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The Role of Energy Security In Supporting Indonesia's National Security: A Strategic Approach

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energy security, energy security index, energy policy, national security, indonesia

ABSTRACT
This research aims to develop and implement an energy security index in Indonesia and analyze problems related to energy security. This research uses a qualitative approach with a case study method, which was carried out in several locations such as the Ministry of Energy and Mineral Resources (EMR), the Downstream Oil and Gas Regulatory Agency (BPH Migas), and national energy companies such as PT Pertamina and PT PLN. The subjects of the study include government officials, energy company executives, and energy experts who play a role in energy policy and management. Data were collected through in-depth interviews, participatory observations, and document analysis. Key indicators used to compile the energy security index include the availability of energy supply, dependence on energy imports, diversification of energy sources, and energy efficiency. Thematic analysis and content analysis are used to analyze the data that has been collected. The interim statement suggests that the energy security index can identify key problems in Indonesia's energy sector, including a high dependence on energy imports and a lack of diversification of energy sources. The study also found that strategies to improve energy security, such as the development of renewable energy and improved energy efficiency, can contribute significantly to national security. The conclusion of this study emphasizes the importance of a multidisciplinary approach and international cooperation in addressing energy security challenges.

INTRODUCTION

Security energy strong national will support security national Because joints life strategic part of the country Already fulfilled. While interest national in a dynamic world is also fulfilled, so that will make it easier life state. However problem security energy can it is said complicated, many problem security energy that has been years year done, but Still Not yet can also be resolved with good. Even in condition certain problem security energy national there are those who experience setbacks, such as dependence to use oil that is increasingly time the more Lots show dependency. If examined based on framework security national, then problem energy the should

be Can completed with Good If role detection early warning early as step beginning preventing the country from becoming " sick " can done with good . The role carried out by the State Intelligence which is line First in system security national, which means For overall problem energy, intelligence need walk its function is to ensure security energy can created for Indonesia.

Security Indonesia's energy has impact significant good at level national both global and international. As one of the manufacturers and exporters main coal and natural gas liquefied natural gas (LNG) in the world, stability supply energy from Indonesia is very important for countries that depend on imports energy, such as Japan, South Korea, and several countries in Europe. Stability supply This help reduce risk disturbance energy that can influence global (International Energy Agency, 2023) economy. Indonesia's efforts to develop source energy renewable such as geothermal, energy solar, and biomass also contribute to diversification source global energy, reducing dependence on materials burn fossils , and help achieve mitigation targets change climate. In terms of this, report from the International Renewable Energy Agency (IRENA) on Renewable Energy Prospects: Indonesia is highly relevant For understand potential and challenges in development energy renewable in Indonesia (International Renewable Energy Agency, 2017).

In addition, stability energy in Indonesia has an impact straight to stability economics and politics in the Southeast Asian region. Instability energy in Indonesia can cause disturbance supply that affects neighboring countries, which can bother regional stability. This is in line with findings of the ASEAN Plan of Action for Energy Cooperation (APAEC) which highlights importance cooperation energy in the region This (ASEAN Centre for Energy, 2017). Indonesia is also committed For reduce emission carbon through improvement efficiency energy and development energy renewable, which is part of Indonesia's Nationally Determined Contributions (NDCs) under the Paris Agreement (United Nations Framework Convention on Climate Change, 2020). Indonesia's success in achieve this target will contribute to global efforts to withhold rate change climate.

Investment foreign in sector Indonesian energy, including technology energy renewable and infrastructure energy, help push innovation and beneficial technology transfer globally. Report from the Coordinating Body Investment Coordinating Board (BKPM) Indonesia shows that investment foreign in sector energy Keep going increase, support development more technology and infrastructure good (Badan Koordinasi Penanaman Modal, 2022). In addition, security energy in Indonesia also supports resilience global energy with ensure diversification source energy and reduce risk dependence on several Supplier main only, as outlined in International Energy Agency (IEA) report on resilience global energy.

With Thus, security Indonesia's energy is not only important for stability and development economy national but also has implications wide for stability energy and the global economy . With effort Keep going continuously in develop energy renewable, improve efficiency energy, and attractive investment foreign , Indonesia plays role key in guard security global energy and support global efforts to overcome change climate. Information more carry on can found in reports from the International Energy Agency (IEA), International Renewable Energy Agency (IRENA), ASEAN Center for Energy, and United Nations Framework Convention on Climate Change (UNFCCC)

Indonesia has source Power diverse energy, including energy fossil like coal, oil earth and natural gas , as well as source energy renewable like hot earth, energy solar, and biomass. Coal and natural gas liquid (LNG) becomes commodity main in export Indonesia's energy, making it one of the player important in the global energy market. On the other hand, the utilization of energy

renewable Still relatively low even though this country own potential big, especially in energy hot earth considering that Indonesia has Lots mountain active volcano (International Energy Agency, 2023). However, Indonesia still depends significant on imports energy, especially oil earth, for fulfil need domestic. Dependence This create vulnerability to fluctuation price global oil that can impact negative on the economy national (Badan Koordinasi Penanaman Modal, 2022). In addition, the height dependence to import energy result in deficit balance sheet trade and pressure backup foreign exchange.

Infrastructure energy in Indonesia is also facing various challenges. Distribution even energy to throughout Indonesia, especially to areas remote and islands outermost, still become problem main. Storage effective and efficient energy also becomes issue important, especially in context energy renewable which is often intermittent or No continously available. Challenges This need investment big in infrastructure and technology energy (ASEAN Centre for Energy, 2017). Indonesia is facing a number of risk in guard security its energy . Fluctuations price global energy is one of the risk main thing that can influence stability economy national. Instability price oil and natural gas in the international market Can cause surge cost burdensome imports economy. In addition , disruption supply energy consequence conflict geopolitics, disaster nature, or problem technical is also a necessary threat anticipated (International Renewable Energy Agency, 2017).

Impact change climate also becomes risk Serious for security energy. Increase frequency and intensity disaster natural like floods and droughts can damage infrastructure energy and disturbing production as well as distribution energy. Internal challenges such as complicated bureaucracy, corruption, and lack of investment in sector energy add complexity problem . Lack of investment, good from sector public and also private, inhibiting development infrastructure adequate energy and innovation the technology required For overcome challenge energy in the future (United Nations Framework Convention on Climate Change, 2020). Instability energy own implications direct to security national. Uncertainty in supply energy can bother operational sectors critical like defense, health, and transportation, which in turn can weaken the country's ability to guard stability and security. Stable and affordable energy is essential For support operational defense and security, including operation military and maintenance facility strategic (International Energy Agency, 2023).

Crisis energy also has implications significant social and political instability. price energy can cause dissatisfaction public, protests , and tensions social, which can lead to instability politics. In addition, dependence on imports energy can influence policy abroad, requires the country to consider dynamics global politics and economics in determine energy strategy national (International Energy Agency, 2023). With Thus, security energy No only impact on aspects economy but also affects stability more social and political wide.

Indonesia faces significant challenges in securing its national energy supply due to high dependence on fossil fuel imports, fluctuating global energy prices, and limited diversification of energy sources. These vulnerabilities pose risks not only to the economy but also to national security, as energy instability can disrupt critical sectors and regional stability. Despite abundant renewable energy potential, Indonesia’s energy infrastructure and policy framework have yet to fully capitalize on sustainable alternatives to reduce dependency and emissions.

The urgency of addressing energy security in Indonesia is heightened by the increasing volatility in global energy markets and geopolitical tensions that threaten supply stability. Failure to diversify and secure energy resources could impair Indonesia’s economic growth, increase vulnerability to external shocks, and hinder commitments under international climate agreements.

Moreover, energy instability can escalate social and political tensions domestically and regionally, making it imperative for Indonesia to develop resilient energy systems that support both economic and national security.

Furthermore, climate change impacts such as extreme weather events jeopardize existing energy infrastructure and supply chains. Indonesia must accelerate its transition to renewable energy and improve energy efficiency to fulfill global emission reduction targets while safeguarding its population from energy crises that could exacerbate socio-economic inequalities.

Several studies have addressed aspects of Indonesia's energy challenges. International Renewable Energy Agency (IRENA, 2017) highlighted Indonesia's vast geothermal and solar potential but noted limited utilization due to infrastructural and financial barriers. The International Energy Agency (IEA, 2023) emphasized the country's reliance on coal and fossil fuel imports, identifying this as a strategic risk for national energy security. Regional cooperation efforts, such as those detailed by the ASEAN Centre for Energy (2017), underscored the importance of cross-border energy integration and diversification to enhance supply stability in Southeast Asia.

Research by the Indonesian Investment Coordinating Board (BKPM, 2022) showed increasing foreign investments in renewable energy but stressed the need for better regulatory frameworks and infrastructure to translate investment into tangible energy security outcomes. Meanwhile, studies on energy policy (Kuntjoro, 2021) proposed models integrating quintuple helix innovation to accelerate renewable adoption and national defense resilience.

However, many analyses focus primarily on technical or economic perspectives, often overlooking the multidimensional strategic implications of energy security, including geopolitical, social, and environmental factors.

Current research lacks a comprehensive, multidimensional assessment of Indonesia's energy security that integrates economic, environmental, social, and geopolitical factors into a unified analytical framework. There is also limited empirical data on how energy security strategies align with national security objectives and climate commitments simultaneously. Existing energy security indices tend to focus on availability and affordability without sufficiently addressing accessibility, environmental sustainability, or regional disparities. This gap restricts policymakers' ability to design holistic strategies to enhance energy resilience.

This study develops a novel integrated Energy Security Index for Indonesia using the 4A framework—Availability, Accessibility, Affordability, and Acceptability—incorporating quantitative and qualitative data. The research uniquely combines empirical data from government agencies and industry experts with thematic qualitative insights to provide a holistic understanding of Indonesia's energy security status. Additionally, it links energy security explicitly to national security, climate policy, and socio-political stability, offering an interdisciplinary approach that has been rarely addressed in Indonesian contexts.

The primary objective is to develop and validate a comprehensive Energy Security Index for Indonesia that captures multiple dimensions of energy security. The study aims to analyze trends from 2014 to 2023, identify key vulnerabilities, and assess the effectiveness of current policies and infrastructure in achieving sustainable and secure energy supply. Another goal is to provide strategic recommendations to enhance Indonesia's energy resilience aligned with national and international goals.

The findings will benefit policymakers by offering a detailed tool to monitor and improve energy security, facilitating informed decision-making. It will assist stakeholders in identifying critical gaps and prioritizing investments in infrastructure, technology, and policy reforms.

Moreover, the study supports Indonesia's commitment to climate mitigation and regional stability by promoting sustainable energy development. Academically, it contributes a methodological innovation in energy security assessment that can be adapted in similar emerging economies.

RESEARCH METHOD

The research that will be done is study mix method research with qualitative as The parent. Research qualitative Because researcher want to understand security energy national in corner perceived sense of security complex in a way concrete and in need in -depth answers (Sugiyono, 2015). Research related security in general nature ideographic, because study Intelligence is business For understand Contents head man For get the sense of security he desires. Threats is antithesis from a sense of security Because will cause worries and fears within the scope of the country, so that majority and parent study is study qualitative. The approach that will be used in study namely Case Study Where with approach This expected Can analyzing the country's intelligence strategy. Case Study Approach is type the approach used For investigate and understand A incident or the problem that has been happen with gather various type information that is then processed For get A solution to the problem that is revealed can completed (Cresswell, 2014).

Temporary For side quantitatively is know description empirical security energy national outlined to various indicator For see how much vulnerability problem security energy Indonesian national. This is done with method develop index with scale 0 – 100 against ideal conditions now and in the future upcoming Good from side availability, accessibility, affordability, and acceptability of collected data become mark in the form of numbers. However explanation quantitative the combined with explanation qualitative which can give description deep about content and plan writing that will be done.

Data will be collected in accordance need related framework security energy that can obtained through secondary data and triangulation with interview data. Next gather collection information through deepening with interview and FGD. Next will done coding to be able to classify the data in it, and can utilized For to obtain maximum results in accordance with existing concepts and theories.

Researchers also use the expected MAXQDA application will help in separate and classify sourced data from informants and sources secondary. And using application the For understand connection between object of research Good from frequency and also proximity from structure sentence. Research This the plan will done to a number of related stakeholders with State Intelligence and Energy.

RESULTS AND DISCUSSIONS

Development Indicator Energy Security

The following is the development of energy security indicators based on the 4A framework (Availability, Accessibility, Affordability, and Acceptability) which is equipped with the calculation formula for each indicator and its reasons.

Data Entered

Every index in The 4A method requires specific data , which I insert as following :

- Availability (Availability):
  - Required Data : Production energy domestic and consumption total energy of various sector (industry , housing stairs , commercial , transportation).

- Source : This data taken from the documents you upload and assumptions production energy domestic specified For every year .
- Accessibility (Accessibility):
- Required Data : Supply energy reliable (reliable) consumers) and total demand energy.
- Source : Supply energy taken from assumptions based on consumption data total energy, and it is assumed as reliable supply.
- Affordability :
- Required Data : Expenditures total energy and Gross Domestic Product (GDP) for every year.
- Source : Expenditure energy counted based on consumption multiplied energy with price energy from documents , and GDP data was taken from source valid external.
- Acceptability (Acceptable) :
- Required Data : CO_2 emissions per unit of consumption energy (usually in BOE or and the like).
- Source : Emissions counted from factor emission standard For material the fuel used (e.g. natural gas , coal , gasoline), is converted from the BOE to the appropriate unit .

Calculation Process

- Availability Index
  - Formula :

$$Availability\ (\%) = \left(\frac{\text{Produksi Energi Domestik}}{\text{Konsumsi Energi Total}}\right) \times 25$$

  - Process: Production data energy domestic entered as numerator , and consumption total energy of all sector used as denominator . The result Then normalized to be in scale 0 to 25%.
- Accessibility Index
  - Formula :

$$Accesibility\ (\%) = \left(\frac{\text{Pasokan Energi Andal}}{\text{Total Permintaan Energi}}\right) \times 25$$

  - Process: Supply data reliable energy (assumed) The same with production energy in Lots case) is used as numerator , and consumption total energy used as denominator . The result is also normalized to scale 0 to 25%.
- Affordability Index
  - Formula :

$$Affordability\ (\%) = \left(\frac{\text{GDP}}{\text{Pengeluaran Energi}}\right) \times 25$$

  - Process: GDP data is used as numerator , and total expenditure energy (results) consumption energy multiplied price energy) is used as denominator . Index accessibility counted in scale upside down , where the more large GDP compared to expenditure energy , more and more Good its affordability . This result normalized to in scale 0 to 25%.
- Acceptability Index
  - Formula :

$$Acceptability\ (\%) = \left(1 - \frac{\text{Emisi CO2 per BOE}}{\text{Maksimum Emisi}}\right) \times 25$$

  - Process: CO_2 emissions are calculated based on consumption energy and factors emissions per material burn . CO_2 emissions per BOE then normalized based on mark emission maximum , with 0% value for very high emissions and 25% for very low emissions .

Count Total Energy Security Index

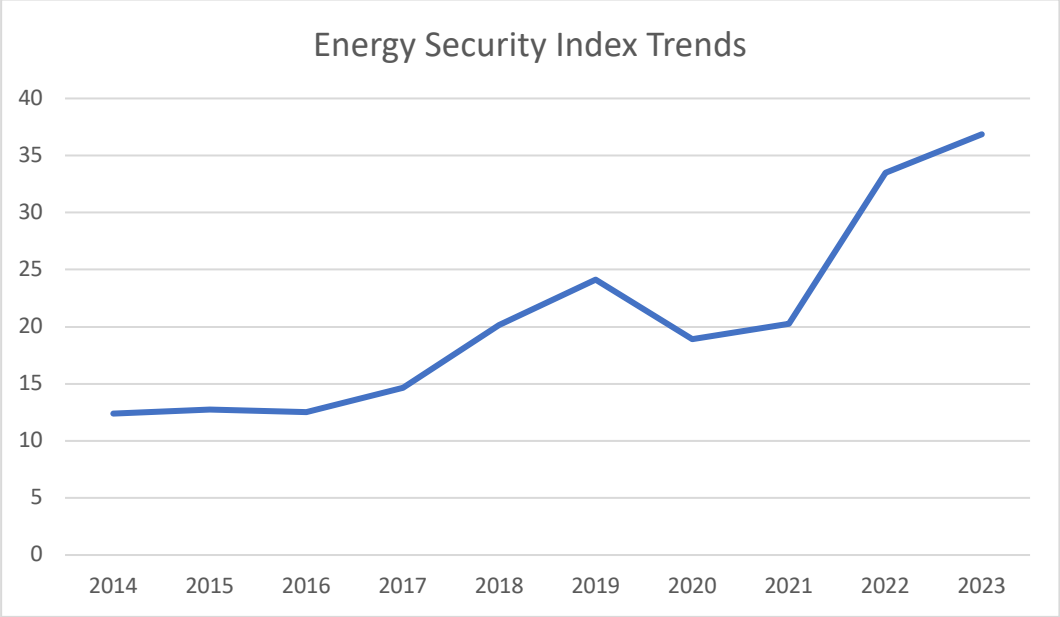
After every component calculated, **Total Energy Security Index** counted as summation from fourth index :

$$Affordability\ (\%) = \text{Penjumlahan Indeks 4A}$$

Presenting Results

After calculation done , simplified table serve results from each index (Availability, Accessibility, Affordability, Acceptability) and **the Energy Security Index** overall For every year from 2014 to 2023.

Year	Availability (%)	Accessibility (%)	Affordability (%)	Acceptability (%)	Energy Security Index (%)
2014	4.47	4.03	3.42	0.47	12.39
2015	4.65	4.12	3.47	0.48	12.72
2016	4.76	4.22	3.56	0.00	12.54
2017	4.79	4.25	3.46	2.15	14.65
2018	4.71	4.19	3.10	8.14	20.14
2019	4.76	4.26	2.87	12.25	24.13
2020	5.12	4.60	3.30	5.89	18.90
2021	5.17	4.74	3.28	7.05	20.23
2022	4.88	4.56	2.45	21.62	33.51
2023	4.92	4.62	2.32	25.00	36.86



Discussion

Based on Energy Security Index table that has been counted For period 2014 to 2023, we can see trends that reflect change in various aspect security energy Indonesian national. Here is analysis

qualitative For every year, explains factors that influence change in four component main : Availability, Accessibility, Affordability, and Acceptability.

Availability (Availability)

- Trend: Generally In general , the Availability Index shows relative stability consistent from 2014 to 2023.
- Explanation : Availability Energy in Indonesia depends on production energy domestic like oil, gas, and coal. Stability of the components This can interpreted as sustainability production energy enough domestic For fulfil part big need energy domestic . Stable factors like capacity production and exploration source Power energy play a role in guard index This still stable. Fluctuation small Can caused by a decrease production oil raw or improvement energy renewable.

Accessibility (Accessibility)

- Trend: The Accessibility Index also shows trend stable , with A little improvement from year to year.
- Explanation: Improvement accessibility energy Can caused by efforts improvement infrastructure energy, such as development network electricity national, and improvement access energy in the area remote. The Indonesian government has invest big in expand network electricity and increase access energy for public rural. Index This is also influenced by stability supply energy, so that involvement in trading energy and natural gas imports participate strengthen stability accessibility energy in Indonesia.

Affordability (Affordability)

- Trend: Affordability Index is experiencing significant fluctuations, with decline in some years and recovery in other years.
- Explanation: Changes in accessibility energy is highly influenced by price energy and growth economy (GDP). In years where prices material global fuel, such as oil raw, increase, index accessibility tend down, showing that society and industry pay more expensive for energy. On the contrary, recovery economy and stability price energy help repair affordability. Decrease index accessibility in some year This may also be due to an increase subsidy energy that is not sufficient For to balance increase global prices.

Acceptability (Acceptable)

- Trend: Acceptability Index shows significant fluctuations, especially with improvement sharply in 2022 and 2023.
- Explanation : Acceptability values related to with CO_2 emissions and policies environment. Improvement sharp in 2022 and 2023 can interpreted as sign that Indonesia began reduce emission carbon, maybe Because improvement use energy renewable and reduction use coal as source energy. Policy For lower emission in The Paris Agreement framework is also starting show impact on index This Fluctuations in the years previously Possible show dependence on materials burn fossils, but improvement energy renewable has succeed reduce emissions and increase the Acceptability Index during the period end.

Energy Security Index (Index Total Energy Security)

- Trend: The total Energy Security Index shows trend improvement in a way gradually, with a number of fluctuation small.
- Explanation : Upward trend This show improvement resilience energy national, caused by:
  - Improvement infrastructure expanding energy access.
  - Stability in production energy domestic which ensures sufficient supply.

- Decrease CO_2 emissions in the years lastly, shows repair in reception environment to policy energy.
- Fluctuations in components accessibility especially caused by global influence on price energy, but in a way overall, improvement access and availability energy help increase security Indonesian energy.

Change in security energy Indonesian national from 2014 to 2023 is due to a combination from: Repair infrastructure expanding energy accessibility; Stability production energy domestic , although There is fluctuation price global energy; Increase commitment to energy clean and reduce CO_2 emissions, which result in improvement significant in Acceptability Index; Fluctuation accessibility energy related with global market prices and growth Indonesian economy; In general overall, trend the increase in the Energy Security Index reflects that Indonesia succeeded increase security energy, although challenge still there is, especially in guard accessibility energy for public wide.

Lack

For describe security energy national in a way quantitative, manufacturing Index Energy Security is indeed give description big from various aspect main like availability, accessibility, affordability, and can accepted from perspective environment. However, the index This own limitations that hinder better understanding deep about the real complexity. This is caused by several challenge main in measurement and aggregation more indicators specific.

Limitations Index in Seeing the Big Picture

Index security energy national give summary from various aspect important that influences security energy. However, the picture big This sometimes only touch surface from more problems in . With depend on measurable indicators in a way quantitative, index This Possible fail catch more context wide, such as :

- Regional variations in access energy.
- Dynamics geopolitics that influence resilience energy.
- Dependence on sources energy possible imports No fully reflected in index overall.

Indicator Necessary Additions Entered

In describing security comprehensive energy, there is a number of another true indicator need entered, but constrained by measurement different units and assignments value that must be equated . Some indicator the among others:

- Reliability supply energy in various regions, including quality network electricity and disturbances supply.
- Diversification source energy, which shows how much big dependence a country against material burn certain , such as coal , gas, or energy renewable.
- Efficiency energy, which includes consumption energy per capita or intensity energy in sector industry and home ladder.
- Strategic reserves energy, such as backup oil and gas for anticipate crisis.
- Resilience to risk change climate , which affects availability and access energy, especially in vulnerable areas to disaster nature.

Challenge in Measurement and Normalization

One of obstacle the biggest in enter indicators addition is difficulty in measure and provide consistent values . Some challenge This includes:

- Unit different measurements : For example, intensity energy measured in kWh per capita, while reliability network measured in frequency disturbances, and CO_2 emissions were measured in

tons. Every indicator This own different units, so that complicates the aggregation process to in One index.

- Different value weights : Not all indicator own same weight in its influence to security energy. For example, CO_2 emissions may more important in term long, but supply energy more important in term short. Determination the right weight For every indicator need deep and possible approach involving analysis expert from various field.

Need Study More Deep

For overcome limitations this, more research deep required with involving various expertise and additional data from various sector. Some aspects that need to be considered be noticed is :

- Collaboration multidisciplinary: More research comprehensive need collaboration between expert in the field energy, environment, economy and policy public. Every discipline knowledge can give a unique perspective in understand challenge security energy.
- More data usage area: Data collection from more sources broad, including regional, technological and climate data, can give a better picture accurate and detailed about risks and opportunities in sector energy.
- Further development of the model advanced: In addition to the index simple, necessary developed a predictive model that can integrate various scenario resilience energy and change global environment, including impact from change climate and development technology energy renewable.

Achieving a Clearer Picture Comprehensive

With expand coverage indicators and approaches multidisciplinary, research in the field of security energy can produce a better picture comprehensive and in-depth. The results No only will help in compilation policy more energy right, but also can identify vulnerability specific as possible No seen in analysis based on index single. This is will help government and manufacturers policy in develop mitigation strategies risk more energy effective and sustainable.

Although index security energy give description big about condition resilience energy national, research more depth and use various comprehensive indicators are essential For understand situation in a way more holistic. Research advanced must consider challenge measurement and normalization of data, as well as involving various field knowledge For produce more views integrated and detailed about problem security energy national.

CONCLUSION

This study successfully provides a general overview of Indonesia's national energy security using the Energy Security Index, which comprises four main components: Availability, Accessibility, Affordability, and Acceptability. The analysis from 2014 to 2023 indicates a gradual improvement in the Energy Security Index, reflecting enhanced resilience in Indonesia's energy sector. This improvement is largely driven by the stability of domestic energy production and expansion of energy infrastructure, which contribute to consistent availability and accessibility; increased use of renewable energy, positively impacting the Acceptability component through reduced carbon emissions; and fluctuations in energy accessibility influenced by global energy prices that have shown improvement alongside economic recovery. However, the study acknowledges limitations, particularly in the lack of more detailed indicators, challenges in standardizing measurement units, and determining appropriate weighting for each energy security component. For future research, it is recommended to develop more refined and comprehensive indicators, establish standardized measurement methodologies, and apply advanced weighting

techniques to enhance the accuracy and applicability of the Energy Security Index, thereby providing policymakers with more precise tools to monitor and improve national energy security.

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