Navigating Indonesia's Energy Transition: Institutional, Policy, And Market Determinants Of Renewable Electricity Adoption

Dr. Alejandro M. Fernández
Department of Economics and Energy Policy, University of Melbourne, Australia

Dr. Sofia R. Delgado
Center for Sustainable Energy Studies, University of São Paulo, Brazil

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ABSTRACT

Indonesia's electricity sector stands at the intersection of competing structural forces: long-standing fossil fuel subsidies, emerging renewable energy technologies, institutional market rigidities, and ambitious national development goals. This article develops a comprehensive, theory-driven analysis of Indonesia's energy transition by synthesizing and critically interrogating existing scholarship on subsidy reform, rooftop photovoltaic adoption, renewable energy investment, excess electricity supply, and broader political–economic dynamics shaping the power sector. Drawing strictly on the provided references, the study constructs an integrated analytical narrative explaining why incremental policy reforms have thus far yielded limited transformation in the national energy mix, despite significant technical potential and growing international momentum for decarbonization. The article adopts a qualitative, interpretive research design grounded in policy analysis and institutional economics, supported by descriptive evaluation of empirical findings reported in prior studies. Particular attention is given to the paradox of subsidy phase-out, which, while theoretically expected to stimulate renewable competitiveness, may in practice reinforce structural inertia when implemented in isolation from market reform and demand-side restructuring. The analysis further explores household-level rooftop photovoltaic policies, highlighting how regulatory uncertainty, tariff design, and utility dominance constrain adoption, even where economic viability appears plausible. The discussion is extended to include electricity oversupply challenges, independent power producer contracts, and the political economy of downstream industrial policies such as nickel processing, situating renewable electricity within Indonesia's broader developmental state strategy. By elaborating theoretical implications, policy trade-offs, and contextual limitations in extensive detail, this article contributes a holistic framework for understanding Indonesia's stalled energy transition. The findings underscore that renewable electricity expansion is not merely a technological or price-driven process but a deeply institutional and political one, requiring coordinated reform across subsidies, market governance, investment regimes, and long-term planning. The article concludes by outlining future research and policy directions, emphasizing the need for integrated, context-sensitive approaches rather than fragmented regulatory adjustments.

Keywords: Indonesia electricity sector, renewable energy policy, energy subsidies, rooftop photovoltaics, electricity market reform, energy transition governance.

INTRODUCTION

Indonesia's electricity sector has long been characterized by a complex interplay of economic development imperatives, energy security concerns, and socio-political commitments to affordability. As one of the largest emerging economies and the most populous country in Southeast Asia, Indonesia faces rapidly growing electricity demand driven by urbanization, industrialization, and rising household incomes. Historically, this demand has been met predominantly through fossil fuel–based generation, supported by extensive energy subsidies that have served both economic and political objectives. These subsidies have been justified as instruments for protecting consumers, supporting industrial competitiveness, and ensuring social stability, yet they have also contributed to fiscal pressure, market distortions, and environmental externalities (Hartono et al., 2020).

In recent decades, global concerns over climate change and the declining costs of renewable energy technologies have brought renewed attention to Indonesia's vast renewable potential. Solar irradiation across the archipelago, substantial wind corridors in specific regions, and broader opportunities for diversifying the energy mix present a compelling case for accelerated renewable deployment (Hesty et al., 2021). At the same time, Indonesia's government has articulated policy commitments to increase the share of new and renewable energy in the national electricity mix, aligning with international climate frameworks and domestic sustainability narratives. However, the empirical reality reveals a persistent gap between stated ambitions and actual outcomes. Renewable penetration remains limited, and the electricity sector continues to be dominated by incumbent fossil-based generation and a state-owned utility with substantial market power.

This tension between aspiration and implementation forms the core motivation of this article. Existing research has examined discrete elements of Indonesia's energy transition, such as the effects of subsidy reform (Hartono et al., 2020), the economics of residential rooftop photovoltaics (Haryadi et al., 2021), and policy mechanisms to encourage household adoption (Hidayatno et al., 2020). Other analyses have highlighted structural challenges such as electricity oversupply and contractual rigidities with independent power producers (Hasjanah, 2023). While each of these contributions offers valuable insights, there remains a need for an integrative, theory-rich synthesis that situates these findings within a coherent analytical framework. Without such integration, policy debates risk being fragmented, addressing symptoms rather than underlying systemic constraints.

The central problem addressed in this article is therefore not merely whether renewable energy is technically or economically feasible in Indonesia, but why, despite feasibility, progress remains slow and uneven. This requires moving beyond narrow cost comparisons to examine institutional design, political economy, learning dynamics, and developmental priorities. The literature suggests that energy transitions in developing countries are shaped by both local and global learning processes, affecting technology costs and investment decisions (Huenteler et al., 2016). Yet learning alone cannot overcome entrenched market structures or misaligned incentives. Similarly, reforms aimed at reducing subsidies may improve fiscal efficiency but fail to catalyze renewable uptake if complementary policies are absent.

This article seeks to fill this literature gap by offering a comprehensive, publication-ready analysis that synthesizes the provided references into a unified narrative. It adopts an explicitly qualitative and interpretive approach, emphasizing depth of explanation over brevity. By elaborating theoretical implications, counter-arguments, and nuanced policy interactions in extreme detail, the study aims to contribute both to academic understanding and to informed policy discourse. In doing so, it responds to calls for context-sensitive energy research that recognizes the unique institutional and socio-economic conditions of developing economies like Indonesia (Stake, 2010).

METHODOLOGY

The methodological approach adopted in this study is qualitative, interpretive, and integrative, consistent with established traditions in policy-oriented energy research. Rather than generating new quantitative data, the article systematically analyzes and synthesizes findings from the provided references, treating them as primary empirical and conceptual sources. This approach is particularly appropriate given the study's objective of developing a holistic understanding of Indonesia's electricity sector dynamics, which are deeply embedded in institutional, regulatory, and political contexts.

Qualitative research emphasizes understanding how and why complex systems operate as they do, focusing on meaning, interpretation, and context rather than statistical generalization (Stake, 2010). In the context of energy policy, this approach allows for an in-depth examination of regulatory design, actor behavior, and structural constraints that cannot be fully captured through numerical indicators alone. The study therefore engages in close reading and interpretive analysis of each reference, identifying key arguments, assumptions, and implications, and then situating them within a broader theoretical framework.

The analytical process proceeds through several interconnected stages. First, the study identifies core thematic domains across the references, including energy subsidy reform, renewable electricity adoption, electricity market structure, investment and learning dynamics, and broader economic policy interactions. Each domain is then explored in detail, with explicit attention to how individual studies contribute to understanding that domain. For example, Hartono et al. (2020) provide a critical examination of subsidy phase-out, while Haryadi et al. (2021) and Hidayatno et al. (2020) focus on household-level photovoltaic adoption from complementary perspectives.

Second, the study employs comparative and relational analysis, examining how insights from different domains interact. Rather than treating subsidy reform or rooftop photovoltaics in isolation, the analysis explores how subsidy policies influence market incentives, which in turn shape household and investor behavior. This relational approach is essential for understanding why policies that appear theoretically sound may fail in practice due to misalignment with existing institutional arrangements.

Third, the methodology incorporates theoretical elaboration drawing on concepts from institutional economics, political economy, and innovation studies. While the article does not introduce external theoretical sources beyond those implicit in the provided references, it expands on the theoretical underpinnings of these studies through detailed explanation and logical reasoning. For instance, the concept of learning effects in renewable energy cost reduction is elaborated by discussing how local and global learning processes operate differently in developing contexts (Huenteler et al., 2016).

Finally, reflexivity and critical interpretation are integral to the methodological stance. The study explicitly acknowledges the limitations inherent in relying on secondary sources and interpretive analysis. However, rather than viewing these limitations as weaknesses, the article treats them as opportunities to generate deeper insight into structural and contextual factors that quantitative models may overlook. This approach aligns with qualitative research principles emphasizing depth, coherence, and analytical rigor (Stake, 2010).

RESULTS

The integrative analysis of the provided literature yields several interrelated findings regarding the dynamics of Indonesia's electricity sector and its energy transition trajectory. These findings are presented descriptively, emphasizing patterns, relationships, and implications rather than numerical outcomes.

One central finding concerns the limited effectiveness of energy subsidy phase-out as a standalone policy instrument. Hartono et al. (2020) argue that reducing or eliminating fossil fuel subsidies is often promoted as a means of improving the competitiveness of renewable energy and diversifying the energy mix. In theory, subsidy removal should correct price distortions, allowing market signals to reflect true costs and incentivize investment in cleaner alternatives. However, the analysis reveals that in Indonesia's context, subsidy phase-out may represent a dead end when not accompanied by deeper structural reforms. The electricity market remains dominated by a vertically integrated state-owned utility, with regulated tariffs and limited competition. As a result, changes in input prices do not necessarily translate into meaningful shifts in generation portfolios or investment behavior.

A second key finding relates to the adoption of residential rooftop photovoltaics. Studies by Haryadi et al. (2021) and Hidayatno et al. (2020) demonstrate that, under certain assumptions, rooftop PV systems can be economically viable for Indonesian households. Declining technology costs, favorable solar resources, and potential savings on electricity bills suggest a substantial market opportunity. However, actual adoption remains modest. The analysis identifies regulatory uncertainty, complex permitting processes, and tariff structures that limit net metering benefits as major barriers. Moreover, the dominant position of the national utility creates an inherent tension between distributed generation and centralized revenue models, further constraining policy support.

The issue of electricity oversupply emerges as another significant result. Hasjanah (2023) highlights that Indonesia faces excess generation capacity in several regions, driven by ambitious capacity expansion plans and long-term contracts with independent power producers. This oversupply reduces the urgency of new generation investment and creates financial strain on the utility, which must pay for capacity regardless of utilization. In such a context, integrating additional renewable generation becomes politically and economically challenging, as it may exacerbate existing inefficiencies rather than alleviate them.

The analysis also reveals the importance of learning and investment dynamics in shaping renewable energy costs and deployment. Huenteler et al. (2016) emphasize that both local and global learning processes contribute to cost reductions, but developing countries often struggle to capture these benefits due to limited domestic manufacturing, weak innovation ecosystems, and policy uncertainty. In Indonesia, this means that global cost declines in solar and wind technologies do not automatically translate into rapid domestic deployment, particularly when investment risks remain high.

Finally, the broader political–economic environment plays a critical role in shaping electricity sector outcomes. The analysis of the nickel downstream program by Hujolly et al. (2024) illustrates how energy policy is intertwined with industrial strategy and national development objectives. Electricity supply decisions are influenced not only by cost or environmental considerations but also by goals related to value addition, export competitiveness, and employment. This reinforces the finding that renewable energy policy cannot be understood in isolation from wider economic priorities.

DISCUSSION

The findings presented above invite a deeper discussion of their theoretical and policy implications. At a theoretical level, the Indonesian case challenges simplistic narratives of energy transition that emphasize cost competitiveness and price signals as primary drivers of change. While economic incentives are undoubtedly important, the analysis demonstrates that institutional arrangements, market structure, and political priorities play an equally, if not more, decisive role.

The limited impact of subsidy phase-out highlights a fundamental insight from institutional economics: markets do not operate in a vacuum. Price reforms may alter relative costs, but their effects depend on how actors are embedded within regulatory and organizational frameworks. In Indonesia's electricity sector, the state-owned utility's central role means that investment decisions are guided by planning mandates, contractual obligations, and political considerations rather than marginal cost signals alone (Hartono et al., 2020). This suggests that subsidy reform, while necessary for fiscal sustainability, is insufficient as a catalyst for renewable energy without complementary reforms in market governance and utility incentives.

The rooftop photovoltaic case further illustrates the importance of aligning policy design with actor incentives. Households make adoption decisions based not only on levelized costs but also on perceived risk, administrative burden, and trust in regulatory stability. Frequent revisions of regulations governing rooftop PV, as discussed by Huzaini and Pratama (2020), undermine investor confidence and discourage long-term commitment. This aligns with broader findings in the literature on policy credibility and investment behavior, reinforcing the argument that stable, transparent frameworks are essential for distributed energy development.

Electricity oversupply introduces a paradoxical constraint on renewable integration. In many contexts, insufficient capacity is seen as a barrier to development, yet in Indonesia, excess capacity reduces the marginal value of new generation, including renewables. This underscores the importance of demand-side management and integrated planning. Without strategies to stimulate demand growth in a sustainable manner or retire inefficient capacity, renewable deployment risks becoming a zero-sum game within an already saturated system (Hasjanah, 2023).

The discussion of learning effects highlights the uneven geography of innovation benefits. While global learning reduces technology costs, local learning is crucial for adapting technologies to specific contexts and reducing non-hardware costs. Indonesia’s limited capture of local learning benefits suggests a need for policies that support domestic capability development, including training, local content requirements balanced with efficiency, and knowledge transfer mechanisms (Huenteler et al., 2016).

Several limitations of this study must be acknowledged. The reliance on secondary sources restricts the ability to capture recent policy changes or on-the-ground implementation challenges. Moreover, the qualitative interpretive approach, while rich in contextual insight, does not provide quantitative estimates of policy impacts. Future research could build on this analysis by combining qualitative frameworks with empirical modeling or case studies of specific regions within Indonesia.

CONCLUSION

This article has presented an extensive, theory-driven analysis of Indonesia’s electricity sector and its energy transition challenges, drawing exclusively on the provided references. By integrating insights on subsidy reform, renewable adoption, market structure, learning dynamics, and political economy, the study demonstrates that Indonesia’s slow progress in diversifying its energy mix cannot be attributed to a single factor. Instead, it reflects the interaction of entrenched institutional arrangements, regulatory uncertainty, oversupply conditions, and competing development priorities.

The central conclusion is that renewable electricity expansion in Indonesia requires a fundamentally integrated policy approach. Incremental reforms, such as subsidy phase-out or isolated rooftop PV incentives, are unlikely to succeed without broader changes in market governance, utility incentives, and long-term planning. Policymakers must recognize that energy transitions are as much about institutions and politics as they are about technology and cost.

By offering a comprehensive and elaborated synthesis, this article contributes to a deeper understanding of energy transition dynamics in developing economies. It underscores the importance of context-sensitive, holistic strategies that align economic, environmental, and social objectives. Such an approach is essential if Indonesia is to move beyond stalled reforms and realize its considerable renewable energy potential.

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