

Energy Transition Roundtables
Policy Brief Series No. 1

GRID & FINANCING CHALLENGES

for Energy Transition in Indonesia

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Abbreviations

ASEAN	Association of South East Asian Nations
BLT	Build-Lease-Transfer
BOT	Build-Operate-Transfer
ENDC	Enhanced Nationally Determined Contribution
ETM	Energy Transition Mechanism
FCAS	Frequency Control and Ancillary services
Jamali	Java – Madura – Bali
IPP	Independent Power Producer
KPBU	Kerjasama Pemerintah dengan Badan Usaha (government and business entities cooperation)
PPA	Power Purchase Agreement
PT PLN	PT Perusahaan Listrik Negara (State Electricity Company)
PT SMI	PT Sarana Multi Infrastruktur
REBED	Renewable Energy Based Economic Development
REBID	Renewable Energy Based Industrial Development
SMV	Special Mission Vehicle
ToP	Take or Pay
VRE	Variable Renewable Energy

Highlights

1. Indonesia's commitment to the Paris Agreement includes an emission reduction target of 31.89% by 2030, with the potential to reach 43.2% with international support. The energy sector targets are 12.5% and 15.5%, **requiring a transition from fossil-based power generation to renewable and low-emission sources.**
2. The energy transitions roadmap towards net-zero emissions by 2060 aims to cease new fossil-based power generation by 2030 and rely solely on renewable energy and other low-emission resources. **This shift poses challenges in terms of grid performance and ensuring reliable electricity supply across Indonesia's diverse islands.**
3. The transition to a net-zero emissions economy in 2060 will **require significant capital investment, estimated at USD 1,108 billion or around USD 28 billion annually.** The majority of this investment will be directed towards power plant development and transmission system improvements.
4. **Financing the renewable energy transition is a major challenge**, with project proponents often lacking bankable project proposals and the banking and financial sector demonstrating a limited understanding of attractive financing arrangements.
5. **Managing grid improvement and development** can be facilitated through energy efficiency measures, the development of storage systems to mitigate intermittency, promoting economic activities near power generation sources, and opening transmission/grid development to other entities.
6. Addressing the financial challenge involves **exploring innovative financing mechanisms beyond public and private finance**, implementing de-risking mechanisms, enhancing the capacity of banking and financial sectors, and revisiting pricing structures.
7. Indonesia's recent **Just Energy Transition Partnership (JET- P)** is an initiative that will play a critical role in accelerating investment in the short term towards decarbonization.
8. Cross-cutting challenges related to policies, regulations, and human resources can be **addressed by improving coordination among sectors/ministries, establishing a strong legal basis for energy transition, and building the capacity of all stakeholders involved.**

Problem context

Indonesia is the most populous nation in ASEAN and, over the past half-century, has been the fourth-fastest growing large economy in the world. The country's impressive economic growth has been powered largely by fossil fuels, particularly coal, which accounts for 47% of the installed capacity, while renewable sources, including hydro, only contribute 15%.¹

The Government of Indonesia has undertaken a number of efforts to advance decarbonization. Indonesia is a signatory to the Paris Agreement, has submitted an Enhanced Nationally Determined Contribution (ENDC), and set a target for net zero by 2060 supported by a road map (Figure 1). The road map commits to reducing Indonesia's greenhouse gas emissions by 1.526 Billion tons CO₂ and breaks this commitment down into practical actions on both the demand and supply side for each 5-year window between now and the deadline. The country, along with 45 other nations, signed the Global Coal to Clean Power Transition Statement, emphasizing the rapid scaling of clean power generation, energy efficiency, and a just energy transition.

A key actor in the Indonesian electricity sector is the state utility company PT Perusahaan Listrik Negara (PT PLN). PT PLN plays a dominant role in the planning, investment, building and operation of energy infrastructure along the entire supply and distribution chain. PT PLN is, therefore, also a dominant factor in Indonesia's energy transition pathway. To date PT PLN has outlined three strategies for the power sector's transformation for the period 2021 – 2030, including renewable energy deployment, coal retirement, and fuel switching, aiming to increase electricity capacity and achieve 29% renewable contribution by 2030.²

To support the energy transition, the Government of Indonesia has launched the Energy Transition Mechanism (ETM) Country Platform, which will finance the phasing-out of coal, the transition to renewable energy, and the development of the electric vehicle ecosystem.

In addition, on 15th November 2022, Indonesia launched the Just Energy Transition Partnership (JET-P), which will mobilize an initial USD 20 billion in public and private financing to decarbonize Indonesia's power sector within a decade.

However, financing new generation in the power sector remains a challenge. Adequate storage systems and a smart grid are essential for managing the intermittency of renewable power generation and ensuring effective transmission. The projected investment required to achieve net-zero emissions by 2060 is USD 1,108 billion, with a significant portion allocated to power plant and storage system investments³.

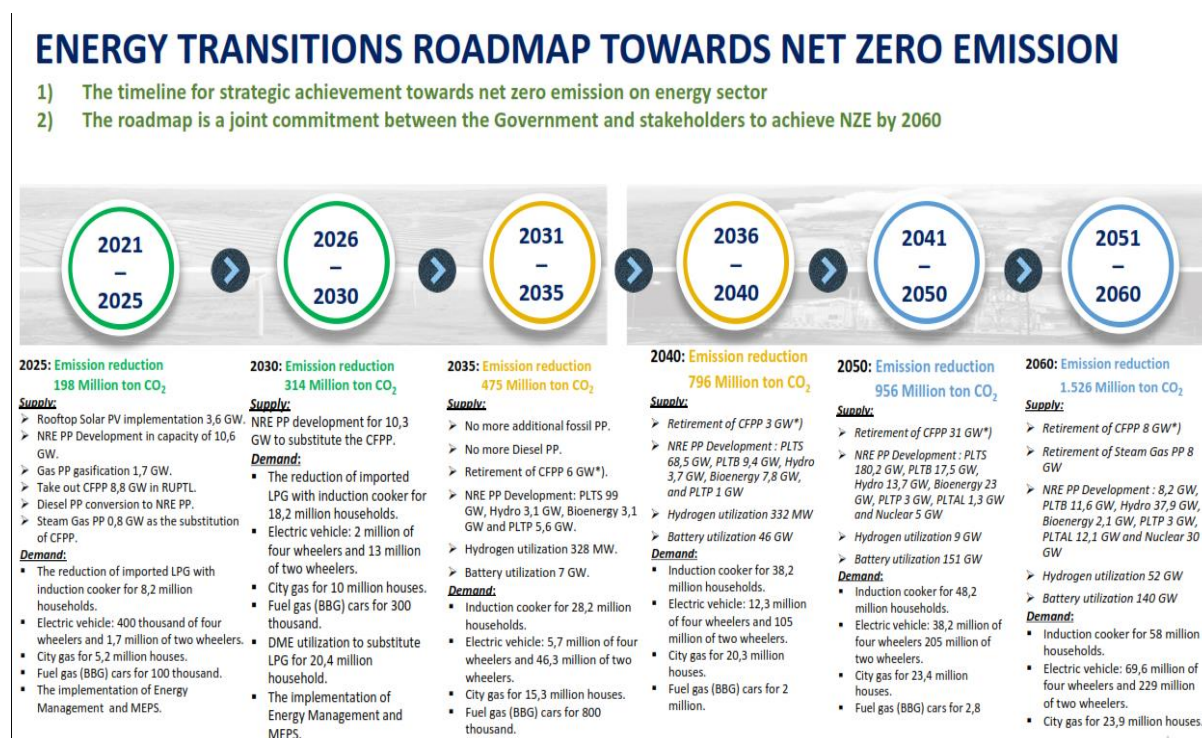
This policy note highlights the strategic challenges hindering Indonesia's energy transition with a focus on grid and financing challenges. It provides recommendations based on a policy roundtable organized by the Southeast Asia Energy Transition Partnership in September–October 2022 in Indonesia.

¹ DG Electricity, MEMR. (2022). Statistik Ketenagalistrikan 2021. ISSN 2829-0992.

² PT. PLN (Persero). (2021). Rencana Usaha Penyediaan Tenaga Listrik PT. PLN (Persero) 2021–2030.

³ Presentation "Electricity Infrastructure Investment Needs to Support the Energy Transition"–Mr. Mr. Wanhar from MEMR Indonesia

Figure 1 | Energy Transitions Roadmap towards Net Zero Emission (Kusdiana, 2022)



Issues Relating to the Electricity Grid

During the deep dive, participants reviewed the existing characteristics and trends in the power sector to brainstorm issues and challenges to decarbonization. Deliberations were divided into two working groups, one focussing on technical challenges related to the grid and the second related to the financial issues for advancing decarbonization. Dozens of issues were identified, which were then prioritized by the group.

Technical and contractual issues for the Indonesian power system

- Geographical complexity:** a key physical constraint on the infrastructure and the technical performance of the power system is the archipelagic and mountainous nature of Indonesia. This has hampered the development of grid infrastructure and placed physical barriers (i.e., the ocean) between demand centers and sites of generation, with knock-on implications for voltage and frequency stability as well as grid reliability. Some of Indonesia's island grids, especially in Jamali⁴ and Sumatera, experience periods of over-supply, which were exacerbated by the COVID pandemic, while other islands experience significant undersupply due to under-investment in generation capacity. Renewables compound this problem as resource potential and land availability issues can limit the potential for large

⁴ Jamali refers to the islands of Java – Madura – Bali which are interconnected on one electricity grid.

centralized RE power stations on the same islands as the nation's demand centers.

- **Power plant inflexibility:** Indonesia is heavily dependent on fossil fuel power generation. These large thermal plants are inflexible and cannot quickly adjust operations. Some fossil-fired power plants will not be economically viable if operated in low load. While renewable energy is variable on a seasonal and daily time step, which makes balancing supply and demand more challenging.
- **Grid infrastructure:** The majority of Indonesia's grid network is configured as a radial grid. While this structure is typically the cheapest to build and common to support grids extending to low-density populations, it suffers from efficiency and resilience issues and can also be inflexible to accommodate more distributed generation options.
- **Contractual structures:** the current take or pay (ToP) system in the Indonesian power purchase agreement (PPA) between PT PLN and independent power producers (IPPs) leads to inflexibility as PT PLN has to prioritize its supply based on the minimum amount in the contract. Similar PPA mechanisms also proscribe fuel supply, forcing PT PLN to purchase a minimum quantum of electricity or fuel and inducing inflexibility in operating gas-based power generation.
- **Ancillary Services:** At present, only energy is traded as an electricity service in the Indonesian power system, with other ancillary services such as Frequency Control and Ancillary services (FCAS), which are used to maintain the stability of electricity supply and system capacity, which is used to ensure reliability of supply are not properly valued in the grid. Instead, the responsibility for grid stability and reliability resides with PT PLN who manage their generation assets outside the market to provide these services.
- **Grid development and ownership:** The transmission system in Indonesia is fully built, operated, and owned by PT PLN. As a result, expansion and improvement of the transmission system have relied on PT PLN's financial capability, whilst the need for expansion and improvement is urgent. In the current RUPTL, the option of the partnership between PT PLN and private investors in grid development is not permitted but is under consideration, through build-operate-transfer (BOT), build-lease-transfer (BLT) and power-wheeling mechanisms.
- **Human resource capacity:** Implementation of the kinds of initiatives needed for grid transition will need a certain set of knowledge and skills. Many of these skills are new for government stakeholders at the national and sub-national levels. Capacity building of human resources is, therefore, also very important. The current grid operators will need training to be able to manage a smart grid network. Therefore, it is also important to have a published roadmap of the transition so that capacity building through formal, informal, and vocational education can be planned and implemented accordingly.

Issues relating to financing

Financing renewable energy development in Indonesia remains one of the largest challenges, with a projected need of approximately USD 1 trillion in financing. Participants highlighted the following challenges:

- **Readiness and understanding of financial institutions:** Financial institutions need to be well-informed and prepared to support renewable energy project financing. Various financing schemes, including blended finance, such as collaboration between the government and business entities (Kerjasama Pemerintah dengan Badan Usaha or KPBU), are crucial to increase the implementation of power sector transition actions, including grid system improvement.
- **Islamic finance:** Islamic finance has played an important role in other economic sectors (as regulated under Law No. 41/2004). Utilizing Islamic finance through waqf could be important for the energy sector. Exploring Islamic finance for supporting the energy transition is promising, as it aligns with sustainability and welfare principles. The National Committee on Islamic Finance (Komite Nasional Keuangan Syariah) governs Islamic financial products; however, there are insufficient financial products tailored to renewables available.
- **Other Innovative financing:** Exploring other innovative financing options, including small-scale and community-level development through crowdfunding, is needed to help RE deployment at multiple scales.
- **Market mechanisms:** The deployment of renewables provides value and environmental benefits to Indonesian society beyond electricity supply, while alternative energy sources such as fossil fuels and crude palm oil create environmental costs. At present, there are insufficient market mechanisms to account for these direct and indirect costs and benefits. The absence of this creates an uneven playing field, favoring some types of energy generation and disadvantaging others.
- **Attracting economically feasible projects:** PT Sarana Multi Infrastruktur (Persero) or PT SMI is a Special Mission Vehicle (SMV) suited to de-risk financing of the energy transition, particularly in electricity and energy efficiency. However, PT SMI faces challenges in attracting economically feasible project proposals and needs to revise its funding model to accommodate smaller-scale projects with significant impacts in rural areas.
- **Role of local banks:** Local banks play an important role, but the high loan size and risk associated with renewable energy-based power generation pose challenges for them.
- **Non-competitive pricing:** The current system of a single off-taker (PT PLN) and fixed electricity tariffs result in prices that do not reflect the real economic value. The undervalued purchasing price by PT PLN from IPPs affects their cash flow and return on investment. PT PLN determines the price, leaving IPPs with limited negotiating power due to the lack of alternative off-takers.

Recommendations

Improvement and development of the grid system in Indonesia is essential for the energy transition. To manage the pace of grid improvement and development, the following interventions are recommended.

Recommendations are aimed primarily at the government, but are also intended to be useful for state-owned enterprises and the private sector.

- **Accelerate Energy efficiency:** As has been the example in Australia, energy efficiency can play an important role in reducing growth in demand. Advancing energy efficiency will be an important element in Indonesia's energy transition management because growth in demand is projected to continue at high rates. Specific measures from Australia, such as innovations in heating and cooling technology, building design, energy efficiency ratings, and tariff price reform, should be considered, while a range of other measures are already identified in the national energy transition roadmap (induction cookers, electric vehicles, Minimum Energy Performance Standards (MEPS), energy metering and management). Indonesia should develop a Demand Management and Energy efficiency plan at national and subnational levels.
- **Development of a national storage strategy:** To manage a changing generation mix and the archipelagic nature of Indonesia's electricity network, requires more system flexibility. Energy storage can provide Indonesia with this built-in flexibility. Indonesia should create a technology-agnostic strategy for energy storage infrastructure to address variability in renewable energy generation profiles and ensure a reliable energy supply. Consider options such as chemical battery storage, pumped storage hydropower, and other storage technologies based on robust economic analysis.
- **Use zoning to plan new demand and generation deployment.** Implement programs like Renewable Energy Based Economic Development (REBED)⁵ and Renewable Energy Based Industrial Development (REBID)⁶ to optimize the transmission and distribution of renewable energy-based electricity. Zoning should also consider promoting the use of distributed energy resources that also support the siting of new generations closer to the site of consumption.
- **Develop a nationwide grid transformation strategy** that considers the Indonesian power system as a whole. Explore the benefits of smart grids, super grids, and distributed microgrids for optimal power sector design.
- **Introduce competition in grid development** by opening transmission and grid development to entities outside of PT PLN through mechanisms like BOT, BLT, and power-wheeling. This will increase the speed, economics, and efficiency of grid transformation.

To address the financial challenges, consider the following measures:

- **Innovate financing beyond public and private finance by exploring blended finance options** such as the KPBU⁷ model. Additionally, explore Islamic finance instruments like waqf and zakat. Crowdfunding can be utilized for small-scale and community-based projects.
- **Use de-risking instruments**, including public de-risking, financial risk mitigation, currency risk mitigation, and liquidity risk mitigation, to attract investment and reduce the cost of capital for the energy transition.

⁵ REBED is the Indonesian Government's program to support local economic development through development of renewable energy system

⁶ REBID is the Indonesian Government's program to develop an integrated large scale renewable energy system (especially hydro and geothermal) with industrial activities and economic clusters

⁷ Kerjasama Pemerintah Badan Usaha (KPBU) is the Bahasa Indonesia terminology for Public Private Partnerships

- **Build the capacity of the banking and financial sectors** to provide better access to financing for project proponents. This can be achieved by combining project financing with corporate financing, analyzing the bankability of renewable energy projects, and implementing recourse project financing and cash flow waterfall schemes.
- **Revisit the electricity pricing structure** to eliminate market distortion (i.e., fossil fuels subsidies) and level the playing field between different generating technologies competing for market penetration. A competitive wholesale electricity market will provide RE IPPs with a lower-risk investment environment and access to more financing options.

Conclusions

The energy transition in Indonesia's power sector is crucial for achieving the goals of the Paris Agreement. Although it comes with challenges, as an archipelagic country with abundant renewable energy resources, addressing the mismatch between resource location and demand requires technical and financial solutions. Sixteen specific recommendations were identified during the deep dive, which seek to provide sufficient finance and infrastructure for a resilient, reliable and affordable grid.



About Energy Transition Roundtables

The Southeast Asia Energy Transition Partnership (ETP) <https://www.energytransitionpartnership.org/> is a multi-stakeholder platform that aims to accelerate the energy transition in Southeast Asia and deliver the Paris Agreement targets on climate change by bringing together Government Donors, Philanthropies and Partner Governments. The ETP offers a strategic opportunity for multiple actors from government, civil society, and the private sector actors to come together and leverage their expertise and resources to support Governments' understanding and advance a more ambitious agenda of reform to optimize the Southeast Asian energy transition.

The Energy Transition Roundtables is a two-year capacity building and networking program that aims to provide an opportunity for the region's energy transition stakeholders – in particular, mid-career policymakers from identified Southeast Asia countries (Vietnam, Indonesia and the Philippines) and regional level bodies – to engage in an intensive 24-roundtable series on the energy transition.

The roundtables are delivered by the Australian National University (ANU) and Australia-Mekong Partnership for Environmental Resources & Energy Systems (AMPERES), in partnership with the Institute for Economic and Social Research, Faculty of Economics and Business, University of Indonesia (LPEM UI), the Indonesia Research Institute for Decarbonization (IRID), Ateneo School of Government (ASOG), University of San Carlos (USC), and MOIT's Electricity & Renewable Energy Consulting, Training and Information Centre (ECTIC).

The COP Policy Dialogue organised on 2 November 2022 is a high-level strategic discussion bringing together experts from Australia and 29 COP delegates from Indonesia and Vietnam to take stock of progress made on COP 26 commitments, share insights and lessons on decarbonising national electricity systems and identify the strategic issues that frame the agenda for effective negotiations at COP 27. This publication summarises and continues the discussion of this event.