

Evaluation of Biomass Energy Policy Implementation in Indonesia to National Defense Support

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Abstract

Biomass energy is recognized as having strategic potential in overcoming energy security challenges and its participation to reduce the impact of environmental problems. The research-purpose is to evaluate how implementing a biomass energy policy can support national defense and sustainability. Through the framework of the literature, this study describes the concept of biomass energy and examines its relation to national defense. Energy policy analysis and reversed with energy security in Indonesia are also obtained from the reflection of the literature. The results show that biomass energy can strengthen the security of a country's energy supply by diversifying energy sources and reducing dependence on imported fossil fuels. This will support the operational defense system in dealing with fluctuations in energy prices and supplies. The implementation of biomass energy also has the potential to increase national energy independence, reduce the risk of energy supply disruptions, and strengthen national resilience. Utilization of biomass energy also contributes to improving climate change and negative environmental impacts. With the right technology, reductions in greenhouse gas emissions can be achieved, supporting environmental sustainability goals and securing the future of national defense

Keywords: Biomass, Energy, Policy, Country, Defense

INTRODUCTION

National defense is an important part of its role in maintaining the stability and security of a nation. In the era of globalization and the complexity of security challenges, the sustainability of energy resources is a critical factor in maintaining a country's independence and defense. Indonesia, a country with abundant natural resource potential, is faced with complex challenges related to energy availability and environmental sustainability. At the same time, climate change and the global environmental crisis have made many countries try to reduce the use of fossil fuels which can increase global warming and environmental damage (Imelda & Adianti, 2023). Biomass energy has emerged as a promising alternative, especially in its role as an alternative to fossil fuels that is also low in emissions.

In Indonesia, implementing biomass energy policies has become a major focus in efforts to overcome energy and environmental challenges. However, a comprehensive evaluation of the implementation of this policy is still needed to understand the extent of its impact and effectiveness in supporting national defense. The involvement of biomass energy in the context of national defense involves aspects of energy sustainability, resource security, and the potential for positive impacts on the defense system as a whole (Kusumaningtyas, 2017). Therefore, this research will evaluate the implementation of biomass energy policy in Indonesia with the aim of analyzing the extent of its contribution in supporting national defense. By understanding the relationship between biomass energy policy and defense aspects, it is hoped that this research will be able to increase knowledge and be used as consideration in decision making to develop sustainable energy policies that have a positive impact on national defense.

RESEARCH METHODS

Descriptive and qualitative methods will be used in this research, namely the type of library research research, namely in the form of collecting information based on the results of literature reviews from several sources of scientific articles and previous research. Apart from that, there are several steps that need to be carried out in a literature review, namely using four phases; (a) designing the review, (b) conducting the review, (c) conducting the analysis, and (d) writing the review. Then this process was developed from various practical experiences which is a synthesis of several guidelines and standards recommended as a literature review. Detailed stages of the literature review method for this research can be explained as follows.

1) Designing the Review

The level of urgency must be identified at this stage, especially regarding the review that needs to be carried out. Thus, in this step, potential problems to be researched need to be identified with the latest facts and data. After the general problem has been obtained, the specific problem can be written as a reference for establishing the objectives and benefits of this research, and then determining the research method that will be used. In the literature review method, it is necessary to create a reliable and relevant strategy, namely by prioritizing factors such as search terms, namely by choosing the right phrases and words when searching for articles, journals, books etc. On the other hand, the suitability of the database also needs to be considered to obtain data that is appropriate to the research

2) Conduct a review

The next stage after writing down the aims, objectives, benefits of the research and the research methods that will be used, is to write a literature review according to a predetermined strategy and test it using search terms and specific criteria on a narrower sample before writing the main review.

3) Conduct Analysis

The stage after conducting a relevant literature review is the need to determine appropriate library sources so that they can be used for appropriate analysis. In determining the right source, comparisons between several sources need to be made in order to obtain reliable and quality data because the appropriate information will be used to obtain solutions. In presenting data, several pieces of information such as topic, type of research, author, year of publication, or results and findings can be used. This analysis stage must also adapt to the method chosen so that the method can accurately answer the objectives of the research.

4) Writing a Review

Writing the results of the review needs to pay attention to several factors, such as, the preparation of the article must be prepared comprehensively and in line with the research method and objectives as a whole and easy to explain again, originality of the research must be applied in writing the research results, namely by embedding quotations and research data sources, then research as well. needs to be reported accurately and clearly, as well as the need for clear benefits when synthesizing literature into findings so that development for further research can use the results of this research.

RESULT AND DISCUSSION

Implementation of biomass energy policy in Indonesia requires in-depth evaluation to understand the extent to which this policy has succeeded in achieving the stated goals. Analysis of established biomass energy policies can provide an overview of the impacts, obstacles and efforts that need to be made to increase the effectiveness of implementation. The following are several important points that need to be analyzed and discussed in this evaluation:

1) Policy Objectives of Biomass Energy

The biomass energy policy implemented in Indonesia has interrelated and significant objectives. One of the main goals is to reduce the country's dependence on fossil energy, such as petroleum and coal, by encouraging the use of biomass as a renewable energy source (Pramudiyanto & Suedy, 2020). Diversifying energy sources is becoming an increasingly important option considering challenges in supply and the changing global environment (Fitriliana et al, 2023). Apart from that, this policy also reflects concrete evidence of Indonesia's commitment to clean energy (ESDM, 2020). By utilizing biomass to produce energy, the country seeks to reduce the environmental impact of the energy sector. The potential of biomass to produce energy with lower emissions can be a significant contribution to maintaining environmental balance and reducing carbon footprints (KLHK, 2017).

Economic aspects are also an important consideration in this biomass energy policy (Nelly et al, 2023). Through the development of the biomass sector, it is hoped that it can encourage local economic growth. Utilization of biomass can create jobs in rural areas, strengthen the local economy, and provide income opportunities for local communities (Kasmaniar et al, 2023). Furthermore, this policy also shows efforts to ensure the sustainability of energy supplies in the future (Radhiana et al, 2023). Biomass is a resource that can be renewed with good management. By using it wisely, Indonesia can reduce the risks related to energy scarcity in the long term.

Biomass energy policy also provides opportunities to develop technology and innovation. Utilization of biomass as an energy source requires the development of efficient and environmentally friendly conversion technology (Hermawati, 2020). This can encourage the growth of the renewable energy technology industry, while increasing domestic technological capabilities. However, implementing this policy can be faced with a number of challenges, including the availability of appropriate technology, community participation, and financial support (Arsyad et al, 2023). Therefore, continuous evaluation is necessary to ensure that these goals are achieved effectively and sustainably.

2) Implementation Analysis

The implementation of the biomass energy policy established in Indonesia has several aspects that need to be analyzed. In many cases, such policies can demonstrate progress, but they may also face a number of obstacles.

First, awareness of the importance of renewable energy and its positive impact on the environment has increased among the community and stakeholders (Iistiawati, 2023). Active participation and support from various parties can facilitate smoother implementation. However, technological and infrastructure challenges may arise. Efficient and affordable biomass conversion technology into energy can be an obstacle, as well as a lack of necessary processing and distribution infrastructure (Hermawati, 2020). In addition, a clear and consistent regulatory framework, both at the central and regional levels, is an important factor. This alignment allows for easier investment and operationalization of biomass projects.

Financial aspects and incentives are also crucial. The success of implementation can be influenced by the availability of funding and supportive incentive schemes (BMTI PPPPTK Team, 2015). In addition, environmental and social impacts need to be considered. Waste management and land use impacts of biomass energy projects must be carefully evaluated (Fitriliana et al, 2023). The importance of monitoring and evaluation systems cannot be ignored. The ability to measure implementation success, identify obstacles, and take corrective action is a key factor in ensuring the effectiveness of this policy (Nelly et al, 2023). Although challenges and obstacles may arise in implementation, long-term success of biomass energy policies can be achieved through continued commitment, cross-sector support, and appropriate adaptation to changing conditions (Indonesia, 2019 & Bappeda Kaltim, 2014). Regular evaluation and the

ability to adapt are key elements in maintaining the momentum and effectiveness of biomass energy policy in Indonesia.

3) Biomass Energy Contribution

The contribution of biomass energy from the biomass energy policy that has been established in Indonesia has the potential to contribute significantly to various important aspects (Amirta et al, 2016). One of the expected impacts is diversification of energy sources, where the development of biomass energy can reduce dependence on unsustainable energy such as coal and petroleum (Fitriliana et al, 2023). Apart from that, the use of biomass energy can also help reduce the production of greenhouse gas emissions caused by fossil energy, support Indonesia's efforts to fulfill its emission reduction commitments, and maintain global environmental sustainability (Pramudiyanto & Suedy, 2020 and Amirta et al, 2016).

Socio-economic contributions can also be seen from biomass energy policies. Through the use of biomass as an energy source, job opportunities can be created in the agricultural, waste processing and renewable energy technology sectors (Nelly et al, 2023, Fitriliana et al, 2023, & Amirta et al, 2016). This has the potential to strengthen local economies, especially in rural areas, and provide social benefits in the form of income and improving people's living standards (Amirta et al, 2016). In addition, the implementation of biomass energy policies can play an important role in achieving energy sustainability goals. By using renewable biomass resources, Indonesia can reduce the risk of energy scarcity in the future and maintain a sustainable energy supply (Bappeda Kaltim, 2014). The development of biomass-to-energy conversion technology can also encourage innovation in the energy and technology sectors, creating new opportunities in the development of local industry.

However, there are also challenges that need to be overcome in implementing this policy. Efficient biomass conversion technology, supporting infrastructure, and a supportive regulatory framework are needed to ensure success (Nelly et al, 2023). In addition, consistent monitoring and evaluation is important in understanding the extent to which biomass energy contributions are achieved and how to overcome obstacles that may arise in the implementation journey. By recognizing these challenges and working to overcome them, the positive contribution of biomass energy policy can be further realized in supporting energy, environmental and economic sustainability in Indonesia.

4) Environmental Impact

The environmental impacts of biomass energy policies that have been established in Indonesia contain complexities that need to be disentangled carefully. The use of biomass for energy has the potential to have both good and bad impacts on the environment (Pramudiyanto & Suedy, 2020 and Amirta et al, 2016). The good impact of using energy from biomass is reducing greenhouse gas emissions, which can help reduce the contribution to global climate change (Amirta et al, 2016). However, these results are highly dependent on the efficiency of biomass resource conversion and management technologies. Poor management can result in higher emissions than expected, as well as result in air pollution.

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Nevertheless, biomass production also requires land, and this can have an impact on changes in land use and land degradation (Kusumoarto et al, 2017). These impacts must be carefully assessed to minimize threats to environmental sustainability and biodiversity. Waste management is a key factor in the environmental impact of biomass energy (Kasmaniar et al, 2023 & Fatriasari, 2022). Waste from the biomass production and conversion process can potentially pollute water and soil if there is a mismatch in management (Edwin et al, 2023). Therefore, careful management of waste needs to be integrated into policy. In addition, biomass

utilization must consider its impact on biodiversity. Biomass extraction from certain ecosystems can threaten species and ecosystems. Policies should promote sustainable governance and maintain environmental balance.

It is also important to consider the impact on water and wastewater quality. Biomass conversion processes, such as biogas production, require the use of water and can produce waste that can affect water quality (Hidayati et al, 2021). Correct water and waste management is necessary to avoid pollution. Overall, environmental impact analysis of biomass energy policies requires a holistic approach. Understanding the positive and negative impacts of various aspects such as emissions, land use, waste and biodiversity is the key to optimizing the environmental benefits of utilizing biomass energy (Fitriliana et al, 2023). In this context, continuous monitoring, improvement and continuous adaptation in policies can help maintain a balance between energy interests and environmental protection.

5) Social and Economic Impact

The biomass energy policy that has been implemented in Indonesia has social and economic impacts with important and complex dimensions (Amirta et al, 2016 & Fitriliana et al, 2023). Utilization of biomass as an energy source has the potential to have a positive impact on both of these aspects. From an economic perspective, the development of biomass energy can stimulate the growth of related economic sectors, such as agriculture and the renewable energy technology industry (PLN, 2023). By creating new jobs and business opportunities, especially in rural areas, this policy can provide more equitable economic benefits and reduce the gap between urban and rural areas (Amirta et al, 2016 & Kasmaniar et al, 2023).

The social impact can also be significant. Increasing economic activity in rural areas through the use of biomass can improve people's living standards and help reduce poverty (Fidyahsari, 2022). In addition, reducing organic waste through use as an energy source can contribute to improving the quality of the local environment, which in turn has a positive impact on community welfare.

However, in observing social and economic impacts, there are several aspects that also need to be considered. Utilization of biomass resources must be balanced so as not to disrupt food security and natural ecosystems. Apart from that, the distribution of economic benefits and community participation in decision making must also be considered so that there are no gaps in the distribution of benefits (Bappeda Kaltim, 2014). Conflicts with other land uses, such as food agriculture or nature conservation, also need to be anticipated. Ensuring that land use for biomass energy does not come at the expense of other important objectives is a complex task. In managing these social and economic impacts, community participation in planning and implementing policies is very important (Fidyahsari, 2022). Regular evaluation and adaptation of policies according to real conditions will help ensure that positive impacts are enhanced and negative impacts are well managed.

6) Obstacles and Challenges

The biomass energy policy that has been implemented in Indonesia faces a number of obstacles and challenges that can affect its smooth implementation. One of the main challenges is the technological and infrastructure aspect (Nelly et al, 2023). Developing efficient technology and adequate infrastructure for the conversion of biomass to energy can be complex and require large investments. Apart from that, the availability of consistent and quality biomass can also be an obstacle, especially with competition for land use for other purposes such as food agriculture.

A consistent regulatory framework and coordination between central and regional levels are important factors in the success of biomass energy policies. Incompatibility or confusion in regulations can hinder investment and development of biomass energy projects (Fitriliana et al, 2023). Funding and incentives also need to be considered. Limited funding and financial support can hinder the development of biomass energy projects that require large capital.

Community and stakeholder involvement in planning and implementing biomass energy policies can also be an obstacle. Public acceptance of technology and the environmental impacts of biomass use play an important role in the success of this policy (EBTKE, 2022). In addition, the environmental and social impacts of this policy, such as changes in land use and impacts on local communities, need to be managed carefully so that negative impacts are minimal (Radhiana et al, 2023).

It is also important to choose the conversion technology that best suits the type of biomass available and the desired energy needs (Parinduri & Parinduri, 2020). Not every technology is suitable for all types of biomass, so appropriate selection must be considered. Education and awareness campaigns also need to be stepped up to ensure better understanding of the potential and benefits of biomass energy.

In facing all these challenges, cooperation between the government, private and community sectors is important. Regular evaluation and the ability to adapt to change will be key in overcoming obstacles and moving biomass energy policy towards set goals.

7) Biomass Energy Policy in Support National Defense

The biomass energy policy that has been implemented in Indonesia has the potential to support aspects of national defense. Although not immediately obvious, there are several ways in which this policy could make an important contribution to national defense.

In terms of diversifying energy sources, developing biomass energy can reduce dependence on imported fossil fuels (Nugroho, 2014). This can help improve energy security and secure energy supplies in emergency situations. In addition, with energy sustainability, the use of local biomass resources can help maintain the long-term availability of energy resources and avoid vulnerabilities due to scarcity (Fitriliana et al, 2023).

Economic development through biomass energy can make a significant contribution to the country's stability. The growth of related sectors, such as agriculture and the renewable energy industry, can support overall economic growth. In addition, energy independence is also related to a society that is more energy independent (Fitriliana et al, 2023). This can help reduce vulnerability to external disturbances and conflict.

Another aspect is social stability. Biomass energy policies can create new jobs and opportunities in various sectors, which in turn can help reduce unemployment and social vulnerability (Amirta et al, 2016). This social stability directly impacts overall national stability.

Overall, although not directly related to conventional defense, biomass energy policies can have an important impact in terms of energy, economic and social security. Good integration between sustainable energy strategies and security and defense considerations will help Indonesia achieve its broader sustainability goals.

8) Integration with Other Policies

The biomass energy policy that has been implemented in Indonesia has had a widespread impact on various other policy sectors, and the importance of good integration between biomass energy policy and other policies has become clear. This integration has the potential to achieve more comprehensive and sustainable goals.

In the context of environmental policy and climate change, the integration of biomass energy policies can support government efforts to reduce carbon emissions (Fitriliana et al, 2023). Managing biomass energy sources in a sustainable and efficient manner is able to minimize negative impacts on the environment and answer the challenges of climate change.

In relation to the agricultural and forestry sectors, integration with agricultural policies can ensure that land use for biomass production does not compete with food production. Integration with forestry policies is also important to ensure that the biomass used comes from sustainably managed resources.

Integration between biomass energy policies and other renewable energy policies can form a more diverse and stable energy system. This can help overcome energy supply challenges and promote overall energy sustainability (Lasaksi et al, 2023).

In the food and food security sector, integration of biomass energy policies needs to consider efficient and sustainable land use (Rhofita, 2022). Ensuring that biomass production does not compromise food security is key. In the industrial and economic fields, the integration of biomass energy policies can stimulate the growth of related industrial sectors, such as renewable energy technology and waste processing (Kasmaniar et al. 2023 & Fitriliana et al., 2023). This can create new economic opportunities and contribute to sustainable economic growth.

Social policy and community participation also need to be integrated. Ensuring active community participation in biomass energy policy planning and implementation can build stronger support and minimize the potential for conflict. The importance of coherent and sustainable integration between biomass energy policies and other policies will help achieve greater synergy in achieving sustainable goals. Continuous evaluation, inter-sector communication, and policy adjustments will be key in ensuring that this integration can be of value to the environment and society.

9) Recommendations and Improvements

In optimizing the biomass energy policy that has been implemented in Indonesia, there are several recommendations and improvements that can be considered. First, further refinement and harmonization of regulations and policies related to biomass energy is necessary, in order to provide legal clarity and reduce investment barriers. The development of more efficient biomass-to-energy conversion technologies must also be encouraged through investment in research and development.

Strengthening of supporting infrastructure, including waste processing facilities and biomass production installations, needs to be improved to ensure smooth production and distribution processes. Furthermore, market development and financial schemes that support biomass energy projects can open up greater investment opportunities with tax incentives or more affordable financing.

Public education and awareness about the benefits and challenges of biomass energy must also be a focus. Educational programs and awareness campaigns can help build community support and avoid potential conflict. Strong collaboration between government, industry, civil society and academia needs to be enhanced to overcome cross-sector challenges.

Regular monitoring and evaluation of policy implementation will help identify necessary changes and evaluate the real impact on established goals. Finally, diversification of biomass sources also needs to be considered to reduce the risk of dependence on one type of resource and maintain balance in land use.

By adopting these recommendations and making improvements, biomass energy policy in Indonesia can increase efficiency, sustainability and positive impacts. Continuing to review and adjust according to environmental and technological developments will be key to ensuring the long-term success of this policy.

CONCLUSION

The biomass energy policy that has been established in Indonesia has great potential to overcome the challenges of energy security, climate change and sustainable development. In its implementation, identifying the main objectives of the policy, comprehensive evaluation of its contribution, and resolving obstacles are key. Integration with other policies, such as

environmental, agricultural and economic, can strengthen broader positive impacts. Apart from that, this policy also has relevance to national defense, with the potential to reduce dependence on imported energy and support resource sustainability. With continued commitment, cross-sector collaboration, and continuous evaluation, biomass energy policy can contribute significantly to sustainable development goals and overall national security.

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