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The Effect of Utilizing Marine Electric Energy Sources on the Environment and Economy

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Abstract

Utilization of renewable energy is by utilizing the available natural potential. One of them is the use of the sea as an electrical energy generator. With the increasingly real threat of the climate crisis, a commitment is needed to reduce the amount of emissions entering the environment. Utilization of the potential of marine power plants is still very minimal compared to other clean energy plants. The use of marine power plants is also still in the research stage and there is no commercial use yet. This is due to several obstacles. The main obstacle is that the funds needed to build a marine power plant are quite large and the lack of adequate technology for converting marine power into electricity. In writing this article using qualitative methods. Qualitative methods are research methods that intend to understand the phenomena discussed by the research subjects. By using a Literature Review to obtain data that will be the topic discussed in this writing. From various locations that are considered to provide potential such as Larantuka, Selayar Islands, Bali, Flores Island, Adonara Island, Toyapakeh Waters in Nusa Penida Bali and the Jeneponto Sea, and of course there are still many coastal areas that have potential as generators but have not yet been detected as capable. produces electrical energy that is comparable to other renewable generators and can contribute to meeting the country's primary electricity needs. The energy results obtained do not contribute to carbon emissions or are in the clean energy category and the tariff for the electricity produced is still affordable.

Keywords :Carbon emissions, Clean energy, Ocean waves, Environment, Ocean Current Power Plants.

INTRODUCTION

Energy needs continue to increase but the availability of fossil energy sources as a primary energy source is limited. Fossil energy, such as petroleum, natural gas, and coal, has been the main source of energy for many years. However, the use of fossil energy has caused significant environmental damage. Global warming, climate change, air and water pollution, habitat loss and ecosystem damage related to the use of fossil energy have become global problems that are increasingly urgent to be resolved. Scientists have long warned about the dangers of excessive use of fossil energy and that we need to switch to clean, renewable and environmentally friendly energy sources, such as solar, wind and hydropower. However, in reality, this transition is not as easy as imagined. Businesses and industries that depend on fossil energy encourage dependence on this resource. Technological constraints, investment costs and lack of supportive policies are also inhibiting factors in switching to cleaner energy sources. However, due to increasingly severe environmental damage, awareness about the importance of using clean and environmentally friendly energy is increasing. We need to find solutions to reduce dependence on fossil energy sources and switch to more sustainable energy sources in order to maintain a healthy and sustainable environment for future generations.

Utilizing renewable energy is an option to balance energy needs. Utilization of renewable energy is by utilizing the available natural potential. One of them is the use of the sea as an electrical energy generator. Indonesia has great potential in producing clean energy from renewable resources, including sea hydroelectric power plants. However, the use of this

technology is still very limited in Indonesia. In fact, Indonesia's seas have enormous water resource potential to be used as a source of electrical energy. Looking at Indonesia's geographical location, which is an archipelagic country with a sea area of 5.9 million km2, it certainly has quite large potential for marine power as an electrical energy generator (DJPRL KKP in Subagiyo et al., 2017). The potential power of the sea can be in the form of utilizing ocean currents, ocean waves, ocean tides, or utilizing temperature differences found in the sea (Sri Luhur, 2013). Each marine potential that can be exploited certainly has an impact on the environment and economy.

One technology that can be used to produce electrical energy from sea water is osmotic power technology or saltwater power (TAA). This technology uses the difference in salt concentration in sea water and fresh water to produce electrical energy. However, unfortunately, this technology is still very limited and not widely used in Indonesia. The lack of utilization of sea hydroelectric power plants in Indonesia is caused by several factors, such as high investment costs, lack of human resources trained and skilled in operating this technology, and lack of support from the government and industrial sector to develop and apply this technology more widely. . If the energy contribution from seawater power plants can be maximized, it will provide many benefits for Indonesia, including reducing dependence on limited fossil energy, reducing greenhouse gas emissions, and producing clean and renewable energy that can be used sustainably to meet needs. energy in Indonesia.

With the increasingly real threat of the climate crisis, a commitment is needed to reduce the amount of emissions entering the environment. One step to avoid emissions is the energy transition, namely changing dependence from fossil fuels to other, cleaner energy sources (Vidura Ahmad, 2022). This type of marine power plant is not only environmentally friendly, but also does not damage the natural ecosystem during its construction and operation, so it can continue to be used as a tourist attraction, which also contributes to the economy of the local community (I Wayan Arta, 2010). Utilization of the potential of marine power plants is still very minimal compared to other clean energy plants. The use of marine power plants is also still in the research stage and there is no commercial use yet. This is due to several obstacles. The main obstacle is that the funds needed to build a marine power plant are quite large and the lack of adequate technology for converting marine power into electricity.

RESEARCH METHODS

In writing this article using qualitative methods. Qualitative methods are research methods that intend to understand the phenomena discussed by the research subjects. By using a Literature Review to obtain data that will be the topic discussed in this writing. According to Hasibuan, Zainal A. (2007), the Literature Review contains descriptions of theories, findings and other research materials extracted from reference materials and used as a basis for research activities. This description of literature research aims to form a clear framework for solving the problems that have been described previously in the problem formulation. A literary review contains reviews, summaries and the author's thoughts from various literary sources (can be articles, books, slides, information from the Internet, etc.) about the topic discussed and is usually placed at the beginning of the book. Number. The results of studies by other researchers can also be used for comparison with the results of the studies reviewed here. All statements and/or research results that do not come from the author must state the source and refer to written sources in accordance with established rules. A good literature review should be relevant, current (within the last three years) and adequate.

According to Dr. Yudi Agusta (2007) regarding research methods: "A literature review is a critical analysis of research on a particular topic or question in a scientific discipline", meaning

that a literature review is a critical analysis of research on a particular topic or question in the form of a question. as part of science. A literature review helps us to develop a framework of thinking in accordance with theory, findings and previous research results to solve our research problem formulation.

RESULT AND DISCUSSION

Ocean Potential as an Electricity Generator

Currents are very broad movements of water masses that occur in all the world's oceans, so their speed and direction can be completely explained. This large water mass movement system results in the movement of water masses in the water column (Yogo Pratomo, 2016). Ocean current energy has potential as a renewable energy generator in coastal areas, especially on small islands in the eastern region (A.Yuningsih, 2010).

Indonesia, which is a maritime country, certainly has enormous potential in several regions. Many researchers have conducted research to see the potential for marine energy generation in several regions of Indonesia.

Study of the Use of Ocean Currents as an Electricity Generator, with socio-economic aspects looking at the potential of ocean currents at the Larantuka location with turbine planning using the Computational Fluid Dynamic (CFD) method for vertical Gorlov type turbines by varying the speed current, researchers show that the design produces 0.3 m/s at low ocean current speeds and at an ocean current speed of 1.2 m/s the resulting rotor power reaches a capacity of 1 kW (Arfie Ikhsan Firmansyah, 2012). Potentials of Wave Power Plant for Fisherman Boats in Selayar Islands, it states that the research aims to determine the design of PLTGL power generators for fishing boats. Where the results obtained with an arm length of 2.0 m and a wave height of 1.6 m are as follows: 71.7 W, 83.72 W. 168 28 W, 240.4 W, 277.64 W and 483.2 W. While the arm length is 4 meters with wave heights that can reach 0.11 meters producing power of 35.76 W, 59.75 W. 72.24 W, 84.35 W. 144.51 W. 471.51 W, 596.64 W, 606 W , 642.83 W, and 800.58 W (Asrianto, 2020).

Research that has been carried out in the Bali area, written in a journal article entitled Ocean Wave Power Plant Using Oscillating Water Column Technology in Bali Waters, it has resulted in a study showing that using an ocean wave power plant equipped with Ocean Oscillating Water Column (PLTGL) technology -OWC), the highest energy production in the Jimbaran area is 16,478,982.17 joules and the lowest is 92.5897 joules. Regarding the electrical power that can be generated by the Water Column Oscillation Ocean Wave Power Plant (PLTGL-OWC) at this location, the largest is 4,174,007,641 watts and the smallest is 175,892 watts (I Wayan Artha Wijaya, 2010). There is a journal article entitled Potential Ocean Current Energy for Generating Electric Power in the East Flores Coastal Area, NTT where research was carried out at a location in the Larantuka Strait between Flores Island and Adonara Island - East Nusa Tenggara Province. Research methods include flow measurements, tidal monitoring, meteorological parameters, beach and seabed morphology in the research area. Based on the results of the analysis of current measurements with a moving ADCP, it was found that the lowest current speed distribution was 0.004 m/s and the highest was 3.68 m/s. Meanwhile, from the results of current measurements with ADCP, the lowest current speed was 0.002m/s and the highest was 2.83m/s. This condition is closely related to the tidal pattern in the research area, namely semi-diurnal tides with 2 high tides and 2 low tides in 24 hours. From the analysis results, it is stated that this current energy has great potential to be used as an electricity generator (Ai Yuningsih, 2011)

The research that has been carried out is in the article entitled Research on the Potential of Ocean Current Energy as a New, Renewable Energy Source in the Toyapakeh Waters of Nusa Penida, Bali. By using current energy potential research methods and measuring current status, monitoring tides, observing meteorological parameters and morphological conditions of the coast and seabed in the research area. The research results show that the placement of tidal turbines is quite good with relatively steep morphology at a depth of ±20 m and close to residential areas. The average discharge in Toyapakeh waters reaches 2.5 to 3.0 m/s for a period of 9 to 18 hours/day with a speed of more than 0.5 m/s. From the analysis results obtained, it can be stated that the Toyapakeh sea is a potential place to be used as a source of new and renewable energy, especially the Ocean Current Power Plant (PLTAL) (A. Yuningsih, 2010). There is data in a journal article entitled Study of Ocean Current Renewable Electric Energy Generation in the Jeneponto Sea Area. Where in this study the minimum average speed of ocean currents at a depth of 10 meters was 13.3 cm/s (0.13 m/s) and the maximum average speed was 27 cm/s (0.27 m/s).). This research uses the Gorlov turbine model and uses calculations based on formulas to find technical parameters and determine turbine values. From the calculation results, the data obtained shows that the power obtained is 60 Watts, which is the minimum potential power limit obtained from calculating the speed of ocean currents at a depth of 10 meters, while the power obtained is 537.69 Watts, which is the potential power limit. Based on research results, the Jeneponto ocean current power plant has application potential for ocean current power plants.

Impact of Marine Power Plants on the Environment

Tidal energy is renewable and environmentally friendly. This energy has the advantage over other forms of renewable energy that it is predictable. So it can make maintenance easier, because you can know exactly how much electrical power it can produce from time to time. This is very important to know, because it is used to determine the amount of alternative energy needed to maintain the stability of the electricity network (Titan Muslim, 2019).

When building a power plant using ocean currents, a number of factors related to environmental impact must be taken into account, such as the impact of turbine rotation on marine animals, acoustic effects, etc. For marine mammals, the impact of installing marine cables on fish habitats, affecting human activities (navigation, diving, etc.). However, based on research conducted by Farid et al., (2012) in Uihlein and Magagna (2016), it shows that there is only a small amount of literature that shows that ocean current turbines can cause the death of marine animals. By adjusting the speed of the turbine so that it does not spin too fast, in this case it could harm the creatures around it, so as not to harm marine biota. Aris Subarkah, M.Si considers that wave energy is an alternative by providing clean energy produced by waves as a power plant that is always renewable continuously and does not cause significant environmental problems such as no environmental pollution. It is stated that the deployment, operation, maintenance and decommissioning, of wave energy will be one of the most environmentally friendly power generation technologies (Bedard, 2007).

The environmental impact of wave power plants has many similarities to offshore wind power plants. Ecological reduction; noise and visuals; Current and wave variations; interaction with coastal sediments; Electromagnetic field emissions; Comfort and travel. Benefits of wave energy emissions In recent years, due to the increasing focus on global climate change, governments have tended to reduce greenhouse gas emissions. So the government has started choosing renewable energy sources. Wave energy is considered an alternative to fossil fuels which produce a number of pollutants related to environmental problems such as acid rain, increasing earth temperatures, and global climate change (Sevda Akar, 2016). The use of marine resources can have significant environmental impacts. For example, overfishing can cause a reduction in fish populations and disrupt marine ecosystems. Additionally, the use of large fishing vessels and trawls can damage seabed habitats and result in bycatch of non-target species

(FAO, 2018). Another environmental impact of using marine resources is pollution. Marine pollution can come from a variety of sources, including oil spills, plastic waste, and chemical runoff from activities on land. These pollutants can harm marine life and ecosystems, and impact human health through the consumption of contaminated seafood (UNEP, 2021).

Impact of Marine Power Plants on the Economy

The impact of marine electricity generation also has quite important economic and socio-economic impacts. Compared to wind and solar generation, marine power generation is easier to assimilate into the grid. However, the use of marine power plants is still very minimal in Indonesia, due to the relatively large cost of capital constraints. Based on the results of electricity tariff price research that has been carried out in the journal article entitled Financial Analysis of Marine Energy Development in Indonesia, it produces tariff data for marine power plants using the power of ocean currents, ocean waves and tides. It is found that the use of ocean currents has a tariff of IDR 1,268/kWh, then ocean waves have a tariff of IDR 1,708/kWh and the electricity tariff obtained by tides is calculated at IDR 2,048/kWh. Where the tariff figures for each generator can compete with PLN's subsidized electricity tariff of IDR 1,163/kWh (Estu Sri Luhur, 2013).

Utilization of marine resources can have significant economic impacts, both positive and negative. On the positive side, marine resources can provide food, jobs and income for millions of people around the world. For example, the global seafood industry is estimated to be worth more than $150 billion annually and provides employment for millions of people (FAO, 2021). Based on installed capacity projections, by 2020, the wave energy sector will generate more than 4,000 jobs and, by 2050, this number will increase to 264,323 jobs (WAVEPLAM, 2010, p. 9). However, the use of marine resources can also have negative economic impacts. Overfishing and other unsustainable practices can lead to depletion of fish populations, which can have significant economic consequences for fishing communities and the seafood industry. Additionally, marine pollution can impact the tourism industry, as well as the seafood industry, by reducing demand for seafood and damaging the reputation of coastal areas (UNEP, 2021).

CONCLUSION

The end of the review in this paper concludes, based on various literature that has been used as a data source, it shows that the potential for marine power plants (PLTGL) is very large in Indonesia. There are various places and locations that have potential as places for marine power plants, such as Larantuka, Selayar Islands, Bali, Flores Island, Adonara Island, Toyapakeh Waters in Nusa Penida Bali and the Jeneponto Sea, and of course there are still many marine coastal areas that have potential as a generator but has not been detected. From various locations that are considered to provide potential based on the data that has been obtained, it is clear that the amount of electrical power produced by marine power plants, by utilizing ocean currents and sea waves, is capable of producing electrical energy that is comparable to other renewable generators and can contribute to meeting primary electricity needs. country.

Based on the results of a review of the environmental impact, it is clear that marine power plants are very minimal and almost not involved in contributing to carbon emissions which can damage the air and increase the effect of greenhouse gases which cause the earth's temperature to rise. Marine power plants have an impact on marine biota and fish habitat in the sea, but this does not have the potential to cause damage. In terms of impact on the economy, marine power plants require large initial capital costs for construction, especially as limited technology creates

obstacles in implementing them in Indonesia. However, the costs required are also comparable to the costs of implementing other renewable energy such as Wind and Solar. In terms of price, electricity tariffs produced by marine power plants can also compete with subsidized electricity prices provided by the government, which shows that the amount of electricity produced is commensurate with the operating costs incurred, and can even be said to be still affordable.

There is a need for more focused planning in utilizing marine energy plants in Indonesia. With enormous potential in producing electrical power, marine power plants can become one of the renewable masters owned by Indonesia, where not all countries have the potential to utilize marine power as a producer of electrical power.

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