Wind Energy Development in Indonesia
Investment Plan

FINAL REPORT | 2024

ENERGY TRANSITION PARTNERSHIP
Powering Prosperity and Enabling Sustainability in South East Asia

UNOPS

FINAL REPORT
Wind Energy Development in Indonesia: Investment Plan

2024

The project is initiated by the Ministry of Energy and Mineral Resources of the Republic of Indonesia (MEMR), managed by the Southeast Asia Energy Transition Partnership (ETP), and hosted by the United Nations Office for Project Services (UNOPS).

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Foreword
Director General of New Renewable Energy and Energy Conservation

Indonesia's commitment to achieving a renewable energy mix target of 23% by 2025 and 31% by 2050. For this reason, good effort and cooperation from all relevant stakeholders is needed. Achieving this target is very important to support the achievement of Indonesia's Enhanced Nationally Determined Contribution (ENDC). Through ENDC, Indonesia targets reducing carbon gas emissions by 2030 by 32% (own efforts) and 43% (with international assistance). One effort to achieve this target is to develop Wind Power Plants (*Pembangkit Listrik Tenaga Bayu*/PLTB). PLTB not only significantly contributes to reducing carbon emissions but also strengthens national energy resilience, improves environmental quality, and promotes local economic development.

This Final Report is based on the Wind Energy Development in Indonesia: Investment Plan project initiated by the Ministry of Energy and Mineral Resources, managed by the Southeast Asia Energy Transition Partnership (ETP), and implemented by the United Nations Office for Project Services (UNOPS). The report summarizes the main findings of four project outputs, namely the Roadmap for Onshore Wind Energy Development in Indonesia, the Permitting and Regulation Assessment for Onshore Wind, the Wind Energy Development Booklet: Assessment of 8 onshore sites across Sumatra and Java, and the Investment Opportunities and Access-to-Finance Guide for Indonesian Wind Energy Projects.

We hope that this report will be beneficial to all stakeholders and encourage concrete steps to accelerate the energy transition in Indonesia. Let us continue to collaborate in order to create a better and more sustainable future for the next generations.

Director General of New Renewable Energy and Energy Conservation,

Prof. Dr. Eng. Eniya Listiani Dewi

"*We hope that this *Final Report of Wind Energy Development in Indonesia: Investment Plan* can help stakeholders in strategizing and making decisions to realize the acceleration of wind energy sector development in Indonesia. Let us together drive the national energy transformation towards a greener and cleaner future*."

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Project Background

Indonesia has set the target for Net Zero Emissions by 2060 or sooner. Also, for the share of renewable energy in its national energy mix, targets have been set in the past to 23% by 2025. Despite such targets, the ample interest from renewable energy developers, and the availability of financing on attractive terms, the development of renewable energy infrastructure has been relatively slow. According to the Indonesia Energy Transition Outlook (IETO) 2022 report by IESR[1], the share of renewable energy in the primary energy mix had even declined to 10.4% in 2022, from 11.5% in 2021.

To achieve these targets, various renewable energy sources must be exploited leading to a balanced energy mix. Wind energy is one of the technologies that can be developed on a large scale both on- and offshore across Indonesia. The estimates of potential vary greatly from 17 GW up to 155 GW. Even if the lower amount is achieved, the leap forward in reaching the renewable energy targets is significant. This is especially because at this moment the utilization of wind energy in the country is lagging far behind its potential: total installed wind farm rated capacity in 2024 is 154 MW, which is contributed by two wind farms in Sulawesi (PLTB Sidrap and PLTB Tolo). This significant underutilization shows an ample opportunity for wind energy to be developed in Indonesia.

In February 2022, the Southeast Asia Energy Transition Partnership (ETP), convened a Wind Technical Working Group (TWG) for wind energy. The findings from that TWG emphasized that accelerating the development of Indonesia's wind energy is not a straightforward process. The current landscape of Indonesia's wind sector is characterized by multiple stakeholders with varying interests, strong competition and discontent among developers, and unclear project development steps. This and several other factors create a high uncertainty and haziness for developers and financiers to enter Indonesia and invest in (early-stage) wind energy development.

The organization and findings from 2022's TWG have shown the needs for a more attractive wind sector in Indonesia and marked the first steps of the project titled ***Wind Energy Development in Indonesia: Investment Plan***. This project is initiated by the Indonesian Ministry of Energy and Mineral Resources (MEMR), managed by ETP, and hosted by the United Nations Office for Project Services (UNOPS). ETP is a multi-donor partnership formed by governmental and philanthropic partners to accelerate sustainable energy transition in Southeast Asia in line with the Paris Agreement and Sustainable Development Goals. UNOPS is the fund manager and host of ETP Secretariat.

[1] Institute for Essential Services Reform

Project Content

The project *Wind Energy Development in Indonesia: Investment Plan* consist of four separate analyses that serve as stand-alone deliverables but have significant interconnecting topics:

Roadmap for Onshore Wind Energy Development

The roadmap is created to determine the existing gaps/barriers that hamper the acceleration of future onshore wind project developments in Indonesia and the steps to overcome these barriers.

Permitting and Regulation Assessment for Onshore Wind

The permitting and regulation assessment is a follow-up to the Roadmap, diving deeper into the regulation and permitting frameworks that underpin Indonesia's wind energy sector. Furthermore, this study is intended to find and explain the challenges in wind regulation and permitting, as well as to propose ways of overcoming the challenges. Therefore, readers can be informed of the recommended action points on regulation and permitting to drive wind energy development forward.

Mapping of Onshore Wind Energy Potential

The onshore wind energy potential mapping consists of elaborate but early-stage assessment of 8 onshore wind locations across Sumatra and Java. The aim of this assessment is to determine the initial techno-economic viability of these project locations in order to ultimately attract donors and investors for funding the subsequent project development stages.

Investment Opportunities and Access-to-Finance Guide for Onshore Wind Energy

The guide provides an overview of the options that are available in Indonesia to finance onshore wind farms. It includes a breakdown of the project development stages, the available financial products, types of investors, and a stepwise approach to access the available financing.

Intended Use and Guidance

The underlying *Final Report* is a merger of the executive summaries of three stand-alone documents based on the first three previously mentioned analyses, namely:

- Roadmap for Onshore Wind Energy Development
- Permitting and Regulation Assessment for Onshore Wind Energy
- Mapping of Onshore Wind Energy Potential

In addition to these three executive summaries, the underlying *Final Report* also includes the *Investment Opportunities and Access-to-Finance Guide for Onshore Wind Energy*, which is also available as a stand-alone document. This is the result of the fourth executed analysis.

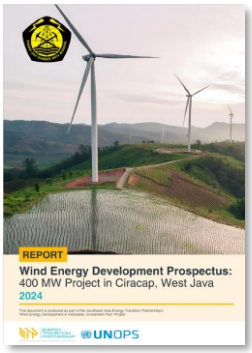
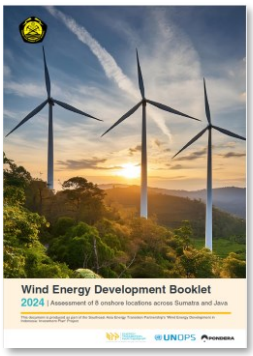
Aside from this Final Report, the following stand-alone deliverables have been created as part of the *Wind Energy Development in Indonesia: Investment Plan*:

Full report: Roadmap for Onshore Wind Energy Development

This deliverable concerns the underlying full report of the included executive summary. It is intended for at least two types of readers. First of all, for private sector parties (investors, developers, services providers, etc.) that are looking for a comprehensive overview of the wind energy sector in Indonesia, its challenges and the roadmap from improvements. Secondly, for organizations and persons that have the intention to improve the wind energy landscape, for which the roadmap can provide specific recommendations.

Full report: Permitting and Regulation Assessment for Onshore Wind

This deliverable concerns the underlying full report of the included executive summary. The intended readers for this deliverable are similar to the ones for the Roadmap. Moreover, the assessment provides specific insights for wind energy developers that are looking for an overview of regulations to which their projects need to adhere.

	**Wind Farm Prospectus for eight onshore wind sites**	The deliverable consists of eight individual reports for all assessed wind sites. This includes the full methodology explanation, analyses and results per onshore wind site. The aim of the prospectus is to attract the interest of investors and developers by providing the necessary preliminary insights in the feasibility of each site.
	**Wind Energy Development Booklet**	This deliverable is a graphic summary of the eight wind farm prospectuses. The essential results from the prospectuses are translated into visuals with the aim that potential investors and developers get a quick understanding of the potential of each investigated onshore wind site and a guide for the next development steps.
	**Investment Opportunities and Access-to-Finance Guide**	This deliverable is intended as guidance for developers that seek options for financing specific project development stages in onshore wind projects. The guide can also be used by the Government of Indonesia to access public financing for onshore wind development.

The deliverables above can be downloaded from the following link:
https://www.energytransitionpartnership.org/publication/

1 Executive Summary: Roadmap for Onshore Wind Energy Development

1.1 Background

Energy has a significant role in fulfilling the needs of the Indonesian population and for the future development of Indonesia. According to the Indonesia Energy Transition Outlook by IRENA (2022), the country's energy demand will increase by more than three times of what it is now because of the rising population and the economic growth in Indonesia. The publication also states that the level of electricity demand in 2050 is expected to be five times the corresponding level in 2022. To fulfil the demand, Indonesia must carefully consider the energy resources to be exploited in accordance with the push for the energy transition.

In Indonesia, wind is a significant source of RE which can be harvested. Indonesia is estimated to have wind energy potential of 155 GW, consisting of 60.6 GW of onshore wind and 94.2 GW of offshore wind (BBSP KEBTKE, 2023). However, the current utilization of wind energy is only 154.3 MW, or less than 0.1% of the potential.

Given the huge yet underutilized potential, it is essential to identify the obstacles and issues that need to be solved in order to achieve the goals stipulated in the National Energy Policy and the international commitments that have been made. This Roadmap for Onshore Wind Energy Development in Indonesia is created to identify these opportunities and difficulties and is intended to serve as a guide for achieving Indonesia's wind energy development goals. Even though there have been numerous prior studies and efforts on this topic, this roadmap is aimed at compiling the results into one comprehensive report, which will serve as a specific roadmap for Indonesia’s wind energy sector.

1.2 Relevance to project objectives

This roadmap (study) is part of a project titled *Wind Energy Development in Indonesia: Investment Plan*. This project is initiated by MEMR, managed by the Southeast Asia Energy Transition Partnership (ETP), and hosted by the United Nations Office for Project Services (UNOPS). ETP is a multi-donor partnership formed by governmental and philanthropic partners to accelerate sustainable energy transition in Southeast Asia in line with the Paris Agreement and Sustainable Development Goals. UNOPS is the fund manager and host of ETP Secretariat.

The purpose of this roadmap is aligned with the overall vision of MEMR as the main beneficiary of the roadmap, which is by providing technical assistance to MEMR in order to overcome challenges in proliferating renewable energy (including wind energy) development in Indonesia. During the formulation of this roadmap, engagement activities with key stakeholders from both public and private sectors, as well as national and international actors, were held through interviews, consultations, and the organization of Wind Power Technical Working Group (TWG) events, in which the preliminary results were disseminated, and the feedback was received.

This roadmap is also in alignment with the objectives of the project. In particular, the roadmap contributes to the fulfillment of two project objectives, namely: (i) gather, stocktake, and compile previous studies and work with regards to the wind sector in Indonesia; and (ii) determine a stepwise roadmap for the development of the wind sector in Indonesia. Moreover, two overarching outcomes of the project are addressed through this roadmap: (i) establish a wind sector development roadmap to guide the sectors development, highlighting gaps and impediments and offering a systematic approach that can be adopted by all stakeholders; and (ii) encourage informed decision-making on the development of wind energy in Indonesia. Furthermore, this roadmap serves as the foundation for the subsequent deliverables created in the overall project (Wind Energy Development in Indonesia: Investment Plan) which are the *Permitting and Regulation Assessment for Onshore Wind*, the *Mapping of Onshore Wind Energy Potential*, and the *Investment Opportunities and Access-to-Finance Guide for Onshore Wind Energy*. Altogether, these four studies form the *Wind Energy Development in Indonesia: Investment Plan*

1.3 Approach

Based on the two project objectives, this study is expected to answer the research questions below:

1. What are the lessons learned from past studies and projects in Indonesia's onshore wind energy sector?
2. Based on the lessons learned, what are the existing gaps/barriers that hamper the acceleration of future onshore wind project developments?
3. What are the steps to overcome these gaps/barriers, who needs to take which step, and when and how shall the steps be taken?

1.4 Results

In the table below, the challenges and lessons learned from past studies and onshore wind projects in Indonesia are identified.

Category	Description	Consequences	Urgency to overcome barriers
Wind data availability	• Limited availability of accurate long-term wind data • High level of uncertainty of mesoscale models as the alternative to long-term wind data • Financial burden of investments for wind measurements during tender processes by developers • Lower probability to reach financial close for a project due to uncertainties in wind data • Unpredictability of wind behavior during wind farm operation, resulting in difficulties for PLN to predict electricity production	Wind data has the highest priority in a wind farm's business case, and thus, these challenges create a high risk profile for developers and investors to step into wind energy development in Indonesia. This risk profile leads to either higher costs (e.g. higher interest rates) or parties starting to invest somewhere else.	Short term solution required
Availability of spatial data and standardized processes	• Absence of a clear Indonesian guideline on the analysis criteria and considerations for the technical, environmental, and social impact of a wind farm • Lack of accessible and consistent digital or high-resolution spatial (planning) data to support screening of potential locations and designing wind farm layout • Lack of standardization in the development process, including minimum prerequisite studies, feasibility study guideline, etc.	The unavailability of spatial data hampers not only the developers, but also the stakeholders in determining the optimal location for wind farm development. Without standardized processes, duration of project development can get extended, and difficulties may arise when comparing bids.	Short term solution required
Policy/Regulation and Permitting	• Uncertainty and frequent change of policies by the Government have created risks for investors and may impact the financial viability of projects • Inconsistent implementation of existing regulations • Delays in permitting process and land acquisition	For long-term investments (e.g. a pipeline of projects), developers and investors require a stable regulatory environment before entering into a country. These challenges create a high risk profile for them to enter Indonesia, and in turn, this condition leads to either higher cost (e.g. higher interest rates) or parties starting to invest somewhere else.	Medium term solution required
Research and Development	• Lack of Research and Development (R&D) activities for wind energy development and deployment to build a mature sector in Indonesia.	Without a proper knowledge base on wind energy in Indonesia, larger long-term challenges (e.g. wind data availability, grid stability, and local supply chain) cannot be solved properly or only with the support from outside of the country.	Long term solution required
Industrial Capacity	• Large investments and a pipeline of projects required for setting up a local supply chain • Lack of local knowledge on the technology • Limited skilled local workforce available	Being dependent on technology from foreign countries creates a vulnerability in terms of cost increase, quality assurance, and geo-political challenges. Furthermore, it could entail a missed opportunity for Indonesia to increase the labor welfare in this sector.	Long term solution required

Category	Description	Consequences	Urgency to overcome barriers
Infrastructure	• Sites with wind energy potential are not always near a well-developed grid; lack of transmission and distribution system infrastructure • Hard to ensure the stability and reliability of wind power given its intermittency; whereas BESS (battery energy storage system) is still relatively expensive to produce and integrate with wind power plants • Lack of supporting infrastructure such as port and road access	Absence of proper infrastructure could increase the project development costs, since the costs would have to include infrastructure improvements (which also lengthen the project duration). If these costs have to be carried by the project developers and are too significant, the feasibility of such projects could drop and hold/stop the project development.	Long term solution required
Financing & Bankability	• Suboptimal impact and support provided by existing fiscal and non-fiscal regulations to investments in wind energy • Perception of wind project investments in Indonesia as 'risky and slow', especially concerning the bankability of the unequally balanced PPAs between PLN and the developer	Before developers and investors decide to make large investment in a wind energy project in Indonesia, they require the right incentives and a well-balanced PPA to ensure a reliable business case throughout the project lifetime. If this business case cannot be guaranteed, they will perceive the project as having a high risk profile. In turn, this risk profile leads to either higher costs (e.g. higher interest rates) or parties starting to invest somewhere else.	Short term solution required
Procurement Mechanism	• Uncertain and unclear PLN procurement process of wind projects, bringing considerable risks for the developers	For long-term investments (e.g. a pipeline of projects), developers and investors require a stable, reasonable, and transparent procurement process before entering a country and starting to bid on projects. If this process cannot be offered, they will perceive the project as having a high risk profile. In turn, this risk profile leads to either higher costs (e.g. higher interest rates) or parties starting to invest somewhere else.	Short term solution required

Using the identified key challenges in the development of wind energy, steps that need to be taken to overcome these challenges are prepared in the form of a roadmap. The roadmap is laid out for the period of 2023-2030 of wind energy development in Indonesia. It includes a list of actions accompanied by the role of stakeholders, which is divided into different types of responsibility based on the RACI (Responsibility Assignment) Matrix. This identifies for each action which stakeholder should be R (Responsible), A (Accountable), C (Consulted), and I (Informed).

For each key area, the matrix specifies which roles are assigned to the stakeholders. Multiple roles can be assigned to a single task, and the specific combination of roles for each task clarifies who is doing the work, who is overseeing it, who needs to be consulted, and who should be kept informed. The table below presents the proposed stakeholders to be involved in performing the actions.

Abbreviation	Description
MEMR	Ministry of Energy and Mineral Resources
MoF	Ministry of Finance
MoI	Ministry of Industry
MoIn	Ministry of Investment
MoPW	Ministry of Public Works and Housing
BSN	Badan Standardisasi Nasional/National Standardization Agency
MoEF	Ministry of Environment and Forestry
KATR/BPN	Ministry of Agrarian Affairs and Spatial Planning / National Land Agency (Kementerian Agraria dan Tata Ruang/Badan Pertanahan Nasional)
BRIN	Badan Riset dan Inovasi Nasional / National Research and Innovation Agency
PLN	PT Perusahaan Listrik Negara (Persero), state-owned enterprise (SOE) in electricity, acting as grid operator and power off-taker
Industry/Association/Lenders	Wind association or Investors/Developers or Lenders (international and local institutions)

For each of the categories included in the action plan for the roadmap, an explanation is first given about the recommended actions to be taken.

1.4.1 Wind data availability

The variable character of wind, in combination with the complex terrain in Indonesia, makes it difficult to pinpoint the real potential of wind energy at specific locations. This is a challenge for the Government (i.e. MEMR and through the SOE PLN) in developing wind energy. For instance, RUPTL PLN contains several planned wind projects on locations with likely too little wind resource.

The current condition also poses a challenge for the developers that seek interesting locations to invest in, since the investment often comes with very high risks. Therefore, it is advised in this roadmap to use a top-down approach for future wind projects in which the Government streamlines the selection of wind project locations and takes responsibility for the first part of the project preparation. This approach consists of the following steps:

Step 1. Identification of potential wind energy locations.

Conducting proper research (using more suitable modelling software for complex terrain assessment like GRASP) on areas that have sufficient potential to be included in a shortlist of potential wind farm locations.

Step 2. Identification of go-zones within potential wind energy locations.

Exclusion of “no-go zones” (e.g. housing, protected forest, economic/commercial areas, etc.) from potential wind energy locations, to determine the go-zones.

Step 3. Verification of wind characteristics at the potential wind energy locations.

It is recommended for the Government (PLN, PLN subsidiaries, or MEMR) to conduct these measurements and to offer them as part of the site data which will be received by the bidders during the project’s tender process. In this way, a standard approach of wind data gathering can be used for all projects and prevent a proliferation of met mast being built in the same region by competing developers. In turn, the financial burden on the developers who wish to participate in the tender will be lowered significantly, creating a more sustainable and healthy wind sector.

Step 4.Develop more accurate, long-horizon forecast models.

More precise and longer-term output forecasts would increase the feasibility of scheduling less rapidly deployable plants with more cost- effective fuel needs, such as coal-fired power plant and combined-cycle gas turbines, to balance the variable wind power in the system. To accomplish this, it is crucial to develop advanced forecasting models that make use of meteorological data, real-time data from operational wind plants, and remote sensing technology.

1.4.2 Availability of spatial data and standardized processes

This roadmap promotes the enhancement of the availability of spatial data and standardized processes through the following three key points:

Digitalization of geospatial maps

It is recommended that all geospatial maps required for the site selection process should be available digitally. To realize this, the Central Government must endorse the digitalization of this information to be prepared by each data-owning institution. Specific guidelines should be provided to align the process, namely, to ensure that the information is processed using a similar standard.

Designing a guideline for site assessment criteria

Several constraints are applicable for selecting the go-zone for a potential wind farm. Aside from a couple of standards in the SNI for wind energy, a clear guideline on the analysis criteria and considerations for the environmental and social impact of a wind farm are not yet present in Indonesia. The strong recommendation from this roadmap is to develop such a guideline, using the attached table with a selection of examples.

Subject	Criteria	Considerations
Wind characteristics	• Application of threshold values for wind speed, turbulence level, wind shear, consistency, etc.	• Wind characteristics vs. investment cost for infrastructure (e.g. in complex undeveloped terrain) • Nearby objects (e.g. large buildings) interfering with the free flow of the wind • Prevailing wind direction in relation to the terrain outlook, considering the wake effects that can occur
Logistic/access	• Maximum distance from port to the site	• Road access conditions • Required upgrades of existing infrastructure
Nearby dwellings	• Minimum distance to urban or residential and industrial areas, considering noise, shadow flickering, and external safety • Minimum distance to airports and military areas	• Potential direct offtake of nearby industrial areas • Nuisance for nearby residents during logistical operation and construction
Topography and Geotechnical	• Maximum elevation and slope for wind farm construction • Maximum level of cut and fill required for foundation and infrastructure (capital intensive)	• Soil conditions determine the type of foundation for the wind turbines • Soft soil and soil with porosity (void) or liquefaction risk to be avoided • Seismic risk (including earthquakes and landslides) • Flood risk • Lightning risk

Designing guidelines for wind development in Indonesia

In order to establish high-quality standards of wind farm development in Indonesia, it is important that project developers and investors are guided on what is expected from them during the project's development stage. A guideline, which includes not only the expectations and requirements of the Government, but also the requirements from banks for project financing to ensure a smooth due diligence process, shall thus be formulated. There are several vital aspects to ensure the effectiveness of this guideline: Consistency, Transparency, Clarity, and Responsibility.

1.4.3 Policy/regulation and permitting

The improvement of policy/regulation and permitting process for accelerating wind energy development can be performed by the following three key points:

Define key conditions for regulations and permitting in the wind sector

- Consistency: Developers and investors should be assured that regulations and permitting processes are always applied in a consistent and diligent manner.
- Transparency: Suggested changes to a policy or regulation should be announced in a timely manner and should preferably involve consultation with the key (private) stakeholders in the wind sector. Moreover, a clear but reasonable cut is required on how this revision applies to ongoing projects and future projects.
- Clarity: Evaluation criteria for permit applications should be reasonable, be clearly defined upfront, and refer to published standards.
- Responsibility: Overlap between requirements and studies from different authorities should be prevented. Specific studies should be evaluated by one authority for approval.

Continuous improvement on OSS system

A standardized, more transparent permitting procedure will reduce project uncertainty. Thus, continuous improvement is crucial, by monitoring and actively gathering feedback from related stakeholders, such as investors and the related government institutions. When possible, it is recommended to create a fast-track program for accelerating permitting process for wind power projects, subject to the fulfilment of pre-requisite documents and requirements for specific permits.

Smoothening land acquisition process

Governments and project developers need to engage in thorough planning, community outreach, and environmental impact assessments. It is essential to consider the social and environmental implications of land acquisition, ensuring that the transition to cleaner energy sources aligns with broader sustainability goals. It is also recommended to formulate an improved national plan of approach to smoothen the acquisition process which takes the values of the landowners and local inhabitants into account.

1.4.4 Research and Development

Specific actions are recommended through this roadmap to improve the level of R&D on wind energy in Indonesia.

Prioritization of specific R&D topics for wind energy development

Based on the three main fundamental challenges which will need further R&D and strategic studies, the following key research topics are defined to be of priority:

- Preparation of a detailed project pipeline for implementation, based on actual and more realistic figures of the targeted installed capacity of wind farms
- A cost-benefit analysis on Indonesia's industrial capacity building for the local manufacturing of wind turbine components
- Research on how transmission-related issues due to the intermittency of WPP and weak grid systems can be solved

Increased international R&D collaboration

Reaching the wind development target in Indonesia necessitates a boost in R&D funding. For this international R&D collaboration, multilateral development banks (MDBs) can serve as vital sources of funding. Financing facilities can be tailored to support various needs on a case-by-case basis. Bilateral development banks also play a crucial role in providing funding for development projects. For instance, the German state-owned Kreditanstalt für Wiederaufbau Bank (KfW) established an agreement with the Indonesian Ministry of Finance in 2022, providing EUR 300 million promotional loan as part of the Sustainable and Inclusive Energy Programme. The financing package was expected to push for reforms in Indonesia's RE sector, which among others include improved regulations for rooftop solar PV and feed-in tariff mechanisms for renewables. Another example is the Asian Development Bank (ADB) who sets up and funds the Energy Transition Mechanism in 2021. For the accelerated early retirement of operational coal-fired power plants, ADB prepares funds to refinance existing coal-fired power plants, bring forward the plants' planned retirement, and replace these plants with cleaner and more sustainable alternatives of power generation.

1.4.5 Industrial Capacity

The wind industry in Indonesia is still in a very premature stage. So far, only wind turbine towers are produced in Indonesia for export. Furthermore, the two wind farms that have been established so far were largely dependent on experts from outside Indonesia. This shows that there is still a significant room to enhance the industrial capacity for the Indonesian wind sector. Such industrial capacity can be subdivided into two aspects:

Development of a local supply chain

When considering the local supply chain development, the following should be taken into account. As mentioned in the subsection on priority R&D topics, it is advisable to first conduct a proper cost- benefit analysis on Indonesia's industrial capacity building for the local manufacturing of wind turbine components. A major challenge is that such local supply chain requires large investments and a pipeline of projects to encourage manufactures (and investors) to establish factories in Indonesia. To establish such a pipeline, many actions have been identified in the other key areas of this roadmap.

Development of local know-how and expertise in wind energy development

This should consider the two underlying challenges namely, lack of local knowledge of the technology and limited availability of skilled local workforce. Specific actions can be taken to overcome these challenges, as proposed in the attached table (limited selection).

Action	Activities
Identify industry needs and standards	This entails identifying the specific skillsets and certifications required in the wind industry. This may include positions like wind turbine technicians, electricians, safety specialists, and project managers. It is also important to understand the industry's safety standards and regulatory requirement.
Engage stakeholders	Collaboration shall be formed with industry associations, local government agencies, wind project developers, and (international) educational institutions to collaborate on education and certification of skilled personnels.
Develop a curriculum	Creation of a curriculum for expertise development can cover both theoretical knowledge and practical skills relevant to the wind industry. It is essential to ensure that the curriculum is aligned with industry standards and safety regulations. The curriculum could include modules on wind turbine operation and maintenance, electrical systems, safety procedures, and environmental considerations.
Select training providers	This covers the selection of partner(s) or training providers (e.g. technical schools, community colleges, or specialized training organizations) to deliver the programs. Part of the selection process is to ensure that these providers have qualified instructors with relevant industry experience.
Funding and resources	Securing funding is important to begin training programs. Funding may come from a variety of sources, including government grants, industry sponsors, development banks, and international funding (e.g. JETP). Resources should be deployed for designing and realizing training facilities, equipment, curriculum development, and training materials.
Accessibility and inclusivity	Training programs should be accessible to a diverse group of participants to achieve gender balance and involve underrepresented or marginalized communities. One option to consider is offering scholarships or financial assistance to those who may face economic barriers to participate.

1.4.6 Infrastructure

Based on the identified challenges, the following recommended actions are included in the roadmap to address the challenges related to infrastructure.

Transmission system expansion, enhancement, and island-interconnections

- The planning and development of grid expansions should be synchronized with RE project planning and development (including onshore wind farms). After the identification of potential wind energy locations, action needs to be taken by PLN to prepare the potential expansion of the grid (with sufficient capacity) to the wind farm location.
- Aside from the grid expansion to wind farm locations, general reliability and stability enhancement of the grid by PLN (with sufficient capacity) is an important requirement to enable the evacuation of electricity from variable RE.
- In the long term, Indonesia will require more interisland connections to link, for example, the grid of Kalimantan with that of Java. A so-called Indonesia Supergrid will lead to optimizations of the nationwide utilization of RE sources and create a large, stable grid in which variable, dispatchable, and baseload electricity production can operate in balance.

In-depth assessment of incentives for BESS integration

An in-depth assessment of incentives for BESS integration in areas with weak grids and RE potential are vital to address energy challenges, promote sustainability, improve grid reliability, and drive economic growth. These efforts are aligned with the broader goals of transitioning to a cleaner and more resilient energy infrastructure.

Identification of potential synergies in multi-beneficiary use of road and port improvements

For an onshore wind farm, reliable road infrastructure is required to transport the very large wind turbine components to the site. This is unavoidable and will in many cases be a significant cost element in the business case of the project. What could be improved is to avoid the construction of road infrastructure only dedicated to the construction and maintenance of the wind farm alone. It would be beneficial if a synergy could be found between access to the wind farm and using the same road (likely with some expansion) to connect economic regions, connect remote villages, or decrease the pressure on existing infrastructure. The same type of synergy could also be looked for in port development. Necessary improvements of port facilities for offloading wind turbine components could also be beneficial to the port owner in the long term (e.g. heavier offloading cranes and larger storage yards).

1.4.7 Financing & Bankability

The technical feasibility of an onshore wind project is one key precondition. The second one is bankability of the project. Bankability is dependent on a predictable and transparent risk and return profile of the project for lenders and investors. Major factors for bankability are:

Incentives to overcome high “learning cost”

In an immature wind energy sector like Indonesia’s, developing a wind farm is associated with a significant “learning cost”. This is due to the lack of a standardized process, industrial capacity, and infrastructure. Although such a high cost is completely normal in a developing sector, with the right (financial) incentives, the learning cost could be overcome and potentially create a viable business case.

Conditions of Power Purchase Agreement (PPA) with PLN

For a period of 20-30 years, the agreement determines how the wind farm will earn back on its investment and creates a return on investment for lenders and investors. Therefore, conditions in the PPA need to be reasonable and consistent in order to result in a bankable project.

1.4.8 Procurement Process

Even though PLN’s procurement process is clearly defined on paper, based on the conducted interviews, the process is still considered as the main bottleneck for a successful wind energy development due to several factors. The following challenges require strong attention to be overcome in the procurement process:

- Considering the nonrecourse project financing, the duration of financial close to be reached after PPA is awarded (PPA effective date), is expected to be more than 6 months, which is stipulated in the tender schedule. This needs to be adjusted in the procurement process.
- More than 1 month is needed to secure all required permits and studies after winning bidder announcement. Time needs to be allocated for this in the procurement process.

- A clear explanation is required if the tender is paused or cancelled (which has happened several times in the past years) to promote transparency.
- The procurement process would improve significantly (in terms reasonable risks for developers, quality assurance, and consistency) if the Government would take the responsibility in the preparation of wind farm projects (e.g. conducting wind measurement, executing pre-FS, and gathering spatial data).
- Issuance of a clear timeline (month, year) when projects will be tendered. Such a timeline should include a pipeline of projects for the coming years, which enables developers to timely prepare resources and start preparations (i.e. studies) for the upcoming tender processes. This will also create a more reasonable market behavior, preventing all developers merely focusing on the next project tendered instead of a long-term investment strategy.

Action Plan	Year								Role of Stakeholder											
	2023	2024	2025	2026	2027	2028	2029	2030	MEMR	MoF	MoPW	MoEF	KATR/BPN	BRIN	MoI	MoIn	BSN	PLN	Assoc. & Industry
Wind data availability																				
Step 1: Identification of potential wind energy locations	→	→							R/A					C				I	C
Step 2: Identification of go-zones within potential wind energy locations		→	→	→					R/A	C	C	C	C	C				I	C
Step 3: Verification of wind characteristics at the potential wind energy locations			→	→	→	→			R/A	C				C				R/A	C
Step 4: Develop more accurate, long-horizon forecast models				→	→	→	→	→	R/A	C				C				R/A	C
Availability of spatial data and standardized processes																				
Digitalization of geospatial maps	→	→	→	→					C		R/A	R/A	R/A						I	
Designing a guideline for site assessment criteria	→	→	→						R		C	C	C						C	
Designing guidelines for wind development in Indonesia	→	→	→						R/A							C	C	R	C	
Policy/regulation and permitting																				
Define key conditions for regulations and permitting in the wind sector	→	→							R/A	C	C				C	C		C	C/I	
Continuous improvement on OSS system	→	→	→	→	→	→	→	→								R/A			C/I	
Smoothening the land acquisition process	→	→											C			R/A			C/I	

Action Plan	Year								Role of Stakeholder											
	2023	2024	2025	2026	2027	2028	2029	2030	MEMR	MoF	MoPW	MoEF	KATR/BPN	BRIN	MoI	MoIn	BSN	PLN	Assoc. & Industry
Research and Development																				
Prioritization of specific R&D topics for wind energy development	→	→	→	→	→	→	→	→	A	C				R	C	C	I	C	C/I
Increased international R&D collaboration	→	→	→	→	→	→	→	→	A					R		C	I	C	C/I
Industrial Capacity																				
Development of a local supply chain	→	→	→	→	→	→	→	→	A	C				C	R	C	C	C	C
Development of local knowhow and expertise in wind energy development	→	→	→	→	→	→	→	→	A								R	C	C
Infrastructure																				
Transmission system expansion, enhancement, and island-interconnections	→	→	→	→	→	→	→	→	A	C	I	I				C		R/A	I
In-depth assessment of incentives for BESS integration	→	→	→	→	→	→	→	→	A	C						C		R/A	C
Identification of potential synergies in multi-beneficiary use of road and port improvements	→	→	→	→	→	→	→	→	C	A	R				C	C		C	C/I

Action Plan	Year								Role of Stakeholder										
	2023	2024	2025	2026	2027	2028	2029	2030	MEMR	MoF	MoPW	MoEF	KATR/BPN	BRIN	MoI	MoIn	BSN	PLN	Assoc. & Industry
Financing & Bankability																			
Implementing support mechanisms that provide sufficient incentives to investors	→	→	→						C	R/A					C	C		C	C
Agreement on a bankable and balanced PPA	→	→	→						R	R						I		R/A	C/I
Procurement Process																			
Define a robust and reliable procurement process with a reasonable pipeline and timeline of projects	→	→	→						C/A							C		R/A	C

1.5 Conclusion and recommendations

Based on the research conducted for this roadmap, it has become clear that so far wind energy utilization is not yet fulfilling the expectations in Indonesia. It is still a question whether 60.6 GW of onshore wind (from RUEN) is a realistic potential, and whether the 8.5 GW onshore wind to be realized by 2030 (from the JETP Comprehensive Investment and Policy Plan) is a realistic target. Nevertheless, having realized only 0.13 GW of installed onshore wind farm capacity until 2023 and having only 0.14 GW in the pre- construction phase show the significant challenge to wind energy development that still lies ahead.

As introduced in Chapter 1, the objective of this research is to eventually answer the following questions:

1. What are the lessons learned from past studies and projects in Indonesia's onshore wind energy sector?
2. Based on the lessons learned, what are the existing gaps/barriers that hamper the acceleration of future onshore wind project developments?
3. What are the steps to overcome these gaps/barriers, who needs to take which step, and when and how shall the steps be taken?

The first question has been answered in Chapter 2 and 3 of this roadmap. Based on the desk research conducted, these two chapters have provided the overarching insights in the current status of wind energy development in Indonesia. The chapters have further shown the large variety of stakeholders (categorized in 20 stakeholder groups) that are involved in the development of a wind farm. This extensive list of stakeholders is a complicating factor in aligning between so many parties in developing onshore wind. Also, the regulatory framework in which wind energy development activities take place is very extensive and difficult to comprehend for the involved stakeholders. Such an extensive framework covers policies, regulations, permits, technical standards, procurement processes, land acquisition processes, and regulations on carbon credits. Although it is important to have a solid regulatory framework in place, such a framework could also intensify bureaucracy, lengthen the project duration, and increase the development process' complexity.

The second question has been answered in Chapter 4 of this roadmap. The interviews that have been conducted for the roadmap have shed some light on the many challenges/barriers perceived by the stakeholders involved in wind energy. The barriers have been categorized in 8 key areas:

- Wind data availability
- Availability of spatial data and standardized process
- Policy/regulation and permitting
- Research & Development activities
- Industrial capacity
- Infrastructure
- Financing & bankability
- Procurement mechanism

These barriers need to be overcome in order to realistically foster a thriving wind energy development in Indonesia in the coming years. Without any concrete actions being taken, it is expected that the same (or even slower) pace of wind projects will be realized, as has happened in the past 10 years. Just as worrisome, such status quo could lead to a less attractive investment climate for Indonesia for investors that wish to invest in wind energy (and possibly also other types of renewable energy).

The third question has been answered in Chapter 5. In this roadmap, a variety of recommended actions have been identified for the short, medium, and long term for each of the 8 key areas. Logically, the priority should be first on the short-term barriers and proposed solutions, while not overlooking the medium- and long-term counterparts. In the short-term, solutions need to be found to address the unavailability of wind and spatial data, the lack of attractive financing incentives, the lack of bankability of the PPAs, and the opaque PLN procurement process.

This roadmap provides a variety of solutions for these challenges with one overall conclusion: the Government of Indonesia should be the key stakeholder in initiating and implementing these solutions. The Ministry of Energy and Mineral Resources and PLN are the main authorities within the Government to take charge of the implementation, with the support from other ministries (the Ministry of Agrarian Affairs and Spatial Planning, Ministry of Public Works, Ministry of Environment and Forestry, Ministry of Industry, Ministry of Investment, and Ministry of Finance). Even implementing the solutions could be challenging because of the broad yet necessary involvement of multiple parties with possibly different interests. Therefore, it is strongly advised for the Government to include a pipeline of wind energy projects as National Strategic Projects.

To ensure a successful execution of the National Strategic Projects, a Government institution needs to be appointed and authorized to initiate, enable, and oversee the implementation of the Roadmap's action plans. This can either be done by establishing an overarching inter-ministerial committee for wind energy, or by appointing a Coordinating Ministry (e.g. the Coordinating Ministry for Maritime & Investment Affairs) to take the lead in the implementation. It could also be beneficial to continue the Wind Power Technical Working Group (TWG) setup, so that close coordination between the relevant stakeholders can be maintained. This leads to the first recommendation based on this roadmap:

Recommendation 1: Designate a pipeline of wind energy projects as National Strategic Projects and a Government institution as the leader in initiating, enabling, and overseeing the implementation of *the Roadmap's action plans*

An often-heard discussion point is that wind energy is not progressing enough in Indonesia because there are insufficient investment funds available. Based on the research, however, it can be concluded that investment funds for actual projects are available, but it can only be deployed if the investor's conditions are fulfilled, namely, the barriers are overcome. Investments are still required but not directly to finance projects, but to finance the enabling factors of these projects. These enabling factors can be summarized in terms of Capacity Building and Technical Assistance.

An important note is that countries which have installed multiple GWs of wind energy do have more expertise in this field than Indonesia so far. Allowing and encouraging foreign experts to participate in Capacity Building and Technical Assistance programs is therefore an important prerequisite. This could for example be in the form of assisting PLN in enhancing the procurement process and assisting MEMR in conducting proper selection of wind energy locations. Another example is an assistance for OJK and local banks on establishing a greater understanding of due diligence processes for wind projects. 'Assisting' should be understood as training programs, deployment of interim staff, knowledge sharing sessions, etc. To facilitate these Technical Assistance programs, they should be integrated into the regular (annual) program of the relevant Indonesian institutions (e.g. OJK and DJEBTKE).

In this manner, Indonesia could solve the aforementioned challenges, while potentially leapfrogging over other challenges that were once faced by the experienced foreign countries. This leads to the second recommendation based on this roadmap:

Recommendation 2: Set-up Capacity Building and Technical Assistance programs at multiple Indonesian authorities with international support (e.g. JETP) to execute the roadmap action plans to overcome the identified barriers

1.6 Further research

On a final note, this roadmap is part of a larger project called the Wind Energy Development in Indonesia: Investment Plan. Within this project, three additional deliverables are created, namely:

- Conducting a permitting and regulation assessment for the Indonesian wind sector and for a selection of wind sites
- Mapping wind energy potential and analyzing possible gaps for 8 selected wind sites
- Establishing an investment opportunities guide for the onshore wind sector

These deliverables can further shed some light into ways to drive Indonesia's wind energy development forward.

2 Executive Summary: Permitting and Regulation Assessment for Onshore Wind

2.1 Background

Renewable energy has become one of the main focuses in various countries, including in Indonesia, as a way to reduce the dependence on fossil fuels that are increasingly limited as well as detrimental to the environment. One form of renewable energy that has received special attention is wind energy. In the context of Indonesia, an archipelago with significant wind potential, the utilization of wind energy becomes strategic to achieve energy sustainability targets and to reduce the negative impacts of climate change.

It is understood that Indonesia has a significant amount of renewable energy (including wind energy) potential which can be utilized to fulfill the nation's demand for electricity. According to BBSP KEBTKE, the wind energy potential of Indonesia amounts to 155 GW, consisting of 60.6 GW onshore wind and 94.2 GW of offshore wind. Nevertheless, at the time of writing, there is only 154.3 MW of onshore wind farm installed capacity; this corresponds to less than 0.1% of the total potential. Knowing that only a small fraction of the huge wind potential is realized raises the question: what are the barriers/challenges that prevent the proliferation of wind energy in Indonesia?

2.2 Underlying project

The question above has been answered in the *Roadmap Onshore Wind Energy Development in Indonesia* ("Roadmap"), which just like this study, is part of a project titled *Wind Energy Development in Indonesia: Investment Plan*. This project is initiated by the Ministry of Energy and Mineral Resources (MEMR), managed by the Southeast Asia Energy Transition Partnership (ETP), and hosted by the United Nations Office for Project Services (UNOPS). ETP is a multi-donor partnership formed by governmental and philanthropic partners to accelerate sustainable energy transition in Southeast Asia in line with the Paris Agreement and Sustainable Development Goals. UNOPS is the fund manager and host of ETP Secretariat.

The Roadmap for Onshore Wind serves as the foundation for this study. One of the highlighted challenges in the Roadmap pertains to regulation and permitting aspects of onshore wind energy. In this study (*Permitting and regulation assessment for onshore wind*), the two aspects are further assessed in greater detail. The study is a follow-up to the Roadmap, diving deeper into the regulation and permitting frameworks that underpin Indonesia's wind energy sector. Furthermore, this study is intended to find and explain the challenges in wind regulation and permitting, as well as to propose ways of overcoming the challenges. Therefore, readers can be informed of the recommended action points on regulation and permitting to drive wind energy development forward.

It is also worth noting that this study served as input for the follow up studies *Mapping of Onshore Wind Energy Potential* and the *Investment Opportunities and Access-to-Finance Guide for Onshore Wind Energy*, part of the same overall project (*Wind Energy Development in Indonesia: Investment Plan).*

2.3 Relevance to project objectives

There are three project objectives that underlie this study, namely, (i) consolidate a selection of suitable sites with the highest potential for wind energy development (referring to the potential sites stated on PLN Electricity Business Plan/RUPTL and from the reference studies available, e.g. from MEMR, and other agencies); (ii) analyze the suitability and quality of selected sites for installation and long-term operation of a commercially viable wind power project; and (iii) inform improved policies and regulations and create a favorable business climate to attract investments. Meanwhile, this study is aimed to contribute to three overarching project objectives, i.e. (i) encourage informed decision-making on the development of wind energy in Indonesia; (ii) streamline the permitting and regulatory processes for wind project development; and (iii) attract donor and business investment through provision of preliminary feasibility analysis.

2.4 Approach

Based on the above objectives, this study is expected to answer the research questions below:

4. What are the regulations related to wind energy project in Indonesia?
5. What are the permits required to build a wind energy project in Indonesia?
6. Based on the results of the research, what are the challenges in wind energy projects in Indonesia?
7. What are the recommendations to overcome these challenges?

The questions above are answered using the insights derived from desk research, interviews with relevant key stakeholders, and Wind Power Technical Working Group (TWG) Events which are conducted as part of this project.

2.5 Results

2.5.1 Overall Regulatory Framework

The regulatory framework relevant to wind energy in Indonesia can be divided into 12 categories:

1. Renewable Energy Regulations

No	Regulations	Description
1	Law No. 30/2007 on Energy	Establishment of DEN (*Dewan Energi Nasional*/National Energy Council), who formulates KEN (*Kebijakan Energi Nasional*/National Energy Policy)
2	Government Regulation (GR) No. 79/2014 on KEN (*Kebijakan Energi Nasional*/ National Energy Policy)	Increase the share of new and renewable energy in the context of the primary energy mix to 23% by 2025 and to 31% by 2050
3	GR No. 25/2021 on Implementation in the Energy and Mineral Resources Sector	Organizing the energy and mineral resources sector which includes minerals and coal, geothermal, and electricity
4	Presidential Regulation (PR) No. 3/2016 on Accelerating the Implementation of National Strategic Projects	Simplification of ease of licensing and non-licensing facilities for national strategic projects

No	Regulations	Description
5	PR No. 22/2017 on RUEN (*Rencana Umum Energi Nasional*/General National Energy Plan)	Cross-sector policy implementation plans to achieve KEN targets
6	PR No. 112/2022 on the Acceleration of Renewable Energy Development for Electricity Supply	Preparation of RUPTL (Electricity Supply Business Plan) in order to accelerate the development of renewable energy and renewable energy electricity tariff
7	PR No. 11/2023 on Additional Concurrent Government Affairs in Energy and Mineral Resources Sector in the Renewable Energy Subfield	Provide legal certainty for local governments in developing renewable energy in the region
8	Minister of Energy and Mineral Resources (MEMR) Regulation No. 39/2017 on Implementation of Physical Activities for the Utilization of New and Renewable Energy and Energy Conservation	Activities for the utilization of new and renewable energy are implemented to improve national energy security
9	MEMR Regulation No. 50/2017 jis. MEMR Regulation No. 53/2018 and MEMR Regulation No. 4/2020 on the Utilization of Renewable Energy Sources for the Supply of Electricity	Mechanism for purchasing electricity from power plants that utilize renewable energy sources

2. Electricity Regulations

No	Regulations	Description
1	Law No. 30/2009 on Electricity	General understanding of electricity regarding the supply and utilization of electricity
2	GR No. 14/2012 on Electricity Providing Business Activities	Business activities in the field of electricity: generation, transmission, distribution, and sale of electricity
3	GR No. 42/2012 on Cross-Border Electricity Purchases	Cross-border electricity purchases mechanism
4	GR No. 14/2012 jo. GR No. 23/2014 on Electricity Supply Business Activities	Regulates conditions on electricity supply business
5	PR No. 4/2016 jo. No. 14 of 2017 on the Acceleration of Electricity Infrastructure Development	Electricity Infrastructure Development to accelerate the realization of the power plant construction program
6	MEMR Regulation No. 28/2012 jo. MEMR Regulation No. 7/2016 on Application Procedures for Business Area Providing Electricity for Public Interest	Regulates business licensing on provision of electricity for public purposes

No	Regulations	Description
7	MEMR Regulation No. 35/2013 jo. MEMR Regulation No. 12/2016 on Electricity Business Licensing Procedures	Regulates licensing procedures for electricity companies, including business licensing provision of electricity for public purposes
8	MEMR Regulation No. 35/2014 jis. No. 14/2017 and MEMR No. 30/2018 on Delegation of Authority to Grant Electricity Business Licenses in the Context of Implementing One-Stop Integrated Services to the Head of the Investment Coordinating Board	Delegates the authority for granting Electricity Business Licenses with the implementation of One Stop Integrated Services (*Pelayanan Terpadu Satu Pintu*/PTSP) to the Head of the Investment Coordination Agency (*Badan Koordinasi Penanaman Modal*/BKPM)
9	MEMR Regulation No. 38/2016 on the Acceleration of Electrification in Undeveloped, Remote, Border Rural Areas and Inhabited Small Islands through the Implementation of Small-Scale Electricity Supply Ventures	Use of renewable energy sources for undeveloped rural areas, remote, border, and small inhabited islands
10	MEMR Regulation No. 10/2017 jis. MEMR Regulation No. 49/2017 and No. 10/2018 on Principles of Power Purchase Agreement	Regulates Principles in the Power Purchase Agreement (PPA or *Perjanjian Jual Beli Listrik*/PJBL) between PLN as off-taker and business entities as the electricity seller
11	MEMR Regulation No. 24/2017 on Mechanism for Electricity Generation Cost Stipulation of PT PLN (Persero)	Regulates determination mechanism for electricity generation costs by PLN, excluding electricity transmission costs
12	MEMR Regulation No. 39/2017 on Implementation of Physical Activity on New and Renewable Energy and Energy Conservation	Regulates the physical activities of renewable energy utilization conducted by the relevant directorate
13	MEMR Regulation No. 20/2020 on Power System Network Rules (Grid Code)	Regulates network management, connection, planning & execution of operations, power transactions, measurements, and a summary of operational schedules
14	MEMR Regulation No. 10/2021 on Electricity Safety	Stipulation that it is mandatory that electricity ventures meet electricity safety
15	MEMR Regulation No. 11/2021 on Implementation of Electricity Businesses	Implementation for business activities in the field of electricity: generation, transmission, distribution, and sale of electricity
16	MEMR Regulation No. 12/2021 on Classification, Qualification, Accreditation and Certification of Electricity Support Services Businesses	Electricity certification procedures

No	Regulations	Description
17	MEMR Regulation No. 10/2022 on the Procedures for Application for Approval of Electricity Selling Price and Electricity Network Lease and Procedures for Application for the Electricity Tariff Stipulation	Guideline in determination of electricity tariff in order to guarantee consumers get reasonable tariff
18	MEMR Decree No. 55.K/20/MEM/2019 on the Amount of the Main Cost of Electricity Supply for Power Generation of State Electric Company PLN (Persero)	Determination of the amount of Main Cost of Electricity Supply (*Biaya Pokok Penyediaan Tenaga Listrik*/BPP) of PLN
19	MEMR Decree No. 143.K/20/MEM/2019 on RUKN / 2019-2038	Ratification of RUKN (*Rencana Umum Ketenagalistrikan Nasional*/General National Electricity Plan) of 2019-2038
20	MEMR Decree No. 169.K/HK.02/MEM. L/2021 on the Amount of the Main Cost of Electricity Supply PT PLN (Persero) / 2020	Determination of the amount of the Main Cost of Electricity Supply (BPP) of PLN Power Generator for 2020
21	MEMR Decree No. 188.K/HK.02/MEM.L/ 2021 on Ratification of PT PLN (Persero) National Electricity Supply Business Plan / 2021 to 2030	Ratification of PLN's Electricity Supply Business Plan (*Rencana Umum Penyediaan Tenaga Listrik*/RUPTL) 2021-2030
22	Board of Directors (BOD) of PT PLN (Persero) Regulation No. 0357 K/DIR/2014 on Guidelines for Connecting Renewable Energy Power Plants to the PLN Distribution System	Guidelines for connecting renewable energy power plants to PLN's distribution system
23	BOD of PT PLN (Persero) Regulation No. 0076.P/DIR/2020 on the Organization and Work Procedures of PT PLN (Persero)	Transformation of organizational changes and work procedures of PLN
24	BOD of PT PLN (Persero) Regulation No. 0012.E/DIR/2023 on Standard Procedures for Procurement of Other Goods/Services	Procedural provisions in the procurement of PLN goods and services
25	BOD of PT PLN (Persero) Regulation No. 0018.P/DIR/2023 on Strategic Policy for Procurement of Goods/Services PT PLN (Persero)	Strategic policy provisions for integrated procurement of goods and services

3. Local Content Regulations

No	Regulations	Description
1	Law No. 3/2014 on Industry	Mandatory use of local products in accordance with TKDN
2	Government Regulation (GR) No. 14/2015 on National Industrial Development Master Plan 2015-2035	Industrial empowerment policies to increase the use of local content in an effort to reduce dependence on imported products, and increase added value in the country
3	GR No. 29/2018 on Industrial Empowerment	Facilities to Green Industries and Strategic Industries in increasing the utilization of Local Products and International Cooperation
4	PR No. 16/2018 jo. No. 12/2021 on Procurement of Government Goods/Services	Government support for micro, small, and cooperative enterprises, as well as the use of local products
5	Ministry of Industry (MoI) Regulation No. 16/M-IND/PER/2/2011 on Provisions and Procedures for Calculating Local Content	Procedure for calculating the local content rate
6	MoI Regulation No. 48/2010 on Guidelines for the Use of Local Products for Electricity Infrastructure Development	Guidelines for TKDN for Electricity Infrastructure Development
7	MoI Regulation No. 54/M-IND/PER/3/2012 on Guidelines for the Use of Local Products for Electricity Infrastructure Development	Guidelines for TKDN for Electricity Infrastructure Development
8	MoI Regulation No. 05/M-IND/PER/2/2017 on Guidelines for the Use of Local Products for Electricity Infrastructure Development	Guidelines for TKDN for Electricity Infrastructure Development

4. Conformity of Spatial Utilization Activity Regulations

No	Regulations	Description
1	Law No. 26/2007 on Spatial Planning	General understanding of spatial planning and spatial planning implementation
2	GR No. 21/2021 on Implementation of Spatial Planning	Planning, utilization, management, supervision, guidance, and spatial planning institutions
3	Ministry of ATR/BPN (KATR/BPN) Regulation No. 12/2021 on Land Technical Considerations	Requirements for approval of control, ownership, use and utilization of land with regard to spatial compatibility (Pertek)
4	Ministry of ATR/BPN Regulation No. 13/2021 on Implementation of Conformity of Spatial Utilization Activities and Synchronization of Spatial Utilization Programs	Application of KKPR (Conformity of Spatial Utilization Activities), previously known as Location Permit
5	Ministry of ATR/BPN Regulation No. 14/2021 on Guidelines for Preparation of Database and Presentation of Maps of Provincial, Regency, and City Spatial Plans, as well as Maps of Regency/City Spatial Detail Plans	Accommodating electricity infrastructure network in spatial plan
6	Ministry of Finance (MoF) Regulation No.143/PMK.02/2021 on Types and Rates of Non-Tax State Revenue for Urgent Needs for Services to Issue Conformity of Spatial Utilization Activities Applicable to the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency	Tariff on Types of Non-Tax State Revenue Applicable to Conformity of Spatial Utilization Activities

5. Forest Area Use Approval Regulations

No	Regulations	Description
1	Law No. 41/1999 on Forestry	Forest areas that are permitted to be used for non-forestry activities
2	GR No. 33/2014 on Types and Rates of Non-Tax State Revenues Derived from the Use of Forest Areas for Development Interests Outside of Forestry Activities Applicable to the Ministry of Forestry	Types and rates of non-tax state revenues derived from the Forest Area Use Approval
3	GR No. 23/2021 on Forestry Implementation	Management plans and forest utilization
4	Ministry of Environment and Forestry (MoEF) Regulation No. 7/2021 on Forestry Planning, Changes in the Designation and Function of Forest Areas, and Use of Forest Areas	Planning, change, designation, and function in the use of forest area (*Pinjam Pakai Kawasan Hutan*/PPKH) in its implementation in coordination with the Forest Area Stabilization Center (*Balai Pemantapan Kawasan Hutan*/BPKH)
5	MoEF Regulation No. 8/2021 on Forest Management and Preparation of Forest Management Plans, as well as Forest Utilization in Protected Forests and Production Forests	Management planning and forest utilization in protected and production forests

6. Environmental Management Regulations

No	Regulations	Description
1	Law No. 32/2009 on Protection and Environmental Management	General overview regarding environmental protection and management of the life environment
2	GR No. 22/2021 on Implementation of Protection and Environmental Management	Environmental approval, management of hazardous and toxic waste, and others related to management of the life environment
3	MoE (Ministry of Environmental) Regulation No. 29/2009 on Guidelines for the Conservation of Biodiversity in the Regions	Biodiversity conservation planning, including determination of policies and implementation of conservation, sustainable use, and control of damage to biodiversity
4	MoEF Regulation (Permen LHK) No. P.92/MEN LHK/SETJEN/KUM.1/8/2018 on Types of Protected Plants and Animals	List of protected plant and animal species
5	MoEF Regulation No. P.102/MENLHK/ SETJEN/KUM.11/2018 on Procedure for Wastewater Discharge Licensing through Electronically Integrated Business Licensing Services	Domestic wastewater discharge licensing procedures and requirements
6	MoEF Regulation No. 3/2021 on Business Activity Standards in the Implementation of Risk-based Business Licensing in the Environment and Forestry Sector	Risk-Based Assessment (RBA) Business Licensing in the Environment and Forestry sector
7	MoEF Regulation No. 4/2021 on List of Businesses and/or Activities that are Required to Have EIA, UKL-UPL, or SPPL	List of businesses and/or activities that are required to have EIA, UKL-UPL, or SPPL
8	MoEF Regulation No. 5/2021 on Procedures for Issuing Technical Approvals and Operational Feasibility Certificates in the Field of Environmental Pollution Control	Procedures and requirements for technical approval and certificate of operational feasibility of environmental pollution control section
9	MoEF Regulation No. 6/2021 on Procedures and Requirements for Hazardous and Toxic Waste Management	Procedures and requirements of the Hazardous & Toxic Material (B3) license during the construction phase
10	MoH (Ministry of Health) Regulation No. 2/2023 on the Implementation of GR No. 66/2014 on Environmental Health	Establishing environmental health quality standards and health requirements for water, air, soil, food, facilities, and buildings, as well as vectors and disease-carrying animals

7. Transportation Regulations

No	Regulations	Description
1	Law No. 22/2009 on Road Traffic and Transportation	Overview of the development and implementation of safe Road Traffic and Transportation
2	GR No. 30/2021 on the Implementation of Road Traffic and Transportation	Activities in the field of traffic and road transport that include the provision of Andalalin
3	Ministry of Transportation (MoT) Regulation No. KM 44/2005 on the Implementation of SNI 03-7112-2005 on KKOP Areas as a Mandatory Standard	Operational standards for KKOP (*Kawasan Keselamatan Operasional Penerbangan* /Aviation Operation Safety Areas)
4	MoT Regulation No. PM 48/2014 on Procedures for Loading, Preparing, Transporting and Unloading Goods by Train	Procedures and requirements for transporting goods by train
5	MoT Regulation No. PM 57/2015 on Ship Guiding and Delaying	Procedures and requirements for transporting goods at the port
6	MoT Regulation No. PM 90/2018 on Norms, Standards, Procedures, and Criteria for Electronically Integrated Business Licensing in the Air Transportation Sector	Licensing of the transport sector including KKOP sector
7	MoT Regulation No. PM 60/2019 on Implementation of Goods Transport by Motorized Vehicles on Roads	Procedures and requirements for land transport licenses
8	MoT Regulation No. PM 17/2021 on Implementation of Andalalin	Procedures and requirements for Andalalin
9	MoT Regulation No. PM 59/2021 on Implementation of Services Related to Water Transport	Procedures and requirements for water transport licenses

8. Land Acquisition for Public Interest Development Regulations

No	Regulations	Description
1	Law No. 2/2012 on Land Acquisition for Public Interest Development	General explanation of land acquisition for public interest development
2	GR No. 19/2021 jo. No. 39/2023 on Implementation of Land Acquisition for Public Interest Development	Acceleration of land acquisition for development for public interest
3	Ministry of ATR/BPN No. 19/2021 on Provisions for Implementing GR No. 19/2021 on the Implementation of Land Acquisition for Public Interest Development	Stages in land acquisition for development in the public's interest

9. Business Licensing Regulations

No	Regulations	Description
1	Law No. 25/2007 on Capital Investment	Forms of domestic and foreign investment activities
2	Law No. 23/2014 on Local Government	Establish regional policies to organize government affairs that are the authority of the region
3	Law No. 6/2023 on Establishment of GR Replacement Law No. 2/2022 on Job Creation becomes Law	Combining several laws into one new law to resolve overlapping regulations and simplification of business licensing procedures (Omnibus Law)
4	GR No. 5/2021 on Risk-Based Business Licensing	Electronically integrated licensing services (OSS-RBA)
5	GR No. 6/2021 on Implementation of Business Licensing in the Region	Authority to implement Business Licensing in the region
6	BKPM Regulation No. 4/2021 on Guidelines and Procedures for Risk-Based Business Licensing Services and Capital Investment Facilities	As a guide for use in providing licensing procedure and capital investment facilities for OSS-RBA Institution, ministry/agency/region, and other stakeholders

10. Building Regulations

No	Regulations	Regulation
1	Law No. 28/2002 on Buildings	Provisions on buildings include functions, requirements, implementation, community roles, and guidance
2	Law No. 2/2017 on Construction Services	Legal basis to ensure the sustainability of the construction services implementation process.
3	GR No. 22/2020 jo. No 14/2021 on Implementation of Law No. 2/2017 on Construction Services	Technical requirements in the implementation of construction work at the construction implementation stage, and building performance at the operation, maintenance, and decommissioning stages
4	GR No. 16/2021 on Implementing Regulations of Law No. 28/2002 on Buildings	Procedures and requirements for PBG (*Persetujuan Bangunan Gedung* or Building Approval)
5	Ministry of Public Works and Public Housing (MPWPH) Regulation No. 27/PRT/M/2018 jo. No. 3/2020 on Certificate of Building Occupancy	Procedures and requirements for SLF (*Sertifikat Laik Fungsi* or Certificate of Functional Eligibility)

11. Fiscal Facilities Regulations

No	Regulations	Description
1	Law No. 7/2021 on Harmonization of Tax Regulations	Realizing a tax system with justice and legal certainty, which is implemented through administrative reforms
2	GR No. 9/2021 on Tax Treatment to Support Ease of Doing Business	Optimizing the utilization of information technology in tax administration
3	Ministry of Finance (MoF) Regulation No. 176/2009 jo. No. 188/2015 on Exemption from Import Duty on Imports of Machinery and Goods and Materials for Industrial Construction or Development in the Context of Capital Investment	Regulates exemption from import duties on goods and services in accordance with applicable regulations
4	MoF Regulation No. 21/2010 on Providing Tax and Customs Facilities for Activities to Utilize Renewable Energy Sources	Taxation and customs facilities for activities that utilize renewable energy sources
5	MoF Regulation No. 66/2015 on Exemption from Import Duty on Imports of Capital Goods in the Context of Building or Expanding the Electricity Generation Industry for Public Interest	Criteria and procedures for recipients of import duty exemptions, and reporting on the realization of imported goods

No	Regulations	Description
6	MEMR Regulation No. 16/2015 on Criteria and/or Requirements for Utilizing Income Tax Facilities for Investment in Certain Business Fields in Certain Regions in the Energy and Mineral Resources Sector	Criteria and procedures for investment in certain business fields in certain regions in the Energy and Mineral Resources sector
7	MoF Regulation No. 16/PMK.010/2016 on Collection of Income Tax Article 22 In Connection with Payment for Delivery of Goods and Activities in the Field of Import or Business Activities in Other Fields	Collection of income tax in relation to the payment on delivery of goods and activities in the field of import
8	MoF Regulation No. 130/2020 on Providing Corporate Income Tax Reduction Facilities	Criteria and procedures for corporate income tax reduction facility provisions
9	Director General of Electricity Regulation No. 263/2015 on Procedures for Applications for Approval and Ratification of Plans to Import Capital Goods in the Context of Building or Expanding Public Interest Power Generation Industry	Application procedure for approval Goods Import Plan (*Rencana Impor Barang*/RIB)

12. Employment Regulations

No	Regulations	Description
1	Law No. 13/2003 on Employment	Instruments to protect and regulate employment in Indonesia
2	Law No. 1/1970 on Work Safety	Occupational safety in the workplace, one of which is the obligation to apply Occupational Health and Safety (OHS) requirements to people and work tools
3	GR No. 34/2021 on the Use of Foreign Workers	Obligation to arrange approval for plans to use foreign workers (RPTKA)
4	Ministry of Manpower (MoM) Regulation No. 5/2018 on OHS Work Environment	Ensure and protect the safety and health of workers through efforts to prevent occupational accidents and occupational diseases
5	MoM Regulation No. 18/2017 jo. No. 4/2019 on Procedures for Mandatory Online Labor Reporting in Companies	Procedures for mandatory labor reporting in companies
6	MoM Regulation No. 8/2021 on Implementing Regulations of GR No. 34/2021 On the Use of Foreign Workers	Approval for plans to use foreign workers (RPTKA)

2.5.2 Overall Permitting

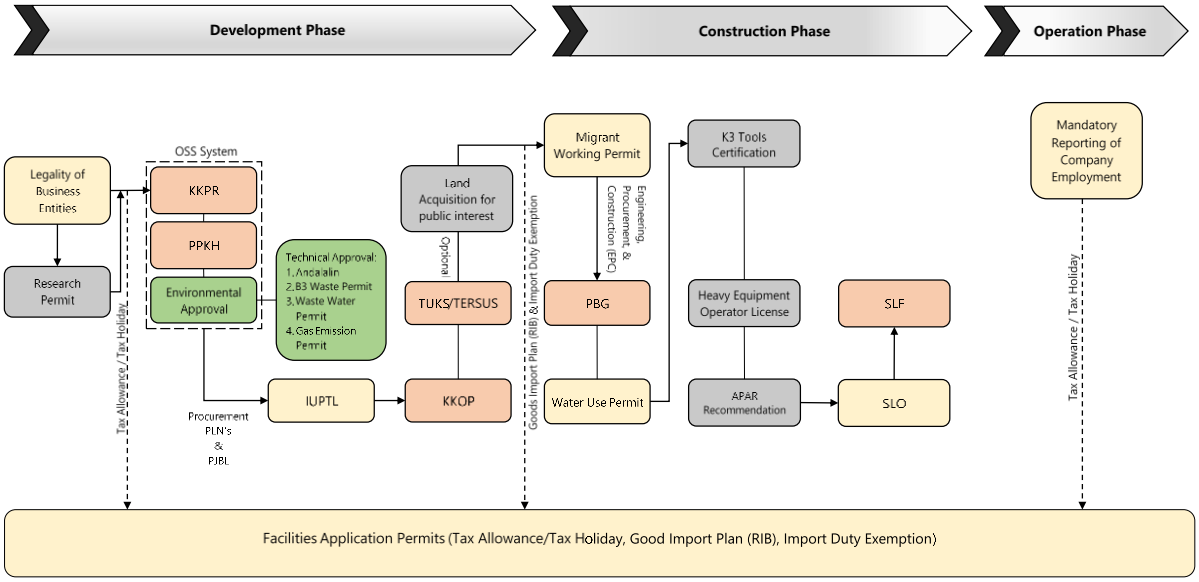
Results of the analysis of overall permitting for wind power plants in Indonesia are divided into two parts, i.e. Online Permitting Services and Overall National Permitting Based on Project Phase.

1. Online Permitting Services
   a. Online Single Submission (OSS) of the Ministry of Investment
   b. E-Procurement of PT PLN (Persero)
   c. Business and Operational Licensing Application of the Ministry of Energy and Mineral Resources
   d. One Stop Integrated Service of the Ministry of Environment and Forestry (PTSP KLHK)
   e. Si Andalan of the Ministry of Transportation
   f. Sehati of the Ministry of Transportation
   g. Building Management Information System (SIMBG) of the Ministry of Public Works and Public Housing
   h. Sisnaker of the Ministry of Manpower

2. Overall National Permitting Based on Project Phase
   a. Permitting in Development Phase
      i. Legality of Business Entities
      ii. Research Permit
      iii. Fiscal Facilities Application
      iv. Conformity of Spatial Utilization Activity (KKPR)
      v. Forest Area Use Approval (PPKH)
      vi. Environmental Approval
      vii. Technical Approval
      viii. Procurement by PLN
      ix. Power Purchase Agreement (PPA/PJBL)
      x. Electricity Supply Business License (IUPTL)
      xi. Recommendations for Aviation Operation Safety Areas (KKOP)
      xii. Terminal Permit for Own Use (TUKS) / Special Terminal (TERSUS)
      xiii. Land Acquisition for Development in the Public's Interest

   b. Permitting in Construction Phase
      i. Facility Application Permit
      ii. Migrant Working Permits
      iii. Building Approval (PBG)
      iv. Water Use Permit
      v. Testing and Certification of Occupational Health and Safety Equipment (K3)
      vi. Heavy Equipment Operator's License
      vii. Recommendation and Certification of Fire Extinguisher (APAR)
      viii. Certificate of Eligibility for Operation (SLO)
      ix. Building Function Certificate (SLF)

   c. Permitting in Operation Phase
      i. Facilities Application Permit
      ii. Mandatory Company Employment Report



2.5.3 Site-Specific Permitting Aspects

To push for wind energy development in Indonesia, potential locations have been identified that are considered strategic for PLTB (*Pembangkit Listrik Tenaga Bayu*/Wind Power Plant) development. Each of these locations has its own characteristics and challenges in terms of permits and regulations. Therefore, special permits are needed that take into account various aspects of each location. The scope of this study is limited to 8 sites in 9 regencies across Indonesia (Sukabumi, Gunung Kidul, Aceh Besar, Dairi, South Tapanuli, North Padang Lawas, Kediri, Ponorogo, and Probolinggo). Results of this analysis served as the basis for the follow up study (*Mapping of Onshore Wind Potential*) and is divided into four parts/sections, i.e. Spatial Plans, Actual Land Use and Land Status, Biodiversity and Environmental Legislation, and Site-Specific Permitting Based on the Project Phase.

Spatial Plans

The spatial planning map of each regency was provided by the Ministry of Agrarian Affairs and Spatial Planning (KATR/BPN), whereas the Wind Turbine Generator (WTG) potential area was provided by Pondera as part of the *Mapping of Onshore Wind Potential.* The analysis entails overlaying the RTRW map (*Rencana Tata Ruang Wilayah* or Regional Spatial Plan) and the WTG potential area for each regency. However, the WTG potential areas for regencies in the East Java (Probolinggo, Ponorogo, and Kediri) have not yet been obtained at the time of writing due to the ongoing site selection procedure, and hence, the analysis for the three regencies is incorporated into the *Mapping of Onshore Wind Potential*. The following table summarizes the spatial plan analysis.

No	Land Use Plan Types	Regency						Remarks
		Sukabumi	Gunung Kidul	Aceh Besar	Dairi	South Tapanuli	North Padang Lawas	
1	Conservation Forest areas	✓						Cannot be used based on GR No. 23/2021
2	Protected Forest areas	✓	✓	✓	✓	✓		Can be used if a forest area utilization permit is acquired from MoEF, based on GR No. 23/2021
3	Fixed Production Forest areas		✓			✓	✓	Can be used if a forest area utilization permit is acquired from MoEF, based on GR No. 23/2021
4	Limited Production Forest areas	✓		✓			✓	Can be used if a forest area utilization permit is acquired from MoEF, based on GR No. 23/2021
5	Community Forest areas		✓	✓				Can be used if a forest area utilization permit is acquired from MoEF, based on GR No. 23/2021
6	Rural Settlement areas	✓	✓	✓		✓		Can be used if a purchase or lease agreement is obtained
7	Urban Rural Settlement areas			✓				Can be used if a purchase or lease agreement is obtained
8	Mining area			✓				Can be used if a mutual agreement (e.g. MOU) is obtained
9	Plantation area	✓		✓				Can be used if a mutual agreement (e.g. MOU) is obtained

No	Land Use Plan Types	Regency						Remarks
		Sukabumi	Gunung Kidul	Aceh Besar	Dairi	South Tapanuli	North Padang Lawas	
10	Non-Forest Estate (APL)						✓	Can be used if a purchase or lease agreement is obtained
11	Wetland Agricultural area	✓		✓				Can be used if a purchase or lease agreement is obtained
12	Dryland Agricultural area	✓	✓	✓		✓	✓	Can be used if a purchase or lease agreement is obtained
13	Water Absorption Potential area		✓					Can be used if a forest area utilization permit is acquired from MoEF, based on GR No. 23/2021
14	*Embung* (retention basin) area			✓				Can be used for public interest activities
15	Flooding area							Can be used for public interest activities
16	Beach Border area	✓		✓				Can be used for public interest activities
17	River Border area	✓						Can be used for public interest activities

Actual Land Use and Land Status

Data of actual land use and land status/ownership are not available, and therefore, some assumptions are made in this analysis based on the land use plans.

No	Land Use Plan Types	Current Land Use	Regency						Land Status
			Sukabumi	Gunung Kidul	Aceh Besar	Dairi	South Tapanuli	North Padang Lawas	
1	Conservation Forest areas	Forest	✓						State
2	Protected Forest areas	Forest	✓	✓	✓	✓	✓		State
3	Fixed Production Forest areas	Forest		✓			✓	✓	State
4	Limited Production Forest areas	Forest	✓		✓			✓	State
5	Community Forest areas	Forest		✓	✓				State & Community
6	Rural Settlement areas	Settlement or others land use	✓	✓	✓		✓		Community
7	Urban Settlement areas	Settlement or others land use			✓				Community
8	Mining area	Mining activities or others land use			✓				Private
9	Plantation area	Plantation area or mixed plantation	✓		✓				State /Private or Community
10	Non-Forest Estate (APL)							✓	State /Private or Community
11	Wetland Agricultural area	*Sawah* (rice field) or others land use	✓		✓				Private or Community
12	Dryland Agricultural area	Dryland plantations or other land use	✓	✓	✓		✓	✓	Private or Community
13	Water Absorption area	Forests, open land, or others		✓					Private or Community
14	*Embung* (retention basin) area	Forests, open land, or others			✓				State or Community
15	Flooding area	Open land or others							State/Private or Community
16	Beach Border area	Open land or others	✓		✓				State
17	River Border area	Forests, open land, or others	✓						State

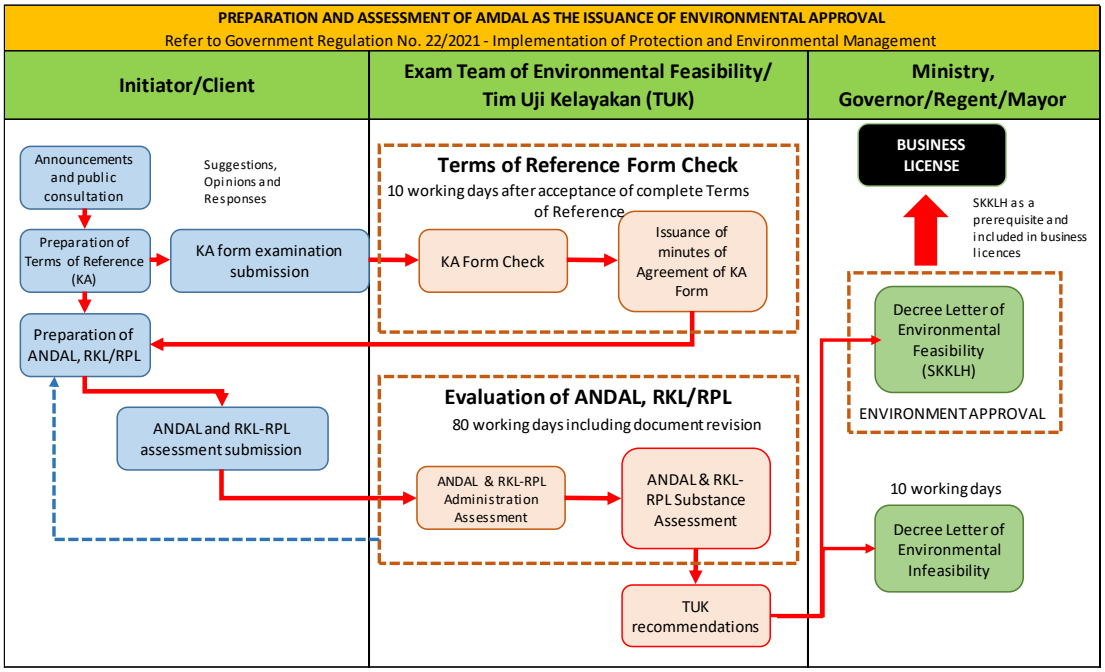
Biodiversity and Environmental Legislation

For the biodiversity aspect, it is necessary to pay attention to the presence of flora and fauna in the protected area, which is guided by the MoEF Regulation No. 20/2018 on *Protected Flora and Fauna*. To preserve protected flora and fauna in the planned activity area, identification of the presence of flora and fauna types in the area must first be conducted. Subsequently, the resulting list of types is then matched with the list attached to MoEF Regulation No. P.20/Menlhk/Setjen/Kum.1/6/2018 concerning *Types of Protected Plants and Animals*. Hence, it can be known whether there are protected types of flora and fauna in the planned activity area.

If the identification results reveal the presence of protected types of flora and fauna within the area, follow-up plans can be prepared to protect and prevent the extinction of these flora and fauna. Such plans include SOPs prohibiting the capture of birds and other animals for employees, preserving habitat, etc. Meanwhile, to maintain the safety and protection of the PLTB from damage, it is necessary to pay attention to the population of birds and bats, which could strike the wind turbine blades.

Given the above aspects, it is necessary to pay attention to Environmental Approval as a basis for construction implementation. The basic regulation for obtaining Environmental Approval, i.e. MoEF Regulation No. 4/2021 on *List of Business and/or Activities that Required to Perform Environmental Impact Assessment, Environmental Management Efforts, and Environmental Monitoring Efforts*, stipulates the preparation of environmental documents (i.e. EIA, UKL-UPL, and SPPL) as the prerequisites.

Another important regulation is MoEF Regulation No. 5/2021 regarding *Procedures for Issuing Technical Approvals and Operational Feasibility Letters in the Field of Environmental Pollution Control*. The core of this regulation states that businesses or activities that require an Environmental Impact Assessment (AMDAL or EIA) and Environmental Management Plan (UKL-UPL) must prepare technical approvals related to waste management in those activities. The results of the technical approval (*Persetujuan Teknis*/Pertek) that have been approved by the competent authority will be included in the AMDAL document. Therefore, the new AMDAL document will only be processed (evaluated) by the AMDAL commission if the technical approval has been completed. Since the publication of Government Regulation 22/2021 in October 2021, the preparation of AMDAL refers to this national regulation, including the process, quality standards, and approval.



Note: SKKLH = Surat Keputusan Kelayakan Lingkungan Hidup (Decree Letter of Live Environmental Feasibility)

2.5.4 Site-Specific Permitting Based on Project Phase

Examples of site-specific permitting based on project phase are mostly taken from Sukabumi Regency and Aceh Besar Regency through interviews with developers and the related regency-level department. Nonetheless, it should be noted that these permitting specifics can be different at other regencies. Results of interviews and desktop studies suggest that PLTB project permits can be divided into two phases, i.e. Development Phase and Construction Phase.

1. Permitting in Development Phase
   a. Research Permit
   b. Conformity of Spatial Utilization Activity (KKPR)
   c. Forest Area Use Approval (PPKH)
   d. Environmental Approval
   e. Technical Approval
   f. Recommendations for Aviation Operation Safety Areas (KKOP)
   g. Terminal Permit for Own Use (TUKS)/Special Terminal (TERSUS)
   h. Land Acquisition for Development in the Public's Interest
2. Permitting in Construction Phase
   a. Building Approval (PBG)
   b. Testing and Certification of Occupational Health and Safety Equipment (OHS)
   c. Heavy Equipment Operator's License
   d. Recommendations and Certification of Fire Extinguisher (APAR)
   e. Building Function Certificate (SLF)

2.5.5 Challenges

No	Challenge	Points
1	Tender process	A consensus between the stakeholders on the tender process is not yet achieved. The list below shows the tender aspects on which a consensus is needed: • Uncertain and unclear PLN procurement process of wind projects, bringing considerable risks for the developers. • Multiple developers agree that met mast data should not have an expiry date, as long as it is uninterrupted for 36 months. One developer disagrees and believes expiry date is important. • Multiple developers agree that 'blanket rule' on having mandatory partners is burdensome. For instance, in the tender of PLTB Tanah Laut project, it is stipulated that the mandatory partner (e.g. PLN subsidiaries) will be required to have at least 30% share in the project's Special Purpose Company (SPC). • One developer believes that operating developers should not be burdened by the obligation to form a new special purpose vehicle (SPV) for their PLTB expansion.
2	Power Purchase Agreement	Multiple developers agree that PLN's ceiling tariff (whether based on tariff/BPP that is calculated equal for all kinds of energy or Predicted Capacity Matrix/PCM that cannot be revised) is unfair.
3	Construction/operation phase – local content requirements (LCR)	Developers differ on whether local content can be fulfilled or not (e.g., whether turbine manufacturers would accept Indonesian made towers). Although there is not yet a specific LCR for PLTB, there are concerns among IPPs that LCR will become applicable to wind projects too. IPPs do not think that the LCR of, for example, 20-30% (as for some other business activities) would be suitable for the current state of Indonesia's wind sector. If such LCR is applied, it could result in major issues as most wind turbine components (e.g. rotor, blades, hub, gear box) as well as electrical components (e.g. generator and transformer) can only be produced by limited or certain manufacturers which are not yet present in Indonesia.
4	Construction/operation phase – incentives	• Multiple developers agree that carbon credit distribution between PLN and developer is unfair (minimum should be 50% for developer). • One developer faces a problem regarding tax incentive being cancelled unfairly.

No	Challenge	Points
5	Wind data availability	• Limited availability of accurate long-term wind data • High level of uncertainty of mesoscale models as the alternative to long-term wind data • Financial burden of investments for wind measurements during tender processes by developers. A rough estimate is that for a small wind farm (10 MW) at least one wind measurement device (met mast or LiDAR) is required for at least one year, with the entailed cost of USD 80,000-130,000 (depending on height and location). For larger wind farms, multiple wind measurements are required to lower the uncertainty over the large terrain. This multiplies the cost for wind measurements, which is likely to be between USD 200,000 – 300,000. • Lower probability to reach financial close for a project due to uncertainties in wind data • Unpredictability of wind behavior during wind farm operation, resulting in difficulties for PLN to predict electricity production
6	Availability of spatial data and standardized processes	• Absence of a clear Indonesian guideline on the analysis criteria and considerations for the technical, environmental, and social impact of a wind farm • Lack of accessible and consistent digital or high-resolution spatial (planning) data to support screening of potential locations and designing wind farm layout • Lack of standardization in the development process, including minimum prerequisite studies, feasibility study guideline, etc.
7	Policy/regulation and permitting	• Uncertainty and frequent change of policies by the Government have created risks for investors and may impact the financial viability of projects • Inconsistent implementation of existing regulations • Delays in permitting process and land acquisition
8	Infrastructure	• Sites with wind energy potential are not always near a well-developed grid; lack of transmission and distribution system infrastructure • Hard to ensure the stability and reliability of wind power given its intermittency; whereas BESS (battery energy storage system) is still relatively expensive to produce and integrate with wind power plants • Lack of supporting infrastructure such as port and road access
9	Financing & bankability	• Suboptimal impact and support provided by existing fiscal and non-fiscal regulations to investments in wind energy • Perception of wind project investments in Indonesia as 'risky and slow,' especially concerning the bankability of the unequally balanced PPAs between PLN and the developer

No	Challenge	Points
10	Coordination between government agencies	Coordination and responsibility allocation between government offices is needed in the process of building a wind farm
11	Overlapping permits	There is overlap between licenses, for example between KKPR, PPKH, AMDAL, and IUPTL licenses. Another case: KKPR Licensing requires land ownership data (e.g. PPKH). However, the submission of PPKH documents require KKPR, AMDAL, IUPTL.
12	Time uncertainty	If there is an error in the input of data to the OSS system, one must recommence from the beginning which would require a long time.

2.6 Conclusion

Based on the research, it has become clear that so far wind energy utilization is not yet fulfilling the expectations in Indonesia. It is still a question whether 60.6 GW of onshore wind (from RUEN) is a realistic potential, and whether the 8.5 GW onshore wind to be realized by 2030 (from the JETP Comprehensive Investment and Policy Plan) is a realistic target. Nevertheless, having realized only 0.13 GW of installed onshore wind farm capacity until 2023 and having only 0.14 GW in the pre-construction phase show the significant challenge (including in permitting and regulations) to wind energy development that still lies ahead.

The Roadmap for Onshore Wind Energy Development shows the regulatory framework in which wind energy development activities take place is very extensive and difficult to comprehend for the involved stakeholders. Although it is important to have a solid regulatory framework in place, such a framework could also intensify bureaucracy, lengthen the project duration, and increase the development process' complexity. The same goes for the numerous permits and approvals that are required during the development, construction, and operation phase as listed in this report.

The results of the research conducted has led to the following conclusions:

Policy/Regulation and Permitting

- The Government's policy/regulation is regularly subject to change, creating uncertainties and risk to investors and often has an impact on the project's financial viability. For long-term investments (e.g. a pipeline of projects), developers and investors require a stable regulatory environment before entering a country. These challenges create an elevated risk profile for them to enter Indonesia, and in turn, this condition leads to either higher cost (e.g. higher interest rates) or parties starting to invest somewhere else.
- Existing regulations are being implemented inconsistently.
- Observable delays had been mainly occurring in the permitting and land acquisition processes.

Spatial Data Availability

- It is difficult to access official/ratified and consistent spatial planning data (in digital and/or high-resolution formats) which are essential to support screening of potential locations and laying out the wind farm.

Procurement Mechanism

- PLN procurement process for wind projects had been viewed as unclear, hence uncertain, creating significant risks for the investors/developers.

Funding/Financing and Bankability

- Existing fiscal and non-fiscal regulations for wind project investments had only been providing sub-optimal impact and support.
- The inequality/non-balanced PPA's between PLN and investors/developers had created the image that wind project investments in Indonesia as "risky and slow."

2.7 Recommendations

Improvement of policy/regulation and permitting can be performed by the following three recommendations:

Recommendation 1: Pre-conditions for policy/regulations and permitting in the wind sector

The recommendation can be categorized into four sub-clusters:

- Consistency:
  - Renewable energy projects, including wind energy projects, require long term commitments and planning. Consistency of policy/regulations is paramount in providing the predictability and stability needed for such long-term large investments.
  - Developers and investors should be assured that regulations and permitting processes are always applied in a consistent and diligent manner. This means that it does not matter if a project is developed in Aceh, Bali, or in other regions. It also means that regulations 'trickle down' in an unchanged manner from the initiating authority to the implementing authority.

- Transparency:
  - Transparency and engagement of stakeholders have been repeatedly highlighted, but the effectiveness of these interactions is to be observed further. It is recommended to have more details on how feedback and recommendations from stakeholders, including business associations and developer/investors, in a transparent manner is being considered and ultimately incorporated in the decision-making process by the Government.
  - Transparency on, apparently "unavoidable" although "undesirable" for developers, frequently changing policies and regulations can be done by announcing them in timely manner with prior consultation of key (private) stakeholders.
  - A more transparent and standardized permitting for projects, like in the case of the OSS System, will reduce project uncertainty in schedule, budget, and compliance to bankability.

- Clarity:
  - Evaluation criteria for permit applications should be reasonable, be clearly defined upfront, and refer to published standards.
  - Upon the occurrences of frequently changing policy/regulations and permitting, there should be Clarity on a reasonable cut for how these revisions apply to ongoing and future projects.
  - For legal clarity on land disputes in land-acquisition process which can lead to legal complications, delay, and costs, it is recommended to have rules and mechanisms that define land ownership and usage rights to help prevent disputes and a legal clarity framework for wind energy projects. Eminent domain rules or similar land use priority can be introduced for renewable energy projects as being beneficial to the general public.

- Responsibility:
  - Responsibilities need to be assigned to a government body with strong leaderships, with effective process tracking and intervention empowerment to mitigate the risk of lack of coordination amongst government stakeholders during this crucial energy transition period.
  - For the wind energy regulations and permitting process, it is important to have a government body which directs allocation of responsibilities to the relevant authorities. In this definition of responsibility and authority, it is important to align and coordinate all key public stakeholders, especially between policymakers and PLN, to ensure that all parties aim for the same targets and execute them coherently in achieving the targets. The appointment of the government body can be based on the recommendation of, for instance, the Wind Power Technical Working Group.

Recommendation 2: Continuous improvement of the OSS system

Improvements are required by focusing on the following:

- Integration of Indonesian complex regulation into the OSS system:
  The regulatory environment in Indonesia is multifaceted and intricate, and integrating all necessary licenses and permits coherently into the OSS system is a substantial undertaking to be meticulously planned, including by monitoring and actively gathering feedback from all related stakeholders. A fast-track program could be tailored for particular cases in accelerating permitting process for wind power projects, which must be subjected to fulfilling pre-requisite documents and requirements for specific licenses and permits.

- Coordination among government bodies:
  Effective cooperation and coordination among government bodies (including between central and regional government bodies) is imperative. Appointing dedicated PICs, both centrally and in each government body would be a significant step in OSS system continuous improvement. Authority and competence should be vested to these PIC's.

Recommendation 3: Streamlining the land acquisition process

Land acquisition is the foremost impedance in all projects in Indonesia, including for wind power projects which are usually located in remote area and locations with specific challenges on local, environmental, and cultural/indigenous issues. It is recommended to streamline the rules and mechanisms to land acquisition issues, specifically on rampant land-overlapping issues in the Indonesian investment environment. This includes:

- Legal clarity:
  As mentioned in Recommendation Cluster 1, Clarity in land acquisition and potential ensuing dispute from clear rules and mechanisms in place ensures that the developers have manageable access to the land they need to develop renewable energy projects.

- Investments and development attraction:
  The potential position of wind energy as one of the technologies crucial for Indonesia's energy transition, could be used as a motive to obtain land-use priority or land acquisition. Fast-tracking may become an example on how Indonesia's investment climate can get rid of the long-lasting "land acquisition stigma."

2.8 Further research

On a final note, this study is continuation of a Roadmap for Onshore Wind which is together with this study part of a larger project called the *Wind Energy Development in Indonesia: Investment Plan*. Within this project, two additional deliverables are created, namely:

- Mapping wind energy potential and analyzing possible gaps for 8 selected potential wind farm locations in 9 regencies
- Establishing investment opportunities guide for the onshore wind sector

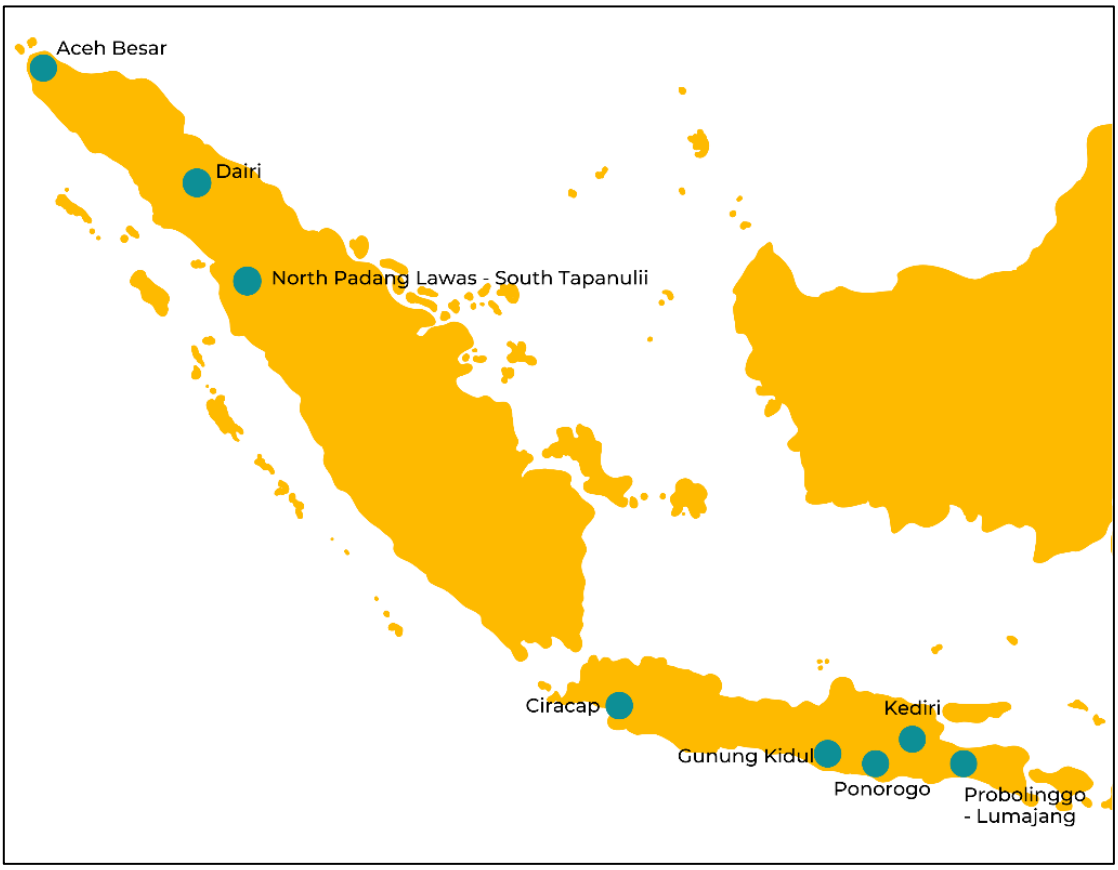
These deliverables can further shed some light into ways to drive Indonesia's wind energy development forward.

3 Executive Summary: Mapping of Onshore Wind Energy Potential

3.1 Introduction

This *Mapping of Onshore Wind Energy Potentia*l is one of the deliverables under the project titled *Wind Energy Development in Indonesia: Investment Plan*.

Initially, there were 14 potential onshore wind locations in Java and Sumatra Island assessed. Three of these locations (2x Tuban and Samas) were excluded based on lacking wind resource. The remaining eleven locations were then clustered into 8 locations for further analysis. Technical and economic viability became the focus of this study, for which the goal is to attract donor and business investment for potential wind sites.



As shown above, the eight potential wind farm locations are Aceh Besar (Aceh), Dairi (North Sumatra), Gunung Kidul (DI Yogyakarta), Kediri (East Java), North Padang Lawas – South Tapanuli (North Sumatra), Ponorogo (East Java), Probolinggo – Lumajang (East Java), and Ciracap (West Java). Findings from the study are consolidated in a wind farm prospectus per location.

In each prospectus, the following items are included:

- Introduction of the location
  - Geographic location
  - The mentioning in PLN Electricity Supply Business Plan (*Rencana Umum Penyediaan Tenaga Listrik*/RUPTL) 2021-2030 and current development status
- Wind resource availability and land use
  - Wind characteristics at the envisioned area
  - Topography at the envisioned area
  - Land use at the envisioned area, including permitting requirements
  - Conclusion on the boundaries of the envisioned wind farm area
- Design of the preliminary wind farm layout
- Accessibility
  - Transportation to the wind farm, including necessary road adjustments and construction of new infrastructure
  - Transportation within the site, including necessary road adjustments and construction of new infrastructure
- Geology and seismicity conditions
- Biodiversity, socio-economic and environmental conditions
- Transmission network design
  - Selection of the point of connection at the PLN grid
  - Schematic design of transmission and distribution network
- Energy yield assessment (based on the wind resource availability and preliminary wind farm layout)
- Business case assessment (based on the wind farm cost and energy yield)
- Overall conclusion on the techno-economic viability of the wind farm and recommended next steps in the development of the wind farm

3.2 Preconditions for each site

A number of restriction criteria were adopted in this study to determine potential wind farm sites within each of the eight locations. These criteria are shown below:

Average yearly wind speed: > 6 m/s
(at 100 m height)

Slope: < 15 degrees
(with a buffer of 100 m around steep ridges)

Exclusion of roads and railways
(with a buffer of 150 m)

Exclusion of other no-go zones
(protected areas, water bodies, airports, etc.; including buffer)

Reference wind turbine
Capacity: 4 MW
Rotor diameter: 170 m
Hub height: 140 m
Inter-turbine spacing: 5x rotor diameter

3.3 Key results

	Aceh Besar (Aceh)	Ciracap (West Java)	Dairi (North Sumatra)	Gunung Kidul (DI Yogyakarta)	Kediri (East Java)	North Padang Lawas – South Tapanuli (North Sumatra)	Ponorogo (East Java)	Probolinggo – Lumajang (East Java)
Geographic location and demand								
Peak load in the province (2020)	542 MW	7,712 MW	1,883 MW	450 MW	5,935 MW	1,883 MW	5,935 MW	5,935 MW
Projected annual demand growth rate	4.7%	3.88%	5.5%	4.88%	3.7%	5.5%	3.7%	3.7%
Listing in RUPTL PLN 2021-2030 on wind energy as planned and potential	258 MW	965 MW	198 MW	60 MW	331 MW	198 MW	331 MW	331 MW
Wind farm layout								
Number of turbines (4 MW each)	30	100	23	20	48	78	20	17
Total installed capacity	120 MW	400 MW	92 MW	80 MW	192 MW	312 MW	80 MW	68 MW
Infrastructure and land use								
Suitable port (Distance)	Port of Malahayati (45 km)	Pelabuhan Ratu fishing port (60 km)	Port of Medan (140 km)	Port of Semarang (170 km)	Port of Surabaya (100 km)	Port of Dumai (300 km)	Port of Surabaya (220 km)	Port of Surabaya (100 km)
Inflicted land use type according to	1. Plantation Area 2. Dryland Farming/ Agricultural Area	1. Plantation Area 2. Wetland Farming/ Agricultural Area	Protected Forest Area	1. Dryland Farming/ Agricultural Area 2. Residential Area	1. Plantation Area 2. Dryland Farming/ Agricultural Area	1. Production Forest Area	1. Plantation Area 2. Wetland Food Agriculture Area	1. Plantation Area

	Aceh Besar (Aceh)	Ciracap (West Java)	Dairi (North Sumatra)	Gunung Kidul (DI Yogyakarta)	Kediri (East Java)	North Padang Lawas – South Tapanuli (North Sumatra)	Ponorogo (East Java)	Probolinggo – Lumajang (East Java)
regency spatial plan	3. Wetland Farming/ Agricultural Area	3. Dryland Farming/ Agricultural Area 4. Beach Border Area 5. River Border Area Rural Settlement Area			3. Urban Settlement Area	2. Limited Production Forest Area 3. Dryland Farming/ Agricultural Area	3. River Border Area 4. Urban Settlement Area 5. Grassland/Shrub Area	2. (Fixed) Production Forest Area
Biodiversity and social impact								
General impression	Primary and secondary forests, with a mix of small villages, small farms, and rice paddy fields	• A variation between a stretched ridge, hills and flatter areas mainly used for larger plantations	• Primary forest, part of a larger elongated forested area with a length of about 60 km • Complex of PLTA Lau Renun nearby	• Homogeneous topography and land use • Small but steep hills which are used for agroforestry, and valleys in between which are in use by farmers	• Villages are mostly located in the valleys, surrounded by mainly rice paddies • East-west oriented ridges are mostly covered by forest and shrubs, small scale farming, and agroforestry	Variation between valley terrain (west), deep gorge (central) and steeper slopes (east)	The area can be divided into several sections: • Mountains surrounding the plateau • Plateau valley • Hills at base of the plateau • Eastern hills	The northern part (coastal plains) and southern part (foot of Mount Bromo) of the site differ from each other both in topography, land use, and population density
Biodiversity based on listing of at least 'near threatened' in IUCN global red list	Several (critically) endangered animal species listed	Several animal and plant species listed	Several animal and plant species listed	Very limited animal and plant species listed	Several animal and plant species listed	No listed animal or plant species in recent times	Very limited animal and plant species listed	Several animal and plant species listed
Social impact	• The central section of the project site consists of a series of rural villages and rice paddy fields	• Villages and scattered houses are present • The social impact could be loss of agricultural land, reduced accessibility during	• Apart from a few houses on and near the power plant complex, the area within and directly around the wind	As the turbines are mostly built in unpopulated valleys and/or hills away from the villages, the social impact is	• Several villages are located in the valleys, in between the ridges • The potential turbines are placed on the slopes or at the top of the	• Apart from the villages near the main road, the area is sparsely populated • The social impact is mainly limited to the loss of	• As most turbines will be built further away from the villages, the social impact is mainly limited to the loss of agricultural land, reduced	• Numerous small villages are located in the area • The visual impact in the southern part (east of the gorge) of the site may be quite limited

	Aceh Besar (Aceh)	Ciracap (West Java)	Dairi (North Sumatra)	Gunung Kidul (DI Yogyakarta)	Kediri (East Java)	North Padang Lawas – South Tapanuli (North Sumatra)	Ponorogo (East Java)	Probolinggo – Lumajang (East Java)
	• The beachfront is an important source of income (tourism) • The social impact is mainly limited to the loss of agricultural land, reduced accessibility during road construction and transport, and visual impact	road construction and transport and visual impact • The area is branded as a tourist destination (UNESCO Geopark)	farm is inhabited by humans • Wind turbine placement may lead to local resistance from the hospitality industry at Lake Toba	mainly limited to the loss of agricultural land, reduced accessibility during road construction, and transport and visual impact	ridges, away from these villages at a distance of at least 300 meters	agricultural land, reduced accessibility during road construction and transport and visual impact	accessibility during road construction and transport, and visual impact • Road construction can greatly improve accessibility on the plateau which may have a positive impact on the local economy	• The mobility of the population nearby is likely to be increased when public roads are upgraded
Transmission network								
Point of connection (PLN substation)	Banda Aceh 150 kV	Pelabuhan Ratu Baru 150 kV	Sidikalang 150 kV	Semanu 150 kV	Surya Zig Zag 150 kV	Padang Sidempuan 150 kV	Semanu 150 kV	Probolinggo 150 kV
Distance to connection	6 km	8km	19 km	7 km	9 km	15 km	17 km	13 km
Required number of transmission towers	19	22	48	21	25	44	46	34
Energy yield								
Average wind speed	5.0 – 7.5 m/s	5.5 – 7.5 m/s	7.0 – 10.0 m/s	5.0 – 7.0 m/s	5.0 – 8.0 m/s	6.0 – 9.0 m/s	5.0 – 8.5 m/s	6.5 – 8.0 m/s
P50 Annual Energy Production	317,543 MWh/yr	1,131,551 MWh/yr	432,897 MWh/yr	218,339 MWh/yr	519,135 MWh/yr	918,143 MWh/yr	564,393 MWh/yr	261,831 MWh/yr

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P90 Annual Energy Production	236,154 MWh/yr	841,523 MWh/yr	321,941 MWh/yr	188,885 MWh/yr	386,075 MWh/yr	682,813 MWh/yr	419,733 MWh/yr	194,721 MWh/yr
P50 full load hours	2,646 hrs/yr	2,829 hrs/yr	4,705 hrs/yr	2,729 hrs/yr	2,704 hrs/yr	2,943 hrs/yr	2,940 hrs/yr	3,850 hrs/yr
P90 (25 yr) full load hours	1,968 hrs/yr	2,104 hrs/yr	3,499 hrs/yr	2,361 hrs/yr	2,011 hrs/yr	2,189 hrs/yr	2,186 hrs/yr	2,864 hrs/yr
Business case calculation[2]								
Assumed tariff Year 1-10 Year 11-25	 $10.49 cents / kWh $5.73 cents / kWh	 $9.54 cents / kWh $5.73 cents / kWh	 $10.49 cents / kWh $5.73 cents / kWh	 $9.54 cents / kWh $5.73 cents / kWh	 $9.54 cents / kWh $5.73 cents / kWh	 $10.49 cents / kWh $5.73 cents / kWh	 $9.54 cents / kWh $5.73 cents / kWh	 $9.54 cents / kWh $5.73 cents / kWh
Lower-bound investment cost Total (per MW)	USD 171,123,000 (USD 1,423,000)	USD 589,312,000 (USD 1,473,000)	USD 126,978,000 (USD 1,380,000)	USD 126,452,000 (USD 1,581,000)	USD 275,730,000 (USD 1,436,000)	USD 469,734,000 (USD 1,506,000)	USD 310,548,000 (USD 1,553,000)	USD 108,732,000 (USD 1,599,000)
Baseline investment cost Total (per MW)	USD 190,803,000 (USD 1,590,000)	USD 654,386,000 (USD 1,635,000)	USD 141,373,000 (USD 1,537,000)	USD 141,578,000 (USD 1,770,000)	USD 307,995,000 (USD 1,604,000)	USD 524,776,000 (USD 1,682,000)	USD 349,783,000 (USD 1,749,000)	USD 121,663,000 (USD 1,789,000)
Upper-bound investment cost Total (per MW)	USD 240,249,000 (USD 2,022,000)	USD 818,661,000 (USD 2,045,000)	USD 174,913,000 (USD 1,901,000)	USD 180,857,000 (USD 2,261,000)	USD 389,374,000 (USD 2,028,000)	USD 667,449,000 (USD 1,901,000)	USD 447,836,000 (USD 2,239,000)	USD 154,218,000 (USD 2,268,000)

[2] Assuming 25 years of operation, gearing of 70/30, debt tenure of 10 years, and interest rate of 9%

	Aceh Besar (Aceh)	Ciracap (West Java)	Dairi (North Sumatra)	Gunung Kidul (DI Yogyakarta)	Kediri (East Java)	North Padang Lawas – South Tapanuli (North Sumatra)	Ponorogo (East Java)	Probolinggo – Lumajang (East Java)
Baseline annual operational expenditure (per MW)	USD 3,577,000 /yr (USD 29,000 /yr)	USD 11,778,000 /yr (USD 29,000 /yr)	USD 2,759,000 /yr (USD 30,000 /yr)	USD 2,404,000 /yr (USD 30,000 /yr)	USD 5,602,000 /yr (USD 29,000 /yr)	USD 9,017,000 /yr (USD 29,000 /yr)	USD 5,951,000 /yr (USD 30,000 /yr)	USD 2,093,000 /yr (USD 31,000 /yr)
Business case results								
Project IRR before taxes at P50 (lower-bound / baseline / upper-bound cost)	11.25% / 9.25% / 5.52%	10.50% / 8.70% / 5.29%	28.75% / 25.40% / 19.62%	8.40% / 6.61% / 3.20%	9.96% / 8.09% / 4.61%	12.93% / 10.80% / 6.77%	10.39% / 8.38% / 4.72%	16.08% / 13.75% / 9.48%
Average DSCR at P90 (lower-bound / baseline / upper-bound cost)	0.90 / 0.82 / 0.67	1.16 / 1.06 / 0.88	1.69 / 1.53 / 1.27	0.90 / 0.82 / 0.66	0.83 / 0.76 / 0.61	0.97 / 0.88 / 0.72	0.85 / 0.77 / 0.61	1.09 / 0.99 / 0.81
Net profit at P50 over 25 years (lower-bound / baseline / upper-bound cost)	USD 119,250,000 / USD 99,468,000 / USD 50,970,000	USD 394,436,000 / USD 324,240,000 / USD 161,459,000	USD 373,619,000 / USD 356,350,000 / USD 316,159,000	USD 58,488,000 / USD 43,708,000 / USD 4,547,000	USD 168,362,000 / USD 134,719,000 / USD 55,086,000	USD 417,987,000 / USD 356,181,000 / USD 210,654,000	USD 206,311,000 / USD 163,811,000 / USD 66,725,000	USD 150,155,000 / USD 134,675,000 / USD 95,760,000

3.4 Disclaimer

The wind farm prospectuses have been written with due care based on assessments conducted by four experienced parties in the wind energy sector (Pondera, Witteveen+Bos, Quadran, and BITA). However, aside from a two-day site visit to the area, the assessments have been executed through a desk study based on publicly available data and information. The nature and accuracy of the data and information used for the report largely determines the accuracy and uncertainties of the recommendations and outcomes of this report. Furthermore, verification and validation through physical surveys, measurements, design, calculations, and stakeholder consultations are required to determine the definitive techno-economic viability of the wind farm. Therefore, no rights can be derived from any of the presented information and results. For some sites, developers have already initiated follow up studies and therefore might come to different considerations and conclusions based on their acquired data. The intended use of the wind farm prospectuses is limited to informing the Indonesian government, developers, and investors about the indicative potential of the presented location for wind energy development. The authors of this report are not responsible for any consequences that may arise from the improper use of the report.

4 Investment Opportunities and Access-to-Finance Guide

DESCRIPTION OF THE BOOKLET

This booklet aims to provide an overview of the options that are available in Indonesia to finance onshore wind farms. Following this summary page, the booklet contains the following elements:

- The second page describes the **project stages** in onshore wind development, in which the project cycle has been split in:
  a. the Preparation & pre-Feasibility Study (pre-FS) stage,
  b. the Feasibility Study (FS) stage,
  c. the Engineering, Procurement and Construction (EPC) stage, and
  d. the Operations & Maintenance (O&M) including decommissioning stage.
- The third page describes various **financial products** and applicable conditions, covering both commercial funding and grant / blended funding options.
- The fourth page lists a wide range of **investors**, clustered into International Financial Institutions (IFIs), Development Financial Institutions (DFIs), bilateral cooperation facilities, private investment funds, Indonesian banks and international banks. It provides an overview of the type of financing that is generally offered by each type of investor.
- The fifth and final page provides a stepwise approach that can be followed to **access financing** and provides **key findings and suggestions** for improving the regulatory framework, aiming to increase the amount of financing accessible to onshore wind developers in Indonesia.

The findings are based on desk research and on interviews with a wide range of private and public investors.

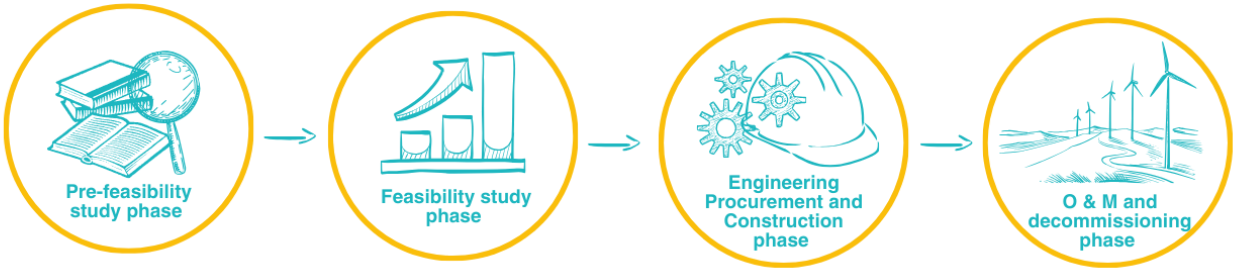
Investment Opportunities and Access-to-Finance Guide: for Indonesian Wind Energy Projects
"Wind Energy Development in Indonesia: Investment Plan" Project
September 2024

The project is initiated by the Ministry of Energy and Mineral Resources of the Republic of Indonesia (MEMR), managed by the Southeast Asia Energy Transition Partnership (ETP), and hosted by the United Nations Office for Project Services (UNOPS).

Author: Pondera Consult

DISCLAIMER

Project stages in onshore wind development



Project Stages	Financing needed during this stage
Pre-Feasibility Study phase The first stage of the onshore wind development consists of three parts. First, targets need to be set, and a roadmap to achieve those targets should be created. Second, pre-FS analyses of potential onshore wind locations need to be executed. Third, any upgrades to physical and digital infrastructure need to be assessed and developed. In contrast with other project stages, this stage is usually government led.	• Grant financing for target setting, roadmap development & regulatory support. • Public loans (on attractive terms) for the government or SOEs to develop electrical infrastructure. • Pre-FS studies for specific locations (publicly or privately - by a developer - solicited and funded). • More information related to market dynamics in ths phase can be found in the *Roadmap for Onshore Wind Energy Development in Indonesia* (Component 1 of this study). More information related to technical aspects and key risks applicable during this phase can be found in the *Wind Farm Prospectuses* (Component 3 of this study).
Feasibility Study phase The Feasibility Study as defined in this report includes executing a wind measurement campaign, executing an infrastructure and geotechnical assessment, designing the wind farm, calculating the business case based on quoted prices for components / services, arranging (conditional) financing, acquiring land, and obtaining the required permits. The IFC performance standards define the minimum quality level that the FS should adhere to. Once the FS has been completed, the project should be 'ready to build'.	• Central procurement of (part of) the FS by the state. Such studies can be recouped from the winner of the tender (not yet possible in Indonesia). • An FS funded from the balance sheet of a developer, co-financed by a loan or credit line to the developer. • An FS initiated by a party that is not willing or able to be the lead developer can seek high risk / return capital (or concessional financing) to start the FS. • Similar to the Pre-FS phase, more information related to market dynamics in this phase can be found in Component 1 of this study, and more information related to technical aspects and key risks applicable during this phase in Component 3 of this study.
Engineering Procurement and Construction phase The Engineering, Procurement & Construction (EPC) stage includes the Financial Investment Decision (FID) as a milestone. This stage ends when the project has reached the operational stage. During this stage the majority of the Capital Expenditures (CAPEX) needs to be deployed.	• 20-30% of the project costs has to be funded from the balance sheet of a developer. A developer (consortium) can raise a (junior) loan or equity financing to fund their equity share. • 70-80% of the project cost can be funded with external debt. This debt can usually be raised once the PPA has been signed. • Similar to the Pre-FS and FS phase, more information related to market dynamics in this phase can be found in Component 1 of this study, and more information related to technical aspects and key risks applicable during this phase in Component 3 of this study.
Operations & Maintenance and Decommissioning phase The Operations and Maintenance (O&M) phase starts when the project has become fully operational, and the power purchase has started. At the end of the O&M stage, the project will need to be decomissioned.	• Refinancing of a project can take place at any time during the project cycle. Once a project has become operational, this sale is used to free up capital for the seller (often to fund new projects), and as a financial investment for the buyer. • Costs during the O&M stage for maintenance and decommissioning will need to be covered. These are usually financed from the cashflow of the project. The loan obtained to fund the CAPEX will need to be repaid during this stage.

Financial products and applicable conditions

This page provides an overview of the various types of financing that are available in the Indonesian onshore wind sector. This financing includes both commercial 'investments', non-commercial 'grants and subsidies', and blended financing that includes features of both types of financing. Non-commercial and blended financing often aims to de-risk onshore wind farm projects.

Commercial financing

Debt

A loan or credit line, with a fixed interest rate and a fixed payback schedule. A loan can often be provided to a wind project once a PPA contract has been signed

Typical features

- Ticket size range: >$10m. Maximum for specific entities vary, often between $50-100m per investor. If larger loans are needed, multiple financiers can fund a single project. A requirement might be that financiers fund only 50%, or for larger projects even smaller sizes of the total investment.
- Funding is often denominated in US$. Interest rates are for example based on the Secured Overnight Financing Rate (SOFR), and a markup of premium ranges normally between 2 and 3%.
- Duration can be up to 20 years, and grace periods of up to 7 years exist. Commercial banks usually provide funding with a shorter duration.
- Minimum Debt Service Coverage Ratio: is usually required to be 1.25 on p90 (this can vary across financiers).

Mezzanine

Combine features of debt and equity. Examples include:

- A junior loan
- Convertible loan
- Preferred shares
- Redeemable equity

Typical features

- Junior loans are subordinate to (senior) loans, therefore higher interest rates generally apply.
- Convertible loans have a potential upside from the potential conversion to equity, and therefore usually feature a lower interest rate.
- Preferred shares have priority over ordinary shares when paying dividends, although these shares usually have no voting rights.
- Redeemable equity is an equity investment where the wind farm developer redeems (buys back) the shares over time through dividends tied to revenues or free cash flows.

Equity

Purchase ownership of a project. An equity stake does not have to be paid back following an agreed upon timeline, and the future return is not agreed upon. An owner of an equity stake is entitled to a proportional share of dividends (when paid), and the equity stake can be sold. An equity investor can enter a project / company at anytime during the project cycle. This will position the investor on equal terms next to the original developer, which also owns (part of) the equity share.

Typical features

- Return on Equity (ROE) expectations vary widely between investors, usually between 10-20%. Country, currency and project risks influence ROE expectations.
- Investors that step into a project at an earlier stage take more risks, and usually require a higher ROE.

Alternative financial products

Alternative financing products include (non-exhaustive): guarantees, currency hedging & floating to fixed rate hedging, and export credits.

Typical features

Hedging costs vary through time.

- Currency hedging from IDR to USD usually costs around 2-5% of the hedged sum annually.
- Floating to fixed hedging costs are depending on the long term interest rates expectations plus a mark-up of around 1-2%.
- Export credit is a form of trade financing, and applicable interest rates can vary widely depending on the duration, the type of goods being exported, the creditworthiness of the buyer, and the prevailing market conditions.

Blended financing

Blended & sub-commercial financial products

Blended financing refers to a combination between commercial and non-commercial financing in a single project or even in a single financial product. Examples include (non-exhaustive):

- Lower interest rate financing
- Increased risk acceptance
- First loss facility (i.e. a junior loan that will (partially) cover losses, if any)
- Concessional loan (i.e. the loan will be remitted under agreed upon circumstances)
- Concessional guarantees
- Subsidized hedging products

Typical features

Blended financing products vary widely, and can yield significant benefits for developers.

- Interest rates can be lowered in some cases to 0-2%. A portion of a loan can be concessional as well.
- An example of this is a financing for a feasibility study, of which 50% will be remitted in case the project does not materialize.
- Sub-commercial guarantees are available to Indonesian onshore wind projects and offer a significant discount compared to commercial guarantees. Generally, blended financing is not offered to commercially viable projects.

Non-commercial financing

Grants (CAPEX/DEVEX)

Capital expenditure (CAPEX) or Development expenditure (DEVEX) grants are funds 'given' to an organization or project, which do not need to be repaid. The grant can usually only be used for specific purposes, and are often designed to overcome a specific hurdle, for example related to the development of a roadmap or to finance a pilot project for a new technology. Grants can also be used to support a project that is commercially unviable but socially or environmentally desired.

Typical features:

Grants can be key to create a viable business case. Characteristics and related conditions of grants vary widely.

- Common grants include 'viability gap' grants, or grants that can fund infrastructure development that is not part of a wind farm, but that is needed to construct or connect it (although this is more commonly financed with loans).
- A fixed maximum percentage of the total investment sum that can be funded by grants does not exist, but 50% is a common maximum.

Subsidies (OPEX / production subsidies)

Operational expenses or production subsidies can be provided to developers to create a guaranteed minimum income or increased revenue. These are usually provided by governments.

Subsidies for onshore wind farms do not yet exist in Indonesia. Indirect subsidies could be applicable when PLN accepts higher electricity prices compared to commercial market conditions.

Description of financiers

This page provides an overview of various financiers that are currently active in the Indonesian renewable energy sector, and that include the Indonesian onshore wind sector in their investment scope. The list is not exhaustive, but aims to provide a starting point for parties to obtain financing.

Category	Example financiers (non-exhaustive)	Financing public or private projects / organizations?	Common types of financing offered	Objectives and benefits of financing
International Financial Institutions (founded by multiple countries)	ADB, World Bank, IFC (part of World Bank Group), IsDB	Public and Private	**Grants** for: Roadmaps, pre-FS studies, preparatory project studies and supporting infrastructure (if not commercially feasible). **Loans & Equity** for: enabling infrastructure financing (for example transmission lines), any stage of wind farm development, other related private development projects (energy storage projects for example), etc.	**Objectives** of International Financial Institutions (IFIs) include providing investments to emerging and developing countries to meet social, climate and other sustainability challenges. **Benefits** of financing from IFIs: funding can be flexible in terms of duration, have an extended grace period, can have a higher risk tolerance, feature lower interest rates, and can have concessional features.
Development Financial Institutions (founded by a specific country)	PT SMI, DFC, EIB, KfW, Proparco, FMO, Temasek, KDB	Public and Private	**Grants** for: Roadmaps, pre-FS studies, preparatory project studies. **Loans & Equity** for: enabling infrastructure financing (for example transmission lines), EPC stage of wind farm development, other related private development projects (energy storage projects for example), etc.	**Objectives** of Development Financial Institutions (DFIs) include providing investments to emerging and developing countries to meet social, climate and other sustainability challenges (similar to IFIs). **Benefits** of financing from DFIs can include: flexibility in terms of duration, grace period, can feature lower interest rates, and can have concessional features.
Bilateral cooperation	EU, USAID, RVO, AFD, FCDO, GIZ, DFAT, CIDA, JICA	Public and Private	**Grants** for: Roadmaps, pre-FS studies, preparatory project studies. **Loans** for: enabling infrastructure financing (for example transmission lines), any stage of wind farm development, other related private development projects (energy storage projects for example), etc.	**Objectives** of bilateral cooperation usually include: supporting social and environmental goals and enhancing international relations. **Benefits** of financing from bilateral cooperation: Often flexible financing to achieve strategic objections, it can be grant based or loan based with concessional features.
Partnerships (Initiatives funded by multiple countries / organizations)	ETP UNOPS, JETP	Public and Private	**Grants** for: Roadmaps, pre-FS studies, preparatory project studies. **Loans & equity** for: enabling infrastructure financing (for example transmission lines), any stage of wind farm development, other related private development projects (energy storage projects for example), etc.	**Objectives** of these partnerships include enhancing cooperation and efficiency by creating an organization that focuses on specific goals. **Benefits** of financing from partnerships: Often partnerships have a strong focus, expertise and a broad network within the sector. Thereby such partnerships can add significant support beyond only the financing.
Private investment funds	CFM, GCF, ACGF, AGCP, ACP, SUSI Partners, Equis Energy, FAST-P, SEASEF	Private	**Loans & Equity** for: EPC and O&M stage of wind farm development, other related private development projects (energy storage projects for example), etc.	**Objectives** of private investment funds usually include the generation of financial return for their shareholders, and increasingly, social or environmental objectives to be achieved alongside financial targets. **Benefits** of financing from private investment funds: Used to funding private sector projects, can sometimes have blended / concessional features.
Indonesian banks	PT BTPN, BNI	Private	**Loans & Equity** for: EPC and O&M stage of wind farm development, other related private development projects (energy storage projects for example), etc.	**Objectives** of Indonesian banks is usually to generate financial return for their public and private shareholders, and increasingly, social or environmental objectives to be achieved alongside financial targets. **Benefits** of financing from Indonesian: Used to funding private sector projects in Indonesia, can provide financing in IDR.
International banks	HSBC, DBS	Private	**Loans & Equity** for: EPC and O&M stage of wind farm development, other related private development projects (energy storage projects for example), etc.	**Objectives** of international banks is usually to generate financial return for their public and private shareholders. Increasingly, social or environmental objectives are set alongside financial targets. **Benefits** of financing from international banks: Their financing can often follow international developers, thereby leveraging connections from other countries.

Abbreviation from top to bottom:

ADB : Asian Development Bank
IFC : International Finance Corporation
IsDB : Islamic Development Bank
PT SMI : PT Sarana Multi Infrastruktur (Persero)
DFC : U.S. International Development Finance Corporation
EIB : European Investment Bank
KfW : Kreditanstalt für Wiederaufbau
FMO : Nederlandse Financierings-Maatschappij voor Ontwikkelingslanden N.V.
KDB : Korean Development Bank
EU : European Union
USAID : United States Agency for International Development
RVO : Netherlands Enterprise Agency
AFD : *Agence Française de Développement*
FCDO: Foreign, Commonwealth and Development Office (UK)
GIZ : Deutsche Gesellschaft für Internationale Zusammenarbeit
DFAT: Department of Foreign Affairs and Trade (AUS)
CIDA : Canadian International Development Agency
JICA : Japan International Cooperation Agency
ETP : Southeast Asia Energy Transition Partnership
JETP : Just Energy Transition Partnership
CFM : Capital Fund Management
GCF : Green Climate Fund
ACGF : ASEAN Catalytic Green Finance Facility
AGCP : Asia Green Capital Partners
ACP : African, Caribbean and Pacific Group of States
SEASEF: South East Asia Skills Enhancement Programme
BTPN : Bank Tabungan Pensiunan Nasional
BNI : Bank Nasional Indonesia
HSBC : Hong Kong and Shanghai Banking Corporation
DBS : Development Bank of Singapore Limited

How to access financing

Accessing available financing sources in an efficient manner is key to both developers and financiers. This section provides a guide on how to access the financing. Furthermore, key challenges related to the Indonesian regulatory framework have been described.

Estimate the type and size of the required financing. Steps to develop this estimation include:

- Create an (initial) design for the wind farm, assess the wind conditions.
- Develop the associated business plan & financial model.
- Understand the financing needs that arises from the financial model, and assess the type(s) of financing required.

Initiate talks with investors. These talks can start once the project is deemed financially feasible and the amount and type of funding has been estimated. It is advised to engage potential financiers well in advance of requiring financing. Ideally such meeting is arranged via an introduction via your existing network. An embassy or chamber of commerce may help to reach out to financiers. During the first meetings with investors, it can help to keep the following in mind:

- Understand the focus and scope of the investor. Often financiers have a website or strategic plan that outlines their investment approach, or it may be possible to talk to people that are familiar with the financier. It is advised to extensively discuss the match between the investment focus / scope of the financier and the specific wind project during the first meeting. The financing needs to match in terms of ticket size, sector, risk profile, project stage, duration, etc.
- Prepare a prospectus, containing/summarizing key information about the project. This prospectus should include at least a description of the wind farm, high-level business and financial details, the envisioned governance and ownership structure, and a timeline & action plan.
- The financier can explain what conditions apply. Examples of such conditions include biodiversity studies, wind measurement conditions, etc. It is key to assess whether these conditions can be met, before further steps are being taken.
- If it seems feasible that a match between the financier and the wind project exists, and that the conditions can be met, the next step requires the submission of documents. It is recommended to create a precise overview of the documents that need to be submitted to obtain financing.

Obtain the required documentation. The documents that are required to be submitted vary depending on the type of financier, the financial product, and the size of the financing. A mid-size onshore wind farm (50-100 MW) usually requires at least the following documents:

- A wind measurement analysis, a business plan including a detailed project design (including turbine manufacturer and EPC contractor), financial model, any required permits, environmental permits (such as AMDAL, UKL-UPL, etc.), collateral, guarantees / warranties from the selected wind farm manufacturer, track record & references.
- Depending on the project stage, a signed PPA with PLN or with a private offtaker may be required. Legal and regulatory considerations to keep in mind during the investment application process can be found in the *Roadmap for Onshore Wind Energy Development in Indonesia* (Component 1 of this study) and in the *Permitting & Regulation Assessment for Onshore Wind* (Component 2 of this study). These components also cover regulations specifically applicable to foreign investors.

It is often possible to **closely engage** with an investor during the initial stages of a project, to ensure a smooth funding process in the future.

Regulatory challenges

The main regulatory challenges hindering the financing of wind farms in Indonesia are:

- **Uncertainties and delays in the procurement process of PLN.** This causes increased financing costs and investors / developers to pull out, leaving a less competitive landscape for onshore wind development.
- **Negative impact on the business case due to the Annual Contracted Energy regulation**. This creates uncertainties in the business case, which in turn will raise financing costs.
- **Lack of power wheeling possibilities.** This hinders new project development and may cause additional transmission systems to be built unnecessarily.
- **A 51% project ownership by a subsidiary of PLN can create a conflict of interest.** This conflict of interest exists due to a role of PLN as both the offtaker and developer. This can lead to difficulties in the financing of the project.
- **Local content requirements for input materials that do not yet have a sufficient track record.** Financiers often have track record requirements. This may block investments if these locally produced inputs cannot meet these requirements.
- **Some PPAs issued by PLN assume that a loan will have been repaid after 10 years, and therefore the electricity tariff will be lowered after 10 years.** Some financiers have expressed that this is not realistic, given that some loans for onshore wind projects can only be fully repaid after 20 years.

Conclusion

A wide range of financing options are available for onshore wind projects in Indonesia. However, availability of suitable financing varies across project stages.

While generally sufficient funding is available for projects at the EPC and O&M stage, funding for projects at the Pre-FS and FS stage is more limited, mainly due to the high risks involved in financing projects at that stage. In addition, financing for supportive infrastructure (including transmission lines, upgrading road infrastructure, smart grid development, etc.) and energy storage solutions is limited, mainly due to the lack of a clear business case for such investments in the current Indonesian context.

While some risks cannot be avoided, risks can be lowered by improving the regulatory framework, or by improved consistency of processes and consistent implementation of regulations. Several key challenges associated with the regulatory framework have been listed in the section on the left. Blended financing can be deployed to finance the development of roadmaps, early-stage projects, supportive infrastructure development or financially unviable projects at the EPC stage.

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