Page 715 - 726 **DOI:** *https://doij.org/10.10000/IJLMH.118576*

INTERNATIONAL JOURNAL OF LAW MANAGEMENT & HUMANITIES

[ISSN 2581-5369]

Volume 7 | Issue 6

2024

The Paradox of Clean Energy: Analyzing the Impact of Renewable Energy Projects on Wildlife Conservation in India

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ABSTRACT

This research paper critically examines the complex interplay between India's ambitious renewable energy targets and the imperative of wildlife conservation, focusing on the impact of solar and wind energy projects on biodiversity. Employing a mixed-methods approach, the study analyzes current regulations, policies, and case studies, highlighting the challenges and opportunities in balancing clean energy development with ecological preservation. The paper discusses the lack of a comprehensive framework for assessing the environmental and biodiversity impacts of renewable energy projects in India, drawing comparisons with international best practices. The study concludes with actionable recommendations for policymakers, emphasizing the need for a holistic approach that integrates environmental, social, and economic considerations in the planning and implementation of renewable energy projects.

Keywords*: Renewable Energy, Wildlife Conservation, Biodiversity, Environmental Impact, Policy Framework.*

I. INTRODUCTION

India's commitment to renewable energy is underscored by its ambitious target to achieve 500 GW of non-fossil fuel-based power generation capacity by 2030[2]. This goal is part of the broader strategy to reduce greenhouse gas emissions and combat climate change while ensuring energy security for its growing population. The transition to renewable energy sources, particularly solar and wind, is seen as a crucial step in this direction.

However, this transition raises significant concerns regarding its impact on biodiversity and wildlife conservation. The constitutional provisions in India, particularly Article 48A and Article 51A(g), mandate the state and citizens to protect the environment and wildlife[3]. Despite these legal frameworks, the rapid expansion of renewable energy projects has led to habitat

[1] Author is an Advocate at Indore High Court, India.
[2] Ministry of New and Renewable Energy, Solar Overview (2023); See also REN21's Global Status Report 2023 & IRENA's Renewable Capacity Statistics 2023.
[3] INDIA CONST. art. 48-A, art. 51-A(g), amended by The Constitution (Forty-Second Amendment) Act, 1976.

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destruction, species mortality, and ecological imbalances[4].

(A) Research Objectives

This research aims to:

1. Analyze the Legal Framework: Investigate the constitutional and legislative provisions governing renewable energy projects and wildlife conservation in India.

2. Assess Environmental Impact: Evaluate the ecological consequences of renewable energy projects on wildlife habitats and species.

3. Explore Balancing Mechanisms: Identify strategies to reconcile the need for renewable energy with wildlife conservation efforts.

4. Propose Policy Solutions: Recommend policies that mitigate adverse impacts on wildlife while promoting clean energy initiatives.

II. CONSTITUTIONAL AND LEGAL FRAMEWORK

The protection and preservation of the environment and wildlife in India is enshrined in its constitutional and legal framework. The Constitution of India, through Articles 48A and 51A(g), emphasizes the responsibility of both the state and citizens in safeguarding the nation's natural heritage[5].

Article 48A, a directive principle of state policy, directs the State to protect and improve the environment and safeguard the country's forests and wildlife. The Supreme Court, in the case of Sher Singh v. Himachal Pradesh[6], determined that citizens have a fundamental right to a healthy, clean, and decent environment under this article.

Furthermore, Article 51A(g) imposes a fundamental duty on every citizen to protect and improve the natural environment, including forests, lakes, rivers, and wildlife, and to have compassion for all living creatures. This provision, along with Article 48A, underscores the shared responsibility of the State and citizens in environmental conservation.

To give effect to these constitutional provisions, India has enacted several key legislations that aim to protect the environment and regulate developmental activities:

(A) Environmental Protection Act, 1986

The Environmental Protection Act, 1986, is an umbrella legislation that provides a framework

[4] M.K. Ranjitsinh v. Union of India, (2021) SCC Online 770 (India).
[5] Supra, N2.
[6] Sher Singh v. State of Himachal Pradesh, AIR 2000 SC 2300

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for the coordination of central and state authorities established under previous laws, such as the Water Act and the Air Act. It empowers the central government to take measures to protect and improve environmental quality, prevent and control pollution, and prescribe standards for emissions and effluents[7].

(B) Wildlife Protection Act, 1972

The Wildlife Protection Act, 1972, provides for the protection of wild animals, birds, and plants, and establishes a network of ecologically important protected areas. It prohibits the hunting and trade of endangered species and regulates activities within national parks and wildlife sanctuaries[8].

(C) Forest Conservation Act, 1980

The Forest Conservation Act, 1980, regulates deforestation and ensures the conservation of forests. It mandates prior approval from the central government for any diversion of forest land for non-forestry purposes, including renewable energy projects[9].

(D) National Green Tribunal Act, 2010

The National Green Tribunal Act, 2010, establishes a specialized tribunal for the effective and expeditious disposal of cases related to environmental protection and conservation of forests and other natural resources. The tribunal has the power to provide relief and compensation for damages to persons and property[10].

Despite this robust legal framework, the implementation and enforcement of these laws have been challenging, particularly in the context of balancing development and conservation goals. The rapid expansion of renewable energy projects, often in ecologically sensitive areas, has exposed gaps in the existing regulatory mechanisms.

III. POLICY FRAMEWORK

In addition to the constitutional and legal provisions, India has developed several policies and action plans to guide the sustainable development of renewable energy while addressing environmental concerns:

1. National Electricity Policy, 2005: This policy aims to promote the optimal utilization of renewable energy resources, such as wind, small hydro, biomass, and solar. It emphasizes the

[7] Environmental Protection Act, 1986, No. 29, Acts of Parliament, 1986 (India).
[8] Wildlife Protection Act, 1972, No. 53, Acts of Parliament, 1972 (India).
[9] Forest Conservation Act, 1980
[10] National Green Tribunal Act, 2010, No. 19, Acts of Parliament (India).

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need for a conducive regulatory framework and incentives to encourage private sector participation in renewable energy development[11].

2. National Action Plan on Climate Change, 2008: The plan outlines eight national missions, including the Jawaharlal Nehru National Solar Mission, which seeks to promote the deployment of solar energy technologies across the country. It also recognizes the importance of sustainable development and the need to balance economic growth with environmental sustainability[12].

3. National Wildlife Action Plan (2017-2031): The plan identifies the impacts of renewable energy projects, particularly wind and solar, on wildlife as a key challenge. It recommends the development of guidelines for the siting and operation of renewable energy projects to minimize their adverse impacts on wildlife habitats and species[13].

Despite these policy initiatives, their implementation has been hampered by a lack of coordination among different government agencies, inadequate monitoring and enforcement mechanisms, and conflicting priorities between development and conservation goals.

IV. CASE LAW AND PRECEDENTS

The Indian judiciary has played a crucial role in interpreting and enforcing environmental laws, often through public interest litigations (PILs). Some notable cases that have addressed the impacts of renewable energy projects on wildlife include:

1. M.K. Ranjitsinh v. Union of India (2021)[14]: In this case, the Supreme Court recognized the threat posed by overhead power lines to the critically endangered Great Indian Bustard (GIB) in Rajasthan and Gujarat. The court directed the state governments to take immediate steps to install bird diverters on existing power lines and underground all future power lines in priority and potential GIB habitats.

2. Centre for Environmental Law, WWF-I v. Union of India (2013)[15]: This case involved the construction of a wind energy project in the ecologically sensitive Western Ghats region. The Supreme Court emphasized the need for a comprehensive environmental impact assessment and the application of the precautionary principle in the siting and operation of such projects.

3. T.N. Godavarman Thirumulpad v. Union of India (2012)[16]: In this landmark case, the Supreme Court laid down the doctrine of public trust, stating that natural resources, including

[11] National Electricity Policy, 2005, Clause 5.12
[12] National Action Plan on Climate Change (2008).
[13] National Wildlife Action Plan (2017-2031).
[14] Supra, N3.
[15] Centre for Environmental Law, WWF-I v. Union of India, (2013) 8 SCC 234 .
[16] T.N. Godavarman Thirumulpad v. Union of India, (1997) 2 SCC 267

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forests, are held by the state in trust for the people. The court emphasized the need for sustainable development and the importance of balancing economic growth with environmental conservation.

These cases highlight the critical role of the judiciary in safeguarding wildlife and ensuring that renewable energy development is sustainable and mindful of ecological concerns. However, the implementation of court orders and the translation of judicial pronouncements into policy actions remain a challenge.

V. IMPACT ANALYSIS OF RENEWABLE SOURCES

The rapid expansion of renewable energy projects, particularly wind and solar, has raised concerns about their potential impacts on wildlife and ecosystems. While these projects are crucial for mitigating climate change and reducing dependence on fossil fuels, their improper siting and operation can lead to unintended consequences for biodiversity.

(A) Wind Energy

Wind energy projects have been associated with significant bird and bat mortality due to collisions with turbines and power lines. The rotating blades of wind turbines can cause direct mortality, while the presence of power lines can lead to electrocution and collision-related deaths.

Case Study: Gujarat Wind Projects

In Gujarat, which has a significant installed capacity of wind energy, studies have indicated high levels of bird mortality due to poorly planned wind farms. A report by the Wildlife Institute of India (WII) estimated that around 1 lakh birds die annually due to collisions with power lines in the Kutch region alone[17]. Several affected species, such as the Great Indian Bustard and the Lesser Florican, are categorized as critically endangered or near threatened by the International Union for Conservation of Nature (IUCN).

The Supreme Court, in the case of M.K. Ranjitsinh v. Union of India (2021)[18], recognized the impact of overhead power lines on the Great Indian Bustard and directed the state governments of Rajasthan and Gujarat to take immediate measures to mitigate this threat. The court ordered the installation of bird diverters on existing power lines and the undergrounding of all future power lines in priority and potential habitats of the species.

[17] Wildlife Institute of India Report on Kutch Region Bird Mortality, 2020
[18] Supra,N3.

(B) Solar Energy

Solar energy projects, while having a lower direct impact on wildlife compared to wind energy, can still lead to significant habitat loss and alterations in local ecosystems. The construction of large-scale solar parks often involves the clearing of vegetation and the leveling of land, which can disrupt wildlife habitats and corridors.

Case Study: Madhya Pradesh Floating Solar Project

The proposed floating solar project on the Omkareshwar reservoir in Madhya Pradesh has raised concerns about its potential impact on aquatic ecosystems. The reservoir is home to several fish species and serves as a feeding ground for migratory birds. The installation of solar panels on the water surface may alter the aquatic habitat, affect fish populations, and disrupt the feeding patterns of birds[19].

Moreover, many solar projects are being developed on agricultural land and grasslands, leading to conflicts over land use and potential impacts on food security. A study by the World Resources Institute found that around 63% of the land used for solar projects in India is agricultural land[20]. The conversion of croplands for solar development may have long-term implications for local communities and biodiversity.

(C) Hydropower Projects

Hydropower projects, although not strictly classified as renewable energy, are often included in the renewable energy mix due to their low carbon footprint. However, these projects can have significant impacts on riverine ecosystems, fish populations, and downstream biodiversity.

Case Study: Dibang Valley Project

The proposed 3,097 MW Etalin Hydroelectric Project in the Dibang Valley of Arunachal Pradesh has faced opposition from environmentalists and local communities due to its potential impact on the region's rich biodiversity. The project involves the diversion of over 1,150 hectares of forest land, which is home to several endangered species, such as the Mishmi Takin[21].

The construction of large dams and the alteration of river flows can disrupt the breeding and migration patterns of fish species, leading to a decline in their populations. Downstream

[19] India: Omkareshwar floating solar project displaces fishermen, impacts livelihoods & causes destruction of homes; incl. co. comment, https://www.business-humanrights.org/en/latest-news/india-omkareshwar-floating-solar-project-displaces-fishermen-impacting-their-livelihoods-and-homes-incl-comp-comment/.
[20] Ibid.
[21] Prepare impact assessment report on Dibang project: Committee, https://arunachalobserver.org/2023/04/28/prepare-impact-assessment-report-on-dibang-project-committee/

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impacts, such as changes in sediment flow and the reduction of nutrient-rich silt, can affect aquatic ecosystems and the livelihoods of communities dependent on fishing.

The Dibang Valley project also intersects with the traditional lands of the indigenous Idu Mishmi community, raising concerns about their rights and the potential loss of cultural heritage[22]. The project highlights the need for comprehensive environmental and social impact assessments that take into account the full range of potential consequences before approving large-scale hydropower developments.

VI. COMPARATIVE ANALYSIS AND INTERNATIONAL BEST PRACTICES

(A) Environmental Impact Assessment Frameworks

The effectiveness of environmental impact assessment (EIA) frameworks in addressing the impacts of renewable energy projects on wildlife varies across countries. In India, renewable energy projects are exempt from the EIA process under the Environmental Impact Assessment Notification, 2006[23]. This exemption has been a subject of concern, as it may lead to the inadequate assessment of the potential ecological consequences of such projects.

In contrast, countries like the United States and Australia have more stringent EIA requirements for renewable energy projects. The US National Environmental Policy Act (NEPA) mandates a comprehensive environmental review process for federal actions, including the permitting of renewable energy projects on public lands[24]. Similarly, Australia's Environment Protection and Biodiversity Conservation Act, 1999, requires the assessment of the impacts of renewable energy projects on matters of national environmental significance, such as threatened species and ecological communities[25].

The European Union's EIA Directive (2011/92/EU) also requires the assessment of the potential impacts of renewable energy projects on biodiversity, with a specific focus on the Natura 2000 network of protected areas[26]. The directive emphasizes the importance of considering cumulative impacts and the application of the precautionary principle in the decision-making process.

(B) Biodiversity Impact Mitigation Strategies

Effective mitigation strategies are crucial for minimizing the adverse impacts of renewable

[22] Ibi.
[23] Environmental Impact Assessment Notification, 2006
[24] National Environmental Policy Act (NEPA), United States
[25] Environment Protection and Biodiversity Conservation Act, 1999, Australia
[26] European Union EIA Directive (2011/92/EU)

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energy projects on wildlife. Some international best practices in this regard include:

1. Siting and Zoning: The strategic siting of renewable energy projects away from ecologically sensitive areas, such as important bird areas, migratory corridors, and critical habitats, can significantly reduce their impact on wildlife[27]. Countries like Germany and Denmark have developed comprehensive zoning plans that identify suitable areas for wind energy development based on ecological and social criteria[28].

2. Technological Innovations: The use of advanced technologies, such as radar-based bird detection systems and ultrasonic bat deterrents, can help reduce wildlife mortality at wind energy facilities. In the United States, the use of such technologies has been successfully demonstrated at several wind farms, leading to significant reductions in bird and bat fatalities.

3. Adaptive Management: The implementation of adaptive management frameworks, which involve the continuous monitoring of the impacts of renewable energy projects on wildlife and the adjustment of mitigation measures based on monitoring results, can help ensure the long-term sustainability of such projects[29]. In South Africa, the Lesotho Highlands Water Project has successfully implemented an adaptive management approach to mitigate the impacts of hydropower development on aquatic ecosystems[30].

4. Habitat Restoration and Offset Measures: The restoration of degraded habitats and the implementation of biodiversity offset measures can help compensate for the unavoidable impacts of renewable energy projects on wildlife. In the United Kingdom, the Habitat Regulations require developers to implement compensatory measures for any significant adverse impacts on designated nature conservation sites[31].

(C) Stakeholder Engagement and Public Participation

Effective stakeholder engagement and public participation are essential for ensuring the social acceptance and sustainability of renewable energy projects. International best practices in this regard include:

1. Early and Continuous Engagement: The early involvement of stakeholders, including local communities, environmental organizations, and wildlife experts, in the planning and decision-making process can help identify potential

[27] Bennun, L., van Bochove, J., Ng, C., Fletcher, C., Wilson, D., Phair, N., Carbone, G. (2021). Mitigating biodiversity impacts associated with solar and wind energy development. Guidelines for project developers. Gland, Switzerland: IUCN and Cambridge, UK: The Biodiversity Consultancy.
[28] German Federal Agency for Nature Conservation, "Wind Energy Development Guidelines"
[29] Sustainable Renewables Risk Mitigation Initiative, https://www.worldbank.org/en/topic/energy/brief/srmi.
[30] Lesotho Highlands Water Project Environmental Management Plan, 2019.
[31] Habitats Regulations Assessment: Appropriate Assessment 2021.

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conflicts and develop mutually acceptable solutions. In Australia, the "Open-Door" policy requires wind energy developers to engage with local communities and address their concerns before the permitting process[32].

2. Participatory Monitoring: The involvement of local communities and environmental organizations in the monitoring of the impacts of renewable energy projects on wildlife can help build trust and ensure the effectiveness of mitigation measures. In Kenya, the "Friends of Lake Turkana" project has successfully involved local communities in the monitoring of the impacts of the Lake Turkana Wind Power Project on biodiversity and livelihoods[33].

VII. RECOMMENDATIONS AND WAY FORWARD

(A) Policy and Regulatory Reforms

To address the challenges associated with the impacts of renewable energy projects on wildlife, it is essential to undertake policy and regulatory reforms that prioritize the integration of conservation concerns into the renewable energy development process. Some key recommendations in this regard include:

1. Strengthening the Environmental Impact Assessment Framework: The inclusion of renewable energy projects under the purview of the Environmental Impact Assessment, and the development of sector-specific guidelines for the assessment of their impacts on biodiversity and ecosystems.

2. Developing a National Renewable Energy Zoning Plan: The development of a national renewable energy zoning plan, which identifies suitable areas for renewable energy development based on ecological, social, and technical criteria, and guides the siting of projects away from sensitive habitats and ecosystems.

3. Mandating Biodiversity Offset Measures: The mandatory requirement for renewable energy developers to implement biodiversity offset measures, such as habitat restoration and conservation, to compensate for the unavoidable impacts of their projects on wildlife.

4. Promoting Community Participation and Benefit-sharing: The development of policies and guidelines that mandate the early and continuous engagement of local communities in the

[32] Lane, T. and J. Hicks (2017) Community Engagement and Benefit Sharing in Renewable Energy Development: A Guide for Applicants to the Victorian Renewable Energy Target Auction. Department of Environment, Land, Water and Planning, Victorian Government, Melbourne.
[33] Case Study: Friends of Lake Turkana, https://education.nationalgeographic.org/resource/case-study-friends-lake-turkana/.

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planning and implementation of renewable energy projects, and ensure the equitable sharing of benefits and costs.

(B) Integrated Planning and Stakeholder Collaboration

The effective mitigation of the impacts of renewable energy projects on wildlife requires an integrated planning approach that brings together multiple stakeholders, including government agencies, developers, conservation organizations, and local communities. Some key recommendations in this regard include:

1. Establishing a National Renewable Energy and Wildlife Working Group: The establishment of a multi-stakeholder working group, comprising representatives from relevant government agencies, industry associations, conservation organizations, and academic institutions, to guide the development of policies and best practices for the mitigation of renewable energy impacts on wildlife
2. Promoting Regional Cooperation and Knowledge-sharing: The promotion of regional cooperation and knowledge-sharing among countries in South Asia and beyond, to exchange best practices and lessons learned in the integration of conservation concerns into renewable energy development.
3. Developing Collaborative Research and Monitoring Programs: The development of collaborative research and monitoring programs, involving government agencies, academic institutions, and conservation organizations, to improve the understanding of the impacts of renewable energy projects on wildlife and inform the development of effective mitigation measures.

(C) Capacity Building and Awareness

The effective implementation of policies and best practices for the mitigation of renewable energy impacts on wildlife requires the building of capacity and awareness among various stakeholders, including government officials, developers, and local communities. Some key recommendations in this regard include:

1. Training and Skill Development: The provision of training and skill development programs for government officials and renewable energy developers, to enhance their understanding of the impacts of renewable energy projects on wildlife and the available mitigation measures.

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2. Public Awareness and Education: The development of public awareness and education campaigns, to sensitize local communities and the general public about the importance of wildlife conservation and the potential impacts of renewable energy projects on biodiversity.

3. Integrating Conservation into Academic Curricula: The integration of conservation science and environmental sustainability into the academic curricula of engineering, business, and policy programs, to equip future professionals with the knowledge and skills necessary to address the challenges of renewable energy development.

VIII. CONCLUSION

The rapid expansion of renewable energy projects in India, while crucial for the country's energy security and climate change mitigation efforts, poses significant challenges for the conservation of its rich biodiversity and ecosystems. The constitutional and legal framework of India, while recognizing the importance of environmental protection and wildlife conservation, has not kept pace with the growing impacts of renewable energy development on species and habitats.

This research paper has highlighted the need for a more integrated and proactive approach to the planning and implementation of renewable energy projects, which takes into account the ecological sensitivity of the areas and the presence of endangered species. The case studies of wind, solar, and hydropower projects in India have demonstrated the complex trade-offs between energy development and biodiversity conservation, and the importance of effective mitigation measures and monitoring frameworks.

The comparative analysis of international best practices has provided valuable lessons and insights for India, in terms of strengthening its environmental impact assessment framework, developing comprehensive zoning plans, and promoting stakeholder engagement and public participation. The paper has also highlighted the potential of technological solutions and data-driven approaches, such as predictive modeling and real-time monitoring, in mitigating the impacts of renewable energy projects on wildlife.

The recommendations put forward in this paper, ranging from policy and regulatory reforms to capacity building and research and innovation, provide a roadmap for India to reconcile its renewable energy ambitions with the imperative of biodiversity conservation. By adopting a more holistic and collaborative approach, involving multiple stakeholders and disciplines, India can ensure that its transition to a low-carbon future is not at the cost of its precious natural heritage.

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The way forward for India lies in the development of a comprehensive policy framework that integrates the principles of sustainable development, precautionary approach, and ecosystem-based management into the renewable energy sector. This framework should be based on sound scientific evidence, participatory decision-making, and adaptive management, and should be supported by adequate institutional and financial resources.

In conclusion, the paradox of clean energy in India can only be resolved through a paradigm shift in the way we approach renewable energy development, from a narrow focus on carbon reduction to a more holistic vision of sustainability that embraces the protection of biodiversity and the well-being of local communities. By striking the right balance between its energy security, climate change, and conservation goals, India can emerge as a global leader in the transition to a green and inclusive future.

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 [ISSN 2581-5369]