



Contents lists available at [Elora Center](#)

Lentera Negeri

Journal homepage: <https://lentera.eloracenter.org/lentera>



Management of oil and natural gas by PT. Pertamina in the context of national energy security

Syawal Fahmi^{*1}, Mohammad Aldilla Muntazar², Rita Paramawati², Asadur Rahman Muhammad²

¹ Universitas Pertahanan RI, Indonesia

² Universitas Brawijaya Malang, Indonesia

Article Info

Article history:

Received Jun 02th, 2026

Revised Jun 24th, 2026

Accepted Jul 14th, 2026

Keyword:

Energy Security,
PT. Pertamina,
Oil and Gas Production,
Renewable Energy,
Geothermal Energy,
Energy Transition.

ABSTRACT

This study examines the role of PT. Pertamina in managing oil, natural gas, and renewable energy in Indonesia, particularly in the context of national energy security. Using a qualitative approach with a literature review and library research, the study evaluates Pertamina's contribution to Indonesia's energy supply through its oil and gas production, refining capacity, and investments in renewable energy. The findings indicate that Pertamina plays a crucial role, contributing 50% of the nation's crude oil production and 30% of natural gas output. In addition to its significant contribution to upstream production, the company expanded its refining capacity from 1.0 million barrels per day (bpd) in 2018 to 1.5 million bpd in 2023, strengthening domestic fuel processing capabilities and reducing dependence on imported refined petroleum products. Additionally, the company has significantly invested in geothermal energy as part of its renewable energy development strategy. Despite these advancements, the study identifies several challenges, including regulatory barriers, global oil price volatility, and the financial and technical obstacles to transitioning to renewable energy. The paper concludes that while Pertamina has made substantial progress in enhancing Indonesia's energy security, addressing these challenges is essential for achieving long-term sustainability. The study recommends further research into the regulatory and technological aspects of energy transition, as well as the socio-economic impacts of biofuel production.



© 2026 The Authors.

This is an open access article under the CC BY-NC-SA license
(<https://creativecommons.org/licenses/by-nc-sa/4.0>)

Corresponding Author:

Syawal Fahmi,

fahmi23868@gmail.com

Introduction

Energy security remains a central issue in global and national development agendas because energy is indispensable for economic growth, industrial activities, and social welfare (Azzuni & Breyer, 2018; Edigareva et al., 2021; Fang et al., 2018; Sunarjanto & Kusumantoro, 2015; Taghizadeh-Hesary et al., 2025). For Indonesia a large archipelagic nation with increasing energy demand achieving sustainable energy security is particularly challenging due to its historical dependence on fossil fuels and fluctuations in global oil markets (Van de Graaf & Colgan, 2016). Despite abundant natural resources, Indonesia has experienced periods of declining production and increasing energy imports, intensifying concerns about national energy resilience (Bappenas, 2012). Therefore, effective management of oil and natural gas resources is critical to ensure that supply meets growing domestic energy needs while supporting long-term national development.

As the state-owned energy company, PT. Pertamina (Persero) plays a pivotal role in the exploration, production, processing, and distribution of oil and natural gas in Indonesia. Pertamina's strategic mandate explicitly includes supporting national energy security through its operational activities across the hydrocarbon value chain (Pertamina New & Renewable Energy, n.d.) (Pertamina Gas, 2018). Given that oil and gas remain the dominant energy sources in Indonesia's primary energy mix, the company's performance directly influences national energy stability and self-reliance. Investments in refining capacity expansion, upstream production enhancement, and renewable energy development further strengthen Pertamina's contribution to ensuring energy availability, accessibility, and affordability, thereby positioning the company as a central actor in Indonesia's energy security strategy (Pertamina Patra Niaga, 2023a).

Although existing studies have examined various aspects of Indonesia's energy security and the role of major national players, there is still a lack of focused research on how oil and gas resource management by PT. Pertamina specifically contributes to national energy security outcomes. Prior research on Indonesia's energy security has primarily focused on broad structural indicators such as energy availability, dependency on imports, and diversification strategies (BIN, 2016), while legal and regulatory analyses highlight institutional roles (Ariefi & Purnama, 2025). However, these studies tend to emphasize macro-level policy frameworks or regulatory arrangements and provide limited analysis of the operational mechanisms, strategic decision-making processes, and measurable contributions of Pertamina's oil and gas management to national energy security. Consequently, the relationship between corporate resource management practices and national energy security outcomes remains insufficiently explored. This gap suggests the need for an in-depth qualitative analysis that synthesizes literature and reports to understand Pertamina's influence on energy security dynamics.

Furthermore, with the global energy transition and Indonesia's commitments to sustainable energy practices, there is an urgent need to evaluate how state energy companies can balance traditional fossil fuel management with evolving environmental benchmarks. Pertamina's recent strategic projects such as refinery modernization and integration into renewable energy portfolios offer a unique context to study this balance (Pertamina Patra Niaga, 2023a). Understanding how these initiatives align with national energy security policies can provide insights into both corporate strategy and public policy formulation aimed at achieving long-term energy sustainability and resilience.

This paper addresses the critical question: How does the management of oil and natural gas by PT. Pertamina contribute to Indonesia's national energy security? Specifically, it examines the strategic approaches, challenges, and outcomes associated with Pertamina's management of hydrocarbon resources. The research employs a qualitative literature-based approach, synthesizing relevant academic studies, policy documents, and corporate reports to articulate a comprehensive picture of Pertamina's role within Indonesia's energy security framework.

The objective of this study is to (1) analyze Pertamina's oil and gas management strategies; (2) explore the implications of these strategies for Indonesia's energy security; and (3) identify gaps and opportunities within current practices for enhancing national energy resilience. This investigation is significant because it links corporate-level resource management with broader national policy goals a connection that remains underexplored in the current literature. The paper contributes to the literature by offering a focused, evidence-based assessment of a key state-owned enterprise's impact on national energy objectives, which has implications for policy design, industry regulation, and future research on energy governance.

This study adopts a qualitative research design based on a literature review and document analysis approach. Data are derived from academic publications, government policy documents, and official reports issued by PT. Pertamina and related institutions. The analysis is guided by the concept of energy security, which in this study is operationalized through three key dimensions: energy availability (domestic production and reserves), energy accessibility (distribution and refining capacity), and energy sustainability (investment in renewable energy and energy transition initiatives). By examining these dimensions, the study seeks to evaluate how Pertamina's resource management practices contribute to strengthening Indonesia's national energy security while supporting long-term sustainability objectives.

Method

The present study adopts a qualitative research design with a literature review approach to investigate how PT. Pertamina's management of oil and natural gas contributes to national energy security in Indonesia. Qualitative research is particularly suitable for gaining an in-depth understanding of complex real-world

issues by interpreting textual and documentary evidence rather than numerical data (Tenny et al., 2017). The literature review approach used in this research involves systematically identifying, selecting, evaluating, and synthesizing relevant scholarly articles, institutional reports, government policy documents, corporate sustainability reports, annual reports, and industry publications. These sources were subsequently analyzed through thematic synthesis to identify recurring patterns, strategic priorities, policy implications, and contributions to national energy security (Snyder, 2019).

The literature review methodology is appropriate for this study because it allows the researcher to critically examine existing knowledge, trace theoretical development, and identify research gaps in the current understanding of energy resource management and energy security (Kraus et al., 2022; Paul & Criado, 2020; Snyder, 2019). Rather than generating primary empirical evidence, this study synthesizes existing academic and institutional knowledge to explain how Pertamina's strategic management practices are represented in the literature and how these practices relate to national energy security objectives.

Data sources for this study include peer-reviewed journal articles, books, government policy frameworks (e.g., national energy policy documents), and official corporate reports published by PT. Pertamina and related entities. These documents were accessed through academic databases (e.g., Google Scholar, Scopus, and institutional repositories) and official organizational websites. The review covered publications released between January 2004 and December 2024.

The inclusion criteria were as follows: (1) publications discussing energy security, oil and gas management, renewable energy development, or Pertamina's strategic role in Indonesia; (2) peer-reviewed articles, books, policy documents, and official institutional reports; (3) publications available in English or Indonesian; and (4) documents published within the defined review period. Exclusion criteria included duplicate records, publications lacking relevance to Indonesia's energy sector, opinion articles without supporting evidence, and documents with insufficient methodological or institutional credibility.

The data collection process involved systematic searching using predefined keywords and Boolean operators. The primary search string was: ("energy security" OR "national energy security") AND ("Pertamina" OR "state-owned energy company") AND ("oil and gas management" OR "hydrocarbon management" OR "energy transition" OR "renewable energy"). Additional searches were conducted using combinations of keywords such as "Indonesia energy policy," "refining capacity," "geothermal energy," and "energy resilience."

The screening process followed four stages adapted from the PRISMA framework: identification, screening, eligibility assessment, and final inclusion. A total of 126 records were initially identified from database searches and institutional sources. After removing 28 duplicate records, 98 documents remained for title and abstract screening. Subsequently, 41 records were excluded due to limited relevance to the research objectives, leaving 57 documents for full-text assessment. Following eligibility evaluation, 38 sources were retained and included in the final analysis.

For data analysis, a thematic synthesis technique was employed where collected texts were coded and analyzed for recurring patterns and major themes. The coding process consisted of three stages: open coding, thematic categorization, and interpretive synthesis. During open coding, relevant information was extracted and labeled according to key concepts. These codes were subsequently grouped into broader thematic categories, including strategic management practices, regulatory and policy contexts, production and refining capacity, renewable energy initiatives, and contributions to national energy security. Finally, an interpretive synthesis was conducted to establish relationships among themes and develop a comprehensive understanding of Pertamina's role in strengthening Indonesia's energy security. The thematic synthesis approach facilitated integrating diverse sources to form coherent insights while maintaining analytical rigor (Paré & Kitsiou, 2017).

To support the validity and reliability of the findings, multiple sources were cross-referenced, and interpretations were grounded in well-established literature and official reports. Source triangulation was applied by comparing findings from academic studies, government documents, and corporate reports to enhance analytical credibility. Potential limitations of this methodology include reliance on secondary data, which may not capture unpublished insights or real-time operational data from Pertamina. Nevertheless, the literature review remains a robust method for synthesizing current knowledge, identifying gaps, and offering conceptual contributions that can inform future empirical research in this domain.

Results and Discussions

The results from this study provide critical insights into the role of PT. Pertamina in ensuring Indonesia's energy security. As Indonesia's state-owned oil and gas company, Pertamina is a major player in managing the nation's energy resources. The findings presented in this section are derived from a synthesis of multiple secondary sources, including PT. Pertamina Annual Reports (2023), government energy policy documents, reports from the Ministry of Energy and Mineral Resources (MEMR), and relevant academic literature. To enhance data reliability, corporate data were cross-referenced with publicly available government statistics and findings reported in previous studies on Indonesia's energy sector. The study highlights PT. Pertamina's significant capacity in both oil production and refining, as well as its growing investments in renewable energy sources.

PT. Pertamina's Oil and Gas Production Capacity

PT. Pertamina plays a dominant role in Indonesia's oil and gas sector, contributing significantly to the country's energy supply. In 2023, the company's crude oil production was approximately 800,000 barrels per day (bpd), accounting for 50% of the nation's total crude oil production. Additionally, Pertamina's natural gas production accounted for 30% of the national output. These figures demonstrate Pertamina's crucial role in ensuring domestic energy security, especially as Indonesia continues to experience rising energy demand driven by economic growth and industrialization (Pertamina Patra Niaga, 2023b). From an energy security perspective, these production levels indicate a substantial contribution to the availability dimension of energy security, which refers to the capacity of a nation to maintain a stable and sufficient energy supply. The ability of a single state-owned enterprise to provide half of national crude oil production reduces dependence on external suppliers and strengthens Indonesia's capacity to respond to supply disruptions. Table 1 summarizes the key data on Pertamina's oil and gas production capacity and its share in the national energy market.

Table 1. PT. Pertamina's Oil and Gas Production Capacity (2023)

Energy Type	Production (bpd or bcf/day)	Domestic Share (%)	Annual Growth Rate (%)
Crude Oil	800,000 bpd	50%	2.3%
Natural Gas	1,500 MMcf/day	30%	4.1%

Source: PT. Pertamina Annual Report, 2023

Refining Capacity Expansion

PT. Pertamina's refining capacity has also expanded significantly in recent years. As part of its strategy to meet domestic fuel demands and reduce reliance on imports, Pertamina increased its refining capacity by 30% between 2018 and 2023. This expansion is particularly relevant to the accessibility dimension of energy security. Increased domestic refining capacity enables Indonesia to process a greater proportion of crude oil domestically, thereby reducing vulnerability to disruptions in international refining markets and enhancing supply-chain resilience. Similar strategies have been implemented by state-owned energy enterprises in emerging economies such as Petrobras in Brazil and Saudi Aramco in Saudi Arabia, where downstream integration has been used as a mechanism to strengthen national energy security and reduce external dependence.

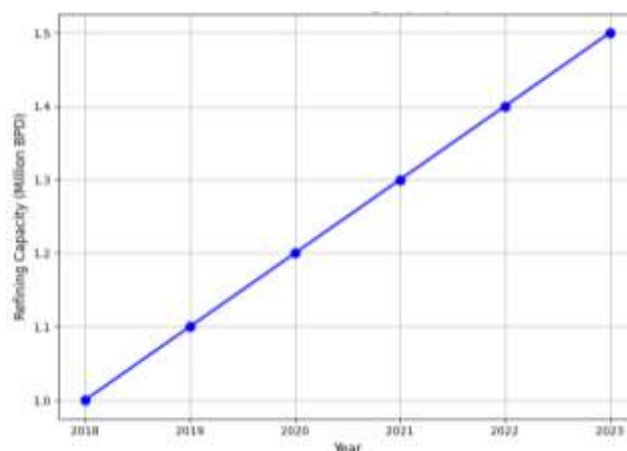


Figure 1. Growth in Pertamina's Refining Capacity (2018-2023)

Source: PT. Pertamina Annual Report, 2023

As depicted in Figure 1, Pertamina's refining capacity increased from 1.0 million bpd in 2018 to 1.5 million bpd in 2023. This growth represents a 30% increase in refining capacity over five years, enhancing Indonesia's ability to process crude oil domestically and reduce its dependency on imported refined products.

Pertamina's Renewable Energy Portfolio

Pertamina has made strides in diversifying its energy sources by increasing investments in renewable energy. The diversification strategy contributes to the sustainability dimension of energy security by reducing long-term dependence on fossil fuels and supporting Indonesia's commitment to energy transition. The emphasis on geothermal energy is particularly significant because Indonesia possesses one of the largest geothermal reserves globally. Consequently, Pertamina's investment strategy aligns not only with corporate growth objectives but also with national targets for renewable energy development and carbon emission reduction.

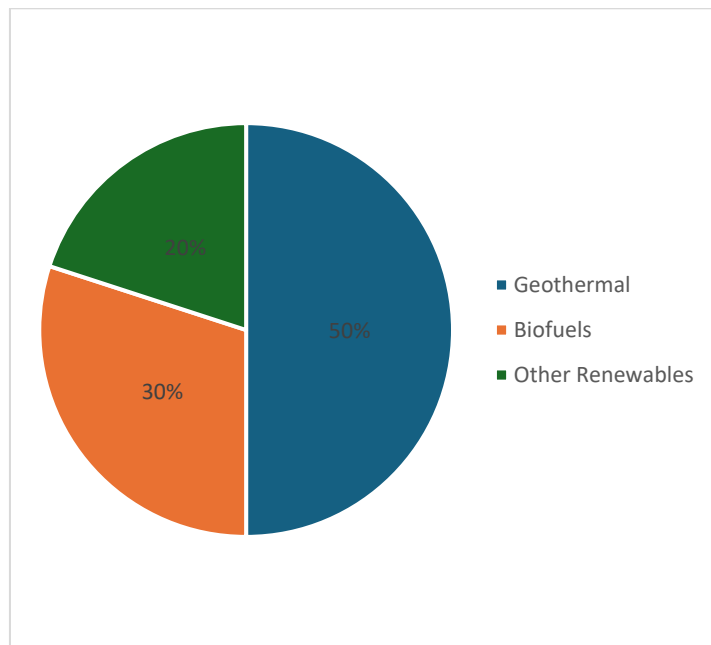


Figure 2. Pertamina's Renewable Energy Portfolio (2023)

Source: PT. Pertamina Annual Report, 2023

As illustrated in Figure 2, geothermal energy remains the largest contributor to Pertamina's renewable energy portfolio, followed by biofuels. The company has expanded its geothermal capacity by 350 MW in recent years and plans to reach an additional 1,000 MW by 2030. This expansion reflects a strategic move to reduce Indonesia's carbon emissions while ensuring long-term energy sustainability.

Challenges in Achieving National Energy Security

While PT. Pertamina has made significant progress in increasing its oil production and refining capacity, several challenges remain in achieving long-term energy security. One of the primary concerns is global oil price volatility, which continues to affect both Pertamina's profitability and Indonesia's energy affordability. Oil price fluctuations often create uncertainty in the national energy market, making it difficult for Pertamina to stabilize fuel prices and manage its operational costs effectively (Sulaiman et al., 2021).

Regulatory challenges also persist, particularly regarding project approvals and policy consistency. While the Indonesian government has developed comprehensive energy policies, such as the National Energy Policy (KEN) and the National Energy Plan (RUEN), there are often delays in implementing these policies at the operational level. These delays hinder the timely development of new oil and gas fields, as well as renewable energy projects (Bappenas, 2012).

Furthermore, the technological and financial barriers to transitioning to cleaner energy remain significant. Despite efforts to adopt cleaner technologies, such as carbon capture and storage (CCS), the upfront capital costs and limited financial incentives for renewable energy projects hinder the widespread implementation of these solutions.

The triangulation of findings from academic literature, government reports, and Pertamina's corporate publications indicates that market volatility, regulatory uncertainty, and technological constraints constitute

the three most significant barriers to achieving long-term energy security. Similar challenges have also been identified in studies of state-owned energy enterprises in emerging economies, including Petronas in Malaysia and Petrobras in Brazil. This suggests that the challenges faced by Pertamina are not unique to Indonesia but reflect broader structural issues associated with balancing energy security objectives, commercial performance, and energy transition commitments.

Limitations and Future Research

This study is based on secondary data and reports, which may not fully capture real-time developments in Pertamina's operations or the internal decision-making processes of the company. Future research could benefit from primary data collection, such as interviews with Pertamina's management or field studies, to gain a deeper understanding of the company's strategies and challenges. Additionally, further research could compare PT. Pertamina's energy management strategies with those of other state-owned energy companies in Southeast Asia, identifying best practices in the management of both fossil fuel resources and renewable energy.

Discussion

The findings from this study highlight PT. Pertamina's substantial role in Indonesia's energy security, particularly in its oil and gas production capacity and renewable energy investments. These results align with current discussions in energy policy and sustainability in Indonesia. The expansion of Pertamina's refining capacity and its growing focus on renewable energy reflect the company's strategic efforts to navigate the challenges posed by energy security and climate change while addressing the increasing demand for energy in Southeast Asia.

Pertamina's production of 800,000 barrels per day (bpd) of crude oil and 1,500 MMcf/day of natural gas, which account for approximately 50% and 30% of Indonesia's total production, underscores its pivotal role in maintaining domestic energy supply. These findings are consistent with previous research by Sulaiman et al. (2021), who noted the importance of state-owned enterprises like Pertamina in sustaining energy security in developing countries. The reliance on domestic oil and gas production helps stabilize Indonesia's energy markets, shielding them from external price shocks. This is particularly significant given the volatility in global oil markets, which has been exacerbated by geopolitical events and economic disruptions, such as the COVID-19 pandemic and the Russia-Ukraine conflict.

From a theoretical perspective, these findings can be interpreted through the three core dimensions of energy security: availability, accessibility, and sustainability (Goldthau & Sovacool, 2012; Johansson, 2013). Pertamina's substantial contribution to national oil and gas production strengthens the availability dimension by ensuring a stable domestic energy supply. The company's operational capacity reduces dependence on external energy sources and contributes to national resilience against supply disruptions. This finding supports the argument that state-owned energy enterprises play a strategic role in securing domestic energy availability, particularly in developing countries where energy demand continues to increase.

In the context of global energy volatility, Pertamina's growing refining capacity is a strategic move to increase the country's self-sufficiency in refined petroleum products. The 30% growth in refining capacity between 2018 and 2023, as illustrated in Figure 1, reflects the company's efforts to reduce reliance on imported refined products and maintain a secure domestic fuel supply. According to BIN (2016), increasing domestic refining capacity is essential for enhancing national energy security and reducing Indonesia's vulnerability to external market fluctuations. However, while the expansion is commendable, Indonesia still faces challenges in terms of excess reliance on fossil fuels, which could become a vulnerability as the world shifts toward cleaner energy.

The refining capacity expansion also contributes to the accessibility dimension of energy security. By increasing domestic processing capability, Pertamina strengthens fuel distribution resilience and reduces exposure to international refining market disruptions. Similar strategies have been adopted by major National Oil Companies (NOCs) such as Saudi Aramco, Petrobras, and Petronas, which have expanded downstream operations to improve national energy self-sufficiency and reduce external dependence (Victor et al., 2011). These comparative experiences suggest that refinery expansion is a common strategic response among state-owned energy enterprises seeking to enhance national energy security (Olaniyi-Quadri, 2026). These findings are consistent with studies emphasizing that strengthening downstream infrastructure is a critical strategy for improving energy security and reducing external supply vulnerabilities (Bhattacharyya, 2019; Van de Graaf & Colgan, 2016).

Alternative explanations should also be considered when interpreting the observed increase in production and refining capacity. While Pertamina's strategic initiatives have undoubtedly contributed to these outcomes, external factors such as post-pandemic economic recovery, growing domestic energy demand, government support for strategic energy infrastructure, and favorable policy interventions may also have influenced the observed performance. Consequently, the improvements cannot be attributed solely to internal corporate management.

Pertamina's investments in renewable energy, particularly geothermal energy, reflect the global shift towards more sustainable energy sources and the growing emphasis on decarbonization within national energy strategies (IRENA, 2022). With 50% of its renewable energy portfolio coming from geothermal sources, Pertamina is positioning itself as a key player in Indonesia's energy transition. This commitment aligns with Indonesia's broader climate goals, as outlined in the Paris Agreement, to reduce greenhouse gas emissions and increase the share of renewable energy in the national mix to 23% by 2025 (Agreement, 2015). The 350 MW geothermal expansion achieved by 2023 is a promising step towards meeting these goals.

In terms of energy security theory, renewable energy investments contribute to the sustainability dimension by diversifying energy sources and reducing long-term dependence on fossil fuels (Child et al., 2018). This diversification is increasingly recognized as a critical component of modern energy security frameworks, which emphasize not only energy availability but also environmental sustainability and resilience to future energy transitions (Sovacool et al., 2022; York & Bell, 2019). This finding is consistent with recent studies that identify renewable energy diversification and decarbonization as essential components of contemporary energy security frameworks (Leal-Arcas, 2023; Sovacool et al., 2019). This finding is consistent with recent studies that identify renewable energy diversification and decarbonization as essential components of contemporary energy security frameworks (Alšauskas, 2024; Leal-Arcas, 2023).

However, as Figure 2 demonstrates, Pertamina's portfolio still heavily depends on geothermal, with biofuels and other renewable sources comprising the remaining 50%. While geothermal energy presents a significant opportunity for Indonesia, it also faces challenges related to geothermal exploration and investment. According to a report by the International Geothermal Association (IGA, 2024), Indonesia is home to the world's largest geothermal reserves, yet there are considerable barriers to development, including technical, financial, and regulatory challenges. Pertamina's ability to overcome these challenges will be critical in achieving its renewable energy targets. The strategic importance of geothermal development has also been highlighted in international energy transition studies, particularly for resource-rich countries seeking to reduce dependence on fossil fuels (IRENA, 2022; Poudineh et al., 2018).

The findings also reflect broader international trends among state-owned energy enterprises. Petronas has expanded investments in low-carbon technologies, Petrobras has diversified into renewable energy projects, and Saudi Aramco has increased investment in carbon management and sustainability initiatives. These developments indicate that the coexistence of fossil fuel development and renewable energy investment is not unique to Pertamina but represents a common strategic response among NOCs facing increasing pressure to balance energy security objectives with decarbonization commitments.

While biofuels have been a key area of focus for Pertamina, particularly in its bioethanol and biodiesel production, the shift towards biofuels must also be scrutinized for its potential environmental and socio-economic impacts. The reliance on palm oil for biofuels, for instance, has been linked to deforestation, biodiversity loss, and land-use conflicts (Fargione et al., 2008). As Indonesia's biofuel sector grows, ensuring that the production of biofuels is sustainable and does not exacerbate environmental degradation is crucial for the long-term success of Pertamina's energy transition strategy.

Despite the growth in refining and renewable energy capacities, Pertamina faces significant regulatory challenges that could slow the progress of energy security efforts. The National Energy Policy (KEN) and the National Energy Plan (RUEN) have provided a framework for energy diversification; however, the implementation of these policies has been inconsistent. Delays in project approvals and lack of coordination between central and local governments have hampered the timely development of crucial energy infrastructure projects (Bappenas, 2012; Florini & Sovacool, 2009). This is in line with the findings of Bappenas (2012), which highlighted the regulatory bottlenecks that continue to hinder energy infrastructure development in Indonesia. Additionally, technological barriers in the transition to cleaner energy remain an issue. The high upfront costs of renewable energy projects and carbon capture technologies are significant challenges, as noted by Sulaiman et al. (2021). While Pertamina has made progress in adopting technologies such as carbon capture and storage (CCS), the pace of implementation is slower than required to meet Indonesia's long-term energy transition goals.

These challenges are consistent with findings from studies on state-owned energy enterprises in other emerging economies, where market volatility, regulatory uncertainty, and technological constraints remain major obstacles to balancing energy security and sustainability objectives (Bank, 2023). The evidence suggests that achieving long-term energy security requires not only corporate commitment but also supportive regulatory frameworks, technological innovation, and institutional coordination among relevant stakeholders.

The continued success of PT. Pertamina in contributing to Indonesia's energy security will depend on its ability to address these technological, regulatory, and financial barriers. The company's ongoing efforts to expand its renewable energy capacity, particularly in geothermal energy, represent a crucial step towards reducing Indonesia's dependence on fossil fuels and achieving a more sustainable energy future. However, the Indonesian government must also play a key role in facilitating these efforts by streamlining regulatory processes, providing financial incentives, and investing in research and development for clean energy technologies.

Several limitations should be acknowledged when interpreting these findings. First, the study relies primarily on secondary data obtained from academic publications, government documents, and corporate reports, which may contain reporting biases or inconsistencies. Second, the study period coincides with significant external disruptions, including the COVID-19 pandemic and geopolitical tensions affecting global energy markets, which may have influenced production performance, investment decisions, and energy demand. Third, because this research focuses exclusively on PT. Pertamina as a single-case study, the findings should not be generalized directly to all state-owned energy enterprises without considering differences in institutional, economic, and regulatory contexts. Future studies employing primary data collection, interviews, or comparative case study approaches could provide a more comprehensive understanding of how state-owned energy enterprises contribute to national energy security and energy transition objectives.

Conclusions

This study has explored the role of PT. Pertamina in ensuring Indonesia's energy security through its management of oil, gas, and renewable energy resources. The findings indicate that Pertamina plays a central role in maintaining the national energy supply, contributing approximately 50% of the nation's crude oil production and 30% of natural gas output. Furthermore, Pertamina has made significant strides in expanding its refining capacity and investing in renewable energy sources, particularly geothermal energy, in line with Indonesia's transition towards a more sustainable energy future. The company's refining capacity grew by 30% between 2018 and 2023, and its renewable energy portfolio, with a strong emphasis on geothermal, aligns with Indonesia's national energy targets. The findings successfully address the three research objectives established in this study. First, the analysis demonstrates that Pertamina's energy management strategy is characterized by a combination of upstream production expansion, downstream refining development, and renewable energy diversification. Second, the study shows that these strategies contribute to Indonesia's energy security through three interconnected dimensions: energy availability, energy accessibility, and energy sustainability (Azzuni & Breyer, 2018). Third, the research identifies several strategic challenges and opportunities related to market volatility, regulatory effectiveness, technological innovation, and energy transition policies. From a theoretical perspective, this study contributes to the literature on energy security and state-owned enterprises by demonstrating that national energy security is influenced not only by resource availability but also by the ability of state-owned energy companies to integrate production capacity, refining infrastructure, and renewable energy investments within a coherent long-term strategy. The findings extend previous studies that primarily focused on macro-level indicators of energy security by providing a corporate-level perspective on how operational and strategic decisions contribute to national energy resilience. The results further suggest that Pertamina's contribution to energy security should not be evaluated solely through production volumes such as crude oil and natural gas output. Rather, the company's role must be understood in relation to its capacity to strengthen domestic energy supply chains, reduce dependence on imported refined products, and support the transition toward a more diversified and sustainable energy system. These findings provide empirical evidence that state-owned energy enterprises can function simultaneously as commercial actors and strategic instruments of national energy policy. However, the study also highlighted several challenges, including the volatility of global oil prices, regulatory bottlenecks, and the technical and financial barriers to the transition to renewable energy. Despite the progress made, Pertamina must overcome these hurdles to achieve long-term energy sustainability. The regulatory landscape, especially delays in

project approvals and inconsistent implementation of energy policies, remains a significant challenge. Furthermore, the reliance on fossil fuels, such as biofuels derived from palm oil, necessitates more sustainable practices to mitigate environmental degradation.

Recommendations for Future Research

Future research should employ mixed-methods approaches that combine quantitative analysis of energy production and investment indicators with qualitative interviews involving policymakers, industry practitioners, and Pertamina executives. Such approaches would provide a more comprehensive understanding of the relationship between corporate strategy and national energy security outcomes. Comparative case study designs examining PT. Pertamina alongside other National Oil Companies (NOCs), such as Petronas, Petrobras, and Saudi Aramco, would also be valuable in identifying best practices and institutional factors that influence energy security performance across different national contexts. Longitudinal studies are further recommended to evaluate how changes in government policy, global energy markets, and technological innovation influence Pertamina's contribution to energy security over time. Such research would provide deeper insights into the dynamic relationship between state-owned enterprises and energy transition processes. Future studies should also investigate the socio-economic and environmental implications of renewable energy development, particularly biofuel production and geothermal expansion, using interdisciplinary approaches that integrate economic, environmental, and policy analysis. Finally, further research on energy policy implementation at both local and national levels should examine how institutional coordination, regulatory consistency, and technological innovation including carbon capture and storage (CCS) can accelerate Indonesia's energy transition while maintaining national energy security and environmental sustainability.

Acknowledgments

We would like to extend our sincere gratitude to all those who contributed to the successful completion of this study. Special thanks go to the researchers and faculty members at Universitas Pertamina RI and Universitas Brawijaya Malang for their invaluable support and guidance. We also appreciate the technical assistance provided by PT. Pertamina in supplying relevant data and information related to the company's operations. This research did not receive any specific funding, but we are thankful for the time and effort invested by all contributors in bringing this study to fruition. Finally, we would like to thank the anonymous reviewers and editors for their helpful comments and feedback throughout the review process.

References

- Agreement, P. (2015). Paris agreement to the United Nations framework convention on climate change. *UNFCCC, Paris*.
- Alšauskas, O. (2024). World energy outlook 2024. *International Energy Agency: Paris, France*.
- Azzuni, A., & Breyer, C. (2018). Definitions and dimensions of energy security: a literature review. *Wiley Interdisciplinary Reviews: Energy and Environment*, 7(1), e268. <https://doi.org/doi.org/10.1002/wene.268>
- Bank, W. (2023). *State-Owned Enterprises and Energy Transition: Emerging Market Perspectives*. World Bank Publications.
- Bappenas. (2012). *Policy paper: Keselarasan kebijakan energi nasional (KEN) dengan Rencana Umum Energi Nasional (RUEN) dan Rencana Umum Energi Daerah (RUED)*. Badan Perencanaan Pembangunan Nasional (Bappenas). https://www.bappenas.go.id/files/6214/7547/7522/Policy_Paper_KEN_RUEN_RUED_2012.pdf
- Bhattacharyya, S. C. (2019). *Energy economics: concepts, issues, markets and governance*. Springer Nature.
- BIN, B. I. N. (2016). *Ketahanan Energi Indonesia 2015-2025 Tantangan Dan Harapan*. Rumah Buku.
- Child, M., Koskinen, O., Linnanen, L., & Breyer, C. (2018). Sustainability guardrails for energy scenarios of the global energy transition. *Renewable and Sustainable Energy Reviews*, 91, 321–334. <https://doi.org/doi.org/10.1016/j.rser.2018.03.079>
- Edigareva, J., Khimich, T., Antonov, O., & Gonzalez, J. (2021). Energy security: key concepts, components, and change of the paradigm. *ArXiv Preprint ArXiv:2106.16117*.
- Fang, D., Shi, S., & Yu, Q. (2018). Evaluation of sustainable energy security and an empirical analysis of China. *Sustainability*, 10(5), 1685. <https://doi.org/doi.org/10.1016/j.jclepro.2017.06.128>
- Fargione, J., Hill, J., Tilman, D., Polasky, S., & Hawthorne, P. (2008). Land clearing and the biofuel carbon

- debt. *Science*, 319(5867), 1235–1238. <https://doi.org/10.1126/science.1152747>
- Florini, A., & Sovacool, B. K. (2009). Who governs energy? The challenges facing global energy governance. *Energy Policy*, 37(12), 5239–5248. <https://doi.org/10.1016/j.enpol.2020.111930>
- Goldthau, A., & Sovacool, B. K. (2012). The uniqueness of the energy security, justice, and governance problem. *Energy Policy*, 41, 232–240. <https://doi.org/10.1016/j.erss.2021.102441>
- IGA. (2024). Global geothermal capacity report. In *International Geothermal Association*. <https://worldgeothermal.org/>
- IRENA, I. R. E. A. (2022). *World Energy Transitions Outlook 2022: 1.5° C Pathway*. International Renewable Energy Agency IRENA.
- Johansson, B. (2013). A broadened typology on energy and security. *Energy*, 53, 199–205. <https://doi.org/10.1016/j.energy.2013.02.054>
- Kraus, S., Breier, M., Lim, W. M., Dabić, M., Kumar, S., Kanbach, D., Mukherjee, D., Corvello, V., Piñeiro-Chousa, J., & Liguori, E. (2022). Literature reviews as independent studies: guidelines for academic practice. *Review of Managerial Science*, 16(8), 2577–2595. <https://doi.org/10.1007/s11846-022-00588-8>
- Leal-Arcas, R. (2023). *Electricity decentralization in the European Union: Towards zero carbon and energy transition*. Elsevier.
- Olaniyi-Quadri, T. (2026). *Crude Oil Production and Nigeria's Reliance on Foreign Refineries: Implications for Trade Dependencies and Energy Security in Foreign Policy*.
- Paré, G., & Kitsiou, S. (2017). *Chapter 9 Methods for Literature Reviews-Handbook of eHealth Evaluation: An Evidence-based Approach-NCBI Bookshelf*. University of Victoria. Available at: <https://www.ncbi.nlm.nih.gov/books/...>
- Paul, J., & Criado, A. R. (2020). The art of writing literature review: what do we know and what do we need to know? *International Business Review*, 29(4), 101717. <https://doi.org/10.1016/j.ibusrev.2020.101717>
- Pertamina Gas. (2018). *Providing Values*. PT Pertamina Gas. [https://pertagas.pertamina.com/Uploads/annual-report/Sustainability Report 2018 PT Pertamina Gas.pdf](https://pertagas.pertamina.com/Uploads/annual-report/Sustainability%20Report%202018%20PT%20Pertamina%20Gas.pdf)
- Pertamina Patra Niaga. (2023a). *Laporan Keberlanjutan: Energizing Your Journey Towards Sustainability*. PT Pertamina Patra Niaga. <https://pertainapatraniaga.com/page/laporan-sustainability>
- Pertamina Patra Niaga. (2023b). *Laporan Tahun 2023: Energizing Your Journey*. PT Pertamina Patra Niaga. <https://pertainapatraniaga.com/page/laporan-tahunan>
- Poudineh, R., Sen, A., & Fattouh, B. (2018). Policies to promote renewables in the Middle East and North Africa's resource rich economies. In *The economics of renewable energy in the Gulf* (pp. 120–138). Routledge.
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339.
- Sovacool, B. K., Hook, A., Martiskainen, M., & Baker, L. (2019). The whole systems energy injustice of four European low-carbon transitions. *Global Environmental Change*, 58, 101958.
- Sovacool, B. K., Newell, P., Carley, S., & Fanzo, J. (2022). Equity, technological innovation and sustainable behaviour in a low-carbon future. *Nature Human Behaviour*, 6(3), 326–337. <https://doi.org/10.1038/s41562-021-01273-8>
- Sulaiman, F., Ahmad, A., & Rahman, M. (2021). Oil price volatility and energy security in developing countries. *Energy Policy*, 156, 112–118. <https://doi.org/10.1016/j.enpol.2021.112118>
- Sunarjanto, D., & Kusumantoro, D. (2015). Optimasi mewujudkan ketahanan energi nasional: penanganan lingkungan dan migas non konvensional. *Lembaran Publikasi Minyak Dan Gas Bumi*, 49(3), 243–253.
- Taghizadeh-Hesary, F., Chang, Y., & Yoshino, N. (Eds.). (2025). *Energy Security, Transition, and Economic Growth*. World Scientific Publishing Co. Pte. Ltd. <https://econpapers.repec.org/RePEc:wsi:wsbook:14296>
- Tenny, S., Brannan, J. M., & Brannan, G. D. (2017). *Qualitative study*.
- Van de Graaf, T., & Colgan, J. (2016). Global energy governance: A review and research agenda. *Palgrave Communications*, 2, 15047. <https://doi.org/10.1057/palcomms.2015.47>
- Victor, D. G., Hufts, D. R., & Thurber, M. C. (2011). *Oil and governance: state-owned enterprises and the world energy supply*. Cambridge University Press.
- York, R., & Bell, S. E. (2019). Energy transitions or additions?: Why a transition from fossil fuels requires more than the growth of renewable energy. *Energy Research & Social Science*, 51, 40–43. <https://doi.org/10.1016/j.erss.2019.01.008>