



Trilemma of Stakeholders in Waste-Based Renewable Energy Management in Indonesia

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Abstract— The aim of this research is examining the ideal stakeholders in managing renewable energy in Indonesia. normative legal with a conceptual and statutory approach was used as research method. Primary legal material includes statutory regulations which are complemented by secondary legal material related to theoretical studies regarding common pool resources and collaborative governance. The analysis technique uses grammatical and systematic interpretation and uses a deductive method with syllogism. The major premise in this research is related to common pool resources and collaborative governance and the minor premise is related to the stakeholder trilemma in waste-based renewable energy management in Indonesia. The finding in this research shows that there is a trilemma of stakeholders (Central Government, Regional Government, and Community) in the management of waste-based renewable energy which is not in accordance with the common pool resources theory which explains that resource management should be managed by various institutions, in this case there is an involvement from the community. The conclusion of this research is cooperation between various parties in developing renewable energy is needed, which means that it cannot be done by just one party alone in developing renewable energy in Indonesia.

Keywords- *Common Pool Resources; Renewable Energy; Waste; Community; Central and Regulatory Government.*

I. INTRODUCTION

Nowadays, the world is faced with the depletion of fossil fuels, such as the remaining petroleum supplies only lasting for 61 (sixty one) years, coal for 28 (twenty eight) years, and natural gas for 50 (fifty) years [1]. One of the causes of the depletion of fossil energy is the increase in the world's population, which currently stands at 8 billion people as of November 15 2022 [2] where the greater the population, the more energy consumption is needed, such as China which has consumed of coal 44 million tons in 1990, then in 2017, increased 2.8 billion tons [3], the United States which has used 35.7% of petroleum, 33.3% of natural gas, and 9.8% of coal [4] and Indonesia which still depends 32% of oil, 38% of coal, 11.2% of gas [5]. Seeing these conditions, various countries are trying to reduce dependence on the use of fossil energy and switch to use renewable energy, including Indonesia.

Indonesia itself has a commitment to use renewable energy as outlined in the Nationally Determined Contribution (NDC) which can begin to be implemented in 2020 [6]. In 2022, Indonesia will increase its NDC to reduce greenhouse gas emissions with its own capabilities from 29% to 31.89% and with international support from 41% to 43.20% [7]. With the existence of this NDC, various parties work together to reduce the use of fossil energy, from the Central Government to the community, where one of the focuses is developing renewable energy by utilizing waste [8] considering that, waste accumulation Indonesia in 2022 has reached 21.1 million tons, with details of 13.9 million tons having been managed and 7.2 million tons not being managed properly in 202 (two hundred and two) Regencies/Cities in Indonesia [9].

As mandated in Article 4 regulation of Energy, the Central Government as well as the Hivos organization and the Rumah Energi Foundation in 2009 (still running to this day) has spread across 16 (sixteen) provinces and has implemented the Home Biogas Program (BIRU) which uses livestock manure and recycled waste to be used as an energy source for cooking using biogas [10], it doesn't stop there, through regulation of waste processing installations into Electrical Energy Based on Environmental Friendly Technology appointing the Regional Government to carry out the processing, one of the cities that is selected to carry out the processing is the city of Surakarta based on Article 3 paragraph (1). The community also participates in utilizing waste into energy. Based on Article 19 paragraph regulation of Energy, the people of Urutsewu Village use cow dung waste and tofu production to make biogas for cooking activities [11].

There are 3 (three) parties who can manage waste based management of renewable energy, namely the Central Government, Regional Government, and Community. Yet when it is grouped, there are 2 (two) views of parties who can manage renewable energy, namely the Government and Community. The first view states that resource management should be carried out by the Government [12] and the second view states that there must be a diversity of institutions in resource management [13] including community involvement. Seeing the differences in these views, this research tries to analyze which party is the most ideal in managing renewable energy in Indonesia.

II. LITERATURE REVIEW

A. An Overview of the Fossil and Renewable Energy in Indonesia

Fossil energy is currently still the main energy source in the world, where this energy causes environmental pollution and also global warming due to the compounds produced such as carbon monoxide (CO), carbon dioxide (CO²), hydrocarbons, nitrogen oxides (NO_x), and sulfur. (Sox) [14]. CO² emissions from fossil fuels are currently estimated to reach 30-40% and will continue to increase, causing global temperatures to rise by 1.5°C to 5.8°C. This very drastic increase in temperature has resulted in changes such as melting of polar ice and sea levels rising by 9-88 cm [15]. The increase in greenhouse gas emissions in recent years has made various countries commit to reducing them. Every year various countries gather in a conference called the Conference of the Parties (COP) to produce a commitment. At COP 21 which was held in Paris in 2015, various countries committed to holding the rate of increase in global temperature below 2°C above the temperature during the pre-industrialization period and holding the global rate to 1.5°C above the temperature during the pre-industrialization period through the Paris Agreement. As a result of the follow-up to the Paris Agreement, various countries that have agreed must make Nationally Determined Contribution (NDC) which can be implemented in 2020 [6]. In 2022, Indonesia has increased the NDC related to reducing greenhouse gas emissions with its own capabilities from the previous 29% to 31.89% and the target with international support which was previously 41% became 43.20%. In Indonesia, the results of COP 21 which was held in Paris were then ratified. It didn't stop there, Indonesia also issued various kinds of regulations related to energy. If you look at energy regulations in Indonesia, the focus is on electricity.

B. An Overview of Biogas from Waste

Biogas is a renewable energy source that can answer energy needs. Biogas is a gas produced from the process of decomposing organic materials by microorganisms under anaerobic conditions. To produce biogas, a biogas reactor (digester) is needed, which is an airtight installation, so that the decomposition process of organic material can run optimally. In addition, the biogas digester can break down methane gas emissions (CH₄), which is one of the gases that causes a greenhouse gas effect which causes the warming phenomenon. Biogas can be used as a substitute for fuel, especially kerosene or Liquefied Petroleum Gas (LPG) which is used for cooking [16].

Utilization of biogas can use waste such as tofu waste which has a high organic compound content (quite high protein), pH 3.5-5.5 which has the potential to produce biogas. In general, tofu production usually produces 2 types of waste, namely solid waste which can be used as animal feed and fisheries and liquid waste which is usually disposed of into the environment. The pollutant content in liquid waste which is yellowish in color and solid waste (dregs) actually contains gases that are harmful to the environment, such as carbon dioxide (CO₂), methane (CH₄), sulfur (S) and ammonia (NH₃). These gases can rise into the air and increase the greenhouse gas content. However, tofu industry waste can be easily broken down by microorganisms into biogas [17].

Apart from tofu waste, biogas can also be utilized using household waste such as processed food scraps, vegetable scraps, or fruit peels. This type of waste is generally more easily decomposed and decomposed by microorganisms because it has short chemical chains [18]. Therefore, most people who have biogas in their homes always use their household waste.

III. METHOD

Normative legal research [19] with a statutory and conceptual approach [20] in this research. Primary legal material includes statutory regulations relating to parties who can manage waste-based renewable energy and secondary legal material includes theoretical studies regarding common pool resources and collaborative governance. The analysis technique uses grammatical and systematic interpretation and uses a deductive method with syllogism. The major premise in this research is related to common pool resources and collaborative governance and the minor premise is related to the stakeholder trilemma in waste-based renewable energy management in Indonesia.

IV. RESULTS

A. Waste-Based Renewable Energy Management done by the Central and Regional Government and Communities

The Rumah Biogas Program (BIRU) is a biogas development program for cooking which is aimed to the community. This program is an initiation of the Central Government in collaboration with Hivos which is a non-profit and non-governmental development organization headquartered in the Netherlands and implemented by the Rumah Energi Foundation (Rumah Energi) which is a nonprofit civil society organization. This program has been started since May 2009 and has spread across 16 (sixteen) provinces and there are 27,909 (twenty seven thousand nine hundred and nine) biogas units that have been built as of June 30 2022 [10]. The financing mechanism for the BIRU Program initially came from through the community, and through APBN funds (State Revenue and Expenditure Budget) but in the last 2-3 years there has been no APBN budget, so the financing mechanism used is collaboration of the Rumah Energi Foundation with cooperatives and credit unions to build BIRU reactors and through carbon sales [21], whereas currently the Government only provides construction facilities [22]. However, there were several obstacles during the program development, such as biogas technology is not being adapted to user needs and not being adapted to climatic conditions [23]. The government once built biogas with 100% of the budget coming from the APBN, but the rate of destruction was very high. Therefore, the government suggests that funds come from the community through village funds so that the community has a sense of ownership of biogas and reduces the level of damage [22]. From this, a conclusion can be drawn that the technology from the

BIRU Program initiated by the Central Government, has a higher level of damage due to the lack of a sense of ownership of biogas by the community.

Regional government also has the authority to develop waste-based renewable energy in electricity through Waste Power Plants. But, this program also had problems, such as what happened in Surakarta City, where until this research was written, the Waste Power Plant (PLTSa) in Surakarta City was not yet running, even though construction of this PLTSa began on October 23 2019. The COVID-19 pandemic also became the reason for the delay in the operation of this PLTSa [24]. Not only in Surakarta, problem with PLTSa also occurred in the city of Surabaya where there is a lack of transparency regarding partnerships by the Regional Government. The form of this lack of transparency is that the public cannot access information regarding the PLTSa partnership in Benowo, Surabaya. Besides, the zero waste program from PLTSa is not running because the technology used is a gasification power plant which can pollute the air. Being able to recycle optimally is the reason why PLTSa Benowo, Surabaya using this technology [25]. From this description, a conclusion can be drawn that the problems faced in the region are related to the management of waste-based renewable energy, which is the lack of transparency to the community, for instance in the case with PLTSa Benowo, Surabaya and the frequent delay of the implementation programs in PLTSa Putri Cempo, Surakarta.

Urutsewu Village, Ampel District, Boyolali is one of the villages that had succeeded in developing renewable energy in the form of biogas from livestock waste and tofu waste, which has been pioneered since the 1990s and was only implemented in the community in 2013. Currently, in Urutsewu Village there are already exists 43 (forty three) biogas units and 3 (three) portable biogas [26]. In the development of biogas carried out by the Urutsewu Village community, the obstacle they felt was that when damage occurred to the biogas installation, it could not be repaired by themselves, technicians and experts in the biogas field were needed to repair it. Apart from that, several residents of Urutsewu Village who have biogas digesters felt a strong smell. This smell comes from biogas sludge. Biogas sludge is the sludge result from the fermentation of organic materials into biogas [26]. From this it can be concluded that the obstacle faced by the community when developing biogas is that when damage occurs, the community is unable to repair it themselves.

From the whole description above, the conclusion is that each party has problems in managing waste-based renewable energy, where the Central Government experiences problems related to technology development that is not on target in the community environment, local governments shows lack transparency regarding information related to partnerships in the construction of PLTSa, meanwhile communities are unable to repair biogas installations if damage occurs.

B. Collaborative Governance as an Ideal Form of Common Pool Resources in Indonesia

Indonesia, as a country that has abundant natural resources, is very likely to have a struggle over their use and this usually results in damage to natural resources [27], which is called the tragedy of the commons [12]. To improve this situation, management of natural resources must be managed sustainably and managed based on common pool resources.

Common Pool Resources is a concept for managing natural and artificial resources that can be utilized jointly in groups [28]. Research conducted by Ostrom shows that communities can manage natural resources successfully and sustainably by building small, large or multi-level institutions according to local needs [28]. The criteria that must be met in resource management according to Ostrom are as follows [28]:

1. Whoever has the right to utilize resources
2. Problems of the number, location, time and technology are used to utilize resources;
3. Anyone is obliged to provide resources for maintenance of the resource system;
4. How to utilize and monitor resources;
5. How disputes arise regarding the use, maintenance and monitoring of resources;

Moreover, Ostrom stated that there are 8 (eight) principles that an ownership can be managed sustainably and together fairly in a community, based on [29]:

1. Clear group boundaries;
2. Regulations governing the resource use;
3. Ensuring that the affected parties by a regulation can participate in changing a regulation;

4. Ensuring that community rights must be respected in regulations;
5. Developing a system so that the public can monitor;
6. Using sanctions for rule violators;
7. Providing dispute resolution facilities that are easily accessible and low cost;
8. Establishing a responsibility to manage shared resources at low levels up to the entire interconnected systems.

Looking at the condition in Indonesia, cooperation/collaborative governance between the Central Government, Regional Government, and the community in managing waste-based renewable energy in Indonesia is needed. Collaborative governance is a method in which the government directly involves other stakeholders outside the government or state with the aim of implementing a policy [30]. The Central and Regional Governments will not be successful in managing renewable energy properly if it is not in accordance with community conditions. On the other hand, the community will also experience problems in managing renewable energy if there is no support from the Central and Regional Governments, such as incentive assistance in the construction of installations or assistance if there is damage on the technology. With good collaborative governance, it is hoped that waste-based renewable energy management in Indonesia can run more optimally.

V. CONCLUSION

Management of waste-based renewable energy in Indonesia is divided into 3 (three) parties, namely the Central Government, Regional Government and Community, where there are 2 (two) views on management, namely Government and Community. The Government's perspective explains that resource management should be carried out by the Government and the community's perspective explains that resource management is carried out by various agencies including community involvement. In the practice of managing waste-based renewable energy in Indonesia, both the government and the community have their own obstacles. When taking a look at current legislation, shows it that the management of waste-based renewable energy in Indonesia is not in accordance with the concept of common pool resources. Thus, so that the renewable energy management in Indonesia can run optimally, collaborative governance is needed between the Government and the Community.

VI. REFERENCES

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