GOVERNMENT STRATEGIES TO ENHANCE THE PROVISION OF OIL BUFFER RESERVES FOR STRENGTHENING NATIONAL ENERGY RESILIENCE

STRATEGI PEMERINTAH DALAM MENINGKATKAN PENYEDIAAN CADANGAN PENYANGGA MINYAK UNTUK MEMPERKUAT KETAHANAN ENERGI NASIONAL

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Abstract— *Indonesia remains highly dependent on fossil fuels, particularly oil, to meet its growing energy needs in the transportation sector. However, the country has yet to establish an adequate strategic oil reserve, leaving it vulnerable to global oil crises and potential supply disruptions. This study aims to analyze government strategies to enhance the provision of oil buffer reserves in Indonesia. It also explores alternative policy directions for the government, focusing on two key approaches: accelerating the transition to electric vehicles and strengthening existing oil infrastructure to enhance national energy resilience. The study employs a qualitative literature review method by analyzing 33 selected documents based on relevance, publication year, and methodological rigor. Findings indicate that transitioning to electric vehicles could reduce oil consumption by 1.5 million barrels per day (equivalent to USD 116.6 million), lower CO_2 emissions by 572.4 million kilograms, and generate USD 5.72 million from carbon trading. Meanwhile, developing domestic oil refineries could yield an economic value of USD 1.22 billion per crude oil processing transaction, while digitalization in the oil sector improves efficiency and prevents fraud. These findings demonstrate that enhancing the provision of oil buffer reserves through energy diversification and digital transformation can significantly strengthen Indonesia's energy resilience. To support these strategies, this study recommends implementing digital technologies, reallocating fuel subsidies to support the adoption of electric vehicles or refinery development, and conducting further research on subsidy reallocation mechanisms.*

Keywords: *Energy resilience, energy security, government strategies, oil buffer reserves, policy implementation.*

Abstrak— Indonesia masih sangat bergantung pada bahan bakar fosil, khususnya minyak bumi, untuk memenuhi kebutuhan energi yang terus meningkat di sektor transportasi. Namun, hingga kini Indonesia belum memiliki cadangan strategis minyak yang memadai, sehingga rentan terhadap krisis minyak global dan potensi gangguan pasokan. Penelitian ini bertujuan untuk menganalisis strategi pemerintah dalam meningkatkan penyediaan cadangan penyangga minyak di Indonesia. Selain itu, penelitian ini juga mengeksplorasi arah kebijakan alternatif dengan menyoroti dua pendekatan utama, yaitu percepatan transisi menuju kendaraan listrik dan penguatan infrastruktur minyak yang telah ada guna memperkuat ketahanan energi nasional. Metode yang digunakan adalah studi pustaka dengan menganalisis 33 dokumen yang dipilih berdasarkan kriteria relevansi terhadap tema penelitian, tahun publikasi, dan ketelitian metodologis. Hasil penelitian menunjukkan bahwa transisi menuju kendaraan listrik berpotensi mengurangi konsumsi minyak sebesar 1,5 juta barel per hari (setara USD 116,6 juta), menurunkan emisi CO_2 sebesar 572,4 juta kilogram, serta menghasilkan pendapatan sebesar USD 5,72 juta dari perdagangan karbon. Di sisi lain, pengembangan kilang minyak dalam negeri berpotensi memberikan nilai ekonomi sebesar USD 1,22 miliar untuk setiap transaksi pengolahan minyak mentah, sementara digitalisasi sektor minyak dapat meningkatkan efisiensi dan mencegah terjadinya kecurangan. Temuan tersebut

menunjukkan bahwa peningkatan penyediaan cadangan penyangga minyak melalui diversifikasi energi dan transformasi digital dapat memperkuat ketahanan energi nasional. Untuk mendukung strategi tersebut, penelitian ini merekomendasikan penerapan teknologi digital, pengalihan subsidi bahan bakar untuk mendukung adopsi kendaraan listrik atau pengembangan kilang minyak, serta perlunya penelitian lanjutan mengenai mekanisme pengalihan subsidi.

Kata kunci: Ketahanan energi, keamanan energi, strategi pemerintah, cadangan penyangga minyak, implementasi kebijakan.

Introduction

Indonesia heavily relies on fossil fuels, including oil, coal, and natural gas, to meet its energy needs. The country imported 25.72 million tons of oil in 2021, 30.07 million tons in 2022, and 32.78 million tons in 2023 (Ahdiat, 2023). These figures show a consistent annual increase in fossil fuel consumption, particularly in oil. Although Indonesia is classified as an oil-producing country, its domestic production is not yet meeting national demand, as shown in the following data.

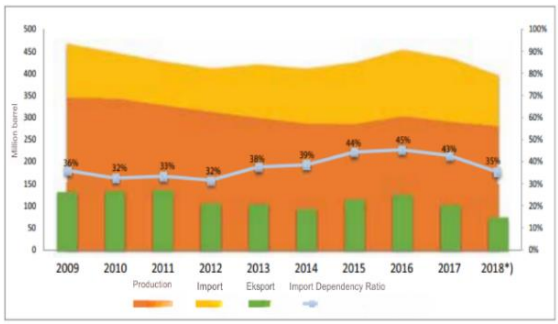

Figure 1. Dependence on Oil Export
Source: Sekretaris Jenderal Dewan Energi Nasional, 2019

The figure 1 show that Indonesia has not yet achieved self-sufficiency in meeting domestic oil needs. This continuing dependence on crude oil imports highlights the urgent need for Indonesia to pursue energy independence. Additionally, the country continues to import refined oil because its domestic refineries are unable to meet the total demand for fuel oil.

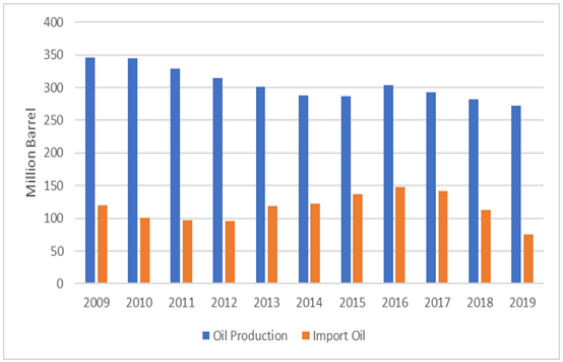

Figure 2. Production and Import of Fuel Oil
Source: Sekretaris Jenderal Dewan Energi Nasional, 2019

Although domestic production of refined oil generally exceeds import volumes, Indonesia still relies on imported refined oil to satisfy national consumption.

According to Government Regulation No. 79 of 2014 on the National Energy Policy, energy management must be based on principles of equity, sustainability, and environmental responsibility to achieve

energy independence and national energy resilience. The regulation identifies several key objectives, including ensuring energy availability to meet national needs, prioritizing the development of domestic energy sources, optimizing the use of national energy resources, and establishing strategic national energy reserves.

The regulation classifies energy reserves into three categories. First, strategic reserves are regulated and managed by the government to ensure long-term energy security. Second, buffer reserves are maintained for use in emergencies or during major disruptions to the regular energy supply. Energy providers manage third, operational reserves to maintain daily operations and handle short-term fluctuations in energy supply and demand. Globally, buffer reserves are commonly associated with oil, given its flexibility in distribution and use (Rahman, 2010).

As of 2021, Indonesia still lacks a national buffer reserve for refined oil (Umam, 2021). Currently, PT Pertamina maintains operational reserves sufficient for 22 days of fuel oil supply and 12 days of liquefied petroleum gas (LPG) supply. The government has instructed Pertamina and other energy companies to extend operational reserves to 30 days.

The absence of a national oil buffer reserve raises serious concerns about potential disruptions in the supply of crude oil and refined petroleum products. Promptly addressing these issues could prevent severe economic losses and potentially trigger social and political instability (Rahman, 2010). Such disruptions would significantly undermine Indonesia's energy resilience.

To address these challenges, the government must formulate integrated and forward looking strategies that focus on enhancing the provision of oil buffer reserves. These strategies should involve close collaboration among government institutions, private energy providers, and other relevant stakeholders. Strengthening coordination among these actors is extremely important for the effective implementation of policies. Based on this context, the present article discusses government strategies to enhance the provision of oil buffer reserves as a means of strengthening national energy resilience.

Research Methods

This study uses a literature review method, which is considered appropriate for analyzing existing policies, strategic

approaches, and theoretical foundations related to national energy resilience. Through this method, the researcher examines various secondary sources to obtain key insights and identify best practices, particularly in formulating effective strategies to strengthen the provision of oil buffer reserves in Indonesia.

The research process was carried out in three main stages. The first stage, data collection, involved identifying and selecting relevant literature using several predetermined keywords, including oil buffer reserves, energy resilience, government strategy, electric vehicles, and carbon credit.

The second stage, data analysis, focused on reviewing and interpreting the selected literature to identify patterns of strategy, challenges, and current policy trends associated with the management and optimization of oil energy reserves.

The third stage, which concluded, aimed to synthesize the findings into a comprehensive understanding and develop strategic recommendations for the government to enhance the provision of oil reserves and strengthen national energy resilience.

This study analyzed a total of 33 documents collected from credible and official online sources. The sources comprise:

1. Six documents published by Indonesian government institutions, such as the Ministry of Energy and Mineral Resources and the Kementerian Lingkungan Hidup (Ministry of Environment and Forestry.)
2. Seven legal and regulatory documents, including presidential decrees, ministerial regulations, and laws.
3. Non-governmental organizations, reputable media outlets, and academic institutions have issued twenty publications.

Most of these documents appeared between 2020 and 2025, capturing current developments in Indonesia's energy policy and management practices. Collectively, these materials provide a strong basis for assessing the government's strategic initiatives to enhance the provision of oil buffer reserves and strengthen national energy resilience.

National Energy Policy

This study refers primarily to Government Regulation No. 79 of 2014, which outlines Indonesia's national energy policy. The regulation defines the policy as a framework for managing energy based on the principles of fairness, sustainability, and environmental responsibility, to achieve national energy independence and security.

The policy consists of two components: main policies and supporting policies, each designed to ensure that energy management aligns with national priorities and long-term resilience, such as:

Table 1. Review of Indonesian Government Regulation No. 79 of 2014

No	Main Policy	Supporting Policy
1	Availability of energy for national needs	Energy Conservation, Conservation of Energy Resources, and Energy Diversification
2	Priority on energy development	Environment and safety
3	Utilization of national energy resources	Energy prices, subsidies, and incentives
4	National energy reserves	Infrastructure and access for the public to Energy and the Energy Industry
		Research, development, and application of Energy technology
		Institutional framework and funding

Source: Indonesian Government Regulation No. 79 of 2014

The two policies mentioned above will be in effect from 2014 to 2050, serving as guidelines to direct national energy management and achieve national energy resilience and independence, while supporting sustainable national development.

National Energy Reserve

Energy reserves are defined by Government Regulation No. 79 of 2014 as energy stocks that have a known location, quality, and quantity. The regulation classifies these reserves into three categories: operational reserves, buffer reserves, and strategic reserves, each serving a distinct function.

1. Operational reserves refer to energy resources managed by energy suppliers or utility companies to ensure the continuity of daily operations and to accommodate short-term fluctuations in energy supply and demand.

2. Buffer reserves represent the amount of energy resources stored nationally to meet domestic energy needs during emergencies or disruptions for a specified period of time.
3. Strategic reserves are reserves regulated and allocated by the government to guarantee long-term national energy security.

Globally, energy buffer reserves are generally centered on oil, since it serves as a flexible energy source in both distribution and utilization (Rahman, 2010).

National Energy Security

Government Regulation No. 79 of 2014 defines energy security as the assurance that energy remains accessible to the public at reasonable prices over time, while maintaining adequate supply and protecting the environment. According Boedoyo (2012), as cited in Utami et al. (2022), four key elements shape the foundation of energy security:

1. Availability. This element refers to the adequacy of energy and energy reserves, the balance between exports and imports, and the efficiency of energy utilization.
2. Affordability. This aspect relates to public income, energy consumption levels, and the national electrification ratio.
3. Accessibility. This includes the development of technology, the availability of infrastructure, and the implementation of energy conservation measures.
4. Acceptability. This involves environmental considerations and the responsible management of energy resources.

In addition to these four components, the Energy Security Program of the Indonesian Defense University introduces a fifth element: sustainability. This element is equally important, as sustainable energy security not only supports long-term economic growth but also strengthens overall national resilience.

Air Pollution

According to Minister of Environment Regulation No. 8 of 2023 air pollution occurs when substances, energy, or other elements resulting from human activities are introduced into the ambient air, exceeding established air quality standards. The regulation also defines

emission quality standards as the maximum permissible concentration of pollutants released into the atmosphere (Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia, 2023).

The Ministry of Environment and Forestry (KLHK) identifies the transportation sector as the largest contributor to air pollution, accounting for 44 percent of total emissions. The industrial sector contributes 31 percent, followed by the residential sector at 14 percent, the manufacturing sector at 10 percent, and the commercial sector at 1 percent (Adhiem, 2023).

These data indicate that the transportation sector plays the most significant role in deteriorating air quality. Consequently, transitioning from fossil fuel-powered vehicles to electric vehicles (EVs) represents a strategic and sustainable measure to reduce air pollution and improve environmental health.

Result and Discussion

Fuel Consumption Diversification in the Transportation Sector with Electricity

Diversifying fuel consumption toward electricity represents a key strategy for reducing emissions in Indonesia's transportation sector. Currently, most vehicles in Indonesia still rely on oil as their primary energy source, making it essential for the government to accelerate the transition to electric mobility to reduce dependence on fossil fuels.

The development of battery electric vehicles (EVs) in Indonesia is regulated under Presidential Regulation No. 55 of 2019 concerning the Acceleration of the Battery Electric Vehicle Program for Road Transportation (Peraturan Pemerintah, 2019). This regulation has encouraged the expansion of electric vehicle adoption and the establishment of supporting infrastructure nationwide (Anshori et al., 2024).

The Government of Indonesia has set an ambitious target to introduce 2 million electric cars and 13 million electric motorcycles, as stated in the press release by the Kementerian Energi dan Sumber Daya Mineral (Ministry of Energy and Mineral Resources) on May 22, 2024. In 2023, Indonesia consumed approximately 1.5 million barrels of oil per day to meet its national fuel needs, with motorcycles accounting for the largest share (Nasution & Puspaningtyas, 2023).

According to the U.S. Energy Information Administration (2025), the average price of Brent crude oil as of

August 1, 2024, was USD 77.74 per barrel. Based on this figure, Indonesia's daily expenditure for oil consumption in the transportation sector can be estimated as follows:

$$Total\ Cost = 1{,}500{,}000\ barrels \times 77.74 \frac{USD}{barrel} = 116{,}610{,}000\ USD/day$$

This calculation indicates that Indonesia spends roughly USD 116.6 million per day on fuel consumption for the transportation sector. If the country succeeds in implementing large-scale diversification toward electric vehicles, this expenditure could potentially be reduced or redirected, allowing Indonesia to save up to USD 116.6 million per day while simultaneously lowering emissions.

The government has taken concrete steps to accelerate the transition toward electric vehicles by introducing a range of incentive programs. These initiatives aim to encourage the public to adopt electric vehicles and to support the development of related infrastructure and technology, as summarized in Table 2.

Table 2. Summary of Indonesian Government Incentives for Electric Vehicle Development

No	Benefit	Sources	Ministry
1.	Electric vehicle purchase subsidy of 7 million Rupiah/Unit	Indonesian Ministry of Industry Regulation Number 21 of 2023	Ministry of Industry, Republic of Indonesia
2.	Conversion subsidy for 2-wheeled electric vehicles of 10 million Rupiah per unit	Adi (2024)	Ministry of Energy and Mineral Resources, Republic of Indonesia
3.	Provision of special electricity incentives for electric-vehicle facility developers	Direktorat Jenderal Ketenagalistrikan (2021)	Ministry of Energy and Mineral Resources, Republic of Indonesia
4.	Exemption from import duties and 10 percent reduction of value-added tax for electric cars	Ministry of Finance Regulation No. 38 of 2024	Ministry of Finance, Republic of Indonesia
5.	Electric vehicles in Jakarta are exempt from the odd–even traffic rule	Governor of DKI Jakarta Regulation No. 88 of 2019	Provincial Government of DKI Jakarta

Source: Data compiled by the author from official and secondary sources, 2025

The implementation of the various government incentive programs listed above naturally requires substantial financial resources. To help sustain these initiatives, the government can leverage the economic opportunities arising from carbon credits generated through the expansion of electric vehicle use. By

doing so, Indonesia can not only reduce its dependence on fossil fuels but also create an alternative source of revenue that supports the long-term financing of its clean energy and oil buffer reserve programs.

The Potential for Air Pollution Reduction and Carbon Credit Revenue in the Electric Vehicle Sector

Every program implemented by the government inevitably requires substantial financial resources. To sustain these initiatives, the government can capitalize on the economic benefits generated from carbon credits associated with the use of electric vehicles (EVs).

According to the Directorate of Energy Conservation during the Sharing Session on the Potential Implementation of the Carbon Market in the Battery Electric Vehicle Sector (2024), one liter of Pertalite fuel can power a vehicle for approximately 10 kilometers, producing about 2.4 kilograms of carbon dioxide (CO_2). In contrast, covering the same distance with an electric vehicle requires only 1.3 kWh of electricity and generates zero CO_2 emissions.

Indonesia currently consumes around 1.5 million barrels of oil per day. According to data from the PGN LNG Company (pgnLNG, 2024), one barrel of oil is equivalent to approximately 159 liters of fuel. Therefore, the total daily fuel consumption can be calculated as follows:

$$1{,}500{,}000\ Barrels \times 159\ Liters$$
$$= 238{,}500{,}000\ Liters$$

Thus, Indonesia's daily oil consumption is equivalent to 238.5 million liters of fuel. Referring to this calculation, the amount of CO_2 emissions produced can be determined as follows:

$$CO_2 = 238{,}500{,}000\ Liters \times 2.4$$
$$= 572{,}400{,}000\ \text{Liters}$$

It can be determined that the CO_2 emissions generated from the use of 238,500,000 liters of fuel amount to 572,400,000 kg of CO_2. If the electric vehicle diversification program is successfully implemented, the potential CO_2 emission reduction that can be achieved is 572,400,000 kg of CO_2.

The carbon trading mechanism can leverage this emission reduction, as each carbon credit signifies a one-ton decrease in CO_2. Therefore, referring to the estimated amount of CO_2 reduction, the potential carbon credits that can be obtained can be calculated based on the previous data as follows:

$$1{,}000\ Kg = 1\ Ton$$

$572{,}400{,}000\ \text{kg} = 572{,}400\ \text{Ton}$

Based on the presented data, it can be concluded that the potential CO_2 emission reduction that can be achieved amounts to 572,400 carbon credits. Under the Voluntary Emission Reduction scheme, each carbon credit is valued at 10 USD. Consequently, the estimated potential revenue from carbon trading could reach 5,724,000 USD per day.

When converted into Indonesian Rupiah using exchange rate data from the Kementerian Dalam Negeri RI (Ministry of Home Affairs), which states that 1 USD = IDR 16,431, this value is equivalent to IDR 94,051,044,000 per day. This indicates that, in addition to contributing to carbon emission reduction, the implementation of electric vehicles also holds significant economic potential through carbon trading mechanisms while accelerating the establishment of oil energy buffer reserves for energy buffering reserves.

Digitalization of Fuel Dispensing Systems

As we are aware, the government offers numerous subsidies in the energy sector, including those for fuel oil, natural gas, and electricity. For 2024, the government has allocated an energy subsidy budget of Rp 186.9 trillion, with details including Rp 87.5 trillion for 3 kg LPG subsidies, Rp 25.8 trillion for fuel oil (BBM) subsidies, and Rp 73.6 trillion for electricity subsidies (Hidranto, 2024).

However, in reality, many people misuse these subsidies, such as by overfilling and hoarding fuel oil by specific individuals (Pangaribowo & Khairina, 2023) and wealthy individuals who also use subsidized 3kg LPG gas for personal gain (Hidranto, 2024).

To address these issues, the government could develop a system using an application to regulate fuel oil purchases with specific limits, such as the MyPertamina Application to prevent exploitation by specific individuals. Additionally, the government could encourage the public to report any violations of the rules related to subsidized fuel oil purchases.

Oil Refinery Development to Maximize Crude Oil Potential

The development of oil refineries in Indonesia plays a vital role in maximizing the country's crude oil potential. As one of the nations with substantial oil reserves, Indonesia can add value to its natural resources by processing crude oil into higher-value products such as gasoline, diesel, and petrochemicals

(Rahman, 2022). Expanding domestic refinery capacity also helps reduce dependence on imported refined oil and strengthens national energy resilience.

In 2023, Indonesia imported 13,264,637 kiloliters of refined oil (Direktorat Jenderal Minyak dan Gas Bumi Kementerian Energi dan Sumber Daya Mineral, 2022), which shows that domestic production still cannot meet national demand. According to data from the U.S. Energy Information Administration (2024), the price of Brent crude on August 1, 2024, was USD 77.74 per barrel, while refined oil products such as gasoline, heating oil, low-sulfur diesel, and propane averaged USD 2.20 per gallon. When converted into barrels, the price of refined oil reached USD 92.40 per barrel, which is USD 14.66 higher than crude oil.

Using these figures, this analysis converts Indonesia's import of 13,264,637 kiloliters of refined oil into liters. Since one kiloliter equals 1,000 liters, the total amount becomes 13,264,637,000 liters. Referring to Energy Education (2024), one barrel equals 159 liters. Therefore:

$$Number\ of\ Barrels = \frac{13{,}264{,}637{,}000}{159\ liters/barrel} = 83{,}444{,}661\ Barrels$$

At a refined oil price of USD 92.40 per barrel, Indonesia would need to spend about USD 7.71 billion to import refined oil. If Indonesia refined its own crude oil domestically, the same amount would cost only around USD 6.49 billion, allowing the country to save approximately USD 1.22 billion from that single transaction.

Beyond financial benefits, developing oil refineries also stimulates wider economic growth. The construction and operation of new refineries generate employment opportunities and strengthen local economies through infrastructure projects and related industries. These activities can increase government revenue from taxes and royalties within the oil and gas sector (Ardiana et al., 2023).

Moreover, having domestic refining facilities improves the stability of the national energy supply. Independent refining capacity enables Indonesia to manage its petroleum stocks and distribution more effectively, allowing for faster responses to market fluctuations and price volatility. This stability helps maintain affordable energy prices and ensures a reliable supply for both public and industrial consumption.

Considering these advantages, refinery development should remain one of the government's main priorities in shaping future national energy policies. Enhancing domestic refining capacity not only supports national energy security but also contributes to Indonesia's long-term goal of achieving sustainable energy independence.

Conclusion, Limitations, and Recommendations

This study examines two primary strategies that the Indonesian government can adopt to optimize the provision of oil reserves for energy buffering and strengthen national energy resilience. The first strategy is to switch from cars that run on fossil fuels to electric cars. The second strategy is to make the most of the oil infrastructure that is already in place by building refineries in the country and using digital technologies to make operations more efficient. The findings indicate that the transition to electric vehicles could save approximately 1.5 million barrels of oil per day, equivalent to around USD 116.6 million daily. This transition not only reduces dependency on fossil fuels but also provides substantial environmental benefits, including a potential reduction of 572.4 million kilograms of CO_2 emissions and potential carbon trading revenues of USD 5.72 million per day. In parallel, optimizing oil infrastructure through refinery development could generate an additional USD 1.22 billion in revenue per oil processing transaction. Furthermore, the integration of digital systems within the oil sector enhances operational efficiency, strengthens transparency in fuel management, and minimizes fraudulent practices in energy distribution.

While this research provides valuable insights, government agencies, private companies, and research groups must collaborate to ensure the continuous development of new technologies in the energy sector. Strategic approaches for improving national energy resilience are primarily based on secondary data and quantitative assumptions derived from existing sources. Consequently, this study has not yet examined the practical effectiveness of these strategies at the local or operational level. The absence of field data and stakeholder perspectives limits the ability to fully capture the implementation challenges that may arise in different regions. Moreover, variations in technological readiness, policy enforcement, and financial capacity

across provinces could influence the feasibility of these strategies. Therefore, the findings should be interpreted as conceptual guidance rather than direct empirical validation, providing a foundation for future applied research.

To ensure the successful implementation of policies, the government is encouraged to adopt an integrated and forward-looking approach. Strengthening digitalization in fuel sales and distribution systems can promote transparency, efficiency, and accountability across the energy sector. Furthermore, reallocating a portion of fuel subsidies to support the adoption of electric vehicles and domestic refinery construction would enhance long-term sustainability while reducing fiscal pressure from energy imports. Reserves for energy buffering are also essential. Collaboration among government institutions, private industry, and research bodies is critical for guaranteeing the continuous development of technological innovations in the energy sector. Ultimately, future research should focus on evaluating the socio-economic impact and long-term effectiveness of subsidy reallocation policies to ensure that they make a meaningful contribution to Indonesia's vision of sustainable energy independence.

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