Electric Vehicle Policy: The Main Pillar of Indonesia's Future Energy Security

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Abstract

Indonesia still has a high dependence on fossil energy. This can be seen through how the use of fossil energy still dominates the energy needs in Indonesia. Most of this fossil energy comes from oil sources. However, the increasing use of energy and the reduction in fossil energy reserves has made Indonesia need to use renewable energy. This needs to be done to achieve energy security in Indonesia. This research will be carried out to see how the conceptual framework and policies regarding energy security in transportation in Indonesia through electrical energy can support energy security in Indonesia. This research will be carried out using a literature study approach. According to the findings of this study, there are multiple concepts in energy security, including the availability of existing energy resources that can meet energy demand, existing support in facilities such as distribution, transportation, and production division that can meet energy consumption needs, and the minimal negative impact of energy production and consumption on human health and the surrounding environment.

Keywords: *Energy Security, Electrical Energy, National Defense, Policy.*

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A. INTRODUCTION

Indonesia is still heavily dependent on fossil fuels. In Indonesia, 95% of the country's energy demands are met by fossil fuels. Up to fifty percent of the fossil energy used in Indonesia is oil. The production and consumption of oil energy in Indonesia are increasingly unbalanced, with more consumption than production (Rahman et al., 2021). Oil consumption in Indonesia continued to increase between 2000 and 2018. Meanwhile, oil production continued to decline between 2000 and 2018. The imbalance of oil production and consumption, where oil is the primary source of Indonesia's energy, can threaten the availability of energy in Indonesia (Ajija et al., 2021).

Oil is one of the fossil fuels, namely energy that is not renewable and will run out in the next few years. It is feared that if no substantial new energy sources are discovered by 2046, Indonesia may have an energy deficit. This is confirmed by the absence of oil reserves in Indonesia (Litvinenko, 2020).

The depletion of Indonesia's oil reserves from year to year, while Indonesia's oil consumption continues to rise, results in significant imports to meet domestic oil demands (about 55% of the nation's total oil supply in 2015) (Yana et al., 2022).

With low fossil energy reserves, while energy use continues to increase, the use of new and renewable energy is a significant concern for the Indonesian government. This is a manifestation of the long-term management of the energy sector by carrying out integrated and sustainable planning related to energy resources that can ensure energy availability in the long term. This is a manifestation of efforts to carry out energy security. Energy security efforts can be carried out by making technical and economic-related policy steps in energy-related policies (Sharvini et al., 2018). This is as stated by Kotarumalos that the concept of energy security in Indonesia emerged due to fluctuations in oil prices and the dependence of the Indonesian people on oil as an energy source. Energy consumption highly dependent on oil can be a consideration for the government to use other energy sources to realize energy security in Indonesia (Siagian et al., 2022).

Article 5 of the Law of the Republic of Indonesia Number 30 of 2007 pertaining to Energy stipulates that the government is required to maintain energy buffer reserves to ensure national energy security. Article 1 of the Government Regulation of the Republic of Indonesia No. 79 of 2014 pertaining to the National Energy Policy states that energy security is the condition of ensuring the long-term availability of energy and the public's access to energy at affordable prices, while protecting the environment. Article 14 of the Government Regulation states that the government regulates and allocates strategic reserves to ensure long-term energy security (Widya Yudha & Tjahjono, 2019).

As a measure of energy security, the government has adopted a policy mandating the use of alternative energy sources for transportation, specifically electrical energy. A policy regarding converting fossil fuels to electricity is needed by looking at the reduced condition of fossil fuels. Following current conditions, the government issued Presidential Regulation (Perpres) No. 55/2019 concerning the Acceleration of the Battery Electric Vehicle (BEV) program. The manufacture of electric vehicles in Indonesia has been carried out since 2012 (Capurso et al., 2022). However, it is deemed not qualified to be used by participants of the Asia-Pacific Economic Cooperation (APEC) conference forum. The carmaker was considered to have committed a crime. It was named a suspect on suspicion of harming state finances which were then sentenced to 7 years in prison and a fine of IDR 200 million subsidiaries to 3 months in jail in March 2016 by the Corruption Court. However, the government is currently taking a policy to enforce the procurement of electric vehicles (Baker, 2020).

The policy of using electric-fueled cars in Indonesia can also cause new problems. It will not be a solution in realizing energy security if it is not accompanied by policies related to producing electrical energy sources. Also, cooperation with related parties, in this case, is PLN (Sunitiyoso et al., 2022). This is because Indonesia's primary electricity production source comes from fossil fuels. Coal's electricity

production reaches 61% of the total national electricity production. Nevertheless, PLN is committed to reducing fuel oil consumption for power plants and replacing it with new renewable fuels from biofuels (Oskarsson et al., 2021).

The advantage of electric-fueled vehicles in terms of energy availability, electric vehicles can use all types of energy that can be converted into electrical energy. Some of the most potential types of energy as power plants, such as nuclear, hydropower, geothermal and so on, can contribute to driving the wheels of the transportation system broadly so that they can be a solution to the scarcity of fuel oil (Weber et al., 2019). This is as stated in Government Regulation Number 79 of 2014 concerning National Energy Policy which stipulates that national energy sources are encouraged to be utilized in power generation, including renewable energy sources of the type of energy flow and waterfalls, geothermal energy, energy movement and differences sea layer temperature, wind energy, solar energy, biomass and waste; new energy sources in the form of solids and gases; and natural gas, coal. Utilization of potential local primary energy sources is prioritized for electric power, such as new and renewable energy, mine mouth coal, and wellhead gas (Rahman et al., 2022).

In this regard, this research is interested in studying the energy security policy based on electrical energy in the transportation sector to support national defence in Indonesia.

B. LITERATURE REVIEW

1. Policy Analysis

According to Winarno, the term policy is used widely, such as in Indonesia's foreign and Japanese economic policy, and it may also be used to mean something more specific, such as when we say government policies on debureaucratization and deregulation. Policy analysis involves studying public authorities' actions in society (Beeson, 2020). Policy analysis based on state theory is a means of explaining the true essence of public action because the policy is defined as revealing its nature. Policy analysis is further divided into different schools of thought which are classified by Mény & Thoenig based on three theoretical models, which are as follows:

a. The first model is part of a pluralist approach that views the state as a service actor that aims to respond to social demands. Public policy is understood as a response to social needs, and its analysis is placed on a perspective based on optimizing collective choices, the rationality of decision-making processes, and bureaucratic behavior (Gatto, 2020).
b. The second model is an interpretive model that emphasizes the state as an instrument that serves either social class (neo-Marxist approach) or specific groups (neomanagerial approach). Analysis of public action makes it possible to show the weakness of state autonomy concerning capitalist interests and related to private actors and organizations within it (Feola et al., 2021).
c. The third model emphasizes the distribution of power and interactions between and among actors, either through the representation and organization of interests based on different sectors or categories (the neo-corporate

approach) or through the organization and institutional rules that frame these interactions (the neo-institutionalist approach) (Ortega, 2019).

2. Energy Security

According to Bachtold, energy is the capacity of a system to perform labor. The International Energy Agency (IEA) defines energy security as the availability of inexpensive, uninterrupted energy sources. In addition, a country is considered to have energy security if its energy supply is sufficient to meet import requests for 90 days' worth of oil equivalent. Energy is crucial to the production of products and services, making energy security necessary (Hamed & Bressler, 2019). Any disturbance that impedes the availability of energy supply in the form of primary fuels (BBM, gas, and coal) and electricity can diminish a region's economic production, and if the severity of the disturbance reaches the national level, it can cause the national financial growth objective to be missed (Zamri et al., 2021).

In line with the IEA, Metcalf defines energy security as the ability of the household, corporate and government sectors to accommodate disruptions in the energy market. Energy security, according to Yergin, entails dependable and economical access to energy supply, diversification, integration into energy markets, and information dissemination. In the early 1970s, when Saudi Arabia ceased supplying crude oil to industrialized nations, energy security became a global concern (Axon & Darton, 2021). In that era, oil was the most vital energy source for Western European countries and the United States, while Saudi Arabia was a major exporter. The unilateral actions of Saudi Arabia have practically disrupted the economic activities of the oil importing countries; which at that time only depended on Saudi Arabia's oil. The international community then became aware of the importance of maintaining supply to not relying on one type of energy source and one energy producer (Norouzi, 2021).

Regarding risk management, energy security studies usually focus on operational risks of infrastructure reliability or energy supply facilities. Risk management for the entire operation is crucial so that energy supply cuts do not occur (Silvast & Virtanen, 2019). However, energy security also includes energy diversification efforts in reducing energy supply dependence on one fuel type. Diversification is also carried out to improve the energy mix by considering the potential reserves of energy sources owned (Solaymani, 2021).

The concept of energy security in a more complex definition stated by Muttitt is "Energy security would mean the security of everything: resources, production plants, transportation networks, distribution outlets and even consumption patterns; everywhere: oilfields, pipelines, power plants, gas stations, homes; against everything: resource depletion, global warming, terrorism, them and ourselves. At its maximum, this logic invests every single object of any kind with and in security. At least potentially, the result is a panoptic view of security that legitimates panoptic security policies" (Carus et al., 2020).

Energy security is defined as the resilience of all aspects of resources, production plants, transportation networks, distribution outlets, and consumption patterns. In addition, there are oil fields, pipelines, power plants, and gas stations everywhere, and they can also overcome resource depletion, global warming, and terrorism. Maximally, this logic invests every object in any form and a safe state (Hobbs, 2021). Article 1 of Government Regulation Number 79 of 2014 of the Republic of Indonesia on the National Energy Policy states that energy security is the condition of ensuring the availability of energy and the public's access to energy at affordable prices over the long term, while protecting the environment (Prananta & Kubiszewski, 2021).

Referring to the preceding definition of energy security, there are three concepts in energy security: the availability of energy resources that meet energy demand; the fulfillment of energy consumption needs with the support of various facilities and other supporting parties such as distribution, transportation, production, and others; and related to the minimal negative impact of energy production and consumption on the surrounding environment as well as the energy infrastructure (Llamosas & Sovacool, 2021). Therefore, in the case of policies related to the procurement of transportation equipment, especially in this case, electric cars are a manifestation of the application of energy security to maintain the availability of energy reserves and also reduce the negative impact of energy use on the environment (Kamyk et al., 2021).

According to Nugroho, energy security can be described or evaluated by methods that have 4A and 1S indicators, including:

a. Availability, related to the physical availability of energy,
b. Accessibility, related to the ease of obtaining energy or the affordability of energy services,
c. Affordability, related to the affordability of the price or the ability of the community to pay the cost of energy,
d. Acceptability, relates to the quality of energy used or the quality of energy that is acceptable and the way energy is provided to the community,
e. Sustainability, related to energy sustainability or the availability of energy sources (Surya et al., 2021).

C. METHOD

This document was prepared utilizing the technique of library research. A library search is conducted by gathering diverse reading references pertinent to the subject under investigation, followed by a rigorous and thorough comprehension to obtain research results. The author did a comprehensive literature review to support this study. A literature review is a literature review that uses library references to obtain resources pertinent to the research topic. These references can be found in books, journals, articles from research reports, and websites. This literature review yields a compilation of references pertinent to the formulation of the problem. The purpose of this research is to deepen the problem and theoretical foundation of the

conceptual framework of the electrical energy-based energy security policy in Indonesia in support of national defense.

D. RESULT AND DISCUSSION

1. Electrical Energy for Vehicles

In the 1990s, another surge of interest in electric vehicles occurred. Renault, Peugeot, and Citron in Europe, as well as General Motors in the United States, create tens of thousands of electric vehicles. The market did not develop, though. GM recalls all-electric vehicles and destroys them one by one. In 8 years, the price of lithium batteries fell by 80% while the energy specs of the batteries increased significantly. This condition makes the price of electric vehicles affordable in the market with mileage above 400 km and becomes a potential vehicle to be developed in the next few years.

There are several potential benefits of electric and hybrid propulsion vehicles driving technological advancements toward civilian and military applications. The advantages of electric and hybrid drive vehicles for military and civilian vehicles are presented in Table 1.

Table 1. Comparison of Advantages of Electric Vehicles

Military	Civil
Vehicle packaging flexibility	Fuel Saving (30-35% emission reduction)
Improved fuel economy (25 - 30%)	Improved Driveability
Onboard power station	Acceleration boost
Stealth Potential (Silent Movement)	Reduced maintenance costs
Acceleration boost	Emission reduction
Reduced maintenance costs	-
Idle time increase	-

Various studies report the benefits of using electric vehicles, including:

a. Environment

When discussing environmental impacts, it is essential to consider the entire vehicle life cycle. This makes it possible to look beyond the emissions from the vehicle itself to the environmental impact of batteries, electricity production, and so on. Burning fuel oil produces carbon dioxide (CO2), a greenhouse gas associated with climate change. Climate change damage from carbon emissions can reduce agricultural productivity, worsen human health, damage property due to increased flood risk, and change energy system costs, such as reduced costs for heating and increased costs for air conditioning (Ebi & Hess, 2020). Electric vehicles emit twice less carbon dioxide (CO2) in a full life cycle than diesel engines. If cars are driven on sustainable electricity, carbon dioxide emissions can be reduced more than ten times. From a wheel-driven perspective, electric vehicles produce four times less particulate matter and 20 times fewer nitrogen oxides (NOx) than conventional vehicles. The life cycle analysis model is used to compare all environmental impact factors in the form

of climate change and air quality and the difference between cars using gasoline, diesel, LPG, and natural gas. The overall environmental impact of a battery-electric vehicle can be up to five times less than that of conventional fuel (Wong et al., 2021).

b. Air Quality

Electricity as a transport system is set to generate an additional one million jobs in Europe by 2030 and double by 2050. These jobs relate to producing components for electric vehicles but are also linked to new services, such as charging infrastructure. Electricity will also reduce dependence on oil as an energy source. Oil imports cost the European economy one billion euros a day. The development of electric vehicles can increase employment, which impacts purchasing power when it is no longer dependent on oil as fuel (Van Mierlo, 2018). However, the loss of revenue from duties and taxes on diesel and gasoline will harm the government budget. However, the development of electric vehicles can improve air quality, which positively impacts the health budget, thereby reducing health care costs (Hensher et al., 2021).

c. Energy Needs

Malmgren states that the use of electric vehicles can save energy. Calculating energy needs measured using the NYSERDA Wattplan calculator gives the result that using electric energy-based vehicles can save energy. This is because the costs used to pay electricity bills as additional costs for electric vehicle energy are much lower than the costs for buying fuel oil for vehicles. The use of electrical energy for the transportation sector can create new problems related to energy use. Other energy sources are needed or need to invest more in energy storage. Electric vehicle batteries can be essential in energy storage (Muratori et al., 2019). If too much wind or the sun is a source of electrical energy, it can be stored in the car battery. When there is not sufficient electricity, return it to the grid. This is referred to as V2G or vehicle to network. V2G applications impact the battery life expectancy of electric vehicles. If the vehicle battery capacity decreases to 80%, we assume that the battery can no longer be used for a car. However, the storage capacity is still 80%, so it can be used for other applications, such as grid or microgrid support (Colmenar-Santos et al., 2019).

d. Vehicle maintenance

Electric vehicles have far fewer moving parts than conventional internal combustion engine vehicles. Batteries, motors and electronics associated with the drive circuit do not require regular maintenance. The oil change is worn out, and no other fluid can be replaced other than brake fluid (Liu et al., 2021). Brakes on electric vehicles require less maintenance than on conventional cars because wear on electric vehicle brakes is significantly reduced due to regenerative braking. Conventional vehicles require tire maintenance, oil changes (every 5,000 miles), automatic transmission fluid, spark plugs and

cables, exhaust, and brakes, while electric vehicles only require tire and brake maintenance (Yuan et al., 2020).

e. Human health

According to the U.S. Environmental Protection Agency/EPA, fine particulate pollution such as that found in vehicle exhaust emissions are:

1). Causes premature death (both short-term and long-term exposure);
2). Causes cardiovascular damage (e.g. heart attack, stroke, heart disease, congestive heart failure);
3). Most likely to cause respiratory distress (e.g. worsening asthma, worsening Chronic Obstructive Pulmonary Disease (COPD), inflammation);
4). Can cause cancer;
5). Can cause reproductive and developmental damage

In addition, fossil fuel emissions also cause autism spectrum disorder (ASD), and low birth weight in infants has been linked to fossil fuel emissions. Children are more vulnerable to the health effects of emissions because of their physiology, growth, and higher respiratory rates (Perera et al., 2019).

f. National defence

The impact of dependence on fuel oil on national security is related to the cost of imports, the cost of military operations required to secure these energy sources, and the costs incurred, but not taken into account in the price of gasoline, including the higher cost of oil produced by a country. Demand for world oil prices and OPEC market forces (demand), as well as costs incurred from the country's economic disruption from oil prices and supply volatility (macroeconomic disruption and adjustment costs) (Samaras et al., 2019). Other costs associated with foreign oil supplies include supply vulnerabilities, regional instability and military conflict due to dramatic wealth disparities resulting from oil distribution and control, and the lack of accountability, free market and democratic reforms in oil-rich governments. Electrical energy is one of the energy sources that can be used to drive vehicles. The energy consumption of electric vehicles varies and depends on several external factors, such as road topology, traffic, driving style, ambient temperature, etc. (Alfaqiri et al., 2019).

2. Energy Policy in Indonesia

Energy policy in Indonesia first appeared in 1976, which was intended to maximize the utilization of energy resources. The government then formed the National Energy Coordinating Agency (Bakoren), which the President led and consisted of ministers related to energy and was responsible for formulating energy policies as well as supervising and evaluating the implementation of energy policies. Bakoren, in 1984 for the first time, issued a General Policy on Energy (Kube). This policy is continuously updated following the socio-economic dynamics in energy development. Kube 1984 was updated in 1990 with a policy for the development of

the energy sector that refers to three approaches: intensification, diversification and energy conservation.

Bakoren issued a revised Kube in 1998, which aims to create a climate that supports the implementation of development strategies in the energy sector and provides certainty to economic actors concerning the procurement, supply and use of energy. The 1998 Kube began to indicate limited energy resources, especially oil. Kube 1998 includes five main policies and nine supporting policies. The main policies are:

a. Diversification is the diversification of energy use, both renewable and non-renewable. For fossil energy, it is possible to import as long as it is economically profitable and does not damage the environment.
b. Intensification is the search for energy sources through survey and exploration activities to increase new reserves, especially fossil energy. The search for energy resources is directed at areas that have not been surveyed and for areas where it is indicated that efforts are made to increase the status of reserves to be more certain.
c. Conservation is carried out from upstream to downstream.
d. The determination of the average energy price is gradually directed to follow the market mechanism.
e. Paying attention to environmental aspects in development in the energy sector, including prioritizing the use of clean energy.

After the economic crisis in 1998, many socio-political dynamics occurred, so many policies, laws, and regulations underwent changes. The following will discuss not only energy policies but also policies and regulations related to the energy sector and the environment.

Government policies and regulations related to energy based on the sequence can be explained as follows:

a. Law (UU)

   Laws that regulate energy management and its relationship to the environment include:

   1). Law no. 30/2007 on energy mandates the government to formulate a National Energy Policy (KEN) as a guideline in national energy management.
   2). Law no. 30/2009 on electricity mandates a change in the structure of the national electricity industry.

b. Government regulations

   The important PP in the energy sector is PP No. 79/2014 on National Energy Policy (KEN). Article 1 states that energy security is a condition of ensuring the availability of energy and public access to energy at affordable prices in the long term while considering the environment's protection. Article 14 of the Government Regulation states that the government regulates and allocates strategic reserves to ensure long-term energy security. This policy's issuance means Presidential Decree (Kepres) No. 5/2006 is no longer valid. The national

energy policy consists of the primary and supporting policies implemented from 2014 to 2050. Key policies include:

1). Availability of energy for national needs;
2). Priority for energy development;
3). Utilization of national energy resources;
4). National energy reserves.

Meanwhile, supporting policies include:

1). Energy conservation, conservation of energy resources, and energy diversification;
2). Environment and safety;
3). Energy prices, subsidies and incentives;
4). Infrastructure and public access to energy and the energy industry;
5). Research, development, and application of energy technology;
6). Institutional and funding.

The energy conservation and diversification policy in PP no. 79/2014 was previously issued in PP No. 70 of 2009 concerning energy conservation. Through this PP, incentives and disincentives for energy conservation are regulated, and energy users in the industrial sector, which are greater than or equal to 6,000 TOE per year, are required to implement energy conservation through energy management.

c. Presidential decree

Presidential regulations related to environmental aspects in energy utilization are contained in Presidential Regulation No. 61/2011 on the National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK). Policies related to other environmental aspects are Presidential Regulation No. 71/2011 on the implementation of the national GHG inventory. At the provincial level, this activity is called the Regional Action Plan for Reducing Greenhouse Gas Emissions (RAD-GRK). As a form of energy security, the government has made a policy to use other alternatives in transportation, namely by using electrical energy. The government issued Presidential Regulation (Perpres) No. 55/2019 concerning the Acceleration of the Battery Electric Vehicle (BEV) program.

d. Presidential decree

Presidential Decrees (Keppres) are individual and once completed. In the implementation of Law no. 10/1997, the government issued Presidential Decree No. 76/1998 concerning the Nuclear Energy Supervisory Agency (Bapeten). Bapeten supervises all activities of using nuclear energy in Indonesia through laws and regulations, permits, and inspections in accordance with the applicable laws and regulations.

e. Presidential Instruction

Presidential instructions cannot bind everyone, as with Presidential Decrees and Presidential Decrees. Presidential Instructions related to the use of new and renewable energy (EBT) include Presidential Instruction No. 1/2006 concerning the supply and utilization of biofuels (biofuels) as fuel and

Presidential Instruction No. 2/2006 concerning the supply and utilization of liquefied coal as another fuel. The Presidential Instruction on energy conservation is Presidential Instruction No. 13/2011 on energy and water saving.

f. Ministerial regulation
To implement Law no. 4/2009 concerning mineral and coal mining, the Minister of Energy and Mineral Resources No. 07/2012 obliges to increase the added value of minerals through mineral processing and refining activities. This regulation was later revised by the Minister of Energy and Mineral Resources No. 11/2012 and modified again by Minister of Energy and Mineral Resources No. 20/2013 on provisions limiting mineral content exports. In addition, the Minister of Trade Regulation No. 39/MDAG/PER/7/2014 concerning requirements for the export of coal and coal products.

g. Ministerial decree
The Ministerial Decree (Kepmen) related to energy management is about coal DMO. ESDM Ministerial Decree No. 2901.K/30/MEM/2013 stipulates the need and minimum percentage of coal sales for domestic purposes for 2014. Every year the policy on coal DMO continues to change according to the conditions of coal demand at that time.

3. Unraveling the Concept of National Defense in Indonesia

National defense, often known as national defense, refers to any measures made to safeguard the state's sovereignty, the territorial integrity of a country, and the safety of the nation against threats and disturbances to the government and state's integrity. National defense, often known as national defense, refers to any measures made to maintain the state's sovereignty, the territorial integrity of a country, and the nation's safety against threats and disruptions to the nation and state's integrity. The essence of national defense is that all defense efforts are universal, with their implementation based on citizens' awareness of their rights and responsibilities and faith in their own strength. The government carries out the national defense and prepares early with the national defense system.

National defense is the elimination of any adversary threats from abroad that threaten and imperil the nation and state's sovereignty, safety, and very survival. According to Law No. 3 of 2002 pertaining to National Defense, the state defense system is a universal defense system that involves all citizens, territories, and other national resources, is prepared early by the government, and is carried out in a total, integrated, directed, and continuous manner in order to defend state sovereignty, territorial integrity, and the safety of the entire nation against all threats.

The national defense also closely relates to one of the national needs. Where in the national needs of the energy sector are one of the essential things that must be considered. In the current condition, the right way to maintain national security is by converting fossil fuel energy into vehicles that use electrical energy. Based on the condition of fossil fuels that are starting to decrease in supply, converting vehicles

with fossil fuels to electric vehicles is a very appropriate idea or idea to maintain national security.

E. CONCLUSION

The author can conclude from the preceding description that there are three concepts in energy security: the availability of energy resources that meet energy demand; the fulfillment of energy consumption needs with the support of various facilities and other supporting parties, such as distribution, transportation, and production; and the minimal negative impact of energy production and consumption on the surrounding environment and human health. Therefore, policies such as Laws, Government Regulations, Presidential Regulations, Presidential Decrees, Presidential Instructions, Ministerial Regulations, and Ministerial Decrees related to energy security, especially in the transportation sector, manifest the application of the principle of energy security. Electrical energy-based energy security benefits various aspects such as the environment, air quality, vehicle maintenance, energy needs, human health, and national security. This form of energy security positively impacts national security and can support national defense.

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