.[62] Also, there is the issue of regulatory and commercial hurdles, including the regulatory environment, which is very much influencing the feasibility and attractiveness of the renewable energy projects. To develop and run such projects, policies and market structures should be in place. Similarly, RECs

57 van Hees, S. (2018). Large-scale water-related innovative renewable energy projects and the habitats and birds directives: Legal issues and solutions. European Energy and Environmental Law Review, 27(1), 15-36. https://doi.org/10.54648/eelr2018002.

58 Agha, M., Lovich, J. E., Ennen, J. R., Todd, B. D. (2020). Wind, sun, and wildlife: Do wind and solar energy development 'short-circuit' conservation in the western United States? Environmental Research Letters, 15(7), 075004. https://doi.org/10.1088/1748-9326/ab8846.

59 Baines, S., Wrubell, S., Kennedy, J., Bohn, C., Richards, C. (2019). How To PPA: An examination of the regulatory and commercial challenges and opportunities arising in the context of private power purchase agreements for renewable energy. Alberta Law Review, 389. https://doi.org/10.29173/alr2580.

60 Mendicino, L., Menniti, D., Pinnarelli, A., Sorrentino, N. (2019). Corporate power purchase agreement: Formulation of the related levelized cost of energy and its application to a real life case study. Applied Energy, 253, 113577. https://doi.org/10.1016/j.apenergy.2019.113577.

61 Wiser, R., Kahn, E. (1996). Alternative windpower ownership structures: Financing terms and project costs. Office of Scientific and Technical Information (OSTI). https://doi.org/10.2172/272563.

62 Holstenkamp, L. (2019). Financing consumer (co-) ownership of renewable energy sources. In Energy Transition (pp. 115–138). Springer International Publishing. https://doi.org/10.1007/978-3-319-93518-8_6.

are contractual documents that represent the environmental value of producing renewable energy. They are applied to address the regulatory requirements and to assist the renewable energy markets.[63]

Common techniques of obtaining long-term contracts with independent power-producing units are auctions, which are known to provide a competitive price and simple procedures. A good auction design involves establishing clear guidelines and contractual provisions, which provide healthy competition and good delivery of projects.[64] Hybrid stochastic and robust optimization models are advanced contracting strategies that can be used to address the risks involved in the generation of renewable energy and market uncertainties. The hybrid approach that stochastic programming is used together with robust optimization assists energy trading firms in Brazil in developing optimal contracting strategies when markets are characterized by uncertainties.[65] Contracts related to renewable energy are associated with special risks and liabilities because such projects are complicated, and the regulatory environment changes over time. The risk management of developing renewable energy projects on polluted premises includes a combination of property and commercial general liability cover and site contamination liability cover. The strategy is good when tackling the long-term risks that are not diminishing in the long run.[66] The significance of dispute resolution in the energy sector is because the WTO offers a legalized dispute settlement system to minimize uncertainty and enhance the utility of the results of dispute resolution. The features of this mechanism include clear substantive rules, procedural rules, and independent legal bodies, legal precedents.[67] Other countries adopt different methods of resolving renewable energy disputes, together with global dispute settlement, which is the WTO. China has also taken an initiative in the dispute trade in renewable energy by using the domestic courts and the WTO dispute settlement mechanism to deal with the anti-dumping and countervailing measures. The design of a construction contract may avoid conflicts, and the mediation, arbitration, and other methods of Alternative Dispute Resolution (ADR) may play an important role in efficient conflict resolution.[68] International arbitration has emerged as one of the popular ways of settling disputes in the energy industry, and there is a just and effective way of reducing the risks that relate to international business dealings.

5. CASE STUDIES

To exemplify the legal issues and aspects of renewable energy technologies. The case studies provided below provide a crucial perspective on the legal issues of renewable energy technologies, especially in new economies such as India, Germany, and the US. Striking a balance between the contractual requirements, regulatory adherence, and just following penalties in the renewable energy project implementation is important towards ensuring project implementation success.

63 Picardi, B. (2016). Renewable energy and policy mechanisms: A case study of renewable energy certificates in India. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2778629.

64 de Barros Correia, T., Tolmasquim, M. T., Hallack, M. (2020). Guide for designing contracts for renewable energy procured by auctions. Inter-American Development Bank. https://doi.org/10.18235/0002583.

65 Picardi, B. (2016). Renewable energy and policy mechanisms: A case study of renewable energy certificates in India. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2778629.

66 Neuman, S., Hopkins, C. D. (2009). Renewable energy projects on contaminated property: Managing the risks. Environmental Claims Journal, 21(4), 296-312. https://doi.org/10.1080/10406020903361381.

67 Moon, D. (2004). Risk considerations in legalized dispute settlement (DS) mechanisms. Korean Journal of International Relations, 44(5), 61-84. https://doi.org/10.14731/kjis.2004.12.44.5.61.

68 Utama, M., Irsan, I. (2018). General overview on selecting and drafting construction contract disputes resolution. Sriwijaya Law Review, 2(2), 152. https://doi.org/10.28946/slrev.vol2.iss2.129.pp152-169.

5.1. The legal battle over solar energy in India – Amicus Solar and the enforcement of solar obligations

India has put a lot of investment in renewable energy, especially solar power, to address climate change.[69] Through the various programs, the Indian government has established lofty goals for the establishment of solar energy systems in the nation. Among them is the National Solar Mission program that promotes the production and utilization of solar energy in generating power. The Indian case of Amicus Solar Pvt. Ltd. v. State of Maharashtra is an example of the court tussle over the solar energy mandate.[70] This was a case of RRPOs being put in place where some entities are bound to purchase a minimum percentage of their energy as renewable energy. The case brought out the difficulties associated with the implementation of RPOs, especially the regulatory and legislative difficulties in compliance by the state agencies, as well as in the case of individual entities. The problems encompassed the interpretation of the RPO requirements, the consequences of failure to comply, and the role of the regulatory bodies in implementing the required targets on renewable energy.[71] The case has shown the importance of a sound legal and regulatory framework to help in promoting renewable energy in India and explicit and binding obligations of stakeholders.

5.2. Cape Wind Project (United States)

The Cape Wind Project would be constructed on the Horseshoe Shoal in Nantucket Sound, and the aim was to install 130 wind turbines, which would produce around 420 megawatts of power.[72] The project can satisfy nearly three-quarters of the electrical needs of Cape Cod and the neighboring islands.[73] This project was also met with serious legal risks, such as environmental lawsuits, local stakeholders' opposition, and the federal and state jurisdiction. The project cast doubts over whether the current regulatory frameworks sufficed in the regulation of offshore wind energy, EIA, and the balancing of the interests of the locals and the national interests in renewable energy.[74] The Cape Wind project continued to encounter legal hurdles in 2010 following a series of challenges by different groups of people, such as environmentalists, local towns, and the Wampanoag tribe.[75] The delays and ultimate failure that Cape Wind witnessed show the necessity to have more efficient regulatory structures and an activity plan on how to engage the masses on renewable energy development projects. It is a warning of what to expect in future projects in the United States and the world over.[76]

69 Girard, B., Sareen, S. (2024). Change everything so that (almost) nothing changes? Investigating the territorial distribution of solar energy subsidies in rural India. Environmental Sociology, 1-12. https://doi.org/10.1080/23251042.2024.2372890.

70 Amicus Solar Pvt. Ltd. v. State of Maharashtra, (2015). [in India].

71 Kar, S. K., Sharma, A., Roy, B. (2016). Solar energy market developments in India. Renewable and Sustainable Energy Reviews, 62, 121-133. https://doi.org/10.1016/j.rser.2016.04.043.

72 Alliance to Protect Nantucket Sound v. U.S. Department of the Army, 288 F. Supp. 2d 64 (D.D.C. 2003). [in United States]

73 Rodgers, M., Olmsted, C. (2008). The Cape Wind Project in context. Leadership and Management in Engineering, 8(3), 102-112. https://doi.org/10.1061/(asce)1532-6748(2008)8:3(102).

74 The Cape Wind Offshore Wind Energy Project. (2011). In Collaborative Modeling and Decision-Making for Complex Energy Systems (pp. 157–181). World Scientific. https://doi.org/10.1142/9789814335201_0006.

75 National Geographic. (n.d.) Case study: Cape Wind Project. https://education.nationalgeographic.org/resource/case-study-cape-wind-project/.

76 Larson, M. J. (2011). Cape wind: Lessons from environment and energy conflict. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.1872859.

5.3. German Energiewende and Feed-in Tariffs(FITs)

The Energiewende (Energy Transition) is a comprehensive policy project to convert the nation into a low-carbon economy that is based on renewable energy, and a significant part of this is wind and solar energy.[77] The Energiewende legal framework involved the establishment of the FITs to promote investment in renewable energy.[78] Nevertheless, there were some pitfalls with these policies, including the controversy about the cost burden on the consumer, the effect on the energy market, and the legal reforms to facilitate the galloping development of renewables. There were also legal difficulties when the EU regulations came into being, and on the state aid and competition law.[79] Although Energiewende has been rather effective in augmenting the renewable energy capacity, it has caused considerable legal and policy controversies regarding energy market reform, the position of subsidies, and how renewables fit into the energy grid.[80] These examples emphasize the significance of stipulating the contractual commitments and contingencies of the renewable energy projects, especially in certain complicated regulatory settings.[81] They also indicate the necessity of governments to streamline the process of regulations in a way that would make renewable energy projects run on time.

6. DISCUSSION

It is observed that in a systematic comparative assessment, the success of the law of renewable energy is determined by the interplay of regulatory certainty, institutional capacity, and the integration of the market; however, each jurisdiction has different tracks.

6.1. Regulatory certainty and investor confidence

As the German experience of feed-in tariffs (FITs) shows, long-term legal stability can lead to a great deal of investment in renewables, though with controversy on the costs to consumers.[82,83] On the contrary, the intermittent nature of tax incentives in the United States makes it a fluctuating investment environment that puts off long-term investments in capital.[84] Even in good statutory frameworks, India is characterized by a lack of fair application of Renewable Purchase Obligations (RPOs), which destroys investor confidence.[85] According to Johnstone, Hascic, and Popp (2009), and other scholars, stable legal incentives have a direct correlation with the activity of patenting and innovation in the renewables and energy sector; Li et al. (2020) warn that excessive protection of intellectual property rights impedes diffusion in developing nations. This is an indication that clarity and enforceability, rather than the exis-

77 Leiren, M. D., Reimer, I. (2018). Historical institutionalist perspective on the shift from feed-in tariffs towards auctioning in German renewable energy policy. Energy Research & Social Science, 43, 33-40. https://doi.org/10.1016/j.erss.2018.05.022.

78 Erneuerbare-Energien-Gesetz [EEG] [Renewable Energy Sources Act] (2017). [in Germany]

79 Nordensvärd, J., Urban, F. (2015). The stuttering energy transition in Germany: Wind energy policy and feed-in tariff lock-in. Energy Policy, 82, 156-165. https://doi.org/10.1016/j.enpol.2015.03.009.

80 Haas, T., Sander, H. (2016). Shortcomings and perspectives of the German Energiewende. Socialism and Democracy, 30(2), 121-143. https://doi.org/10.1080/08854300.2016.1183996.

81 European Commission v. Federal Republic of Germany, Case C-405/16 P (2019). [in European Union]

82 Leiren, M. D., Reimer, I. (2018). Historical institutionalist perspective on the shift from feed-in tariffs towards auctioning in German renewable energy policy. Energy Research & Social Science, 43, 33-40. https://doi.org/10.1016/j.erss.2018.05.022.

83 Nordensvärd, J., Urban, F. (2015). The stuttering energy transition in Germany: Wind energy policy and feed-in tariff lock-in. Energy Policy, 82, 156-165. https://doi.org/10.1016/j.enpol.2015.03.009.

84 Yi, H., Feiock, R. C. (2014). Renewable energy politics: Policy typologies, policy tools, and state deployment of renewables. Policy Studies Journal, 42(3), 391-415. https://doi.org/10.1111/psj.12066.

85 Kar, S. K., Sharma, A., Roy, B. (2016). Solar energy market developments in India. Renewable and Sustainable Energy Reviews, 62, 121-133. https://doi.org/10.1016/j.rser.2016.04.043.

tence of laws, are influential in the determination of investor behavior.

6.2. Institutional capacity and project acceleration

The problem of institutional weakness comes up as a setback. The Amicus Solar Pvt. Ltd. v. State of Maharashtra case provides an example of the inability to adhere to the RPOs due to the lack of proper enforcement of the regulations and its impact on the project timeline.[86] On the same note, the long court battle over the Cape wind Project shows a divided jurisdictional power in the U.S.[87,88] Conversely, the Energiewende in Germany was aided by consistent institutions, but was limited by the EU competition law.[89] The literature tends to believe that the enforcement of the institution takes a back seat to the policy design, although case studies show that institutional strength is vital in ensuring timely project delivery.[90] Delays can be reduced by regulatory streamlining, such as statutory deadlines on Environmental Impact Assessments (EIAs), which would raise the cost of projects.[91]

6.3. Market integration and cost Reduction

The cost-efficiency of the deployment of renewable energy is also influenced by market mechanisms. German Competitive auctions have shown that there is downward pressure on renewable energy tariffs[92,93] whereas the Renewable Energy Certificate (REC) system in India has failed because of poor compliance and poor enforcement.[94,95] The use of storage technologies in the U.S. has been inconsistently integrated because of the fragmented state-federal regulation.[96] Despite the broad praise of auctions in the literature of scholarship in terms of efficiency gains,[97] not much is said about the legal enforceability of auctions and their correspondence to supranational law. One of the comparative lenses implies that a legal coherence in the design of the auction is as important as economic competitiveness in guaranteeing sustainable cost savings.

86 Ibid.

87 Rodgers, M., Olmsted, C. (2008). The Cape Wind Project in context. Leadership and Management in Engineering, 8(3), 102-112. https://doi.org/10.1061/(asce)1532-6748(2008)8:3(102).

88 Larson, M. J. (2011). Cape wind: Lessons from environment and energy conflict. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.1872859.

89 Leiren, M. D., Reimer, I. (2018). Historical institutionalist perspective on the shift from feed-in tariffs towards auctioning in German renewable energy policy. Energy Research & Social Science, 43, 33-40. https://doi.org/10.1016/j.erss.2018.05.022.

90 Saurer, J., Monast, J. (2020). Renewable energy federalism in Germany and the United States. Transnational Environmental Law, 1-28. https://doi.org/10.1017/s2047102520000345.

91 Schumacher, K. (2017). Large-scale renewable energy project barriers: Environmental impact assessment streamlining efforts in Japan and the EU. Environmental Impact Assessment Review, 65, 100-110. https://doi.org/10.1016/j.eiar.2017.05.001.

92 Nordensvärd, J., Urban, F. (2015). The stuttering energy transition in Germany: Wind energy policy and feed-in tariff lock-in. Energy Policy, 82, 156-165. https://doi.org/10.1016/j.enpol.2015.03.009.

93 Haas, T., Sander, H. (2016). Shortcomings and perspectives of the German Energiewende. Socialism and Democracy, 30(2), 121-143. https://doi.org/10.1080/08854300.2016.1183996.

94 Goyal, M., Jha, R. (2009). Introduction of Renewable Energy Certificate in the Indian scenario. Renewable and Sustainable Energy Reviews, 13(6–7), 1395-1405. https://doi.org/10.1016/j.rser.2008.09.018.

95 Picardi, B. (2016). Renewable energy and policy mechanisms: A case study of renewable energy certificates in India. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2778629.

96 Sakti, A., Botterud, A., O'Sullivan, F. (2018). Review of wholesale markets and regulations for advanced energy storage services in the United States: Current status and path forward. Energy Policy, 120, 569-579. https://doi.org/10.1016/j.enpol.2018.06.001.

97 Kilinc-Ata, N. (2016). The evaluation of renewable energy policies across EU countries and US states: An econometric approach. Energy for Sustainable Development, 31, 83-90. https://doi.org/10.1016/j.esd.2015.12.006.

6.4. Balancing environmental and social interests

The other theme that is common in different jurisdictions is the harmony between environmental conservation and renewable growth. The literature tends to criticize EIAs due to delays in their processes, but it tends to understate the democratic and justice-promoting aspect of EIA.[98] The case of Cape Wind litigation demonstrates the effects of insufficient engagement of stakeholders,[99] whereas EU directives indicate the tension between biodiversity protection and renewable implementation.[100] A comparative approach indicates that in the case of a legal process of streamlining and participation, environmental assessments can simultaneously protect the ecosystems and promote the uptake of renewables.[101]

6.5. Critical engagement with existing scholarship

In a closer examination of the literature available on renewable energy law, it can be observed that much of it is descriptive as opposed to being evaluative. It is common practice to list categories of policies, including feed-in tariffs, renewable energy certificates, tax incentives, etc. in studies, but there is seldom a systematic comparison of their enforceability and effectiveness in the long run across jurisdictions. As an illustration, Johnstone, Hascic, and Popp (2009) highlight the beneficial connection between policy support and patenting activity, but pay little focus on the legal certainty and enforceability of such measures, which the present study states as the key factors in investor confidence.[102] On the same note, Goyal and Jha (2009) show promise of REC in India, but emphasize without addressing the chronic non-compliance with the scheme, which undermines its utilization in reality.

The literature on institutional capacity also has contradictions. Dubey, Agrawal, and Sharma (2023) highlight a boisterous statutory targets of India, but the cases, including Amicus Solar Pvt. Ltd. v. State of Maharashtra, have shown that enforcement mechanisms are weak and thus cannot support the expectation of the state. Weschenfelder et al. (2020) observe the incentives offered by the government, especially the taxes, in stimulating renewable development in the United States, yet the time-consuming Cape Wind Project litigation demonstrates the potential risks of split federal, state authority,[103] which is not sufficiently emphasized by current analyses. Germany, in contrast, is often portrayed as a success story because of its Energiewende and feed-in tariff system,[104] although the legal conflict caused by EU competition law[105] is of-

98 Salvador, S., Gimeno, L., Sanz Larruga, F. J. (2018). The influence of regulatory framework on environmental impact assessment in the development of offshore wind farms in Spain: Issues, challenges and solutions. Ocean & Coastal Management, 161, 165-176. https://doi.org/10.1016/j.ocecoaman.2018.05.010.

99 Rodgers, M., Olmsted, C. (2008). The Cape Wind Project in context. Leadership and Management in Engineering, 8(3), 102-112. https://doi.org/10.1061/(asce)1532-6748(2008)8:3(102).

100 Sakti, A., Botterud, A., O'Sullivan, F. (2018). Review of wholesale markets and regulations for advanced energy storage services in the United States: Current status and path forward. Energy Policy, 120, 569-579. https://doi.org/10.1016/j.enpol.2018.06.001.

101 Agha, M., Lovich, J. E., Ennen, J. R., Todd, B. D. (2020). Wind, sun, and wildlife: Do wind and solar energy development 'short-circuit' conservation in the western United States? Environmental Research Letters, 15(7), 075004. https://doi.org/10.1088/1748-9326/ab8846.

102 Johnstone, N., Haščič, I., Popp, D. (2009). Renewable energy policies and technological innovation: Evidence based on patent counts. Environmental and Resource Economics, 45(1), 133-155. https://doi.org/10.1007/s10640-009-9309-1.

103 Rodgers, M., Olmsted, C. (2008). The Cape Wind Project in context. Leadership and Management in Engineering, 8(3), 102-112. https://doi.org/10.1061/(asce)1532-6748(2008)8:3(102).

104 Leiren, M. D., Reimer, I. (2018). Historical institutionalist perspective on the shift from feed-in tariffs towards auctioning in German renewable energy policy. Energy Research & Social Science, 43, 33-40. https://doi.org/10.1016/j.erss.2018.05.022.

105 Nordensvärd, J., Urban, F. (2015). The stuttering energy transition in Germany: Wind energy policy and feed-in tariff lock-in. Energy Policy, 82, 156-165. https://doi.org/10.1016/j.enpol.2015.03.009.

ten overlooked in scholarly research as a critical limitation, which is the focus of the current study. There are contradictions in environmental regulation literature, also. An example of this is by Schumacher (2017), who criticizes the idea of EIA due to delays in the procedure; however, these descriptions do not reflect the democratic and participatory merit of Environmental Impact Assessment. Entering this paper will show that procedural rigor, coupled with legislative schedules and participation of local communities, can simultaneously protect the environment and increase the uptake of renewable sources, thus resolving the efficiency and legitimacy dilemma.[106]

By filling such gaps and contradictions, the study will add to the literature by showing that law does not display only such policy tools but is a more structural determinant of renewable energy transitions. Comparative examination of India, the US, and Germany demonstrates that such variables as regulatory certainty, institutional strength, and policy instruments' enforceability are the tools that cannot be ignored and are frequently forgotten in the current literature.

CONCLUSION

This comparative study confirms that law is not a passive context but an active factor that determines the results of renewable energy. The divergent cases of India, the US, and Germany show that regulatory certainty, institutional capacity, and market integration are the determining variables influencing the success of renewable energy transitions. To minimize the identified gaps, it is possible to promote a number of evidence-based recommendations.

One, the jurisdictions should focus on regulatory certainty to improve investor confidence. This would entail enforcing RPOs bindingly in India, whereas harmonized creation of renewable portfolio standards would reduce policy volatility in the US. The predictability of incentive plans on the long term (FITs, competitive auctions, tax credits, etc.) needs to be preserved across the jurisdictions to reduce sudden inversion and the loss of trust, and a disincentive to invest capital.

Second, institutional capacity is critical for the acceleration of projects. By setting up statutory deadlines on environmental approvals, delays would be minimized, and costs related to litigation would be reduced. Moreover, the regulatory bodies have to be given enough institutional freedom to be left alone to perform their task without the interference of politics, to ensure that any dispute is resolved in time, as well as the enforcement of contracts.

Third, to realize cost-cutting, it needs more coherent market integration. The efficiency and transparency of auction rules, which can be enforced across borders, would make the auction systems more efficient and cost-effective. Moreover, greater enforcement of the Renewable Energy Certificate schemes would increase the liquidity in the market, as well as, where feasible, linking the schemes with carbon trading systems, which would help in efficient allocation of resources.

Lastly, balanced development necessitates legal structures that assist in acknowledging environmental protection as well as social legitimacy. Costly post-approval disagreements can be avoided by using participatory models of EIA, whereby the local communities are involved during the initial phases of project design. In the same vein, integrating biodiversity guidelines with renewable implementation strategies would prevent the occurrence of conflicting regulations, which would otherwise interfere with a smooth implementation of projects.

This research has highlighted how such recommendations can be advanced by emphasizing the fact that adaptive legal innovation based on enforceability, institutional strength, and policy consistency is necessary to create re-

106 Schumacher, K. (2017). Large-scale renewable energy project barriers: Environmental impact assessment streamlining efforts in Japan and the EU. Environmental Impact Assessment Review, 65, 100-110. https://doi.org/10.1016/j.eiar.2017.05.001.

newable energy systems that are cost-effective, socially acceptable, and appealing to investors.

It represents a continuation of the main part of the text. It briefly and shortly sums up the results of the research, describes the main idea of the given research, scientific novelty, and its value, describes the main findings and possible recommendations, and creates interest and further perspective for continuing the research.

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