

Opportunity and challenge mapping for achieving energy transition in Indonesia's electricity sector

Muhammad Rizky¹, Maman Suhendra^{2*}

Fiscal Policy Agency, Jakarta, Indonesia¹

Polytechnic of State Finance STAN, South Tangerang, Indonesia²

ABSTRACT

The climate change phenomenon compels the government to develop policies that can preempt catastrophic losses, including reducing emissions in the energy industry, a task that requires significant financial resources. This study explores Indonesia's energy transition program, particularly within the power sector, and financing methods, primarily focusing on blended finance. It then examines the prospects and constraints of financing Indonesia's energy transition program. It utilizes a qualitative single case study approach, gathering primary data from interviews with policymakers, policy implementers, and academics regarding energy transition financing. The study concludes that while Indonesia's energy transition financing presents significant opportunities, challenges remain in securing sustainable funding, aligning policies, and ensuring reliable implementation. Addressing these gaps through improved coordination, innovative financing mechanisms, and stakeholder engagement will be essential for the transition's success. This study is expected to contribute to policy considerations for both the government and business sectors engaged in implementing Indonesia's energy transition program.

KEYWORDS:

Blended finance; electricity; energy transition; policy

HOW TO CITE:

Rizky, M., & Suhendra, M. (2025). Opportunity and challenge mapping for achieving energy transition in Indonesia's electricity sector. *Jurnal Tata Kelola dan Akuntabilitas Keuangan Negara*, 11(1), 1-23. <https://doi.org/10.28986/jtaken.v11i1.1788>

*Corresponding author's

Email: msuhendra@pknstan.ac.id

ARTICLE HISTORY:

Received : 21 September 2024

Accepted : 7 January 2025

Revised : 20 November 2025

Published : 26 June 2025

Copyright © Jurnal Tata Kelola dan Akuntabilitas Keuangan Negara. This is an open-access article under a CC BY-SA license

INTRODUCTION

Indonesia's energy sector, the country's second-largest emitter and one of its most capital-intensive industries, plays a crucial role in the government's pursuit of the net-zero emission (NZE) target (Rifan, 2023). In a business-as-usual (BAU) scenario extending to 2060, emissions from the energy sector are projected to surpass 1,927.4 million tonnes of CO₂e. However, implementing renewable energy sources and energy efficiency measures could reduce emissions by 93% compared to the BAU pathway (Ministry of Energy and Mineral Resources, 2023).

Indonesia ranks among the top 10 carbon emitters globally, contributing around 4% of global emissions, with almost 2,000 metric tons of net emissions annually as of 2018. Within this, the energy sector accounted for around 650 metric tonnes, equivalent to 1.7% of worldwide emissions (Resosudarmo et al., 2023). The electricity sector remains the dominant contributor, responsible for 40% of the total emissions, with the energy sector (Agarwal et al., 2024).

Perusahaan Listrik Negara (PT PLN) projects that emissions from electricity production in the BAU scenario could reach 1.057 million tons of CO₂e annually by 2060 (PT PLN, 2023). This highlights the urgent need for transformative efforts to speed up the energy transition. Significantly boosting the share of renewable energy and reducing fossil fuel reliance is crucial to aligning the electricity sector with Indonesia's NZE objectives. Figure 1 displays the national electricity supply roadmap, detailing the transition to renewable energy sources aimed for completion by 2060.

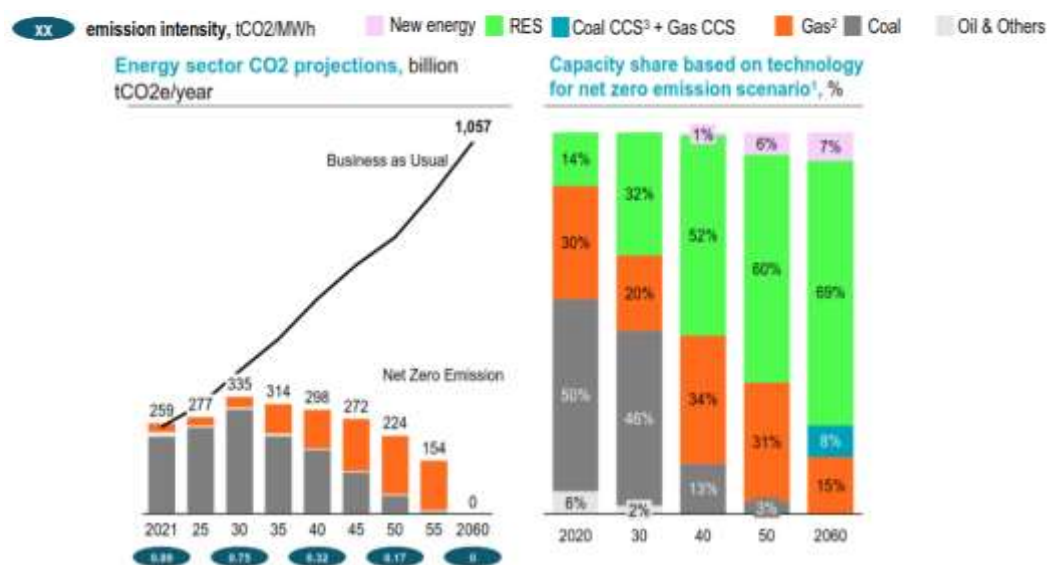


Figure 1. Electricity Sector Net-Zero Emission Roadmap 2060

Source: PT PLN (2023)

Transforming the electricity sector is crucial to Indonesia's broader energy transition agenda. Tackling emissions through renewable energy deployment, energy storage innovation, grid modernization, and policy frameworks forms the backbone of the nation's path toward sustainable, climate-resilient development. The Indonesian government introduced the energy transition mechanism (ETM) as a platform known to drive the energy transition. This policy is a significant breakthrough designed to substantially contribute to achieving the country's emission reduction targets. It will also accelerate energy infrastructure development and expedite Indonesia's energy transition to meet the NZE target (Reyseliani & Purwanto, 2021; Badan Kebijakan Fiskal, 2022). The energy transition program will focus on two main objectives: reducing carbon emissions by phasing out coal-fired power plants (CFPPs) and constructing clean energy facilities to replace fossil-based plants (The Climate Investment Funds, 2022). The energy transition program aims to

reduce carbon emissions from power plants by 250 million tonnes of CO₂e annually until 2030; this can be done by increasing the share of renewable energy in the national energy mix (Agarwal et al., 2024).

Indonesia's energy transition will require substantial investment. It is estimated that over US\$1 trillion is required to support the early retirement of more than 16 gigawatts (GW) of power capacity—a total of 33 power plants—with an average cost of approximately US\$400-450 million per GW (Rachman, 2022). A blended finance approach has been proposed to address this funding challenge without straining state finances. This model combines resources from various sources, such as government agencies, development banks, commercial banks, climate change funds, equity investors, other financing institutions, and philanthropists (Purwanto & Alfian, 2021).

Previous research has examined the economic and implementation challenges of Indonesia's energy transition. Resosudarmo et al. (2023) evaluated the feasibility of Indonesia as a middle-income country with a limited government budget, achieving its NZE target by 2060. Sekaringtias et al. (2023) highlighted the importance of addressing the socioeconomic and environmental challenges related to the energy transition. Consistent with these findings, Hendriwardani et al. (2022) and Suroso et al. (2022) explored financing mechanisms through public and international climate funds as strategic options to support the energy transition. Adrian et al. (2023) recommend optimizing renewable energy utilization, whereas Nugroho et al. (2021) emphasize the need for strong regulatory frameworks to ensure a successful transition.

Gray et al. (1996) expressed the importance of accountability theory, which is divided into two types of responsibilities: the obligation to perform or refrain from certain activities and the commitment to explain these actions. Understanding accountability ensures an entity's long-term survival by promoting investigative thinking about the organization's operational implementation (Frink & Klimoski, 2004). Accountability theory also involves the responsibility to inform a wide range of stakeholders about the social and environmental impacts of their operations (Deegan, 2014). Accountability is crucial in implementing Indonesia's energy transition, particularly regarding anti-corruption arrangements, financing, information distribution, and working with affected communities (WALHI, 2022).

Unlike previous studies, this study provides a comprehensive analysis of the prospects and challenges of financing Indonesia's energy transition. It determines opportunities, challenges, and policy actions required to expedite the transition. It also explores various blended finance schemes and other innovative funding strategies that can be leveraged to achieve this goal. By providing actionable policy recommendations for government agencies and presenting optimal financing strategies to support Indonesia's energy transition, this study contributes to the literature on public finance and energy infrastructure.

To achieve its objectives, this study draws on a wide range of existing literature and theoretical frameworks that provide insights into the mechanisms and challenges of financing energy transitions. Understanding the collaborative dynamics in energy transition programs, such as Indonesia's ETM, is crucial for exploring methods to ensure diverse stakeholders can contribute to achieving the NZE target. Furthermore, examining theories such as transaction cost management provides an in-depth analysis of the economic implications of financing strategies and infrastructure development.

Indonesian Energy Transition Program (ETM)

The ETM is a scalable collaborative program developed alongside low-income countries,

utilizing market-based methods to expedite the transition from fossil fuels to renewable energy (Asian Development Bank, 2021). The ETM platform aims to accelerate the transition to NZE by 2060 or earlier, adhering to principles of fairness and cost-effectiveness (Puspitasari & Indriastuty, 2023). In summary, the energy transition program involves reducing emissions by retiring CFPPs early and developing green energy facilities to meet Indonesia's electricity demand (Badan Kebijakan Fiskal, 2022).

In Indonesia, the ETM plan will be implemented with PT Sarana Multi Infrastruktur (PT SMI) as the country platform. PT SMI will receive blended financing based on the Steering Committee's direction. It will then accelerate the CFPP's retirement through the CRF scheme, leveraging government funding and investing in renewable power plants through the CEF scheme, consistent with the electricity supply business plan (RUPTL). This program is also expected to generate carbon credits, which can be traded on carbon exchanges, providing additional revenue for the ETM account through nontax revenues. Figure 2 illustrates the ETM scheme.

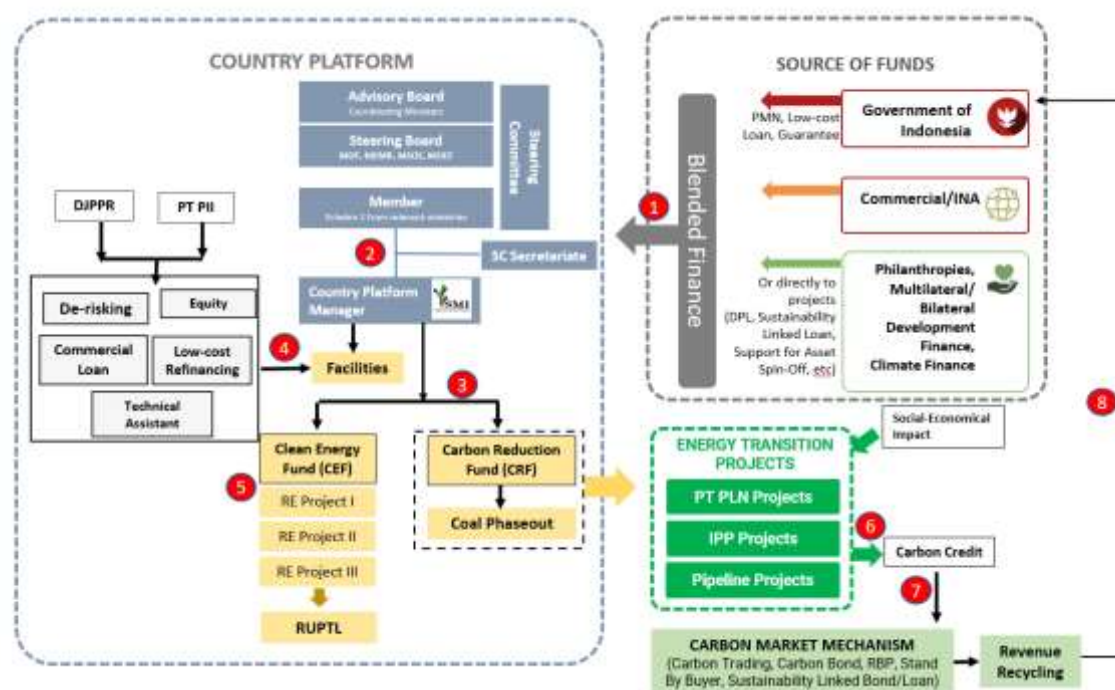


Figure 2. Energy Transition Mechanism (ETM) Scheme in Indonesia

Source: Ministry of Finance, 2023

Collaboration Concept in Various Projects

Collaboration occurs when a group of stakeholders within a specific problem domain engages in an interactive process using shared rules, conventions, and structures to address or determine issues related to that domain (Wood & Gray, 1991). A collaborative process should involve independent stakeholders, shared decision ownership, shared responsibility for the ongoing domain, and joint arrangements to address the problem's increasing complexity (Jamal & Getz, 1995).

The collaboration scope can vary at different levels, such as local, regional, national, or international, depending on the partnership's objective and purpose (Jamal & Stronza, 2009). Collaboration among various entities, such as enterprises, nonprofit organizations, and government agencies, is considered an effective strategy to achieve common goals (Gajda, 2004). The government can promote collaboration with private and informal sectors, particularly in

infrastructure provision, by developing legislation, managing finances, and providing socioenvironmental safeguards (Surachman et al., 2022).

Transaction cost management in the energy transition

Transaction cost theory evolved from efficiency theory, focusing on various organizational behaviors within the economic system. This theory emphasizes behavioral assumptions, explores asset specificity, compares transactional benefits across institutions, and considers institutions as economic actors rather than production functions (Williamson, 2005). The transaction cost theory is crucial for analyzing the impact of infrastructure development and management costs. The cost of delivering public infrastructure depends on the chosen procurement method, which influences societal expenses, such as production costs, transaction costs, and project externalities (De Schepper et al., 2015).

The theory also applies to evaluating who benefits and who bears the costs, as well as the best strategy for involving the private sector in providing infrastructure as a public good (Whittington, 2012). Additionally, transaction cost analysis in the energy transition program serves as a foundation for the government and country platform managers to develop a structure that does not strain state finances (Badan Kebijakan Fiskal, 2022). The country platform manager is crucial in developing the financing and investment framework for the energy transition program. This involves collaborating with various donor institutions, securing soft and commercial loans, providing technical assistance, and engaging with equity investment institutions (Birny, 2022).

RESEARCH METHOD

This study utilized both primary and secondary data. Primary data were collected using answers from semistructured and in-depth open-ended interview questions to investigate phenomena according to research objectives (Creswell & Creswell, 2018). Meanwhile, secondary data were gathered from the following sources: scoping reviews of previous scientific literature reports on the implementation of the energy transition, syndicated materials, and regulations regarding Indonesia's energy transition.

Participants were selected based on their involvement, expertise, and professional experience in facilitating energy transition discussions. They were identified through a stakeholder database and snowball referrals from one participant to another. The stakeholder database is maintained by the analyst working group at the Badan Kebijakan Fiskal (Fiscal Policy Agency). The author received referrals to continue interview sessions with the department or division directly handling energy transition issues within the Directorate General of Budget Financing and Risk Management, the Ministry of Energy and Mineral Resources, the country platform manager/PT SMI, and the state electricity company/PT PLN. Academics further strengthen the triangulation process by providing an independent perspective on energy transition financing. Interviews were conducted to gain a comprehensive understanding of the energy transition program framework. They also served as a foundation for data triangulation from various viewpoints and previous studies aimed at achieving dependability and validity in qualitative research (Saunders et al., 2019).

The interviews for this research sought insights from policymakers, policy implementers, and academics. However, this study did not include perspectives from the private sector and affected communities, focusing instead on opportunities and challenges originating from within the government. In the triangulation process, the author considers the different roles of each

government institution. The Ministry of Finance serves as a policymaker and fiscal manager, the Ministry of Energy and Mineral Resources as a regulator of the energy sector, and PT SMI and PT PLN as economic entities implementing the energy transition program. Table 1 lists all the participants in this study.

Table 1. Informant and Interview Details

Informant	Agency
ENS	Academics
GPS	Fiscal Policy Agency, Ministry of Finance
HQ	Directorate General of Budget Financing and Risk Management, Ministry of Finance
BA	Directorate General of Budget Financing and Risk Management, Ministry of Finance
PA	Directorate General of Budget Financing and Risk Management, Ministry of Finance
FA1	Ministry of Energy and Mineral Resources
FA2	Country platform manager/PT SMI
RF	State Electricity Company/PT PLN
MM	State Electricity Company/PT PLN
YT	State Electricity Company/PT PLN

The data and information collected during the interviews will be processed using the NVIVO tool. This will generate a thematic analysis of the prospects and challenges of blended finance for Indonesia's energy transition program. The goal of data processing for thematic analysis is to produce visual displays, such as project maps, mind maps, or concept maps, as well as narratives in the form of textual explanations (Ibrahim, 2012). Data processing with the NVIVO tool is also intended to create a formal framework for interpreting interview data in qualitative studies (Williams & Moser, 2019).

Recorded interviews with participants were further processed using first-cycle coding and second-cycle coding. First-cycle coding captures real field conditions. The second cycle coding involves the generalization of the first cycle results, producing categories, themes, causal relationships, or theoretical constructions (Miles et al., 2014). The coding of data processing results into specific categories is guided by the need to answer the previously formulated research objectives. Additionally, this study has incorporated feedback from academic reviewers at an international conference panel session. This addresses the limited perspectives of the participants and the short-term goals that must be achieved.

RESULT AND DISCUSSION

The results of the interviews with the participants, which comprise the field data, are further processed to achieve the goal of the thematic analysis. The interview data were transformed into transcripts and labeled during the coding step. The purpose is to easily organize and analyze the data systematically and simplify the mapping and synthesis of research findings. Subsequently, cases were created to categorize each research issue—opportunities and problems—based on participant opinions, providing a foundation for data analysis categorization. The overall coding outputs were then displayed in a project map to assist in developing a writing framework. Figure 3 illustrates the project map.

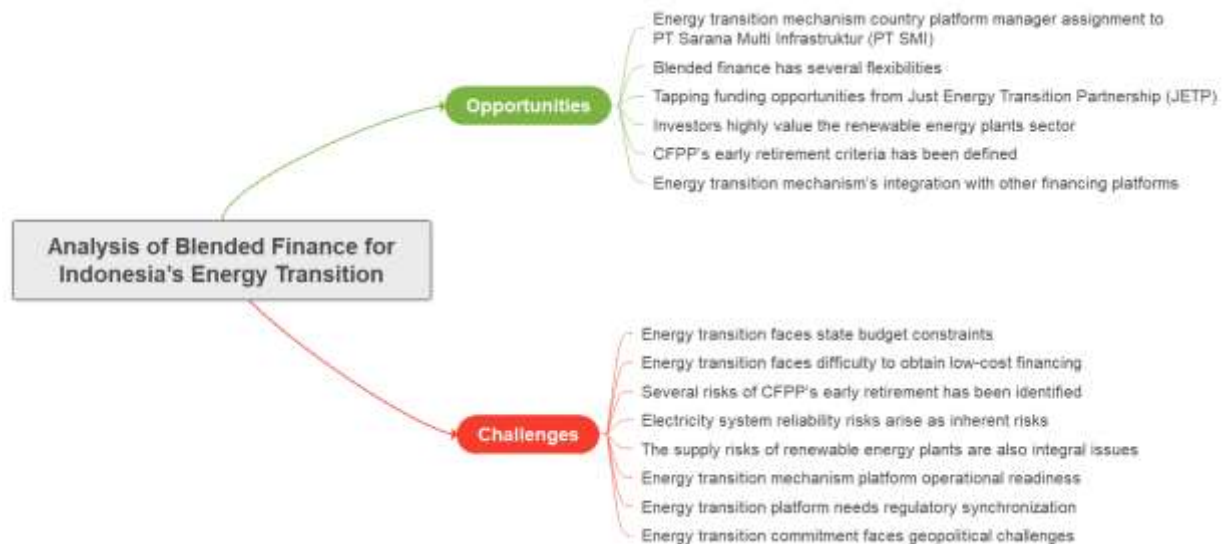


Figure 3. Project Map for the Research Findings

Financing Opportunities for Indonesia's Energy Transition Programs

Opportunities for financing the energy transition program are those that can support Indonesia in achieving its energy transition goals. Participants identified key conditions that present opportunities for financing these programs. The insights from interviews were categorized into six broad themes, visualized in a project map, and served as the foundation for the thematic analysis, as illustrated in Figure 4.

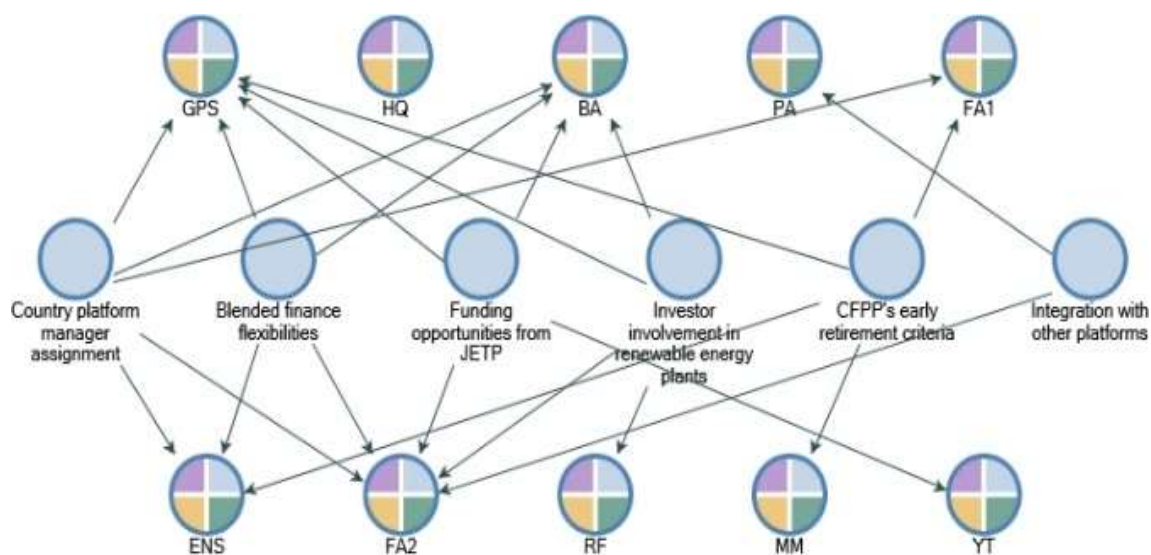


Figure 4. Project Map for Energy Transition Program Financing Opportunities

Country platform manager assignment to PT SMI

PT SMI has been appointed as the implementer of fiscal support for the energy transition in the power sector, as stipulated in Minister of Finance Decree Number 275/KMK.010/2022. It may utilize a funding and financing framework through blended finance, drawing from the state budget or other legal and eligible sources. Similarly, an informant (BA) highlighted that PT SMI's role as the country platform manager can accelerate structuring various funding sources within a blended finance framework. ENS further emphasized that the country platform manager's responsibilities can enhance funding opportunities and act as a catalyst for infrastructure development projects.

“PT SMI is prepared to coordinate the money that enters Indonesia to be consolidated into a financial facility that will significantly improve the project. The objective of PT SMI is to be a catalyst for infrastructure development. It will finance projects that private investors or banks are unable to fund because the risk is too great or because the studies have not been calculated” (ENS).

The development of the country platform manager offers additional benefits, such as sovereignty and accountability. Regarding sovereignty, the best practice for the energy transition program involves its operations by a special mission vehicle institution to perform specific tasks. The accountability concept emphasizes the creation of a fund management organization separate from the public budget process, enabling it to make business decisions more transparently and responsibly. The matchmaking mechanism that PT SMI can utilize to construct the ETM platform framework exemplifies the role of the country platform manager. PT SMI is crucial to matchmaking efforts, serving as a beneficiary of investor funds and channeling these funds into projects within the energy transition program framework.

“Why would we need a fund manager? So, there is sovereignty and possession by a single country, and we happen to have a specific mission vehicle, PT SMI. The second issue concerns accountability. The third option is the ETM scheme itself. So, the ADB directs that this be administered by a nongovernment fund manager” (GPS).

Blended finance flexibilities

With PT SMI as the country platform manager, energy transition financing in Indonesia could become more flexible if managed by an independent special mission vehicle, separate from government mechanisms. This platform would be designed to integrate diverse financing sources, including concessional loans, commercial loans, grants, equity financing, and government guarantees.

“There should be a quasi-public but not-public institution that is more adaptable in its organization to capture those monies and then be structured into a funding product that environmentally friendly enterprises are looking for” (ENS).

Blended finance provides fiscal support from the government, which can help reduce risk. According to BA and FA2, blended finance might involve a government loan and supplementary legitimate loans from international financial institutions and commercial lenders. This financing mix is tailored to deliver the expected rate of return on investment, resulting in greater positive outcomes. Additionally, PT SMI administers the OIP program, a government trust fund invested through PT SMI to generate acceptable returns for the state budget. The sourcing effort for the energy transition blended finance platform could explore other institutions as potential low-cost funding sources, such as multilateral development banks (MDBs). Funding sourced from MDBs often has lower borrowing costs compared to commercial loans from banks. This is because MDB financing typically includes concessional loans and grace periods, allowing loan interest payments to be waived for a set period. However, financing the energy transition program cannot primarily rely on MDB funds; it must also effectively incorporate other sources of financing, including commercial loans.

However, mobilizing blended finance from multiple sources remains a significant challenge. For instance, the Philippines' energy transition is funded through ACEN, a platform that raises capital primarily via equity components and debt issuances, largely supported by the domestic capital market (ACEN Renewables, 2023). Climate-specific financing institutions, such as the Green Climate Fund, offer alternative low-cost funding. Other potential sources include donor and

philanthropic institutions, both multilateral and bilateral, that provide grants without imposing substantial loan costs (Suroso et al., 2022). The effective use of blended finance underscores the necessity of collaboration in advancing climate change mitigation efforts.

Funding opportunities from the JETP

Indonesia has a significant opportunity to fund its energy transition program through an international cooperation known as the Just Energy Transition Partnership (JETP). This partnership comprises two groups: the International Partners Group (IPG) which includes the United States, Japan, Canada, Denmark, the European Union, France, Germany, Italy, Norway, and the United Kingdom; and the Glasgow Financial Alliance for Net Zero (GFANZ) that includes the Bank of America, Citibank, Deutsche Bank, HSBC, Macquarie, MUFG, Standard Chartered, and other MDBs (Ministry of Energy and Mineral Resources, 2023). The committed investment value of this JETP collaboration is substantial, with a total of US\$21 billion. This includes US\$11.5 billion from IPG and the remaining USD 10 billion from GFANZ (Perdana, 2023). The next challenge for the government is to ensure that this funding commitment is effectively absorbed into national energy transition projects.

Another example of a JETP funding commitment was received by South Africa at the Conference of the Parties (COP) 26, amounting to US\$8.5 billion (Presidential Climate Commission, 2022). These funds will be invested in electricity infrastructure, including early retirements of power plants, the expansion of renewable energy transmission, and improvements to the community electricity distribution systems. BA presented this possibility and detailed the transmission procedure for the JETP funds.

“JETP is an institution that brings together financial sources dedicated to supporting the development of the energy transition. So, JETP has a concessional funding source that will be handed to the World Bank, ADB, KfW, and others, who will fund projects under the energy transition framework” (BA).

Investor involvement in renewable energy plants

The high level of investment in the new renewable energy (NRE) generation sector has created significant momentum for Indonesia’s energy transition program. As investment in NRE power plants is crucial to reducing Indonesia’s reliance on CFPPs, which emit high levels of greenhouse gases, this acceleration is essential for the energy transition. This commitment is reinforced by the energy sector’s reputation for delivering relatively high returns on investment. Consequently, the electrical sector presents a promising investment opportunity. Maximizing this potential should involve the active participation of the private sector. Therefore, the government must create domestic economic conditions favorable to the investment climate, especially for the energy transition. Additionally, the government can provide relevant and appropriate fiscal support for the implementation of energy transition projects.

“Compared to the forestry and trash sectors, energy has the highest return on investment. So, imagine if we could involve the private sector and mobilize it, but the government intervened in everything. If we encourage SMVs to administer the money and circulate it to the private sector to entice private sector participation, the multiplier should be bigger than anything managed by the government” (GPS).

CFPP’s early retirement criteria

The Ministry of Energy and Mineral Resources and PT PLN have set criteria for CFPPs eligible for early discontinuation. According to MM, these factors should ensure that the power system

reliability is not compromised, resulting in selected CFPPs being less productive and efficient during operation. Meanwhile, GPS believes that the opportunity for early retirement of CFPP operations is accompanied by Indonesia's current oversupply of electricity, making it less likely that the early retirement of certain CFPPs will significantly disrupt system reliability. FA1 outlined the following requirements for early retirement. However, while implementing the energy transition project, the government must also address the required financing capacity and effectively manage the social and environmental impacts of the transition.

“First, the technology used looks to be inefficient. The second criterion is that the availability factor for the previous five years is less than 80%; if it is less than 80%, it indicates frequent interruptions. Third, the capacity factor is below 50%, indicating that not much is entering the system” (FA1).

Integration with other platforms

PT SMI was nominated to implement fiscal support to finance Indonesia's energy transition program due to its performance in managing other platforms. Currently, PT SMI manages two platforms: SDGs Indonesia One (SIO) and Geothermal Sector Infrastructure Financing (Pembiayaan Infrastruktur Sektor Panas Bumi, PISP). The SIO platform is an integrated infrastructure financing cooperation platform designed to help Indonesia achieve its SDGs. Meanwhile, the PISP platform manages funds to promote geothermal development in Indonesia by providing state equity participation (Penyertaan Modal Negara/PMN) to PT SMI.

PA suggested that managing SIO and PISP funds through PT SMI has the potential to be integrated into the energy transition platform and administered concurrently. FA2 also supports this opportunity, noting that linking the energy transition platform is a form of interoperability.

“The funds can be mingled if we have reached the transaction level. We do not separate them anymore; this fund is from ETM, SIO, or PISP. However, consider how monies, such as those from SIO, are allocated to the de-risking structure. Then, the ETM element from OIP is incorporated into the loan” (FA2).

Financing Challenges for Energy Transition Programs in Indonesia

Challenges in financing the energy transition program refer to issues that the government must address, anticipate, or overcome. This will enable Indonesia to commence the energy transition program without delay. In the financing opportunities section, participants directly expressed their concerns about financing energy transition programs in Indonesia. The author classified these cases based on the interview results for each participant. A project map visually represented eight major issues, which served as the foundation for the analysis, as illustrated in Figure 5.

State budget constraints

According to Indonesia's NDC, the energy sector demands the largest financing for emission reductions, estimated to reach IDR3,500 trillion or about US\$219 billion by 2030 (UNFCCC, 2022). Meeting these needs solely through the state budget is challenging. Thus, the government's establishment of an energy transition platform is crucial for diversifying funding sources beyond the state budget.

“This is an effort to diversify climate change financing because we know that the financing gap for climate change is large, almost IDR4,000 trillion until 2030. If we just keep quiet, it is not easy to pursue the investment target, so we try to diversify opportunities or financing channels

that can be developed” (GPS).

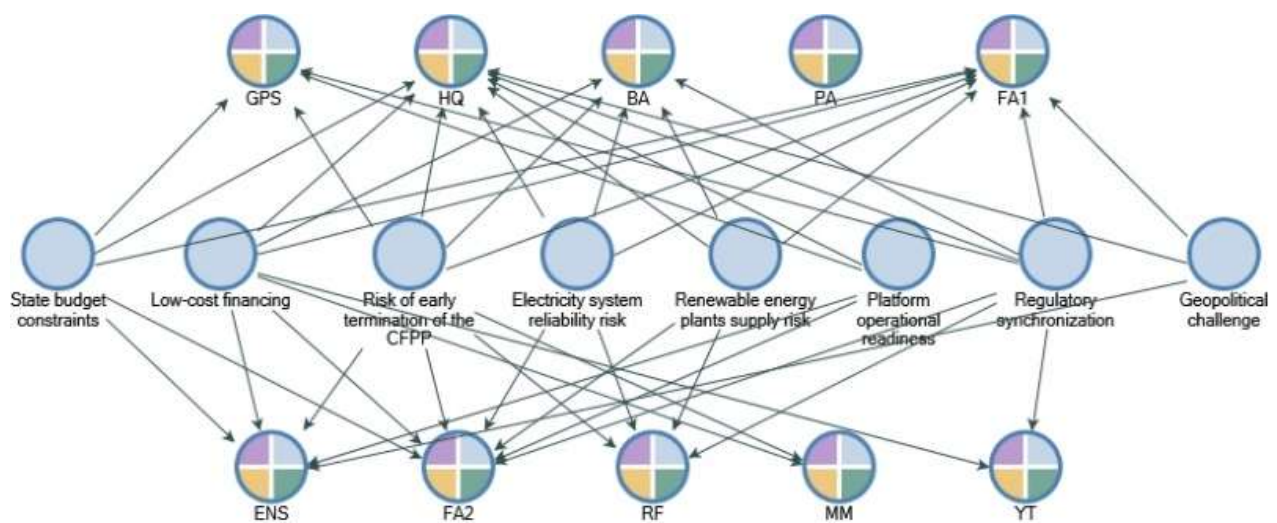


Figure 5. Project Map for Energy Transition Program Financing Challenges

The limited availability of state budget funds for financing the energy sector in Indonesia is a significant obstacle to establishing the country’s future energy policy. This reliance on financing sources from developed countries, mainly commercial and concessional financing, has resulted in intervention in implementing energy transition policies in the power sector. Another issue related to budget constraints is that the selling price of green electricity from NRE plants remains higher than the cost of electricity generated by CFPPs. This situation results in additional subsidy and compensation bills that the government must cover, particularly when substituting the cost of energy production through PT PLN.

Limitations on low-cost financing

Another barrier to implementing the energy transition program in Indonesia is the challenge of securing low-cost financing. This issue arises from the government’s need to align the energy transition platform with investors’ governance criteria and the funds available for energy transition projects. BA believes that commercial financing remains limited by higher borrowing costs and shorter loan terms compared to concessional loans due to the poor fund-bearing capacity of national banking institutions. ENS also emphasized the constraints on obtaining of low-cost financing.

“The cheap funding that was promised is not that easy to provide, so it becomes a significant question whether there is truly cheap funding or not. Green, ecologically friendly projects typically have a high cost and few sources of income. So, how can we make it feasible? The cost of money should be inexpensive.” (ENS)

The concept of blended finance is assumed to generate the desired borrowing costs by combining various funding sources. This idea aligns with Williamson’s (1989) theory, which suggests that transaction costs incurred in financing a project must be organized within a well-structured management framework. Achieving the most cost-effective combination of transaction costs can be accomplished through blended financing.

Risk of early termination of the CFPP

The immediate cessation of CFPP operations has several implications. First, investors interested in the energy transition platform prefer to invest in NRE plants, but more funds are required to shut down CFPPs early. Second, the costs associated with the early termination of CFPP

operations include two major components: divesting the power plant company's assets and compensating for projected future cash flows expected during the power plant's concession period. Consequently, the government will need to absorb the higher power production costs due to the shorter operational timeframe, which leads to increased asset depreciation and generating costs from NRE plants.

Another implication of the early termination of CFPP operations is the need to balance the social and environmental interests of the government, power generation companies, workers, consumers, and communities (Christensen & Suharsono, 2022). To address these aspects, the ADB and the Fiscal Policy Agency collaborated on thematic research titled "Strategic Environment and Social Assessment" to map the potential social and environmental implications of the energy transition program.

Electricity system reliability risk

To ensure a reliable electricity supply, PT PLN, as the electricity system operator, must evaluate the role of retiring CFPPs in the system and how an NRE plant might replace them. One initiative is diversifying the composition of NRE plants to avoid concentration in a single plant and developing a responsive NRE plant backup system. This backup system can be built alongside gas plants, diesel plants, and battery storage systems, resulting in higher extra investment costs.

It should also be noted that the electrical refers to the backup system in question, which is designed to address the intermittent nature of NRE plants. Intermittent nature refers to the inability of NRE plants to consistently produce energy due to uncertainty about the energy sources (PT PLN, 2023). Because of this inherent characteristic, NRE power sources are commonly known as variable renewable energy (VRE). FA1 also emphasizes the need to maintain the reliability of the power system.

"Intermittent comes with some requirements. Once VRE enters dominantly, it must be accompanied by rapid response throughout the generation. Then we prefer to say spinning reserve, so a reserve is ready to spin if it suddenly disappears. The spinning reserve is prepared initially and does not arise out of nowhere" (FA1).

Supply risk of renewable energy plants

Delivering NRE power plants, which are intended to lead the national energy transition program, comes with high risks, specifically regarding potential optimization and governance (Adrian et al., 2023). First, the development of NRE power plants must consider the location's geographical conditions. For example, hydropower can only be developed in areas with significant water flow, such as plateaus. Conversely, geothermal power plants can only be constructed in mountainous regions with active seismic activity to produce the necessary heat.

The second risk is that expanding NRE plants frequently introduces new environmental and social issues. To establish a reliable NRE plant, the development of hydropower or geothermal power projects may require protected forest areas or land owned by local communities. The most recent controversy in the Wae Sano area of East Nusa Tenggara highlighted this issue, as the local Indigenous community fiercely opposed the development of geothermal power plants (PT Geo Dipa Energi, 2023).

"Geothermal and hydropower plants have high environmental issues because they must clear forest land and sometimes protected forests. Hydropower also has big environmental issues, so the challenge is the risk that if it is stopped, is the replacement plant ready enough to replace it in terms of energy security" (HQ).

Third, building NRE plants requires significant investment, necessitating various financing options, including fiscal assistance, to expedite deployment. The intermittent nature of NRE plants, classified as VRE, raises the capital costs for constructing backup systems to ensure a reliable power supply.

Platform operational readiness

Another roadblock in implementing the energy transition program in Indonesia is the lack of operational features, such as a national energy transition roadmap. This component complements other well-established features, such as regulatory and institutional aspects. PT SMI, the main executor, considers the energy transition program well-prepared for implementation due to its extensive expertise in operating the blended finance platform. This need for operational clarity aligns with FA2's opinion.

"It should be on a road map produced by the Ministry of Energy and Mineral Resources. The operational preparedness in this scenario is somewhat hampered by the lack of a road map that can provide clear advice on the implementation" (FA2).

Regulatory synchronization

The readiness of the roadmap to retire CFPP operations is related to the synchronization of rules that serve as the framework for creating the document. Various documents serve as references for executing national energy policy, particularly in the electrical sector. These include the National Energy Policy (KEN), the National Energy General Plan (RUEN), the National Electricity General Plan (RUKN), and the Electricity Supply Business Plan (RUPTL). The KEN, RUEN, and RUKN publications are policy documents, whereas the RUPTL is a technical document that extensively references these policy documents. However, the execution of the energy transition in Indonesia remains not addressed in these agreements, leaving significant gaps in harmonizing national electricity policies.

"So, is this energy transition legitimate? No KEN or RUEN mention it. RUKN may be the first time we have heard that the electricity sector will be emissions-free by 2060. The documents RUEN, KEN, and RUKN are policy documents that are later turned into projects. RUPTL must decide what policies will be established next" (FA1).

The next legal issue to resolve is the conclusion of the power purchase contract and the implementation of the associated government guarantee. This is challenging as the parties involved—especially the government, PT PLN, and the investor (for CFPP held by IPP)—must add contract addendums or even terminate and renegotiate the contract. The other legal issue to address is how to consider CFPP assets terminated before their operating period ends, resulting in stranded assets. Resolving these asset-related issues is required to ensure that the CFPP assets on PT PLN's balance sheet after early retirement are not considered state losses.

Geopolitical challenges

The final obstacle complicating the implementation of the energy transition program in Indonesia is the inconsistent global commitment to energy transition. For example, to protect domestic energy security, Germany restarted CFPP due to gas supply shortages caused by the prolonged Russia- Ukraine war. This is unfair to developing countries, such as Indonesia, which feel compelled to undergo an energy transition to reduce carbon emissions and improve living conditions. In reality, Indonesia still requires a large supply of energy to drive economic growth and achieve its goal of becoming a developed country. Therefore, the government must strengthen diplomatic efforts in international forums, such as the G20 and COP, to ensure that the developed

countries fulfill their financial commitments.

“The demand to achieve net-zero emissions does not mean all parties can implement their commitment. The pressure comes from developed countries, who have an interest because if climate change occurs and emissions continue to rise, the first to be harmed are developed countries, specifically European ones” (HQ).

CONCLUSION

The discussion on financing Indonesia's energy transition highlights several key opportunities to accelerate its implementation. First, the government has appointed PT SMI as the platform manager for energy transition financing. Second, the use of blended finance offers flexibility and access to diverse funding sources. Third, the program benefits from financial commitments under the Just Energy Transition Partnership (JETP), leveraging global public and private partnerships. Fourth, Indonesia's renewable energy sector presents significant investment potential, particularly in power generation. Additionally, opportunities exist to establish clear criteria for the early retirement of coal-fired power plants (CFPPs) and integrate financing mechanisms with other PT SMI platforms, such as SIO and PISP.

Despite these opportunities, several challenges remain. First, the program must secure funding beyond the state budget, which is constrained. Second, the current high-interest-rate environment makes accessing low-cost financing difficult. Third, early CFPP retirement poses financial, social, and environmental complexities. Fourth, the energy transition policy introduces risks to power system reliability, necessitating robust backup solutions. Additionally, renewable energy (NRE) projects must align with geographic potential, address intermittency challenges, and navigate government-imposed pricing constraints. Platform operational limitations further hinder efficiency, while misalignment between policies and technical regulations weakens implementation. Lastly, geopolitical factors contribute to policy inconsistencies as developed nations struggle to fulfill their financial and regulatory commitments.

This study also acknowledges limitations that future research could address. The interviews primarily included policymakers, policy-implementing businesses, and government-affiliated academics, excluding perspectives from communities, independent environmental experts, private power corporations, and investors. Future studies could incorporate these viewpoints to provide a more holistic analysis. Additionally, research could explore the practical implementation of energy transition initiatives, including timelines, key performance indicators, and specific financing mechanisms required to achieve long-term sustainability.

REFERENCES

- ACEN Renewables. (2023). *ACEN's Energy Transition Mechanism (ETM)*. <https://www.acenrenewables.com/etm/>
- Adrian, M. M., Purnomo, E. P., Enrici, A., & Khairunnisa, T. (2023). Energy transition towards renewable energy in Indonesia. *Heritage and Sustainable Development*, 5(1), 107-118. <https://doi.org/10.37868/hsd.v5i1.108>
- Agarwal, V., Balasubramanian, A., Discha, F., & Tan, K. T. (2024). *Indonesia's green powerhouse promise: Ten bold moves*. McKinsey & Company.

- Asian Development Bank. (2021). *Energy transition mechanism explainer: How ETM will support climate action in Southeast Asia*. <https://www.adb.org/news/features/energy-transition-mechanism-explainer-support-climate-action-southeast-asia#:~:text=What%20is%20ETM%3F,fossil%20fuels%20to%20clean%20energy>.
- Badan Kebijakan Fiskal. (2022). *Energy transition mechanism*. <https://fiskal.kemenkeu.go.id/fiskalpedia/2022/11/10/21-energy-transition-mechanism>
- Birny. (2022, November 14). *Indonesia luncurkan ETM country platform untuk percepat transisi energi yang adil dan terjangkau*. Gatra.com. <https://www.gatra.com/news-557986-internasional-indonesia-luncurkan-etm-country-platform-untuk-percepat-transisi-energi-adil-dan-terjangkau.html>
- Christensen, L. T., & Suharsono, A. (2022, July 25). *Achieving a just energy transition in Indonesia*. International Institute for Sustainable Development. <https://www.iisd.org/publications/brief/achieving-just-energy-transition-indonesia>
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage Publications.
- De Schepper, S., Haezendonck, E., & Dooms, M. (2015). Transaction cost analysis of public infrastructure delivery. *International Journal of Managing Projects in Business*, 8(3), 441-456. <https://doi.org/10.1108/IJMPB-10-2014-0075>
- Deegan, C. (2014). *Financial accounting accounting theory*. McGraw-Hill Education.
- Frink, D. D., & Klimoski, R. J. (2004). Advancing accountability theory and practice: Introduction to the human resource management review special edition. *Human Resource Management Review*, 14(1), 1-17. <https://doi.org/10.1016/j.hrmr.2004.02.001>
- Gajda, R. (2004). Utilizing collaboration theory to evaluate strategic alliances. *American Journal of Evaluation*, 25(1), 65-77. <https://doi.org/10.1177/109821400402500105>
- Gray, R., Owen, D., & Adams, C. (1996). *Accounting & accountability: Changes and challenges in corporate social and environment reporting*. Prentice Hall.
- Hendriwardani, M., Geddes, A., Sumarno, T. B., & Hohenberger, L. (2022). *Using public funding to attract private investment in renewable energy in Indonesia executive summary*. <https://www.iisd.org/projects/fossil-free-recovery>
- Ibrahim, M. F. (2012). Thematic analysis: A critical review of its process and evaluation. *West East Journal of Social Sciences-December*, 1(1), 39-47. <https://api.semanticscholar.org/CorpusID:15161897>
- Jamal, T. B., & Getz, D. (1995). Collaboration theory and community tourism planning. *Annals of Tourism Research*, 22(1), 186-204. [https://doi.org/10.1016/0160-7383\(94\)00067-3](https://doi.org/10.1016/0160-7383(94)00067-3)
- Jamal, T., & Stronza, A. (2009). Collaboration theory and tourism practice in protected areas: Stakeholders, structuring and sustainability. *Journal of Sustainable Tourism*, 17(2), 169-189. <https://doi.org/10.1080/09669580802495741>
- Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A method sourcebook*. Sage
- Ministry of Energy and Mineral Resources. (2023, February 16). Sekretariat JETP terbentuk, siap Realisasikan kerja sama pendanaan Transisi energi. <https://www.esdm.go.id/en/media-center/news-archives/sekretariat-jetp-terbentuk-siap-realisasikan-kerja-sama-pendanaan-transisi-energi>

- Nugroho, H., Rustandi, D., & Laila Widyastuti, N. (2021). What position should Indonesia have in placing its renewable energy development and energy transition plan? *Bappenas Working Papers*, 4(2), 239-254. <https://doi.org/10.47266/bwp.v4i2.100>
- Perdana, A. P. (2023, December 2). *Setahun berlalu janji Rp 300 triliun program JETP*. Kompas. <https://www.kompas.id/baca/ekonomi/2023/11/30/ficer-sekelumit-ujud-pendanaan-transisi-energi>
- Presidential Climate Commission. (2022). *South Africa's Just Energy Transition Investment Plan (JET-IP)*. <https://www.climatecommission.org.za/south-africas-jet-ip>
- PT Geo Dipa Energi. (2023, November 9). *Pemerintah lanjutkan proyek geothermal Wae Sano*. <https://www.geodipa.co.id/pemerintah-lanjutkan-proyek-geothermal-wae-sano/>
- PT PLN. (2023, March 10). *Dorong transisi energi, PLN: Teknologi mempunyai peran penting*. <https://web.pln.co.id/media/siaran-pers/2024/03/dorong-transisi-energi-pln-teknologi-mempunyai-peran-penting>
- Purwanto, E. A., & Alfian, M. B. (2021). *Blended finance: Antara manfaat dan tantangan dalam penerapannya*. KPBU Kemenkeu. <https://kpbu.kemenkeu.go.id/read/1130-1294/umum/kajian-opini-publik/blended-finance-antara-manfaat-dan-tantangan-dalam-penerapannya#:~:text=Blended%20Finance%3A%20Antara%20Manfaat%20dan%20Tantangan%20dalam%20Penerapannya,-Oleh%3A%20Eko%20Agus&text=Tahun%202021%20d>
- Puspitasari, A. D., & Indriastuty, D. E. (2023). Funding urgency to establish an energy transition mechanism country platform through Green Bond Financial Instruments in Indonesia. <https://doi.org/10.33258/birci.v6i1.7445>
- Rachman, A. (2022). *Biaya Pensiun Dini PLTU per Giga Watt sekitar US\$400-450 Juta*. Tempo. <https://bisnis.tempo.co/read/1643805/biaya-pensiun-dini-pltu-per-giga-watt-sekitar-us-400-450-juta>
- Resosudarmo, B. P., Rezki, J. F., & Effendi, Y. (2023). Prospects of energy transition in Indonesia. *Bulletin of Indonesian Economic Studies*, 59(2), 149-177. <https://doi.org/10.1080/00074918.2023.2238336>
- Reyseliani, N., & Purwanto, W. W. (2021). Pathway towards 100% renewable energy in Indonesia power system by 2050. *Renewable Energy*, 176, 305-321. <https://doi.org/10.1016/j.renene.2021.05.118>
- Rifan, A. A. (2023). *Kebijakan fiskal untuk mendukung transisi energi menuju ekonomi hijau [Powerpoint presentation]*. https://iesr.or.id/wp-content/uploads/2022/06/220630-04_Kebijakan-Fiskal-untuk-Mendukung-Transisi-Energi-Menuju-NZE-compressed.pdf
- Saunders, M. N. K., Lewis, P., & Thornhill, A. (2019). *Research methods for business students*. Pearson.
- Sekaringtias, A., Verrier, B., & Cronin, J. (2023). Untangling the socio-political knots: A systems view on Indonesia's inclusive energy transitions. *Energy Research and Social Science*, 95. <https://doi.org/10.1016/j.erss.2022.102911>
- Surachman, E., Handayani, D., & Suhendra, M. (2022). *Integrated sustainable waste management and financing framework: A call for collaboration among local governments, central governments, multilateral agencies, and private institutions* [Policy brief]. Inclusive, Resilient, and Greener Infrastructure Investment and Financing. <https://www.researchgate.net/publication/363250152>

- Suroso, D. S. A., Setiawan, B., Pradono, P., Iskandar, Z. S., & Hastari, M. A. (2022). Revisiting the role of international climate finance (ICF) towards achieving the nationally determined contribution (NDC) target: A case study of the Indonesian energy sector. *Environmental Science and Policy*, 131, 188-195. <https://doi.org/10.1016/j.envsci.2022.01.022>
- The Climate Investment Funds. (2022). *Accelerating coal transition (ACT) investment plan for Indonesia*. https://cif.org/sites/cif_enc/files/knowledge-documents/ACT_IP_Indonesia_Factsheet_0.pdf
- UNFCCC. (2022). *Enhanced nationally determined contribution of the Republic of Indonesia*. https://unfccc.int/sites/default/files/NDC/2022-09/23.09.2022_Enhanced%20NDC%20Indonesia.pdf
- WALHI. (2022). *Nilai dan prinsip transisi energi yang adil dan berkelanjutan*. <https://www.walhi.or.id/uploads/buku/Nilai%20dan%20Prinsip%20Transisi%20Energi%20yang%20Adil%20dan%20Berkelanjutan.pdf>
- Whittington, J. (2012). When to partner for public infrastructure? Transaction cost evaluation of design-build delivery. *Journal of the American Planning Association*, 78(3), 269-285. <https://doi.org/10.1080/01944363.2012.715510>
- Williams, M., & Moser, T. (2019). The art of coding and thematic exploration in qualitative research. *International Management Review*, 15(1), 45-55.
- Williamson, O. E. (1989). *Transaction cost economics*. Handbook of Industrial Organizations, 1, 135-182.
- Williamson, O. E. (2005). Transaction cost economics and business administration. *Scandinavian Journal of Management*, 21(1), 19-40. <https://doi.org/10.1016/j.scaman.2005.02.002>
- Wood, D. J., & Gray, B. (1991). Toward a comprehensive theory of collaboration. *Journal of Applied Behavioral Science*, 27(2), 139-162. <https://doi.org/10.1177/0021886391272001>

Selected and Revised Papers from The Public Sector International Conference (PSIC) 2024. (PKN STAN, by 11-12 September 2024) after being peer-reviewed by the Organizing Committee of PSIC and Peer-reviewers of Jurnal Tata Kelola dan Akuntabilitas Keuangan Negara