

## Evaluation of Biomass Development Policies and Strategies for Sustainable Energy

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### ABSTRACT

Fossil energy is a threat to Indonesia. The national primary energy mix is dominated by coal, while many foreign investors are aiming for Indonesia's biomass to be used as a power plant. It would be ironic if foreigners controlled it. Policies and regulations in the energy sector are needed for managing and utilizing existing resources. Using descriptive qualitative research methods aims to understand the phenomena experienced by the research subjects. Implementing policies and strategies for developing biomass for sustainable energy is also related to purchasing renewable energy, developing small-scale Biomass Powerplant management in the frontier, outermost and underdeveloped areas, utilization of wastes, municipal waste, and Co-firing systems in existing Coal Powerplant. Policy adjustments are urgently needed regarding using biomass to accelerate the renewable energy mix along the issues to maintain sustainability.

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## INTRODUCTION

Energy is a very important issue in various parts of the world, a phenomenon that occurs in many countries is an increase in energy demand which is inversely proportional to the amount of energy reserves. The Indonesian government must quickly take policies and prioritize development on Renewable Energy. In addition, Indonesia has several national strategic issues, where Indonesia has a commitment to the United Nations Framework Convention On Climate Change (UNFCCC) and COP21 or often called the Paris Agreement. This commitment took place during the reign of President Joko Widodo until at COP26, Indonesia has renewed its nationally determined contribution, namely reducing greenhouse gas (GHG) emissions by 29% by 2030.

The Electricity Supply Business Plan (RUPTL) 2019-2028 is also a strategic issue based on the National Energy Policy (KEN), Indonesia targets to have a Renewable Energy mix of 23% by 2025. Indonesia's renewable energy potential reaches 443,208 MW, but the utilization is still low at 1.9% or equivalent to 8215.5 MW. (EBTKE, 2021). Fossil energy is also a serious threat to Indonesia. The consequences arising from the continuous use of fossil energy are the depletion of petroleum reserves, an increase and instability in prices due to a higher rate of energy demand and greenhouse gas emissions arising from burning fossil fuels (Lubis, 2007). In dealing with these strategic issues, a policy to accelerate the energy transition is a must for Indonesia.

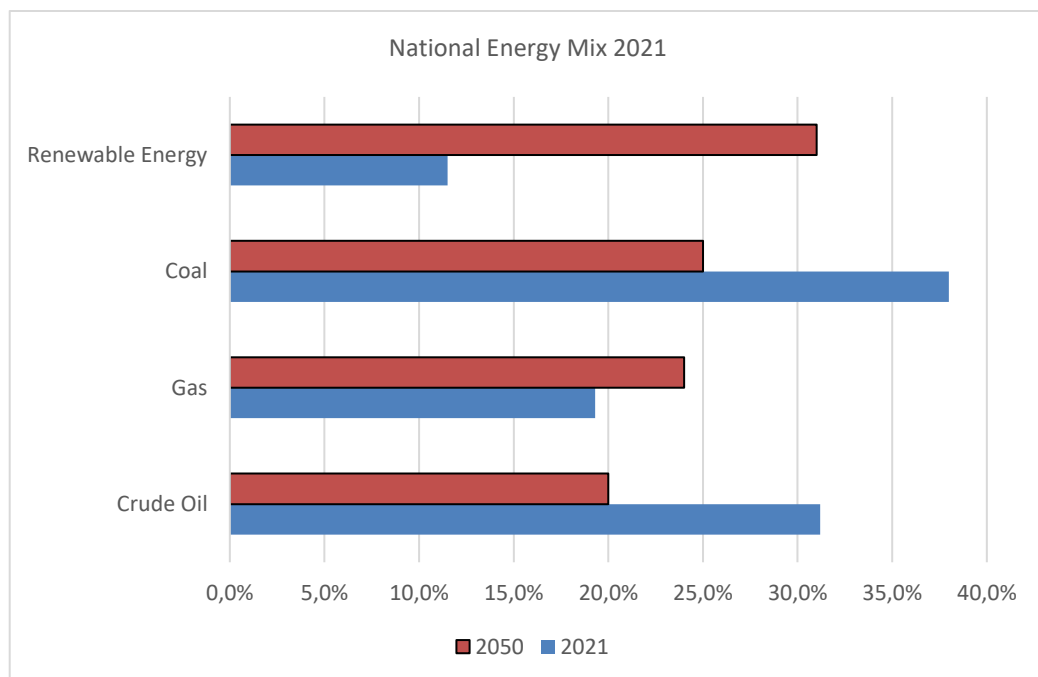


Figure 1. National Energy Mix

The report above shows the portion of the national energy mix in 2021, the share of oil in the national primary energy mix is around 31.2% and 19.3% of natural gas. Meanwhile, 38% of the national primary energy mix is still dominated by coal and only 11.5% for Renewable Energy. The projection that Indonesia wants to achieve in 2050 is that natural gas will increase to 24%, oil will

decrease to 20%, coal is also projected to decrease to 25% in 2050. Meanwhile, NRE is projected to increase to 31%. Indonesia still needs very concrete and planned efforts to achieve the New Renewable Energy Mix target of 23% in 2025 (ESDM, 2021).

Biomass is one type of NRE that can accelerate the national energy transition. This energy has a strategic role for Indonesia. Where, the territory of Indonesia itself is very wide and consists of thousands of islands scattered in various regions with geographical conditions that produce many biological resources from nature. Indonesia has many areas that do not have adequate fossil fuel reserves or are not even covered by electrification. Biomass has a very strategic role in providing energy in the region, because biomass biological resources are available in almost all parts of Indonesia. The following is the potential of Indonesia's biomass for power generation.

Table 1. The Potential of Indonesia's Biomass

No	Potency	Sumatera	Kalimantan	Jamali	Nusa Tenggara	Sulawesi	Maluku	Papua	Total (MWe)
1	Palm Oil	8,812	3,384	60	-	323	-	75	12,654
2	Cane	399	-	854	-	42	-	-	1,295
3	Rubber	1,918	862	-	-	-	-	-	2,781
4	Coconut	53	10	37	7	38	19	14	177
5	Rice Husk	2,255	642	5,353	405	1,111	22	20	9,808
6	Corn	408	30	954	85	251	4	1	1,733
7	Cassava	110	7	120	18	12	2	1	271
8	Wood	1,212	44	14	19	21	4	21	1,335
9	Livestock Waste	96	16	296	53	65	5	4	535
10	City Trush	326	66	1,527	48	74	11	14	2,066
<b>Total (MWe)</b>		<b>15,588</b>	<b>5,062</b>	<b>9,215</b>	<b>636</b>	<b>1,937</b>	<b>67</b>	<b>151</b>	<b>32,654</b>

As a major energy source prospect, biomass has the potential to drive Indonesia's economic growth. In 2021, the installed capacity of bioenergy in Indonesia is 1,889.8 MW, with an on-grid capacity of 206.02 MW and an off-grid capacity of 1,683.78 MW, including rice husks, coconut, palm oil, rubber, sugar cane, corn, wood, cassava, livestock waste. Currently, the total power plant in all regions in Indonesia is 31.65 MW (ESDM, 2020). The following is a projection of the low use of Biomass in Indonesia.

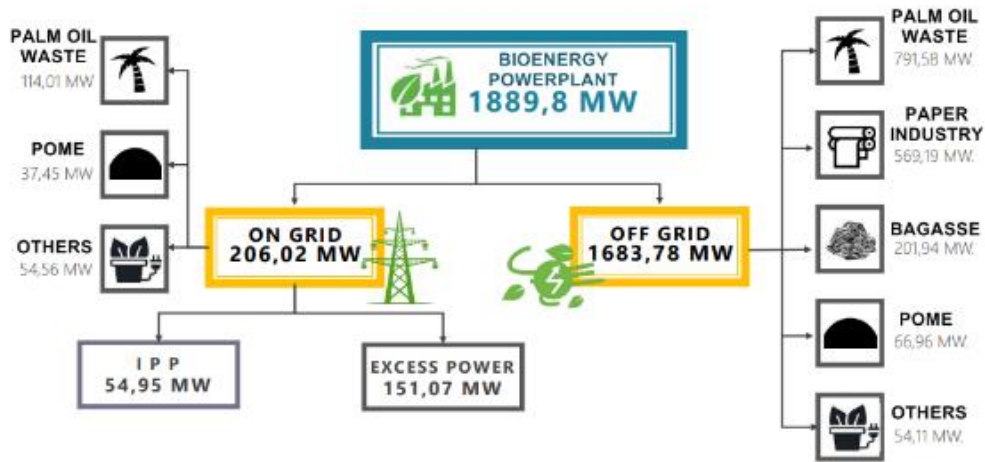


Figure 2. The Projection of the Low Use of Biomass in Indonesia

Many foreign investors are aiming for Indonesia's biomass to be used as a power plant. This requires Indonesia to immediately implement policies that can protect Indonesia's energy resources. It would be ironic if the use of biomass was controlled by foreigners. Effective policies in the energy sector for the management and utilization of biomass as a huge potential to become an energy source that is utilized by the wider community (Haryana, 2015). Government policies and strategies for the management and utilization of biomass have been implemented but are still low compared to other energies, so that many of these programs still have problems in terms of policies, funds, costs and other aspects that need to be evaluated.

This study aims to identify and analyze the problems of implementing policy evaluations on biomass energy sources so that they become optimal policy recommendations. In accordance with the policy direction towards the optimum national energy mix as stated in the General National Energy Plan. There is no clear policy support and the main problems to be faced are competition, land allocation and the use of biomass products for energy, food and animal feed purposes. So we need an optimal policy to overcome these problems.

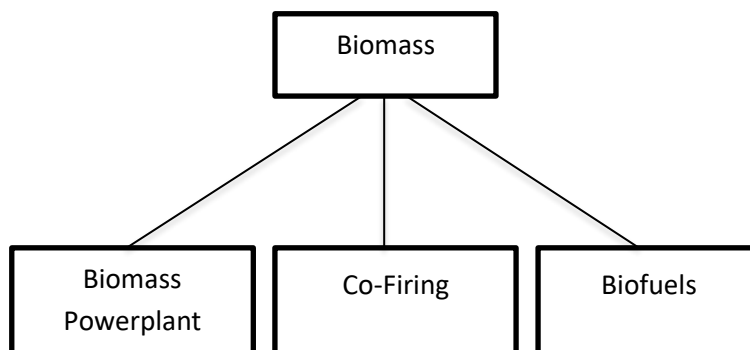


Figure 3. Acceleration of Biomass Utilization

## THEORETICAL REVIEW

### *Biomass Co-Firing*

Cofiring is a process of adding biomass as a partial replacement fuel into a coal boiler without making significant modifications (Surjosatyo, 2018). The purpose of cofiring is to reduce the use of non-renewable fossil energy. Although biomass is a potential energy source, its behavior is much different from that of coal. Therefore, it is important to understand the behavior of coal and biomass and their effect on combustion efficiency (Idris, et. al, 2012). Cofiring is a near-term, low-cost option for efficiently converting biomass to electricity by adding biomass as a partial substitute fuel in high-efficiency coal boilers. It has been demonstrated, tested and proven in all boiler types commonly used by electric utilities. There is little or no loss in total boiler efficiency after adjusting the combustion output for the new fuel mixture (DOE, 2000).

### *Policy Evaluation*

Policy evaluation is an activity involving estimation or policy assessment that includes substance, implementation and impact (Anderson: 1975). Policy evaluation is carried out at the final stage and for the entire policy process. W. Dunn explained, the term evaluation has a related meaning, each of which refers to applying several value scales to the results of policies and programs. Evaluation includes conclusions, clarifications, criticisms, adjustments and reformulation of the problem.

### *Energy Policy*

The national energy policy is an Energy Management policy based on justice, sustainability, and environmental insight to create National Energy Independence and Energy Security. The National Energy Policy aims to direct efforts in realizing domestic energy supply security and domestic energy supply security (BPHN). National Energy issued through the Decree of the Minister of Energy and Mineral Resources Number 0983 K/16/MEM/2004 Policy has been followed up by compiling the National Energy Management Blueprint (BP-PEN) 2005 - 2025. And the policies set forth Presidential Decree Number 5 of 2006 concerning National Energy Policy (ESDM, 2006).

### *Energy Security*

According to the World Energy Council (WEC) & Asia Pacific Energy Research Center (APEREC), the existence of five things that are generally indicators of energy security, namely: Availability, namely the availability of energy in sufficient quantities for the sustainability of economic activities, whether obtained from local resources or other countries; Accessibility, namely the aspect of energy affordability for people in need from a spatial perspective; Affordability, namely the aspect of energy affordability for consumers in terms of economic level and people's purchasing power; Acceptance, acceptance of all elements of the nation towards the exploitation and utilization of certain types of energy resources, especially those related to social aspects; and Sustainability, the continuous availability of energy (Tuvail, 2018). Sustainable energy is the

ultimate energy offering that meets the needs of the present without compromising the ability of future generations to meet their needs.

## **METHODOLOGY**

This research use a descriptive research method with a qualitative approach. A qualitative study is a literature study using books and literature as a reference. Qualitative research is research that aims to understand the phenomena experienced by research subjects. This research, by collecting concepts, information, responses and descriptions in the form of descriptive (Moleong, 2007). The subject of this research is the New and Renewable Energy Policy Implementer. The object of this research is the implementation of policies and strategies for developing biomass for sustainable energy.

## **RESULTS AND DISCUSSIONS**

Biomass management and utilization is focused on 3 things, namely Biomass Power Generation, Co-Firing Implementation in existing of Coal Powerplant and the use of biomass for biofuel. The Ministry of Energy and Mineral Resources outlines Indonesia's strategic plan in accelerating development of biomass energy as a sustainable energy source, including, revision of regulations regarding the Purchase of Electricity in Renewable Energy. Encouraging capacity building for Biomass Power Plants based on the commitment of the Biomass Powerplant managers in accordance with the Electricity Supply Business Plan. Implementing the Co-firing system on the existing Coal Powerplants, it is hoped that the participation of State Electricity Company and also the private sector to contribute to the implementation of co-firing, with a composition of 1-5%. Co-Firing is expected to be able to optimize the utilization of biomass. The cofiring program at Coal Powerplant can continue to be developed by taking into account the economic aspect. In addition, in the implementation of its management, the State Electricity Company parent unit can cooperate with their Research and Development Center in this co-firing program.

Development of small-scale Biomass Powerplant management in the frontier, outermost and underdeveloped areas which is balanced with the development of forests with energy plants and optimal use of lands for biomass with collaboration between the Ministry of Environment and Forestry of the Republic of Indonesia or local government and communities around the area to maintain its sustainability. Utilization of wastes in the field of industrial meter and waste for biomass pellets, as well as a program for replanting oil palm plantations. The government's program for the Energy Saving Healthy Stoves, the result of collaboration with the World Bank "clean stove initiative" has problems in terms of policies, prices, incentives, until the market is not clear. With the adjustment of policies, prices and other matters, it is hoped that stoves can be implemented in tandem with the goal of stoves, namely diversifying renewable energy to support daily needs in the household sector, management and utilization of biomass is expected to meet long-term energy needs and be able to reduce LPG subsidies.

It is hoped that the implementation and direction of policies from the Ministry of Energy and Mineral Resources can be carried out soon, with various programs, and the times are growing. Innovation and periodic evaluation are needed to support the smooth management and utilization of biomass. The implementations of Biomass as the urgency of the national energy transition:

- Optimization of biomass for domestic purposes.
- Research development and crop productivity for biomass.
- Contributions of experts and academics for innovation and technological development in biomass.
- Biomass management according to local potential.
- Utilization of marginal and degraded land for the development of energy crops.

While the implementation of biodiesel. Things that need to be highlighted are sufficient production capacity, tests, fuel with appropriate specifications, Standard Operating Procedures and Technical Guidelines for Handling and Storage of biodiesel, monitoring of quality and quantity, and the most important thing is funds. Massive socialization is also needed on the importance of using biodiesel to overcome the uneven distribution of biodiesel. In addition, the quality of human resources in handling and storing also needs to be improved, as well as the fulfillment of facilities and amenities. Meanwhile, policies on the development of Biofuels; regulated in Presidential Instruction No. 1 of 2006 the development of biofuels and a roadmap for the development, utilization of biofuels (biodiesel and bioethanol). There is a clear market and minimum rules for the use of biodiesel as a fuel mixture until 2020 and 2025 (Government Regulation of The Ministry of Energy and Mineral Resources Numb. 32 of 2008, adjusted for Government Regulation of The Ministry of Energy and Mineral Resources Numb. 25 of 2013 and Government Regulation of The Ministry of Energy and Mineral Resources Numb. 20 of 2014). Fiscal policy is also highly expected, as well as clear financing.

Biomass Development Strategy for sustainable energy from regulatory substance Board of Director State Electricity Company 01/2020: (Cahyo, 2021)

- Preparation of the mechanism for cofiring of Coal PLTU
- Procurement of Biomass Fuel
- Determination of the highest benchmark price for Biomass Fuel for cofiring
- Calculation of electrical energy production at PLTU that carries out cofiring
- Measurement of the quality and quantity of biomass fuel
- Cofiring implementation development
- Carrying out Monitoring and Evaluation

Meanwhile, the challenges that producers, State Electricity Company or generators need to be aware of as well as policy makers or regulators are:

- Sustainability Feed Stock
- Changes in the price of biomass, because until now there has been no clear price explanation for Co-Firing in particular.
- Durability Test on Generator

- Biomass Co-Firing Ratio Optimization and Scanning Technology
- Meanwhile, from the Regulator's side, the acceleration of the draft PERMEN implementation of Co-Firing, Incentives and Biomass Specification Standards.
- In biofuels, there is a need for bioenergy diversification with various types of plants, as well as the need for political and policy incentives to achieve this. (Lusia, 2022)

Sustainability strategies need to be empowered and monitored and evaluated for entities involved in sustainability efforts, including State Electricity Company, Indonesia Power Company and Pembangkit Jawa Bali Company, State Gas Company, Central Government, Local Governments, Private Electricity Entrepreneurs, MSME Entrepreneurs, Private Entrepreneurs or Investors (domestic and foreign), and other entities (Sutijastoto, 2020).

## **CONCLUSIONS**

Indonesia's new renewable energy mix target is expected to reach 23% by 2025. To achieve this, it is necessary to encourage the acceleration of the energy transition, one of the biological resources used as fuel is biomass. However, the utilization of biomass has not been considered optimal, or it is still quite low. Meanwhile, Indonesia's potential is so great, that it is necessary to encourage implementation and policies to encourage this acceleration. Biomass itself is managed in three products, namely Biomass Powerplant, Co-Firing on existing Coal Powerplant and the use of biomass as biofuel (liquid biomass). These three products are still experiencing many obstacles in terms of regulations, prices, incentives and other things. This research encourages a strategy or policy in encouraging efforts to accelerate the energy transition towards Net Zero Emission 2060. Among the strategies are optimal management of energy reserves, pricing according to policy, technology development to regulation, implementation, monitoring and evaluation.

## **RECOMMENDATIONS**

Sustainability strategies with related entities must balance each other, updating all forms of policy within a certain time to suit the state of energy resources

- Biomass must be utilized optimally, because the great potential cannot be taken for granted.
- So that there are many studies that examine the management of biomass and plant materials by creating more advanced technology.

## **FURTHER STUDY**

Where, the territory of Indonesia itself is very wide and consists of thousands of islands scattered in various regions with geographical conditions that produce many biological resources from nature. Indonesia has many areas that do not have adequate fossil fuel reserves or are not even covered by electrification. Biomass has a very strategic role in providing energy in the region,

because biomass biological resources are available in almost all parts of Indonesia.

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