MAPPING POTENTIAL FOR WIND ENERGY IN COASTAL MARINE SENGGIGI FOR RENEWABLE ENERGY DEVELOPMENT SUPPORT

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Abstract

His form of energy self-sufficient villages throughout Indonesia is the government's goal in the field of energy. Utilization of wind energy as a renewable energy source is an attempt to answer the problem for change and the natural environment is also one of the conservation of conventional energy sources. The purpose of this research study is to get the wind potential in accordance with the site characteristics such as speed and direction as a basis for planning SKEA. Potential awakened power of the wind potential and value of the benefits to be derived based on economic analysis if the potential energy is utilized for the generation of renewable energy on the grid system. The method used is the method of distribution. The results of the analysis of wind energy potential in Selaparang in 2011 until 2013, increased in 2011 the potential energy of 278, 5 KW KW rose to 562.5 in 2012 and in 2013 to 522, 4 KW wind speed has increased so the potential for increased power. Increased wind speed at the beginning of the year and the end of the rainy season occurred. The magnitude of the potential of wind energy can be used for supplying the electricity needs of the population about the number of households 500. The potential of wind energy in Kediri in 2011 until 2013, the image can be seen that the energy per year decline in 2011 the potential energy of 1751.33 KW dropped to 636 , 96 KW in 2012 and declined in 2013 to 44.954 KW wind speed so that the lower the potential for wind power down. Economic analysis produces BCR value of 1.4. Wind speed in Kediri greater than in Senggigi same year, but increased wind speeds in Senggigi and in Kediri decreased..

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1. Introduction

Wind energy is a renewable energy source and still a little utilization in Indonesia. Utilization of wind energy as a renewable energy source is an attempt to answer the problem for change and the natural environment also one of the conservation of conventional energy sources. For example, according to a report AWEA in America for 750 KW wind power generation with wind speeds of 5.76 m/s height of 10 m which operates during the year were able to reduce emissions of harmful gases include 1179 tonnes of CO2; 6.9 tons of SO2 and NO2 above 4.3 tonnes of fuel usage. (Nana, 2011). Indonesia as a country that is at the equator, the potential of the thermal power station is not too large. Some areas in Indonesia, for example, NTB and NTT, which has great potential. Most regions in Indonesia have an average wind speed of about 4 m/s, except for the two provinces. PLTB suitable to be developed in Indonesia is a plant with a capacity of less than 100 KW. In contrast to Europe that concentrates on developing thermal power station with a capacity above 1 MW or greater to be built off shore.

The main problem is the use of thermal power station availability is low. To overcome this problem then fired plant should be operated in parallel with other power plants. Other power plants can be based SEA or conventional plants. PLTB only arouse less than 100 KW power, it can be built dozens of thermal power station in one area. Utilization of thermal power station makes the need for fossil fuels will be much reduced, in addition to reducing operating costs will increase the use of thermal power station of a regional energy security. The islands as well as NTB and NTT which all energy needs to be imported from other regions, where fired plant will help increase independence. Fired plant has the potential to reduce CO2 emissions of 700 grams for every kWh of electrical energy generated (Yell A.D. 2011).

Utilization of renewable energy with wind energy in Indonesia is as follows of the grid / stand-alone total installed 65 KW in West Java, Central Java, Yogyakarta, NTB, NTT, Maluku Hybrid (wind-solar-diesel) of a total of 100 KW installed in Kep. A thousand, Madura, Rote Ndaonese, TTU, TTS, Sulawesi, DIY and on the grid (micro grid) total installed 1,275 KW in Nusa Penida(Suripno, 2011).

PT. PLN branch Mataram explained that if PT. PLN not immediately build new power plants, as is now being done in the development Ampenan diesel, then 2014 will be a shortage of 15 MW power in the city of Mataram which resulted in rolling blackouts in 2010 again like last year. Given the machines used today are rented generator from abroad at a cost which is very expensive (Lombok post, 2014).

The purpose of this study is to obtain the location of the wind energy potential, the source direction of the wind, the value of velocity (m/s), the amount of potential energy is aroused (KW). Cosh benefit ratio value that would be obtained if the economic analysis of potential energy is utilized for the generation of renewable energy to the grid on the system. Formulation of this research is to determine where the points of potential wind energy resources, the amount of potential energy is aroused and economic analysis produced in the coastal areas of the sub-district Batu Layar Senggigi Lombok Barat use wind direction and speed of data daily. The results of these measurements will be used as a basis for making SKEA for renewable energy development in West Lombok district in particular.

2. Methodology

The research was conducted by means of primary data collection in the field and compared with secondary data from relevant agencies. The scope of this study include wind speed and power potential awakened.

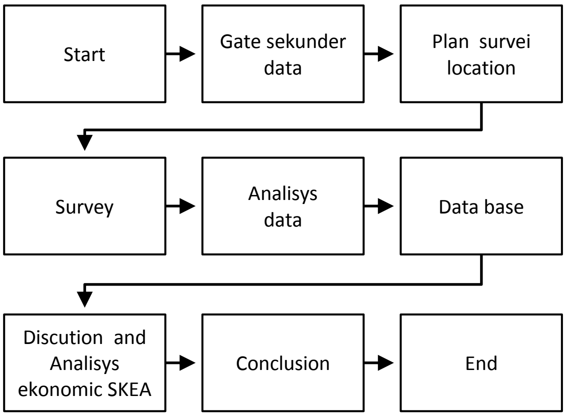

Figure 1. Flow diagram of the study

The tools used are digital anemometer with units of measurement km/h. The measurement results are analyzed using the widrose diagram plots. Variable research is wind speed, wind direction and potential power awakened every location. Power analysis technique that is by analyzing the timing, frequency and power estimation awakened every location in a given year.

Study Design

This study will take place as follows:

a. This study begins with a review of literature related to the theme support and research. Time used for the study of literature is in accordance with the schedule of research.
b. The collection of secondary data from relevant agencies
c. A preliminary survey of wind potential as a location for data retrieval.
d. Find data in 7th place can grow and change according to the results of the initial survey and secondary data in the form of wind speed at a certain height location of each 3 days one location measurement.
e. The data obtained were analyzed to obtain the potential of wind energy to power the location estimation and economic analysis.
f. Conclusions from the results of research to answer the research objectives.

Data Collection and Analysis Techniques

Techniques of data collection and data analysis both primary data collection and secondary data will be described in more detail as below.

a. Primary Data Collection
Primary data consists of information and data relating to the wind gathered from observation through field surveys. Wind speed measurements carried out in coastal and mountainous areas using wind speed measuring devices (anemometer) with a mast height of 10 m for 12 hours / day from 07.00 am - 19:00 pm for three consecutive per location.

b. Secondary Data Collection
Secondary data collection was done in order to get an overview of the research object, so that the location and scope of the research areas to be observed can be estimated and research activities can be done purposively.
Secondary data collection include:
1. The collection of wind data from the Bureau of Meteorology and Geophysics in West Lombok Region;
2. The collection of data from the departments/ agencies related technical in scope Government of West Lombok, such as the Department of Energy and Mineral Resources;
3. Data collection districts in West Lombok;
4. consultation activities to the relevant departments at the national level;
5. Literature study and secondary data will begin this study followed by observation through field surveys to obtain primary data.

Secondary data and observations were analyzed to form the basis of the general design of the wind energy conversion system (SKEA).

Data Analysis

Time Series Analysis

Plot of monthly data with a daily average in the form of a histogram showing the wind fluctuations perharinya.Dari this graph the average wind speed per month and per year can dihitung.Jika resolution sampling of the average data gets smaller, say 10 minutes, which is very useful additional information like a gust of wind speed can also be collected. Other information obtained from the distribution of information about the period of time is a low wind under a wind speed reference. For mechanical SKEA this information is useful in determining the size of the volume for the electrical penampungan.Sedangkan tub, this information is useful to know the period in which the wind turbine is not operating.

Analysis of Wind Speed Frequency

Analysis of wind resources, in addition to information regarding the distribution of wind speeds within a certain time, information on the number of hours per month or per year for each wind speed required also. Information value is called the frequency distribution of wind speed. Wind speed frequency distribution is presented in the form of a histogram with the ordinate axis hour and wind speed interval. Histogram shows the highest wind speeds occur most often but not the average wind speed rata. For area with wind speed is not too varied, biased so the average wind speed is the most frequent wind speed. But in areas with wind speed greatly fluctuated in general the average wind speed is higher than the most frequent wind speed Ahmad ZZ (2011).

Power estimation aroused

Distribution of both wind direction and speed can be calculated by using a Windows-based software WRPLOT View which raises the calculation of wind rose and a graphical display that depicts meteorological variables over time and date to suit the user's needs. Wind rose depicts the frequency of occurrence in each direction of the wind and wind speed classes at the location and time. Wind rose can also be used to display a chart of trend direction of the wind in a region. Due to the influence of the local slope, the possible effects of the coast, the range of tools, and the temporal variability of the wind, the wind rose calculations do not necessarily represent the real movement in the region. Grafik wind direction frequency distribution and wind speed created using software WRPLOT View. Wind Energy Potential calculation based on a formula that already exists.

3. Results and Discussion

The results of this study are presented in the pictures below:

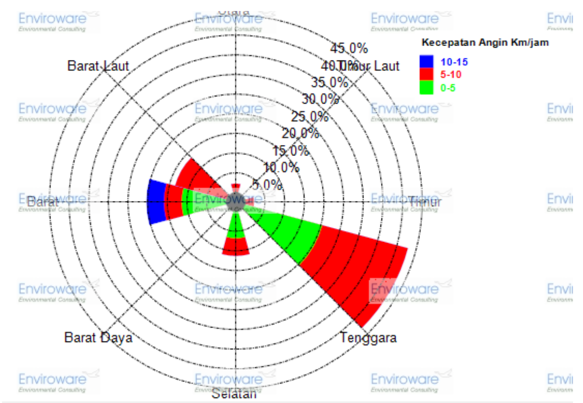

Figure 2. Windrose wind 2011 until 2014 in Senggigi

Windrose analysis of 2011 to 2014 showed that the predominant wind speed to the southeast with a maximum speed of 10 km / h with a frequency of 42%. In addition to southeast winds blowing during the year 2011 to 2014 the wind was also blowing to the west with a maximum speed of 15 km / h by 20%, towards the northwest at a maximum speed of 10 km / h with a frequency of 14% and towards the south with a maximum speed of 10 km / h with a frequency of 12%. Wind for 4 years can be grouped into groups with a weak wind can drive wind turbines records.

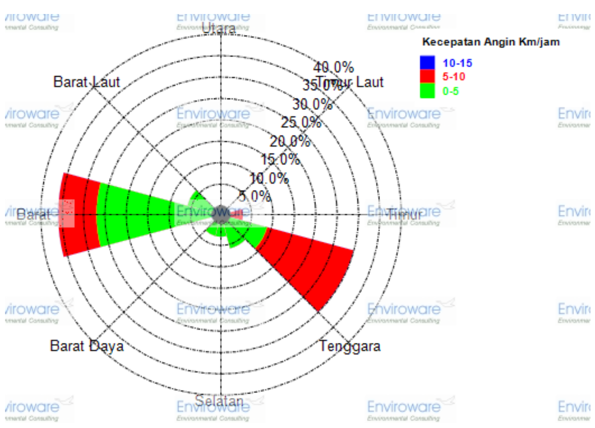

Figure 3. Windrose wind 2011 until year 2014 in Kediri station

Windrose graph above shows the analysis of wind direction and speed for 4 years with the wind blowing at a speed of dominant towards the west and south-east with a speed of 10 km/h with a frequency of 30%. Wind for 4 years can be grouped into groups with a weak wind can drive wind turbines records.

Table 1. Potential awakened power of wind energy

Station	Years	Potential awakened power of wind (KW)
Selaparang	2011	278,5
	2012	562,5
	2013	522,4
	2014	212,4
Kediri	2012	1751,33
	2013	636,96
	2014	44,95

The increase in potency and decrease overall power awakened from both locations depicted in Figure 3 below.

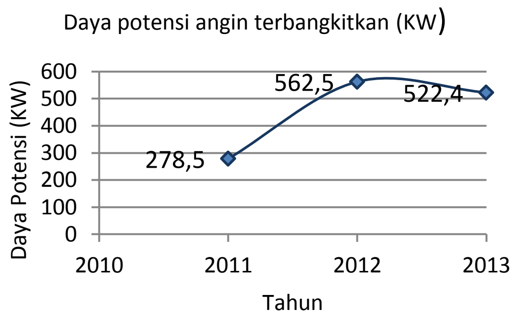

Figure 4. Potential power Selaparang location

Figure 4. Shows the wind energy potential in Selaparang in 2011 until 2013, the image can be seen that the energy per year increase in 2011 the potential energy of 278, 5 KW rise to 562.5 in 2012 and decreased in 2013 to 522, 4 KW it is clear that increasing the wind speed so the potential power increase. Increases wind speed due to the end of the year and the beginning of the rainy season occurred. The magnitude of the potential of wind energy can be used for supplying the electricity needs of the population about the number of households 500.

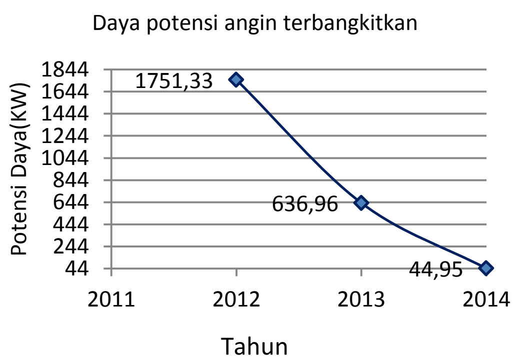

Figure 5. Potential power in Kediri station

Figure 5. Shows the wind energy potential in Kediri in 2011 until 2013, the image can be seen that the energy per year decline in 2011 the potential energy declined from 1751.33 KW to 636.96 in 2012 and 44.954 KW in 2013, this

explained that the lower the wind speed so that the potential of wind power down. Increased wind speeds due to the end of the year and the beginning of the rainy season occurred. The magnitude of the potential of wind energy can be used for supplying the electricity needs of the population about the number of households 500. Both of these graphs shows that the wind speed in Kediri greater than in Senggigi in the same year, but in Senggigi wind speed increases and decreases in Kediri.

Economic Analysis

Energy has become expensive because the price is relatively expensive small wind turbine, which is about USD 7- 20 million / kW installed power (rated), but competitive with other alternative generation. As a comparison can be drawn that the costs of wind turbine energy (approximately USD 1,150 / KW), in addition to the micro (about USD 500 / KW), competitive with diesel (about USD 1,960 / KW), expansion of the network (approximately USD 3,185/KW) or photovoltaic (approximately USD 3,230 / KW). Large wind turbine costs experienced significant cost reduction. America installed cost decreases of approximately USD 7.5 million / KW (1981) to around USD 2 million / KW (1987). The cost of energy production today is about USD 100-300 / KW (wind speed at a height 6,5-8,5m / s, is projected to decline by about 30 percent in 2010 and about 10 percent more next 20 years.

Socio-economic aspects of the development of rural electrification was instrumental in improving the welfare of society and can be powered by alternative energy applications. The use of micro relatively cheaper, but limited to the location of potential alone. The use of wind turbines overseas products as done so far, considered expensive. As an illustration, the cost of energy production with wind turbines as in Jepara, estimated around 1500 - 4000 USD / kWh.

Potential power in 2013 on the site of 522 Senggigi, 4 KW, if built with an investment of Rp. 7 million / KW, the initial capital required Rp. 3.6568 billion. Economic analysis show that wind energy investment profitable even if the value is not reduced by the operating expenses and salaries of the operator.

Along with run the time SKEA future development efforts provide lucrative prosfektif. This value can be determined BCR of 1.4, with the profit of Rp. 1.533.766.400 profit per year, if the reduced maintenance and operational costs by 10% to Rp.1.380.389.760, and return of investment (ROI) is 2.6 years.

4. Conclusion

The conclusions of this research are:

1. Wind energy is the energy that should be considered because of the potential for large utilization and available year round.
2. Potential wind along Senggigi beach in 2011, amounted to 278.5 KW, in 2012 amounted to 562.5 KW, in 2013 amounted to 522.4 KW.
3. Estimated economic analysis SKEA at that location with BCR 1.4, with the profit per year Rp.1.380.389.760. with the old investment of 2.6 years to repay the loan.

Suggestions for the next researcher is:

1. Power prediction is also performed by testing using wind turbines.
2. Primary data was measured with a long enough time span of more than 1 hour and more than 7 days each location.
3. The method of analysis with the latest models and more sophisticated if there is already the latest.

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