West Science Nature and Technology
Vol. 3, No. 02, June 2025, pp. 136~143

Analysis of the Sustainability of Renewable Energy in Supporting Indonesia's Net Zero Emissions Target by 2060

Loso Judijanto
IPOSS Jakarta

Article Info

Article history:

Received June, 2025
Revised June, 2025
Accepted June, 2025

Keywords:

Renewable energy,
net zero emissions,
sustainability,
energy transition,
Indonesia

ABSTRACT

Indonesia's commitment to achieving net zero emissions by 2060 underscores the pivotal role of renewable energy in ensuring environmental sustainability and energy security. This study analyzes the sustainability of renewable energy systems in Indonesia through a comprehensive literature review and document analysis. It examines the progress, challenges, and opportunities in renewable energy development, highlighting the critical role of policy frameworks, financing mechanisms, technological innovations, and community engagement. The findings reveal that while Indonesia has made significant strides in geothermal and hydropower, systemic barriers such as policy inconsistencies, financial constraints, and infrastructure limitations hinder the transition. Lessons from successful renewable energy transitions in Germany, India, and China provide actionable insights for accelerating Indonesia's energy transition. Recommendations include strengthening policy coherence, mobilizing green financing, modernizing energy infrastructure, and fostering international collaboration to achieve Indonesia's ambitious net zero emissions target.

Corresponding Author:

Name: Loso Judijanto
Institution: IPOSS Jakarta
Email: losojudijantobumn@gmail.com

1. INTRODUCTION

The global commitment to combating climate change has necessitated a transition to sustainable energy sources. Indonesia, as one of the world's largest greenhouse gas emitters, has pledged to achieve net zero emissions by 2060—an ambitious goal aligned with international frameworks such as the Paris Agreement, which calls for substantial reductions in carbon emissions to mitigate global warming. Central to this endeavor is the deployment of renewable energy systems as viable alternatives to fossil fuels, promoting both environmental sustainability and energy security. The Indonesian government has set targets to increase the share of renewable energy in the national energy mix—from 23% by 2025 to 31% by 2050—requiring robust policy development and strategic planning to overcome existing challenges [1], [2]. To reinforce its commitment to the Paris Agreement, Indonesia has revised its Nationally Determined Contributions (NDC) and outlined energy diversification plans through the Ministry of Energy and Mineral Resources [1], [2]. Studies indicate that scenarios involving large-scale renewable deployment

and coal retirement are both cost-effective and capable of significantly reducing CO_2 emissions [3]. The NZ50 scenario, which targets net zero by 2050, emerges as particularly effective, offering deeper emission cuts at a cost comparable to the NZ60 pathway [3]. Nonetheless, persistent challenges such as a heavy reliance on coal, gaps in policy implementation, and insufficient investment in renewable technologies remain [2]. Addressing these issues calls for the adoption of new energy technologies, enhancement of renewable energy investment, and development of supportive policies that facilitate the shift to a low-carbon economy [2].

Indonesia possesses immense renewable energy potential, with abundant natural resources such as solar, wind, hydropower, and geothermal energy; however, despite this advantage, the country faces persistent challenges in transitioning to a renewable energy-based system. Key issues include limited policy coherence, inadequate infrastructure, financial constraints, and a continued reliance on fossil fuels, all of which impede progress and complicate integration into the national grid, particularly across the country's vast and dispersed archipelago. Regulatory inconsistencies and the absence of cohesive policy frameworks further hinder the transition, necessitating effective strategies that combine economic incentives with strong political support [4]. While the government has set ambitious renewable energy targets—23% by 2025 and 31% by 2050—achieving them requires sustained and coordinated policy efforts [1]. Financial limitations, stemming from Indonesia's lower-middle-income status and constrained public budgets, pose additional barriers to infrastructure development, making international investment and finance critical to the success of its energy transition [5]. Nonetheless, progress has been made in expanding renewable energy production, particularly in geothermal, hydropower, and solar energy [6], with a theoretical capacity of up to 420 gigawatts—highlighting vast untapped potential, especially in solar and hydro energy sources [7]. To fully realize this potential, strategic planning and substantial investment in grid infrastructure are essential to address integration difficulties and ensure equitable access to clean energy throughout the nation [1], [6].

This paper examines the sustainability of renewable energy in supporting Indonesia's net zero emissions target by 2060 through a comprehensive literature review and document analysis. The study assesses the current state of renewable energy development in Indonesia, evaluates the effectiveness of existing policies and strategies, and identifies critical enablers and barriers to achieving this ambitious goal. Specifically, it seeks to answer three key questions: (1) What is the current progress of renewable energy development in Indonesia? (2) What are the main challenges and opportunities in achieving a sustainable energy transition? and (3) How can renewable energy systems be optimized to align with the net zero emissions target by 2060?

2. LITERATURE REVIEW

2.1 Renewable Energy Potential in Indonesia

Indonesia's renewable energy potential is vast, particularly in solar and geothermal energy, yet utilization remains low due to a range of challenges. Solar energy offers the largest untapped potential, with an estimated capacity of 207.8 GW and the ability to generate over 200,000 terawatt-hours per year through installations on rooftops, inland reservoirs, and maritime floating solar systems [8], [9]. Despite high irradiation levels and abundant space, infrastructural limitations and investment barriers have constrained its development. Similarly, Indonesia holds approximately 40% of the world's geothermal reserves, estimated between 27,000 to 29,000 MW, yet only around 4.2% of this has been utilized, contributing a mere 2.7% to the national electricity generation [10], [11]. Although the government has launched various programs and incentives to boost geothermal exploitation, progress has been limited by persistent regulatory and financial obstacles

[10]. In addition to policy and financial challenges, technical barriers such as the need for advanced technologies and infrastructure, along with logistical complications due to the archipelagic nature of the country, continue to hamper renewable energy development [8], [10].

2.2 Policy Frameworks and Regulatory Landscape

Indonesia's renewable energy policies, including the National Energy Policy (KEN) and the Electricity Supply Business Plan (RUPTL), are designed to boost the share of renewables in the national energy mix to 23% by 2025; however, their effective implementation faces numerous challenges. Key barriers include regulatory inconsistencies, insufficient infrastructure, inadequate incentives for private sector participation, and the absence of integrated, cohesive planning frameworks [4]. The current regulatory environment fails to sufficiently support the development and integration of renewable energy technologies, which are essential to achieving the 2025 target [12]. Economically, Indonesia remains heavily dependent on fossil fuels, and the lack of strong economic incentives and political backing further impedes progress toward a sustainable energy future [4]. To overcome these challenges, strategic tools such as geographic explicit energy modeling—like the BeWhere model—can be employed to identify optimal locations for renewable technologies based on cost-efficiency and existing infrastructure [13]. Policy recommendations include enhancing regulatory clarity and support, increasing investment in research and development, and offering targeted economic incentives to attract and retain private sector investment in renewable energy projects [12], [13].

2.3 Financing Mechanisms and Investment Challenges

The transition to renewable energy requires substantial investment, and innovative financing mechanisms are essential to bridge existing funding gaps caused by high upfront costs, perceived risks, and limited access to green financing. Public-private partnerships (PPPs) and international cooperation are critical in mobilizing the necessary resources, as demonstrated by successful models in countries such as India and Brazil, which provide valuable lessons for Indonesia. These models show how innovative financing can reduce risk and increase investment appeal, thereby accelerating the energy transition. Green bonds and crowdfunding have proven effective in attracting capital for renewable energy projects by enhancing investor confidence and promoting community involvement [14], while blockchain technology contributes to greater transparency and transactional efficiency, further lowering investment risks [14]. India's renewable energy expansion, driven by strategic PPPs and large-scale investments, underscores the importance of such partnerships in realizing climate targets [15], and PPPs can effectively distribute risks between the public and private sectors, making projects more viable [16]. Moreover, international cooperation plays a pivotal role in sharing technological and financial resources, with instruments such as green bonds and financial guarantees helping to lower barriers for investment in developing countries [17]. Case studies of global collaborations illustrate their significant impact in advancing renewable energy initiatives, offering a framework that Indonesia can adopt to strengthen its own transition strategy [18].

2.4 Technological Advancements and Grid Integration

Technological advancements in renewable energy systems—such as smart grid technologies, battery storage systems, and decentralized energy solutions—are essential for enhancing efficiency and reducing costs in Indonesia's energy transition, especially given the country's aging grid infrastructure that remains heavily dependent on coal-fired power plants. Smart grids offer improved demand response management and greater grid resilience, enabling more effective integration of renewable energy sources; however, their

implementation requires supportive legal frameworks and substantial infrastructural upgrades [19]. These technologies can address not only technical but also regulatory and financial barriers to renewable energy adoption [19]. Battery Energy Storage Systems (BESS) are particularly vital in mitigating the intermittency of renewable sources like solar and wind, with lithium-ion batteries—especially those offering four-hour storage—identified as the most suitable option, potentially supporting more than 1000 GWh of storage capacity [20], [21]. Meanwhile, decentralized energy solutions, including distributed generation systems, offer enhanced flexibility and enable deeper penetration of renewables into the energy mix, with various real-world case studies demonstrating their feasibility and the importance of such innovations in transforming Indonesia's distribution grid systems [22]

2.5 Social and Environmental Impacts

The socio-environmental dimensions of renewable energy development are crucial to ensuring the sustainability, equity, and acceptance of such projects, particularly in a diverse country like Indonesia. Community engagement plays a vital role in enhancing social acceptance and ensuring that renewable energy initiatives align with local needs and aspirations, leading to improved project design, management, and outcomes [23], [24]. Inclusive and participatory approaches not only mitigate potential risks such as community displacement, biodiversity loss, and land-use conflicts but also promote equitable distribution of benefits among all stakeholders, especially marginalized populations [24], [25]. Equitable energy access must be prioritized to ensure that clean energy reaches underserved communities, with decentralized solutions like off-grid solar systems proving effective in expanding access and reducing energy costs in developing regions [26]. To further address structural inequalities, including gender disparities in energy decision-making, equity-oriented policies and participatory planning are essential [26]. Nevertheless, challenges remain in the form of high installation costs, policy gaps, and limited funding, reinforcing the need for international cooperation and financial support to achieve a truly just and inclusive energy transition [26].

2.6 Gaps in the Literature

While substantial research has been conducted on Indonesia's renewable energy potential, critical gaps persist in understanding the systemic barriers to scaling up adoption, particularly regarding the interplay between renewable energy initiatives and the country's complex socio-political dynamics, as well as the long-term viability of existing policy frameworks. Moreover, emerging technologies such as green hydrogen and carbon capture have received limited scholarly attention, leaving significant questions about their potential role in Indonesia's energy transition. This literature review underscores the multifaceted challenges and opportunities inherent in Indonesia's renewable energy landscape and, by synthesizing insights from existing studies, lays the groundwork for a comprehensive analysis of how renewable energy can sustainably support the nation's ambition to achieve net zero emissions by 2060.

3. METHODS

This research is structured as a systematic review of academic literature, policy documents, and technical reports, employing qualitative content analysis to examine the interplay between renewable energy development and Indonesia's environmental, economic, and social goals, with the primary aim of offering an integrated perspective on the challenges and opportunities associated with renewable energy systems. The study draws on diverse data sources, including peer-reviewed academic articles on renewable energy, climate policy, and sustainability; national policy documents such as the National Energy Policy (KEN) and the Electricity Supply Business Plan (RUPTL); reports from international organizations like the International Renewable Energy Agency

(IRENA), World Bank, and Asian Development Bank (ADB); and case studies from countries with successful renewable energy transitions, such as Germany, India, and China. The data collection process involved a structured literature search using databases like Scopus, Web of Science, and Google Scholar, guided by keywords such as "renewable energy in Indonesia," "net zero emissions," and "sustainable energy transition." Document selection focused on materials from official government sources, international agencies, and reputable industry publications, followed by a rigorous screening process that prioritized relevance, quality, and recency. The qualitative content analysis involved thematic coding to identify key themes—such as policy implementation, technological challenges, and socio-economic impacts—followed by trend analysis to uncover patterns over time, and comparative analysis to extract lessons from international case studies applicable to Indonesia's renewable energy context.

4. RESULTS AND DISCUSSION

4.1 Current Progress in Renewable Energy Development

Indonesia has made significant strides in deploying renewable energy, particularly in the geothermal, solar, and hydropower sectors, yet notable challenges remain in achieving its future energy targets. As the world's second-largest geothermal energy producer with an installed capacity of 2.3 GW, Indonesia's progress reflects strong policy efforts and the strategic utilization of its abundant geothermal resources [27], [28]. The government has introduced breakthrough policies to boost geothermal development, though obstacles such as regulatory inefficiencies and social resistance persist [27]. In the solar energy sector, rooftop solar programs are beginning to gain momentum, but high costs and slow adoption continue to limit widespread implementation [6], signaling a need for increased investment and more robust policy support to enhance solar contributions to the national energy mix [12]. Hydropower also plays a key role, with large-scale projects like the Batang Toru Dam significantly bolstering clean energy capacity [6], its development exemplifies Indonesia's ongoing commitment to renewable energy expansion, especially in support of the 23% energy mix target by 2025 [28]. However, despite these advancements, the overall pace of renewable energy adoption remains insufficient to meet the ambitious 2025 and 2060 net-zero goals, necessitating more aggressive and coordinated efforts across sectors [1], [12].

4.2 Challenges in Renewable Energy Development

The analysis identifies several systemic barriers that hinder the expansion of renewable energy in Indonesia, stemming from intertwined issues in policy, finance, infrastructure, and geography. Policy and regulatory inconsistencies create a climate of uncertainty for investors, where unclear frameworks, lengthy permitting processes, and opaque procurement mechanisms slow down the implementation of renewable energy projects [4], [29]. Additionally, the lack of attractive pricing schemes and limited incentives further discourage private sector participation [27]. Financial constraints also pose a significant hurdle—high upfront investment costs, combined with limited access to financing, deter both developers and consumers in a market still dominated by cheaper coal-fired power [29], [30].

Infrastructure and geographic limitations further exacerbate these challenges. Indonesia's aging electricity grid is ill-equipped to accommodate the variable nature of renewable energy sources like solar and wind [4], and its heavy reliance on coal-based generation hinders the diversification of the energy mix [30]. Moreover, the country's archipelagic geography introduces additional logistical and financial burdens—distributing and accessing renewable energy across thousands of islands significantly increases the complexity and cost of infrastructure development [31]. These structural barriers collectively impede Indonesia's ability to achieve its renewable

energy targets and transition to a more sustainable, resilient energy system.

4.3 Opportunities for Accelerating Renewable Energy

Despite the challenges, Indonesia's renewable energy sector presents significant opportunities for advancement through policy enhancements, technological innovations, international cooperation, and inclusive community engagement. Consistent and supportive regulatory frameworks—such as feed-in tariffs and tax incentives—have proven effective in attracting investments, particularly in geothermal and hydropower projects [32]. However, inconsistencies and low tariff rates continue to hinder the growth of solar and wind sectors [32]. To address this, a cohesive policy environment that integrates economic incentives with strong political commitment is essential for removing regulatory bottlenecks and promoting a resilient renewable energy sector [4]. Technological advancements—especially in energy storage, smart grids, and decentralized systems—are vital for overcoming integration and distribution issues, though the current lack of investment in research and development remains a major barrier. Strengthening the role of universities in renewable energy innovation is also critical to building long-term technological capacity [33].

International cooperation plays a key role in addressing Indonesia's infrastructure and funding gaps. Partnerships with global institutions and foreign investors can bring in much-needed technical expertise and financial resources, as demonstrated in successful international case studies that emphasize policy stability and targeted technological strategies [32]. Moreover, inclusive planning processes that engage local communities are crucial for fostering public acceptance and ensuring that the socio-economic benefits of renewable energy projects are distributed equitably [34]. Community engagement not only enhances project legitimacy but also helps align energy initiatives with local development priorities. By harnessing these opportunities through strategic, coordinated efforts, Indonesia can accelerate its renewable energy transition and move closer to achieving its national and international sustainability goals.

4.4 Comparative Insights and Lessons Learned

The success of renewable energy transitions in countries such as Germany, India, and China offers valuable lessons for Indonesia as it seeks to strengthen its own energy transition strategy. Each of these nations has implemented distinct approaches tailored to their policy environments and market structures, resulting in significant progress in renewable energy deployment. Germany's Energiewende program underscores the importance of setting clear and ambitious targets, securing public support, and implementing innovative financing mechanisms [35]. India has leveraged competitive renewable energy auctions to significantly lower costs and accelerate deployment, offering a replicable model for Indonesia, particularly through initiatives like the bilateral CASE (Clean, Affordable, and Secure Energy) program with Germany [27], [36]. Meanwhile, China's strategy of state-led investments and massive infrastructure projects highlights the role of government leadership in overcoming financial and logistical barriers to renewable energy expansion

These international case studies reveal several key strategies that Indonesia could adopt or adapt to its own context. Germany's alignment of political will, public support, and grid infrastructure investment demonstrates that renewable energy transitions require systemic coordination and long-term commitment [35]. India's success with auctions suggests that market-based mechanisms, when transparently managed, can attract private investment and increase competitiveness in the renewable sector. For Indonesia, where financial and infrastructural constraints are persistent, China's example shows the potential of state-driven initiatives in facilitating large-scale renewable energy development [6]. By learning from these global experiences, Indonesia can formulate a

more coherent and effective renewable energy strategy that balances market mechanisms, state involvement, and community engagement to achieve its energy security and sustainability goals.[36].

4.5 Policy Implications and Recommendations

To achieve its net zero emissions target by 2060, Indonesia must adopt a multi-faceted approach:

1) Strengthen Policy Coherence: Align national energy policies with climate goals and establish robust monitoring and evaluation mechanisms.
2) Mobilize Financing: Develop green financing instruments, such as green bonds and climate funds, to reduce the financial barriers to renewable energy adoption.
3) Enhance Infrastructure: Modernize the energy grid and prioritize investments in energy storage and distribution networks.
4) Promote Innovation: Support research and development in renewable energy technologies to reduce costs and improve efficiency.
5) Foster Collaboration: Encourage public-private partnerships and international cooperation to share best practices and resources.

5. CONCLUSION

Renewable energy development is crucial to achieving Indonesia's net zero emissions target by 2060. While notable progress has been made—particularly in geothermal and hydropower—persistent challenges such as policy inconsistencies, financial barriers, and infrastructure limitations continue to hinder the acceleration of a sustainable energy transition. This study underscores the need for a coherent and supportive regulatory framework, the adoption of innovative financing mechanisms, and the modernization of energy infrastructure. Strengthening international partnerships and drawing lessons from successful global strategies can further enhance Indonesia's renewable energy landscape. Additionally, fostering community engagement and ensuring equitable energy access are vital to creating a just and inclusive transition. By capitalizing on its abundant renewable resources and implementing these strategic recommendations, Indonesia can realize its climate commitments, strengthen energy security, and actively contribute to global climate action. Though the path to net zero is fraught with complexity, it remains within reach through coordinated, multi-sectoral, and sustained national efforts.

REFERENCES

[1] M. Syabriyana, "Progress and Challenges of Renewable Energy Transition in Indonesia's Energy Mix Towards Net Zero Emissions," *JURUTERA-Jurnal Umum Tek. Terap.*, vol. 11, no. 02, pp. 76–82, 2024.

[2] H. Ardiansyah, E. Wahyuni, and P. Ekadewi, "Bridging the Gap between Policy and Net-Zero Realization in Indonesia: An Outlook of Available Approaches," in *Journal of Physics: Conference Series*, IOP Publishing, 2024, p. 12003.

[3] P. Paiboonsin, G. Oluleye, M. Howells, R. Yeganyan, C. Cannone, and S. Patterson, "Pathways to Clean Energy Transition in Indonesia's Electricity Sector with Open-Source Energy Modelling System Modelling (OSeMOSYS)," *Energies*, vol. 17, no. 1, p. 75, 2023.

[4] K. Mudhoffar and L. Magriasti, "Ekonomi Politik Energi Terbarukan: Peluang dan Tantangan di Indonesia," *Multiverse Open Multidiscip. J.*, vol. 3, no. 1, pp. 47–52, 2024.

[5] B. P. Resosudarmo, J. F. Rezki, and Y. Effendi, "Prospects of energy transition in Indonesia," *Bull. Indones. Econ. Stud.*, vol. 59, no. 2, pp. 149–177, 2023.

[6] B. S. Ramadan *et al.*, "Successful energy transition—Case study in Indonesia," in *Decarbonization Strategies and Drivers to Achieve Carbon Neutrality for Sustainability*, Elsevier, 2024, pp. 391–408.

[7] A. Raihan, "An overview of the energy segment of Indonesia: present situation, prospects, and forthcoming advancements in renewable energy technology," *J. Technol. Innov. Energy*, vol. 2, no. 3, pp. 37–63, 2023.

[8] N. A. Pambudi *et al.*, "Renewable energy in Indonesia: current status, potential, and future development," *Sustainability*, vol. 15, no. 3, p. 2342, 2023.

[9] D. F. Silalahi, A. Blakers, M. Stocks, B. Lu, C. Cheng, and L. Hayes, "Indonesia's vast solar energy potential," *Energies*, vol. 14, no. 17, p. 5424, 2021.

[10] H. Setiawan, "Geothermal energy development in Indonesia: Progress, challenges and prospect," *Gas*, vol. 1, p. 280,

2014.
[11] M. I. Alhamid, Y. Daud, A. Surachman, A. Sugiyono, H. B. Aditya, and T. M. I. Mahlia, "Potential of geothermal energy for electricity generation in Indonesia: A review," *Renew. Sustain. Energy Rev.*, vol. 53, pp. 733–740, 2016.
[12] E. T. Purba, C. Wulandari, and S. Bakri, "Kajian Hukum Kebijakan Energi Terbarukan Indonesia dan Realisasinya Menuju Tahun 2025," *Justicia Sains J. Ilmu Huk.*, vol. 9, no. 2, pp. 390–404, 2024.
[13] S. Leduc, P. Patrizio, P. Yowargana, and F. Kraxner, "An optimal renewable energy mix for Indonesia," in *EGU General Assembly Conference Abstracts*, 2016, pp. EPSC2016-14632.
[14] Y. Zhang and Y. Su, "Towards a Sustainable Future: Exploring Innovative Financing Models for Renewable Energy," *MEDAAD*, vol. 2024, pp. 34–40, 2024.
[15] S. K. MOHANTY, "Renewable energy strengthening through ecosystem in India".
[16] P. D. Long, N. H. M. Tram, and P. T. B. Ngoc, "Financial mechanisms for energy transitions: a review article," *Fulbright Rev. Econ. Policy*, vol. 4, no. 2, pp. 126–153, 2024.
[17] С. В. Плетос, С. М. Колонтай, and О. О. Бондаренко, "Тенденції розвитку транспортної логістики в Україні," *Економіка і регіон*, no. 2, pp. 92–99, 2024.
[18] V. Agbakwuru, P. O. Obidi, O. S. Salihu, and O. C. MaryJane, "The role of renewable energy in achieving sustainable development goals," 2024.
[19] C. C. Nzeanorue and B. C. Okpala, "Smart Grids and Renewable Energy Integration: Challenges and Solutions," *Path Sci.*, vol. 10, no. 9, pp. 3050–3060, 2024.
[20] C. H. B. Apribowo, S. P. Hadi, and F. D. Wijaya, "Integration of Battery Energy Storage System to Increase Flexibility and Penetration Renewable Energy in Indonesia: A Brief Review," in *2022 5th International Conference on Power Engineering and Renewable Energy (ICPERE)*, IEEE, 2022, pp. 1–6.
[21] A. Amiruddin, R. Dargaville, and R. Gawler, "Optimal Integration of Renewable Energy, Energy Storage, and Indonesia's Super Grid," *Energies*, vol. 17, no. 20, p. 5061, 2024.
[22] S. Singh and S. Singh, "Advancements and challenges in integrating renewable energy sources into distribution grid systems: A comprehensive review," *J. Energy Resour. Technol.*, vol. 146, no. 9, 2024.
[23] K. Buhmann, P. Bowles, D. Cambou, A.-S. H. Skjervedal, and M. Stoddart, "Toward socially sustainable renewable energy projects through involvement of local communities: Normative aspects and practices on the ground," in *Renewable Economies in the Arctic*, Routledge, 2021, pp. 165–183.
[24] O. T. Oladipo, I. N. Dienagha, and W. N. Digitemie, "Building inclusive growth frameworks through strategic community engagement in energy infrastructure development projects," *J. Energy Res. Rev.*, vol. 17, no. 1, pp. 1–9, 2025.
[25] P. A. Østergaard, N. Duic, Y. Noorollahi, H. Mikulcic, and S. Kalogirou, "Sustainable development using renewable energy technology," *Renewable energy*, vol. 146. Elsevier, pp. 2430–2437, 2020.
[26] L. Jiao and Y. Tan, "Social Equity and Renewable Energy Access in Developing Countries," *MEDAAD*, vol. 2024, pp. 27–33, 2024.
[27] H. Hariyadi *et al.*, "Target An Assertive Geothermal Power Development from Indonesia's Omnibus Law: A Critical Review," 2024.
[28] F. A. Munaziza, Farizal, and D. S. Gabriel, "Optimization of Dimethyl Ether (DME) Transportation Routes Using the Multi-Objectives Model," in *Proceedings of the 3rd Asia Pacific Conference on Research in Industrial and Systems Engineering*, 2020, pp. 64–68.
[29] A. Halimatussadiah, W. Kruger, F. Wagner, F. A. R. Afifi, R. E. G. Lufti, and L. Kitzing, "The country of perpetual potential: Why is it so difficult to procure renewable energy in Indonesia?," *Renew. Sustain. Energy Rev.*, vol. 201, p. 114627, 2024.
[30] K. Roesad, "Barriers to Renewable Energy Investment in the Indonesian Power Sector," 2017.
[31] E. P. Purnomo, T. Khairunisa, and C. F. Hung, "Renewable Energy and the Future of a Sustainable Economy in Indonesia," in *IOP Conference Series: Earth and Environmental Science*, IOP Publishing, 2024, p. 12051.
[32] I. Agustina, H. Khuan, B. Aditi, S. A. Sitorus, and T. P. Nugrahanti, "Renewable energy mix enhancement: the power of foreign investment and green policies," *Int. J. Energy Econ. Policy*, vol. 13, no. 6, pp. 370–380, 2023.
[33] A. N. Nurjaman, V. S. D. Soedarwo, D. S. Sayogo, and R. K. D. Susilo, "Assessing the Challenges and Opportunities for Implementing New and Renewable Energy Policy in Indonesia: A Qualitative Study," *J. Gov. Civ. Soc.*, vol. 8, no. 1, pp. 77–90, 2024.
[34] L. C. Cameron and X. van Tilburg, "Barriers to medium scale renewable electricity generation in Indonesia," *ECN Policy Stud.*, 2016.
[35] P. Sopher, "Lessons Learned from Germany's Energiewende: The Political, Governance, Economic, Grid Reliability, and Grid Optimization Bedrock for a Transition to Renewables," *Renew. Energy Law Policy Rev.*, vol. 6, no. 2, pp. 99–112, 2015.
[36] A. Nazarov, V. Sulimin, and V. Shvedov, "Renewable energy sources: global implementation experience," in *E3S Web of Conferences*, EDP Sciences, 2024, p. 1030.