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Comparing Solar Energy Investment Policies: Legal Perspectives from Indonesia and Vietnam

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Abstract: *Although Indonesia possesses significant potential for solar energy, it remains behind Vietnam, highlighting the critical need for policy and investment reforms to meet the increasing demand for renewable energy. This study aims to explores the normative issues within the Indonesian legal framework for investment and benchmarks it against Vietnam's to assess the legal gap that may have hindered Indonesia's progress in supporting solar technology investments. This study adopts a normative-empirical approach by integrating normative legal analysis of regulatory frameworks with the presentation and examination of empirical data. The empirical dimension of this research incorporates analysis of implementation outcomes, including renewable energy capacity data, carbon footprint measurements, and regulatory effectiveness indicators. The results of this study highlights normative inadequacies from Indonesia, with the lack of foundational normative support, followed by the lack of support in the form of complimentary regulations. Vietnam, on the other hand, has a significantly more developed framework to support investments in solar technology, serving as comparative evidence of the stark contrast between the country's success and Indonesia's ongoing challenges.*

Introduction

As the 2030 deadline for the Sustainable Development Goals approaches (Sharma et al., 2024), it is crucial to evaluate pressing global challenges, particularly those concerning environmental sustainability (Fenner & Cernev, 2024). It's even more important for Indonesia, particularly when its environmental dynamics is taken into account, as it plays a key role in tackling environmental sustainability issues (Yan et al., 2024). One of the ways sustainability can be accelerated is by promoting the use of renewable energies, Indonesia unfortunately still struggles to apply (Pambudi et al., 2023). Not only that, renewable energy is also found to be able to boost economic growth (Chen et al., 2022). Unfortunately, Indonesia is still ridden with many environmental issues, particularly its CO_2 emission. This can be attributed to the country's dependence on fossil fuels and the sluggish transition to sustainable energy sources.

Table 1. Indonesia's Carbon Footprint (2018-2022)

Year	Fossil CO_2 Emissions (tons)	CO_2 Emissions Change (%)	CO_2 Emissions per Capita	Population	Population Change (%)	Share of World's CO_2 Emissions (%)
2022	692,236,110	13.14%	2.48	278,830,529	0.75%	1.91%
2021	611,819,050	2.95%	2.21	276,758,053	0.71%	1.69%
2020	594,276,970	-6.68%	2.16	274,814,866	0.85%	1.64%
2019	636,791,090	6.68%	2.34	272,489,381	0.94%	1.76%
2018	596,941,720	10.13%	2.21	269,951,846	0.97%	1.65%

Source: (Worldometer, 2022).

Table 1 highlights Indonesia's challenges in reducing carbon emissions from 2018 to 2022. While there was a brief decline in emissions in 2020, they increased again in 2021 and surged even higher in 2022, accounting for approximately 1.91% of the world's total CO_2 emissions. Indonesia's effort to address this issue is also not entirely clear, as its progress in transition to renewable energy remains questionable. The empirical evidence regarding the state of development of Indonesia's transition to renewable energy is described in detail in table 2 below.

Table 2. Progress of Renewable Energy in some ASEAN Countries

Country	Total Installed Renewable Energy Capacity (2021)	Renewable Energy Share in Electricity Generation (2021)	Notable Renewable Energy Sources
Indonesia	10.6 GW	14%	Geothermal, Hydropower
Malaysia	8.5 GW	23%	Hydropower, Solar
Singapore	0.5 GW	3%	Solar
Thailand	12 GW	20%	Biomass, Solar
Philippines	7.6 GW	21%	Geothermal, Hydropower
Vietnam	17 GW	30%	Solar, Wind

Source: (IRENA & ACE, 2022)

Empirical evidence presented in Table 2 indicates that Indonesia remains behind in its transition to sustainable energy, trailing neighboring countries such as Malaysia, Thailand, the Philippines, and Vietnam. As a tropical country, Indonesia is blessed with sunlight throughout the year, providing the entirety of the country a warm temperature all around the year (Joewono et al., 2023). Therefore, solar panel is often cited as one of the best possible solutions to Indonesia's resolution in transitioning to renewable energy (Dhona & Dalimi, 2023), in Indonesia. However, this is not a significant

source of renewable energy in Indonesia, as the country seems to favor geothermal and hydropower more. Interestingly, Vietnam is the country with the highest utilization of solar power, contributing to its 30% renewable energy share in electricity generation. This figure is particularly significant, especially in contrast to Indonesia's 14%.

To examine Indonesia's slow progress in developing and transitioning to sustainable energy, it is essential to analyze the relevant legal framework. Legal norms of the relevant legal framework can significantly affect the transition into sustainable energy. Legal certainty, most importantly, provides the basis of which a technology can be legally utilized. In this way, the legal framework plays a key role in ensuring that there's a filtering process to ensure that the relevant technology is actually beneficial and is not harming any public interest, focusing primarily on its utility (Oduro et al., 2024). In the context of sustainability, this issue becomes even more critical, as Indonesia urgently requires sustainable innovations to reduce its dependence on non-renewable practices, particularly in the energy sector (Mulyana & Siswandi, 2018).

This is especially relevant in investment law, where legal regulations play a crucial role in shaping both domestic and foreign investment flows, particularly in the pursuit of sustainable development (Ghaziani et al., 2023). In the realm of renewable energy, investments play a key role in ensuring adequacy of resources, which can make sure that the technology for renewable energy can be properly installed and utilized for the benefit of everyone (Poszwa, 2021). It's also important in ensuring the spread of the technology, as a way to promote equitable growth and smooth transition to renewable energy in Indonesian society as a whole. Adequate funding from investments is also needed to prepare for the challenges that lies ahead in the future of renewable energy, particularly in the case of Indonesia, where different regions have their own unique natural and socio-economic characteristics. Examining Vietnam's legal framework in comparison to Indonesia's can offer valuable insights into enhancing Indonesia's transition to renewable energy, especially given Vietnam's success in integrating solar power into its energy transition efforts.

Numerous studies have emphasized the critical role of transitioning to renewable energy in achieving sustainability and reducing dependence on fossil fuels. (Tvaronavičienė, 2024) highlighted in a study that some of the pressing environmental issues and how they're closely connected to the reliance on non-renewable sources of energy. The study also showed that without a circular economy approach, the shift to renewable energy could lead to increased demand for additional resources and recycling challenges, ultimately creating an adverse cycle that undermines environmental sustainability. Building on the key point of circular economy, another study conducted by (Romero-Castro et al., 2023) also emphasized the pressing need to transition to sustainable energy. investments as essential in mobilizing local support and financial commitment for community renewable energy (CRE) projects. Romero-Castro *et al.* highlighted that the success of these investments is influenced by diverse investor profiles, which are shaped by varying risk preferences and levels of financial literacy.

Vietnam's success in developing and implementing solar technologies has been examined in several studies. One study conducted by Do et al. highlight that Vietnam has been quite successful in its transition to renewable energies, mainly solar and wind (Do et al., 2021). Solar energy, in particular, has seen substantial growth due to a mix of policies, such as favorable feed-in tariffs, tax incentives, and government-backed initiatives that have attracted significant private investment, resulting in the rapid expansion of solar capacity across the country. This success is in line with the massive potential that Vietnam has, as highlighted by (Le et al., 2023) in their study. As Vietnam's solar energy capacity continues to expand, studies highlight that the country's high solar irradiance and abundant land resources make solar energy an increasingly viable solution to meet its growing energy needs, despite existing infrastructure and policy challenges.

Solar technology, especially in the context of Indonesia, remains an underexplored topic in existing research. Despite some literatures explaining the potentials of solar energy in Indonesia (Kibtiah et al., 2024) and how it can help further Indonesia's environmental sustainability goals (Raihan et al., 2023), none has discussed why solar technology is not yet the preferred choice of renewable energy to develop in Indonesia. This study focuses on this analysis gap, using Vietnam as the benchmark comparison, due to its success in the transition to renewable energy through solar technology. The analysis will focus on investment law and its impact on Indonesia's transition to solar energy, which holds significant potential. It aims to uncover the normative complexities that contribute to the limited adoption of this renewable energy source in the country.

Method

This study utilizes the normative legal research method, with a primary focus on analyzing legal norms within the existing regulatory framework (Disemadi, 2022). In its purest form, this analysis involves analyzing secondary data in the form of primary law sources, to provide a legal lens regarding a certain topic (Tan, 2021). The empirical dimension of this research incorporates analysis of implementation outcomes, including renewable energy capacity data, carbon footprint measurements, and regulatory effectiveness indicators. By examining these empirical elements alongside normative structures, the study presents a holistic view of how legal frameworks translate into real-world renewable energy development. To support the normative analysis, this research also employs the comparative approach, which considers the legal frameworks as subjects of comparison. This approach assumes both similarities and differences *(praesumptio similutudinis* and *praesumptio distinctio)* between the selected legal traditions or regulatory systems (Negara, 2023). By comparing these aspects, the study seeks to reveal nuanced insights and variances among different legal system. The secondary data used in this study include Law No. 25 of 2007 on Investments, Presidential Regulation No. 10 of 2021 on Investment Business Fields, Presidential Regulation No. 112 of 2022 on the Acceleration of Renewable Energy Development, Vietnam's Law on Investment, and Circular No. 19/2023/TT-BCT on Methods for Determining Solar Power and Wind Power Generation Pricing Framework.

Results and Discussion

Renewable Energy Through the Lens of Indonesian and Vietnamese Investment Law Framework

Investing in solar technology is a crucial aspect of Indonesia's future, alongside advancements in other renewable energy technologies, as the country continues to refine its environmental sustainability targets for 2050 (Reyseliani & Purwanto, 2021). Indonesia is also facing continued rising demand for energy (Sudarmaji et al., 2022), which can be attributed to the continued economic growth, supported by digital technologies (Saidi et al., 2017). As energy is important in ensuring that economic growth can continue the upward trend, Indonesia must find a sustainable solution to its continued rising demand for energy, particularly because of the country's high carbon emissions (Khamid, 2022). From a normative perspective, the fundamental legal basis for transitioning to solar energy as a renewable source is rooted in investment laws and policies. These regulations must establish a strong legal framework that acknowledges and supports such innovations, ensuring their growth and integration within Indonesia's investment landscape.

Investment laws and policies play a crucial role in maintaining a steady and efficient flow of funds to support various businesses, public development initiatives, and key technological innovations. Investments play a pivotal role in driving sustainable development, particularly in fostering advancements and adoption of renewable energy technologies (Erwin et al., 2024). A robust investment framework is essential to ensure a steady flow of resources that can fuel innovations, infrastructure, and capacity-building efforts necessary for an effective transition to sustainable practices (Yang et al., 2024), including the transition to renewable energy. In this context, the regulatory environment significantly influences the direction and volume of investments, as favorable laws and policies can create a stable and attractive landscape for both domestic and international investors. For both Indonesia and Vietnam, analyzing the legal framework governing investments in sustainable technologies provides valuable insights into how regulatory support influences the growth and direction of renewable energy initiatives.

Examining investment laws and policies in both Indonesia and Vietnam is crucial for understanding the regulatory factors that facilitate or obstruct investment in renewable energy. Indonesia, with its substantial reliance on non-renewable resources, faces challenges in creating an environment conducive to renewable investments, particularly in solar technology. Comparing Indonesia's framework with that of Vietnam, which has achieved notable success in incorporating solar energy into its electricity generation, provides critical insights into how legal structures can attract or deter investors. This comparative analysis provides an evidence-based understanding of how policy adaptations in Indonesia could help bridge the gap in renewable energy development. By examining Vietnam's success in streamlining investment channels and creating favorable conditions for sustainable technology growth, Indonesia can identify strategies to enhance its own renewable energy sector.

Indonesia's primary legal foundation for investment law is Law No. 25 of 2007 on Investments (Yuliansyah et al., 2024). Article 1, Paragraph 1 of this law defines investment as all forms of investment activities carried out by both domestic and foreign investors to conduct business within the territory of the Republic of Indonesia. The law establishes principles of sustainable and environmentally friendly investment, as highlighted in Article 3, which includes "sustainability" and "environmental awareness" among the guiding principles (Bahlian, 2017). This regulatory approach encourages investment activities that align with long-term ecological preservation and sustainable practices. Additionally, Article 16 outlines an obligation for investors to uphold environmental standards, ensuring that investment activities do not harm the environment and contribute to sustainable development goals. Article 18 further reinforces this commitment by offering incentives, such as tax reliefs and import duty exemptions, for investments that focus on environmentally friendly practices, technological advancements, and sustainable infrastructure. Furthermore, Article 17 of the law mandates that investors engaged in the exploitation of non-renewable resources allocate funds for environmental restoration. This provision aims to mitigate the environmental impact of resource extraction while ensuring the sustainability of affected areas.

A significant limitation of the Investment Law is its broad, generalized incentives for environmentally friendly investments, which do not adequately accommodate the specific needs and challenges of renewable technologies such as solar and wind energy. Lacking technology-specific provisions in Article 18, the law creates regulatory ambiguity, limiting its appeal to investors who seek clear alignment between the regulatory framework and each technology's operational needs. While it can certainly be argued that such normative sophistication would warrant a more specific policy, the mention of at least sustainable innovations and technologies as a separate part of incentives can better attract investments, as it limits investment risks and opens the doors for more incentives to be governed by more complex and specific regulations. Furthermore, Indonesia's Investment Law also lacks the normative basis for coordination, which is particularly important for an archipelagic country. This geographical characteristic could present a significant challenge, with investment practices potentially encountering obstacles such as communication difficulties and bureaucratic hurdles.

Vietnam's Law on Investment (Law No. 61/2020/QH14) governs both domestic and foreign investment activities within the country, outlining regulations that facilitate and oversee investment processes. Article 3 defines investment as any form of capital expenditure for business purposes, covering activities such as establishing new entities and expanding projects. Key principles outlined in Article 5 include transparency, equality, and state protections for lawful asset ownership and investment activities. For foreign investors, Article 9 specifies conditions and market access, including restricted sectors. Articles 15 and 16 detail investment incentives like tax reductions, land-use benefits, and customs exemptions, targeting prioritized sectors, such as high technology, renewable energy, and rural infrastructure development. The inclusion of these three aspects is essential to ensuring that the transition

to renewable energy is supported by adequate technology and can be widely accessible and beneficial to people across the country.

More importantly, Vietnam's Law on Investment provides well-defined incentives, including corporate tax reductions, land-use exemptions, and customs duty waivers, as outlined in Article 15. These incentives are transparently targeted at prioritized industries such as high technology, renewable energy, and rural infrastructure development. Indonesia's Investment Law similarly offers incentives but lacks explicit sectoral focus and transparency in criteria application. Vietnam's approach, linking specific benefits to targeted sectors, is clearer and could be more effective in attracting investments with high sustainability impact. This is especially crucial for highly specialized sectors that rely on innovative technologies, such as renewable energy, which remains a key priority in both countries' sustainability frameworks and development goals.

From a fundamental normative framework perspective, Vietnam is more advanced in providing adequate support for the transition to renewable energy. Vietnam has a normative structure that is more in line with the nation's agenda for the transition to renewable energy, by providing key support and explicit acknowledgement on renewable energy as favorable sector for its investment sphere. This can be intrinsically connected to the country's success in renewable energy, particularly the solar energy (Wakhidiyanto & Koestoer, 2022). On the other hand, Indonesia still relies on heavily generalized provisions using "sustainability" as its main framework, providing lesser clarity to potential investors who are seeking to pour funds into potential projects that can help the nation to transition to renewable energy. It's important to note that these are only the basic legal framework for both countries. A more in-depth analysis is necessary, particularly regarding specialized regulations that directly influence investment dynamics in renewable energy technology, with a specific focus on solar energy.

Complimentary Support for Solar Energy Transition in Indonesia and Vietnam

As previously highlighted, Indonesia lags behind Vietnam in its efforts to transition to renewable energy sources. Even more so in the case of solar technology, which has been a crucial source of renewable energy in Vietnam's success in generating electricity for some of its population. On the other hand, Indonesia has yet to fully utilize the massive potentials provided by solar energy, despite being blessed with sunlight all year due to country's geographical location being ran through right in the middle by the equator line. This indicates a possible disproportion in the investment figures, which in turn could indicate an even deeper problems, particularly within Indonesia's framework for policies to support investment in renewable energies. Therefore, it is essential to analyze complementary regulations that influence the investment landscape in both countries. This deeper examination will help uncover the intricacies that either drive or restrict investment flows, as illustrated in Table 3 below.

Table 3. Normative Analysis of Complimentary Regulations Around Solar Energy

Aspect	Vietnam	Indonesia
Key Policy Mechanism	Transition from Feed-in Tariffs (FiTs) to an Annual Electricity Generation Pricing Framework under Circular No. 19/2023/TT-BCT.	Harga Patokan Tertinggi (Maximum Benchmark Price) under Presidential Regulation No. 112/2022 for negotiated Power Purchase Agreements (PPAs).
Tariff Determination	- Prices calculated annually by ERAV (Electricity Regulatory Authority of Vietnam). - Based on fixed costs, operational costs, and regional factors.	- Negotiated tariffs are subject to a maximum benchmark price, which is determined based on location and project type. - Fixed for the entire PPA duration.
Flexibility for Investors	Higher flexibility with annual adjustments reflecting market conditions.	Low flexibility due to fixed rates with no escalation or adjustments during the PPA.
Guaranteed Returns	No guaranteed fixed tariffs; investors negotiate rates annually based on ERAV's framework.	No guarantees; tariffs often negotiated below the benchmark, eroding potential returns for investors.
Ease of Implementation	Transparent and dynamic pricing framework with annual updates, though negotiations still required for PPAs.	Complex, as prices require negotiation with PLN (state utility), adding time and bureaucratic hurdles.
Support for Investment Recovery	Detailed cost-based calculation ensures recovery of fixed and operational costs (Articles 4–6, Circular No. 19/2023/TT-BCT).	Investment recovery subject to PLN's negotiation leverage and adherence to maximum benchmark prices.
Specific complimentary regulation.	Vietnam has its own regulation that can complement further investment into solar energy, which includes which indicates the country's seriousness in further developing its solar energy sector	Still mainly relies on broad normative aspects under the umbrella term of renewable energy, from various generalized legislations.

Source: Authors' original analysis of the relevant frameworks.

Vietnam's renewable energy policy has evolved significantly, shifting from a Feed-in Tariff (FiT) model (Le et al., 2022) to an annually reviewed pricing framework. The FiT system, previously governed by Decision No. 11/2017 and later revised in Decision No. 13/2020, offered fixed tariffs for solar energy projects, guaranteeing long-term returns for investors over a 20-year period. While this system successfully drove rapid solar energy deployment, it became financially burdensome as the market matured. Recognizing the need

for sustainability and adaptability, Vietnam introduced the Annual Electricity Generation Pricing Framework under Circular No. 19/2023/TT-BCT. This dynamic mechanism adjusts tariffs annually, taking into account regional factors, project costs, and operational expenses, resulting in a more flexible and market-responsive pricing structure.

In stark contrast, Indonesia's solar investment framework, as outlined in Presidential Regulation No. 112 of 2022 on the Acceleration of Renewable Energy Development for Electricity Supply, relies on the *Harga Patokan Tertinggi* (Maximum Benchmark Price) mechanism, which imposes a cap on negotiated tariffs for solar projects. While the benchmark price provides a reference for tariff negotiations, its rigidity, which is fixed for the entire duration of Power Purchase Agreements (PPAs), limits investor flexibility and undermines profitability. Additionally, the absence of escalation mechanisms to account for inflation or rising operational costs further erodes investor confidence. This approach inherently makes Indonesia's investment landscape less attractive compared to Vietnam's, as it reflects a rigid framework for a sector in which the country has yet to establish significant success in development.

Vietnam's adaptive policy shift underscores a normative emphasis on balancing investor attractiveness with market sustainability, creating a more conducive environment for renewable energy investment. By revisiting tariffs annually, it mitigates risks associated with long-term fixed pricing while ensuring that project costs and market dynamics are fairly reflected. Articles 4–6 of Circular No. 19/2023/TT-BCT exemplify this approach by anchoring tariff calculations in transparent, cost-based methodologies. On the other hand, Indonesia's static and highly generalized legal framework, which relies heavily on PLN's negotiation leverage, prioritizes state-controlled cost management at the expense of market competitiveness. The absence of guaranteed returns or an adaptive pricing mechanism places Indonesia at a disadvantage in attracting large-scale solar investments. This is further compounded by the country's restrictive investment framework, which does not permit either small- or large-scale private investments in the solar energy sector.

Indonesia also enforces other restrictive regulations, particularly Presidential Regulation No. 10 of 2021 on Investment Business Fields, which imposes limitations on various sectors, including renewable energy investment. This regulation, through Article 7, limits foreign investment to large enterprises with a minimum investment value of IDR 10 billion, excluding land and buildings, thereby restricting small and medium-scale foreign investments and ensuring that such investments contribute significantly to the national economy. Without a recognized track record or international acknowledgment for successfully supporting the transition to solar energy unlike Vietnam, Indonesia presents a significantly higher risk for investors. The uncertainty is further exacerbated by the lack of guaranteed support from complementary regulations, making investment in the country's solar energy market less appealing.

Based on this analysis, it is evident that Indonesia lags significantly behind Vietnam, not only in measurable progress toward renewable energy

transition but also in the development of supportive policies and regulatory frameworks. Within the investment law perspective, this highlights the lack of focus and emphasis on the urgency that the transition to renewable energy posits for the future of Indonesia. Indonesia also appears to lack a firm grasp on its relatively limited track record of success in developing solar energy. Thus far, the country has primarily relied on its vast solar energy potential rather than implementing concrete strategies to drive substantial progress in the sector (Laksana et al., 2021).

Most importantly, Vietnam has a complementary regulatory framework that specifically addresses solar energy, significantly reducing legal risks for investors. This framework also provides much-needed clarity and certainty on various complexities relevant to solar energy investment and development. Indonesia, on the other hand, still does not have any regulation that can be considered an equal counterpart of Vietnam's Circular No.19/2023/TT-BCT. This, as extensively analyzed, allowed more room for specificities, which in turn opens ways for flexibility in many aspects of investments, particularly returns. Overall, Vietnam has a far more advanced legal framework to support the transition to solar energy. This advantage stems from its foundational Law on Investment, which is equipped with robust structures for renewable energy investments, as well as its highly specific Circular No. 19/2023/TT-BCT, which provides clear regulatory guidance for solar energy development.

Conclusion

A comprehensive analysis in this study ultimately provides normative and comparative evidence explaining why Indonesia lags significantly behind Vietnam in the transition to renewable energy, particularly in the solar energy sector. Despite the massive potential, Indonesia hasn't thrived in this specific department, as it has not provided enough support for investors with adequate legal framework. Vietnam, on the other hand, focused not only on their solar energy potentials, but also on key legal frameworks to ensure investors remain interested in the prospects of solar energy in Vietnam, with support from the foundational normative structure to complimentary ones. Limitation of this research stems from the nature of its results, which still needs further exploration, particularly in the qualitative sense. Further research can explore this area by examining empirical data on solar energy investments and analyzing investor perceptions of key legal frameworks. This could provide deeper insights into the practical impact of regulations on investment decisions and the renewable energy transition.

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