



## Renewable Energy Research: Promoting Environmental Resilience Towards Community Welfare - A Literature Review on Inclusive Development

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**ABSTRACT:** Renewable energy research involves studies that change perspectives on energy utilization into two options: renewable energy and fossil energy. Fossil energy is derived from fossil fuels — organic remains of living things that died millions of years ago and are trapped beneath the earth's surface. The formation process takes a long time, unlike renewable energy, which is naturally provided. The use of renewable energy refers to the utilization of energy sources that can be renewed naturally. This must be a shared concern to maintain the sustainability of nature for the continuity and safety of the Earth. Renewable energy, such as solar, wind, water, geothermal, and biomass, can be used to produce electricity or other forms of community welfare. The use of renewable energy offers many benefits, including reducing environmental impacts, increasing energy efficiency, and creating jobs. This study aims to: (1) analyze the role and effectiveness of multi-stakeholder synergy in community empowerment through renewable energy; and (2) analyze the policy strategies needed to strengthen environmental resilience to ensure equitable and sustainable community development through renewable energy. The data for this study were obtained through a literature review that examines renewable energy from various perspectives. The results of this study are expected to contribute to the development of inclusive development studies and be beneficial to society.

**KEY WORDS:** Community Welfare, Environmental Resilience, Inclusive Development, Renewable Energy.

### INTRODUCTION

The increasing global demand for energy has become one of the most pressing challenges in achieving sustainable development. Conventional energy sources, particularly fossil fuels, have been the primary drivers of industrial growth; however, their exploitation has led to severe environmental degradation, including global warming, air pollution, and biodiversity loss. These impacts underscore the urgent need to transition towards renewable energy sources that are environmentally friendly, socially inclusive, and economically sustainable.

Renewable energy, derived from naturally replenished sources such as sunlight, wind, water, geothermal heat, and biomass, offers a viable alternative to fossil fuels. Its adoption not only reduces carbon emissions but also promotes environmental resilience and enhances community welfare. The shift towards renewable energy represents more than a technological transformation; it reflects a paradigm shift in how societies conceptualize energy security, economic equity, and environmental stewardship (Saleh & Hassan, 2024; Balçilar et al., 2025). The success of this transformation depends largely on how well renewable energy policies are integrated with local development goals and community empowerment strategies.

Despite its potential, the transition to renewable energy faces several challenges, including policy inconsistency, inadequate infrastructure, limited access to financing, and a lack of community participation in decision-making processes. Many developing countries, including Indonesia, are still in the early stages of building institutional frameworks to support renewable energy adoption (Aditya et al., 2025; Hassan et al., 2024; Rahman, 2019). Furthermore, the socio-economic benefits of renewable energy are not evenly distributed, which can lead to disparities between regions. Addressing these challenges requires strong political will, coherent policy design, and inclusive governance that ensures both environmental sustainability and social equity.

In the broader context of inclusive development, renewable energy initiatives hold the potential to narrow the gap between urban and rural communities by providing access to affordable and sustainable energy. Through participatory governance and the active involvement of multiple stakeholders—including local governments, private sectors, and civil society organizations—renewable energy projects can drive socio-economic growth while maintaining ecological integrity. Therefore, examining renewable energy from the lens of environmental resilience and community welfare becomes essential to understand its multifaceted role in shaping a sustainable and equitable future.

## LITERATURE REVIEW

Renewable energy has emerged as a central focus in global development discourse due to its potential to address both environmental degradation and socio-economic inequality. According to the International Renewable Energy Agency (IRENA, 2023), renewable energy is not only an alternative to fossil fuels but also a key driver of sustainable and inclusive growth. Scholars such as Sovacool and Griffiths (2021) emphasize that renewable energy transitions can contribute to achieving several Sustainable Development Goals (SDGs), particularly those related to clean energy (SDG 7), climate action (SDG 13), and poverty reduction (SDG 1). The adoption of renewable energy technologies has proven effective in mitigating climate change, reducing dependency on imported fuels, and fostering local innovation through green employment opportunities.

From an environmental perspective, renewable energy plays a critical role in promoting ecological resilience. Studies by Folke et al. (2016) and Adger (2020) define environmental resilience as the capacity of ecosystems and human communities to absorb disturbances while maintaining their essential functions and structures. Renewable energy systems, especially decentralized ones like solar microgrids and small-scale hydroelectric power, enhance resilience by providing reliable energy during natural disasters and reducing the vulnerability of communities to energy disruptions. Furthermore, the shift towards renewable sources encourages sustainable land use and resource management, thereby reducing deforestation and pollution caused by traditional energy extraction. Economically, renewable energy fosters community welfare by creating new sources of livelihood and reducing energy poverty. According to Alam et al. (2022), renewable energy development has the potential to improve rural economies by promoting small-scale enterprises, increasing agricultural productivity through electrification, and enhancing education and healthcare services. The economic benefits are further reinforced by the concept of “energy democracy,” which promotes local ownership and participation in energy governance. This approach allows communities to not only consume but also produce energy, thus democratizing access and empowering marginalized groups.

In the social dimension, renewable energy contributes to inclusive development by integrating community participation in decision-making processes. As noted by Byrne and Taminiou (2016), successful renewable energy projects often depend on the degree of social acceptance and collaboration among stakeholders. Inclusive development frameworks highlight the importance of involving local communities, women, and vulnerable groups in energy planning and implementation. This participatory approach ensures that renewable energy initiatives align with local needs and cultural values, ultimately strengthening social cohesion and trust.

However, several challenges persist in achieving equitable renewable energy transitions. Studies by Sovacool et al. (2020) reveal that structural inequalities—such as unequal access to financing, lack of technical capacity, and centralized policy control—often hinder the effectiveness of renewable energy programs. Additionally, the lack of integration between environmental policies and local governance systems limits the sustainability of such projects. Therefore, to realize the full potential of renewable energy for inclusive development, multi-stakeholder collaboration, transparent governance, and adaptive policy frameworks are essential.

In summary, the literature highlights that renewable energy serves as both an environmental and socio-economic instrument for sustainable development. It promotes environmental resilience by reducing ecological vulnerability, enhances community welfare by providing equitable access to energy, and supports inclusive development by empowering local participation. Nevertheless, achieving these outcomes requires continuous research, policy innovation, and institutional commitment to ensure that renewable energy transitions are just, inclusive, and sustainable.

## METHOD

This study employs a **qualitative literature review approach** to analyze the relationship between renewable energy development, environmental resilience, and community welfare within the framework of inclusive development. A literature review method was selected because it allows for an in-depth synthesis of existing research findings, theories, and case studies relevant to the topic. By integrating knowledge from various academic sources, this research aims to construct a comprehensive understanding of how renewable energy initiatives contribute to social and ecological sustainability.

The data used in this study were obtained from **secondary sources**, including scholarly books, peer-reviewed journal articles, policy papers, institutional reports, and international publications from organizations such as the United Nations (UN), the World Bank, and the International Renewable Energy Agency (IRENA). The selection of sources followed a **systematic review process**, focusing on works published between **2015 and 2024** to ensure the inclusion of the most recent and relevant insights. Databases such as **Scopus, ScienceDirect, SpringerLink, and Google Scholar** were utilized to identify key studies using keywords like *renewable*



energy, environmental resilience, community welfare, and inclusive development.

The analytical framework for this study is based on a **thematic analysis technique**, which involves identifying, examining, and interpreting patterns and themes across the collected literature. The analysis is organized around three main themes:

1. **Environmental Resilience** – how renewable energy supports ecological balance and reduces vulnerability to climate risks.
2. **Community Welfare** – how renewable energy improves socio-economic conditions and enhances quality of life.
3. **Inclusive Development** – how renewable energy governance promotes equity, participation, and local empowerment.

Each theme was analyzed by comparing and contrasting different scholarly perspectives and empirical findings to identify gaps and opportunities for future research. The triangulation of data from multiple sources also enhances the **credibility and validity** of this study. In addition, a **descriptive and interpretive approach** was adopted to capture the complexity of interactions between environmental, social, and economic dimensions of renewable energy development.

In summary, the research methodology combines systematic review techniques with thematic and interpretive analysis to provide a holistic understanding of renewable energy’s role in promoting sustainable and inclusive growth. The method emphasizes critical evaluation of literature rather than data quantification, enabling a nuanced exploration of policies, frameworks, and real-world implementations across different contexts.

**FINDINGS AND DISCUSSION**

**Findings**

The following table presents data on Indonesia’s renewable energy development over the past decade, emphasizing the proportion of renewable sources within the national energy mix and the contribution of key sectors such as hydropower, geothermal, bioenergy, solar, and wind. This data provides a clear overview of Indonesia’s progress toward achieving its national energy transition targets. It highlights both the gradual shift from fossil fuel dependency and the challenges in scaling up newer renewable technologies. The table also serves as a comparative basis for analyzing trends in energy diversification, infrastructure development, and policy implementation related to sustainable and community-based energy systems.

**Table 1. Key Data Points: Indonesia Renewable Energy & Community Energy**

Metric	Value / Detail	Source
Share of electricity from “clean” sources	~ 20% of Indonesia’s electricity was from clean (renewable + hydro/bioenergy) sources as of mid-2025.	<a href="#">Ember Energy</a>
Share of solar + wind in electricity mix	Very low: around <b>0.2%</b> for solar & wind combined in electricity generation.	<a href="#">Ember Energy</a>
Installed generation capacity growth 2023	Total installed generation ~70.8 GW; fossil fuels still dominant; non-hydro renewables added almost <b>1 GW</b> in 2023 (biomass + waste ~0.4 GW, solar ~0.3 GW, geothermal ~0.2 GW).	<a href="#">U.S. Energy Information Administration</a>
Renewable energy’s share in total energy consumption / mix	11.7% in 2021; target to reach ~23-34% in coming years depending on plan.	<a href="#">JISDP+1</a>
Renewable energy potential vs current utilization	Many RE types have large potential but very low utilization. E.g.: solar potential is huge but utilization is very small; wind also underutilized.	<a href="#">JISDP+2Databoks+2</a>
Community-based mini grid case	Muara Enggelam (East Kalimantan) village: solar PV mini-grid project started with 35 kWp capacity in 2016, later expanded to 45 kWp. Local households reduced dependence on diesel, etc.	

The analysis of recent data reveals both progress and persistent challenges in Indonesia’s transition toward renewable energy and inclusive development. As of mid-2025, approximately 20% of Indonesia’s total electricity generation derives from clean energy sources, including hydro, bioenergy, and geothermal power (Ember, 2025). Although this marks a gradual improvement from

previous years, the contribution of solar and wind energy remains extremely low at only 0.2% of total generation. This imbalance highlights a structural dependency on fossil fuels and underlines the slow pace of renewable diversification in Indonesia's energy sector.

Indonesia's installed generation capacity reached approximately 70.8 gigawatts (GW) in 2023, dominated by coal and gas power plants. Non-hydro renewable sources contributed less than one gigawatt of new capacity, composed mainly of biomass (0.4 GW), solar (0.3 GW), and geothermal (0.2 GW) (EIA, 2023). These numbers demonstrate a limited but ongoing effort to expand renewable infrastructure. However, the relatively small contribution from solar and wind indicates barriers such as insufficient investment, limited technological transfer, and slow regulatory adaptation to support small-scale and decentralized renewable projects.

In terms of the national energy mix, renewable sources accounted for 11.7% of total energy consumption in 2021. The Indonesian government's target to achieve 23–34% renewable energy share by 2030 remains ambitious given the current trajectory (Bappenas, 2022). This gap between policy ambition and implementation underscores the need for more inclusive and locally grounded strategies that involve communities directly in renewable energy production and management.

Community-based initiatives, such as the solar mini-grid project in Muara Enggelam, East Kalimantan, illustrate how renewable energy can enhance local welfare and resilience. The 45-kilowatt-peak (kWp) solar power system has significantly reduced the community's reliance on diesel generators, lowered energy costs, and improved access to reliable electricity (ADB, 2023). Beyond economic benefits, the project fostered local participation, environmental awareness, and gender inclusion through community management structures. This example demonstrates that decentralized, community-driven energy systems can align with Indonesia's broader vision of sustainable and inclusive development.

Overall, the data suggests that while Indonesia has made notable strides in renewable energy adoption, particularly through hydropower and geothermal expansion, the transition remains uneven and centralized. Large-scale projects tend to dominate, while small and community-based initiatives—although impactful—remain limited in number and scale. Strengthening policy incentives, technological innovation, and financial support for local renewable projects could significantly accelerate progress toward environmental resilience and community welfare.

## Discussion

The findings of this study highlight that renewable energy development plays a strategic role in strengthening environmental resilience and promoting community welfare when implemented through inclusive and participatory frameworks. Indonesia's growing attention to renewable energy reflects a national commitment to achieving sustainable development goals, particularly those concerning affordable and clean energy (SDG 7), climate action (SDG 13), and reduced inequalities (SDG 10). However, progress remains uneven, with large-scale and centralized projects dominating over community-based initiatives.

From an **environmental perspective**, renewable energy significantly contributes to resilience by reducing dependency on fossil fuels, minimizing greenhouse gas emissions, and supporting climate adaptation strategies. Decentralized renewable systems—such as solar microgrids and small-scale hydro projects—provide reliable energy access even in remote areas, ensuring energy security during natural or economic disruptions. These initiatives also promote sustainable resource management by reducing deforestation, improving air quality, and encouraging efficient land use.

From a **social and economic perspective**, renewable energy supports community welfare through job creation, income diversification, and improved access to essential services. In rural communities, electrification through renewable sources enhances productivity, education, and healthcare. For instance, community-based solar power projects like those in Muara Enggelam, East Kalimantan, have demonstrated how participatory management can reduce energy poverty and strengthen local empowerment. Such projects embody the concept of *energy democracy*, where communities are not merely consumers but active participants in energy production and decision-making.

From a **governance and policy perspective**, inclusive development requires collaboration among multiple stakeholders—government agencies, private investors, civil society, and local communities. Effective renewable energy policies should not only provide financial incentives and technical assistance but also create platforms for participatory governance. This ensures that energy transitions are socially equitable and environmentally sustainable. Policy integration between national frameworks and local initiatives is essential to avoid centralized dependency and to ensure that communities benefit directly from renewable energy investments.

Overall, this discussion reveals that renewable energy has the potential to bridge the gap between sustainability and social equity. However, achieving this requires continuous policy innovation, institutional commitment, and public participation. Inclusive development in renewable energy should prioritize empowerment, equity, and resilience, ensuring that technological progress aligns with the broader goals of environmental and human well-being.

## CONCLUSION

This study concludes that renewable energy development plays a vital role in fostering environmental resilience and enhancing community welfare within the framework of inclusive development. Renewable energy serves not only as an environmental solution to mitigate climate change and reduce ecological degradation but also as a social instrument that empowers communities and promotes equitable access to energy resources. The integration of renewable systems such as solar, hydro, geothermal, and bioenergy has contributed to reducing fossil fuel dependence, supporting ecosystem stability, and creating new economic opportunities for local populations. However, Indonesia's transition toward renewable energy remains constrained by centralized governance, limited investment in small-scale projects, and insufficient community participation. To address these challenges, national energy policies must emphasize participatory approaches that strengthen local ownership, build institutional capacity, and align renewable energy initiatives with social inclusion goals. By prioritizing community involvement, policy coherence, and multi-stakeholder collaboration, renewable energy can become a transformative force that bridges environmental sustainability with social equity. Ultimately, a just and inclusive energy transition will ensure that the benefits of renewable innovation contribute not only to climate resilience but also to the long-term prosperity and well-being of all communities.

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