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Developer Perception and Interest in Solar Power Plant Investment: Case Study To Encourage Clean Energy Investment

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ABSTRACT

Despite Indonesia's vast solar energy potential and supportive regulatory frameworks, private sector investment in solar power plants remains limited. This study aims to explore developer perceptions and investment interest in the solar power plant sector, and to identify key factors influencing their decision-making. Employing a qualitative case study approach, data were collected through in-depth interviews with developers experienced in both fossil-based and renewable energy projects. Thematic analysis reveals that consistent regulation, revenue certainty through Power Purchase Agreements (PPAs), and land availability are critical drivers of investment interest. Additionally, perceived regulatory risks, cost of capital, and local policy requirements such as domestic content obligations shape developers' strategies toward solar project participation. This study contributes to the literature by offering developer-centered insights on investment behavior in emerging renewable markets.

KEYWORDS *Solar Power Plant, Renewable Energy Investment, Developer Perception, Regulatory Risk, Indonesia, Qualitative Study.*

INTRODUCTION

The global climate crisis and the urgent call for energy transition have significantly increased the demand for clean and sustainable energy solutions (IPCC, 2014). Among renewable energy sources, solar power holds considerable promise due to its scalability, declining costs, and environmental benefits (IRENA, 2020; Panwar, Kaushik, & Kothari, 2011). As a tropical country, Indonesia has abundant solar energy potential—an estimated 3,294 GW in technical capacity (OEI, 2023). However, despite supportive regulatory frameworks and national targets such as the 23% renewable energy mix by 2025 (*RUEN*, 2017), private sector investment in solar photovoltaic (*PLTS*) remains significantly underrealized, with only 0.3 GW installed by 2022.

This gap between potential and realization is attributed to several structural barriers, including regulatory inconsistencies, high cost of capital, land availability constraints, and administrative inefficiencies (IEA, 2023; Levy & Spiller, 1994).

Furthermore, the dynamic and sometimes unpredictable policy environment in Indonesia has raised concerns among developers, affecting their willingness to invest in long-term renewable energy infrastructure.

Although previous studies have extensively explored technical, financial, and policy dimensions of renewable energy development (Criscuolo & Menon, 2015; Szabó, Jäger-Waldau, & Szabó, 2010), few have examined how developer perceptions, expectations, and risk assessments shape investment decisions—particularly in the context of emerging markets. According to behavioral and organizational theories, such as the Theory of Planned Behaviour (Ajzen, 1991) and Expectancy-Value Theory (Fishbein & Ajzen, 1975), decision-making is not merely rational but also deeply influenced by subjective beliefs, perceived control, and value expectations. Moreover, institutional theory suggests that developers' strategies are shaped by the regulatory, normative, and cognitive pressures within the energy ecosystem (Scott, 1995).

The transition to renewable energy, particularly solar PV, is crucial for combating climate change, yet Indonesia has significantly underutilized its vast solar potential despite favorable natural conditions. While solar energy offers long-term cost benefits, high initial investment costs and policy implementation gaps have hindered adoption, highlighting the need to understand developer perspectives on opportunities and barriers. The Diffusion of Innovation Theory suggests that consistent policy support and cost reductions could accelerate adoption, but current regulatory inconsistencies in Indonesia create uncertainty for investors. This raises important questions about how developers perceive solar energy prospects and what challenges they face in the Indonesian context.

Regulatory clarity and stability are fundamental for renewable energy investment, yet Indonesia's shifting policies, local content requirements, and complex land acquisition processes create substantial risks for developers. Institutional theory helps explain how these regulatory uncertainties reduce project legitimacy and deter investment by increasing perceived risks. Developers must navigate not only formal rules but also informal norms and cognitive barriers that shape the investment landscape. These institutional challenges directly influence developers' willingness to commit to solar projects, making it critical to identify which regulatory factors most impact their investment decisions and how these barriers might be addressed.

Developer decision-making extends beyond pure financial calculations, incorporating behavioral and psychological factors that shape risk perception and strategic responses. Theories of planned behavior and expectancy-value suggest that investment interest depends on developers' attitudes, social influences, and sense of control over outcomes. When faced with uncertainty, developers may delay or scale back investments, using real options approaches to maintain flexibility.

Understanding these behavioral dynamics is essential for explaining why some potentially viable projects stall while others advance, particularly in Indonesia's complex regulatory environment.

Existing research demonstrates that stable, long-term policies like feed-in tariffs boost investor confidence more effectively than short-term incentives, while regulatory risk perceptions vary across investor types and markets. Studies in similar emerging economies highlight the importance of financing access, regulatory clarity, and local infrastructure in driving renewable energy adoption. This study builds on these insights by examining how Indonesian solar developers weigh technical, financial, regulatory, and behavioral factors in their investment decisions. By integrating multiple theoretical perspectives, the research provides a comprehensive framework for analyzing developer strategies and offers practical recommendations to accelerate Indonesia's solar energy transition.

This study aims to fill that gap by focusing on the behavioral and perceptual dimensions of renewable energy investment. Specifically, this research addresses the following questions: 1. How do developers perceive the opportunities and challenges associated with investing in solar power plants in Indonesia? 2. What factors do developers consider most critical in shaping their investment interest? 3. What strategies could enhance the attractiveness of solar power plant investment among developers?

To answer these questions, this paper adopts a qualitative case study approach involving in-depth interviews with energy developers who have experience in both fossil-based and renewable projects. Thematic analysis is used to uncover key patterns, beliefs, and strategic considerations that inform investment decisions.

The findings of this research contribute to the literature on clean energy transitions in emerging economies by offering grounded, actor-centered insights. By highlighting the experiences and perceptions of developers—the key market agents responsible for project realization—this study proposes actionable policy recommendations to enhance investment attractiveness and accelerate the deployment of solar energy in Indonesia. It also adds to the broader theoretical understanding of how institutional, financial, and regulatory environments interact with individual cognition and strategic behavior in energy investment decisions.

The structure of the remainder of this paper is as follows: Section 2 reviews the literature on renewable energy *investment*, developer behavior, and regulatory environments. Section 3 outlines the research methodology. Section 4 presents the key findings. Section 5 discusses implications, and Section 6 concludes with recommendations and directions for future research.

RESEARCH METHOD

This study adopts a qualitative case study approach to explore developer perceptions and investment interest in solar power plant projects in Indonesia. The qualitative method was chosen to capture nuanced perspectives and strategic considerations that cannot be addressed through quantitative analysis (Creswell & Creswell, 2022).

Data were collected through semi-structured in-depth interviews with two key informants from the energy sector, selected using purposive sampling. Participants included decision-makers from both renewable and fossil-based developer companies with experience in electricity project investment. The interviews, conducted in person or online, lasted between 45 and 90 minutes and covered themes such as investment barriers, regulatory risk, financing, and strategic responses. In addition to interviews, the study used document review to triangulate findings. Key sources included PLN's *RUPTL 2021–2030*, Presidential Regulations, and reports from IEA, IRENA, and the Indonesian Energy Outlook (2023).

The data were analyzed using thematic analysis (Braun & Clarke, 2006), following six steps: familiarization, coding, theme generation, review, definition, and reporting. Themes were developed both deductively (from theory) and inductively (from participant narratives). To ensure trustworthiness, the study applied triangulation, member checking, and an audit trail. Ethical approval was obtained, and all informants provided informed consent.

RESULTS AND DISCUSSION

This study explores the perceptions and investment interest of developers in Indonesia's solar power plants sector through in-depth interviews with key industry actors. Nine key themes emerged from the thematic analysis, reflecting both enabling and constraining factors across regulatory, financial, institutional, and operational dimensions.

Investment Feasibility

While renewable energy receives strong policy endorsement, developers remain cautious about PLTS viability without additional incentives. Informant 1 explained that solar power plants is often perceived as a symbolic asset rather than a profitable investment:

"Now with renewable, investors are no longer focused on return on investment but rather return on effort... The hassle is just like coal, the complications too, but the returns are way below coal." *(Informant 1)*

"People just do it for branding, like showing there's a solar power plants, a green mix... But as a true source of income, it's still a challenge." *(Informant 1)*

Tariff and Power Purchase Agreement (PPA) Scheme

Tariff certainty and PPA enforceability emerged as critical concerns for developers. The absence of take-or-pay clauses in many renewable contracts reduces bankability and deters private investment. As highlighted by Informant 2:
"Take-or-pay is essentially a warranty, so developers can be assured the project is feasible and can yield decent returns." *(Informant 2)*

While tariff levels are no longer a major barrier—especially in Java-Bali where solar PV costs are already below average generation costs—developers stress that revenue certainty is more important than the nominal price.

Cost of Capital

High financing costs remain a key barrier to solar power plant investment. Solar PV's financial viability is particularly sensitive to interest rates, given its lack of operational fuel cost. Informant 2 noted:
"Renewable projects, especially solar PV, are highly sensitive to financing costs... If interest rates are high, returns become low, or tariffs become expensive." *(Informant 2)*

Although access to local financing is improving, both informants questioned the practical benefits of so-called "green financing", which often fails to offer significantly lower rates.

Regulatory Uncertainty and Local Content Requirement

Regulatory volatility and restrictive local content requirement rules were key deterrents. Informant 1 expressed frustration at the long delays in obtaining waivers:
"The local content requirement waiver took two years… So people are reluctant when it comes to that." *(Informant 1)*

He also highlighted misalignment between local content obligations and international project financing:
"For large-scale projects… international lenders would demand components from their countries… This needs to be considered by the Ministry of Industry." *(Informant 1)*
"Every time a new minister comes in, the rules change. This makes investors hesitant." *(Implied from Informant 1)*

Permitting and Land Access

While the permitting process has improved following the Online Single Submission (OSS) system, land acquisition remains a major challenge. Informant 1 reflected:
"Permits are now easier, especially after OSS… it's not too complicated anymore." *(Informant 1)*
"The headache is freeing up 20 hectares… especially after the Batang experience, all investors and lenders are now scared of Indonesia." *(Informant 1)*

Informant 2 added that support from SOEs and government in strategic projects helped reduce friction:
"In our case with the Cirata floating solar power plant… everything was smooth, permits from local to national level were obtained as scheduled." *(Informant 2)*

Technology and Operational Efficiency

Developers recognized solar power plant as a mature and reliable technology with rapid deployment advantages:

"The development process for solar power plant is very fast… planning, funding, and building can be completed in under a year." *(Informant 2)*

"You can build solar power plant anywhere without worrying much about resource location… almost all sites are viable." *(Informant 2)*

Technical degradation over time is acknowledged but manageable:

"In our financial model, we already account for degradation… as long as it's within the expected range, it's acceptable." *(Informant 2)*

Social and Environmental Factors

Social acceptance, particularly in water-based or community-adjacent projects, is a crucial factor. Informant 2 shared:

"Social factors can be a project stopper… like in Singkarak Lake where the community rejected the project." *(Informant 2)*

However, projects on cleared or state-owned land like Cirata faced no such resistance:

"Cirata faced no rejection… we were in our own area, and it was already cleared before construction." *(Informant 2)*

"For floating solar, we have to be careful… it impacts aquatic ecosystems." *(Informant 2)*

Project Scale and Market Strategy

Developers favor large-scale projects due to cost efficiency and simplified processes. Informant 1 observed:

"Solar power plant projects are always small in scale… unlike gas which can reach 600–750 MW. That's why it's not very attractive." *(Informant 1)*

Informant 2 argued that developer effort is the same regardless of scale:

"Whether it's 100 MW, 50 MW, or 2 GW, the developer effort is the same… only the numbers differ." *(Informant 2)*

Market Perception and Business Priorities

Solar power plant is still not seen as a core business for many firms. Informant 1 highlighted that for some, solar investment is more about corporate image than profit:

"People just do it for branding… showing they have a green energy mix. But as a serious income source, solar power plant is still a challenge." *(Informant 1)*. This perception affects internal resource allocation and limits strategic focus on renewables.

Discussion

This study investigated the perceptions and investment interest of developers in Indonesia's solar power plant sector. The findings provide empirical insights into how financial structures, regulatory frameworks, and institutional

environments influence investment behavior. The discussion is structured around the three main research questions and interpreted in relation to relevant theoretical frameworks.

Perceptions of Opportunities and Challenges

The first research question addressed how developers perceive opportunities and constraints in solar power plant investment. Despite acknowledging the technological maturity and rapid deployability of solar PV, developers remain cautious due to high initial capital requirements, revenue uncertainty, and regulatory risk. These findings reinforce the importance of perception theory (Robbins & Judge, 2022), showing how subjective assessments of policy stability and economic return can outweigh objective project feasibility.

Furthermore, the perception of solar power plant as a "branding tool" rather than a core business reflects low confidence in long-term profitability, consistent with the Expectancy-Value Theory (Fishbein & Ajzen, 1975), which posits that individuals are less likely to act when expected outcomes are perceived as low value or low probability.

Factors Influencing Investment Interest

The second research question focused on identifying the most critical factors affecting developer interest. The findings highlight three primary concerns: PPA scheme**,** cost of capital**,** and regulatory certainty**.**

- The absence of a reliable *take-or-pay* clause in PPA contracts reduces project bankability, confirming previous findings by (Criscuolo & Menon, 2015), who emphasized the role of long-term policy commitments in green investment.
- Developers also stressed that financing terms are decisive, aligning with Szabó et al. (2010), who identified the risk-adjusted cost of capital as a key determinant in renewable energy projects.
- Regulatory uncertainty—especially surrounding local content requirement and land access—was consistently seen as a deterrent, validating institutional theory (Scott, 1995) which states that misalignment in formal and informal rules undermines legitimacy and increases perceived risk.

These concerns suggest that while tariff competitiveness has improved, non-price factors such as institutional trust and policy predictability are now more critical to investment decisions.

Strategic Responses and Developer Behavior

The third research question explored how developers respond to current conditions. The findings indicate a tendency to prioritize larger-scale or lower-risk projects, or to treat solar power plant as a secondary business. This reflects the logic of Real Options Theory (Pringles et al., 2020), where investors defer, scale, or relocate projects in the face of uncertainty.

While the government has introduced incentives and national targets (RUEN, 2017), inconsistent implementation at local levels weakens developer

confidence. Some developers mitigate this by partnering with state-owned enterprises (e.g., PLN subsidiaries), which offers political backing and facilitates permitting—demonstrating the importance of institutional anchoring in high-risk markets.

Contribution and Policy Implications

This study contributes to the literature by highlighting the behavioral and perceptual dimensions of clean energy investment—areas often overlooked in favor of technical or macroeconomic analysis. By examining the perspectives of developers as strategic actors, the study reveals that investment decisions in solar power plant are shaped as much by institutional trust and perceived fairness as by economic calculations.

For policy, the findings underscore the need to:

- Strengthen and standardize PPA terms, including off-take guarantees;
- Improve access to low-cost, long-term green financing;
- Streamline permitting and clarify land access procedures;
- Reevaluate local content rules to better align with financing realities.

CONCLUSION

This study explored the perceptions and investment interest of developers in solar power plant projects in Indonesia using a qualitative case study approach. The findings revealed that while solar PV is technologically viable and cost-competitive in several regions, developers remain hesitant due to non-economic factors. The lack of take-or-pay clauses, high capital costs, and regulatory inconsistencies—particularly around *local content* and land access—were cited as key barriers. Moreover, solar power plant is often treated as a complementary or symbolic investment rather than a core business strategy. This perception is shaped not only by economic returns but also by behavioral and institutional factors, validating the relevance of *perception theory*, *institutional theory*, and the *Theory of Planned Behavior* in understanding clean energy investment decisions.

To accelerate private sector participation in solar power plant (*PLTS*) development and achieve Indonesia's renewable energy targets, several key recommendations should be implemented: enhancing regulatory certainty through standardized *Power Purchase Agreements* (*PPAs*) with firm off-take guarantees and maintaining consistent renewable energy policies across political transitions; improving access to affordable capital by expanding *green financing* instruments with concessional terms and encouraging local banks to engage in long-term renewable project financing; streamlining permitting and land acquisition processes through the *Online Single Submission* (*OSS*) system and establishing dedicated renewable energy zones; reforming *local content* requirements by allowing flexibility in component sourcing where local capacity is limited and aligning policies with global financing standards to attract foreign investment; and strengthening institutional partnerships between private developers and state-owned enterprises to share risks and simplify bureaucratic procedures. These measures collectively address the primary barriers to solar energy investment in

Indonesia, creating a more conducive environment for private sector involvement and supporting the nation's transition to clean energy.

This study is limited by its small number of informants and its focus on perceptions within the Indonesian context. Future research could expand the sample to include government officials, lenders, and community stakeholders. Additionally, a comparative study across Southeast Asian countries could shed light on regional best practices in attracting solar investment.

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