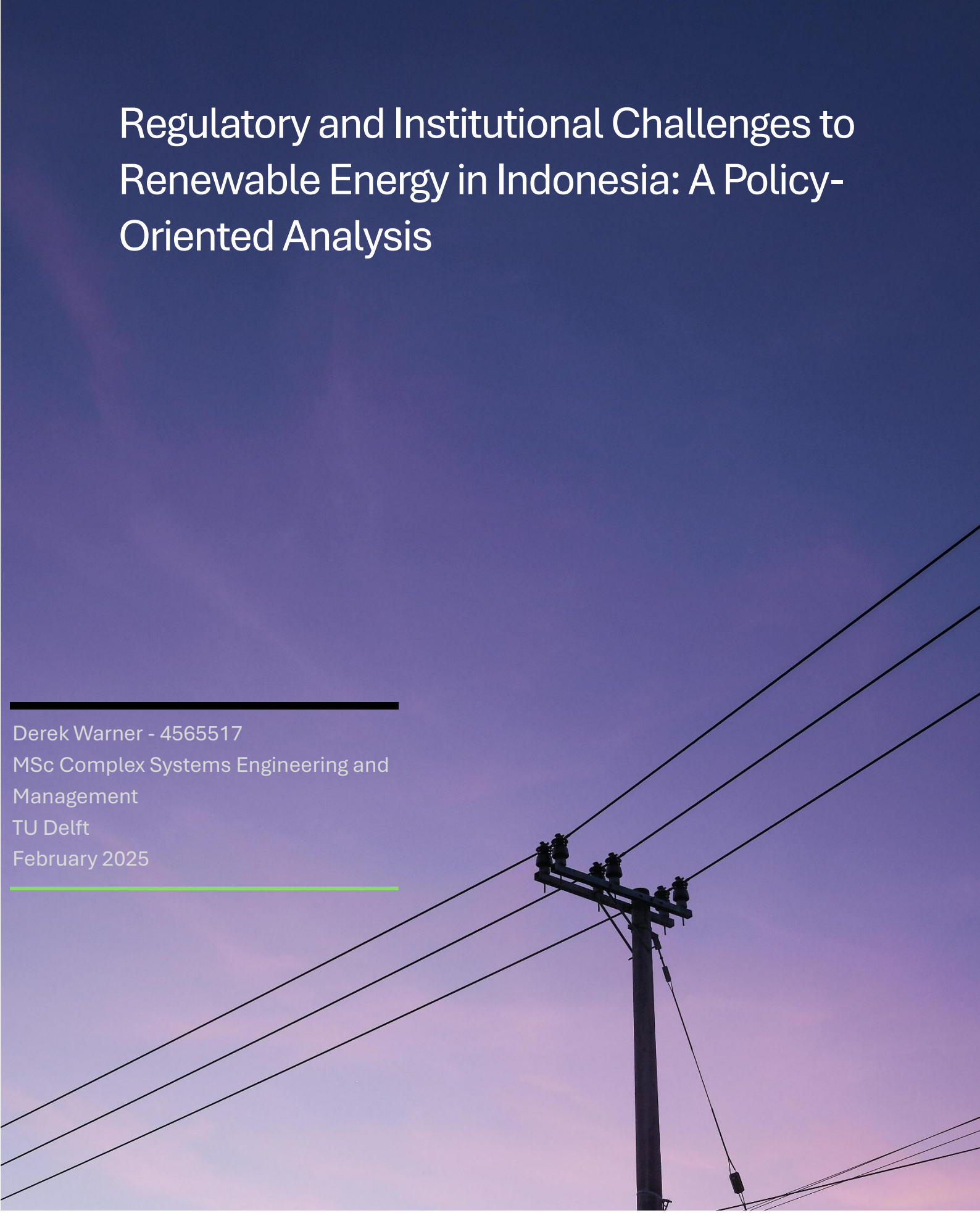
Regulatory and Institutional Challenges to Renewable Energy in Indonesia: A Policy-Oriented Analysis



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February 2025

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Regulatory and Institutional Challenges to Renewable Power in Indonesia

A Policy-Oriented Analysis

By

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In partial fulfilment of the requirements for the degree of: Complex Systems Engineering and Management

Master of Science

in Complex Systems Engineering and Management (COSEM)

at the Delft University of Technology,

to be defended publicly on May 15th, 2025 at 14:00

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Executive Summary

Indonesia has set ambitious renewable energy targets as part of its commitment to reach Net Zero Emissions (NZE) by 2060. Yet progress remains limited. Despite abundant resource potential and strong political rhetoric, PLN's (national utility company) renewable electricity investment has stalled due to persistent institutional obstacles—particularly in how generation capacity is procured. This thesis investigates those obstacles and proposes targeted, regulation-level reforms to improve renewable energy procurement without requiring major legislative change or sizeable financial stimuli.

This thesis applies a layered analytical approach rooted in New Institutional Economics (NIE), which examines how formal and informal rules shape actor behaviour and policy outcomes. Two complementary NIE frameworks guide the research: the Williamson Four-Level Institutional Framework (WLIF) and the Institutional Analysis and Development (IAD) framework.

First, the WLIF framework is used to map the legal, financial, and governance structures that shape procurement incentives in Indonesia's national utility dominated electricity sector. This system-level analysis identifies four key institutional obstacles to renewable electricity investment: (1) Overcapacity and Solvency Constraints, (2) PLN's Procurement Procedure Inefficiencies, (3) Transmission Infrastructure Gaps, and (4) A Lack of Government Commitment. These findings were validated through expert interviews with stakeholders from PLN, independent developers, and energy consultants.

Next, the IAD framework is used to evaluate seven policy alternatives aimed at improving procurement outcomes. These scenarios are assessed against five qualitative criteria: development costs for private actors, transaction complexity, financial viability constraints, fiscal exposure for PLN and the government, and perceived risk to investors. Expert feedback was again used to validate the analysis and refine the most promising policy interventions. The final four recommendations are:

1. **Levelling the playing field through feasibility study and land acquisition aupport with cost recovery**, to reduce entry barriers and enable more inclusive competition without overburdening PLN financially;
2. **Centralized and transparent tender management with defined DPT deadlines**, to improve information symmetry and reduce procedural uncertainty;
3. **Improved bid evaluation practices**, to reduce reliance on outdated pricing benchmarks and support value-based procurement;
4. **Standardized Power Purchase Agreement (PPA) templates**, to reduce legal friction and streamline negotiations based on international best practice.

Each policy targets a specific rule-based obstacle identified in the procurement process and is designed to be implementable under existing regulatory authority. Together, they offer a coherent set of reforms that could make Indonesia's renewable electricity investment environment more predictable, transparent, and bankable—while supporting the country's broader decarbonization goals under NZE 2060.

This thesis thus contributes to institutional energy transition research by offering both a detailed national-level diagnosis and a replicable framework for policy design in state-dominated electricity sectors. Its findings are directly relevant for Indonesian ministries, PLN, development partners, and private developers seeking to accelerate renewable deployment through targeted institutional reform.

Acknowledgements

I would like to express my sincere gratitude to my primary supervisor, Dr. Jaco Quist, for his continuous support, critical feedback, and structured guidance throughout this thesis. His bi-weekly check-ins, encouragement, and help in finding interview participants were invaluable to both the quality and feasibility of this research.

I also thank my secondary supervisor, Dr. Rutger van Bergem, for his availability and helpful input, particularly in shaping the institutional theory components of this work. His insights helped clarify complex theoretical concepts and connect them to the practical context of the Indonesian energy sector.

I am especially grateful to the expert interview participants who shared their time, insights, and professional experiences with me. Their perspectives grounded this research in real-world challenges and helped validate its findings. While they remain unnamed here for reasons of anonymity, their contributions were essential.

Finally, I thank my friends and family for their support, patience, and encouragement—not just during this thesis process, but throughout my studies.

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Abbreviations

ASEAN	Association of South-East Asian Nations
BKPM	Indonesian investment coordinating board
CFPP	Coal Fired Power Plant
CIPP	Comprehensive Investment and Policy Plan
COSEM	Complex Systems Engineering & Management
DMO	Domestic Sales Order
EPC	Engineering, Procurement, Construction
ESKOM	South African Energy Monopoly
ETP	Energy transition platform
FS	Feasibility Study
HVDC	High Voltage Direct Current
IAD	The Institutional Analysis and Development framework
IPP	Independent Power Producer
IUPTL	Business licence for utility companies
JETP	Just Energy Transition Partnership
KEN	National Energy Strategy
MoEMR	Ministry of Energy and Mineral Resources
MoF	Ministry of Finance
MSO	Mandatory Sales Order

MoSOE	Ministry of State-owned enterprises
NEK	National Energy Council
NZE 2060	Net Zero Emissions by 2060 commitment
NIE	New Institutional Economics
O&M	Operations and Management
PERTAMINA	Gas Monopolist of Indonesia
PFS	Pre-Feasibility Study
PI-grid	Power-Interest grid
PLN	Perusahaan Listrik Negara (national utility)
PPA	Power Purchase Agreement
RE	Renewable Energy
RES	Renewable Energy Supply
RfP	Request for Proposal
RoI	Return on investment
RUEN	National Energy Plan
RUED	Regional Energy Plan
RUKD	Regional Electricity Plan
RUKN	National Electricity Plan
RUPTL	National Power Supply and Demand Plan
VRE	Variable Renewable Energy

1. Introduction

1.1 Indonesia's complex energy sector

Indonesia is one of the world's largest coal exporters and among the fastest-growing electricity markets in Southeast Asia. National demand is projected to quadruple between 2020 and 2050, driven by industrial expansion, population growth, and rising living standards (Kamandika et al., 2023). While this growth creates new opportunities for development, it also poses a major climate challenge. Over 60% of electricity is currently generated from coal, and without structural reforms, emissions from the power sector are expected to rise sharply.

In pursuit of its ambition to become an advanced economy by 2045—and in alignment with international climate goals—the Indonesian government has pledged to achieve Net Zero Emissions (NZE) by 2060. This long-term commitment has triggered a wave of recent policy initiatives aimed at accelerating the energy transition, including the 2022 ban on new coal-fired power plants (PR112/2022), a national emissions trading system launched in 2023, and the USD 20 billion Just Energy Transition Partnership (JETP), designed to support coal phase-outs and expand renewable capacity. These policies signal growing ambition, but implementation has been challenging. From 2018 to 2023, total renewable capacity rose by just 3.3 GW—of which only 0.6 GW came from solar and wind (Setyawati & Setiawan, 2024). Renewables now make up 18.5% of the power mix, largely due to legacy hydro and geothermal projects rather than recent initiatives.

This gap between ambition and real-world progress cannot be fully explained by technical or financial constraints. Indonesia has vast renewable energy potential and improving access to international climate finance. Instead, structural features of the electricity sector continue to impede clean energy investment. PLN, the state-owned utility, holds vertically integrated control over the power sector—it plans new capacity, procures generation, and serves as the sole buyer of electricity from private producers in the country. Retail electricity tariffs are fixed by the government to guarantee cheap and equitable access to the public, making PLN operate at a loss while the utility's generation costs are supported through government subsidies and the Domestic Market Obligation (DMO), which mandates price-capped coal sales to PLN from domestic mining operations. These incentives support fossil fuel expansion but disincentivize renewables, which must compete under unequal conditions without comparable pricing certainty or risk mitigation.

In short, institutional misalignment—not technology or capital—has become the primary bottleneck. Renewable energy generators are disincentivized, procurement procedures are opaque, rules are inconsistently applied, and developer risks remain high. Unlocking Indonesia's renewable energy potential will therefore depend not just on bold policy targets, but on targeted institutional reform. This thesis investigates how

institutional structures and rule configurations shape the renewable electricity sector and explores which policy interventions could help bridge the implementation gap.

1.2 Problem Statement and Knowledge Gaps

Despite significant public investment, political commitment, and high-level policy ambition, Indonesia has seen only modest growth in renewable electricity capacity in recent years. The country remains unlikely to meet its 23% renewable energy target by 2025—a trend that cannot be fully explained by financial limitations or technological readiness alone. Instead, structural features of the electricity sector appear to constrain the pace and scale of renewable energy development.

A growing body of evidence points to Indonesia's institutional environment as a central factor in shaping investment outcomes. Institutions—understood here as the formal and informal rules, governance structures, and incentive mechanisms that guide actor behaviour—play a decisive role in enabling or hindering energy transitions. In Indonesia, institutional obstacles include long-term fossil fuel contracts, procedural bottlenecks in procurement, and limited regulatory coordination across government actors.

As shown in the literature review (Chapter 2), however, existing research has not yet provided a sufficiently detailed and comprehensive analysis of these constraints. Three key knowledge gaps remain with respect to the Indonesian electricity sector:

1) Limited volume of institutional research on Indonesia's electricity sector.
2) Limited mechanism-level analysis in studies covering Indonesia's institutions.
3) Absence of a comprehensive, national-scale institutional analysis.

This thesis responds directly to these gaps by conducting a structured institutional analysis of Indonesia's electricity sector. The goal is to identify and explain the core institutional obstacles to renewable electricity investment and to develop actionable, regulation-level policy recommendations for overcoming them.

In this thesis, the term 'institutional obstacle' is used broadly to refer to barriers that are either caused by existing institutional arrangements—such as laws, rules, or incentive structures—or that can be addressed through institutional reform, even if their immediate manifestation is financial, procedural, or infrastructural.

By targeting these obstacles through tractable reforms—particularly in the area of procurement—this research aims to provide actionable insights that support Indonesia's long-term climate strategy, including its commitment to Net Zero Emissions by 2060.

1.3 Research Objectives and Research Questions

The core objective of this research is to address Indonesia's renewable energy transition challenges by identifying the main institutional obstacles to the expansion of renewable power generation and developing targeted policy recommendations to overcome them.

This objective is supported by the following three sub-objectives:
1. To develop a socio-technical overview of the Indonesian electricity sector;
2. To identify and evaluate the main institutional obstacles to renewable electricity investment;
3. To formulate and assess policy recommendations that address at least one of these obstacles.

The research questions have been designed to align directly with these sub-objectives:

Main Research Question:

What policies can the Indonesian government apply to reduce the main institutional obstacles to renewable electricity investments?

Sub-questions:

SQ1: What is the socio-technical system of the electricity sector?
This question establishes a foundational understanding of Indonesia's electricity sector, including grid structure, key actors and their relationships, incentive mechanisms, and the formal and informal institutions that govern the system.

SQ2: What are the main obstacles to renewable electricity investment?
Expanding on the socio-technical context from SQ1, this question identifies and evaluates specific institutional obstacles, using concrete examples from policies, regulations, and actor dynamics.

SQ3: What are the most feasible policies to reduce the main obstacles to renewable electricity investment?
This question develops and assesses a set of policy alternatives aimed at mitigating the most significant institutional obstacles. These alternatives are evaluated using an institutional framework and validated through expert interviews.

1.4 Research Approach

This research adopts a qualitative approach to investigate institutional obstacles to renewable electricity investment in Indonesia. Given the complex and multi-layered nature of institutions—encompassing laws, policies, incentive structures, and actor interactions—a qualitative methodology is appropriate for mapping and analysing these dynamics. As Mwangi et al. (2017) argue in A Qualitative Toolkit for Institutional Research, exploratory "what" questions are best addressed through qualitative tools, particularly when institutional environments are context-specific and politically embedded.

The research design followed three main stages:

1. System mapping through a socio-technical description

The first phase involved developing a socio-technical overview of Indonesia's electricity sector. This included an overview of market and grid structure, an actor analysis to map key stakeholders (e.g. PLN, developers, regulatory bodies) and an institutional analysis

based on Williamson's Four-Level Framework (WLIF). WLIF distinguishes between layers such as formal rules, informal norms, governance structures, and underlying institutional foundations. This framework was used as a structure to map how institutions shape actor behaviour and energy system dynamics.

2. Identification and analysis of institutional obstacles

Based on the socio-technical description, specific institutional obstacles to renewable electricity investment were identified. Each obstacle was analysed in terms of its underlying institutional drivers, the actors involved, and how existing incentives and governance arrangements contribute to its persistence. This phase focused on understanding the mechanisms through which these obstacles affect renewable electricity investment, particularly through the actions of PLN and developers.

3. Policy development and evaluation using the IAD framework

In the final stage, this thesis focused on a specific set of institutional obstacles related to renewable energy procurement. This scope was chosen not only for its high relevance to investment outcomes, but also because procurement-related obstacles were particularly amenable to institutional reform without requiring major legal or structural overhauls. Using the Institutional Analysis and Development (IAD) framework, policy alternatives were formulated according to rule-based logic, evaluative criteria were defined, and expected outcomes specified. This enabled a structured assessment of how each intervention might alter the incentive environment for key actors. The resulting policy recommendations were validated through expert interviews and synthesized into a set of feasible, regulation-level strategies.

This research approach was designed to answer the sub-questions outlined in Section 1.3: It generated a socio-technical system overview (SQ1), identified and explained key institutional obstacles (SQ2), and evaluated policy alternatives to address them (SQ3). The overarching goal has been to provide policy-relevant insights for the Indonesian government and other coal-dependent developing countries pursuing a renewable energy transition.

1.5 Alignment to COSEM (Complex Systems Engineering and Management)

The institutional make-up of Indonesia's electricity sector may be considered a complex system. It is in essence a network system that provides a technical function that is in a state of flux due to societal conditions and climatic targets. How the system may adapt to meet national climate goals is highly dependent upon legislation on national and regional scales, institutional arrangements and a diverse set of stakeholders. This makes the research subject a logical fit for the COSEM programme.

This research was conducted as part of TU Delft's collaboration with Indonesian partners under the "Regional Development Planning and Ideal Lifestyle of Future Indonesia" project, funded by the Dutch Research Council (NWO). The project supports

Indonesia's net-zero emissions ambition by combining policy, technology, and institutional research to inform sustainable energy development.

1.6 Thesis outline

This thesis is structured across eight chapters, each building toward the central goal of identifying institutional policy options to improve renewable energy procurement in Indonesia:

- Chapter 1 - introduces the problem context, policy relevance, and research questions.
- Chapter 2 - provides a brief literature review, outlining existing findings on Indonesia's renewable energy sector and identifying key knowledge gaps.
- Chapter 3 - presents the theoretical foundations and methodology. It introduces the New Institutional Economics (NIE) frameworks used in the analysis—namely the WLIF and IAD frameworks—and explains how these are operationalized to answer the research questions.
- Chapter 4 - begins the analysis with a socio-technical system description and actor mapping of Indonesia's power sector, followed by the application of the WLIF framework to identify the institutional structure of the sector.
- Chapter 5 - builds on this by conducting an obstacle analysis of renewable electricity investment, drawing from Chapter 4 to identify, evaluate, and group key institutional obstacles for development of policy recommendations.
- Chapter 6 - develops policy alternatives in response to the main procurement-related obstacles identified in Chapter 5. It applies the IAD framework to assess how institutional reforms could change actor behaviour and refines these proposals through expert interviews.
- Chapter 7 - discusses the findings in light of the research question, theoretical frameworks, and implications for academic and practical audiences.
- Chapter 8 - concludes by answering the research questions, summarizing the final policy recommendations, and outlining directions for future research.

2. Literature Review

This chapter reviews the existing literature on institutional obstacles to renewable electricity development in Indonesia. The purpose of the review is to assess how these obstacles have been conceptualized, which dimensions have received scholarly attention, and where important analytical or empirical gaps remain. Academic studies were surveyed using the academic database Scopus and several MSc theses were found through expert recommendations. Given the country-specific nature of institutional dynamics in the energy sector, particular emphasis was placed on Indonesia-focused studies, though a limited number of comparative works were included for conceptual relevance. The chapter identifies three key knowledge gaps that inform the research design and justify the need for a more detailed, national-scale institutional analysis.

2.1 Method

To identify relevant knowledge gaps related to institutional obstacles in Indonesia's renewable electricity sector, this literature review addresses the following question:

What types of institutional obstacles to renewable electricity development in Indonesia are identified in the academic literature, and how have they been analysed?

The objective of this review is twofold: (1) to understand which institutional factors are known to obstruct renewable electricity investment and development in Indonesia, and (2) to assess the extent to which these issues have been explored in the academic literature.

Two search strings were developed for use in the SCOPUS database. The first targeted literature focused specifically on Indonesia, using keywords such as energy, transition, institutional, analysis, and Indonesia. This search produced a limited number of results (9 articles, of which 5 were selected after abstract screening).

To address this limitation, a second search string was created using the same core keywords but replacing 'Indonesia' with 'developing'. This was intended to identify institutional analyses from countries with comparable electricity sector structures, as Indonesia is classified as a developing nation. Filters were applied to ensure results remained focused on energy transition topics within peer-reviewed literature. This second search yielded 8 articles, of which 2 were selected for inclusion—focused on South Africa and Japan. These were included based on structural and institutional similarities to the Indonesian context, as detailed in Section 2.2. For more details on search parameters on keyword inclusion see *table 2.1* below:

Table 2.1: Search Parameters

Search String 1	Reason for Inclusion
Keywords: Energy + Transition	Include reduction of fossil fuels *and* addition of RE capacity as both are projected in RUEN (MoEMR, 2017)
Keywords: Institutional + Analysis	Focus on institutional and political elements of energy transition
Keyword: Indonesia	Limit results to the case: Indonesia
Filters: None	Low number of results
Search String 2	**Reason for Inclusion**
Keywords: Energy, Transition, Institutional, Analysis	Same as Search String 1
Keyword: Developing	Include developing countries outside of Indonesia with similar circumstances
Filters: *Subject*-Energy, *Language*-English, *Publication Type*-Articles, *Keywords*-Energy Transition	Limit large number of results to manageable quantity

Additionally, three master's theses from the TU Delft repository were added based on expert recommendations, as they provided relevant institutional analyses of the Indonesian electricity sector. Three potentially relevant articles were excluded due to access limitations within the TU Delft network. Articles focused solely on energy poverty, energy justice, or niche technologies (e.g., biochemical energy generation) were excluded to maintain a focus on investment-relevant institutional obstacles at the electricity system level. The aim was to capture system-wide institutional dynamics rather than narrow technical or social justice perspectives. See *table 2.2* below for the search process and *Appendix F* for article-level summaries.

Table 2.2 Search Process

SEARCH CODE	DATABASE	SEARCH QUERY	NUMBER OF PUBLICATIONS	
			Pre selection	Post selection
ST1	*SCOPUS*	*TITLE-ABS-KEY (energy AND transition AND institutional AND analysis AND indonesia) AND (LIMIT-TO (PUBSTAGE , "final"))*	9	5
ST2	*SCOPUS*	TITLE-ABS-KEY (energy, AND transition, AND institutional, AND analysis, AND developing) AND (LIMIT-TO (SUBJAREA , "ENER")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (EXACTKEYWORD , "Energy Transition"))	8	2
RECOMMENDATIONS	TU Delft MSc repository			3

2.2 Literature Review Results

The literature reviewed suggests that Indonesia's limited progress in expanding renewable electricity generation is primarily linked to institutional obstacles within the country's power sector. Based on the review, three main knowledge gaps emerge regarding how these institutional obstacles are understood and documented in the academic literature.

Gap 1: Limited volume of institutional research on Indonesia's electricity sector.
The first and most evident gap is the limited number of Indonesia-specific studies addressing institutional barriers to renewable electricity development. Despite resorting to a second search string only 8 relevant academic sources were identified that directly analyse Indonesia's institutional context. Given the complexity and country-specific nature of energy sector institutions, this scarcity represents a significant gap. Comparative institutional research is often not generalizable, as regulatory environments, political economies, and market structures vary substantially even among countries with similar developmental profiles (Hall and Soskice, 2001).
Two non-Indonesian studies were included due to conceptual relevance. Ting and Byrne (2020) examine how South Africa's electricity monopoly, ESKOM, uses institutional mechanisms to hinder renewable integration—offering a useful comparison to PLN's role in Indonesia. Trencher et al. (2019) highlight how Japan's coal industry influences national energy policy, providing insight into how vested interests may shape institutional outcomes even in different developmental contexts.

Gap 2: Limited mechanism-level analysis in studies covering Indonesia's institutions
A second gap relates to the analytical depth of studies that include Indonesia in their institutional analyses. Several sources examine the role of institutions in Indonesia's energy transition, often as part of broader comparative studies. However, these studies tend to describe institutional obstacles in abstract terms—referring to "low institutional quality" or "weak governance" (e.g., Gyamfi et al., 2022; Bekun et al., 2021). While such characterizations indicate that institutions matter, they do not identify which rules, actors, or governance mechanisms are at play. For instance, Loseva et al. (2020) compare Indonesia with other island nations such as Cyprus and attribute differences in renewable energy progress to stronger institutions in the latter. Although this includes Indonesia-specific insights, it remains analytically high-level, offering little diagnostic value for policy design. This is not necessarily a shortcoming of the research itself—whose aim may lie elsewhere—but it underscores the limitations of relying on studies that do not disaggregate institutional dynamics.

In short, even among studies that explicitly cover Indonesia, there is a lack of detailed, mechanism-level analysis that would allow scholars and practitioners to identify concrete barriers or design targeted policy responses.

Gap 3: Absence of a comprehensive, national-scale institutional analysis.

A third gap emerges from the opposite problem: while some studies do provide detailed, mechanism-specific insights into Indonesia's institutional landscape, they are limited in scope. Five studies analyse institutional obstacles in Indonesia's electricity sector, but each is constrained in scope of geography, technology, or policy instruments. Setyowati and Quist (2022) study the regions of Bali and South Kalimantan, finding that inflexible coal-based PPAs restrict renewable development in the former, while coal industry influence shapes policy outcomes in the latter. Simanjuntak (2021) focuses on wind energy and identifies unattractive feed-in tariffs as a key regulatory barrier. Funk (2022) investigates the coal industry's institutional influence in South Kalimantan, emphasizing the role of political lobbying in slowing transition efforts. Van Asselt (2023) analyses institutional obstacles to financing inter-island transmission infrastructure, while Purnamasari and Nurachmah (2023) focus on the design and implementation of a national carbon market.

While these studies offer valuable insights into specific obstacles, none provide a national, system-wide institutional overview. This limits our the ability to identify core institutional issues across the power sector or to develop broadly applicable policy solutions.

This review identifies three main knowledge gaps in the literature on Indonesia's institutional obstacles to renewable electricity development: (1) limited country-specific research, (2) insufficient detail on the nation's specific institutions, and (3) absence of a comprehensive, national-level institutional analysis. This thesis aims to address these gaps by mapping the key institutional obstacles across Indonesia's power sector and developing targeted policy recommendations for overcoming them.

3. Theory and Methodology

This chapter presents the theoretical and methodological foundations of the research. It begins with an explanation of the two core frameworks from New Institutional Economics (NIE) used in the analysis: the Williamson Four-Level Institutional Framework (WLIF) and the Institutional Analysis and Development (IAD) framework. These frameworks provide a layered structure for diagnosing institutional obstacles and designing policy interventions within Indonesia's electricity sector. The second part of the chapter outlines the research methodology, including the specific strategies applied to answer each sub-question. It details how desk research, stakeholder analysis, institutional mapping, and expert interviews were combined to generate and evaluate policy recommendations grounded in institutional realities.

3.1 Institutional Frameworks and Analytical Approach

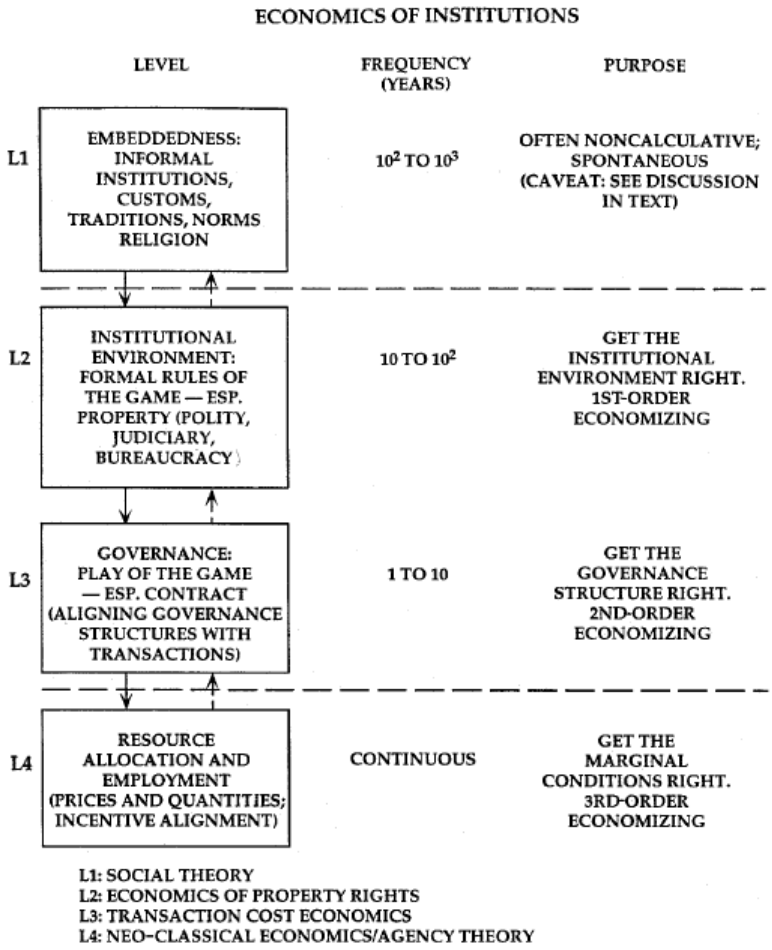
This research draws on two core frameworks from NIE: the WLIF and the IAD framework. Together, they provide a multi-layered analytical structure for diagnosing institutional challenges and evaluating policy responses in the context of Indonesia's electricity sector. In this field institutions are defined as the formal and informal rules, governance structures, and incentive mechanisms that guide actor behaviour. NIE is particularly well-suited for this study as it emphasizes the role of transaction costs, bounded rationality, and institutional complexity in shaping economic behaviour and investment decisions (Williamson, 2000). The relevance of WLIF in particular has been demonstrated in energy sector research, where it has been used to align institutional and technical layers in the governance of electricity infrastructures (Scholten & Künneke, 2016).

3.1.1 The Williamson Four-Level Institutional Framework (WLIF)

The WLIF framework provides a hierarchical model (*see figure 3.1*) for analysing institutions across four levels of social organization, each with distinct temporal dynamics and policy levers:

- **Level 1: Embeddedness** – Deeply rooted norms, beliefs, and cultural legacies that evolve slowly over centuries. These shape societal expectations and political discourse.
- **Level 2: Institutional Environment** – Constitutions, laws, and formal regulations that define the rules of the game for public and private actors. These typically change over decades.
- **Level 3: Governance** – Organizational arrangements and contractual mechanisms used by actors to manage transactions and uncertainty. These evolve over years.
- **Level 4: Resource Allocation and Employment** – Day-to-day decisions made by individuals and firms in response to prices and incentives, typically studied using neoclassical economics.

Figure 3.1: Williamson's Four Layered Institutional Framework (Williamson, 2000)



In this thesis, Levels 1–3 are used to diagnose the institutional obstacles to renewable electricity investment in Indonesia. The framework is applied in Chapter 4.3 to trace how long-term developmental goals, regulatory structures, and governance practices interact to shape the performance of the electricity sector.

3.1.2 The Institutional Analysis and Development (IAD) Framework

The IAD framework, developed by Elenor Ostrom, complements the WLIF by offering a dynamic and actor-oriented lens through which to evaluate institutional interactions. The IAD framework was chosen not only for its capacity to map complex institutional settings, but specifically for its diagnostic utility in real-world reform processes and its potential to assess the impact of institutional reforms (policies) on actor behaviour (Ostrom, 2005). Its action situation construct offered a targeted lens on the procurement process, enabling systematic evaluation of proposed rule changes (policy scenarios) and their likely impact on developer incentives, PLN's constraints, and procurement outcomes.

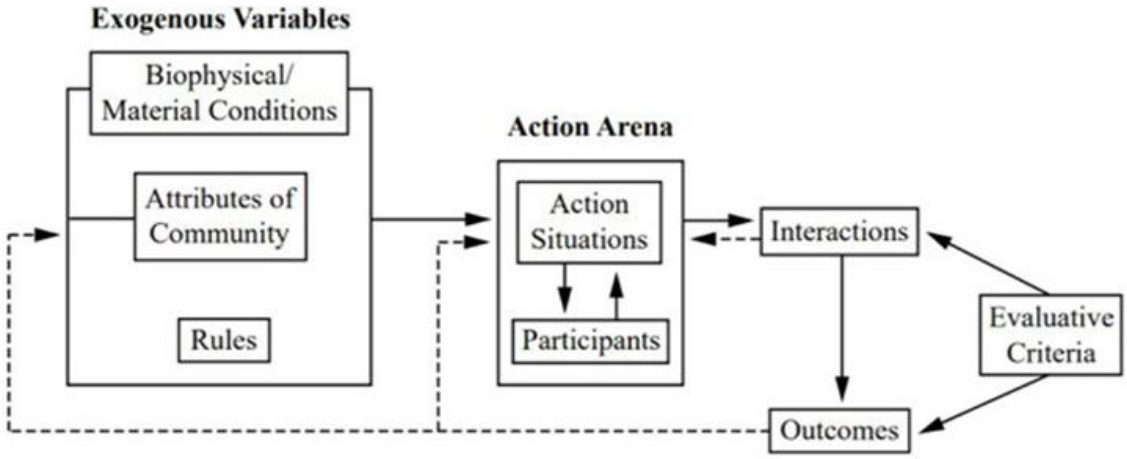
At its centre is the *Action Arena*, composed of:

- *Actors* – such as regulators, utilities, developers, and financiers;
- *Action Situations* – structured decision-making environments shaped by shared rules and contextual factors.

These are influenced by three exogenous variables:

- *Biophysical Conditions* – such as geography, infrastructure, and technical constraints;
- *Attributes of the Community* – including shared norms, risk preferences, and prior experience;
- *Rules-in-Use* – both formal regulations and informal practices that shape behaviour.

Figure 3.2: IAD Framework (Adopted from Ostrom, E., Gardner, R., Walker, J. (1994). *Rules, Games, and Common-pool Resources.* University of Michigan Press.)



The framework is used in Chapter 6 to diagnose how procurement practices within PLN shape the dynamics of renewable electricity investment. It allows for the scenario-based comparison of policy interventions as changes to the action situation and provides a structured approach to evaluate the expected outcomes of different reforms according to the determined evaluative criteria.

In line with Ostrom's IAD framework, this thesis also classifies the rules-in-use that shape actor behaviour into seven rule types: position, boundary, choice, aggregation, information, payoff, and scope rules. These rule types serve as a diagnostic tool to unpack the institutional logic of procurement in Chapter 6, revealing how formal regulations and informal practices jointly structure participation, decision-making, incentives, and expected outcomes (Ostrom,2005).

3.1.3 Integration of WLIF and IAD in This Study

While the WLIF framework is applied to map the structure of Indonesia's electricity sector (Chapter 4) and to set the groundwork for the identification of persistent institutional constraints (Chapter 5), the IAD framework is used to evaluate how targeted policy changes might alter actor behaviour and procurement outcomes

(Chapter 6). WLIF helps identify which layers of the institutional environment are responsible for observed challenges (e.g. legal rigidity vs. governance inefficiencies), while IAD provides the analytical tools to design and test policy responses that are sensitive to actor incentives, rule structures, and system-wide feedback loops.

The sequential use of these two frameworks reflects the logic of the study:

1. First, map and analyse institutional structures and actor configurations (Ch. 4) using WLIF;
2. Then, identify and prioritize barriers using a structured obstacle analysis (Ch. 5);
3. Finally, design, simulate, and refine policy interventions using IAD (Ch. 6), grounded in both formal rules and informal dynamics.

This layered theoretical approach ensures that policy recommendations are not only technically sound, but also politically and institutionally feasible within Indonesia's evolving electricity sector.

3.2 Research Methodology and Framework Implementation

This study employs a qualitative research design, combining exploratory desk research with expert interviews to investigate institutional obstacles to renewable electricity development in Indonesia and evaluate potential policy solutions. The research is structured around three sub-questions, each corresponding to a major chapter of the thesis (Chapters 4–6) and addressed using a dedicated set of methods.

Rather than treating desk research as a passive background activity, this study adopts an iterative documentary analysis approach. Regulatory texts, planning documents, institutional reports, and industry assessments were reviewed continuously throughout the research to inform system mapping, institutional analysis, and policy design. Triangulation was used to guarantee accuracy of sources. Expert interviews were used to validate findings and assess the feasibility of proposed policy reforms. Each method is discussed in more detail below.

3.2.1 SQ-1: What is the socio-technical system of the electricity sector?

This sub-question was addressed through a layered analysis of Indonesia's power sector, focusing on three dimensions: the market structure and grid properties, key actor dynamics, and institutional structures. This approach provided the foundation for understanding how technical constraints, actor interactions and institutional arrangements shape the renewable power sector in Chapter 4.

System Description and Market Structure

The first step involved documenting the physical and organizational structure of the grid. Key features such as regional segmentation, generation capacity, reserve margins, energy mix, and interconnection plans were identified through desk research. This information was drawn from official reports, regulatory publications, and sector

analyses produced by institutions such as the Institute for Essential Services Reform (IESR) and the Ministry of Energy and Mineral Resources (MoEMR).

Building on this technical overview, the second layer of analysis focused on the electricity market structure. Special attention was given to the single-buyer structure of the sector and its associated institutional mechanisms.

This two-layered system mapping provided the basis for understanding how physical infrastructure and market rules jointly shape renewable electricity investment conditions in Indonesia.

Together, these elements form the technical and market baseline for understanding Indonesia's electricity sector and its implications for renewable energy integration.

Actor Analysis

An actor analysis was conducted to identify and evaluate the key organizations shaping Indonesia's electricity sector and their roles in renewable electricity investment. The goal was to determine which actors influence regulatory structures, infrastructure planning, and project-level investment conditions — all of which affect the institutional space for renewable energy development.

The process consisted of four steps: stakeholder mapping, actor selection, actor summarization, and actor-based tool development. Each step draws on established methodologies in stakeholder and institutional analysis (Moncrieffe & Luttrell, 2005; Enserink et al., 2022).

Stakeholder Mapping and Actor Selection

The first step was to cast a wide net over all organizations involved in energy generation, transmission, regulation, planning, and finance. This included both state and non-state entities, with attention to those linked to the renewable power sector either directly or through upstream roles (e.g., rulemaking or funding). The mapping process remained dynamic throughout the research to accommodate newly relevant actors as institutional or regulatory shifts became apparent.

To narrow this list into a focused group of actors, stakeholders were assessed against four inclusion criteria: (1) involvement in national energy policy design, (2) possession of formal regulatory authority, (3) control over generation or transmission infrastructure, or (4) significant influence over investment flows or project approvals. Only those meeting at least one of these criteria were retained for in-depth analysis.

Actor Summarization

Each selected actor was then, through desk research, summarized based on their formal roles, institutional mandates, regulatory or operational authority, investment responsibilities, and key dependencies or relationships with other actors. These summaries — provided in Appendix A.2 — formed the empirical basis for subsequent actor positioning and network analysis.

Power–Interest Grid

To assess relative influence and motivation, each actor was scored on a 10-point ordinal Power–Interest scale. “Power” reflects an actor’s ability to influence decision-making through legal authority, market leverage, or control of critical infrastructure. “Interest” measures the extent to which the actor is interested in a successful or unsuccessful conclusion. Scores were determined comparatively across actors, with cross-validation using the actor summaries to ensure consistency. The 10-point scale offered enough granularity to distinguish between actors in the electricity sector without overly small degrees of difference.

The resulting Power–Interest grid provided a strategic lens for identifying which actors are likely to support or resist specific policy reforms, especially those altering procurement practices or cost structures.

Formal Relationship Mapping

Finally, a formal relations chart was created to map regulatory, operational, and financial linkages between actors. Only documented, official mechanisms — such as oversight relationships, statutory mandates and coordination obligations — were included. This helped clarify which actors formally influence one another and revealed the centrality of certain actors in the sector. While informal influence (e.g., political lobbying, personal networks) was acknowledged, it was not systematically analysed due to methodological and data constraints.

Institutional Analysis

This study applied Levels 1 through 3 of the WLIF framework to structure the institutional analysis of Indonesia’s electricity sector in Chapter 4.3. Each layer was used to identify specific mechanisms through which institutional structures shape renewable electricity investment.

- At *Level 1*, the analysis focused on historical drivers of Indonesia’s energy development—particularly the legacy of energy poverty, coal abundance, and emerging global and domestic pressure for decarbonization.
- At *Level 2*, a detailed legal and regulatory mapping was conducted through desk research. Key laws and policy instruments—ranging from energy strategy documents to procurement rules, price caps, and foreign ownership restrictions—were analysed to understand how they constrain or enable actor behaviour, especially in relation to developers and the state utility PLN.
- At *Level 3,* the analysis examined how these formal rules are translated into governance practices, with a particular focus on PLN’s planning procedures, tendering processes, control over project approval, and its ability to influence financial guarantees. Governance practices were linked to institutional obstacles that raise transaction costs or reduce investment attractiveness for renewable energy projects.

By applying WLIF in this way, the study was able to systematically diagnose where institutional frictions occur, how they shape actor incentives, and what kinds of policy

levers may be effective at different layers. This structured approach served as a foundation for identifying institutional obstacles, which were then analysed and prioritized for policy development in later chapters.

Given the complexity and fragmented nature of Indonesia's electricity sector governance, no exhaustive master list of institutions could be defined at the outset. Instead, relevant laws and governance practices were identified through an exploratory desk research process using snowballing and iterative review techniques. Inclusion was based on institutional relevance to renewable electricity investment and frequency of appearance in policy, academic, and industry sources. This method reflects the inherently distributed and partially informal character of institutional structures in the sector.

The actor-specific incentives and constraints identified through the WLIF framework, combined with the observed legal and procedural dynamics, formed the foundation for identifying institutional obstacles to renewable electricity investments. These findings were used to compile a list of potential obstacles, which were subsequently evaluated and grouped in the next section. Section 3.2.2 explains how these obstacles were assessed, consolidated, and selected for deeper policy analysis in Chapter 6.

3.2.2 SQ-2: What are the main institutional obstacles to renewable electricity investment?

This sub-question identifies and analyses the key institutional factors that hinder renewable electricity investment in Indonesia, with a specific focus on variable renewable energy (VRE) sources such as solar and wind. This delineation from broader renewable energy (RE) technologies was made to narrow the scope of the research to the most institutionally complex and investment-sensitive segment of the power sector. VRE technologies face distinct integration and procurement challenges due to their intermittency, yet they also offer scalable potential and play a central role in global energy transitions (Agarwal et al., 2023; CIPP, 2023). The RUPTL (National power supply and demand plan) also emphasizes the importance of VRE, increasing targets for solar and wind, and their international prominence justifies the focus on them in this research.

The research proceeds to answer the sub-question in Chapter 5 through the following three steps: (1) generation of potential institutional obstacles, (2) evaluation and filtering of these obstacles, and (3) ranking and bundling to determine the most suitable obstacle for in-depth policy development. Each step applies structured qualitative reasoning rooted in institutional theory and desk research.

Generation of Potential Obstacles

The first step was to generate a broad set of potential institutional obstacles that could be contributing to slow renewable electricity investment. This process was grounded in the findings of Chapter 4.3, which used the WLIF framework to examine Indonesian

electricity sector institutions across multiple layers. The conclusion of that chapter identified likely structural issues in the tendering process between developers and the national utility PLN. However, the full scope of potential obstacles was intentionally kept broad at this stage to avoid early over-selection.

Obstacles were categorized into three thematic groups based on theoretical reasoning and prior institutional insights:

1. **PLN Incentives to Offer Attractive Proposals** – obstacles stemming from incentive structures within the national utility that may discourage attractive project offerings to developers.
2. **PLN Resource Limitations** – issues linked to organizational capacity, infrastructure gaps, or human capital constraints that reduce the utility's ability to plan or manage VRE investments at scale effectively.
3. **Regulatory Requirements Affecting Developers and PLN** – regulations that affect either PLN or developers and may unintentionally raise transaction costs or limit competitiveness.

This categorization helped structure the exploratory process and define the scope of potential obstacles. These were then identified through a combination of institutional theory (including New Institutional Economics and transaction cost theory), practical examples from the literature (e.g., Yustika, 2024; Bridle et al., 2018; CIPP, 2023)), and insights from the previous system-level analysis in Chapter 4.

Evaluation of Obstacles

Each obstacle was then evaluated according to four self-selected criteria: Validity, Relevance, Policy Levers, and Solvability—chosen to reflect both analytical soundness and policy utility.

- *Validity* – assesses whether the obstacle is supported by verifiable evidence or theoretical coherence.
- *Relevance* – estimates its likely impact on slowing renewable energy uptake.
- *Policy Levers* – investigates whether institutional mechanisms exist to influence the obstacle.
- *Solvability* – judges the scale of institutional change required to meaningfully reduce the obstacle.

These criteria were inspired by the overall goal of producing actionable and politically feasible policy recommendations for the Government of Indonesia (GoI). The evaluation was based on extensive desk research (see Section 3.2.4) and presented in a qualitative argument-based format, not quantified scoring. This choice was made because trade-offs between impact and feasibility are inherently contextual and not amenable to simple scoring.

Ranking, Bundling and Selection

Following evaluation, the verified and relevant obstacles were restructured and grouped to reflect logical overlaps. Then a selection method was applied to the criteria below in order to determine the most suitable one for development of policy solutions:

1. Overcapacity and Solvency Constraints
2. Procurement Process Inefficiencies
3. Transmission Infrastructure Gaps

Each grouped obstacle was compared in terms of Relevance and Solvability to determine the best fit for further institutional analysis and policy development using the IAD framework. The aim was not merely to find the "most important" obstacle, but the one that offered high potential for meaningful institutional reform, given current political and financial constraints.

The obstacle selected for policy design in the next chapter was: *2. Procurement Process Inefficiencies*.

This final selection provides a focused entry point for applying the IAD framework in Chapter 6, where institutional context, actor interactions, and policy design can be systematically explored.

3.2.3 SQ-3: What are the most feasible policies to reduce the main obstacles to renewable electricity investment?

The final sub-question aims to identify actionable policies that reduce institutional obstacles to renewable electricity investment, focusing specifically on obstacles in the procurement process between developers and PLN (Section 5.3). To structure this analysis, Elinor Ostrom's IAD framework was applied.

Framework Application

The IAD framework was applied by interpreting the procurement process as the focal action situation, where developers and investors interact with PLN through a Direct Selection mechanism governed by specific rules-in-use.

To accurately represent how procurement-related rules are created, approved, and enforced, two nested action situations were also identified. These included rule-making processes and oversight functions performed by ministries. These nested arenas clarify the political and institutional feasibility of proposed reforms.

Contextual elements from the IAD framework—such as biophysical conditions, attributes of the community, and rules-in-use—were drawn directly from the preceding analysis of the Indonesian power sector. Key features were noted and used as the foundation for the action situation and associated outcomes.

Based upon these different elements an IAD framed base scenario of the procurement process was developed. *Figure 6.1* serves as a visual representation of this base scenario. This representation served as a neutral point of reference against which the

effects of various policy interventions could be assessed. Each proposed policy was considered in terms of how it altered rule configurations, actor interactions, and institutional outcomes within the procurement setting. To support this analysis, the rules-in-use governing the procurement process were categorized using Ostrom's rule types, which provided a structured lens to diagnose how current institutional arrangements shape the action situation. This rule classification—applied in Section 6.1.3—also clarified which specific rules were most amenable to reform through regulatory or governance interventions. A qualitative set of criteria, in IAD terminology evaluative criteria, was developed in Section 6.1.4 to guide the policy evaluation process.

Policy Generation and Scenario Analysis

An initial list of policy alternatives was generated using insights from the obstacle analysis in Chapter 5, cross-referenced with the institutional dynamics clarified through the IAD lens. Each policy had to meet three inclusion criteria: direct or indirect relevance to procurement process reform, minimal fiscal burden on PLN or the state, and implementability through regulatory means rather than parliamentary legislation.

The likely impact of each policy was then explored using a structured scenario analysis. This process examined how each intervention would reshape the action situation, adjust actor incentives, and influence the procurement outcomes outlined above. Chapter 6.4 provides a comparative overview of these scenarios based on their alignment with the evaluative criteria.

Expert Interviews: Data Collection and Triangulation Process

To validate and refine the policy scenarios developed through the IAD framework, three semi-structured expert interviews were conducted. These interviews served to triangulate findings from the desk-based obstacle analysis and scenario evaluation, providing grounded insight into institutional dynamics and the real-world feasibility of proposed reforms.

Participants were selected using purposive sampling based on their institutional affiliation and direct involvement in Indonesia's renewable energy procurement process. Two interviewees were identified via the academic and professional networks of the thesis supervisors, while one was contacted directly after authoring an influential industry report encountered during desk research. The final set included a developer-side procurement manager, a current PLN procurement official, and a policy consultant with expertise in Indonesian electricity infrastructure development.

Each interview lasted approximately 45–60 minutes, was conducted online in English via Microsoft Teams, and followed a semi-structured format guided by a shared interview protocol. Core questions addressed project-level transaction costs, procurement bottlenecks, PLN's internal procedures, and the behaviour of key actors such as PLN and MoEMR. Interviewees were also asked to critique proposed policies

and identify additional obstacles – such as political commitment and institutional inertia—that may affect implementation.

All interviews were recorded and automatically transcribed using Microsoft Teams. The transcripts were then manually checked and anonymized by the researcher. To avoid unintentional disclosure of personally identifiable information, the full anonymised transcripts are not included in the report. However, anonymized quotes from the transcripts serve as the basis for interview-derived citations in Chapter 6. Informed consent was obtained from all participants prior to the interviews, in line with TU Delft ethical clearance. The interview protocol and consent form are provided in Appendices E.1 and E.2, respectively.

The interviews were used to confirm the relevance of the identified obstacles, refine the framing of key policy interventions, and provide critical input on feasibility constraints.

Taken together, the methods presented in this chapter form an integrated research strategy. Each methodological step builds on the previous one: the system and actor analysis in Chapter 4 provides the empirical foundation for obstacle identification in Chapter 5, which in turn provides a specific obstacle for the development and evaluation of targeted policy alternatives in Chapter 6. This sequential design ensures that the final policy recommendations are not only grounded in institutional theory, but also tailored to the practical realities of Indonesia's renewable energy procurement context.

4. Socio-Technical Analysis of Indonesia's Electricity Sector

To form a working understanding of the arena in which energy policy is made and strategies are executed a socio-technical analysis was done. A system description of the existing energy infrastructure and electricity market was created to understand the reality on the ground of the sector in which the actors influence each other. Following this an actor analysis was carried out to determine the relevant players in the market and how they can influence the sector. Finally, the most relevant dynamics and regulations in play were isolated and categorised according to Williamsons framework to provide an institutional perspective on the electricity sector's most important actor relationships.

4.1 Technical and Market Structure of Indonesia's Electricity Sector

To help answer Sub-Question 1 — "What is the socio-technical system of the electricity sector?" — this section provides a structured overview of Indonesia's electricity sector through both technical and market lenses. The goal is to understand how the design and operation of the electricity grid, power market, and regulatory setup jointly shape the conditions for renewable electricity investment. The analysis proceeds in 6 parts: (1) Determining the market structure of the electricity sector, with a focus on the dominant role of the state utility PLN and its implications for actor interactions; (2) Mapping the size and segmentation of the national grid and regional capacity distribution; (3) Evaluating the current energy mix; (4) Assessing the degree of interconnection and system flexibility; (5) Reviewing ongoing expansion strategies; and (6) Identifying key structural challenges—such as overcapacity, fossil dependency, and transmission constraints—that influence the feasibility and attractiveness of renewable energy development. Together, these elements define the physical and institutional baseline conditions within which Indonesia's energy transition must unfold.

4.1.1 Electricity Market Structure: The Single-Buyer Model

Indonesia's electricity market is structured around a highly centralized model in which the state-owned utility PLN occupies a dominant role. It is formally responsible for the planning, purchasing, transmission, and distribution of almost all grid-connected electricity. While IPPs (Independent Power Producers) can generate electricity, PLN holds a statutory monopoly over the right to buy and resell electricity to end users. This configuration is commonly referred to as a *single-buyer model*, where one central utility acts as the exclusive intermediary between generators and consumers (Heller & Victor, 2004; Dehdashti, 2004).

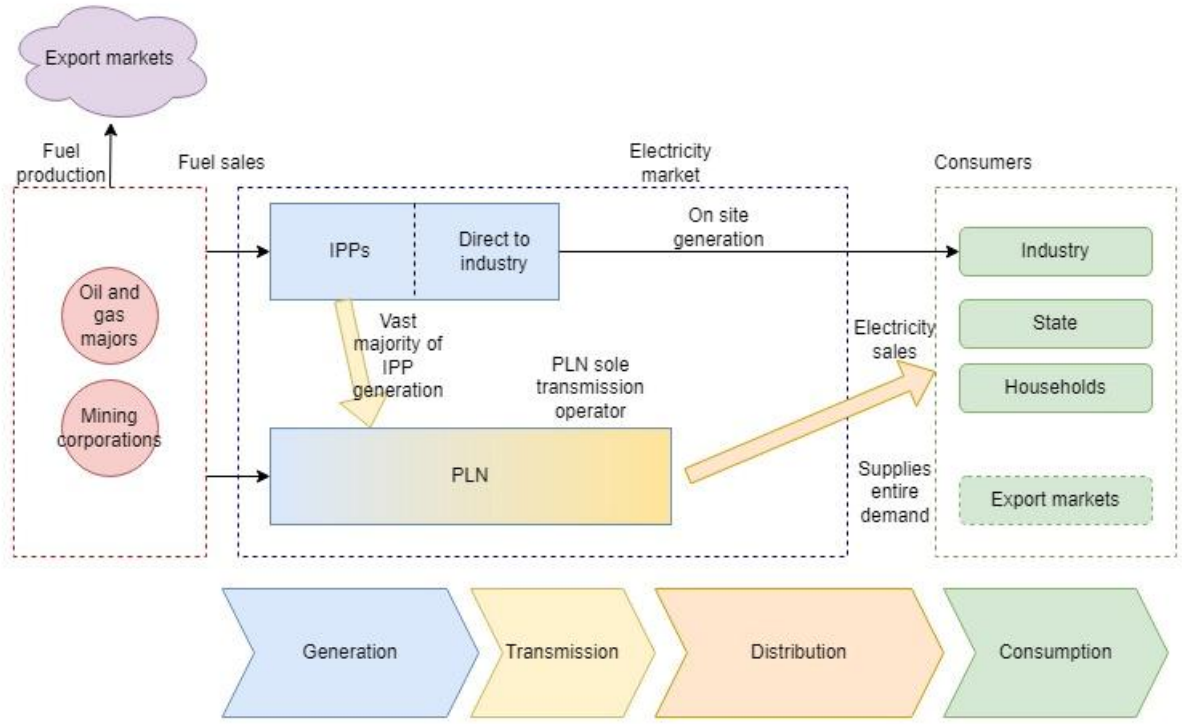
The system is also "bundled" in that PLN controls multiple layers of the value chain: it develops transmission infrastructure, distributes power to consumers, and also owns and operates the majority of generation capacity. As of 2023, PLN still accounted for

approximately 80% of national electricity generation (PwC, 2023), even though private parties are increasingly involved in project development through PPAs and the formation of IPPs. These PPAs are tendered out by PLN and must be consistent with the national electricity supply plan, the RUPTL, which PLN drafts and the MoEMR approves.

In limited cases, developers may sell electricity without involving PLN—for instance, when power does not flow through the national grid in cases like captive generation or private networks (Energy Law 30/2009; PR112/2022). However, these are exceptions to the norm and remain relatively small in scale.

The structure of the electricity market—including PLN's central role, the layered procurement system, and the influence of national planning—can be seen in *figure 4.1*, which maps the core actor relationships and market configuration.

Figure 4.1: Electricity Market Structure



Electricity prices are shaped by strong government intervention. Fuel producers, especially coal and gas suppliers, are subject to Domestic Market Obligations (DMOs) and price ceilings, forcing them to supply fuel to PLN at below-market rates (Laan et al., 2011). This has a significant impact on generation costs and reinforces the cost-competitiveness of fossil fuels. On the consumer end, retail electricity tariffs are capped by the MoEMR to ensure affordability (Energy Law 30/2007), with subsidies provided to PLN to cover the financial shortfall resulting from PLN operating at a loss.

This system helps ensure affordable energy access to the public but has created chronic losses for PLN, which are offset through annual public subsidies. As a result, PLN's financial solvency remains tightly linked to government pricing policies,

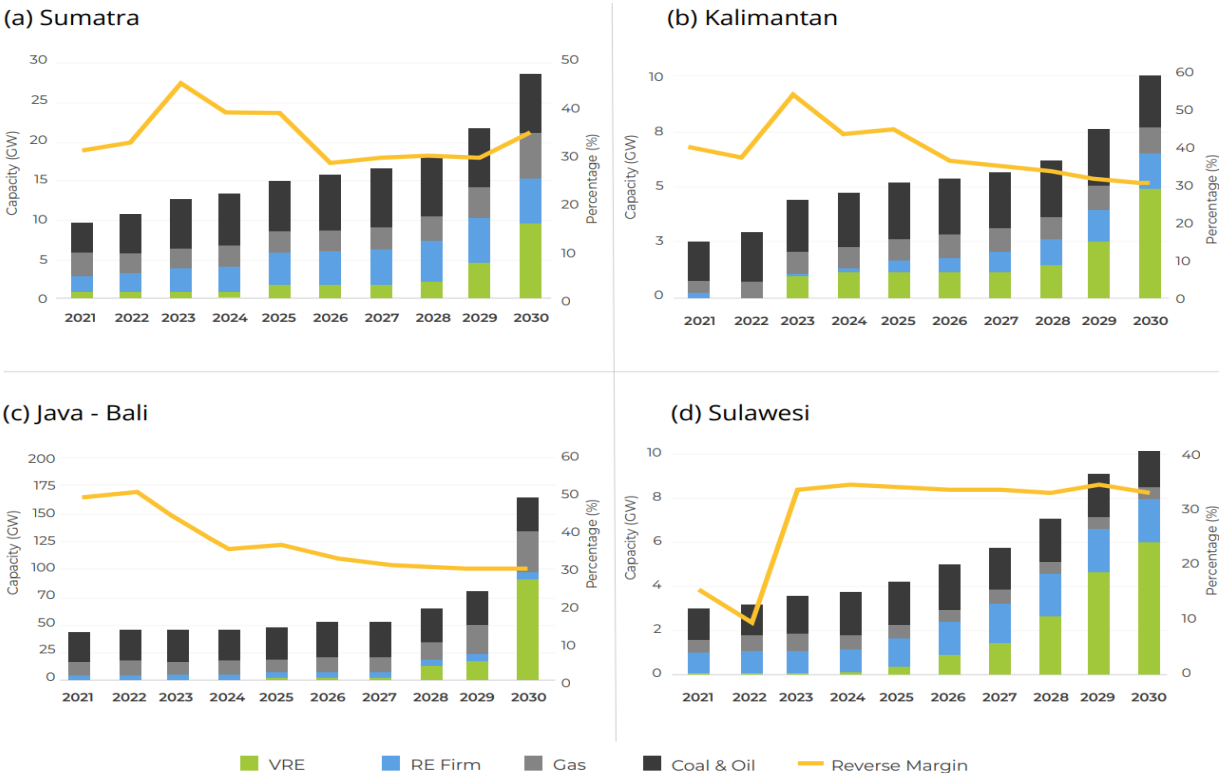
complicating long-term investment planning—especially for capital-intensive renewables.

4.1.2 Grid Size and Segmentation

Indonesia's electricity grid is not a unified system but a network of fragmented regional grids, reflecting the country's vast archipelagic geography of more than 17,000 islands. Operated almost entirely by PLN, these systems vary widely in development and connectivity, posing significant logistical and technical challenges for system integration (IESR, 2024).

The Java–Bali grid, Indonesia's economic and demographic core, is by far the most developed. It supports about 60% of the population and the majority of national electricity demand, underpinned by relatively advanced high-voltage transmission and distribution infrastructure. This region alone accounts for nearly 50 GW of installed capacity (MoEMR, 2023), and its reserve margin—defined as (Installed Capacity – Peak Demand) / Peak Demand—stood at around 50% in 2022, well above Indonesia's technical target of 30% (IESR, 2022). See *figure 4.2* below for regional reserve margins:

Figure 4.2: Reserve margins of major grids (IESR, 2022)



Sumatra's grid is the second largest, covering urban and industrial areas with more than 10,000 km of transmission lines and about 15 GW of capacity. Its geography presents challenges for voltage stability, despite its reserve margin of 40% exceeding technical benchmarks (PwC, 2023; IESR, 2022).

Grids in Kalimantan, Sulawesi, and Papua are smaller and often underdeveloped, together supplying around 9 GW of capacity. Many of these regions remain undersupplied and rely on fragile infrastructure, including isolated microgrids or stand-alone diesel generators. Sulawesi, for example, had a reserve margin of only 10% in 2022, threatening system reliability and limiting renewable energy integration (IESR, 2022).

Eastern Indonesia, including the Nusa Tenggara and Maluku islands, faces the most acute infrastructure gaps. These areas rely heavily on diesel generation, which remains common due to low up-front costs and operational flexibility, but contributes to Indonesia's high diesel power capacity (approximately 4 GW) exacerbating carbon emissions and generation costs (PwC, 2023).

In summary, Indonesia's grid is highly fragmented, with major disparities in capacity and infrastructure across regions. Overcapacity in Java–Bali and Sumatra contrasts sharply with undercapacity in peripheral grids, complicating efforts to integrate renewables system-wide. This imbalance not only constrains coordinated energy planning but also affects where and how PLN prioritizes future capacity expansion.

4.1.3 Power Generation Mix: Fossil Fuels and Renewables

Indonesia's electricity generation is dominated by fossil fuels, with coal alone accounting for over half of total installed capacity. Despite policy ambitions to increase the share of renewables, the power sector remains structurally carbon-intensive. Table 4.1 summarizes the composition of national installed capacity as of 2022.

Table 4.1 Energy Mix 2022 (MEMR, 2023)

Source	Installed Capacity (MW)	Share of Capacity
Coal	46,014	54,9%
Gas	20,831	24,9%
Diesel	4,352	5,2%
Hydro	6,689	8,0%
Geothermal	2,360	2,8%
Other renewables (incl. Solar and wind)	3,566	4,3%

Fossil Fuels

- Coal - is the dominant energy source in Indonesia's electricity sector, due to its domestic abundance and long-standing role in energy security and industrial development.
- Natural gas - is used primarily near urban and industrial centres, where lower emissions and fast-start capabilities are valued. The government currently sees it as a promising energy source for replacing coal.
- Diesel - remains widely used in remote areas due to its portability and ease of deployment, although it is highly inefficient and expensive compared to other options.

Renewables

- Hydropower and geothermal are the largest contributors among renewables, with geothermal offering particularly strong long-term potential.
- Solar and wind—in this thesis collectively referred to as VRE—make up only a small portion of installed capacity. Given their cost-effectiveness, modularity, and scalability, the limited uptake of wind and solar is concerning, as these technologies are widely regarded as essential to accelerating renewable deployment in emerging economies (IRENA, 2023).

Policy Targets and Implementation Gap

The government reaffirmed its goal of reaching 23% renewable energy in the national mix by 2025 in the latest RUPTL (PLN, 2021). However, with that target year already underway, it is increasingly clear that the goal will not be met. This shortfall was already anticipated in far earlier analyses (Bridle et al., 2018), and the gap remains significant today. Integration constraints, regulatory obstacles, and persistent fossil fuel incentives continue to hinder the scaling of renewables. This slow progress poses a challenge not only for short-term energy planning but also for Indonesia's long-term climate goals, including its national commitment to achieve Net Zero Emissions by 2060.

4.1.4 Grid Interconnection and System Flexibility

Indonesia's electricity system is characterized by limited inter-island connectivity and relatively weak internal grid flexibility. Currently, there are no high-voltage interconnections between the country's major island grids (Java-Bali, Sumatra, Sulawesi, Kalimantan, Papua), which means that electricity must be generated and consumed within each island group. Even within individual grids, transmission circuits often lack sufficient capacity to allow for flexible power routing and backup supply in case of local outages or supply-demand mismatches (Bagaskara & Makahekum, 2024).

This fragmented structure limits the system's ability to balance loads across regions or smooth out generation fluctuations from variable renewable energy (VRE) sources. Larger, interconnected grids are generally more capable of absorbing intermittent inputs from sources like solar and wind, as they can rely on broader spatial diversity of supply and demand. In Indonesia's case, this lack of interconnection restricts where renewable projects can be developed and increases the cost and complexity of grid integration.

There are several ongoing efforts to improve the situation. A high-voltage direct current (HVDC) undersea cable is planned to connect the Java and Sumatra grids—although progress has been slow, in part due to seismic risk in the Sunda Strait. Other infrastructure upgrades aim to link isolated areas in Sulawesi, Kalimantan, and eastern Indonesia. On a regional scale, Indonesia is participating in the ASEAN (Association of South East Asian Nations) Power Grid initiative, which aims to promote future cross-border electricity trade and shared infrastructure across Southeast Asia (ASEAN, 2023).

However, these plans remain at early stages, and system flexibility is expected to remain a bottleneck for VRE investment in the near and medium term.

4.1.5 Infrastructure Expansion and Development Strategies

Significant expansion efforts are underway to enhance the capacity and reliability of Indonesia's energy grid. Numerous projects are focused on increasing geothermal, hydro, and solar capacities. Notable developments include the Sarulla Geothermal Power Plant in North Sumatra and various solar farms in eastern Indonesia (Asian Development Bank, 2023).

Despite a national policy to halt new coal-fired power plants, PLN continues to develop additional coal and gas capacity to meet short-term demand and maintain energy security, as outlined in the RUPTL (PLN, 2019). This is partly due to the long lead times of renewable projects and the government's desire to ensure stable baseload supply in key regions.

To support nationwide access to electricity, grid extension and off-grid solutions are being pursued in tandem. The "Bright Indonesia" program, for example, seeks to reach full electrification by expanding the main grid and deploying decentralized microgrids where grid connections are impractical (Simatupang et al., 2021).

Several high-priority transmission projects are also in development. Projects such as the 500 kV Java–Sumatra interconnection and undersea cables between major islands aim to reduce regional imbalances and enable more efficient dispatch of electricity across grids (Nugraha et al., 2016). These are especially important for renewable integration, as they allow generation from high-potential but remote areas to reach major demand centres.

However, implementation lags persist. Transmission buildout is behind schedule in several regions, and institutional obstacles at PLN have hampered timely execution of key infrastructure plans. Coordination issues, regulatory hurdles, and internal capacity limitations have collectively slowed progress (Bagaskara & Makahekum, 2024). As a result, despite ambitious planning, the system remains unevenly developed—particularly in regions outside Java and Sumatra.

4.1.6 Structural Challenges to Grid Reliability and Renewable Power

Indonesia's electricity sector faces three major structural challenges that complicate both grid reliability and the integration of renewable energy: geographic fragmentation, infrastructure limitations, and continued fossil fuel reliance.

Geographic fragmentation stems from Indonesia's archipelagic nature, which presents serious challenges for grid development and management. Many rural and remote regions remain isolated from the national grid, relying instead on local diesel generators or microgrids. These systems tend to be less efficient, more costly to operate, and more carbon-intensive than grid-based alternatives (PwC, 2023). Moreover, the lack of

interconnections between major islands and grids limits the possibility for system-wide balancing and coordinated renewable deployment.

Infrastructure deficiencies are another core issue. Many regions, particularly outside Java and Sumatra, suffer from aging grid components, transmission losses, and insufficient substation capacity (Bagaskara & Makahekum, 2024). Long distances between generation sources and load centres—especially in Sumatra and Eastern Indonesia—lead to higher losses and reduced reliability (PwC, 2023). Transmission expansion projects exist on paper but have repeatedly fallen behind schedule (Dwita, 2024).

Fossil fuel reliance remains deeply embedded in Indonesia's power mix. While the government has introduced policies to promote a shift to renewables, coal and gas remain the primary energy sources powering the grid. These fossil fuels are supported through strong regulatory incentives. These include DMOs and price ceilings on coal, which significantly reduce input costs for PLN (Laan et al., 2011). At the same time, integrating VRE sources such as solar and wind presents new challenges due to their intermittent nature. The lack of advanced grid management technologies, energy storage systems, and skilled personnel limits the ability of the grid to absorb large volumes of VRE (Bagaskara & Makahekum, 2024).

Together, these factors create a highly uneven energy landscape. Large grids like Java–Bali enjoy overcapacity and comparatively robust infrastructure, while many outer islands suffer from poor reliability, limited renewable integration, and continued dependence on expensive, carbon-intensive diesel generation. Overcoming these structural challenges will be critical to achieving a cost-effective and secure energy transition.

4.1.7 Main findings

The main findings for this analysis concern the complexity of Indonesia's electricity sector, where physical fragmentation, uneven capacity distribution, and centralized institutional control jointly constrain the uptake of renewable energy. The overcapacity of key grids, limited interconnection, and dependence on fossil fuels present structural barriers to integrating variable renewables. At the same time, the dominant role of PLN in both planning and procurement creates a heavily centralized decision-making environment. These conditions shape the broader arena in which actors interact, and institutions evolve — setting the stage for the actor and institutional analysis in the following sections.

4.2 Actor Analysis

To further answer Sub-Question 1 — "What is the socio-technical system of the electricity sector?" — this section identifies and analyses the key actors shaping Indonesia's electricity sector. It builds on the system overview in Section 4.1 by

examining the landscape of organizations that influence energy policy, infrastructure development, project financing, and renewable electricity procurement.

The analysis begins by defining the boundaries of the electricity sector and constructing a stakeholder map that spans fuel supply, generation, transmission, planning, and regulation. From this broader set, relevant actors are selected based on their ability to influence decision-making, planning, or investment flows. These actors are then evaluated in three ways: through structured actor summaries detailing their responsibilities, influence, and incentives; a power-interest grid that visualizes their strategic positioning; and a formal relationship map that captures key regulatory and institutional linkages.

While the analysis emphasizes formal authority and procedural influence, informal power dynamics — such as lobbying pressure or narrative framing — are also acknowledged where relevant. Taken together, these components offer a structured view of the actor landscape within which renewable energy policies must operate, paving the way for the institutional analysis in Section 4.3.

Terminology Note: In this section, the term *Renewable IPP* refers broadly to the private-sector actors involved in renewable electricity development, including both pre-PPA developers and post-PPA project companies. While there is a formal distinction—developers typically form consortia and assemble financing before a Power Purchase Agreement (PPA) is signed, after which the entity becomes a special-purpose company known as an Independent Power Producer (IPP)—this section uses the terms *developer* and *IPP* interchangeably.

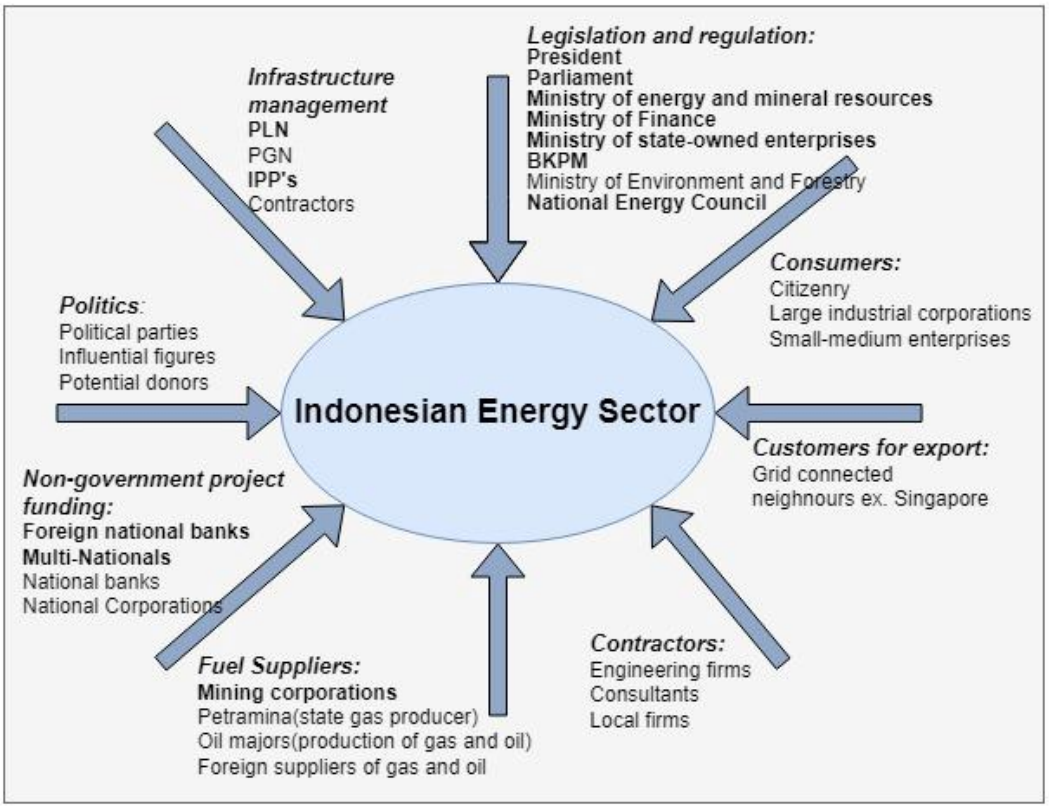
4.2.1 Stakeholder Mapping and Actor Selection

This section defines the scope of Indonesia's electricity sector by mapping its key stakeholders and identifying which parties are treated as institutional actors in the rest of the analysis. A wide stakeholder net was cast—covering fuel supply, generation, transmission, regulation, financing, and project implementation—before filtering for actors with influence over policy design, regulatory enforcement, infrastructure development, or investment flows.

Figure 4.3 shows the full stakeholder landscape, with actors included in the formal analysis highlighted in bold. Some parties—such as contractors, political parties, or PERTAMINA (national gas monopolist)—are excluded from detailed analysis due to their limited influence on renewable electricity investment decisions within PLN's

procurement process. The selection criteria are described in Chapter 3.2.1 and were applied iteratively as the analysis developed.

Figure 4.3: Stakeholder overview (Actors in **bold**)



4.2.2 Actor Summaries

This section provides short summaries of the core actors identified through stakeholder mapping and selection (see Section 3.2.1 for inclusion criteria). Each actor is described based on their formal roles, regulatory authority, influence on electricity sector dynamics, and incentives relevant to renewable energy development. These profiles were developed through desk research, drawing on policy documents, academic literature, government reports, and industry analyses. They serve as the empirical foundation for the power–interest analysis in the following section. Full role descriptions, power–interest scores, and supporting references can be found in Appendix A.2.

The selected actors are listed individually below, based on their centrality in the planning, financing, regulation, or implementation of electricity infrastructure in Indonesia:

Presidential Office: Holds the highest executive authority, including the power to issue and revoke regulations. Actively involved in energy strategy formulation (e.g., RUEN, CIPP) and has strong influence in Parliament. Recent shifts in presidential leadership may significantly alter future energy policy directions.

Parliament: Shares legislative authority with the president. Its influence is fragmented due to diverse party coalitions and varying priorities. Lobbying, especially from the fossil sector, can shape parliamentary positions.
Ministry of Energy and Mineral Resources (MoEMR): The lead regulator for electricity and fuels. Approves the RUPTL, sets feed-in tariffs, and regulates procurement schemes like PPAs. Also issues price caps and DMOs for domestic coal.
Ministry of Finance (MoF): Oversees subsidies to PLN, manages state finances, and regulates fiscal instruments relevant to investment. It plays a key role in funding renewable energy development through guarantees and budget allocations.
Ministry of State-Owned Enterprises (MoSOE): Formally oversees PLN and Pertamina as their sole shareholder. While its influence is indirect (via board appointments), it plays a key role in ensuring alignment with national policy goals.
Ministry of Investment (BKPM): Facilitates investment into the electricity sector, especially for renewables. Issues permits, tax incentives, and coordinates between domestic institutions and foreign financiers.
National Energy Council (NEC): An advisory and coordinating body chaired by the President and Vice-Chaired by the MoEMR. Engages stakeholders in strategy design and alignment between national and regional planning.
Regional Governments: Responsible for regional power plans (RUKD) that feed into national power planning documents like the RUKN (national electricity plan) and RUPTL. Have some fiscal autonomy but limited influence over national procurement decisions.
PLN (Perusahaan Listrik Negara): The state-owned utility is both market operator and primary developer of electricity infrastructure. It drafts the RUPTL, manages the procurement of power, and signs all PPAs. Although subordinate to the MoEMR, it retains considerable autonomy and policy influence.
Renewable Independent Power Producers (IPPs): Private developers that rely on PPAs with PLN for grid access and project bankability. They are highly sensitive to regulatory barriers, price ceilings, and procurement uncertainty.
Mining and Drilling Corporations: Primarily fossil fuel actors with vested interests in coal extraction. Though lacking formal authority, they exert significant informal influence through lobbying and political connections.
Overseas Financial Institutions: Provide grants, loans, and technical support to private developers and government actors. While external, their funding preferences can shape policy alignment and renewable deployment strategies.

These actors collectively define the landscape in which procurement decisions are made and renewable electricity investments are pursued. Their interdependencies and formal roles are further explored in the power-interest grid (Section 4.2.3) and formal relationship mapping (Section 4.2.4).

4.2.3 Power-Interest Analysis

To compare the relative influence and motivation of core actors, each was assessed using a power–interest grid. This method, introduced in Section 3.2.1, positions actors based on two dimensions:

- *Power:* Formal authority, regulatory control, and operational capacity;
- *Interest:* The degree to which an actor is strategically engaged with renewable electricity investment.

Actors were scored on a 10-point ordinal scale for both dimensions. Scores were assigned on a ten-point ordinal scale, drawing from the actor summaries in *Appendix A.2*. *Table 4.2* presents the scores and *figure 4.4* the final Power Interest Grid.

Table 4.2 Power Interest Scores

Actor	Power	Interest
President	9	7
Parliament	8	4
MoEMR	7	7
MoF	6	6
MoSOE	5	5
MoI-BKPM	5	8
NEC	5	8
Regional governments	5	5
PLN	7	8
Renewable IPPs	3	9
Mining corporations	4	4
Overseas Finance	6	6

Figure 4.4 Power-Interest Grid

The resulting distribution reveals several patterns:

- High-power, high-interest actors include the Presidential Office, the MoEMR, and PLN. These actors jointly control the development of electricity strategy, project approval, and grid access, making them central to the implementation of renewable energy policy (Bridle et al., 2018; Bagaskara & Makahekum, 2024). In Indonesia's highly regulated electricity sector, changes in policy—such as adjustments to tariffs, feed-in schemes, or infrastructure planning—can have outsized effects due to the state's expansive role in energy governance (Bridle et al., 2018).
- Parliament appears as a high-power but low-interest actor. Despite holding legislative authority, its influence is fragmented and its engagement in renewable energy debates is relatively limited. This reflects both a wide divergence of interests across political parties and a lack of technical expertise in energy matters (Bridle et al., 2018).
- Renewable IPPs and overseas financial institutions have high interest but low power. Their ability to participate in the sector is shaped heavily by the regulations and procurement decisions made by actors with formal authority. Developers, in particular, are heavily dependent on the enabling environment created by PLN and the MoEMR—including the design of PPAs, eligibility under the RUPTL, and feed-in tariff structures (Bridle, 2018; Bagaskara & Makahekum, 2024).
- Mining corporations and regional governments occupy lower positions on both axes. They are not primary drivers of national policy, but their actions can still influence implementation—particularly at the regional level.

This mapping offers a snapshot of the actor configuration that frames Indonesia's electricity sector. It supports the subsequent institutional analysis by clarifying where authority is concentrated, where interest is aligned, and where tensions between power and interest may affect renewable energy outcomes.

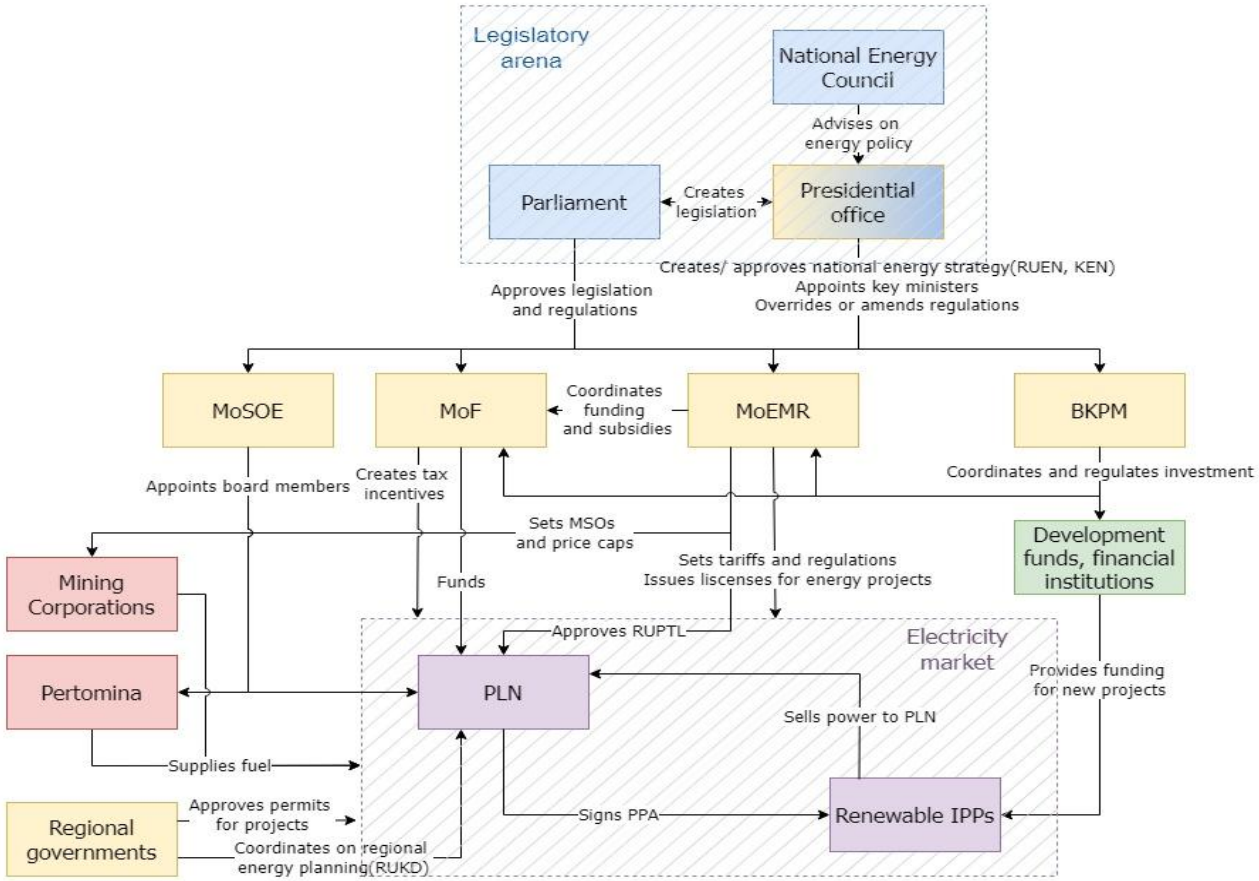
4.2.4 Actor Relationships

This section outlines the formal relationships between key actors in Indonesia's electricity sector. These relationships include regulatory oversight, procurement roles, operational authority, policy coordination, and contracting. Together, they define the institutional architecture within which electricity planning, procurement, and investment decisions take place.

The analysis is grounded in *table A.1* (Appendix A.1), which maps the formal ties between actors—such as which ministries regulate PLN, how investment flows are facilitated, and which institutions collaborate in energy planning. Based on these findings *figure 4.5* visualizes the most important formal relationships as directional links between actors, using color-coding to distinguish their primary roles: **Blue**—*Legislative bodies*, **Yellow**—*Regulatory agencies*, **Red**—*Fuel suppliers*, **Purple**—*Energy producers/sellers*, **Green**—*Financial actors*.

It is important to note that the chart only includes formal (i.e., rule-based or contractual) relationships. As a result, actors with significant informal influence—such as IPPs/developers, coal lobbies, and overseas financial institutions—may appear less central than they are in practice.

Figure 4.5 Formal Relations Chart (Blue—*Legislative bodies*, Yellow—*Regulatory agencies*, Red—*Fuel suppliers*, Purple—*Energy producers/sellers*, Green—*Financial actors*. Based on Table A.1, see Appendix for full interaction descriptions)



The figure underscores several important features of Indonesia's energy governance structure:

- PLN and the MoEMR are the most connected actors in the system. PLN is not only responsible for procurement and planning but also engages with nearly every actor in the value chain. The MoEMR and by extension the President hold regulatory authority over fuel pricing, procurement frameworks, and planning approvals, making it central to both upstream and downstream dynamics. The extent of their formal ties highlights their institutional power—and the importance of targeting these actors when proposing reforms or policy interventions.
- Developers, coal companies, and financial institutions have limited formal leverage. While these actors may exert considerable influence through lobbying, partnerships, or external financing, they possess few statutory mechanisms to directly shape outcomes. In the case of developers their ability to develop RE plants therefore

depends on the formal openness and responsiveness of PLN and regulatory institutions like MoEMR.

- The main regulatory ministries are mutually interlinked. Ministries such as MoEMR, MoF, MoSOE, and BKPM all engage in overlapping planning and financing functions, requiring close coordination. Any successful policy effort—especially one aimed at removing institutional obstacles—will need to navigate these interdependencies carefully.

Together, these formal relationships reflect the concentrated structure of authority in Indonesia's power sector. They also indicate potential chokepoints and opportunities for intervention, many of which are explored in the institutional analysis in Section 4.3 and Chapter 5.

In summary, this actor analysis reveals a highly centralized institutional landscape in which a few state actors—especially PLN and the MoEMR (and President)—hold the majority of formal authority over electricity planning, procurement, and pricing. While actors like developers, coal companies, and foreign investors play important roles, they remain structurally dependent on the decisions and regulatory openness of the central institutions. These power and interest dynamics help explain how key actors engage with renewable electricity development, and why some investment pathways remain constrained. The formal relationships and asymmetries identified here form a critical foundation for the institutional analysis in Section 4.3, which examines how rules and governance structures shape the actual transaction environment for renewable energy projects.

4.3 Institutional analysis

This section concludes the socio-technical analysis of Indonesia's electricity sector by examining the institutional arrangements that shape how the system operates in practice. While Section 4.1 outlined the physical infrastructure and market structure, and Section 4.2 mapped the key actors and their interrelations, this section focuses on the underlying institutions that constrain or enable action within the system.

Using the WLIF, the analysis spans three layers. Layer 1 highlights foundational context and societal features that influence how energy policy is viewed and exercised. Layer 2 identifies key formal rules and regulations — the "rules of the game" — that govern procurement, pricing, planning, and grid access. Layer 3 then explores the "play of the game": the governance routines, coordination practices, and procedural norms through which these rules are applied and navigated in practice.

Together, these layers reveal how institutional structures interact with actor strategies and system design — shaping the obstacles to renewable electricity investment and setting the stage for the obstacle identification in Chapter 5.

4.3.1 Layer 1: Embeddedness

At the first level of the WLIF framework, long-standing structural and societal features help explain the institutional logics behind Indonesia's electricity sector. Three embedded characteristics are especially relevant: historical poverty and underdevelopment, resource abundance, and international climate pressure.

First, Indonesia's electricity policies are deeply shaped by its development trajectory. Compared to regional peers such as Malaysia and Vietnam, Indonesia industrialized relatively late, and a large share of the population lived in poverty well into the 2000s. In this context, expanding electricity access became a top political and developmental priority. With abundant domestic coal reserves, coal-fired power plants provided a cost-effective means of rapidly scaling up generation capacity to support household electrification and industrialization. This logic still underpins major investment decisions, despite growing awareness of long-term sustainability challenges. Only in the past five years has the country reached near-universal electricity access (Hasjanah, 2023).

Second, Indonesia's vast coal reserves continue to shape its energy strategy. These reserves are not just economically attractive—they also represent a form of energy sovereignty that has historically reduced reliance on imports and provided stability in planning and pricing. This has entrenched a coal-first development model, reinforced by pricing regulations that make coal artificially cheap.

Third, Indonesia is increasingly embedded in global efforts to mitigate climate change. Due to its NEZ 2060 commitments and being a signatory to the Paris Agreement, the country has faced mounting external pressure to decarbonize its energy system. Simultaneously, international support for a green transition has grown. The most prominent example is the JETP, which includes concessional financing mechanisms and long-term decarbonization planning under the 2023 CIPP. These international support mechanisms — such as the JETP, which is specifically designed to accelerate Indonesia's transition through concessional finance and long-term planning — offer the country a new developmental pathway, albeit one still constrained by entrenched interests and legacy infrastructure.

The specific policies and governance arrangements examined in the following sections were identified through an exploratory desk research process, as described in Section 3.2.

4.3.2 Layer 2: Legal and Regulatory Framework

This section provides a focused analysis of legal structures shaping Indonesia's electricity sector, based on desk research summarized in *table 4.3* and detailed in Appendix B.1. These laws and regulations define the formal boundaries of action for actors discussed in the previous section, and establish many of the incentives, constraints, and permissions relevant to renewable electricity investment.

The regulatory landscape relevant to renewable energy development in Indonesia spans energy planning, procurement rules, fuel pricing, fiscal guarantees, and market participation restrictions. A full legal inventory with source references is provided in Appendix B.1. *Table 4.3* below offers a high-level summary of the regulatory categories and their most relevant instruments.

Table 4.3: Summary of Key Legal Instruments by Category

Category	Key Instruments	Regulatory Focus
1. Energy Planning	Energy Law 3/2007; KEN; RUEN; RUKN; RUPTL; PR 112/2022	National planning hierarchy; renewable energy targets; coal plant moratorium
2. Fuel Subsidies	MEMR 34/2009; Gov. Regulation 23/2010; Permen 17/2010	Domestic Market Obligations (DMOs); coal price ceiling; supply-side fuel market control
3. Market Regulation	Energy Law 30/2009; MEMR 1/2006; PR 112/2022	Single-buyer model; IPP procurement methods; captive generation exemptions
4. Financial Guarantees	MoF Reg. 173/2014; PR 4/2016; Gov. Regulation 29/2000	Financial guarantees for developers; PPP eligibility; informal requirements for RUPTL-listed projects
5. Carbon Regulation	PR 98/2021; MEMR 16/2022; MEMR Decree 14.K/2023	Emissions Trading System; carbon emissions caps; credit eligibility for coal-fired plants
6. Electricity Tariffs	PR 112/2022; Energy Law 3/2007; Energy Law 30/2009	LCOE matching (now exempt for RE); price ceilings; consumer tariff caps and PLN subsidy compensation
7. Foreign Participation Limits	PR 39/2014; MEMR 11/2024; MEMR Decree 191/2024	Local content requirements; foreign ownership limits; land access constraints for foreign developers
8. Overcapacity Drivers	Fast Track I & II; 35 GW Program	Guaranteed coal capacity expansion based on overestimated demand; inflexible long-term contracts

Energy Planning and Market Structure

Indonesia's power sector operates under a centrally planned structure. The presidential office sets long-term national targets through the KEN(National Energy Strategy), which are elaborated into strategy and implementation documents like the RUEN(National Energy Plan), RUKN, and RUPTL(see Appendix B.3 – *figure B.2 for a visual overview*). The RUPTL, drafted by PLN and approved by the MoEMR, effectively determines which energy projects can be built—making it a critical potential bottleneck for renewable investment. Although planning laws imply a hierarchical coordination between national and regional governments, most authority remains centralized at the MoEMR and PLN.

The market itself follows a single-buyer model, where PLN holds statutory monopoly over the purchase and distribution of electricity. While private developers can build generation capacity, the resulting IPP may only sell exclusively to PLN under tightly regulated PPAs. This structure gives PLN disproportionate power to determine which projects succeed.

Coal Cost Structure and Domestic Market Obligations

Indonesia's coal competitiveness is enhanced not only by abundant reserves but also by regulatory instruments that lower production costs further. DMOs require coal producers to sell a portion of their output to PLN at capped prices far below global market rates—US$70 per ton for power generation as of 2023. These artificially low

costs strengthen coal's position in the generation mix and raise the barrier for renewable competitiveness. Sometimes sources refer to this structure as a subsidization of coal however in practical terms the government does not expend resources in order to lower the prices but leverages mining permits and potential coal export profits to achieve the desired result.

LCOE Matching and Recent Reform

Until 2022, PLN was prohibited from purchasing electricity at a price higher than the Levelized Cost of Electricity (LCOE) in a given region—effectively blocking most renewable PPAs, since the regional LCOEs were skewed downward by cheap coal. *PR 112/2022* lifted this requirement for renewables, replacing it with technology-specific price ceilings. This was a significant regulatory shift that removed a major legal obstacle to renewable development.

Procurement Mechanisms and Transparency

PLN has three legally defined procurement channels: *open tender***,** *direct selection*, and *direct appointment*. While open tenders are generally transparent, direct selection and direct appointment, which are commonly used for renewable projects under *PR 112/2022*, allow for more discretion and less transparency. As a result, PLN's internal decision-making—particularly during RUPTL planning—has significant implications for which projects move forward. (see Appendix B.3 *figure B.1 for a visual overview*).

Energy Tariffs and Subsidies

Retail electricity tariffs are capped by the MoEMR to ensure affordability, while coal price caps reduce generation costs. The gap between PLN's actual costs and its revenue is filled by annual state subsidies, making its financial health dependent on public transfers. These financial mechanisms indirectly shape PLN's investment behaviour and procurement preferences, as the utility has little margin for risk or long-term cost increases.

Foreign Investment Restrictions

Foreign investors face several legal constraints. Ownership caps vary by project type and size, while land acquisition rights are limited to use and building rights—not full ownership. New regulations (*MEMR 11/2024* and *Decree 191/2024*) have significantly lowered local content requirements for renewable technologies, softening previous barriers to foreign-financed projects. However, implementation challenges and eligibility conditions may still present de facto limitations.

Carbon Pricing and Overlapping Incentives

Indonesia introduced a carbon pricing framework in 2023 through *MEMR 16/2022* and related decrees. While this creates a modest disincentive for coal generation, its impact is currently outweighed by entrenched fossil incentives like the DMO on coal. As such, the policy sends mixed signals: promoting decarbonization on paper, while reinforcing coal dominance in practice.

Taken together, all these legal instruments define the regulatory context in which procurement decisions, investment patterns, and actor interactions occur. The next section explores how these rules are interpreted, implemented, and navigated in practice through governance processes.

4.3.3 Layer 3: Governance Arrangements and Implementation Practices

This section examines how the Layer 2 legal instruments analysed in the previous section are enacted in practice through governance arrangements. These include the internal procedures, planning processes, and contracting structures that shape how electricity projects are developed and managed—especially those involving renewable energy. The goal is to understand how institutional structures and implementation practices influence the effectiveness of Indonesia's attempts to increase RE capacity. This section draws from a full inventory of governance arrangements identified through desk research, summarized in Appendix B.2. The most relevant practices are analysed thematically below.

PLN Organizational Structure and Planning

PLN operates through a regionally segmented structure with centralized control over long-term planning. Generation assets are managed by two subsidiaries—PLN Indonesia Power and PLN Nusantara Power—while planning activities are coordinated through the RUPTL, a ten-year supply and demand plan drafted by PLN and approved by the MoEMR. Despite formal alignment with national strategies, the utility remains far behind its renewable targets outlined in the 2021–2030 RUPTL, suggesting implementation barriers rather than planning omissions (see Appendix B.3 *figure B.3 for a visual overview*).

IPP Tendering and Project Development

The pre-qualification process for developers—known as the DPT list—is a prerequisite to participate in PLN's tenders, most of which use Direct Selection. Qualified developers bid on project-specific RfPs, with timelines that often exceed the mandated 180 days. Delays and cancellations are not uncommon, and limited transparency in decision-making undermines investor confidence (Yustika, 2024b). The IPP entity is usually formed after PPA signing, with equity shared between the developer, investors, and often PLN (see Appendix B.3 *figures B.4 and B.5 for visual overviews*)

Financial Guarantees and Equity Requirements

Projects can receive financial guarantees from the government if classified as Public-Private-Partnerships (PPPs) or if PLN holds equity. In practice, PLN often requires a controlling stake (typically 51%) to apply for a guarantee, which slows investor returns and raises concerns over control and credit risk. These guarantees can be essential for foreign financiers, but PLN's equity demand can limit project bankability and developer interest.

Fossil Fuel Cost Structures

Coal remains the cheapest generation source not just due to natural reserves but also because of regulatory levers. DMOs and price caps lower coal costs significantly, making it difficult for renewables to compete. While often labelled subsidies, these mechanisms effectively shift costs onto mining companies, and the benefits cannot easily be transferred to non-fossil energy sources through policy.

Land Acquisition for Renewable Projects

Developers are typically responsible for securing land access before financial close. The process is often lengthy and complex, especially for connecting transmission lines. In some cases, PLN assists with land acquisition in return for equity, but this adds another layer of complexity and negotiation.

Regional Planning and Lobbying Dynamics

Regional governments develop their own regional electricity supply plans (RUKDs) in collaboration with PLN and the MoEMR. Although the national strategy takes precedence, there is a limited space for regional influence. Within this narrow margin, lobbying efforts—both from environmental groups and coal interests—can shape regional ambition either toward or away from renewables. The actual impact is thus highly dependent on local political dynamics, though bounded by central oversight.

Carbon Market Implementation

Indonesia launched its carbon market in 2023, with emissions caps initially targeting 99 coal plants. However, low carbon prices—averaging around USD 4.45/ton—had resulted in minimal impact in 2023. The system sends mixed signals: on one hand, it introduces a price on carbon; on the other, it coexists with entrenched cost-lowering policies for coal, creating contradictory incentives that reduce its effectiveness.

Overcapacity and Grid Saturation

Indonesia's largest grids—Java-Bali and Sumatra—suffer from significant overcapacity, a legacy of over-ambitious demand projections and incentive-driven coal expansion under the 35 GW and fast-track programs. These grids now host inflexible long-term coal contracts, known as Take-or-Pay contracts, that crowd out new capacity. This structural surplus weakens the government's incentive to integrate additional renewables, especially where coal-fired plants must be paid regardless of actual dispatch and demand.

4.4 Main findings

This chapter has analysed Indonesia's electricity sector using a layered socio-technical approach to answer Sub-Question 1: *What is the socio-technical system of the electricity sector?*

The main findings are as follows:

1. **The electricity system is highly centralized and dominated by coal**, both in terms of physical infrastructure and institutional arrangements. Grid

fragmentation across islands, high reserve margins in Java-Bali, and weak inter-island transmission reduce the ability to scale renewable energy deployment.

2. **PLN plays a structurally dominant role as a single buyer, system planner, and gatekeeper of investment.** Its internal incentives, limited transparency, and financial exposure create systemic risk aversion, constraining the participation of developers in successfully forming IPPs.
3. **Key government actors, including the MoEMR and Presidential Office, exert strong top-down influence on energy planning and procurement.** However, coordination between ministries and alignment with long-term decarbonization goals remain inconsistent.
4. **Legal and governance structures continue to reinforce fossil fuel lock-in.** These include coal pricing mandates (e.g. DMO), procurement rules that disadvantage renewables (e.g. LCOE matching), and limited reform of PPA structures. Recent policy efforts have not targeted the core institutional levers needed for change.
5. **While political support for renewables exists on paper, the implementation environment remains high-risk and high-cost for developers.** Opaque procedures, regulatory discretion, and limited influence for private actors continue to shape a difficult investment climate.

These findings show that institutional, rather than purely technical or financial, dynamics are central to Indonesia's renewable energy challenges. The next chapter builds on these insights to identify and evaluate the most critical institutional obstacles limiting renewable electricity development.

5. Obstacle Analysis

This chapter builds on the institutional findings of Chapter 4 to identify and evaluate the most important barriers to renewable electricity investment in Indonesia. Drawing from the legal, regulatory, and governance structures identified in Sections 4.3.2 and 4.3.3, it aims to move from a broad landscape of institutional constraints toward a targeted list of institutional obstacles detailing where and how the most impactful reforms can take place.

The analysis proceeds in three stages:

1. Section 5.1 generates a list of *potential institutional obstacles*, based on the conclusion of Chapter 4 and supported by relevant economic reasoning. These are grouped into three categories:
    - Obstacles related to the *incentives of PLN* to make attractive project proposals,
    - Obstacles arising from *limitations in PLN's resources and organizational capacity*, and
    - Obstacles resulting from *regulatory requirements* imposed by other government actors on either PLN or developers.
2. Section 5.2 evaluates each of these potential obstacles through structured desk research, following the framework introduced in Chapter 3.2.2. Four criteria are used to assess each obstacle's validity, relevance, the availability of policy levers, and the feasibility of reform.
3. Section 5.3 consolidates the validated obstacles into three bundles and compares those bundles in terms of their likely impact and solvability. This process identifies a single bundle—related to inefficiencies in the procurement process—as the most suitable focus for targeted policy development in Chapter 6.

The overall purpose of Chapter 5 is to ensure that the policy recommendations developed in later chapters are grounded in a transparent and well-reasoned obstacle analysis. By systematically moving from a broad institutional overview to a narrowed policy focus, this chapter provides the analytical bridge between institutional diagnosis and reform design.

5.1 Generation of Potential Obstacles

This section develops a set of potential obstacles that may contribute to slow renewable electricity investment in Indonesia. These obstacles are grounded in the institutional landscape described in Chapter 4.3 and are structured according to three categories introduced in the methodology (Section 3.2.2):

1. PLN's Incentives – how utility-level motivations may discourage the availability of attractive proposals;
2. PLN's Resource Limitations – capacity or capability constraints that reduce the quality or quantity of tenders;
3. Regulatory Requirements Affecting Developers and PLN – legal or procedural rules that increase transaction costs or limit investor confidence.

These categories serve to organize an exploratory process: the obstacles presented here are *not yet validated*, but represent institutional mechanisms and actor interactions that may, in theory, hinder renewable electricity investment. Each is briefly described below in *tables 5.1–5.3* (see Appendix C.1 - *tables C.1-C.3* for the full overviews).

A full evaluation of these obstacles — including their validity, relevance, policy levers, and solvability — follows in Section 5.2.

The identification of potential obstacles draws on institutional economic logic, particularly the role of transaction costs, incentive misalignments, and procedural uncertainty in shaping investment decisions (Williamson, 2000).

Category 1: PLN's Incentives to Offer Attractive Proposals

This category includes mechanisms that may reduce PLN's motivation to initiate or support new renewable energy projects. These obstacles may lead to fewer tenders being released, or proposals being unattractive to developers and investors.

Table 5.1 Obstacles from PLN Incentives

Obstacle	Description
1.1 Maintaining majority share of generation	PLN owns most generation assets and relies on IPPs for new renewable projects. Growing IPP involvement — especially under current BOO (build-own-operate) agreements — may reduce PLN's control over generation. The utility could favour slower renewable deployment to protect its market share in power generation.
1.2 Overcapacity of coal energy	Aggressive demand projections and fossil-heavy fast-track programs have left grids like Java-Bali with excess capacity which must still be paid for by PLN regardless of demand. PLN may hesitate to expand renewables further to avoid stranding assets or breaching take-or-pay obligations.
1.3 Protecting credit ratings	Despite sustained losses, PLN maintains a BBB credit rating. Signing PPAs adds financial liabilities; any risk of default could harm its rating. PLN may limit exposure by minimizing PPAs or structuring them to reduce perceived risk.
1.4 Pressure to improve solvency	PLN faces strong pressure to reduce debt and improve financial health. Given overcapacity and low tariffs, the utility may prioritize low-cost projects with limited risk exposure — even at the cost of missing renewable targets.

Category 2: PLN's Resource Limitations

This category reflects internal constraints that prevent PLN from offering viable tenders or efficiently managing renewable energy development.

Table 5.2 – Obstacles from PLN Resource Limitations

Obstacle	Description
2.1 Transmission network inadequate	Many of Indonesia's regions with high renewable potential are geographically distant or poorly connected to the major grids, while limited transmission capacity within existing grids further restricts project siting and grid integration. This narrows the range of viable locations for VRE development, limiting the number and scale of feasible projects. These constraints increase uncertainty and reduce the number of attractive tenders that PLN can offer.
2.2 Lack of human capital	PLN has limited internal capacity and experience with intermittent renewables, affecting feasibility studies, tender design, and project integration. This may reduce the quality or quantity of viable project offerings.
2.3 Inconsistent procurement management	Developers face vague requirements, untransparent evaluation, and sudden project cancellations. These procedural weaknesses raise transaction costs and deter participation — especially for new entrants.

Category 3: Regulatory Requirements Affecting Developers and PLN

These obstacles originate from government regulations or institutional arrangements that impose constraints on project design, pricing, or financing — even when PLN is willing and able to move forward.

Table 5.3 – Obstacles from Regulatory Requirements

Obstacle	Description
3.1 Price ceiling per kWh	Ministerial Regulation PR 112/2022 sets maximum prices per kWh for renewable electricity, limiting the tariffs PLN is allowed to offer to developers. Although this regulation replaced a more restrictive LCOE-matching rule, the price ceilings remain an institutional constraint — especially when market rates exceed the cap. Exceeding the ceiling requires ministerial approval, a process that has proven slow and often unsuccessful, discouraging flexible tariff design.
3.2 Local content requirement thresholds	Developers must use domestic components and contractors. This raises costs, lowers RoI, and adds uncertainty due to exemption requirements and unclear procedures.
3.3 Land acquisition difficulties	Developers must secure land rights before financial close. Complex ownership structures and foreign land use restrictions lead to long delays and high transaction costs.
3.4 Government guarantee availability	Financial guarantees from the Ministry of Finance reduce investor risk when partnering with PLN. However, these are typically only available if PLN or its subsidiaries hold a 51% equity stake in the IPP, which reduces autonomy and delays investor repayment. This high bar limits the availability of guarantees for developers seeking third-party financing, especially from international lenders that prefer lower-risk arrangements.
3.5 PPA structure	Standard PPAs used for renewable projects are often rigid and poorly aligned with the characteristics of variable renewable energy. Terms such as pricing flexibility, contract length, and risk allocation are set unilaterally by PLN, with limited room for negotiation. This can reduce project bankability and make tenders less attractive for developers and financiers.

Together, these 12 obstacles represent the most salient institutional or institution-shaped barriers to renewable electricity investment identified in the prior chapter. Their potential impact will be systematically assessed in the next section, using the evaluation framework defined in Sub-Section 3.2.2.

5.2 Evaluation of obstacles

This section evaluates the twelve potential institutional obstacles identified in Section 5.1. Each obstacle is assessed according to four criteria introduced in the methodology (Section 3.2.2): Validity, Relevance, Policy Levers, and Solvability. The evaluation is based on desk research using industry reports, academic literature, and regulatory documentation with an overview with full references available in Appendix C.2 (*table C.4*). The goal is to determine which obstacles are both substantively impactful and amenable to policy intervention. Only those obstacles that meet all four criteria are considered "validated" and carried forward for further analysis. These "validated obstacles" are institutional or institutionalized barriers that have a demonstrable effect on renewable electricity investment and are traceable to actor behaviour, governance practices, or regulatory constraints. A summary of the evaluation is provided in *table 5.4*, followed by short narrative justifications for each validated obstacle.

Table 5.4: Evaluation of Potential Obstacles

(✓ = Criterion met; ✗ = Criterion not met; ~ Criterion mostly met)

Obstacle No.	*Obstacle Description*	*Validity*	*Relevance*	*Policy Levers*	*Solvability*
1.1	Majority share of generation	✗	✗	✓	✓
1.2	Overcapacity of coal energy	✓	✓	✓	~
1.3	Protecting credit ratings	✗	✗	*N/A*	*N/A*
1.4	Pressure to improve solvency	✓	✓	✓	~
2.1	Transmission network inadequate	✓	✓	✓	~
2.2	Lack of human capital	✓	✓	✓	✓
2.3	Limited procurement transparency and reliability	✓	✓	✓	✓
3.1	Price ceilings (PR112/2022)	✓	✓	✓	✓
3.2	Local Content Requirement Threshold	✗	✗	*N/A*	*N/A*
3.3	Land acquisition difficulties	✓	✓	✓	✓
3.4	Financial guarantee requirements (PLN equity demand)	✗	✗	*N/A*	*N/A*
3.5	PPA structure (inflexibility, poor fit for VRE)	✓	✓	✓	✓

Obstacle—1.2 Overcapacity of Coal Energy

The Java-Bali and Sumatra grids are significantly overbuilt, with generation overcapacity estimated at 40%—far exceeding the ideal 15% reserve margin (CIPP, 2023, p. 88). This surplus stems from overly optimistic demand projections and fossil-fuel-focused fast-track programs. Since these legacy plants are locked into long-term take-or-pay contracts, PLN's flexibility to integrate new renewable capacity is significantly reduced. (Brown, 2020; Yustika, 2024). The result is a structural disincentive to expand renewables, as doing so risks stranding costly fossil investments.

Obstacle—1.4 Pressure to Improve Solvency

PLN has been under consistent pressure to improve its financial solvency, a constraint highlighted in analyses by Bridle et al. (2019), Yustika (2024b), and the CIPP (2023). The utility operates at a loss, requiring public subsidies to maintain services, and this affects its capacity and willingness to support potentially more expensive RES projects. In the absence of retail tariff increases or major structural reform, PLN is incentivized to avoid procurement deals that increase financial exposure—even if such deals would support national renewable targets.

Obstacle—2.1 Transmission Network Inadequate

Insufficient and uneven transmission infrastructure restricts where and how much VRE capacity can be added. Many regions with high renewable potential are either not connected to the main grid or are served by underdeveloped transmission systems. As a result, feasible project locations are limited, particularly in areas where capacity additions could most support decarbonization goals (CIPP, 2023, p. 74; Dwita, 2024). This technical constraint reduces the number of viable projects PLN can propose to developers.

Obstacle—2.2 Lack of Human Capital

PLN's internal capacity to manage renewable energy development remains low. IESR (2024) and CIPP (2023, p. 188) both highlight experience gaps in areas such as grid planning, intermittent resource integration, and tender design. Despite ongoing training efforts (Dwita, 2024), the shortage of experienced personnel continues to constrain PLN's ability to issue robust, well-designed renewable project tenders.

Obstacle—2.3 Poor Procurement Management Practices

Developers face high uncertainty due to unclear criteria, inconsistent requirements, and sudden delays or cancellations during PLN's tender process (Yustika, 2024b). Reports by Bridle et al. (2019) and CIPP (2023, p. 194) confirm that this opacity increases perceived risk and transaction costs for investors. The resulting reluctance to bid—especially from foreign developers—limits competition and delays project execution.

Obstacle—3.1 Price Ceiling per kWh

PR 112/2022 introduced ceiling prices for renewable energy that were intended to be more flexible than the earlier LCOE-matching system. Low price ceilings reduce ROI

and deter RES investment. However, PLN's practice of comparing bids to localized average generation costs—often below the ceiling—creates an additional obstacle, effectively tying RES prices to subsidized CFPP costs (CIPP, 2023 – p. 193). This undermines PR112/2022's intent.

Obstacle—3.3 Land Acquisition Difficulties

Developers often face long delays in acquiring land, due to ambiguous property rights, foreign ownership restrictions, and unregistered parcels. Foreign developers, in particular, must settle for temporary land-use rights, creating additional legal and procedural complexity (Norton Rose Fulbright, 2015; Yustika, 2024b). These issues substantially increase lead times and investor risk, discouraging participation in tenders without PLN's support.

Obstacle—3.5 PPA Structure

Current PPA templates used for renewable projects in Indonesia often reflect outdated assumptions suited to coal-fired plants. As noted by Setyowati and Quist (2020) and CIPP (2023, p. 187), these rigid contracts—regarding duration, payment schedules, and load guarantees—are poorly matched to the needs of intermittent sources like solar and wind. As a result, developers face higher financial risk and limited flexibility, which discourages participation in new projects.

In conclusion, the evaluation process identified eight obstacles that are both substantiated and potentially addressable through institutional intervention. However, not all of these can be explored in equal detail within the scope of this thesis. The next section consolidates related obstacles, compares them based on their relevance and solvability, and identifies the most suitable target for in-depth policy development in Chapter 6.

5.3 Ranking of obstacles

This section narrows the twelve potential institutional obstacles identified in Chapter 5.1 by selecting those that were validated in Chapter 5.2. The purpose of this section is to answer Sub-Question 2 (Section 1.3) and determine which obstacle is most suitable for in-depth policy development using the IAD framework in Chapter 6. Obstacles are evaluated not only on their individual characteristics but also based on their conceptual overlap and shared root causes.

For improved analytical clarity and reduction of redundancy, the validated obstacles have been reorganized into three bundled categories representing the main obstacles to RE growth. This provides a clear answer to Sub Question 2: "*What are the main obstacles to renewable electricity investment?"* and a final list of obstacles from which to choose for Chapter 6:

1. **Overcapacity and Solvency Constraints** – encompassing coal overcapacity, pressure to improve PLN's solvency, and the legacy of inflexible PPAs. These issues

stem from past procurement programs and continue to influence PLN's financial decisions today.

2. **Procurement Process Inefficiencies** – integrating obstacles related to opaque tendering practices, limited human resources, land acquisition delays, rigid renewable PPA structures, and institutional selectiveness in evaluating proposals. These institutional obstacles increase transaction costs and reduce developer confidence in engaging with PLN.
3. **Transmission Infrastructure Gaps** – referring to the technical and geographical limitations of Indonesia's transmission system, which restrict the location and scale of viable renewable energy projects, especially for intermittent sources like solar and wind.

Each of these three bundled obstacles is assessed in the following section according to two key criteria introduced in the methodology (Section 3.2.2):
Relevance, or how significantly the obstacle impacts renewable electricity investment; and *Solvability*, or how feasible it is to reduce the obstacle through regulatory or governance reform.

This final selection will identify which obstacle is both impactful and politically actionable, providing the analytical foundation for policy design in Chapter 6. See *table 5.5* for a visual overview of the obstacle bundle comparison.

Table 5.5 Obstacle Bundle Comparison

Description	Relevance	Solvability
1. Overcapacity and Solvency Constraints		
Includes PLN's legacy CFPP overcapacity, financial stress, and limited ability to expand renewables due to locked-in contracts.	✓	✗
2. Procurement Process Inefficiencies		
Includes poor project preparation, human resource gaps, weak transparency, land acquisition delays, and PPA misalignment.	✓	✓
3. Transmission Infrastructure Gaps		
Includes uneven grid capacity and lack of access in high-potential areas, constraining renewable project siting.	✓	~

1. Overcapacity and Solvency Constraints

Indonesia's coal-heavy expansion programs, such as the 35 GW initiative, created long-term overcapacity on major grids—particularly Java-Bali and Sumatra. These capacity additions were secured through take-or-pay contracts with Independent Power Producers (IPPs), obligating PLN to purchase electricity regardless of actual demand (CIPP, 2023; Brown, 2020). As a result, PLN faces a structural disincentive to integrate new generation from variable renewable energy (VRE) sources, which would further increase excess capacity and potentially threaten its financial stability. This bundle is highly relevant, as it affects nearly all aspects of procurement and grid planning. However, solvability is low: it would require costly renegotiation of legacy contracts, regulatory reform, or politically sensitive tariff increases—none of which are easily achievable under current institutional conditions.

2. Procurement Process Inefficiencies

The renewable energy procurement process managed by PLN is shaped by multiple overlapping governance challenges. These include limited project preparation, lack of transparency in the RfP process, limited capacity to support developers with feasibility studies or land acquisition, and rigid PPA templates that fail to accommodate the technical characteristics of VRE (IESR, 2024; Yustika, 2024; CIPP, 2023). Together, these factors raise transaction costs, delay project development, and reduce investor confidence—especially for foreign investors. This bundle is both highly relevant and highly solvable: many of the governance practices and procedural inefficiencies it contains can be addressed through regulatory reform, improved transparency, and organizational capacity-building within PLN. For this reason, it is selected for in-depth policy development in Chapter 6.

3. Transmission Infrastructure Gaps

Many regions with strong renewable energy potential remain poorly connected to the main grid or are served by limited transmission capacity (Dwita, 2024; CIPP, 2023). This restricts where renewable projects can be sited and how easily intermittent generation can be absorbed. The impact is particularly acute in outer islands, where demand is low but solar and wind potential is high. This bundle is highly relevant, especially from a long-term planning perspective, but moderately solvable. Physical infrastructure upgrades are expensive and slow, and PLN has limited capacity and incentives to prioritize VRE-driven transmission expansion. However, targeted regulatory interventions and improved strategic planning could gradually reduce these constraints over time.

Selected Obstacle for Further Analysis

Based on the evaluation above, 2. Procurement Process Inefficiencies is selected as the focal obstacle for in-depth policy analysis in Chapter 6. This category encompasses transparency issues, limited human resources, inflexible PPA structures, and land acquisition challenges — all of which directly affect project-level transaction costs and investor confidence. Unlike other high-impact obstacles, such as overcapacity or solvency pressure, procurement inefficiencies are considered more politically and institutionally solvable through targeted regulatory and organizational reforms. As a result, this obstacle represents the most promising entry point for designing actionable policy interventions using the IAD framework.

6. Development of Policy Suggestions

This chapter develops and evaluates a set of targeted policy interventions to address the most pressing institutional obstacle identified in Chapter 5, namely *Procurement Process Inefficiencies*. The chapter applies the Institutional Analysis and Development (IAD) framework as a qualitative tool to analyse how changes to institutional rules and actor interactions may improve procurement outcomes. The objective is to propose policies that increase renewable electricity investment through institutional restructuring, without imposing unsustainable financial burdens on PLN or the government.

The IAD framework is used not as a quantitative model, but as a structured diagnostic tool. It enables a comparative analysis of institutional scenarios by mapping key rule types, actor interactions, and likely outcomes. Section 6.1 outlines the current procurement configuration using IAD's core components: biophysical conditions, community attributes, rules-in-use, action situations, and evaluative criteria. The resulting baseline scenario—summarized visually in *figure 6.1*—represents the status quo of PLN's Direct Selection process and provides the reference point for scenario-based policy evaluation.

Section 6.2 introduces seven policy alternatives selected based on three inclusion criteria: (1) they directly or indirectly target the procurement process, (2) they can be implemented without large financial outlays, and (3) they are feasible under current legal frameworks (e.g., through regulation). These are evaluated qualitatively in Section 6.3, where each scenario is analysed against the base scenario outcomes developed in Section 6.1, according to the five chosen evaluative criteria: transaction costs, exploration costs, return on investment, cost to PLN, investor risk perception, and expected renewable capacity additions (Section 6.1.4).

Section 6.4 compares the relative performance of each policy scenario across these criteria. This comparison is visualized using directional scoring and a heatmap to aid the reader in understanding trade-offs, although no quantitative claims are made. Section 6.5 then presents findings from three expert interviews with practitioners from the public and private sector, which validate, challenge, and refine the scenario results. Finally, Section 6.6 proposes a refined set of four integrated policy recommendations, re-evaluated through the IAD criteria in light of the expert interview findings.

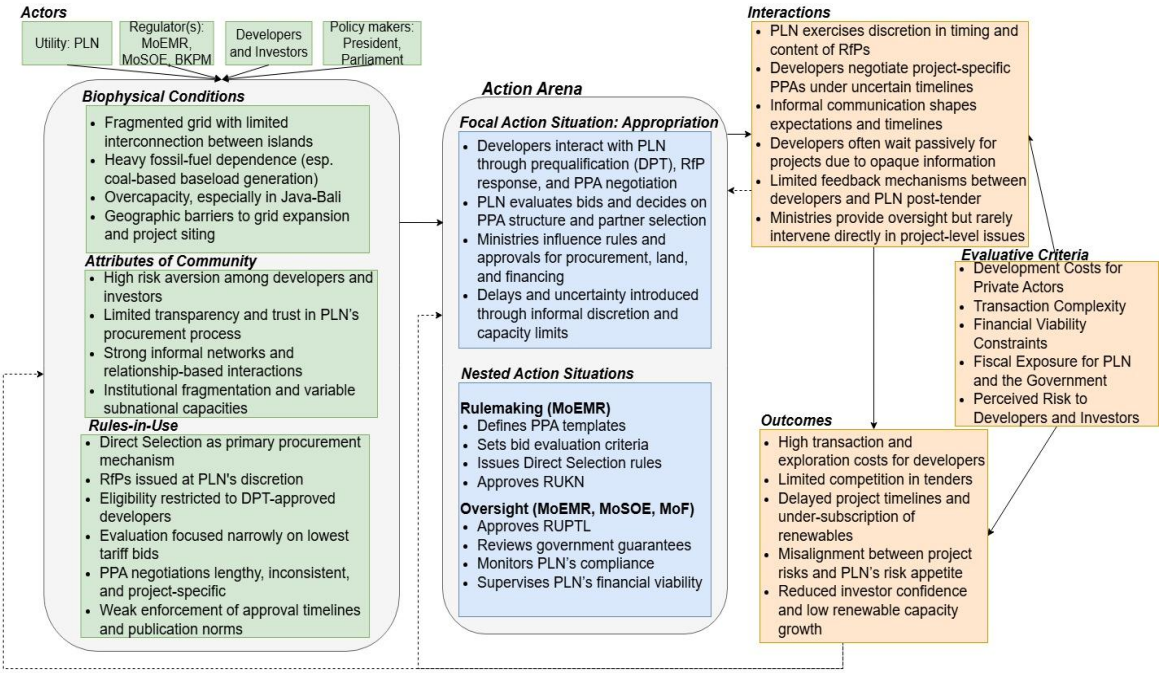
In doing so, this chapter translates high-level institutional analysis into actionable procurement reform proposals that reflect both regulatory feasibility and real-world actor dynamics.

6.1 IAD framework application

Base Scenario

Using the IAD framework a base scenario was developed by synthesizing the contextual elements introduced above according to the Procurement Process. The visual overview *figure 6.1* is presented here preceding the analysis that led to its creation in order to provide the reader with visual context prior to an in-depth explanation. The following Sub-Sections 6.1.1-6.1.5 will explain how each IAD framework element was synthesized. The exogenous variables (Section 6.1.1) define a procurement environment characterized by high physical constraints, misaligned actor incentives, and procedural uncertainty. The action arena (Section 6.1.2) consists of a set of rule-based interactions which frame the steps taken between a developer and PLN in order to achieve a PPA. Section 6.1.3 explains how these rule-based interactions frame the behaviour of actors in the action arena according to the seven rule types of Ostrom. The evaluative criteria (Section 6.1.4) form the lense with which policy outcomes are evaluated. Finally outcomes (Section 6.1.5) determines the state of the action arena in the current scenario and serves as a base scenario during the policy scenario evaluations in Section 6.3. This base scenario serves as a reference point for evaluating the institutional impact of policy reforms in Sections 6.2 - 6.4.

Figure 6.1: IAD Base Scenario - *IAD base scenario representation of Indonesia's renewable electricity procurement environment. This diagram synthesizes the biophysical conditions, actor attributes, rules-in-use, and transaction structure that shape current procurement outcomes.*



6.1.1 Procurement System Overview

This section outlines the exogenous variables that define the institutional environment in which renewable energy procurement occurs. In the IAD framework, these variables shape the structure and behaviour of actors in a given action situation but are not themselves directly affected by the outcomes of that situation (Section 3.1.2). In the IAD framework three categories of exogenous variables are used: (1) biophysical conditions, (2) community attributes, and (3) rules-in-use. A fourth component: Transactional context is added in order to provide a theoretical foundation for the action situation. Together, they form the contextual baseline for analysing procurement processes and assessing the impact of institutional reforms.

Biophysical Conditions

Indonesia's archipelagic geography poses significant challenges to infrastructure development. The national grid is fragmented across major islands, with limited interconnection and uneven transmission capacity. While densely populated regions like Java-Bali and Sumatra exhibit coal-driven overcapacity, many high-potential renewable energy (RE) zones—particularly for solar, wind, geothermal, and hydro—are located in remote or poorly connected areas. Within regions, local grid limitations also constrain the integration of VRE sources due to issues like congestion and load balancing.

Indonesia also faces physical vulnerability due to frequent natural disasters (e.g., earthquakes, typhoons, and flooding), which affects both infrastructure reliability and investment risk. Despite these constraints, the country has vast untapped RE potential due to its equatorial location, high solar irradiation, and geothermal and hydro resources concentrated in mountainous regions.

Attributes of the Community

Several characteristics of the actor environment shape behaviour in the procurement process:

- PLN, as a state-owned utility and sole electricity buyer, is under financial pressure to limit generation costs. It prioritizes cost-minimization due to government-imposed electricity tariff controls and the need for ongoing subsidies.
- Private developers and investors view Indonesia as a high-potential but high-friction market. While the country has strong credit ratings and ambitious RE targets, investors remain wary due to procedural opacity, unclear incentives, and unpredictable delays (Yustika, 2024b).
- Government ministries, including MoEMR and MoSOE, set procurement rules and performance targets for PLN. Their role in regulation and oversight is central but often limited by coordination challenges or shifting political priorities.

These attributes create an environment where incentives are often misaligned with national RE ambitions. Developers perceive high risk, PLN avoids costly projects, and government agencies are reluctant

Rules-in-Use (Overview)

The procurement process in Indonesia's renewable electricity sector is shaped by a mix of formal regulations and informal governance practices. The primary mechanism is *Direct Selection*, which governs most utility-scale renewable projects and is structured around a closed prequalification system. Only developers on the DPT list are eligible to receive RfPs from PLN or its subsidiaries. Bid evaluation processes, while formally anchored in price competition, are subject to PLN's internal guidelines, which often emphasize the lowest tariff benchmarked against prior projects, even in cases where local project conditions differ significantly in terms of technical characteristics as a result of LCOE matching being PLN's benchmark method.

Informally, several unwritten practices influence how these rules operate. For instance, RfPs are only published after regional units within PLN initiate project requests, introducing delays and regional discretion into what would otherwise be a centralized process. Moreover, PLN's limited guidance in land acquisition and feasibility studies result in significant inconsistency in what is offered to developers in each tender. Finally, PPAs are highly individualized, due to the inclusion of clauses incompatible with VRE resulting in lengthy negotiations with PLN, contributing to high transaction costs and legal uncertainty for developers. These rules-in-use shape the strategic behaviour of actors within the procurement action situation and are critical to understanding the feasibility of potential reforms.

A detailed breakdown of these rules is provided in Section 6.1.3 using Ostrom's seven rule types. They are introduced here to complete the system overview and frame outcomes in the base-scenario IAD overview presented in *figure 6.1*.

Transactional Context: Nature of Goods and Exchange Structure

In Indonesia's procurement system, the good exchanged is not electricity itself but the opportunity to secure a Power Purchase Agreement (PPA) through Direct Selection. This opportunity represents the transactional core of the action situation: it determines whether a renewable project can proceed and shapes how actors behave.

To compete, developers must invest significant resources—feasibility studies, land acquisition efforts, DPT prequalification, and bid preparation—without any guarantee of success. These upfront, sunk costs transform procurement into a high-risk gateway to market entry.

The process imposes several layers of cost and risk, including:

- Feasibility and land preparation expenses
- Legal and procedural navigation
- Delays in DPT approval

- Exposure to opaque or informal decision-making

Because these burdens precede contract award, the perceived value of the PPA depends heavily on how procurement rules are designed and applied. Opaque or rigid rules reduce expected returns and deter participation, particularly from smaller or international developers unfamiliar with PLN procedures.

This transactional structure explains much of the observed behaviour: developers avoid high-risk bids or exit the market entirely, while PLN prioritizes low tariffs above all. In short, the PPA—an exclusive and uncertain contract—creates strong incentives for strategic selectiveness on all sides, reinforcing narrow participation and limiting competition.

6.1.2 Action Situations and Interactions

In the IAD framework, action situations refer to the structured interactions among actors within a specific institutional context. For the purposes of this analysis, the focal action situation is defined as: "**The appropriation of renewable electricity generation capacity through PLN's Direct Selection procurement process**."

This action situation is shaped by formal and informal incentive structures, market constraints, and strategic behaviour from both public and private actors as well as by two nested action situations 1. Rulemaking and 2. Monitoring and Control.

Focal Action Situation: Procurement via Direct Selection

The focal interaction involves developers (acting as project initiators) and PLN (as a gatekeeper and single buyer) in a process aimed at reaching bankable PPAs. The following steps characterize this action situation:

- **Pre-qualification via DPT**: Developers must obtain DPT Approved status to be eligible for Direct Selection. This is based on financial, technical, and organizational criteria and must be renewed every 3 years.
- **RfP Distribution**: PLN distributes a Request for Proposal (RfP) to prequalified firms on the DPT list, specifying technical, financial, and legal requirements, including generation capacity, pricing ceilings, equity requirements, and draft PPA terms.
- **Feasibility Assessment**: Developers are responsible for site selection, resource assessments, land acquisition, feasibility studies, and risk evaluation. These costs are borne privately and precede formal bidding.
- **Bidding and Evaluation**: Qualified developers submit proposals. PLN selects the winning bid based on compliance and perceived value, though pricing is the dominant criterion.
- **PPA Signing and IPP Formation**: Once selected, a new IPP (typically a joint venture between developer, investor, and sometimes PLN) is formed and a long-term PPA is signed.

Informal Dynamics

In practice, the formal structure is complemented—and often complicated—by informal communication, bureaucratic discretion, and decentralized decision-making within PLN. Investors often rely on informal channels to gain insight into upcoming tenders and regulatory changes. PLN's interpretation of national targets—particularly where they conflict with solvency constraints—also influences behaviour, often reducing predictability.

- **Asymmetric information**: Developers often lack transparency on evaluation timelines, selection criteria weighting, and expected lead times.
- **Discretion in Tendering timelines**: PLN can delay tenders or alter technical conditions, creating additional risks for bidders.
- **Financial caution**: PLN's budgetary constraints incentivize risk aversion, selectiveness, and preference for low-cost, low-risk proposals.

Nested Action Situations

According to the IAD framework, action situations are shaped by broader institutional arenas. In Indonesia's case the focal action situation – renewable energy procurement – is embedded within two particularly influential nested action situations: (1) rulemaking, and (2) monitoring and oversight. These settings determine how procurement rules are created, enforced, and adapted, and are essential to understanding both the institutional constraints and the political feasibility of reform.

1. Rulemaking

The MoEMR is the central actor in procurement rule design. It issues the legal and regulatory instruments that govern key aspects of renewable energy procurement, including many Direct Selection procedures, PPA guidelines, and bid evaluation criteria. MoEMR also coordinates national energy planning through its authorship of the RUKN, which shapes PLN's RUPTL.

Through this regulatory authority, MoEMR defines the formal "rules-in-use" that structure interactions between PLN and developers in the IPP formation process. Importantly it also frames the rules which PLN is allowed to make. As such, it is the primary gateway for institutional reforms aimed at improving procurement practices—whether through standardized templates, land acquisition procedures, or adjusted evaluation metrics.

2. Monitoring and Oversight

In addition to designing rules, MoEMR plays a crucial oversight role in their implementation. It reviews and approves PLN's RUPTL, monitors compliance with procurement regulations, and can delay or block tenders that fall outside national development priorities. This gives MoEMR leverage not only as a rulemaker but as a gatekeeper for project approval and institutional change.

Two additional ministries share in this oversight capacity. The MoSOE supervises PLN's strategic and financial performance, shaping incentives through executive

appointments, corporate mandates, and state-owned enterprise reforms. The MoF plays a critical fiscal role—reviewing government guarantees, disbursing subsidies, and influencing PLN's risk exposure through public financing mechanisms.

Together, these institutions form a dense web of nested governance through which procurement practices are interpreted, enforced, and contested. Understanding these interdependencies is crucial to identifying politically feasible and institutionally robust policy solutions. These nested arenas determine not just the formal rule structure, but also the institutional levers available for reform—making them a critical focus for policy design in later sections.

6.1.3 Rule Types Shaping the Action Situation

In line with Ostrom's IAD framework, this section identifies how specific rules influence the behaviour of actors in the focal action situation defined in Section 6.1.2: the procurement of renewable electricity capacity via PLN's Direct Selection process. The goal is to clarify the formal and informal constraints that shape the incentives and strategies of actors involved. These rules are categorized according to Ostrom's seven rule types: *position, boundary, choice, aggregation, information, payoff,* and *scope*.

These 7 rule types help explain how formal procedures and informal practices create issues such as transaction costs, exploration costs, investor confidence, and renewable capacity growth—providing the analytical foundation for policy design in later sections. For instance, boundary rules limit who may participate in tenders by requiring prequalification through the Developer Pool (DPT), while payoff rules expose developers to high upfront costs without guarantees of reward.

Table 6.1 provides an overview of how each rule type manifests in PLN's Direct Selection process and summarizes their institutional implications. A full overview of the various rules according to the 7 rule types along with detailed descriptions for each rule type can be found in Appendix D.1.

Table 6.1: Rule Types in PLN's Procurement Process

Rule Type	How It Appears in Procurement	Institutional Implication
Position Rules	PLN as evaluator; developers as prequalified bidders	Roles are fixed and entry tightly controlled
Boundary Rules	DPT approval required to bid	Limits competition and delays participation
Choice Rules	PLN discretion to delay/cancel tenders; developers fund studies	Creates uncertainty and risk for developers
Aggregation Rules	Internal bid evaluation with limited external oversight	Decision-making may be opaque or biased
Information Rules	Limited transparency in RfPs and evaluation feedback	Increases information asymmetry and perceived risk
Payoff Rules	High sunk costs for developers; capped returns; low PLN penalty	Asymmetric risks deter high-quality participation
Scope Rules	Projects must align with RUPTL; weak enforcement of targets	Limits ambition and excludes marginally viable projects

This rule-type analysis highlights key leverage points for policy reform. For instance, improving boundary and information rules could reduce entry barriers and increase trust; altering payoff and choice rules could make participation more attractive for high-quality bidders. These observations directly inform the design of policy alternatives in Chapter 6.2.

Having described the structure of the procurement system, the focal action situation, and the relevant institutional rules, the next step is to establish criteria for evaluating how policy interventions might improve outcomes. These evaluative criteria serve as the benchmark against which different scenarios will be assessed in the IAD framework. They are directly derived from the challenges identified in the action situation and reflect the interests of key actors involved in renewable energy procurement.

6.1.4 Evaluative criteria

To evaluate the effectiveness of proposed policy interventions, this study applies a set of five qualitative criteria derived from the IAD framework. These criteria reflect how different rule changes may affect the behaviour and incentives of key actors in the procurement process, particularly PLN, developers, and investors. The criteria are designed to assess the likely impact of each policy on the functioning of the procurement process. These do not represent quantified metrics but serve as conceptual categories for structured comparison.

The five criteria are:

1. **Development Costs for Private Actors**
   This criterion assesses the extent to which a policy reduces the upfront costs that developers must incur to participate in tenders. These include site-specific feasibility studies, technical assessments, and legal due diligence. Lower development costs can increase competition and improve project economics for smaller or newer market entrants.
2. **Transaction Complexity**
   This refers to the procedural and administrative burdens associated with the procurement process, such as interpreting RfP requirements, managing resubmissions, and dealing with delays or ambiguous timelines. Policies that streamline these procedures reduce uncertainty and resource drain for both PLN and bidders.
3. **Financial Viability Constraints**
   This criterion assesses the extent to which a policy affects the perceived profitability and bankability of renewable energy projects. Key considerations include tariff structures, payment guarantees, contract flexibility, and expected return on investment (RoI). Greater constraints in this area reduce the attractiveness of the market to developers and financiers, while improvements are likely to increase capital inflows and participation from qualified actors.

4. **Fiscal Exposure for PLN and the Government**
   This captures the direct and indirect cost implications of a policy for PLN or the state, including administrative burdens, subsidies, land acquisition costs, or the risk of increased PPA tariffs. High fiscal demands may greatly reduce a policy's political feasibility and long-term sustainability.
5. **Perceived Risk to Developers and Investors**
   This criterion addresses non-financial risks that undermine investor confidence, such as regulatory opacity, inconsistent enforcement, and sudden policy shifts. Lower perceived risk is expected to improve the investment climate and reduce the risk premium required by financiers.

The ultimate objective of these policy interventions is to increase renewable electricity investment. This outcome is treated as a composite effect of the five criteria above. Increases in contracted and built renewable capacity are assumed to follow when transaction costs are lowered, risks are reduced, and project economics become more favourable.

These five criteria serve as the analytical lens through which each policy alternative is assessed in Sections 6.3 and 6.4, enabling structured comparison relative to the base case (figure 6.1).

6.1.5 Outcomes

In the IAD framework, outcomes refer to the results that emerge from interactions within a rule-structured action situation. In this thesis, the focal outcome of interest is the limited progress in contracting and developing renewable energy capacity through PLN's procurement process. This outcome is primarily driven by misaligned incentives, high transaction costs, limited transparency, and constrained institutional capacity, as described in Sections 6.1.1 to 6.1.4, though broader systemic constraints—such as transmission gaps or overcapacity—also play a role.

Under current institutional arrangements, the procurement process creates disincentives for private participation and limits PLN's ability to initiate or conclude bankable projects. Developers face high entry barriers, unclear timelines, and weak guarantees of return, while PLN operates under tight budgetary constraints and opaque accountability structures. These conditions collectively suppress competition, delay project implementation, and contribute to the underachievement of Indonesia's renewable energy targets.

The outcomes below are analytically derived by interpreting how the rules, actor attributes, and context described in Sections 6.1.1–6.1.4 interact within the IAD framework. They reflect a synthesis of desk research, including regulatory review, and secondary literature.

The central outcome trends identified in this analysis are:

- **Low Number of Renewable PPAs Signed**
  Despite ambitious national targets, the actual capacity contracted through Direct Selection remains limited—particularly from variable renewable energy (VRE) sources such as solar and wind. This suggests a structural mismatch between planning goals and implementation capacity.
- **Developer Withdrawal and Weak Bid Competition**
  Repeated delays, information asymmetries, and administrative burdens contribute to a high dropout rate among pre-qualified developers. Bidding pools are often shallow, and tender processes yield limited viable options for PLN.
- **High Perceived Risk and Lack of Investor Confidence**
  Investors, especially international financiers, remain wary due to persistent regulatory uncertainty, non-transparent procedures, and unpredictable delays. This raises project risk premia and further limits competitive pressure in tenders.
- **PLN Reluctance to Advance RE Projects**
  Due to overcapacity in key grids and the pressure to minimize fiscal exposure, PLN may strategically avoid initiating projects with unclear short-term benefits—even when they align with long-term RE targets.
- **Missed Opportunities for Learning and Institutional Improvement**
  A lack of transparency, feedback mechanisms, and external oversight reduces institutional learning. Best practices in project design and evaluation are not consistently shared, preventing iterative improvement of procurement processes.

These outcomes justify the focus of this chapter on procurement process inefficiencies as the most actionable institutional obstacle identified in Chapter 5. By structuring the analysis around these systemic results, the IAD framework enables a clearer identification of where institutional reform is most needed and which rules might be adjusted to improve actor behaviour and system performance.

6.2 Policy Alternatives

This section introduces a set of 7 policy alternatives designed to address inefficiencies in Indonesia's renewable energy procurement process. These alternatives were generated through desk-research based institutional analysis and are structured to influence actor behaviour in the action situation and thus the outcomes described in Sections 6.1.2 & 6.1.5. Each policy is intended to improve one or more aspects of the procurement process — including transparency, transaction costs, and investor confidence — without imposing substantial new fiscal burdens or requiring legislative reform. The policies were selected based on three inclusion criteria: 1) Relevance to procurement process reform, 2) Cost sensitivity to PLN and the government, and 3) Implementability through ministerial or regulatory action**.** See *table 6.2* for a visual overview of the policies in relation to the criteria.

Table 6.2 – Policy Alternatives and Selection Criteria *(✓ = Criterion met; ~ = Partially met; X = Not met)*

Policy Alternative	Direct Relevance	Resource-Light	Regulatory Feasibility
1. RfP Minimum Requirement	✓	~ (Down-stream costs)	~ (Political resistance possible)
2. PLN Feasibility Study Obligation	✓	~ (Moderate cost)	✓
3. Transmission Network Data Requirement	✓	✓	✓
4. PLN Land Acquisition Support	✓	~ (Targeted cost)	~ (Needs budget approval)
5. RUPTL–Transmission Planning Integration	✓	✓	✓
6. Transparency Requirements for Direct Selection	✓	✓	✓
7. PPA Template Standardization	✓	✓	✓

Descriptions of Proposed Policy Alternatives

In the following section the proposed policy alternatives are described in specific detail and pre-ceded by a short overview of which of the 7 rule types of Ostrom it is expected to impact and why. See Appendix D.2 for the extended overview of policy alternatives.

1. RfP Minimum Requirement

- Boundary rules – Expands who can participate by increasing the number of opportunities.
- Scope rules – Sets the minimum quantity of RE capacity to be procured annually.
- Aggregation rules – Requires coordination between PLN and MoEMR on planning and approval.

Introduce a regulatory mandate requiring PLN to issue a minimum volume of renewable energy RfPs per year. This would be aligned with the targets set out in the RUPTL and enforced by the MoEMR. The policy aims to increase project opportunities and reduce uncertainty for developers by ensuring predictable tender volumes.

2. PLN Feasibility Study Obligation

- Information rules – Mandates sharing of feasibility data with all bidders.
- Position rules – Shifts PLN's role toward early-stage project preparation.
- Choice rules – Specifies new required actions by PLN before tendering.

Require PLN to conduct and publish baseline feasibility studies as part of each RfP. These would include assessments of RE resource potential, land acquisition constraints, and basic grid connection possibilities. This would shift some early-stage development costs away from private actors and enable more developers to participate competitively.

3. Transmission Network Data Requirement

- Information rules – Requires disclosure of transmission and substation data in RfPs.
- Choice rules – Imposes procedural duties on PLN during RfP drafting.

Mandate the inclusion of detailed transmission and substation capacity data in all RfPs. This would improve bid quality and lower exploration costs by giving developers better insight into potential grid constraints and connection opportunities. Since PLN already possesses much of this data, implementation would require only procedural change.

4. PLN Land Acquisition Support

- Choice rules – Assigns PLN new responsibilities in pre-tender land preparation.
- Boundary rules – Reduces entry barriers by making more land-accessible sites available.
- Payoff rules – Affects cost structure and risk-sharing for developers.

PLN can be mandated or supported to assist developers with land acquisition either (a) directly—by securing land before issuing the RfP, or (b) indirectly—by offering standardized legal support and mediation services during the bidding process. Implementation could be supported through a dedicated budget line from the MoF or MoSOE, or through PLN procurement reform under a Presidential Instruction.

5. RUPTL–Transmission Planning Integration

- Aggregation rules – Adjusts how planning actors (e.g., transmission planners) coordinate with RUPTL drafting teams.
- Scope rules – Affects the kinds of projects that are included in procurement planning.

An MoSOE guided restructuring of PLN's working groups for RUPTL drafting to include transmission planners to ensure alignment between future RE project locations and grid expansion priorities. This policy is intended to increase the number of technically and financially viable sites included in procurement planning without requiring major new investment.

6. Transparency Requirements for Direct Selection

- Information rules – Requires disclosure of evaluation criteria and outcomes.
- Boundary rules – Indirectly expands perceived accessibility for non-connected developers.

Mandate basic transparency in Direct Selection tenders by requiring PLN to publish non-sensitive information on evaluation criteria, tender status, and outcomes. This would improve accountability and reduce information asymmetries that currently deter market entrants and increase perceived risk.

7. PPA Template Standardization

- Payoff rules – Alters the structure and clarity of financial terms and risk allocation.

- Choice rules – Constrains PLN's and developers' negotiation space through standardized contract elements.

Introduce standard PPA templates tailored to different RE technologies. These templates would be designed according to international best practices (e.g., IRENA 2018) and aim to simplify negotiations and reduce perceived risk for developers and investors. Implementation would require regulation but minimal additional resources.

6.3 Scenario Analysis

This section applies the IAD framework to assess the institutional impact of seven targeted policy alternatives introduced in Section 6.2. Each policy aims to improve Indonesia's renewable energy procurement process by altering specific rules-in-use and shifting incentives within the action situation described in Section 6.1.2.

The analysis uses the five evaluative criteria established in Section 6.1.4 to examine how each intervention affects the transaction environment for developers, the cost exposure of PLN, and the overall accessibility and viability of the renewable energy market. The policies are evaluated qualitatively against the base case described in Section 6.1, without assigning numerical weights or forecasting outcomes. Instead, this section presents directional reasoning that is then visually summarized in Section 6.4. For an extended overview of the scenario analysis, see Appendix D.3.

Readers seeking a condensed comparison of policy effects may refer to *table 6.3* at the end of Section 6.4.

1. RfP Minimum Requirement

Policy Impact:
This intervention mandates a minimum volume of renewable capacity to be offered annually through PLN tenders, aligned with the RUPTL. It aims to ensure a steady flow of opportunities for pre-qualified developers.

Impact on Incentives:
While increasing the number of RfPs could reduce market entry uncertainty, it does not alter PLN's fundamental incentives, which remain shaped by financial constraints and overcapacity concerns. As a result, there is a risk that implementation would be symbolic rather than substantive.

Evaluative Implications:
Development and transaction costs for developers may remain unchanged if issued tenders lack viability or are poorly structured. Fiscal exposure could increase if PLN is pressured to issue RfPs it cannot support financially. Investor confidence is unlikely to improve unless paired with quality enforcement mechanisms.

2. PLN Feasibility Study Obligation

Policy Impact:
PLN would be required to provide standardized feasibility studies—including resource

assessments, transmission access, and land considerations—as part of each RfP package.

Impact on Incentives:
Shifting early-stage risk and cost to PLN helps level the playing field for developers. Better site data reduces uncertainty and lowers exploration costs, particularly for smaller or foreign entrants. It also reduces duplicated efforts across competing bidders.

Evaluative Implications:
The policy is expected to significantly reduce development costs and perceived risk while reducing financial viability constraints. While upfront costs to PLN increase, improved bid quality and competition may yield more favourable tariffs. The effect on fiscal exposure is therefore mixed, depending on implementation design.

3. Transmission Network Data Requirement

Policy Impact:
PLN would be required to include transmission and substation capacity data in all renewable RfPs.

Impact on Incentives:
Providing grid data marginally improves transparency and planning for developers, especially those less familiar with local conditions. However, as this information is already informally accessible in many cases, the overall impact is expected to be modest.

Evaluative Implications:
Exploration costs and transaction complexity may decrease slightly, but not dramatically. The policy is low-cost for PLN and may contribute incrementally to investor confidence. It is best viewed as a minor technical improvement rather than a transformative reform.

4. PLN Land Acquisition Support

Policy Impact:
PLN would offer land acquisition support—either by pre-securing land or by providing legal and administrative assistance to developers during the bidding process.

Impact on Incentives:
Land acquisition is one of the most unpredictable and time-consuming stages for developers. By reducing this uncertainty, the policy improves project bankability and could encourage participation from more medium sized international firms.

Evaluative Implications:
Development costs and risk perception would likely fall, while improved project readiness may reduce financial viability constraints. However, implementation costs for PLN are non-negligible and require coordination with local governments and land agencies, potentially increasing fiscal exposure.

5. RUPTL–Transmission Planning Integration

Policy Impact:
Transmission planning units within PLN would be formally integrated into the RUPTL

drafting process to ensure better alignment between procurement plans and grid development.

Impact on Incentives:

Better coordination may expand the number of technically viable project sites included in the RUPTL and subsequently tendered. However, the policy does not directly affect the tendering process or developer-facing procedures, limiting short to medium term impact

Evaluative Implications:

Transaction costs may remain unchanged, but financial viability constraints could improve if better-sited projects reduce delivery risks. Fiscal exposure is likely neutral, though institutional inertia within PLN could hinder implementation without strong leadership.

6. Transparency Requirements for Direct Selection

Policy Impact:

PLN would be required to disclose key elements of the Direct Selection process, including selection criteria, timelines, and final outcomes, to improve clarity for market participants.

Impact on Incentives:

Reducing information asymmetry lowers uncertainty and improves market trust—particularly for new entrants without informal networks. This may improve competition and reduce bid premiums linked to procedural risk.

Evaluative Implications:

Transaction complexity and perceived risk are expected to decline. Since implementation is procedural rather than financial, fiscal exposure is minimal. The policy offers a high impact-to-cost ratio and enhances accountability.

7. PPA Template Standardization

Policy Impact:

PLN would adopt standardized PPA templates tailored to different renewable energy technologies, reducing the need for complex contract negotiation.

Impact on Incentives:

Standardized contracts increase predictability for developers and reduce the legal burden associated with deal structuring. By lowering the expected time spent in negotiations with PLN firms will be more willing to step into the ring. This is especially true for foreign or first-time bidders who face steep learning curves,

Evaluative Implications:

The policy is expected to significantly reduce transaction complexity and risk perception. It may also improve financial viability by lowering negotiation costs and speeding up financial closure. As a low-cost procedural fix, it offers strong benefits with minimal downside.

6.4 Comparative Evaluation of Policy Scenarios

This section synthesizes the results of the scenario-based assessment presented in Section 6.3. Each of the seven policy alternatives was evaluated across the five qualitative criteria, based on the IAD framework application in Section 6.1.4—1)Development costs for private actors; 2) Transaction complexity; 3) Financial viability constraints; 4) Fiscal exposure for PLN and the government; 5) Perceived risk to developers and investors. The results are presented visually in *table 6.3,* using a heatmap format to indicate the relative impact of each policy on these outcome dimensions.

Importantly, this evaluation is qualitative and comparative in nature. No numeric scores or rankings are applied. Instead, directional assessments reflect how each policy performs relative to the current procurement process, based on institutional reasoning and policy design logic. The objective is to help identify promising interventions, illuminate trade-offs, and support the refinement of procurement-focused policy proposals.

Table 6.3 Heatmap Evaluative Criteria (Green = Positive Development, Yellow = Neutral, Red = Negative)

Policy Alternative	Development Costs	Transaction Complexity	Financial Viability Constraints	Fiscal Exposure	Perceived Risk
1. RfP Minimum Requirement	=	=	=	=/+	=
2. PLN Feasibility Study Obligation	– –	–	-	+	– –
3. Transmission Network Data Requirement	=/–	=/–	=	=	=
4. PLN Land Acquisition Support	– –	–	-	+	– –
5. RUPTL–Transmission Planning Integration	=	=	=/-	=	=/–
6. Transparency in Direct Selection	=	=/–	=/-	=	–
7. PPA Template Standardization	=	–	-	=	–

Strong Performers Across Multiple Criteria

Two policy alternatives stand out for their consistently positive impact across all five evaluative criteria: *PLN Feasibility Study Obligation* and *PLN Land Acquisition Support*. Both measures directly address upstream development risks that disproportionately affect new market entrants and smaller developers. By shifting key early-stage burdens

from developers to PLN, these policies reduce transaction costs and perceived risk while enhancing the financial viability of projects. Although they introduce moderate fiscal exposure to PLN, this exposure is partially offset by the expected increase in project quality and bid diversity.

The *PPA Template Standardization* policy also performs well across multiple criteria, offering a low-cost way to reduce transaction complexity and perceived risk. While it does not directly affect development costs or fiscal exposure, its alignment with international practices makes it a relatively simple and impactful intervention to improve legal clarity and accelerate deal closure.

Policies with Targeted Impact or Trade-Offs

The *Transparency Requirements for Direct Selection* policy offers clear benefits in terms of reducing transaction complexity and risk perception, particularly for developers with limited local presence. Its main advantage is institutional: increasing procedural predictability and reducing reliance on informal networks. While it does not alter underlying cost structures, its implementation could improve the functioning of the existing procurement framework with minimal fiscal impact.

The *RUPTL–Transmission Planning Integration* policy represents a more strategic intervention. Its effect is more indirect and long-term, helping ensure that procurement planning aligns with realistic infrastructure capabilities. This may not yield immediate cost or risk reductions but can improve project viability over time by enabling better siting and fewer stranded assets.

Mixed or Limited Impact

The *Transmission Network Data Requirement* policy shows more limited impact. While procedurally straightforward and easy to implement, its benefits depend on the quality and consistency of the data made available. On its own, this measure may modestly reduce exploration costs but is unlikely to shift developer behaviour in a meaningful way unless paired with other reforms.

The *RfP Minimum Requirement* is the most structurally ambitious policy, aiming to enforce more ambitious tendering behaviour by PLN. While it sends a strong market signal, it also risks pushing tenders forward without resolving upstream constraints, potentially increasing fiscal exposure without improving investment conditions. It also does not address the incentives which create the current situation, leaving this policy vulnerable to poor implementation or gaming. The measure's effectiveness would therefore depend heavily on enforcement mechanisms and complementary reforms.

Summary and Forward Link

Overall, the analysis highlights that policies which restructure early-stage responsibilities—such as feasibility preparation and land acquisition—offer the most direct and wide-reaching improvements to procurement outcomes. These measures reduce friction for developers while maintaining PLN's ability to select viable projects. By contrast, information-focused or planning-aligned policies offer incremental or

supporting benefits but may require pairing with broader changes to achieve significant impact.

These conclusions provide the analytical foundation for the expert validation step in the next section. In Section 6.5, the scenario findings are tested and refined based on interviews with three senior experts active in Indonesia's energy policy and renewable procurement landscape. Their insights are used to confirm or contest the results above and help shape the final selection of policy recommendations.

6.5 Expert Validation Interviews

To validate the conclusions drawn from the scenario analysis, expert interviews were conducted with three individuals holding distinct forms of expertise regarding renewable energy procurement in Indonesia. Their insights helped reassess the relevance of previously identified obstacles, confirm or challenge proposed policy measures, and guide final policy recommendations.

6.5.1 Validation of Key Obstacles

The three core obstacles identified in Chapter 5—Overcapacity, Procurement Process Inefficiencies, and Transmission Network Limitations—were all validated by the interview participants. However, the interviews also revealed a fourth obstacle not initially recognized in Chapter 5: **Lack of government commitment**.

Obstacle 1 – Overcapacity

All participants confirmed overcapacity as a significant constraint on renewable energy development. Participant 1 cited take-or-pay clauses with fast-tracked CFPPs as severely limiting PLN's ability to integrate renewables. Participant 2 explained that regional divisions of PLN will not request new RE capacity unless projected demand growth exceeds existing capacity, directly limiting how many tenders PLN can issue. Participant 3 suspected that PLN strategically delays RE tenders due to these overcapacity issues.

Obstacle 2 – Procurement Process Inefficiencies

Each participant emphasized the institutional inefficiencies within PLN's procurement practices. Participant 1 highlighted how process mismanagement creates risk and uncertainty for developers. Participant 2 mentioned legal limitations on feed-in tariffs in PR112/2022 and organizational constraints as major barriers. Participant 3 focused on inconsistent application of procedures and inefficient design, which deter investor participation by creating uncertainty.

Obstacle 3 – Transmission Network

The relevance of the transmission network varied. All three participants agreed it limits RE deployment in high-potential remote areas, but also stressed that within developed grids (like Java-Bali), the transmission system could support significantly more VRE. Participant 3 noted: "I have read that another 2 GW VRE would not even cause an issue

with today's grid in Java. Another market player in RE is saying the same thing, Java can absorb much more VRE than it currently has."

Additional Obstacle 4 – Government Commitment

An obstacle not originally included in Chapter 5 but consistently emphasized was government commitment. Each participant independently raised concerns about unclear or inconsistent political will:

- Participant 1: "In my opinion the government needs to commit. Constantly they throw around the narrative that solar and wind can't be incorporated because of intermittency issues but then organisations do analysis and determine this is not a limiting factor."
- Participant 2: "The government takes a very important role. The tariff issues with the de-Dieselization project are an example of how we are impacted by a lack of government direction."
- Participant 3: "I think proper implementation of policies like we discussed is more reliant on the government's ambition and commitment to their plans than the specifics in a policy's design. It is difficult for investors to trust Indonesia at this point. This is the biggest problem in Indonesia right now—frankly, the procurement process is secondary."

6.5.2 Validation of Proposed Policies

The interviews also validated or contested the proposed policy scenarios. The results are summarized below and a visual overview can be found in *table 6.4*:

Table 6.4: Policy Validation Overview

(✓ = Criterion met; ~ = Partially met; X = Not met)

Policy Alternative	Participant 1	Participant 2	Participant 3
1. RfP Minimum Requirement	X	X	X
2. Feasibility Studies in RfP	✓	✓	✓
3. Transmission Network Data Requirement	X	X	X
4. PLN Land Acquisition Support	✓	✓	✓
5. RUPTL–Transmission Planning Integration	X	X	X
6. Transparency in Direct Selection	✓	N/A	✓
7. PPA Template Standardization	✓	~	✓

Policy 1 (RfP Minimum Requirement) was unfeasible according to information provided by participants. Participant 2 explained that PLN cannot initiate tenders without requests from its regional operations divisions: "Having regional operations divisions being responsible for initiating RfP development by the main office is a critical part of PLN's process."

Policy 2 and 4 (Feasibility Studies and Land Support) received unanimous support, though concerns were raised about PLN's ability to finance or manage these

responsibilities. Participant 2 noted limitations in PLN's land acquisition powers and financial capacity.

Policy 3 (Transmission Data) was deemed unnecessary by all three experts. The required data is already provided by PLN during tenders and is not a limiting factor in the current process.

Policy 5 (RUPTL–Transmission Integration) was similarly seen as redundant. Participants all agreed that transmission and RUPTL planning are already coordinated to a functional degree.

Policy 6 (Transparency in Direct Selection) was strongly supported by Participants 1 and 3, who emphasized the risks created by current opaqueness. Participant 1 stated: "It is very difficult for all developers and other organisations involved to understand what the current status of the tender is and the result is fewer bids placed."

Policy 7 (PPA Template Standardization) was endorsed by all participants, though Participant 2 did emphasize that PPA practices were already improving. Participant 3 criticized current templates, saying: "What we see is that VRE tenders sometimes require developers to commit a given annual contracted energy…when they are able to supply more than that it is subject to PLN's approval…but of course they are also penalized if they underdeliver."

6.5.3 Divergent Views and Limitations

Some differences in interpretation and emphasis emerged across the interviews:

- PPA Template Quality**:** While Participants 1 and 3 viewed current PPAs as deeply flawed, Participant 2 saw them as evolving and improving over time.
- Transparency Barriers**:** Participants 1 and 3 advocated for strong transparency mandates. Participant 2, however, noted that some delays and procedural opacity stem from constraints outside PLN's control.
- Subsidiary Procurement Schemes**:** All three participants expressed concerns over inconsistent use of Direct Appointment versus Direct Selection, particularly where PLN subsidiaries are involved, but used different terms and explanations. This semantic inconsistency highlights challenges in interpreting PLN's internal processes.

Moreover, while all participants touched on major themes from the scenario analysis, not all discussed every policy in detail. The semi-structured format allowed them to emphasize their areas of expertise but limited systematic comparison across all scenarios.

6.5.4 Implications for Policy Suggestions

Based on the interview findings, the original policy list is revised to reflect what experts confirmed as both impactful and feasible:

1. Levelling the Playing Field through Feasibility Study and Land Acquisition Support: Modified to include a concession mechanism whereby PLN contracts feasibility studies to a third party and recoups costs through the winning bidder upon awarding the tender. All experts supported this target but raised concerns about PLN's resource limitations which is now addressed by cost-recovery.
2. Centralized Tender Communication and DPT Reform**:** A new combined policy addressing the lack of transparency and DPT unpredictability. The aim is to create a centralized database of tenders and enforce DPT approval timelines to expand developer access.
3. Improved Bid Evaluation and Price Benchmarking**:** A consolidated policy tackling tariff reference issues and the lack of technical discretion in bid evaluation. Interviews confirm that PR112/2022 is not fully implemented and that project-specific factors are still underappreciated.
4. International-Standard PPA Templates**:** Maintained with the recommendation to anchor templates in international guidelines (e.g., IRENA, 2018). PPA risk allocation and inflexibility were widely cited as barriers.

Meanwhile, the following policies are excluded from further consideration:

- RfP Minimum Requirement (unfeasible)
- Transmission Network Data Requirement (redundant)
- RUPTL–Transmission Planning Integration (already occurring)

These interview-informed revisions strengthen the empirical grounding of the policy recommendations and ensure they respond to real actor constraints and capacities in Indonesia's renewable energy procurement system.

6.6 Final Policy Suggestions

Based on the scenario analysis (Sections 6.3–6.4) and validation interviews (Section 6.5), four policy alternatives are selected for final recommendation. These options reflect not only their theoretical ability to improve procurement outcomes, but also their feasibility and perceived impact according to expert stakeholders. The policies are revised to reflect practical implementation concerns raised in interviews, while remaining consistent with the IAD-based structure developed earlier in this chapter.

The goal of these policies is to address the institutional bottlenecks in PLN's procurement process by lowering development and transaction costs, reducing investor risk, and increasing participation in renewable energy tenders—without overburdening PLN or the state financially. The resulting suggestions are grounded in real-world constraints and actor dynamics.

1. Levelling the Playing Field Through Feasibility Study and Land Acquisition Support

PLN would be required to include standardized feasibility studies and pre-secured land information in the RfP and PPA drafts provided to developers. To address feasibility

concerns raised in the interviews, this policy is structured as a cost-recovery concession system. PLN would contract out feasibility studies in advance, recover the cost from the winning bidder, and clarify this arrangement in the PPA.

All participants agreed that enabling developers to bid based on a common site and data set would substantially reduce perceived risk, increase fairness, and improve bid quality. Participant 1 emphasized this would "prevent developers from absorbing losses from feasibility costs" while Participant 2 raised the issue of PLN's limited capacity to produce all studies internally. The revised cost-recovery model addresses both concerns.

2. Centralized and Transparent Tender Management with Defined DPT Timelines

All tenders—whether managed by PLN headquarters or its subsidiaries—should be published on a centralized platform accessible to both DPT-approved and prospective developers. A regulation should also define a strict timeline for DPT approval, ensuring that developers have a predictable path to eligibility before submission deadlines.

Participant 1 stressed that "the current confidentiality of the process limits participation" and that DPT timelines are a source of significant uncertainty. Participant 3 also noted ambiguity around the legal procedures used by PLN subsidiaries, which may contribute to perceptions of favouritism or discretionary evaluation.

This policy improves boundary and information rules by making tender visibility and participation conditions more consistent and accessible—thereby expanding the pool of potential bidders and reducing the perception of risk.

3. Improved Bid Evaluation Practices and Decoupling from Localized Generation Cost Benchmarks

This policy proposes revising PLN's bid evaluation procedures to formally integrate non-price factors—such as technical capacity, energy source, and project context—while reducing reliance on regional average generation cost as a benchmark.

All three participants identified the use of outdated or uncontextualized price comparisons as a major barrier to project viability. Participant 3 highlighted how "PLN's reference to the Tanah Laut wind farm has spoiled the wind energy market," and Participant 2 confirmed that "reference prices are often applied too rigidly."

This policy directly addresses distorted payoff rules in the current action situation, allowing for more nuanced and competitive bid assessments while also reducing the likelihood of artificially suppressed RE development.

4. Standardized Renewable Energy PPA Templates Based on International Best Practice

MoEMR should develop and mandate a set of standardized PPA templates tailored to different RE technologies, using international examples (e.g. IRENA, 2018) as a model. These templates should include fair and transparent provisions for curtailment, delivery obligations, and tariff adjustments.

Participants 1 and 3 agreed that current PPAs are overly complex and poorly aligned with VRE project risks, often leading to prolonged negotiations. Participant 3 specifically noted the burden of "annual contracted energy" provisions, which result in penalties for undersupply and limited flexibility for oversupply. Participant 2 acknowledged improvements in recent templates but recognized that further standardization could reduce delays and enhance trust.

This policy improves information and payoff rules by reducing negotiation time, aligning expectations, and improving bankability.

Main Findings

These four policy recommendations reflect both the structured institutional logic of the IAD framework and the grounded perspectives of sectoral experts. Compared to the original seven policy alternatives, three were excluded from the final list.

The refined policy set therefore reflects the original objective of Chapter 6 which is to answer Sub-Question 3: *What are the most feasible policies to reduce the main obstacles to renewable electricity investment?* by providing feasible, targeted interventions that improve renewable energy procurement in Indonesia through institutional reform—without creating undue fiscal burdens or legal complexity. These options now form the basis for the thesis' final conclusions and policy implications.

These four refined policy recommendations represent the outcome of a full-cycle institutional analysis and expert validation process. Their broader implications, limitations, and relevance to the Indonesian energy transition are discussed in the next chapter.

7. Discussion

7.1. Summary of Key Findings

This research identified 4 key institutional obstacles constraining renewable energy procurement in Indonesia: 1) Overcapacity and Solvency Constraints, 2) Procurement Process Inefficiencies, 3) Transmission Infrastructure Gaps, and finally 4) Lack of government commitment. These challenges were derived through a WLIF-based institutional analysis and confirmed through expert interviews.

To address these challenges, seven policy alternatives were formulated and qualitatively assessed using the IAD framework. This evaluation applied five criteria: development costs, transaction complexity, financial viability constraints, fiscal exposure, and perceived risk. Based on this assessment and subsequent expert feedback, four policy recommendations were selected: (1) feasibility study and land support with cost recovery, (2) centralized and transparent tender processes, (3) improved bid evaluation mechanisms, and (4) standardized PPA templates. Together, these interventions aim to reduce upstream procurement inefficiencies while remaining feasible under Indonesia's current legal and fiscal arrangements.

7.2. Reflections

This research set out to investigate the institutional obstacles to renewable electricity investment in Indonesia by focusing on the rules and actor dynamics that shape procurement outcomes. The combination of the WLIF and IAD frameworks proved highly effective for this purpose. WLIF offered a system-level map of legal, financial, and governance structures, while IAD enabled a focused analysis of the procurement process through the lens of rule types and actor interactions. This dual-framework approach allowed for both structural and behavioural insights—yielding what might be termed an "actionable diagnosis" of institutional bottlenecks.

Conceptual Reflections

One of the conceptual contributions of this study lies in tracing seemingly technical obstacles—such as delayed tenders, land acquisition barriers, or opaque pricing benchmarks—back to their institutional roots. The research showed how high-level constraints like overcapacity and PLN's solvency obligations translate into selective procurement practices, and how formal reforms, such as the repeal of LCOE matching, have limited effect when underlying routines remain unchanged. By revealing how these institutional logics play out in practice, the analysis moves beyond the generalized diagnoses common in the literature (e.g., single-buyer risk or regulatory opacity) toward a more granular and reform-oriented understanding.

However, the process also exposed the limits of certain analytical lenses. For instance, while WLIF effectively captures formal governance structures and rule hierarchies, it

does not adequately account for less tangible factors such as political will. The consistent emphasis on "government commitment" by interview participants—despite its absence in the WLIF-based obstacle identification—illustrates the value of triangulating desk research with field-based expert insight. Informal power structures, shifting political priorities, and unspoken norms continue to shape procurement outcomes in ways that lie outside the scope of formal institutional models.

The decision to focus on variable renewable energy (VRE) sources was made to limit the scope to the most relevant and institutionally complex segment of the renewable energy landscape. However, the analysis suggests that most findings are also applicable to other renewable technologies. This is because the procurement process for VREs does not appear to be strongly constrained by VRE-specific technical limitations—at least not in the medium term. Instead, the key barriers identified are rooted in broader institutional dynamics that affect procurement across renewable technologies.

Methodological Reflections

Methodologically, this thesis developed its own layered approach to institutional diagnosis, combining WLIF system mapping, qualitative obstacle analysis, IAD-based scenario evaluation, and expert validation. This sequential process allowed not only for the identification of institutional obstacles but also for the design and testing of targeted, regulation-level policy interventions. The approach proved particularly useful in a governance context like Indonesia's, where formal policies and informal practices often diverge.

One novel element of this research was the development of a custom methodology for evaluating institutional obstacles, presented in Chapter 5. This approach combined theoretical guidance from WLIF with qualitative reasoning to assess the validity, relevance, policy levers and solvability of each obstacle. Rather than applying a ready-made framework, the method was tailored to the specific demands of this thesis—focusing on rule-based, actor-sensitive, and policy-relevant barriers. While exploratory in nature, the approach offered a structured way to prioritize obstacles for further policy analysis and may be useful for other researchers working in similarly complex institutional environments.

The framework's structured yet flexible application also helped clarify scope: while transmission gaps and coal overcapacity were acknowledged as significant challenges, the methodology steered the focus toward procurement as the most tractable arena for intervention. At the same time, expert feedback revealed opportunities to refine this method further—for instance, by integrating political economy analysis more explicitly, or by bundling policy interventions to explore synergy effects.

In sum, the layered institutional approach used in this research enabled a problem-driven, actor-aware, and rule-focused diagnosis of renewable procurement challenges.

It demonstrates how theory, empirical mapping, and practitioner feedback can be combined to move from systemic diagnosis to concrete policy design.

7.3 Scientific Significance

This thesis contributes to the academic literature on energy transitions and institutional governance by addressing several persistent gaps in research on Indonesia's renewable electricity sector. Using a layered diagnostic method grounded in New Institutional Economics (NIE), it applies the WLIF and IAD frameworks not only to explain systemic constraints but to develop targeted, rule-level policy recommendations. This approach enables a deeper institutional diagnosis than typically found in the literature.

First the thesis directly addresses the limited volume of Indonesia-specific institutional research identified in the literature review. While existing studies often acknowledge governance challenges (e.g., Purnamasari & Nurachmah, 2023; Bekun et al., 2021), few provide detailed, nationally scoped analyses. This study fills that gap by mapping key institutional features—across procurement, planning, transmission, and regulation—at the national level, offering a systemic account of how institutional rules shape renewable electricity investment outcomes.

Second, it responds to the lack of mechanism-level analysis in prior work. Many studies refer to broad institutional weaknesses—such as "low regulatory quality" or "single-buyer risk"—but stop short of specifying how these dynamics operate. This thesis advances the field by identifying specific rules-in-use (e.g., Direct Selection criteria, DPT approval procedures, tariff benchmarking), actor behaviours, and informal practices that contribute to underperformance in the procurement process. For example, while the repeal of LCOE matching was a formal policy shift, this study shows that PLN's internal pricing routines still reflect earlier constraints (CIPP, 2023; Participant 1).

Third, the study offers an integrated, national-scale institutional analysis that synthesizes multiple governance layers—something absent in the fragmented, geographically or technologically narrow case studies common in prior literature (e.g., Setyowati & Quist, 2022; Simanjuntak, 2021). The use of the WLIF framework enabled a sector-wide structural overview, while the IAD framework supported targeted scenario-based evaluation. This combination yields not only a descriptive understanding but also a reform-oriented analytical pathway.

Finally, while grounded in Indonesia's context, the methodology—combining WLIF system mapping, IAD-based scenario evaluation, and expert validation—is transferable. It offers a replicable framework for diagnosing procurement bottlenecks in other state-dominated electricity sectors where formal and informal rules interact. This provides a contribution not just to country-specific policy discourse, but also to comparative institutional research on clean energy transitions.

7.4 Relevance for knowledge users

This thesis offers direct insights for key actors involved in Indonesia's renewable electricity sector—particularly government ministries, PLN, international development partners, and private sector developers. While the analysis is grounded in academic frameworks, its outcome is a set of feasible, regulation-level reforms aimed at addressing procurement inefficiencies through institutional restructuring.

For PLN, the proposed policy recommendations respond to long-standing internal constraints related to project initiation, site preparation, and bid evaluation. Measures such as feasibility study support, PPA template standardization, and centralized tender publication are designed to reduce upstream transaction costs without undermining PLN's role as system planner and sole offtaker. Importantly, these recommendations account for PLN's solvency pressures and avoid imposing unsustainable financial burdens or bypassing existing oversight mechanisms.

For government ministries—particularly the MoEMR and MoSOE—the proposed interventions offer actionable levers for institutional improvement without requiring major legislative reform. Standardizing PPAs, enforcing basic transparency in the Direct Selection process, and aligning procurement planning with system capacity can all be implemented through ministerial regulation or executive instruction. These policies are therefore compatible with Indonesia's existing legal framework and offer a near-term pathway to improving procurement outcomes.

For international donors and development finance institutions, including those supporting the Just Energy Transition Partnership (JETP), this thesis provides a structured diagnostic framework for identifying institutional reform priorities. While the WLIF–IAD framework is relatively complex, its application clarifies where bottlenecks emerge and which reforms offer the greatest leverage. In practice, donor support could target enabling reforms such as the creation of a national tender portal, capacity-building for land acquisition processes, or the adoption of technology-specific PPA templates—efforts that could accelerate renewable uptake without direct infrastructure financing.

For developers and investors, the recommended policies aim to reduce perceived risk, entry barriers, and procedural opacity. By increasing transparency, improving tender quality, and minimizing negotiation uncertainty, the reforms would create a more predictable and competitive procurement environment. This could lower the cost of capital, expand participation from international actors, and improve overall market performance.

In sum, the relevance of this research lies in its ability to translate academic institutional analysis into policy proposals that are both technically feasible and politically actionable. The insights generated can inform regulatory design, donor engagement, and project development strategies in Indonesia—and may also serve as a

template for improving procurement processes in similarly structured energy systems elsewhere.

7.5. Limitations

This study is subject to several limitations that shape the interpretation and applicability of its findings. While the analysis aims to provide a robust institutional diagnosis of Indonesia's renewable energy procurement process, it remains exploratory in nature and should be understood in context.

Policy and Political Context

The findings are situated within the policy environment under President Joko Widodo, whose administration emphasized renewable energy growth while maintaining strong ties to coal-based infrastructure. The transition to President Prabowo Subianto may introduce shifts in regulatory enforcement or political priorities. However, Indonesia's overarching climate commitments—particularly the Net Zero Emissions (NZE) 2060 target and the 2060 electricity sector roadmap—are expected to remain in place. This continuity provides a degree of stability for institutional reform, but the pathways and timelines may evolve with future administrations.

Legal Feasibility and Implementation Assumptions

The feasibility of proposed policies was assessed qualitatively, based on existing regulatory instruments and stakeholder feedback. No formal legal analysis was conducted to confirm the precise authority or drafting requirements needed for implementation. While many proposals align with current ministerial or executive powers, the actual steps required to codify reforms—particularly those involving PLN restructuring or land processes—would require further design and institutional buy-in.

Policy Interactions and Bundling Effects

Policy alternatives were analysed individually to clarify their distinct effects. However, this approach does not fully capture potential synergies or trade-offs between policies. Some interventions may be more effective when implemented together—for example, combining land acquisition support with improved feasibility studies could significantly reduce developer risk. Future work should examine how different policy mixes interact, especially in contexts where reforms must be staged or politically sequenced.

Reliance on Interview-Based Validation

While expert interviews added valuable insight and grounded the scenario analysis in real-world dynamics, they also introduced subjectivity. Diverging views were expressed regarding the role of informal networks, the importance of certain bottlenecks, and the feasibility of specific reforms. Triangulation with regulatory analysis helped mitigate bias, but some interpretations—especially around implementation feasibility—may reflect individual perspectives rather than generalizable trends.

Source Diversity and Data Consistency

The study draws from a wide range of sources—including academic literature, government regulations, and industry reports—that do not always converge on a single interpretation of Indonesia's renewable energy landscape. Discrepancies between sources required judgment calls to reconcile conflicting information. For example, academic and industry accounts sometimes diverged on the enforcement of pricing rules or the scope of internal reforms within PLN.

Taken together, this research provides a structured institutional diagnosis of procurement-related barriers to renewable investment. However, the findings should be seen as directional rather than definitive, and future studies should build on this approach with additional legal analysis, political economy modelling, and policy integration studies to further test and adapt the recommendations offered here.

7.6 Future Research Directions

This study focused on procurement reform as the most tractable institutional obstacle to renewable energy development in Indonesia. However, several equally critical bottlenecks—particularly coal overcapacity and transmission infrastructure limitations—were identified in Chapter 5 but excluded from the scenario analysis due to their structural complexity. These issues represent promising areas for future institutional research using a similar methodology.

Institutional Approaches to Coal Overcapacity

Overcapacity in Java-Bali, driven by legacy coal contracts and take-or-pay provisions, remains one of the most binding constraints on PLN's ability to contract new renewable capacity. While well-documented, this obstacle has yet to be systematically addressed from an institutional design perspective. Future research could use the IAD framework or public economics theory to model interventions that mitigate sunk cost pressures—for instance, through phased renegotiation of PPAs, strategic early retirements, or layered procurement planning. Given the sensitivity of coal-related reforms, such studies would benefit from close stakeholder engagement and political economy analysis.

Transmission Planning and Grid Integration

Transmission constraints were confirmed in the interview process as a limiting factor—particularly for remote, high-potential renewable zones. Yet transmission expansion is influenced by inter-ministerial coordination, spatial planning rules, and long project timelines, making it difficult to incorporate into the procurement-focused analysis presented here. A future application of this thesis' framework could map institutional rules and coordination failures in grid planning, explore the barriers to inter-island connections, and develop phased strategies for transmission prioritization that align with RE targets and fiscal constraints.

Regime Incumbency and Political Economy

This study originally considered—but ultimately excluded—the concept of regime incumbency. The term often implies active resistance by established actors (e.g., utilities or coal lobbies) against renewable electricity investment. While there is limited direct evidence of obstructionist behaviour by PLN, interview data and literature suggest that legacy interests do influence procurement incentives and planning assumptions. Future work might revisit this lens through a political economy or governance-oriented framework, exploring how vested interests shape policy inertia or delay structural reforms, particularly in energy pricing and infrastructure prioritization.

Cross-Sectoral and Comparative Applications

The combined use of WLIF and IAD in this thesis demonstrates how institutional analysis can translate into actionable policy proposals. This layered methodology could be replicated in other emerging markets with single-buyer electricity systems, particularly where policy ambition outpaces institutional capacity. Comparative studies could explore how procurement bottlenecks differ between contexts, what rule-based interventions are most portable, and how regulatory sequencing affects reform outcomes.

Data Quality and Evidence Base

While the use of expert interviews added significant contextual depth to this research, future studies could enhance both the reliability and scope of qualitative validation. First, increasing the number of interview participants would improve triangulation and help surface a broader range of institutional perspectives—particularly from ministries or financing institutions that were underrepresented in this thesis. Second, incorporating structured interview protocols or comparative scoring exercises could support more consistent evaluation of institutional obstacles and policy scenarios. Finally, improved access to internal planning documents, project-level data, or unpublished policy drafts could offer stronger empirical grounding for both obstacle identification and policy feasibility assessments. Together, these improvements would deepen the evidentiary base and enable more robust institutional analysis in similar settings.

In short, while procurement reform offers a concrete entry point for institutional intervention, Indonesia's energy transition is ultimately shaped by a broader set of interlocking constraints. Future research can build on this study's approach to address those challenges through grounded, actor-focused institutional analysis.

8. Conclusion

This chapter summarizes the main findings of the research by directly answering the three sub-questions and the overarching research question. The answers are based on the institutional analysis, scenario-based evaluation, and expert validation conducted throughout the study. The chapter closes with targeted recommendations for key actors involved in Indonesia's renewable electricity sector.

Sub-question 1: What is the socio-technical system of the electricity sector?

Indonesia's power sector is dominated by PLN, a vertically integrated state utility with control over planning, procurement, and operations. The system operates under a single-buyer model with limited competition and high reliance on coal, especially in Java-Bali, where overcapacity reduces PLN's incentive to contract new renewable projects. Renewable potential exists across the archipelago, but transmission gaps and fragmented grid systems hinder integration. Institutional governance is shaped by overlapping mandates across ministries and slow procedural reform. These structural and institutional conditions create uncertainty and reduce the investment appeal of renewable energy projects.

Sub-question 2: What are the main obstacles to renewable electricity investment?

Main obstacles identified are 1) Overcapacity and Solvency Constraints, 2) Procurement Procedure Inefficiencies, 3) Transmission Infrastructure Gaps, and 4) A Lack of Government Commitment. These obstacles were uncovered through WLIF-based system analysis and confirmed through expert interviews. Overcapacity limits PLN's willingness to initiate new projects, while opaque and selective procurement rules create uncertainty for developers. Transmission constraints make it difficult to connect high-potential renewable zones, especially in eastern Indonesia. Meanwhile, shifting priorities and limited coordination across ministries contribute to weak policy credibility and planning misalignment.

Sub-question 3: What are the most feasible policies to reduce the main obstacles to renewable electricity investment?

This thesis recommends four targeted reforms: 1) Levelling the Playing Field Through Feasibility Study and Land Acquisition Support; 2) Centralized and Transparent Tender Management with Defined DPT Timelines; 3) Improved Bid Evaluation Practices and Decoupling from Localized Generation Cost Benchmarks; 4) Standardized Renewable Energy PPA Templates Based on International Best Practice. These measures directly respond to institutional bottlenecks identified through IAD analysis. Each intervention is designed to be legally feasible, fiscally contained, and scalable within PLN's current mandate. Collectively, they offer a practical route to reduce risk, improve access, and align procurement with national renewable targets.

Main Research Question: What policies can the Indonesian government apply to reduce the main institutional obstacles to renewable electricity investments?

This thesis finds that Indonesia's renewable electricity investment landscape is shaped more by institutional misalignment than by technical or financial limitations. Through a multi-step process combining system-level mapping, institutional rule analysis, and scenario-based policy evaluation, the research identified a small set of policy interventions that directly address rule-based inefficiencies in procurement. These reforms respond not only to observable barriers—such as procedural delays, legal uncertainty, and asymmetric risk—but to the deeper incentive structures within PLN and its regulatory environment that perpetuate them. While the final recommendations centre on targeted changes to how tenders are issued, evaluated, and supported, their real value lies in how they reshape the behaviour of both PLN and developers within existing institutional constraints. In doing so, the study demonstrates a practical pathway for Indonesia to unlock more consistent, transparent, and bankable renewable electricity investment—an essential step toward achieving long-term decarbonization goals such as NZE 2060.

Recommendations

Based on the institutional analysis and validated policy evaluation, the following actor-specific recommendations are proposed to reduce procurement barriers and improve renewable electricity investment outcomes in Indonesia:

Ministry of Energy and Mineral Resources (MoEMR):

- Develop and mandate standardized PPA templates for renewable energy, with clear clauses on curtailment, tariff adjustment, and termination.
- Introduce revised bid evaluation guidance that reduces reliance on historical tariff benchmarks and encourages value-based assessments.

PLN (Head Office and Regional Units):

- Establish a centralized tender portal with transparent timelines, clear eligibility criteria, and early RfP announcements.
- Provide feasibility studies and land for planned tenders, using a cost-recovery mechanism for successful bidders to reimburse PLN.

Ministry of State-Owned Enterprises (MoSOE):

- Reinforce the procurement transparency mandate as part of PLN's corporate performance targets.
- Support internal coordination reforms to reduce bottlenecks between regional and head-office tendering processes.

International Donors and Climate Finance Institutions:

- Provide technical assistance for implementing transparent tendering systems and legal reform of PPA templates.

- Consider targeted funding for early-stage project preparation, including land screening and environmental assessments, to reduce upstream risks for developers.

These actions require no major legislative overhaul and can be implemented through executive mandates, ministerial regulations, or internal corporate reforms. They collectively aim to reduce transaction costs, improve investment certainty, and align procurement practices with Indonesia's renewable energy ambitions.

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Appendix

A. Actor Analysis

1. Actor Relationships

Table A.1 Actor Relationships.

Actor	Formal Relationship with Other Actors	Key Responsibilities and Influence
Presidential Office	• Influences energy policy and strategy (e.g., RUEN, KEN) and appoints key ministers. • Can override or amend regulations impacting the energy sector. • Provides overall direction for national energy policies. • Engages in high-level coordination with ministries and national agencies.	• Sets national energy policy and regulatory frameworks. • Appoints ministers and key officials. • Guides policy implementation and can drive changes in regulations and priorities.
Parliament (DPR)	• Approves laws and regulations alongside the Presidential Office. • Engages with lobbying groups including energy corporations. • Plays a role in shaping the legislative framework for the energy sector.	• Enacts legislation affecting the energy sector. • Represents diverse political interests, influencing energy policy debates and outcomes. • Reviews and approves national budgets.
Ministry of Energy and Mineral Resources (MoEMR)	• Regulates the entire energy sector, including issuing licenses for energy projects. • Approves PLN's RUPTL and oversees its implementation. • Sets tariffs and mandatory sales orders for fossil fuels. • Coordinates with the Ministry of Finance for funding and subsidies. • Engages with BKPM for investment facilitation.	• Oversees energy policy implementation and regulation. • Controls project approvals and licensing. • Manages pricing and subsidies for energy resources.
Ministry of Finance (MoF)	• Provides funding and subsidies for PLN. • Oversees financial incentives for RES development. • Coordinates with BKPM on investment policies and incentives. • Engages with international financial institutions for project financing. • Works with MoEMR on fiscal policies affecting the energy sector.	• Manages national budget and financial support for energy projects. • Regulates financial incentives and investments. • Ensures fiscal stability in energy sector financing.
Ministry of State-Owned Enterprises (MoSOE)	• Sole shareholder of PLN and other state-owned enterprises. • Appoints board members of state-owned enterprises like PLN and Pertamina. • Ensures alignment of state-owned enterprises with national policies. • Monitors the operational efficiency of state-owned enterprises. • Coordinates with MoEMR and MoF on energy policies and investments	• Oversees state-owned enterprises. • Appoints leadership and guides strategic alignment. • Monitors and ensures compliance with national policies.

Indonesia Investment Coordinating Board (BKPM)	• Facilitates and regulates investment in the energy sector. • Coordinates with MoF and MoEMR for investment incentives. • Issues permits and licenses for energy projects. • Manages risks associated with foreign investments. • Engages with international and local investors to promote energy sector investments. • Coordinates financing pathways with international and domestic financial institutions.	• Regulates and promotes investments. • Facilitates permit issuance and compliance. • Coordinates investment incentives and financial stability in energy projects.
PLN (State Electricity Company)	• Operates under regulatory oversight of MoEMR. • Prepares and implements the RUPTL. • Signs and manages PPAs with IPPs. • Receives subsidies and funding from MoF. • Engages in policy discussions and implementation with MoSOE and MoEMR. • Coordinates with regional governments for regional energy planning. • Manages grid infrastructure and electricity distribution.	• Monopolizes electricity generation, transmission, and distribution. • Implements national energy plans (RUPTL). • Manages and negotiates PPAs with Developers. • Coordinates grid management.
Renewable Independent Power Producers (IPPs)	• Compete for PPAs under PLN's RUPTL. • Regulated by MoEMR for project approvals and tariffs. • Coordinate with BKPM and MoF for investment and financing incentives. • Engage with regional governments for local approvals and compliance. • Seek funding from domestic and international financial institutions under oversight of BKPM and MoF. • Sell power to PLN or directly to consumers, depending on infrastructure requirements.	• Develop and operate renewable energy projects. • Engage in PPAs and direct power sales. • Coordinate with multiple stakeholders for project approvals and financing.
Mining and Drilling Corporations	• Subject to mandatory sales orders and price caps by MoEMR. • Engage with PLN and IPPs for fuel supply contracts. • Coordinate with regional governments for local regulatory compliance. • Can influence policy through lobbying efforts. • Collaborate with developers and investors for renewable energy projects on mining sites.	• Supply fuel for energy generation. • Engage in contracts and compliance with MoEMR regulations. • Influence energy policy and participate in RES projects.
Regional Governments	• Develop regional energy plans (RUKD) that align with national plans (RUKN) and RUPTL. • Provide local permits and approvals for energy projects. • Coordinate with PLN and developers for regional energy needs and project compliance. • Create local tax incentives for RES projects. • Engage with MoEMR for alignment and compliance with national energy policies.	• Develop regional energy strategies. • Provide local permits and incentives. • Ensure compliance with national energy plans and support local RES development.
National Energy Council (DEN)	• Advises on national energy policies and strategies. • Works closely with MoEMR and Presidential Office. • Engages with stakeholders across the energy sector for policy input and feedback. • Plays a key role in the formulation of energy policy documents like RUEN. • Coordinates with regional and national authorities to ensure cohesive energy planning and policy implementation.	• Advises on energy policy. • Coordinates energy planning and stakeholder engagement. • Facilitates the formulation of national energy strategies.

International Financial Institutions	• Provide grants, loans, and technical assistance for energy projects. • Coordinate with MoF and BKPM for project financing and regulatory compliance. • Engage with developers and investors for project funding and development. • Influence policy through financial and technical support for RES projects. • Work with multiple stakeholders for alignment with national energy goals and compliance.	• Provide funding and technical assistance for energy projects. • Coordinate with national authorities and developers for project implementation. • Influence policy through financial support.

2. Actor P/I summaries

Presidential office

In Indonesia the presidential office has a great deal of executive power and influence. Besides being able to appoint ministers the president is able to create and revoke regulations imposed on the power sector. Generally, the presidential office has a great deal of influence in parliament as well when it comes to stimulating debate and bringing attention to new policy proposals (Bridle et al., 2018). This means that the president is the most powerful actor in the government when it comes to the creation of energy policy and regulations. Historically the priority of the presidential office has been to keep power prices low by subsidizing PLN to sell power at low rates in the form of tariffs. In order to keep government spending in check it is beneficial for PLN to have the lowest possible generation costs, which has meant a historical reliance on cheap domestic coal production for generation. The presidential office is highly involved in the formulation of energy strategies like the RUEN and CIPP and is also the president of the National energy council (NEK) (Bridle et al., 2018). It is very important to note that as of writing this article a new president has been elected with significantly differing views, mainly on geopolitical and strategic independence, to the president of the last 10 years and how this will affect energy policy is not clear at this moment. The impact on policy is expected to be significant.

Power 9, The presidential office has the highest possible degree of regulatory authority, legislative authority, political influence and is highly involved in policy creation and strategy.

Interest 7, Energy policy has historically been very important to the popularity of the sitting president with the population wanting cheap electricity and external pressure to transition to sustainable sources being significant. However it remains one of many important topics for the president.

Parliament

Has the power to propose ad approve laws together with the president. Incentives and interests are highly fractured due to the variety of political parties and lobbying interests making this a relatively unmotivated actor on the part of energy policy. Coal lobbies have historically held some sway over parliament which should be noted (Bridle, 2018).

Power 8, Legislative authority and can oppose presidential regulations. Less powerful than the president because Parliamentary action is contingent on the will of the coalitions which have diverse interests and opinions.

Interest 3, Parliament has a very divided set of opinions in terms of what energy policy should look like as well as a generally low level of knowledge which results in not much action being taken(Bridle,2018)

Ministry of Energy and Mineral resources

The main regulatory body for all energy infrastructure as well as mineral resource extraction. Responsible for approving PLN's energy plan RUPTL which decides schedules for retirement, expansion and addition of power plants in the various regions of Indonesia (Jakob and Steckel, 2020 as cited by Kieron Funk, 2022). The MoEMR also regulates the contracts or 'PPAs' that developers must sign with PLN. Feed in tariffs paid by PLN as well as consumer electricity prices must also be approved by this ministry. Mandatory sales orders and price caps for fuel are regulated by it as well(Laan et al., 2011). This Ministry is very important as an actor as it is often the agent that plans and implements presidential energy strategy through its regulations. It is also deeply involved in the formulation of energy strategy plans like the RUEN, KEN and CIPP (Bridle et al. 2018). As the main overseer for PLNs activities this ministry also plays a crucial role in the operations of the energy market.

Power 7, Has regulatory authority over the electricity and fuel markets which is subject only to the presidential office. Provides a high degree of autonomy.

Interest 7, MoEMR is clearly interested in the stimulation of RES investments as they have set renewable targets like 23% by 2025(RUEN). The ministry also created incentives and funding structures in order to stimulate investment from overseas. However their pace of progression on certain matters that may oppose PLN interests like power wheeling has been noticeably slow.

Ministry of Finance

The MoF is responsible for the financing of the Indonesian government. In terms of energy policy this relates to the financial support of the loss-leading PLN in the form of subsidies, the allocation of grants, loans and assistance given to the government for development of RES, regulation of private investment into IPPs and creation of tax incentives for stimulation of RES (Ordonez et al. (2021)). This means the ministry has many tools with which to influence the electricity sector. Historically the MoF has been very concerned with the indebtedness of PLN which stems from unexpected losses that needed to be covered by short to medium term loans with domestic banks, thus increasing the costs incurred by PLN through interest payments (Bridle, 2018). This means that the MoF is largely incentivized to reduce operating costs of PLN by either raising electricity prices or prioritizing development of cheap energy plants like CFPPs. Any incentive to assist with emission reductions will be largely on behalf of the presidential office.

Power 6, The MoF has the authority to create fiscal regulations that can significantly affect the energy market, as well as a role in keeping PLN afloat with subsidies.

Interest 6 The MoF is largely interested in reducing the number of subsidies PLN requires to operate and reducing its indebtedness which poses issues for the ministry (Bridle, 2018)

Ministry of State-owned Enterprises

This actor is responsible for the state-owned enterprises in Indonesia on behalf of the central government. The ministry is in fact the sole shareholder of any state owned enterprise (PLN, w.d.). This means that Pertamina and PLNs boards of directors and boards of commissioners are both appointed by the MoSOE. The ministry is responsible for making sure the SOEs are aligned with the goals of the central government as well as

monitoring the operations of these enterprises to ensure they are run efficiently and according to regulations. Due to this ministry effectively having a lot of power and influence over actors like Pertamina and PLN this actor in a formal sense indirectly has a large amount of influence. However, this influence is limited in practice due to the complexity an size of the SOEs, as well as the ministry having a lack of options for corrective or punitive measures on them.

Power 5, Is sole shareholder of Pertamina and PLN which are important players in the electricity sector. However, only has indirect control through board appointments and other measures.

Interest 5, Is primarily focused on maintaining operational efficiency and compliance of the SOEs, not particularly focused on energy strategy or governance.

Ministry of Investment (BKPM)

The Indonesia Investment Coordinating Board (BKPM) as an actor plays a significant role in the development of renewable energy sources (RES) by facilitating and regulating investments. BKPM simplifies the investment process through issuing necessary permits and licenses, aligning projects with national energy policies. It can administer financial incentives like tax holidays and import duty exemptions, which can help attract investment in renewable energy. BKPM attempts to coordinate between international and local stakeholders, to foster partnerships that bring advanced technologies and funding. It has regulatory authority to ensure investment structures are compliant with national laws (Kresna Panggabean, 2019). Additionally, BKPM manages risks associated with RES investments, with the goal of enhancing investor confidence and stability in the sector. By influencing policy implementation, investment facilitation, and market competitiveness, BKPM is a relevant actor however it does not have the formal authority to alter the most crucial regulations like the MoEMR.

Power 5, The degree of formal authority the BKPM has to exert over PLN and the power sector is small but not insignificant. Therefor it scores decently in terms of power but significantly less than parties that exert more direct influence in the sector.

Interest 8, This ministry has a goal of attracting investors to Indonesia for a variety of projects. If there is significant foreign investment it is a sign of success for the BKPM which leaves them highly incentivized to promote foreign funded RE projects.

National Energy Council

Advises on national energy policies and strategies. Works closely with MoEMR and Presidential Office and the president and minister are Chair and Vice-chair of the council respectively. Engages with stakeholders across the energy sector for policy input and feedback. Plays a key role in the formulation of energy policy documents like RUEN. Coordinates with regional and national authorities to ensure cohesive energy planning and policy implementation. Coordinates energy planning and stakeholder engagement. Facilitates the formulation of national energy strategies.

Power 5, The National Energy Council largely exists as a coordinator between the president's office, MoEMR and other government entities on the topic of energy. Its goal is to offer advice and coordinate plans rather than affect change on its own. Its board members are the president himself and the head of the MoEMR however, so it is assigned a notable degree of power.

Interest 8, It is highly involved in planning and coordinating policies and governance of the Energy sector including RES development.

Regional governments

Despite energy policy being centralized in Indonesia regional authorities do have some formal authority. They are responsible for developing the RUKD which the regional electricity supply plan. The national electricity supply plan or RUKN must take these regional plans into account (Bagaskara and Makahekum, 2024). PLNs RUPTL in turn must be within the bounds of the RUKN and thus the RUKDs to be approved. This gives regional government a certain level of influence over the final content of the RUPTL. As a regional authority they also have the power to create tax incentives and implement other policies in order to stimulate RES investment on a regional scale.

Power 5, They have influence in the development of the RUKD's however PLN and MoEMR do have final say limiting the degree of formal authority they can exercise.

Interest 5, Energy policy and RE development is largely a national affair managed by the President, MoEMR and PLN. Regional governments are not very invested in the process. Regional development plans were instituted in order to create more ownership in terms of energy policy but most of the regions have not even written one yet (Setyowati &Quist, 2022)

PLN

PLN is the state-owned monopoly that is responsible for the planning, maintenance and operation of the national grid. PLN is not only responsible for generation of over 80% of Indonesia's power but also the largest domestic consumer of coal. PLN makes the RUPTL, energy supply and balance plane, which is responsible for ensuring sufficient capacity in the future based on demand projections. It is also highly involved in policy design and formulation of regulations by other government actors (Bridle, 2018). It is a requirement for new PPAs to be congruent with this plan, otherwise developers cannot construct new plants. Any developer wishing to sell power via the grid can only do so by selling it directly to PLN through the formation of an IPP. This means that PLN is the only option for IPPs to sell to giving PLN massive leverage in negotiations. Tender processes for new power plants are managed by PLN, however there are situations where acquisitions can be made through direct selection and direct appointment which give PLN even more influence over the outcome (PR112/2022).

Due to the fact that PLN is a state-owned enterprise and falls under regulatory purview of the MoEMR one might expect it to be devoted to the cause of the presidential office however in the past this has been proven false numerous times (Bridle, 2018). In reality PLN has a great deal of autonomy and influence over government actors. Due to PLNs nature as a monopoly the incentives are such that PLN will likely prioritize maintaining its monopolistic position and reducing its dependence on the government for funding by keeping energy costs low. This means that PLN is likely to oppose any policy that allows other actors to operate on grid infrastructure or reduces PLNs independence to operate with lowest possible losses. It must however still abide the regulations that are passed by the presidential office and MoEMR. Another reason PLN is ineffective at increasing RES development is likely a lack of means in the forms of funding and expertise (Bagaskara and Makahekum, 2024).

Power 8, PLN is responsible for nearly all of the policy implementation at the governance level. It is also highly influential in the development of the policies themselves such as the RUPTL, the most important national energy plan.

Interest 8, PLN must ensure cheap access to power for the population of Indonesia and therefor plan ahead. It is also responsible for realising the administrations RES goals. Therefor it must be considered highly interested.

Renewable Independent Power Producers

These actors are generally private companies which leverage financing schemes to construct a power plant and sell the power it generates to PLN for a profit. The price is agreed upon in a PPA which is generally a 10-year contract. For these actors to successfully construct an operational power plant they are reliant on many other actors. The plant capacity and location must be congruent with the RUPTL which is created jointly by PLN and the MoEMR (Bagaskara and Makahekum, 2024). The operator must obtain an IUPTL license in order to connect to national power infrastructure. The power must be sold under set price ceilings to qualify for a PPA(PR112/200). They must get approval from regional authorities and the MoEF (Ministry of Environment and Forestry) for construction. A certain number of resources used for the plant must come from Indonesia (Minister of Industry, 2023). Because financing must be available through grants, loans or assistance through the government or direct investment these actors are not considered very influential or powerful in the energy sector. Their main leverage is that governments, development banks and private institutions around the world are willing to give the Indonesian government financial assistance in order to further the RES development in the nation meaning the government must make these funds available and adjust regulation so that IPPs can compete in the market to an extent (JETP, 2023). These actors are incentivized to support policy that undermines the dominance of PLN over grid infrastructure, raises the price plants pay for coal and gas and sets emissions quotas that force PLN to reconsider the current energy mix.

Power 3, These actors have no formal power and also have a weak negotiation position compared to PLN who is the sole buyer of electricity with the exception of captive generation.

Interest 9, The goal of IPPs is to make a profit on developing RE plants through PPA contracts with PLN, these actors are highly interested in the dynamics of the power sector and increasing RE.

Mining and drilling corporations

In Indonesia, mining corporations exert influence over the development of RES. Mining companies often possess significant financial resources and established infrastructures. However, mining corporations likely hinder RES development due to their vested interests in fossil fuel resources, potentially lobbying against policies that favour renewables to protect their existing investments in coal and other non-renewable energy sources. This conflict of interest can lead to policy resistance and a slower transition. Furthermore, environmental degradation caused by mining activities can limit the availability of suitable sites for RES development, adversely affecting the growth of the sector led by renewable focused private developers. As an actor they have no formal authority over energy policy, however with their lobbying power they can exert an undetermined but likely significant amount of influence over Parliament and relevant Ministries (Bridle,2018).

Power 4, No formal power but they are entrenched wealthy actors with many political connections and powerful lobbying capabilities

Interest 4, These actors benefit from the export of coal and are not necessarily keen on halting RES progress in order to maintain domestic consumption as this is not under threat and the prices they get domestically are lower than the international market.

Overseas Financial institutions

Provides grants, loans, and technical assistance for energy projects. Coordinates with MoF and BKPM for project financing and regulatory compliance. Engages with developers and other investors for project funding and development. Influences policy through financial and technical support for RES projects. Works with multiple stakeholders for alignment with national energy goals and compliance. Provides funding and technical assistance for energy projects. Coordinates with national authorities and developers for project implementation. Influences policy through financial support.

Power 6 These actors wield significant influence on the sector as they determine what IPP projects are feasible for development. They also have the funds to effectively lobby the government and affect change.

Interest 6 These actors are quite interested in developing markets such as Indonesia where growth is happening much faster and are also keen to meet goals for renewable investment depending on the organisation. The institutions that are in the JETP are a good example.

B. Desk Research

In order to properly carry out an analysis of relevant institutions and actors primary and secondary sources were be crucial. Many of relationships and power balances between the actors mentioned are codified into laws and regulations. These are often available in English however very recent changes may prove challenging to find, in this scenario secondary sources must be relied on along with triangulation to determine accuracy.

1. Legal Framework Desk Research Summary

Energy strategy and planning documents: KEN, RUEN, RUKN, RUED, RUKD and RUPTL.

Based in Indonesia's *Energy Law 3/2007* a tiered set of energy plans is made and maintained in a centralized manner, see *Appendix B.3: figure B.2* for an overview of these documents. At the top the national energy council and the presidential office draft the KEN, which outlines the nations long term energy goals in the form of a policy. These things include targets for renewable energy capacity and total generation capacity based on growth projections. KEN 2014 stipulates 23% renewable energy mix in 2025 and 31% in 2030 as targets. The Ministry of Energy and Mineral Resources is then responsible for implementing this plan through the creation more detailed lower tier plans.

The RUEN, national energy general plan, and the RUKN, national electricity plan, are then drafted by the relevant ministries to show how the goals in the KEN are to be reached. These plans contain regional demand projections and capacity expansions based on energy or fuel type. According to Indonesian law PLN may only schedule plant construction and contracts that are congruent with these plans.

The RUED and RUKD are the regional versions of the previous plans. These are drafted with the MoEMR and the regional government in order to be congruent with the national plans, PLN is generally also involved. The RUKN is altered to reflect the regional plans. The level of autonomy regional governments have in their respective energy plans is limited as the MoEMR has the final say (Setyowati and Quist, 2022).

The RUPTL is the electricity supply business plan. Drafted by PLN and approved by the MoEMR this document has the nations current power supply mapped out on individual plant level as well as all planned capacity expansions with timelines, demand projections and businesses involved. According to PR 112/2022 development of new CFPPs is prohibited apart from any plants which were scheduled prior.

Fuel subsidy: DMO/DSO, Coal price cap, Pertamina

The Indonesian power sector is heavily subsidized by Domestic Market Obligations for fuel production and price ceilings for domestically sold fuel to power plants and important industries. The most relevant fuel source for power is coal however similar schemes exist for oil and gas which is sold by the SOE Pertamina.

MEMR 34/2009 gives the MoEMR authority to demand mining companies sell a percentage of annual projected coal production on the domestic market. The percentage is determined yearly by the MoEMR but has been around 25%. This regulation also creates a cap-and-trade mechanism where companies that have not met the quota and purchase mining credits from companies that have exceeded it (Atteridge et al., 2018). Mining companies that fail to comply face strict sanctions and penalties including a cut of 50% in maximum production permissions the following year (Global trade alert, 2009).

Coal prices are capped according to *Government Regulation No. 23/2010* which states that the benchmark price for domestic sales will be established under further Ministerial Regulations (Permen). This led to *Permen No. 17/2010* (as amended by *Permen No. 19/2018* and *Permen No. 11/2020*), which provided that the price of domestic sales was to be linked to international market prices. *Permen No. 17/2010* sets out the procedures and formulas for determining the domestic price, with the key points summarized as follows: 1) The price is based on the government's monthly reference export price for high-quality coal—the Harga Batubara Acuan (HBA); 2) To accommodate for variation in coal quality, the price of coal of lower CV is scaled down from the HBA based on the formulae set out in the regulations, CV being the main driver of the price adjustment; and 3) The domestic price is applicable to spot and long-term sales. For long-term sales, the price is based on a weighted average of prices in periods prior to contract signing, and pricing reviews are permitted over the term of the contract (CIPP, 2023- *page 178*).

The price caps set for coal at 70$ per tonne for coal sold to PLN and 90$ per tonne for domestic industry (Reuters, 2023). This is relatively far below market rates. Additionally

due to the reference price for coal being in USD, price fluctuations as a result of exchange rate changes are possible (Yustika, 2024a*)*.

Market Regulations: PLN single buyer, PLN tender, IPP, IUPTL, Industry energy sale, ETS

PLN is the company that is entrusted with the task of guaranteeing the Indonesian people with affordable and accessible electricity through the authority of *Energy Law 3/2007*. Power generated in Indonesia is sold to PLN which then distributes this to consumers at tariffs set by the MoEMR. In addition, *Energy Law 30/2009* states exceptions which allow for generators that have been allocated to a specific business area to sell to other parties than PLN. Captive generation where the generated power is consumed by the same facility is also permitted.

PLN outsources part of domestic generation to IPPs through a public private procurement process. *MEMR 1/2006* as amended by *MEMR 4/2007*, *MEMR 3/2015* and *PR112/2022* stipulates how PLN may make tenders available (Norton Rose Fulbright, 2015; Assegaf Hamzah & Partners, 2022). There are three tender processes PLN must use for new energy projects: 1) Direct appointment in which a company is simply selected to carry out the project, 2) Direct selection where a limited group of companies, selected by PLN, may bid on the project and 3) Tender where PLN makes a public announcement and draft agreement for the project which any company can compete for.

The use of methods 1 and 2 are restricted by the *PR112/2022* mentioned above with Direct Appointment being limited to capacity expansions and certain types of renewable energy like geothermal and hydroelectric generators while Direct Selection encompasses most other renewable generators like solar PV, wind and biofuels (Appendix B.3 *Figure B.1*).

For a power plant to be set up various licences must be acquired, and several requirements must be met (Norton Rose Fulbright, 2015). The most relevant to energy projects however is the question of land acquisition which is subject to *Law 2/2012* on Land Procurement in the Public Interest which gives the government authority to procure land when it is in the public interest as well as lease it to private companies. *PR 38/2015* allows the government to help private companies procure land as a part of the PPP.

Guarantees: PPP, Partnership, Fast-Track Program

Foreign investors in IPPs can obtain financial guarantees from the Indonesian government that PLN will make good on the agreed upon PPA despite PLN's solvency issues. Initially there were 2 methods to do this:1) to be on a fast-track list which warrants the business viability guarantee issued by the Minister of Finance (MOF); and 2) the relevant IPP project was listed as a public private partnership (PPP) project, a

package of two guarantees provided by the Indonesia Infrastructure Guarantee Fund and the MOF. These rights are provided by regulations *MoF Regulation No. 173/PMK.011/2014* and *Government Regulation No. 29 of 2000*(as amended by *Government Regulation No. 59 of 2010*) respectively (Norton Rose Fulbright, 2015).

In 2016 however *PR 4/2016* was added to provide opportunities for the many projects that did not qualify for these guarantees. This regulation allows for PLN to apply for a guarantee by MoF for any project listed in the RUPTL (Baker McKenzie, 2021). However, according to an IEEFA report it is an informal requirement that the IPP is created in collaboration with a subsidiary of PLN which is at least 51% PLN owned (Yustika, 2024b).

ETS: Carbon market, emissions caps, carbon credits

Since September 2023 Indonesia has implemented an emissions trading system. MEMR 16/2022 is the sector regulation for pricing and carbon markets. It establishes emission thresholds for the electricity sector in the form of carbon emissions caps, notably only applied to CFPPs in 2023-2024, and determines which businesses can obtain tradeable credits when their emissions are below the threshold. The thresholds for CFPPs connected to PLN's grid are stipulated in MEMR Decree No. 14.K/TL.04/MEM.L/2023, with the 2024 emissions cap for CFPPs with greater than 400MW capacity being 0.911 tons CO2e/MWh (Draps et al., 2023).

These regulations are given their authority by the framework regulations *MEF 21/ 2022* and *PR 98/2021* on the Implementation of Carbon Pricing.

Energy tariffs: LCOE matching, Renewable price ceiling, PLN price setting, PLN subsidy

PLN may only add generation capacity when the cost of power per KWh is equal or lower to the levelized cost of electricity in the region the added capacity is planned. This is done to guarantee PLN does not make decisions that raise the cost of energy which will negatively affect its finances. *PR 112/2022* decouples renewable energy sources from this requirement and rather sets ceiling prices for these renewable generators that are then multiplied by a factor depending on the region.

Energy Law 30/2009 gives the MoEMR authority to determine the energy tariffs which the consumers must pay to PLN. This together with PLN's generation and transmission costs determine PLN's yearly deficit. The utility is then compensated for this difference by the MoF as is stated in *Energy Law 3/2007*.

Foreign restrictions: ownership, labour and equipment

MEMR 11/2024 states that all energy infrastructure in the public interest is subject to domestic production requirements, meaning captive generation is exempt from the regulation. PLN owned plants as well as IPPs are required to use specified proportions of domestic goods and services in the construction and operation of power plants. The Minimum Local Content Threshold for each type of power infrastructure is stipulated in

MEMR issued Decree 191/2024, with 20% for Solar, 15% for Wind, and 18.83% for CFFPs over 600MW(Draps et al., 2024). It is important to note that this is a very recent regulation which supersedes *MOI 54/2012* that generally had much higher thresholds of 40-60% for most infrastructure elements, making this a very large and recent shift in policy.

MEMR 11/2024 makes general exceptions to the required thresholds under the following conditions: 1) The goods required are not produced domestically; 2) the technical specifications of domestically produced goods do not meet the project requirements; and/or 3) domestic production cannot meet the demand as confirmed by the relevant manufacturer or association of manufacturers (Draps et al., 2024). Case dependant exceptions can be made for project funded by foreign loans or grants when specified in the loan/grant agreement. This is exemption is possible provided the project will 1) supply power for domestic demand, entirely or in part, *and* 2) at least 50% of the funding is coming from multilateral or bilateral creditors (such as development banks, financial institutions etc.)

Foreign ownership of assets is also regulated under *PR 39/2014* which imposes limits on foreign ownership of power plants, with restrictions varying by plant size and type. For example, foreign ownership is capped at 49% for plants under 10 MW, while larger projects can have up to 95% foreign ownership, and public-private partnership (PPP) projects under 100 MW may be wholly foreign-owned (Norton Rose Fulbright, 2015).

Land rights in Indonesia are restricted for foreign entities. There are 3 types of land rights for registered land in Indonesia: 1) Right of ownership, similar to the Western concept of ownership, is strictly limited to Indonesian nationals; 2) Right of building, allows use of the land for 30 years, is available to companies and foreign owned entities as well as Indonesian nationals; 3) Right of use, which is grants rights for 20 years, is also available to the same parties as Right of Building. Much of Indonesian land however falls under Unregistered Land, which must be converted into registered land before rights can be allocated.

Regulations leading to overcapacity

The 35GW program, Fast Track I & II are policies that were implemented with the specific goal of expanding Indonesia's energy capacity to match high energy demand projections made from 2000-2016. It provided financial guarantees and other incentives to investors in CFPP's to rapidly increase capacity which led to current severe localized overcapacity on Indonesia's largest grids, Java-Bali and Sumatra (IESR, 2022).

LCOE Matching and Recent Reform

Until 2022, PLN was legally prohibited from purchasing electricity at a price higher than the Levelized Cost of Electricity (LCOE) in a given region—a policy known as LCOE matching. This regulation, introduced under MEMR Regulation No. 50/2017, was originally intended to ensure cost efficiency in electricity procurement. However, in

practice, it became a major barrier to renewable energy investment. Regional LCOEs were calculated based on the generation mix already in operation, which in most areas consisted primarily of coal-fired plants which benefit from artificially low fuel prices. As a result, the benchmark prices were significantly skewed downward, failing to reflect the true cost of renewable project development. This made it nearly impossible for Independent Power Producers (IPPs) to secure Power Purchase Agreements (PPAs) for solar or wind projects, as their cost structures could not compete with legacy coal prices.

In recognition of these limitations, Presidential Regulation No. 112/2022 removed the LCOE matching requirement for renewables and introduced a new mechanism based on technology-specific price ceilings. This reform was a significant regulatory shift, as it decoupled renewable tariffs from regionally averaged coal prices and allowed for a more realistic valuation of renewable project economics. While the new price ceilings remain relatively conservative and may still pose challenges for more expensive or remote projects, the reform nonetheless eliminated a key legal constraint and created greater regulatory space for renewable energy development.

2. Governance Practices Desk Research Summary

PLN Structure and Planning: Organisation, Holdings, RUPTL schedules.

PLN is a massive utility company with a large number of departments, subsidiaries and holdings. PLN operations cover the entire territory of Indonesia. PLN divides its operations among three regions: the Sumatra and Kalimantan region; the Java, Bali, and Madura region; and the Sulawesi, Maluku, Papua, and Nusa Tenggara region. Generation is managed by the PT PLN Holding Subsidiary since 2022 to collect all of PLN's generation assets under one roof. PT PLN Holding Subsidiary has divided its generation assets under 2 subsidiaries: PT PLN Indonesia Power and PT PLN Nusantara Power. Transmission and distribution are managed by PLN. Depending on the region these tasks are divided into transmission units, load-dispatch units and distribution units (PLN, 2022).

PLN schedules its projects based on the RUPTL. The RUPTL is a 10-year plan however it is generally revised on a yearly basis to reflect new goals or realities. This document contains all expansion plans for Generation, Transmission and Distribution infrastructure. According to Dwita (2024) the planning process is as follows:

1) Reference to RUKN – PLN analyses the RUKN to ensure that any plan made is compliant with the document in terms of policies, energy targets and demand projections.
2) Establishing policies and assumptions – PLN Headquarters establishes policies and assumptions based on the RUKN and other relevant governmental policies. These include projections on population growth, electricity demand, GDP growth etc.

3) Electricity load forecasting – Through a bottom-up approach electrical load is estimated for each province by PLN Regional/Distribution units under PLN Headquarters through demand forecast analysis.
4) Formulating plans - Based on demand forecasts plans will be made for expansion or upgrades of generation, transmission and distribution infrastructure.
5) Planning consolidation – Consolidation of the plans to verify and agree upon the demand forecast, capacity balance, substation plans, transmission plans, and isolated power system generation plans produced by PLN for Regional/Distribution/Dispatch Centers. During this workshop, verification of Commercial Operating Date (COD) schedules for PLN and Independent Power Producer (IPP) power plant projects, gas supply estimates from Liquified Natural Gas (LNG)/Compressed Natural Gas (CNG), specific needs, and rental power generation programs to address short-term electricity shortages are carried out.
6) Drafting and Approval of RUPTL: The consolidated system planning product across all PLN business areas forms the Draft RUPTL. The submission for RUPTL approval to the Minister of Energy and Mineral Resources is conducted by PLN Board of Directors. The RUPTL then serves as a reference for preparing the Company's Long-Term Plan (RJPP) for the next five years and as a basis for PLN's annual investment decisions within the Annual Work Plan and Budget (Annual Budget Plan (RKAP)).

RUPTL inclusion of RES capacity investments

The most recent RUPLT document 2021-2030 has a projected increase in capacity 40,575 MW with the majority, about 51.6%, coming from renewables. This is the first RUPTL document that has ever had a majority renewable capacity increase projection. PLNs increasing reliance on IPPs for power generation makes this possible because PLN has relatively lacking human and technical resources for the development of RES in comparison to fossil power plants (IESR, 2024). This is therefor also the RUPTL with the largest share of generation planned through IPPs so far, around 26 MW out of 40 MW. However, it must be noted that the RUPTL's projections stem from 2021 and currently in 2024 PLN is far behind these targets.

Contracting/tendering IPPs by PLN in practice- Guarantees, joint venture, direct selection

The tendering process is done based on the RUPTL and the stated energy targets in the RUKN while also taking the regional plans (RUKDs) into account. Direct Selection is most frequently the procedure that is used. PLN maintains the DPT list (Selected providers) which private companies can apply to be added to. Developers must apply separately for different types of renewable energy, meeting certain administrative, financial, and technical criteria. If the criteria are met, they will receive feedback from PLN within a period of a few weeks to as long as a year from application. When PLN determines it needs added capacity of a certain kind in a given region it makes available a RfP (Request for Proposal) containing the required characteristics which DPT-registered companies can bid on. Lead times until PPAs are mandated to be 90 days for Direct Appointment and 180 days for Direct Selection, in practice these times are not guaranteed. PLN is supposed to make tenders available according to the RUPTL's

timeline or the project risks getting cancelled or disallowed by the MoEMR. However, tenders do not always follow this timeline in practice (Yustika, 2024b).

It is required that the developer issue a bid bond with its proposal in order to take part in the tender process. Bid bonds require the bid winning party to compensate PLN should they fail to meet their obligations. Typically this takes the form of an up front cash deposit for a percentage of the tender price. In practice PLN's requirements of the bid bonds vary depending on the project and have not been transparent. Developers can either provide the cash themselves or use a third party guarantor depending on the bond requirements. Third party guarantors may demand developers provide collateral in the form of cash payments for a portion or the entirety of the bond. Upon signing of the PPA the IPP must issue a performance bond which similarly guarantees adequate performance of the IPP upon commencement of the project (Yustika, 2024).

Financial guarantees can be provided to developers should PLN fail to meet payment obligation under certain conditions. Either the IPP is a Public-Private Partnership (PPP) or PLN or one of its subsidiaries has equity in the project. In the case of the second scenario PLN applies on behalf of the IPP for a guarantee letter from the MoF. In practice PLN interprets this as a requiring a 51% equity share of the project which is financed through a loan to PLN from the investing party. There notably have recent been cases where projects require smaller stakes by PLN but these projects tend to be smaller (CIPP, 2023 – *page 188*)

These financial guarantees are important for developers because their funding often comes from international banks or other foreign parties that benefit from government guarantees in terms of their solvency.

Fossil fuel subsidies

The term 'subsidies' is often used to explain why fossil fuels cost PLN less than the market rate for power generation. However as can be seen in the legal overview, the regulations that lead to cheap coal (and gas to a lesser extent) are not 'subsidies' in the traditional sense where a state provides funds to keep the price of a commodity low. In the current structure coal companies are forced to sell a portion of their supply domestically at sub-market rates to be permitted to produce up to heir quota the following year. The portion these companies can sell on the export market for higher prices makes up for the impact of the domestic market obligations. Therefor it must be understood that conceptually it is the coal mining corporations which are subsidizing the price of domestic coal used by PLN and not the Indonesian government. This structure keeps energy prices low and costs the Indonesian government nothing. It must be understood that this advantage can therefor only be applied to CFPP's and is not transferable to other energy sources like solar etc. This common misconception of the term *subsidies* explains why the Indonesian government doesn't simply shift subsidies from coal to renewable sources.

IPP land acquisition

PLN generally expects the developer to acquire rights to the land for the power plant and the transmission lines to the nearest substation themselves prior to the financial

closing date and formation of the IPP. In practice the land acquisition process is often one of the longest lead times in the development of a such a power project. It is increasingly common for PLN to assist in land acquisition in return for an equity stake in the project (CIPP, 2023 - *page 188*).

RUKD development and lobbyists

In Indonesia regional government have a certain degree of autonomy over their long-term power planning. This is largely through the RUKD which is the regional version of the RUKN or national electricity plan. The RUKD is made with PLN and MoEMR to ensure it fits into the national strategy and is approved by the MoEMR. The influence of PLN and MoEMR is such that regional governments are limited in what they can add into their regional plans should this obstruct the national strategy. Lobbyists such as environmental organizations and coal mining corporations have had influence in the regional governments ambition for their RUKD, where certain regions have fought for more aggressive renewable energy targets and others barely seem interested in meeting the MoEMR minimum targets (Setyowati and Quist, 2022).

Carbon market

In 2023 the emissions caps were limited to a select group of 99 CFPPs which sell or buy credits depending on whether they are above or below the threshold set by the MoEMR. The average secondary market price was 4.45 USD in 2023(ICAP, 2023). This is quite low compared to foreign existing carbon markets and not expected to grow to a comparable amount in the near future. Therefor expected to have a limited impact on the price of coal (Yustika, 2024).

Over-Capacity Issues

Past policy initiatives based on inflated demand projections have resulted in PLN expanding generation capacity through IPP tenders on the Java-Bali and Sumatra grids far beyond what was needed to meet demand and maintain a 15% reserve margin, with both grids having an overcapacity of about 40% (Brown, 2020). This was done with Take-or-Pay schemes which are relatively disadvantageous to PLN in order to obtain funding for the necessary projects. The overwhelming majority of these new plants were CFPP's as this was the cheapest and easiest source to develop at the time. The current situation is that PLN has a large overcapacity for the vast majority of the grid, with long term contracts requiring them to buy power from coal plants regardless of whether the power is needed to supply the grid (Yustika, 2024).

3. Helpful Images

Figure B.1 PLN Tender Procedures(Assegaf Hamzah & Partners. (2022)

Procurement Method	Types of Power Plant	Remarks	Procurement Lead Time
Direct Appointment	1. Hydroelectric power plant – utilising dam/water reservoir or multipurpose irrigation stream constructed by the government; 2. Geothermal power plant; 3. Additional capacity of any renewable energy power plant (except for biofuel); and 4. Excess power of geothermal power plant, hydroelectric plant, biomass, and biogas.	• Tariff is determined based on negotiation but must not exceed the ceiling tariff. • PLN is tasked to purchase electricity from hydroelectric power plant (utilising dam/water reservoir or multipurpose irrigation stream constructed by the government) and geothermal power plant.	90 days
Direct Selection	1. Hydroelectric power plant in general including those designated as load peaker; 2. solar PV; 3. wind power plant; 4. biogas or biomass power plant; 5. tidal power plant; and 6. biofuel power plant.	• Based on the quota capacity stipulated by the Ministry. • Tariff is determined based on the lowest bid but must not exceed the ceiling tariff.	180 days

Figure B.2. Energy Planning Documents Overview (Bagaskara and Makahekum, 2024)

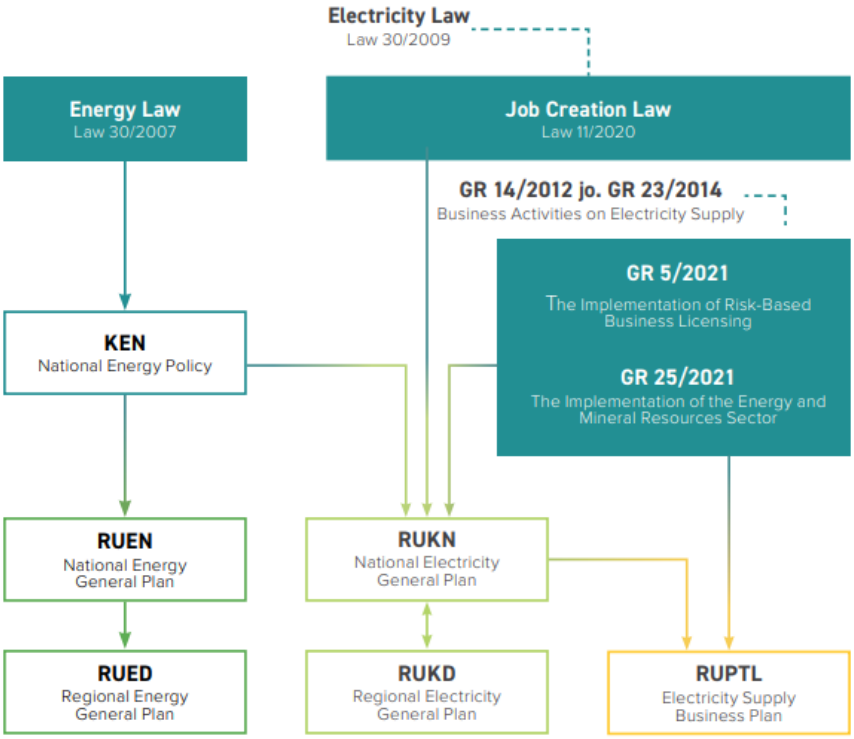

Electricity Law
Law 30/2009
Energy Law
Law 30/2007
Job Creation Law
Law 11/2020
GR 14/2012 jo. GR 23/2014
Business Activities on Electricity Supply
GR 5/2021
The Implementation of Risk-Based Business Licensing
GR 25/2021
The Implementation of the Energy and Mineral Resources Sector
KEN
National Energy Policy
RUEN
National Energy General Plan
RUKN
National Electricity General Plan
RUED
Regional Energy General Plan
RUKD
Regional Electricity General Plan
RUPTL
Electricity Supply Business Plan

Figure B.3 PLN Subsidiaries Overview (PLN Company Profile, 2022)

Figure B.4. PLN Open Tender Process (PLN IPP Procurement Division, 2017)

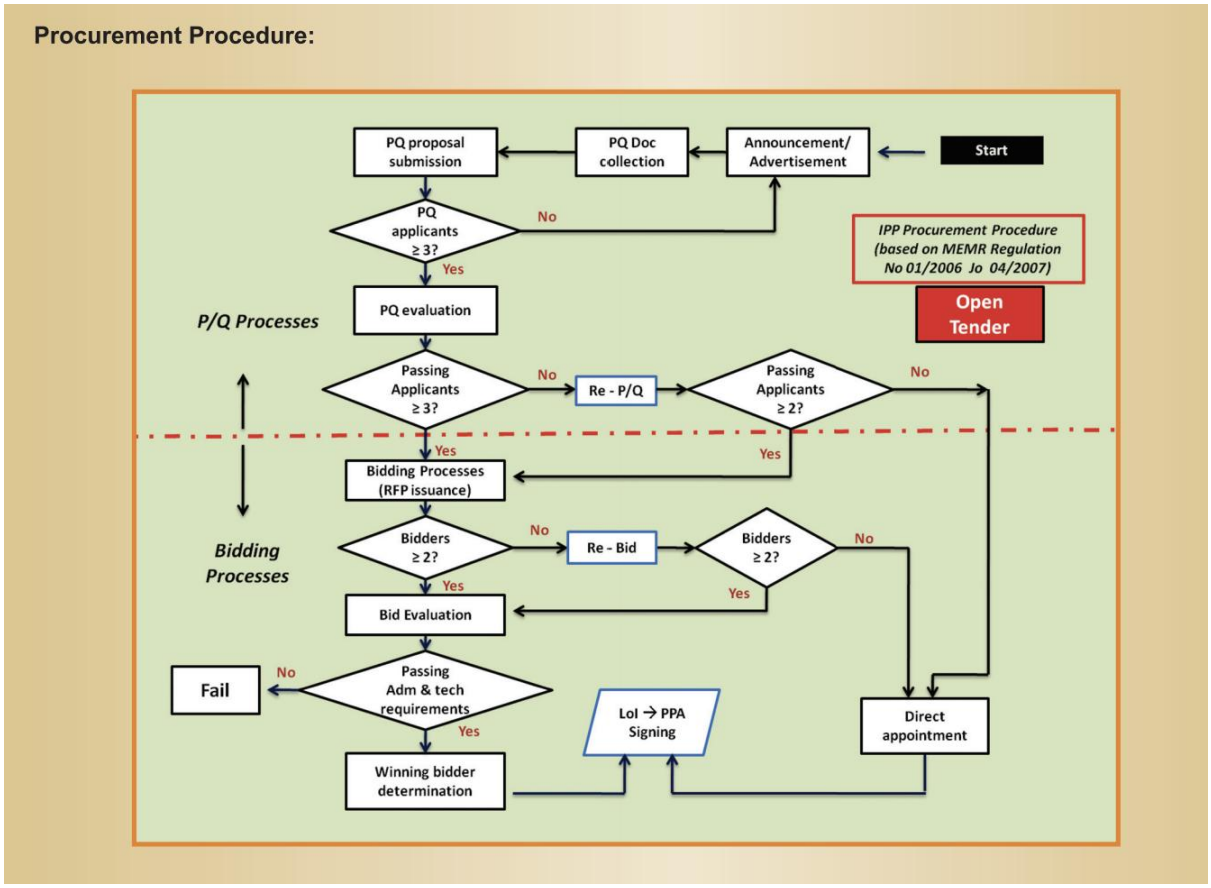


Figure B.5 PLN Direct Selection Process (Assegaf Hamzah & Partners. (2022)

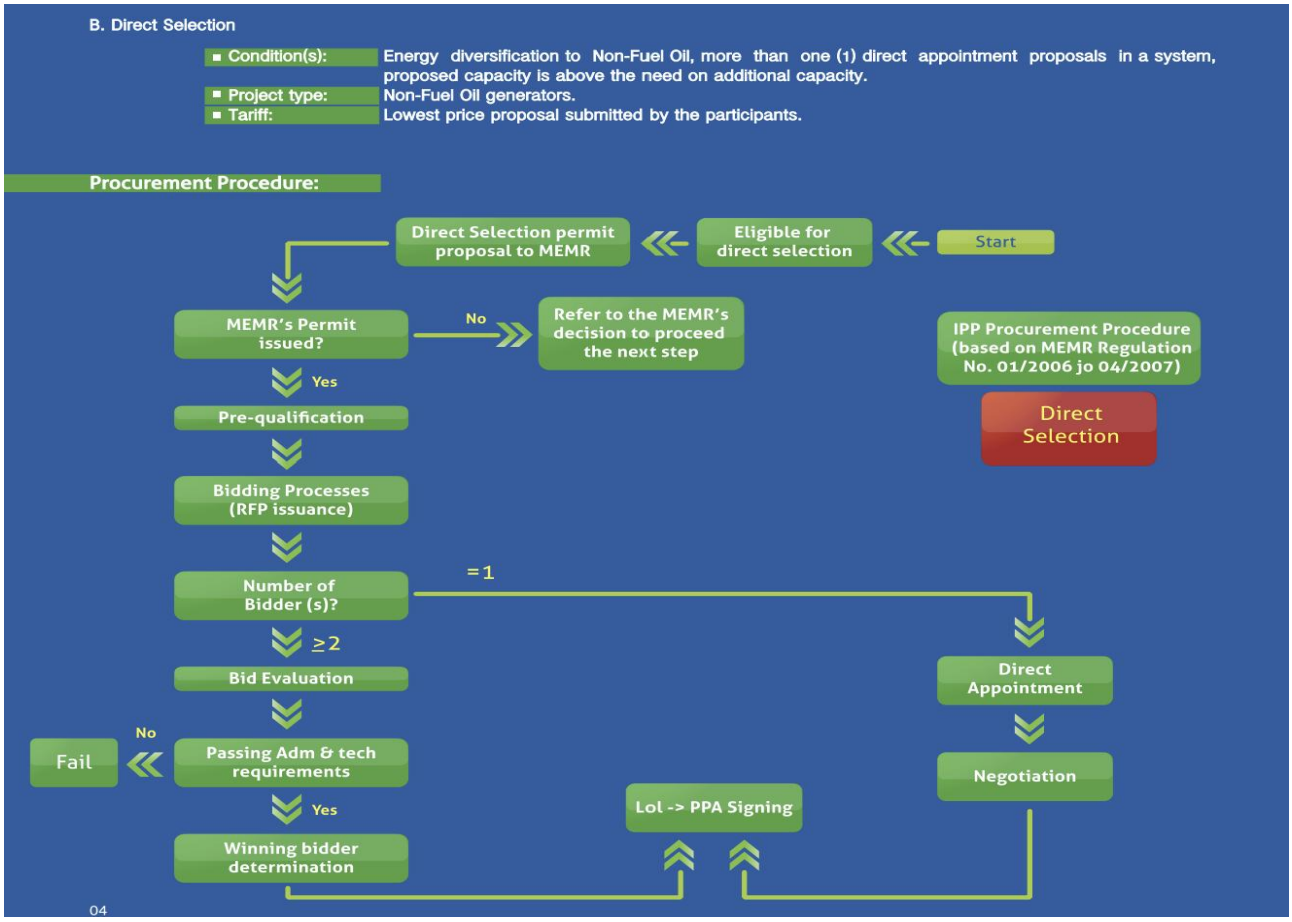
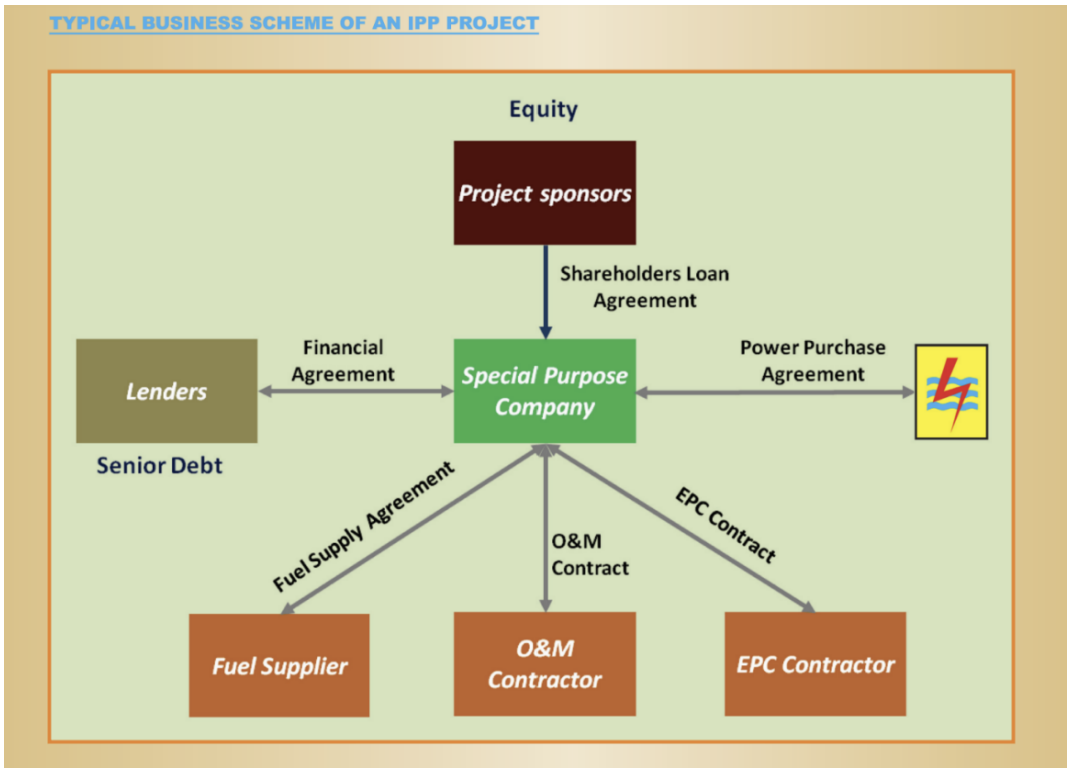


Figure B.6 Typical IPP Business Scheme (PLN IPP Procurement Division, 2017)



C. Obstacle analysis

1. Generation of potential obstacles full tables

Table C.1 Obstacles from PLN Incentives (long version)

Maintaining majority share of generation	PLN currently has ownership of the vast majority of Indonesia's generation infrastructure. Development of VRE however requires expertise that PLN lacks meaning that capacity additions will be done through IPPs. The agreements have also changed from BOOT to BOO meaning that adding VRE capacity takes away from PLN's share of generation. This will only be bolstered by the fact that CFPP's will be the first plants to get retired. Such a reduction in generation capacity will loosen PLN's grip on the generation market. PLN could be limiting the development of Solar in order to maintain its current dominant position in the power generation sector.
Overcapacity of coal energy	From 2010-2019 the generation capacity was increased massively to meet demand projections. This was mostly done through accelerated development schemes for CFPP's. However, these demand projections were far too aggressive and the Covid pandemic also had a large impact on demand growth on top of this. The result is that there is a significant overcapacity on the Java-Bali grid due to an excessive amount of CFPP's. The Java-Bali grid is home to the majority of Indonesia's population as well as its industry meaning that most of the nation's demand is based in a region that has too much capacity as it is. It is possible that PLN is limiting the amount of capacity additions to protect the CFPP's from becoming stranded assets. Should this happen, PLN will have to retire plants, and this is a costly process depending on the contracts involved.
Protecting Credit Ratings	PLN as a company has issues with liquidity and solvency. As a company it operates at a relatively large annual loss which is then compensated by the MoF in the form of a PSO (public service obligation). When PLN requires more money to stay afloat then expected or other unforeseen issues occur the MoF may not have the funds available to make the payment. This requires PLN to take on loans from other parties which then leads to higher costs in following years (Bridle et al., 2019). Despite this PLN has a high credit rating of BBB (Fintcher Ratings, 2024). Contracts with IPPs require PLN to make payments to IPPs for sales of power as well as loan repayments in return for equity. If PLN does not make good on these payments the credit rating will be impacted negatively. PLN can protect itself from this possibility either by signing fewer PPAs or demanding controlling equity shares in future projects. If PLN does not make good on a payment to its own subsidiary there may be an insulating effect on its credit rating.
Pressure to improve solvency	PLN is under immense pressure by the government to improve its solvency. This could result in PLN limiting new projects to only the most advantageous ones possible, where they incur the fewest transaction costs, get advantageous equity shares and the lowest possible generation costs. Due to overcapacity issues any added generation that is not done under incredibly advantageous terms for PLN will have a negative impact on solvency, made even worse by take-or-pay schemes that are applicable to much of the current capacity on the Java-Bali grid (Brown, 2020).

Table C.2 Obstacles from PLN Resource Limitations (long version)

Transmission network inadequate	Transmission capacity is a necessity for the addition of generation capacity and therefor potentially a limiting factor. To accommodate future generation capacity, PLN is constantly upgrading the transmission network to take on more load from new plants. However, it is currently behind on its planned transmission development (Dwita, 2024). Solar PV as a power source provides intermittent generation which requires a more robust and expansive transmission grid to be optimal. If the grid is not setup in a way to facilitate this optimally the value of the power generated and sold to PLN is not as high. This would then either 1) reduce the attractiveness of Solar in the eyes of PLN in a scenario where transmission infrastructure is lacking and incentivize PLN to focus on development of non-intermittent capacity; or 2) make the RfP's that are available limited in capacity and scale, reducing potential returns for investors and therefore negatively impacting the amount of developers willing to bid on projects.
Lack of human capital	Solar PV technology is relatively new and distinct to coal and gas generation which PLN is more familiar with in terms of planning and grid integration. PLN lacks human capital with the know-how to manage Solar PV tenders and plan transmission expansion accordingly (IESR, 2024). This lack of human capital has the potential to impact 1) PLN's ability to conduct feasibility studies on its own, which are very important to developers. 2) Site-selection, formulating proper requirements for Solar based RfP's and managing the bids. 3) Capacity for grid-integration and transmission management. This will result in PLN not being able to make as many attractive tenders available and limit PLNs ability to incorporate renewables into the grid in general.
Poor management practices in terms of transparency and reliability	PLN simply may not be able to manage tenders very well because of their management practices being lacklustre. In terms of project finance, it is very important for developers that the tender provider is a reliable and effective business partner, as this greatly impacts the potential for success of such projects as well as transaction costs incurred by the developer. PLN has a reputation for being vague in terms of its requirements as well as untransparent about its decision-making processes (Yustika, 2024b). There have also been scenarios where PLN has cancelled projects with little warning impacting its perceived reliability. This may limit developers' willingness to bid on available proposals.

Table C.3 Obstacles from Regulatory Requirements (long version)

Price ceiling per KWh	PR 112/2022 sets ceiling prices per KWh generated by Solar, this is then multiplied by a set factor per region in order to make more isolated regions more interesting for development. If these prices per KWh are such that developers struggle to make adequate returns for their investors in a timely fashion it will limit the developers willing to bid on PLN's RfPs.
Local Content Requirement Threshold and On-Shore contractor requirements	These regulations impact the costs incurred by developers during construction and maintenance of power plants. This is because the domestic production of components necessary for Solar plants is not as competitive as those available on the international markets. This raises the material cost of solar development. On-Shore contracting is in certain cases also limited to domestic contractors which impacts the options developers have and increases the costs of construction should the domestic market not be advantageous. These both impact the return on investment for developers and their investors making it less likely that they will make bids on an RfP. There are regulatory and legal exceptions allowing developers to get around these requirements however to make use of these increases transaction costs for investors. The extent to which transaction costs are increased is also greatly dependent on the transparency and explicitness of these exceptions. Higher transaction costs likewise discourage developers.

Land acquisition difficulties	Land acquisition is a very difficult process in Indonesia, due to property rights and foreign ownership regulations. It is well documented that this usually accounts for the longest lead times in the setup of an IPP. A difficult and lengthy land acquisition process means high transaction costs and less confidence for developers. This in return affects the developers willingness to make bids negatively. It is also notable that the majority of new solar plants have had land acquisition done through PLN in return for a 51% stake in the project rather than through private means.
Government Guarantee availability	Government guarantees have value because they alleviate the risk of doing business with unreliable partners, in this case PLN. PLN has a BBB credit rating which is generally high enough for developers to rely on however it is possible that financial institutions which are providing the funding require government guarantees despite this fact as it benefits their solvency. If financial institutions value such a guarantee highly developers will be forced to take part in the so-called "Partnership scheme" which requires the sale of 30-51% of the project equity to PLN (Yustika, 2024). This impacts the rate at which the developer can repay their investors and decreases attractiveness of PLN's tenders to developers.
PPA structure (take or pay, ceiling prices, price increases, contract length etc.)	Regulations limit the ability of PLN to make PPAs attractive to developers. Ceiling prices per KWh were already discussed but requirements on contract length, price increase and other components all also impact the potential for PLN to make attractive tenders available (CIPP, 2023)

2. Obstacle Evaluation

Table C.4(Obstacle Evaluation)

1.1 Majority share of generation	
Validity	PLN has been losing generation capacity share to IPPs for years, even before the 2022 RES expansion commitments. CFPP overcapacity from the 35 GW program was also IPP-driven, showing past tolerance for reduced PLN share. Recent changes are unverified, so this obstacle lacks validity for further research.
1.2 Overcapacity of coal energy	
Validity	Coal overcapacity is well-documented, with Java and Sumatra at 40% overcapacity despite a 15% ideal margin, posing a major obstacle to RES expansion (CIPP, 88).
Relevance	This impacts PLN's solvency and liquidity while also guiding transmission development to high-capacity nodes rather than a more RES-friendly network. Long-term take-or-pay PPAs further complicate renegotiation or decommissioning.
Policy levers	PLN can renegotiate contracts, pause planned projects, or limit CFPP expansions.
Solvability	Solutions are costly and constrained by PLN's liquidity issues. Possible mitigation measures include contract renegotiation, plant upgrades for flexible generation, or buyouts for decommissioning.
1.3 Protecting Credit Ratings	
Validity	PLN's BBB credit rating enables better project financing terms. In the past, lower ratings forced the government to secure capacity expansions under unfavourable conditions (Brown, 2020). However, verifying whether credit ratings are a current motivation is beyond this research's scope.
1.4 Pressure to improve solvency	
Validity	PLN faces documented pressure to improve its financial balance (BRIDLE, CIPP, IEEFA). It may manipulate tenders to aid solvency at the expense of RES development, though verifying its impact on proposal limitations is difficult.
Relevance	Pressure to enhance solvency and liquidity is significant. Without higher energy tariffs, PLN must cut expenditures and risk to meet expectations.

Policy levers	Energy Tariffs, DMO's and price caps
Solvability	Solving this would require major energy market restructuring or a sharp rise in consumer energy costs.
2.1 Transmission network inadequate	
Validity	PLN's limited transmission infrastructure restricts VRE integration (CIPP, 2023 – p. 74), though its exact impact on planning is unclear.
Relevance	CIPP (2023) and Dwita (2024) highlight its significance, but its extent remains hard to quantify.
Policy levers	Transmission network planning and construction is done through PLN. Steering from the ministerial overseers could impact the resources and management of transmission infrastructure development.
Solvability	This is not easily solvable as the causes for the lack in transmission infrastructure development are not obvious and would require a lot of research outside the scope of this article to determine.
2.2 Lack of human capital	
Validity	PLN's lack of expertise in integrating intermittent RES is well-documented (IESR, 2024; CIPP, 2023 – p. 188). Efforts to train personnel are underway (Dwita, 2024), but adaptation remains slow.
Relevance	A shortage of skilled personnel hinders effective RES integration. Better planning and developer engagement could increase project tenders (CIPP, 2024 – p. 188).
Policy levers	MoEMR regulations and MoSOE influence on the structure and goals of PLN as an organization.
Solvability	Ministries have authority to implement meaningful reforms, and PLN governance can be influenced through indirect measures
2.3 Poor management practices in terms of transparency and reliability	
Validity	PLN's lack of transparency in requirements and selection increases perceived risk for developers (Yustika, 2024; Bridle et al., 2019; CIPP, 2023 – p. 194). This discourages bids, complicates project planning, and raises financing difficulties, notably without impacting PLN's credit rating.
Relevance	Developers and investors rely on PLN's cooperation for utility-scale RES projects. While the impact is hard to quantify, it is significant.
Policy levers	MoEMR regulations as well as MoSOE authority over PLN leadership have the power to steer PLN towards better business practices.
Solvability	This issue is relatively solvable, as existing ministerial powers could drive meaningful improvements without new laws.
3.1 Price ceiling per KWh/ PLN imposition of localized generation costs	
Validity	Low price ceilings reduce ROI and deter RES investment. However, PLN's practice of comparing bids to localized average generation costs—often below the ceiling—creates an additional obstacle, effectively tying RES prices to subsidized CFPP costs (CIPP, 2023 – p. 193). This undermines PR112/2022's intent.
Relevance	limiting bids to those below local average generation costs significantly reduces viable offers from developers.
Policy levers	The MoSOE and Government of Indonesia has the authority to steer PLN away from this governance practice
Solvability	This issue could be addressed through stricter procurement transparency and ministry oversight. However, since PLN's financial health is also a government priority, political will for reform is uncertain.
3.2 Local Content Requirement Threshold	
Validity	Past local content regulations were far stricter, with the IEEFA (Yustika, 2024b) and the CIPP (2023) citing them as serious obstacles. Current rules require about half the previous local content (Draps et al., 2024), making them significantly less rigorous. Given the lack of assessments on the new regulation's impact, this is not yet considered a valid institutional obstacle.
3.3. Land acquisition difficulties	
Validity	Land acquisition in Indonesia is complex, with much land unregistered and requiring lengthy processes to determine ownership. Foreign companies cannot own land and must settle for ~30-year usage rights (Norton Rose Fulbright, 2015). This significantly impacts lead times (Norton Rose Fulbright, 2015; Yustika, 2024b).

Relevance	Long lead times significantly increase project risk and delay investor returns, reducing investment appeal.
Policy levers	Government assistance for developers that take a PPP route, as well as in cases where PLN has equity in IPP or IPP falls under government program such as 35 GW Program.
Solvability	Existing support mechanisms require PLN equity in IPPs, but loosening criteria through ministerial regulation adjustments could improve land acquisition feasibility.
3.4 Government Guarantee availability	
Validity	PLN can apply for government guarantees through the MoF on behalf of IPPs in exchange for equity, typically demanding a 51% stake, which is considered steep (Yustika, 2024). However, given PLN and the Indonesian Government's BBB credit rating (Fitch Ratings, 2024), financial institutions are likely willing to invest without guarantees. Developers may accept the 51% stake requirement more for PLN's additional support, such as feasibility studies or land acquisition, rather than the guarantee itself. Therefor this obstacle is not considered valid.
3.5 PPA structure (take or pay, ceiling prices, price increases, contract length etc.)	
Validity	The rigid structure of PPAs has locked PLN into long-term contracts with legacy IPPs, limiting RES expansion (Setyowati & Quist, 2020; CIPP, 2023 - p.187). Recent capacity additions, especially coal overcapacity, rely on take-or-pay schemes to attract private investment, but these agreements reduce room for future RES integration. Additionally, current PPA templates for RES are not designed for intermittent power sources, complicating development for IPPs.
Relevance	PPA structures significantly impact developers and influence their willingness to propose projects. They also restrict PLN's long-term flexibility and will remain a challenge if unaddressed. However, this is unlikely to be a primary factor behind slow RE adoption.
Policy levers	MoEMR can propose or amend regulations governing PPA structures, while PLN can adjust terms under MoSOE guidance.
Solvability	This issue is relatively solvable, as the GOI has regulatory and informal mechanisms to drive change.

D. IAD-Analysis

1. Ostrom's Rule Types Categorisation of Rules-in-Use

1. Position Rules

Position rules define the roles that actors can occupy in the action situation. In the procurement process:

- PLN acts as both the initiator and evaluator of renewable energy tenders.
- Developers (often through consortia) assume the role of pre-qualified bidders responsible for bid preparation.
- Regulators (primarily MoEMR) provide oversight and define procedural requirements.
- Investors (e.g., financial institutions) often operate in the background but influence whether developers can form viable bids.

These roles are relatively fixed, and entry into formal positions—particularly for developers—is strictly controlled through the DPT prequalification system.

2. Boundary Rules

Boundary rules define how actors enter or exit positions. For developers, boundary rules are particularly restrictive:

- Access to the DPT list is mandatory to submit bids. Entry is granted based on technical, financial, and organizational criteria, and must be renewed every three years (Bissett et al., 2021).
- DPT approvals can take weeks or even over a year, depending on PLN's internal processes (Yustika, 2024b).
- Only DPT-approved entities may form consortia to respond to RfPs, excluding potentially competitive actors from participating if approval is delayed or denied.

This restrictiveness raises transaction costs and creates timing risks for interested bidders.

3. Choice Rules

Choice rules specify what actions are permitted, required, or forbidden for actors in specific positions. In this setting:

- PLN is required to use Direct Selection for most VRE procurement (PR112/2022), with associated requirements for RfPs and bid evaluation.
- Developers must independently assess feasibility and prepare complete bid proposals, including financing, technical design, and site analysis.
- PLN may delay or cancel tenders during the pre-award phase, sometimes without providing clear justification to bidders. Although formal explanations are often required, developers frequently report vague or non-communicative responses in practice.

This creates uncertainty and limits the ability of developers to predict the costs and risks of participation.

4. Aggregation Rules

Aggregation rules determine how decisions are made and by whom.

- PLN carries out bid selection internally, without formal involvement from independent evaluation committees. External oversight may occur in specific cases—such as when a project lies outside the RUPTL—where MoEMR approval is required before a PPA can be finalized.
- Regulatory actors such as MoEMR approve procurement rules but are not involved in bid-level decision-making.
- The concentration of decision-making power within PLN increases the risk of internal bias or inconsistency, particularly where subsidiaries are involved in managing procurement.

This structure contributes to the perception of opaque or discretionary behaviour in PLN's bid selection processes (Yustika, 2024b).

5. Information Rules

Information rules determine what information must or may be shared, and with whom. Current practices exhibit low levels of mandatory transparency:

- RfPs contain high-level technical and financial requirements but lack detailed data on transmission constraints or feasibility conditions.
- Tender progress and evaluation outcomes are generally not disclosed publicly, and non-selected developers report limited feedback on bid rejection. This lack of transparency is a recurring concern in industry commentary (Bridle et al., 2019; Yustika, 2024b)
- PLN shares available pre-feasibility studies and site data; however, the extent and quality of this information can vary, and in some cases, may be limited.

These information gaps increase investor uncertainty and reliance on informal channels, undermining trust in the procurement process.

6. Payoff Rules

Payoff rules affect the incentives and disincentives associated with participating in the action situation.

- Developers face high upfront costs (feasibility studies, bid bonds, site assessments) without any guarantee of project award or compensation.
- PLN is financially constrained by government-imposed price ceilings (PR112/2022) and political pressure to keep consumer tariffs low. Additionally, it often employs regional average generation costs as a benchmark for setting maximum prices for new projects, a practice that, while not mandated by current regulation, remains prevalent.
- There is little penalty for PLN if tenders are delayed or cancelled, but developers may suffer sunk costs or reputational damage.

This asymmetry contributes to risk-averse behaviour from potential bidders.

7. Scope Rules

Scope rules define the outcomes that can be affected within an action situation and delineate the potential results of interactions among participants. They essentially set the boundaries for what the participants can achieve. For example, in a legislative context, scope rules might specify the types of laws that can be enacted. In the context of PLN's procurement processes, scope rules would pertain to the range of project outcomes that can be pursued, such as the types of energy projects eligible for tender.

- The intended outcome of procurement is the signing of PPAs and construction of new VRE capacity aligned with the RUPTL targets.
- In practice, PLN is not penalized for failing to meet these targets and may prioritize financial solvency over renewable expansion.
- Developers are expected to propose projects that minimize costs and risks to PLN, often at the expense of return on investment or long-term sustainability.

Scope rules thus define a narrow and risk-sensitive pathway to successful procurement, excluding projects that are technically viable but financially marginal under current pricing regimes.

2. Generation of Policy Alternatives

1. Regulations for minimum amount of RfP's offered per year based on RUPTL goals. Minimum percentage of target in RUPTL or min number of RfP's with a threshold generation capacity.

This policy is designed to target the main issue very directly which is the lack of will on the side of PLN to commit to developing RES infrastructure. It effectively forces PLN to act against its current incentives by increasing the amount of renewable generation capacity projects that private companies can develop bids for. There are two potential major issues with this policy:

It will create a massive incentive for gaming on the part of PLN, there are many ways within the current framework for PLN to make RfP's available yet very unlikely to lead to the development of actual projects and;

The number of regulations and oversight necessary to make PLN implement this effectively is very high.

It is unclear if this policy can be achieved through regulations as there is no existing legal framework requiring PLN to build RES capacity to meet its RUPTL targets, nor is there an existing system to sanction PLN in case of non-compliance.

Finally, it is not transparent how many RfP's are currently offered, it could be that PLN is already making enough MW's in offers available to comply with the RUPTL despite the current assumption that this is not the case.

2. Requirement for PLN to conduct feasibility studies and share the results with bidding entities as part of RfP.

Currently the burden of doing feasibility studies is generally considered to be on the developer. This is an issue because it means that a developer is required to make an investment to obtain the necessary information to make a competitive bid. These up front costs incurred are not guaranteed to be made back as the developer may not win the bid. The requirement of incurring these costs also increases the needed return for private owned projects to be profitable.

Not all developers are equally setup in terms of infrastructure and connections to conduct quality feasibility studies in Indonesia. By shifting this burden, the transaction costs and potential losses of proposing bids are reduced resulting in more competitive bids from the perspective of PLN.

In addition, the fact that developers are not capable of conducting feasibility studies as well as PLN, which has more experience, local resources and data available to it meaning the studies will be more useful. Increasing the quality of data developers can with will result in better bids and less uncertainty on the part of investors, thus making

the bids more competitive. This will also avoid duplication of efforts where developers would normally all do their own feasibility studies in order to place separate bids on the same RfP. It will also create a more level playing field between developers that are setup in Indonesia vs those that aren't, resulting in more competition between developers.

A regulatory framework already exists which stipulates that the RfP contains a minimum set of details of the final PPA, this could potentially be expanded to include a minimum amount of information in the form of feasibility studies (4.3.2).

A potential issue is that this will increase PLN's costs associated with submitting an RfP and therefor disincentivize publication of more RfP's. Another issue is that in terms of oversight this is difficult to implement as PLN may simply decide to spend very few resources on the feasibility studies, there is not an easy or transparent way for a regulator to guarantee a minimum quality from PLN on a per study basis.

3. Requirement for PLN to share transmission network data as part of RfP.

Currently PLN is not required to provide data on their transmission network with private parties (CIPP, 2023), this means that resources must be expended to acquire this information on the part of developers thus increasing the transaction costs associated with making a bid.

Developers cannot easily know what transmission infrastructure will be developed in the near future without the help of PLN thus giving PLN leverage over developers.

However PLN does not have much to lose monetarily by making this data easily available to developers as this data is already available to them and does not need to be acquired through research. A regulatory framework already exists which stipulates that the RfP contains a minimum set of details of the final PPA, this could potentially be expanded to include a minimum amount of information on the existing transmission infrastructure. Linking generation capacity procurement with transmission planning in this way may encourage the different PLN departments to start planning these in tandem resulting in a more optimized network for intermittent sources.

The main drawback of such a policy is it increases the effort required for PLN to submit an RfP as more research and data is required per submission. However, this additional effort can be considered to be quite minimal compared to other policies mentioned as there is likely no need for the acquisition of new data or large scale reorganisations of responsibilities within PLN.

4. Provide PLN with specified funds specifically to assist in land acquisition.

Land acquisition is currently one of the major obstacles to energy projects in Indonesia (4.3.4). Due to complex regulations concerning land ownership rights and unclear ownership of land in general it is very difficult for developers to buy and develop land which creates risk for investors. Lengthened lead times resulting from this also increase

the time it takes for investors to recoup their investment, resulting in them requiring higher interest rates or equity. This makes the bids PLN receives less competitive.

If PLN can effectively assist developers with acquiring the necessary information and then its legal interpretation a portion of these issues could be mitigated resulting in more competitive bids and a lower threshold to participate in bidding for private parties.

PLN already assists certain projects with land acquisition to varying degrees, for example with the Cirata floating solar plant (Adji, 2024). To provide PLN with funding and requirements to provide certain degrees of assistance in the form of pre-acquisition, legal counsel and mediation would not require PLN to create capabilities it does not currently possess. It would merely need to expand certain departments obfuscating very high costs.

5. Connect RUPTL drafting with transmission network planning.

In the current situation transmission network planning and the drafting of the RUPTL are decoupled processes. By requiring these two to be connected in the planning stage it could result in more realistic RUPTL's being created and the transmission network being more capable of integrating intermittent power sources like solar and wind.

Regulatory implementation of this is complicated but this may be achievable through the MoSOE's exerting pressure on PLN's leadership to integrate the two processes.

6. Make Direct Selection process transparent to developers and investors, if not the public.

Currently the history of PLN's RfP's and the developers' bids are not available to aspiring investors and developers. By making these available to private parties upon request it will be easier for them to assess the costs and risks associated with entering the market, reducing the need for independent research and thus lowering transaction costs for these potential participants.

PLN does not receive as much public scrutiny on their methods of evaluating bids or RfP's they publish as they would if the information was available to the public. By requiring them to share this information with private parties it is likely that the public will be able to get a hold of it and use this for scrutinizing decision-making.

7. PPA templates required to be tailored to the energy type, with a clear focus on intermittent resources

Currently there is no proper PPA template tailoring to the specific needs of renewable generators, which differ significantly from fossil generators. This is particularly an issue for intermittent sources like wind and solar power because their generation patterns are inherently unpredictable.

By requiring templates to be made along an existing set of guidelines like that of the IRENA (2018) on a per energy source basis private parties will be easier able to evaluate

potential ROI and risk factors, leading to lower transaction costs involved in developing a bid. This may result in more bids at more competitive rates.

Maintaining such a standard will require PLN to put in resources and potentially invest in acquiring some human capital to develop adequate templates. However, PLN may also benefit from more and better bids for power plants resulting in savings in the long run.

3. Scenario Analysis

1. Regulations for minimum amount of RfP's offered per year based on RUPTL goals. Minimum percentage of target in RUPTL or min number of RfP's with a threshold generation capacity.

This policy suggests a change in the rules-in-use in the form of a regulation by the MoEMR which requires PLN to output a minimum amount of renewable capacity in RfP's on an annual basis which is defined by the RUPTL. This policy directly addresses the lack of opportunities private developers are given to bid and compete for the development of RES.

There is an assumption made by this policy that private parties interested in developing RES in Indonesia are limited by the total amount of projects PLN makes available for bid, based on desk research this seems likely but as this data is not publicly available there is no way to confirm this unequivocally. Attempts will be made to gain a higher degree of certainty during the interviews.

By requiring PLN to increase the number of projects up for bid without changing the incentive structure for the actors involved in some way this policy is likely to have a slew of unintended consequences. PLN is limiting projects up for bid for legitimate reasons that are related to inadequacy of transmission infrastructure, existing overcapacity in its most populated regions, lack of experience in RE- grid integration and concerns over their financial solvency. This policy addresses none of these underlying issues resulting in a situation where the regulator MoEMR is not incentivized to monitor compliance properly and PLN is not incentivized to implement it properly. This may in serious gaming to maintain the status quo in terms of RES development.

For example, PLN could publish a slew of symbolic RfP's that have requirements so unfavourable to investors that serious bids are unlikely if not impossible to provide. These offered projects will never come to fruition but will cost PLN resources to submit RfP's for. Private parties will also expend resources to determine feasibility and will generally be disappointed. This could in turn have and impact on the private sector's perception of PLN as a business partner resulting in a loss of interest even when viable projects do come along. Informal information flows between PLN and investors will become more important, to help investors distinguish between sincere and insincere opportunities. This results in a decrease in transparency and an increase in transaction costs, as relying on informal lines of communication does not come without cost. It may be that a few more PPAs will end up being signed here and there due to the sheer

number of increased RfP's, however the impact would not be of the magnitude one would expect.

This is merely a prediction however, there are other ways this gaming could be used to nullify this policy. How PLN attempts to deal with this policy is highly dependent on the degree to which the MoEMR, MoSOE and GoI communicate that it will be enforced. If it is informally communicated that this will not be enforced at all, then literally nothing would change. If it is enforced to the extent that the quality of the RfP's is guaranteed to be of a standard adequate to result in serious bids the impact of the policy will be much more positive, be it with a negative impact on PLN's solvency. Based on the current situation however it is likely that if the MoEMR were to implement such a regulation they would not let it be ignored outright but require PLN to at least be seen attempting to make and effort to implement it. Full enforcement down to the RfP quality seems impossible considering the lack of incentives for the MoEMR and GoI to do so. For this reason, the outcomes of the initial example are assumed in this scenario in order to show the potential harm which can be done by a policy that runs counter to PLN's incentives.

Evaluative Criteria:

- Development Costs =
- Transaction Complexity =
- Financial Viability Constraints =
- Fiscal Exposure =/+
- Perceived Risk =

2. Requirement for PLN to conduct feasibility studies and share the results with bidding entities as part of RfP.

This policy attempts to shift some of the burden of exploration costs from private parties towards PLN through a regulation necessitating a meaningful degree of data gathering by PLN on the potential of a given project as well as the sharing thereof with potential investors. Feasibility studies include assessments of RE potential, grid-connection assessments, land acquisition assessments and finally Environmental and Social Impacts Assessments which are commonly required by investors.

Due to overcapacity in Indonesia's most populated regions PLN is more likely to offer RE projects in more rural areas of the country where this problem does not exist. Much of the rhetoric from PLN about the energy transition is about developing RE in rural regions for this reason, and policies like the regulation determining the price ceilings IPPs can receive for RE output have a higher multiplier for remote regions not only due to higher cost of development but also to incentivize development where there is no overcapacity.

However, these more remote regions are also areas which have had much less data gathered on them and require much higher exploration costs on the part of investors. It is also the case that in the current situation communication between PLN and investors is such that PLN does not share data they have obtained from their own feasibility studies as part of RfP's, requiring investors/developers to duplicate work or obtain it from PLN through informal channels.

It is also generally the case that feasibility studies are best performed large domestic organizations like PLN which have much more resources and experience in conducting such research. By leaving this to the investors and their contractors it is unlikely a similar standard of quality could be achieved thus requiring investors to base their decisions on less reliable data. This affects the risk profile of a project.

Such a policy will require significant resources from PLN as they would need to expand their data gathering capacity and their RfP publication process, however the number of resources needed to accomplish this fall within a relatively acceptable range as feasibility studies and exploration are processes that PLN is already familiar with conducting. PLN has the resources to hire and train employees to increase the capacity for data gathering. Besides this PLN also stands to benefit from collecting and sharing this data, as it reduces risk and exploration costs for investors which will result in a lower threshold to bid on RfP's as well as lower interest rates on debt due to lower risk profiles. This will mean that the price per KWh investors need for an acceptable Return on Investment (RoI) will go down which in combination with increased private sector competition for these projects shall result in better offers from PLN's perspective. Another benefit is that this requirement will effectively remove a step of the pre-development process of the IPP which will result in shorter lead times of the project.

Evaluative Criteria:

- Development Costs – –
- Transaction Complexity -
- Financial Viability Constraints -
- Fiscal Exposure +
- Perceived Risk - -

3. Requirement for PLN to share transmission network data as part of RfP

This policy can be considered a less impactful but much easier to implement version of policy number 2 which encompasses grid connection assessments. The main difference between the two is that this policy will not impose a meaningful cost to PLN as sharing transmission network data does not require any expansion of data gathering capacity or addition of pre-development activities.

The benefit of this policy is limited to a marginal decrease in the exploration costs associated with the feasibility studies that must be performed by private parties while the disadvantages are nearly non-existent.

Evaluative Criteria:

- Development Costs =/–
- Transaction Complexity =/-
- Financial Viability Constraints =
- Fiscal Exposure =
- Perceived Risk =

4. Provide PLN with specified funds specifically to assist in land acquisition

PLN already has experience in the acquisition of land for IPPs when it comes to parties that take part in the PPP scheme which requires PLN or one of its subsidiaries to hold a significant stake in the IPP. The goal of this policy would be to expand this function in such a way that before submission of any RfP PLN has a plan in place to either acquire the land itself, on behalf of the winning party or assist the developer in its acquisition. This could be done by making conditional land-lease agreements or providing legal assistance and mediation between the investors and land holders. This would go beyond simple land acquisition assessments by attempting to provide if not a guarantee to private parties a significant degree of assurance that land acquisition will not be a project ending obstacle or the source of unexpected delays and substantial unexpected transaction costs.

Currently the acquisition of land for RE projects is a significant source of risk, delays and transaction costs for investors. In many cases issues concerning the IPP's land acquisition directly affect PLN as the step of land acquisition always comes after the signing of the PPA at which point delays affect both parties. Attempting to streamline this process through shifting the burden to before the RfP publication will greatly impact risk perception and RoI because of shorter expected lead times.

This policy would come at a cost to PLN as its capacity to conduct pre-development activities like land acquisition planning is limited, necessitating investment and expansion of relevant departments. However, it would cost PLN much less to undertake these activities than a private party due to its already existing resources and experience in domestic land acquisition for energy projects. This means that the benefit to developers and investors will be much greater than the cost to PLN, resulting in more attractive bids, less risk and shorter expected lead times that will be a net benefit over a situation where the cost to private parties is calculated into the bids in the form of higher energy tariffs and longer, riskier development cycles.

Evaluative Criteria:

- Development Costs – –
- Transaction Complexity -
- Financial Viability Constraints -
- Fiscal Exposure +
- Perceived Risk - -

5. Connect RUPTL drafting with transmission network planning.

What are the outcomes and their impact on evaluative criteria?

To optimize the potential of connection of RE generators to the grid for the same total investment in transmission infrastructure this policy aims to bring the processes of transmission and generation planning closer together. RE potential is locally highly variable based upon terrain and climate conditions, as well as risk factors like earthquakes and extreme weather event which are common in Indonesia. This means that for optimal development transmission planners should consider the regional RE potential as well as future development plans when planning the expansion of the network. The importance of joint planning is compounded by the fact that intermittent renewables have certain requirements of their transmission connections to be utilized optimally.

By targeting the optimization of transmission planning for the integration of renewable capacity this policy will relieve pressure on PLN's procurement planning department by making more sites and projects viable for development. By adding more potential options and flexibility for the construction of RE plants PLN will be able to make more projects available for bid that meet their steep financial criteria, which exists because of pressure to maintain adequate solvency. This will ultimately increase the amount of viable RfP's put out by PLN.

Options for renewable projects will be increased without the need for a large investment on the part of PLN in transmission infrastructure. This will however require a restructuring of PLN's internal RUPTL and transmission design processes as well as the acquisition and training of staff capable of planning transmission infrastructure with intermittent energy sources in mind.

Evaluative Criteria:

- Development Costs =
- Transaction Complexity =
- Financial Viability Constraints =/-
- Fiscal Exposure =
- Perceived Risk =/-

6. Make Direct Selection process transparent to developers and investors, if not the public.

The Direct Selection method of procurement is the de facto standard for RE projects since regulation PR112/22 came into effect. There are fewer regulatory requirements for PLN to meet compared to open tenders which allows PLN more leeway and authority in negotiations and bid evaluations. This has the effect of lowering the amount of resources required by PLN to put out proposals for such projects. However, the current method of direct selection has disadvantages for aspiring developers and investors, chiefly a lack of transparency.

Currently there is not much information available on how past auctions for these projects were conducted as the communication is done privately and under NDA(PT PLN, 2023). This means that private actors in general but especially newer parties to the table have much less information to base their decisions on which severely impacts the perceived risk profile for investors. By having to rely on second-hand or informal information streams there is a great deal of uncertainty and information asymmetry introduced into the process as well as a potential lack of efficiency on the part of PLN due to a lack of incentive to maintain optimal communication standards throughout procurement.

Making these processes publicly available after completion, cancellation or an elapsed time period this policy would work to give investors and developers more information to determine whether it is worth bidding on an RfP, lowering transaction costs and risk profiles. These will translate into more attractive bids form the perspective of PLN.

Evaluative Criteria:

- Development Costs =
- Transaction Complexity =/-
- Financial Viability Constraints =/-
- Fiscal Exposure =
- Perceived Risk -

7. PPA templates required to be tailored to the energy type, with a clear focus on intermittent resources.

Currently PPAs are structured in ways that are optimal for traditional non-intermittent power sources that can generate predictable load from small amounts of land based on predicted demand. This lack of proper RE focused templates which are designed to take the unique characteristics of each generation source into account results in a messy and complex situation for the competing private parties. They must expend resources on developing a competitive bid and simultaneously negotiate with PLN to assure that the PPA terms are formulated in an acceptable way for the intended energy source.

This policy will mandate the creation of PPA templates based on international standards (ex. World Bank, IRENA) on a per energy source basis and require their integration into the relevant RfP's.

These tailored PPAs will have the effect of providing certainty for investors, thus reducing perceived risk, and simplifying negotiations which will greatly reduce transaction costs. These will impact the number of bidders and the competitiveness of the bids positively from PLN's perspective by lowering the proposed generation costs in the bids.

Evaluative Criteria:

- Development Costs =
- Transaction Complexity -
- Financial Viability Constraints -
- Fiscal Exposure =
- Perceived Risk -

E Interviews

1. Interview Protocol

Thank you for participating in this interview. The goal of the interview is to gain the perspective of experts on PLN's procurement process for renewable energy and compare these to the recommendations of my own policy analysis.

In the following section are the interview questions. The interview will follow these questions but has the potential to deviate as it will be conducted in a semi-structured manner. Certain questions are tailored towards experts with private party experience on energy procurement, while others are tailored to the PLN/governance side. This will be indicated in the list.

The questions are broken up into three parts:

- Exploration, where personal context is discussed and I ask for information that I was unable to find through my research;
- Validation, determining expert views on the obstacles from my analysis and discussing possible policy suggestions for them;
- Closing section, were there any important matters left out or possibilities not looked at?

Exploration and personal context

1. *Who are you and how do you or your organization work on renewable electricity/energy in Indonesia?*
2. *RE Capacity is lagging behind the GoI's targets as noted in the RUPTL, RUEN and CIPP. What are in your opinion the main causes of this?*

3. *My research has defined the procurement process between PLN and private parties as one of several obstacles to RE development. How does this procurement process work according to you?*
4. *Is the procurement process a relevant obstacle in your opinion?*
5. *PLN/Governance questions:*
    a. *How does PLN evaluate bids on projects for which it has submitted Request-for-Proposals and which components of a bid are the most important?(Price, Bidder Reliability, Technical Experience, Design etc.)*
    b. *Which bid requirements do private parties seem to struggle with the most?*
    c. *What is the main difference between managing variable renewable energy projects and non-variable projects? Are there any specific challenges?*
    d. *Does the number of projects PLN puts up for bid match the amounts as planned in the RUPTL? And if not, what are the main reasons for this in your opinion?*
    e. *When it comes to increasing energy capacity, how is RE viewed in terms of costs compared to more conventional sources like coal and gas? Is it considered more expensive, or does it genuinely compete with fossil generators in terms of cost per KWh?*
6. *Private party questions:*
    a. *Has your organisation been involved in project proposals for PLN? If so, what was the intended role of your organization in the project? If not do you have other kinds of experience with this process?*
    b. *How did the project process work in your case, what worked well and what was complicated/constraining?*
    c. *How was the project (intended to be) financed? (Through Development Banks, own funds, PLN, other financial institutions etc.)*
    d. *According to several sources PLN's bidding process for RE is described as untransparent due to how it applies the direct selection method; How was bidding conducted and what was communication with PLN like?*
    e. *Do you think a high overall risk perception significantly impact interest rates for the financing of the project?*
7. *To what extent does PLN assist private parties in the development of their bids by providing relevant data? (RE Potential, Site Selection, Transmission network plans etc.)*
8. *Do you think the existing transmission network constrains the options for new renewable power plants?*

Backup Questions:

- *Is pre-qualification (DPT) a straightforward process?*
- *Private party: How were you informed of the opportunity to bid on the project, did you receive a Request-for-Proposal from PLN?*

- *Private party: Was land acquisition considered a major risk factor in the process of developing a bid and if so, why?*
- *Private party: How did you obtain transmission network data, was this a challenge?*
- *Private party: Was the initially proposed structure of the PPA an issue from your perspective?*

Validation

1. *Do you think that PLN's current procurement process factors into the slow uptake of RE in Indonesia?*
2. *From my research the Policies that would require PLN to provide a minimum amount of data in the form of feasibility studies on RE potential, Site Selection and Transmission Network Data would be helpful for investors. Does this conclusion reflect your personal experience and if so in what ways?*
3. *What could be done to make placing bids more attractive to investors/developers?*
4. *Do you have any suggestions on how the land acquisition process could be improved from your perspective?*
5. *Can you think of any adjustments to the procurement process which would lower the price/KWh a developer/investor could offer PLN?*

Backup Questions:

- *Do you feel that the procurement division of PLN is limited in its capacity to manage a large number of projects and communicate effectively with all the parties involved in bidding?*
- *Would a policy requiring a more transparent tender process impact the way private parties perceive doing business with PLN positively?*
    - *PLN/Governance: Would demanding such transparency be feasible from PLN's perspective?*
- *Is requiring PLN to use PPA templates tailored to the characteristics of RE energy sources an effective way to simplify negotiations and reduce perceived risk for investors?*

Closing section

1. *Do policies targeting the procurement process have the potential to make a meaningful difference in how easily PLN is able to incorporate renewables through IPPs?*
2. *Are there any elements of the procurement process which were not discussed so far that have a large impact on renewable uptake in your opinion?*
3. *Aside from the procurement process, what are in your opinion the main factors influencing renewable uptake in Indonesia?*
4. *Do you see a bright future for Indonesia's energy transition?*

2. Informed Consent Form

Delft University of Technology
HUMAN RESEARCH ETHICS
INFORMED CONSENT TEMPLATES AND GUIDE
(English Version: January 2022)

You are being invited to participate in a research study titled "Understanding Indonesia's path to net-zero: An institutional analysis and policy recommendations to further the Indonesian energy transition". This study is a MSc Thesis project being done by corresponding researcher Derek Warner and responsible researcher Dr. Ir. Jaco Quist from the TU Delft.

The purpose of this research study is to determine feasible policy alternatives for the Indonesian government with the goal of boosting investments in RES technologies in the nation. Data collection will be done through 30-60 minute semi-structured interviews. The data will be used for the expert validation of policy alternatives. We will be asking you to judge the potential effectiveness of the varying policy alternatives as well as their political feasibility based on your expert knowledge of Indonesia's institutions or energy markets in general. Data collected will include a full audio or video recording of the interview as well as a transcript made from those recordings. Once the research has been concluded the transcripts and recordings will be destroyed with only quotes and references in the final report remaining.

As with any online activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by storing and Personal Identifiable Information(PII), signed consent forms, interview transcripts and recordings on a TUD institutional storage, accessible only to the TUD research team. These will be destroyed at the latest 2 years after completion of the research.

Following the interview, we will write an anonymous summary of the conversation. The summary will be sent to you, and you will be welcome to provide suggestions or modifications to the summary. The summary will be made publicly available as part of the supplementary material of the MSc thesis.

Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any questions. The data will be stored on a TUD institutional storage only accessible to Derek Warner, Jaco Quist and Rutger van Bergem. The personal data will be handled according to the European General Data Protection Regulation.

Explicit Consent points

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the study information above or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	☐	☐
2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the interview study at any time, without having to give a reason.	☐	☐
3. I understand that taking part in the interview study involves: A video or audio recorded interview which will be transcribed into text.	☐	☐
4. I understand that my participation in the study will end upon completion of the interview and that the study will be completed by late 2025 when the thesis will be defended.	☐	☐
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
5. I understand that taking part in the study also involves collecting specific personally identifiable information (PII), such as name and employment history. See main text for mitigation steps.	☐	☐
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
6. I understand that after the interviews the information I provide as well as resources found as a result of the interview. will be used for the exploration or validation of research on energy infrastructure, in the form of quotes and references to anonymized summaries	☐	☐
D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE		
7. I understand the final report will be stored in the TU Delft MSc Thesis repository and from there be publicly available. The final report will contain the anonymous summary of the conversation.	☐	☐
8. I understand PII will be stored in encrypted form in the TU Delft Projects Storage for up to two years.	☐	☐

Signatures

_____	_____	_____
Name of participant [printed]	Signature	Date

Study contact details for further information: [*Name, email address*]

F. Literature reviews

Table F.1 Literature Review Summaries

Purnamasari & Nurachmah. (2023)	Determine that carbon pricing has a lot of potential to reduce emissions and fostering sustainable investment in Indonesia, however overcoming political and institutional obstacles is crucial in order to potentially apply any such policy effectively
Gyamfi et al. (2022)	Conclude that based on historical data of E7 economies like Indonesia institutional quality is an essential factor in the reduction of environmental degradation and that it must be improved in order to have meaningful climate policy.
Setyowati & Quist. (2022)	Find that national policy in Indonesia is insufficient in enabling ambitious regional initiatives and even limiting them in multiple cases, implying that a decentralized approach would be fruitful.
Bekun et al. (2021)	Concludes that E7 nations do not have the necessary institutional fortitude to 'spur a clean environment' based on historical data.
Ting & Byrne. (2020)	With a case study on the South African energy provider ESKOM they find that regime-incumbency can offer a significant form of resistance to the incorporation of niche innovations into the electricity sector. Deliberate institutional design may prove meaningful in reducing the negative effects of regime incumbency.
Loseva et al. (2020)	Describe that policies and initiatives in developed countries tend to have much greater effect on sustainable investment and carbon emissions reduction than in their less developed counter parts due to the better institutions and market conditions in place, specifically comparing the cases of Cyprus and Indonesia.
Trencher et al. (2019)	Find that Japan's struggles to phase out coal are due to a high degree of regime incumbency. The authors propose several institutional and market focused policies in order to mitigate this problem, including carbon pricing and coal phase out timelines.
Funk (2022)	Determines that measures need to be taken to prepare South Kalimantan, a region in Indonesia that is economically dependant on coal production, for a phase out of coal in order to reduce the economic shock the region is likely to experience when coal production decreases. Cites institutional lock-in as a barrier for implementing effective measures and that currently many potentially effective solutions are unfeasible due to the institutional realities of the region. Specifically referencing the monopolistic position of PLN, corruption, non-adherence to laws and lobbying efforts to keep carbon prices low.
Simanjuntak(2021)	Finds that Indonesia is in an advantageous position to expand wind farm capacity at relatively low levelized costs of electricity but that institutions in place form a barrier to investments. Relevant institutions named as barriers are take or pay contracts between PLN and IPPs, restrictions on foreign investments and ownership and lack of incentive on behalf of PLN to plan additional wind capacity.
Van Asselt(2023)	Concludes that despite the significant benefits that inter-island interconnections offer the Indonesian power grid institutional obstacles are responsible for a sizeable amount of resistance. Recommends policies like integrated transmission planning, strengthening of investment and creating a separate governing body for interconnectivity to smooth institutional obstacles.