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Basic Watershed and Coastal Management

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Abstract

The aim of writing a paper can be achieved using the literature study method which is described descriptively-qualitatively. The literature used is in the form of journals related to renewable energy development and scientific articles. Journals are used to identify renewable energy potential that can be applied in Indonesia. Coastal and marine areas have potential resources that can be developed as energy resources. Indonesia, which has very extensive coastal and ocean areas, needs to develop the potential of sea and wind currents in coastal andocean areas so that the need for electrical energy in Indonesia, including in remote areas, will be met. Regulations and policies that the government has made through government regulationsthat have been issued such as: Presidential Regulation no. 5/2006 concerning National Energy Policy, Law no. 30/2007 concerning Energy and Minister of Energy and Mineral Resources Regulation No. 002/2006 concerning the Business of Medium Scale Renewable Energy PowerPlants, must be carried out well so that the development and management of renewable energymust be realized in real terms in the field. If this is realized, Indonesia will become a renewableenergy sovereign country in the future.

Keywords: coastal management, basic watershed, water management

Introduction

Indonesia is an archipelagic country that has a very extensive coastal and marine area with a coastline of 81,000 km (Sutisna, 2006). The large number of islands in Indonesia, morethan 17,000 islands with 13,466 registered with the UN (Yusuf, 2014), makes Indonesia's coastal

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areas very extensive. Indonesia is also a country with a sea area of 2/3 of the total area of Indonesia (Sutisna, 2006). Indonesia's vast coastal and marine areas have potential resourcesthat can be developed. Coastal and marine areas are areas rich in resource potential. The resources on the coastcan be in the form of mangroves and fairly fertile land resources. One of the coastal lands thatis quite fertile can be used for agriculture. Agriculture in coastal areas can be developed in coastal areas in the form of watermelon and dragon fruit farming as found on the coast of KulonProgo. Coastal areas with existing resources can also be developed as residential and tourism areas.

Marine resources can include fisheries, minerals and other biological resources such asreefs and seaweed. Indonesia's abundant marine resources are still not utilized optimally. For example, Indonesia is the second country in the world behind China in terms of fish productionfrom 2008 to 2009 (Table 1). Indonesia could actually become the country with the number one fish production in the world if fisheries resources are managed well. Management of marine resources, especially fisheries, is able to support the economy, especially in coastal areas. The resource potential of coastal and marine areas is not only limited to biological resources, but also the potential for renewable energy resources. Renewable energy from marine areas can be energy originating from waves or currents, ocean heat, ocean chemistry orwind (Adminstrator, 2011). Waves or currents in Indonesia have great potential to be developedas renewable energy. The fairly strong currents in Indonesia's coastal areas which directly border the Pacific and Indian oceans can be optimized for renewable energy sources. Marine thermal energy and marine chemistry can also be developed in coastal areas that are directly adjacent to the ocean, such as on the south coast of Java and the west coast of Sumatra, as wellas those that are directly adjacent to the sea, such as on the north coast of Java and the coast ofKalimantan. Wind energy can also be developed because Indonesia's climate allows the wind to blow at optimal speeds (4-5 m/s) throughout the year (Pakpahan, 2006).

Table 1. Total Production of Fish, Crustaceans, Molluscs and others in the World (units in tonnes)

	Country	Year				
		2008	2009	2010	2011	2012
1	China	14,791,163.00	14,919,596.00	15,414,830.00	15,768,630.00	16,167,443.00
2	Indonesia	4,995,477.00	5,099,708.00	5,374,621.00	5,701,440.00	5,813,800.00
3	USA	4,349,853.00	4,222,052.00	4,425,961.00	5,153,452.00	5,128,381.00
4	India	4,099,227.00	4,066,756.00	4,689,316.00	4,311,132.00	4,862,861.00
5	Peru	7,394,538.00	6,914,452.00	4,261,091.00	8,248,482.00	4,841,524.00

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6	Russian Fed	3,383,724.00	3,826,129.00	4,069,879.00	4,254,877.00	4,331,398.00
7	Japan	4,311,188.00	4,104,878.00	4,065,850.00	3,775,545.00	3,644,328.00
8	Myanmar	2,493,750.00	2,766,940.00	3,063,210.00	3,332,979.00	3,579,250.00
9	Vietnamese	2,136,400.00	2,280,500.00	2,414,400.00	2,514,300.00	2,622,200.00
10	Chile	3,554,816.00	3,453,786.00	2,679,742.00	3,063,467.00	2,572,881.00

Source: Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia, 2013

The development of renewable energy is important to meet national energy needs, especially basic electricity needs and so that Indonesian people no longer depend on fossil energy. This is because Indonesia is still very dependent on fossil energy such as petroleum, natural gas and coal. The use of fossil energy in Indonesia is 95% of the total national energy use (Setiawan, 2012). The use of fossil energy can also cause a greenhouse effect which playsa role in global warming. Fossil energy is also non-renewable energy and can run out. Therefore, the development of new, renewable energy originating from coastal and marine areas is an important thing to implement.

The purpose of this paper is to describe potential energy that can be developed from coastal and marine areas, and analyze the development and management of energy originatingfrom coastal and marine areas that has been and will be developed by the government.

Method

The aim of writing a paper can be achieved using the literature study method which is described descriptively-qualitatively. The literature used is in the form of journals related to renewable energy development and scientific articles. Journals are used to identify renewable energy potential that can be applied in Indonesia. Scientific articles, especially from the government, in this case the Ministry of Energy and Mineral Resources (ESDM), are used to analyze the development and management of renewable energy originating from coastal and marine areas that has been and will be carried out by the government.

Results and Discussion

World energy needs, including Indonesia, continue to increase. Until 2030, world energy demand will increase by 45% (International Energy Agency, in Administrator, 2008). The world's increasing energy demand is driven by population growth. World energy demandis still dominated by fossil energy, namely oil, coal and gas. World energy demand, which predominantly uses fossil energy, continues to increase, which will lead to the exhaustion of this energy source in the future. Therefore, it is necessary to develop and manage renewable

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energy, especially in Indonesia. Renewable alternative energy that has the potential to be developed in Indonesia is energy that comes from the coast and ocean. Several alternative energies that can be developed in Indonesia's coastal and marine areas include ocean current energy and wind energy.

Energy Potential of Ocean Currents

Ocean currents are the movement of sea water masses in a layer of water that move horizontally or vertically (Gross, 1990). According to Gross (1990), the movement of ocean currents is influenced by internal and external factors. Internal factors are sea water mass density gradients, horizontal pressure gradients and water layer friction. External factors are the gravitational forces of the sun and moon, tectonic forces and wind. Ocean currents move on the surface and below the surface of sea water. Ocean currents that move on the surface are usually influenced by wind, while ocean currents that move below the surface are influenced by underwater gradients and the effects of upwelling and downwelling. Upwelling is gthe movement of water masses which causes the movement of water from the deep layers to the upper layers which usually occurs at a depth of 100-200 m (Nybakken, 1982 in Adzan et al). Upwelling occurs when the wind blows parallel to the equator and the Coriolis force pushes water towards the center by forming a shape 900 away from the coastline. Downwelling occurs when the wind blows parallel to the coastline but surface currents flow perpendicular to the coast. As a result, the mass flow of water moves downwards (Nybakken, 1982 in Adzan et al). The influence of wind on surface current speed is 2% of wind speed (Bernawis, 2000). The current speed will decrease as the water depth increases until ultimately the wind has no effect at a depth of 200 meters (Bernawis, 2000).

The movement of ocean currents can be used as renewable energy, especially for electricity generation. The development of ocean current energy is carried out by converting kinetic energy into electrical energy. The development of ocean current energy is veryappropriate to be applied in Indonesia's coastal and marine areas. The development of ocean current energy in coastal areas will later be able to meet the basic electricity needs of small islands and other coastal areas that do not yet have electricity.

The energy potential of ocean currents in Indonesia is very large. StudyFraenkel (2002)shows that the ideal location for a current-powered electric generator installation has aminimum bidirectional current speed of 2 m/s and the ideal is 2.5 m/s or more.The results of research by Yuningsih and Masduki (2011) on the East Flores coast show that the current speedon the East Flores coast is 0.002 m/s to 3.68 m/s and can produce 0.1 kW to 2 kW of power. The results of the analysis regarding the speed of ocean currents show that the energy producedby ocean currents has great potential to be developed as an electrical energy generator. The speed of sea currents in other parts of the Indonesian coast is almost the same, assuming that the driving

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forces of sea currents such as wind, underwater morphology and water mass gradients are not much different in other Indonesian coastal areas. The speed of ocean currentson the coast of East Flores provides an illustration that ocean currents also have the potential to be developed as renewable energy.

Ocean Current Energy Development and Management

Fulfilling the basic energy needs of all Indonesian people is still ongoing. Meeting basicenergy needs, especially electricity, in Indonesia still relies heavily on energy originating fromcoal. The government, through the Ministry of Energy and Mineral Resources, has made effortsto fulfill energy needs, in this case electrical energy, by developing alternative energies that can be applied in coastal areas and small islands. The focus was chosen to develop alternativeelectrical energy in coastal areas and small islands because almost all coastal areas and small islands in Indonesia which are far from city centers still lack electrical energy. This is the impact of underdeveloped development. Alternative energy that is being developed in coastal areas and small islands is energy that comes from ocean currents. Ocean current energy is veryappropriate to be developed in coastal areas and small islands because coastal areas and smallislands have very limited land natural resources so they are unable to generate their own electricity, while the available marine resources are sufficient to support people's daily lives. - day. The development of ocean current energy in coastal areas and small islands will later be able to meet electricity needs in these areas. Fulfilling electricity needs will have an impact on improving the economy of communities in coastal areas and small islands.

One example of ocean current energy development is in the Lombok Strait and Alas Strait which is carried out by the Marine Geology Research and Development Center, the ESDM Research and Development Agency and the ITB oceanography study center. Potentialocean current measurements are carried out using the Acoustic Doppler Current Profiler (ADCP) method. Measurements of potential ocean currents are carried out to find out whetherocean currents can be used to generate electricity. The first turbine prototype as a marine current power generator (PLTAL) was developed by the ITB engineering group and PT Dirgantara Indonesia in 2006-2010 (Figure 1). In 2009, this first turbine prototype was officially used as a tool for PLTAL which can be applied in strait waters. It is hoped that the use of ocean current energy as an electricity generator will be able to meet renewable energy needs of 5% of the total target of 25% for all types of renewable energy such as wind and solar(Lubis, 2014).

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Figure 1. First Prototype Developed as PLTAL (Source: Lubis, 2014)

Ocean current energy management must be carried out with various related agencies such as the Ministry of Energy and Mineral Resources, academics and the community itself. Proper management can maintain the continued availability of ocean current energy for coastalareas and small islands. Good management takes the form of participation by the government assisted by academics and the private sector in providing PLTAL equipment. PLTAL equipment that has been installed and can produce electrical energy should be well looked after and maintained by the surrounding community. Ocean current energy management must also pay attention to ideal locations with constant ocean current speeds and be equipped with equipment that is resistant to the threat of extreme weather. Ocean current energy must also be managed in a long-term sustainable manner not only to meet electricity needs, but also to meet other needs that support productivity such as capture water fisheries, water supply, research and technotourism. The preparation of regulations, standardization and certification for ocean current energy development is also needed so that the development and management of ocean current energy runs well.

Wind Energy Potential

Coastal and oceanic areas are areas that have large wind energy potential. Wind in coastal areas is ideal for use as energy generator. The small number of obstacles that block wind movement in coastal areas means that the wind that blows in coastal areas has a speed and direction that tends to be constant. Therefore, apart from ocean currents, the appropriate energy to be developed in coastal and ocean areas is wind energy.

The potential for wind energy is quite large in Indonesia. As a tropical country, Indonesia has various seasonal wind movements, namely the west monsoon and the east monsoon. Constant wind direction each season is one of the supporting factors for the development of wind energy,

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apart from the speed factor. Wind speed in Indonesia also tends to be constant with an annual average wind speed of 2.34 m/s obtained from a height of 20 m (Ryski, n.d.). Other research shows that the wind speed in the Indian Ocean which directly borders the islands of Sumatra, Java, Bali and its surroundings is 5.1 m/s taken from a height of 1000 mb (Martono, 2009). Wind speeds of 2 m/s to 5 m/s in Indonesia have the potential tobe developed as small, medium and large scale power plants with energy potential of 10 kW –100 kW (Pakpahan, 2006). The following is a map of wind speed distribution in Indonesia published by NASA.

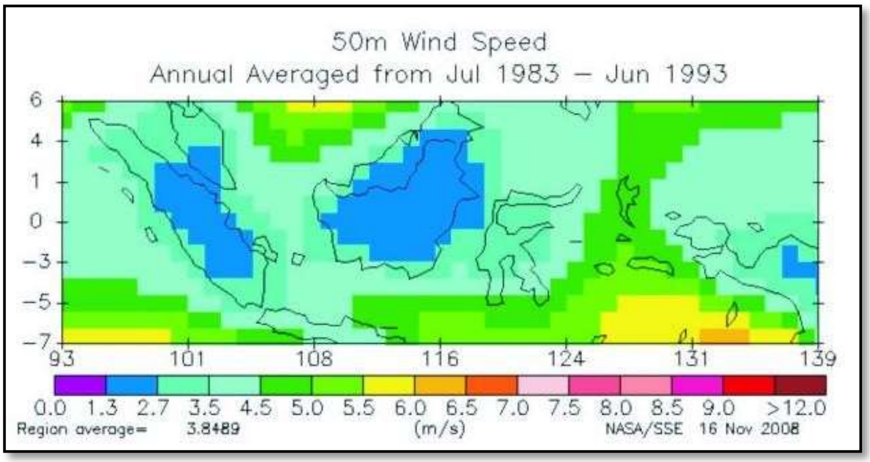

Figure 2. Annual Wind Speed Distribution Map in Indonesia measured at a height of 50m

Wind Energy Development and Management

Various wind energy developments have been carried out by the government in collaboration with the private sector and the community. One of these efforts is to carry out comprehensive studies on the potential of wind resources and how wind power generation (PLTB) technology can be applied. In 2009, the installed capacity of wind energy conversion systems throughout Indonesia reached 1.4 MW (WWEA 2010 in Baruna, 2010) spread acrossSelayar Island (North Sulawesi), Nusa Penida (Bali), Yogyakarta and Bangka Belitung. The government carried out the first large-scale PLTB development in 2013 at Samas Beach, Bantulwith a total energy of 50 MW. Private investors through the Director General of New, Renewable Energy and Energy Conservation (EBTKE) are interested in developing 50 MW ofwind energy in Parangtritis. The development of wind energy assisted by the private sector is expected to be able to meet renewable energy needs of 25% of total energy consumption.

One of the technical energy developments is carried out using the Wind Energy Conversion System model(SKEA)/wind turbine. Research developed by Pakpahan (2006) illustrates that

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wind turbines with a wind-diesel system (Figure 3) are easy to apply for medium-scale energy supply. The working system of this wind-diesel is that when the wind blows hard, the wind turbine will supply more electricity to consumers, while when the wind blows slowly, the electricity income will be automatically diverted to the diesel generator. Wind-diesel systems have been developed in NTT and South Sulawesi.

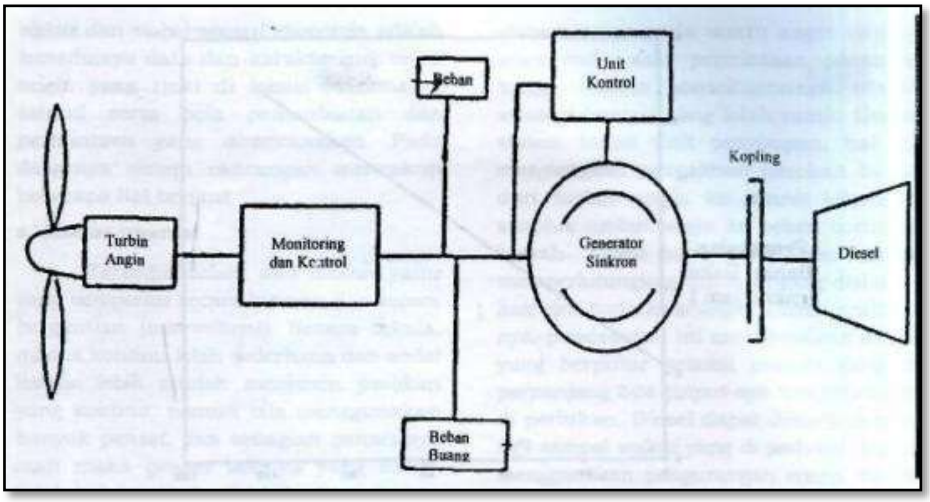

Figure 3. Wind-Diesel Scheme Developed for Medium-Scale Energy Generation

The development and management of wind energy must continue considering that Indonesia has a large coastal area. Constant wind speed and wind direction as well as a strongdaily offshore wind pattern from the Indian Ocean are potential factors for the development ofwind energy. Management must involve all parties, both government and society.

Conclusion

Coastal and marine areas have potential resources that can be developed as energy resources. Indonesia, which has very extensive coastal and ocean areas, needs to develop the potential of sea and wind currents in coastal and ocean areas so that the need for electrical energy in Indonesia, including in remote areas, will be met. Regulations and policies that the government has made through government regulations that have been issued such as:Presidential Regulation no. 5/2006 concerning National Energy Policy, Law no. 30/2007 concerning Energy and Minister of Energy and Mineral Resources Regulation No. 002/2006 concerning the Business of Medium Scale Renewable Energy Power Plants, must be carried out well so that the development and management of renewable energy must be realized in realterms in the field. If this is realized, Indonesia will become a renewable energy sovereign country in the future.

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