

Rural Green Financing: Tackling Challenges For Village-Based Energy Transition

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Abstract

Indonesia's target of achieving net-zero emissions by 2060 requires a massive energy transition, which must be implemented starting at the village level. Green energy independence at the village level will significantly contribute to the national energy mix target. Given that the energy transition entails a substantial financial burden, private sector participation is imperative. Green bonds have emerged as a viable financing instrument, with Village-Owned Enterprises serving as strategic entities for implementation. This study examines the challenges of accessing green financing to strengthen village capacity in undertaking energy transition initiatives. Employing a normative juridical approach—encompassing statutory, conceptual, and comparative analyses—the research highlights the critical role of green bonds, as one of the key financial mechanisms, in advancing village-based energy transition. The findings indicate that while green bonds are recognised as an important financing tool, their legal framework remains underdeveloped, thereby limiting their potential as an effective instrument of green financing.

I. Introduction

Indonesia's energy consumption remains predominantly reliant on fossil fuels, with coal (37.2%), petroleum (32.2%), and natural gas (18.9%) constituting the principal sources of domestic energy use usage (Krisnawati, 2023). By 2024, the share of renewable energy had reached only 14,68%, well below the national target of 23% by 2025 (Mineral, Direktorat Jenderal Energi Baru, 2024). This shortfall demonstrates a substantial gap between policy objectives and actual progress, highlighting the urgency of adopting more effective strategies to accelerate the energy transition.

The enduring reliance on fossil fuels in Indonesia is closely associated with intensified mining activities, which in turn contribute to environmental degradation, escalating carbon emissions, and the worsening of climate change (EU, 2022)— developments that stand in sharp contrast to Indonesia's commitments under the Paris Agreement, ratified through Law No. 16 of 2016. The Agreement seeks to limit the rise in global temperature to below 2°C, with Indonesia pledging carbon reduction and the attainment of Net Zero Emissions (NZE) by 2050 or, at the latest, 2060, as stipulated in the Enhanced Nationally Determined Contribution (ENDC) and reaffirmed at COP 29 (Change, 2024).

Indonesia's NZE commitment is also grounded in constitutional mandates, notably Article 28H(1) of the Indonesian Constitution, which guarantees the right to a healthy environment, and Article 33(4), which requires environmentally sustainable economic development. In this regard, the government, as the principal regulator, is obliged to establish a robust legal and policy framework to ensure the sustainable utilisation of energy resources (Yusa & Hermanto, 2018).

The utilisation of renewable energy is a fundamental pillar of the energy transition and serves as a crucial instrument for achieving NZE while upholding environmental rights, as mandated by the Constitution. Indonesia possesses vast renewable energy potential, including micro-hydro (95 GW), solar energy (3,286 GW), wind energy (155 GW), geothermal energy (23 GW), and bioenergy (95 GW) (Mineral, Direktorat Jenderal Energi Baru, 2024). Nevertheless, despite this substantial potential, the contribution of renewable energy has consistently fallen short of the targets set within the national energy mix, reflecting a persistent gap between policy ambition and actual implementation (Mineral, Direktorat Jenderal Energi Baru, 2024). Geothermal, for example, from 40% of world geothermal reserves, Indonesia only able to utilised less 10% of the potential (Wahyuni, 2023). One of the principal barriers lies in financing, as renewable energy projects often require substantial upfront investment and long-term capital support, which remain inadequately addressed by existing

mechanisms.

The policy framework for new and renewable energy development is articulated in the Draft New and Renewable Energy Law (Draft NRE Law), which, at the time of writing, has yet to be enacted. Article 59(1) of the Draft NRE Law mandates collaboration between the government and society in the management, development, and implementation of renewable energy (T. I. E. Agency, 2023). In this regard, active community participation emerges as a critical factor in accelerating the transition to sustainable energy, particularly through the involvement of both State-Owned Enterprises and Village-Owned Enterprises. Strengthening financial accessibility—such as through green bonds and other innovative financing mechanisms—will be indispensable in enabling village-based actors to effectively contribute to Indonesia's energy transition.

Optimising the role of Village-Owned Enterprises (VOEs) in renewable energy management is central to realising the concept of Community-Owned Renewable Energy (CORE) (Davies et al., 2021). This approach fosters resilient local energy systems by leveraging community participation. The CORE framework is particularly important in shifting the prevailing paradigm that places sole responsibility on the government for achieving ENDC targets. It ensures that renewable energy development is aligned with regional potential while simultaneously enhancing public awareness and engagement in the transition towards sustainable energy.

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Despite its promise, CORE implementation through VOEs remains limited. The high costs associated with renewable energy utilisation have prevented large-scale or optimal adoption. VOE financing continues to rely heavily on central government transfers through the Village Fund (Saputra, 2021), leaving local enterprises with inadequate resources to expand renewable energy initiatives or achieve village-level energy self-sufficiency (DJP, 2020). This structural dependence highlights the need for alternative financing instruments capable of supporting decentralised energy transitions.

In this regard, green bonds present a potential solution. Designed to finance environmentally sustainable projects, green bonds have gained

significant traction globally and demonstrate strong growth potential. They could provide VOEs with access to long-term financing under the CORE framework, thereby facilitating sustainable and community-driven energy transitions (Nordea, 2023). However, in Indonesia, no legal framework currently recognises green bonds as a financing instrument for renewable energy projects at the VOE (BUMDes) level or within the implementation of CORE.

Accordingly, this article examines the role of green bonds as a financing instrument for VOE-led renewable energy projects, analyses the legal and institutional challenges to their implementation, and evaluates their compatibility with the CORE framework. By addressing these issues, the study contributes to the broader discourse on sustainable financing and the decentralisation of energy transition strategies in Indonesia.

2. Research Method

This study employs a descriptive and analytical legal research methodology to evaluate the viability of green bonds as a financing mechanism for BUMDes-led renewable energy projects within the Community-Owned Renewable Energy (CORE) framework. It adopts a normative approach, drawing on legal principles and doctrines established by both the legislature and the judiciary (Hutchinson, 2018), integrates statutory, conceptual, and comparative analyses (Watkins & Burton, 2017). The statutory approach examines relevant legislation, regulatory instruments, and international commitments, while the conceptual approach explores the doctrinal basis of green bonds, renewable energy development (NRE), and CORE as frameworks for decentralised energy transition. The comparative approach considers international practices in green bond regulation and community-based renewable energy financing to identify insights applicable to the Indonesian context. Legal materials consist of primary sources, including statutory law, regulatory provisions, and judicial decisions, alongside secondary sources such as scholarly literature, policy papers, and expert commentary (Marzuki, 2017). with a systematic analysis conducted to ensure regulatory coherence (Marzuki, 2017).

3. Results and Discussion

Indonesia's Commitment On Energy Transition

Indonesia's commitment to energy transition is integral to its broader climate agenda. This commitment is reflected in the National Energy Policy, which mandates that energy management adhere to the principles of equity, sustainability, and environmental awareness, with the objective of achieving energy independence and national energy resilience. This policy framework is

reinforced in Article 2 of Government Regulation No. 79 of 2014 on the National Energy Policy (GovReg 79/2014). The national energy mix, which sets the blueprint for balancing fossil fuels and renewable energy sources, is primarily designed to address energy security. Energy security itself is assessed through four key parameters, known as the 4As: availability, accessibility, affordability, and acceptability (Wahyuni et al., 2023). In aligning energy security with climate commitments, the government issued Presidential Regulation No. 112 of 2022 on the Acceleration of Renewable Energy Development for Electricity Supply (PresReg 112/2022) (K. E. dan S. D. M. R. Indonesia, 2022). This regulation strengthens Indonesia's energy transition agenda, promotes green energy development, and supports the achievement of NZE.

Financing remains a crucial factor in advancing green energy development. Renewable energy projects are inherently complex, requiring high investment costs, advanced technology, and risk mitigation. Ensuring adequate financial support is therefore essential for the development and expansion of renewable energy infrastructure. Financing, however, is often perceived as the sole responsibility of the central government and is largely directed towards large-scale national projects, resulting in high costs and limited local participation. This top-down approach needs to shift towards a bottom-up model, where community involvement is central to green energy initiatives. In such a framework, the government can empower state-owned, local-owned, and village-owned enterprises to implement renewable energy projects, thereby ensuring broader engagement and alignment with sustainability goals.

Indonesia's international commitments also shape its energy transition pathway (Colgan & Hinthorn, 2023). The country has long demonstrated its commitment by joining the UNFCCC and subsequently ratifying the Paris Agreement through Law No. 16 of 2016. This ratification signalled a new phase in Indonesia's climate mitigation efforts, binding the state to act in coherence with global mitigation and adaptation objectives. In line with Article 4 (9) and Article 14 (1) of the Paris Agreement, state parties are obliged to submit their Nationally Determined Contributions (NDCs) and Long-Term Strategies (LTS). On 23 September 2022, Indonesia submitted its Enhanced NDC, outlining updated commitments to accelerate its energy transition and climate action.

Table 1. Emission Level of Energy Sector

Sector	GHG Emission Level 2010* (MTon CO2-eq)	GHG Emission Level 2030			GHG Emission Reduction				Annual Average Growth BAU (2010-2030)	Average Growth 2000-2012
		MTon CO2-eq			MTon CO2-eq		% of Total BaU			
		BaU	CM1	CM2	CM1	CM2	CM1	CM2		
1. Energy*	453.2	1,669	1,311	1,223	358	446	12.5%	15.5%	6.7%	4.50%
2. Waste	88	296	256	253	40	43.5	1.4%	1.5%	6.3%	4.00%
3. IPPU	36	69.6	63	61	7	9	0.2%	0.3%	3.4%	0.10%
4. Agriculture	110.5	119.66	110	108	10	12	0.3%	0.4%	0.4%	1.30%
5. Forestry and Other Land Uses (FOLU)**	647	714	214	-15	500	729	17.4%	25.4%	0.5%	2.70%
TOTAL	1,334	2,869	1,953	1,632	915	1,240	31.89%	43.20%	3.9%	3.20%

Notes: CM1= Counter Measure 1 (*unconditional mitigation scenario*)

CM2= Counter Measure 2 (*conditional mitigation scenario*)

*) Including fugitive.

**) Including emission from estate and timber plantations.

(Source: Indonesia Enhanced NDC, 2022)

In line with the Enhanced NDC, the government published the Long-Term Strategy for Low Carbon and Climate Resilience 2050 (LTS-LCCR 2050) on 22 July 2021 (Colgan & Hinthorn, 2023). This document sets out several scenarios for reducing greenhouse gas (GHG) emissions and addressing climate change, namely: (i) the extended unconditional commitment of the NDC or current policy scenario (CPOS), (ii) the transition scenario (TRNS), and (iii) the low-carbon scenario compatible with the Paris Agreement target (LCCP) (Nurbaya, 2021). Furthermore, in the energy sector, the LTS-LCCR outlines several pivotal pathways for climate mitigation. These include: (i) the implementation of energy efficiency measures; (ii) the use of decarbonised electricity in the transport and building sectors; (iii) a fuel shift from coal to gas and renewables in industry; and (iv) the enhancement of renewable energy across power, transport, and industry. The implementation of energy efficiency measures is supported by the Clean Technology Fund, a strategic policy initiative that seeks to accelerate the promotion of efficiency, electrification of transport, and expanded access to electricity, backed by a financial commitment of USD 400 million (Pacific, 2020). This strategy also highlights the role of green bonds as a tool to address the investment gap for achieving the 2030 energy transition targets.

The Announced Pledges Scenario (APS) further underlined Indonesia's efforts to expand access to clean energy, including the use of bioenergy in the industrial sector, with projections of approximately 3.3 EJ of modern solid bioenergy being utilised by 2060 (I. E. Agency, 2022). Meanwhile, in the transport sector, Indonesia has pledged to increase the use of biofuels, with a target of doubling the 10 percent share recorded in 2021 by 2030 (I. E. Agency, 2022). These strategic measures are intended to reduce GHG emissions in the

energy sector from 1,030 MtCO₂e in 2030 to around 572 MtCO₂e by 2050 (I. E. Agency, 2022). Enhanced NDC which submitted by the government to the UNFCCC strengthen the strategy by stating mechanism for energy efficiency and low carbon (Table 1).

Table 1

Energy Sector 2030		
Mitigation Actions		CM1
Renewable Energy (RE)	Additional RE in Power according to RUPTL	Installed RE 20,923 MW
	Solar rooftop, PV *Wilus and Hydro *Wilus, Off grid RE	Installed RE 15,483 MW
	Biofuel	18 million KL FAME in B-40
	Cofiring	Biomass utilisation 9 Mton
	Direct Utilisation of Biomass and Biogas for off-grid power generation	333,776 BOE
Energy Efficiency	Enhanced Energy Management Mandatory	oil fuel saving 71 million BOE
	Energy Efficiency Improvement of Equipment	electricity saving 15,187 GWh
	Electric Vehicle (EV)	15,197,000 units
	Street lighting with efficient lamp	energy saving 1,31 million BOE
	Induction Electric Stove	18,170,000 units
Low Carbon Emitting Fuels	Oil Fuel Switching (from RON 88 to Higher RON)	4,050,000 KL
	Kerosene to LPG Conversion	8,247,000 Ton

	CNG for public transport	1,029 MMSCFD
	Gas Pipeline Network Expansion	10 million connections
Clean Coal Technology and Gas Power Plant		27,487 MW
Post Mine Reclamation		81,069 Ha

(Source: Annex 1 Enhanced NDC, 2022)

Village-Owned Enterprises: Catalyst for Community Owned Renewable Energy

Table 1 illustrates the extent of the country's potential in renewable energy; nonetheless, financing remains a crucial factor in advancing green energy development. Renewable energy projects are inherently complex, characterised by high costs, advanced technological requirements, and considerable risks. Ensuring adequate financial support is therefore indispensable for the development and expansion of renewable energy infrastructure. At present, financing is often regarded as the sole responsibility of the central government and is predominantly allocated to large-scale national projects, leading to high costs and limited community engagement. This top-down approach necessitates a shift towards a bottom-up model in which community participation becomes central to green energy initiatives. Within such a framework, the government can leverage state-owned, regional-owned, and village-owned enterprises as key institutions for implementing renewable energy projects, thereby ensuring broader participation and greater alignment with sustainability goals.

The legal foundation for Village-Owned Enterprises (VOEs) - *Badan Usaha Milik Desa*- is provided under Article 117 (1) of Law No. 11 of 2020 on Job Creation, which amended Article 1 (6) of Law No. 6 of 2014 on Villages. VOEs are defined as legal entities established by a village or a consortium of villages to manage businesses, utilise village assets, develop investment activities, provide services, and engage in other enterprises for the welfare of the village. A similar definition is codified in Article 1 (1) of Government Regulation No. 11 of 2021 on Village-Owned Enterprises (GovReg 11/2021), issued as the implementing regulation of the Job Creation Law. This legal framework positions VOEs as key drivers of economic governance and rural development, enabling the mobilisation of local resources to foster entrepreneurship and

reduce unemployment. It should be noted that the legislative process of the Job Creation Law was procedurally flawed, leading to a Constitutional Court decision requiring meaningful public participation. As a result, Law No. 6 of 2023 was enacted to replace the 2020 Job Creation Law, while retaining its substantive provisions. Consequently, the amendment to the Village Law concerning VOs, together with Government Regulation No. 11 of 2021, remains in force and continues to provide the legal foundation for the role of VOs in advancing local economic and energy transition initiatives.

Referring to Friedmann's mixed economy theory, the presence of state, local government, and village-owned enterprises reflects the state's entrepreneurial function in economic development (Friedman, 1971). Schumpeter emphasises that entrepreneurs play a crucial role in fostering economic growth by driving innovation, creating employment opportunities, and improving societal welfare (Schumpeter, 1934). Consequently, a greater number of entrepreneurs is positively correlated with higher levels of economic development (Malia, 2018). In this context, VOs embody the government's entrepreneurial function, serving not only as entities for profit generation but also as tangible instruments of national energy policy in advancing commitments to green energy development.

The government has begun prioritising local-based energy development to enable communities to meet their own needs. This commitment is reflected in Minister of Energy and Mineral Resources Regulation No. 25 of 2013, which amends Regulation No. 32 of 2008 on the Supply, Utilisation, and Trade of Biofuels as Alternative Fuels (MEMR 25/2013) (Desa, 2023), and introduces the concept of energy self-sufficient villages that utilise local renewable sources to supply more than 60 percent of their energy requirements. This initiative positions VOs as central actors in managing renewable energy under the Community-Owned Renewable Energy (CORE) model, which facilitates collective management and accelerates the transition to sustainable energy (EU, 2024). Community participation is essential for effective energy governance. Principle 10 of the Rio Declaration recognises public involvement as a foundation of environmental governance, while Article 59 of the Draft New and Renewable Energy Law formalises this right within Indonesia's context. Genuine stakeholder engagement bridges the gap between communities and decision-makers, fostering trust, acceptance, and the long-term sustainability of renewable energy projects. Empowering VOs through the CORE model not only advances energy transition goals but also translates participatory governance into practice. Although MEMR 25/2013 focuses primarily on biofuels, its underlying principle—utilising local renewable resources to

strengthen village-level energy security—can be extended to other forms of renewable energy. Achieving this expansion, however, requires addressing the critical challenge of financing, for which innovative instruments such as green bonds can provide sustainable support.

The energy self-sufficient village programme offers a promising strategy to optimise renewable energy utilisation. The IEA estimates Indonesia’s renewable energy potential at 3,692 gigawatts; yet, as of 2021, only 10.5 gigawatts, or 0.3 percent, had been realised (I. E. Agency, 2022). This stark gap demonstrates that regulatory initiatives alone are insufficient without addressing the financial barriers to renewable energy deployment. Micro-scale projects managed by VOEs present an opportunity to expand energy independence while promoting environmental sustainability. In Central Java, for example, 2,353 villages have adopted this programme, producing tangible benefits such as job creation, poverty reduction, and enhanced community skills (P. I. Indonesia, 2023).

Similar initiatives can be seen in Tasikharjo Village, Tuban, East Java, where solar panels are used to support small and medium enterprises, including the production of Batik Sekar Tanjung and the culinary hub *Kampung Kuliner Pujasera Energi* (K. Indonesia, 2019). Comparable successes have been recorded in Eka Jaya Village (Jambi), Larangan Village (Cirebon), Singapura Village (Lahat), and Kalijaran Village (Cilacap) (K. Indonesia, 2019), all of which demonstrate how renewable energy can drive community-based economic development. These initiatives highlight the pivotal role of VOEs in managing renewable energy projects that not only support the broader energy transition but also strengthen local economy. However, replicating and scaling these successes requires innovative financing beyond government transfers. Green bonds, managed through VOEs, offer a promising mechanism to mobilise sustainable local investment and enhance the CORE model (EU, 2024), in which communities collectively manage renewable energy to ensure household, educational, business, and public infrastructure needs are sustainably met (Institut, n.d.). While relatively new in Indonesia, this approach reflects a long global tradition of community-based energy management, seen since the late nineteenth century in Europe and the United States through rural electrification cooperatives.

Green Bond : Green Financing instrument

A bond is generally defined as a medium- to long-term debt instrument that can be traded and is classified as a type of security listed on the stock exchange (Rosuli et al., 2025). Bond is one form of capital securities. A bond

obliges the issuer to pay periodic interest (coupons) and repay the principal at the end of the agreed term (Arifardhani & Selian, 2024). Green bonds, however, are specifically designed to fund environmentally sustainable projects while offering investors a fixed or regular return (Bhutta et al., 2022). Their structure mirrors conventional bonds, but with a binding commitment that proceeds are allocated exclusively to projects with measurable environmental benefits, particularly in renewable energy development (Hu & Jin, 2023). Since the World Bank first issued green bonds in 2008, investor appetite for sustainable instruments has grown rapidly, reflecting heightened awareness of climate risks following the 2007 Intergovernmental Panel on Climate Change (IPCC) report linking human activities to global warming (Monteiro et al., 2022).

In Indonesia, green bonds are regulated under Financial Services Authority Regulation (POJK) No. 60/POJK.04/2017 on the Issuance and Requirements of Debt Securities with Environmental Insight (Green Bonds) (POJK No.60/POJK.04/2017), which defines them as debt securities whose proceeds are used, in whole or in part, to finance environmentally sustainable business activities (Article 1 (2)). The introduction of this regulation reflects recognition that conventional financing instruments alone are insufficient to meet Indonesia's ambitious renewable energy targets (Yunita et al., 2023). By mobilising private capital, green bonds serve as a strategic mechanism to bridge the persistent financing gap, reduce reliance on government budgets, and channel investment directly into projects that advance Indonesia's energy transition and climate commitments (Rakatama et al., 2024).

At the village level, however, funding for VOEs remains dominated by central government transfers, as outlined in Article 72 of the Village Law and its implementing regulations. This structure mirrors the broader dependency of village budgets on national allocations through Transfers to Regions and Village Funds (Widhiawati & Darma, 2025). Such heavy reliance not only creates fiscal dependency but also limits the capacity of VOEs to expand renewable energy initiatives. Integrating VOEs into Indonesia's green bond framework would enable them to mobilise private investment directly for community-based renewable energy projects. This approach would diversify village revenue sources while empowering VOEs to play a more active role in advancing the local energy transition. Green bonds also offer a strategic solution to reduce the renewable energy sector's dependence on the national budget, which has so far remained the primary funding source. Greater collaboration with the private sector is therefore essential to ensure sustainable financing of the transition (Andrea et al., 2022). Viewed through the Political, Economic, Social, Technological, Legal, and Environmental (PESTLE) framework, renewable

energy adoption faces resisting factors such as political instability, economic limitations, and societal reluctance. Bottleneck factors, including regulatory and structural barriers, also slow progress. Nevertheless, enabling elements such as financial incentives, technological innovation, and supportive regulation serve as driving forces that accelerate global climate commitments, strengthen market demand, and increase public awareness of sustainable energy.

Green bonds fall under the category of indirect investment and have gradually evolved into new forms, such as green sukuk, which are structured in accordance with Islamic law but follow the same fundamental principles (Muttaqin, 2024). In Indonesia, their development has shown notable progress. While data from the Ministry of Finance for 2019–2021 specifically records green sukuk, total issuance during this period reached 1 trillion rupiah, demonstrating strong investor enthusiasm and optimism that could support the broader growth of green bonds (Ambrose et al., 2023). Despite this potential, the current regulatory framework under POJK No. 60/POJK.04/2017 does not yet accommodate the financing of green bonds for VOEs. This regulatory gap is significant, as ensuring community participation and awareness in the energy transition is crucial to enable villages to achieve energy self-sufficiency. VOEs, therefore, represent an important institutional instrument for bridging this participation, allowing local communities not only to manage renewable energy projects but also to benefit directly from their economic and environmental impacts. According to POJK No. 60/POJK.04/2017, green bonds are specifically designated for financing environmentally sustainable projects. To ensure accountability and investor confidence, the regulation outlines a set of eligible project categories that define which initiatives may receive financing through this instrument. The categories are presented in the following table.

Tabel 1: *Green Bond* classification

No.	Categories	Eligible Projects
01	Renewable Energy	Power generation from renewable energy sources, including offshore and onshore wind, solar power, tidal energy, hydropower, and geothermal energy.
02	Energy Efficiency	Improvement of energy efficiency in infrastructure, resulting in energy

		consumption at least 10% below the national average energy consumption for equivalent infrastructure.
03	Green Transportation	Electric transportation, hybrid vehicle modes, light rail transportation, and mass rapid transit.
04	Sustainable Management of Natural Resources	Irrigation.
05	Sustainable Water Management	Waste minimization, collection, management, rehabilitation of areas, water supply management, and drainage.
06	Pollution Management	Management of contaminated land and waste, including waste management and decontamination, waste prevention, and waste-to-energy conversion. Management of contaminated land and waste, including waste management and decontamination, waste prevention, and waste-to-energy conversion.

source: Author analysis from <https://ptsmi.co.id/green-bonds>

Table 1 identifies renewable energy as one of the project categories eligible for green bond financing under Article 4 of POJK No. 60/POJK.04/2017. This alignment demonstrates the suitability of green bonds as a financing mechanism for VOEs engaged in renewable energy management and utilisation. In principle, VOEs operating in environmentally sustainable energy initiatives should therefore be eligible to benefit from green bond financing. However, in practice, VOEs face significant barriers to accessing the stock exchange. A major obstacle is that most VOEs have not yet adopted the accounting standards required for public listing, while weaknesses in managerial capacity, financial transparency, and community engagement further constrain their credibility (Winarti et al., 2023). These factors are critical for attracting investor confidence, as bond issuers must demonstrate robust governance and accountability. Additional challenges include the absence of proper oversight and evaluation mechanisms for the use of investor funds and

the lack of clear risk management frameworks tailored to VOEs. Collectively, these structural deficiencies hinder VOEs from leveraging green bonds as a viable financing tool, despite the strong regulatory and policy rationale for their inclusion.

Utilising Green Bonds as a Financial Instrument for Village-Owned Enterprises within Community-Owned Renewable Energy Framework

The implementation of community-based green bonds has been successfully demonstrated in the United Kingdom through the Community Municipal Investment (CMI), a specialised financing mechanism established by municipal authorities and managed via a regulated investment platform (Ranjan, 2025). Introduced in 2020, the CMI was designed to support local communities in financing low-risk renewable energy projects while diversifying funding sources (Sierro & Blumer, 2025). One of its notable applications was in West Berkshire, where it financed renewable energy infrastructure to advance the region's carbon neutrality target for 2030 (Cintra et al., 2025). Investor capital was directed with high transparency into green infrastructure projects such as solar panels, electric vehicle charging stations, and community-based renewable energy systems.

This model has since become a benchmark for community green finance, having supported renewable energy development across 404 local authorities and mobilised approximately 3 billion euros, with return rates ranging from 1 to 1.5 percent. Its credibility is reinforced by a low-risk profile, strong transparency standards, and an innovative risk management framework. A study by the Place-Based Climate Action Network (PCAN) highlights the model's significant role in promoting local engagement, reporting that 73 percent of UK savers and investors expressed interest in community-issued green bonds. The modest return rate was generally viewed positively, reflecting a preference for low-risk, transparent, and accountable investment mechanisms that align with sustainable energy objectives.

A key feature of the CMI is its safety net mechanism, under which local governments act as guarantors, thereby reducing default risks and enhancing investor confidence. Operationally, the financing mechanism follows a structured process, beginning with project mapping and needs classification by local authorities, followed by approval procedures, bond issuance, and transparent fund allocation (Zhang et al., 2021). This layered approach ensures both financial accountability and effective delivery of community-based renewable energy projects. Furthermore, the second stage involves submission, where project proposals for green bond issuance are submitted to the CMI for

selection in renewable energy management. The selection process evaluates existing assets and applies three criteria: (i) an environmental impact assessment of renewable energy production and management, referencing the Green Bond Principles and Sustainable Bond Guidelines; (ii) an asset assessment based on energy performance standards, using the Look Back Period parameter; and (iii) an evaluation of renewable energy management and infrastructure sustainability, aligned with future financing through green bonds (Pregmolato et al., 2022). Next, fund framework development is on the third stage, in which the CMI establishes a structured plan for allocating bond proceeds to renewable energy projects. By adhering to the European Green Bond Regulation, this stage ensures high issuance standards and minimises the risk of greenwashing. The fourth stage entails preparation of a prospectus, detailing fund utilisation, infrastructure investment, renewable energy management, and the anticipated environmental and financial impacts (Akhigbe et al., 2024).

In the fifth stage, the city council collaborates with the CMI to issue green bonds on the stock exchange (Lin & Hong, 2022). These bonds, characterised by low interest rates and minimal risk, are offered with a defined maturity period. Once investors are secured, the sixth stage involves fund management, with proceeds temporarily held in cash, government bonds, or short-term assets under the oversight of the city council. Rigorous tracking, monitoring, and reporting are ensured through treasury functions and external audits, reinforcing transparency and accountability. The final stage focuses on impact reporting, where issuers disclose fund allocation and project outcomes, supported by independent ratings to strengthen investor trust and long-term sustainability (Roor & Maas, 2024).

Learning from CMI, before proposing a similar mechanism for Indonesia, it is essential to assess national strengths, weaknesses, opportunities, and challenges in implementing community-based green bonds. Indonesia's vast renewable energy potential positions green bonds as a viable instrument for strengthening community-owned renewable energy, with community participation as a critical component of success. However, weaknesses remain, particularly the absence of a dedicated regulatory framework and specialised oversight body. Opportunities are significant, given the existence of 83,381 villages nationwide (Zhao et al., 2024), but challenges persist. These include limited financial literacy in rural areas, low awareness of investment mechanisms, and the legal status of VOEs, of which only 12,945 had legal recognition as of March 2023, while 42 percent of villages have yet to establish one. The capacity constraints faced by VOEs must also be addressed by the

government, particularly in relation to human resources. Capacity-building programmes are essential to strengthen the managerial competence of VOE board members, ensuring they are able to comply with regulatory requirements, implement sound financial management, and oversee renewable energy projects effectively. Government-led training and technical assistance would enhance VOEs' ability to operate transparently, attract investor confidence, and manage community-based renewable energy initiatives in a sustainable manner.

This study identifies three fundamental aspects that must be addressed to enable the use of green bonds as a financial instrument for VOEs in developing renewable energy within the CORE model. Drawing on Lawrence M. Friedman's legal system theory, these aspects are: (i) legal substance; (ii) legal structure; and (iii) legal culture (Asyiqin et al., 2025). From the perspective of legal substance, financing VOEs through green bonds for renewable energy management requires formal legal recognition. A new regulatory framework must define the mechanisms, classifications, and eligibility criteria for VOEs-based green bond financing. Under Article 7(1) of Law No. 12 of 2011 on the Law-Making Process, Financial Services Authority (OJK) regulations are not part of the formal hierarchy of laws, which limits the legal standing of POJK No. 60/POJK.04/2017. To address this, a Government Regulation should be adopted as the formal legal foundation for green bonds, complemented by specific provisions in the forthcoming NRE Law to ensure coherence and sustainability of the financing framework. For implementation, a Green Bond Committee should be established under the Ministry of Finance to oversee regulatory compliance, feasibility assessments, issuance, and risk management, in coordination with OJK and relevant ministries. OJK would act as the registration body for VOEs, while the Committee would provide supervisory authority to ensure financial transparency and accountability. Coordination with the Ministry of Villages would support certification and empowerment of VOEs, and the Ministry of Energy and Mineral Resources would contribute to infrastructure development, capacity-building, and energy classification. The Committee should also include experts in environmental science, renewable energy, and investment to strengthen monitoring, evaluation, and impact assessment, thereby ensuring rigorous governance of green bond financing.

In addition, Friedmann highlighted legal culture as one of the essential aspect in legal theory. It intended to foster public awareness and active community participation. Indonesia's tradition of *gotong royong* (mutual cooperation) and communal engagement provides a strong foundation for implementing community-based green bond financing. This collective ethos

can encourage active participation in renewable energy projects, ensuring their sustainability and integration into the local economy. Yet, improving public literacy on green energy and financial instruments remains essential. The government should therefore prioritise awareness campaigns, socialisation, and training programmes to familiarise communities with the concept and benefits of green bonds. In addition, community-based supervision needs to be institutionalised, either through VOs or direct public involvement in monitoring and reporting to the Green Bond Committee. Such participatory oversight would not only enhance accountability and build public trust but also embed collaborative governance in the financing and management of renewable energy.

For green bonds to be applicable to VOs, their issuance must follow a structured pre-issuance and post-issuance process to ensure compliance, feasibility, and financial viability. At the pre-issuance stage, VOs submit renewable energy business proposals to the Green Bond Committee for review. The committee conducts a two-step assessment—comprising a proposal review and on-site evaluation—while classifying eligible renewable energy sources such as hydropower, biomass, solar, and wind based on their potential in Indonesia. Proposals deemed feasible receive a letter of consent, which is forwarded to the Financial Services Authority (OJK) for registration. Ineligible proposals are returned with recommendations for revision. Following OJK submission, legal and financial arrangements, including the appointment of a notary and auditor, are finalised. Once regulatory approval is secured, the green bond is issued, listed on the stock exchange, and made available for investor purchase, thereby mobilising capital for VO-led renewable energy projects.

The post-issuance stage focuses on monitoring, evaluation, and accountability. The Green Bond Committee oversees fund utilisation to ensure that at least 70 percent of proceeds are allocated to renewable energy projects. Evaluation then assesses whether bond proceeds align with renewable energy development objectives, identifying strengths and weaknesses in project implementation and financial allocation. The final step is the issuance of a project rating, which measures the effectiveness of green bond utilisation. This rating not only ensures transparency and compliance but also determines a VO's eligibility for future green bond financing, thereby reinforcing accountability and supporting the long-term sustainability of community-based renewable energy investments.

As a final note, the author emphasises the necessity of establishing a safety net mechanism to safeguard investors in cases where VO-led projects fail to meet performance expectations or encounter financial difficulties. Such a

mechanism may take the form of risk-sharing arrangements with local governments, guarantee schemes, insurance coverage, or credit facilities designed to mitigate potential losses. By reducing investor exposure, these measures would reinforce confidence in green bond financing and secure the long-term financial sustainability of community-based renewable energy initiatives. Equally important, adequate financial support for the proposed Green Bond Committee as the supervisory body must be ensured, with full backing from the government in its dual role as regulator and provider. This would guarantee effective oversight, strengthen institutional credibility, and embed resilience within Indonesia's green bond framework.

4. Conclusion

Strengthening the role of VOs in implementing renewable energy projects is essential for advancing Indonesia's energy transition. Green bond financing, anchored in the CORE framework, provides a viable mechanism to achieve this objective. Beyond fostering rural energy self-sufficiency, it offers a sustainable financing pathway that complements Indonesia's national commitment to achieve net-zero emissions, particularly given the limitations of the state budget. As strategic institutions, VOs have the potential to act as catalysts in mobilising investment and managing community-based renewable energy.

However, two critical deficiencies remain: the absence of a comprehensive regulatory framework and the lack of a dedicated supervisory body with transparent procedures. Without these, VOs cannot fully leverage green bonds as effective financial instruments. This study therefore concludes that a structured regulatory mechanism is urgently required. Such a framework should include the enactment of a government regulation on green bonds, their integration into the forthcoming Renewable Energy Law, and the establishment of a Green Bond Committee tasked with assessment, supervision, and evaluation. Finally, the adoption of a structured pre- and post-issuance process would ensure accountability, transparency, and long-term sustainability, enabling VOs to drive Indonesia's renewable energy transition from the village level.

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