Optimization of Monocrystalline Solar Panels Using Reflector Scanning Technology

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Abstract. The need for energy continues to increase lately due to the increase in the number of people in the world. Solar panel technology is currently being developed, especially to maximize the output voltage of solar panels. This research is a research conducted to determine the output voltage and current produced by the solar panels that are designed. Reflector is used to increase the lighting of solar radiation to solar panels. Data collection from the output voltage generated can be obtained by direct analysis using solar panels without reflectors and solar panels with reflectors. It was found that solar panels with reflectors designed to emit a voltage close to the maximum with an output voltage of 46.81 solar radiation starting from 08.00-17.00. Based on the results, it was concluded that solar panels designed with additional reflectors have the potential to be developed so that they can help maximize the output voltage of the solar panels.

Keywords: Solar Panel, Voltage Output, Reflector, light reflection, Rayban

1. Introduction

Electricity has become a staple requirement that is consumed by people today. Current electrical energy needs are very large due to the rapid development of technology in all fields [3]. With so many energy needs, even fossil fuels such as petroleum, coal and natural gas are not able to meet all the needs of electricity, so to meet these needs requires alternative energy, namely renewable energy [1]. Considering that Indonesia is in a tropical region that gets sunlight every day with good radiation. This sun radiation brings energy which has a very important role in the processes that occur in nature both needed by living things and all other natural processes. that, sunlight can be used optimally without damaging the substance so that solar energy from the sun is classified as renewable energy [5].

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The problem now is how to use solar cell panels to get optimal electricity output. The use of solar cell panels is generally placed in a certain position with no changes, for example the solar cell panel is faced upwards. With the panel facing upwards and if the panel is considered different which has a flat surface, the panel will get maximum solar radiation when the sun is perpendicular to the panel area [6]. Conduct research to optimize the solar panel with a fresnel lens to get maximum energy. Fresnel lens can increase and optimize the intensity of sunlight absorbed by solar cells so that the efficiency increases. Testing and data collection in this study include testing solar panels using fresnel lens and testing solar panels without using a fresnel lens. Data measurements include voltage, current, power, which is affected by wind speed, air humidity, temperature, and light intensity [5]. The results of the study by using Fresnel lens obtain quantitative significance increase in power by 29.6 Watts, with efficiency in solar panels of 119.2%. Calculation of errata value can result in accuracy and confidence of 54% without using fresnel lens and 62% using fresnel lens. While this research designs a reflector as a scanning tool to detect maximum power points that are more accurate, it is expected that solar panels can provide maximum efficiency values and determine the energy feasibility due to the use of a concave mirror as a reflector.

2. Research Methodology

The research was carried out in three stages: the tool design stage, the testing phase and the experimental stage, as well as analyzing the results and evaluation of the design results within a period of nine months starting from July 2017 to April 2018. Scanning Concave mirror reflectors use materials made of acrylic and coated with ribens of car glass that has a thickness of 80% to get maximum light reflection.

2.1 Research Methods

The research method discusses the process of designing a solar panel system which is considered to have an important role to produce maximum voltage and output power. Some considerations that need to be considered when designing a solar panel system such as material that will be used, the system and position of the placement of solar panels, which will affect the absorption of solar radiation [10,11].

2.2 Design of Monocrystalline Research with Scanning Technology

The research will design a monocrystalline solar panel system by applying scanning technology that will be used to generate electrical energy with an optimum output power [9]. At the time of testing the tool, the researcher will analyze the scanning technology and the feasibility of using scanning technology from the reflection of the concave mirror to the solar panel. In this study the data taken are the output power and efficiency produced by monocrystalline solar panels that use scanning reflector technology and solar panels without scanning reflector technology. Time of observation took ten time variations from 08.00 WIB to 17.00 WIB with a 1 hour scanning interval.
2.2.1 Reflection on Mirror

The mirror is a slippery plane that can reflect all the light falling on the surface plane. Broadly speaking, mirrors are divided into three types, namely: flat mirrors, concave mirrors and convex mirrors.

2.2.2 Rayban

Rayban is a type of darker colored glass. The word "ray" means light or light and "tire" means blocking or limiting, so it is concluded that the riben glass is darker in color. So, riben glass is dark glass but can still penetrate the view. Riben glass can also be called colored glass (blue, green, and brown) (Susanta, 2007). In general, the thickness of the most popular rayban glass is the size of 3mm and 5mm thickness [4].

2.2.3 Monocrystalline Solar Panels

Solar cells also called photovoltaic cells are a P-N junction of single crystalline silicon. By using photo-electric effects from semiconductor materials so that it can collect solar radiation and convert it into electrical energy [2]. The electrical energy generated from the solar cell is in the form of DC current and can be used directly or it can also use a battery as a storage system so that it can be used when needed especially at night [7]. The specifications of the solar panel are shown in Table 1 as follows.

| Type      | Value     |
|-----------|-----------|
| Modul     | Solar Module Mixenoch Moonocrystalline 50 Wp |
| Pmax      | 50 W      |
| Vmp       | 17.0 V    |
| Imp       | 2.95 A    |
| Voc       | 21.5 V    |
3. Results and discussion

The results that can be obtained by researchers by observing and analyzing the effects of solar radiation on the design of solar panels without reflectors and solar panels with reflectors. The output of the solar panel is measured by a multimeter as shown in Figure 2 and Figure 3.

Based on the graph above, the solar panel without reflector produces the lowest power of 9.22 V and current of 0.37 A while the solar panel with a reflector produces the lowest power at 12.37 V and current of 0.42 A. The output voltage of solar panels without reflector is 3.41 and solar panels the reflector is at a voltage of 5.20 can be seen in figure 4 below.
During direct sunlight and added reflection of light from the reflector to the solar panel that is designed, produces a reflector-free current of 0.37 A and 0.42 A with a reflector. Current output also increases when solar radiation is at peak hours. The highest voltage output is generated at 1:00 p.m. with a power of 19.95 V, current of 2.10 A and voltage of 29.53 for solar panels without a reflector while solar panels with reflectors produce power of 29.41, current of 2.73 and voltage of 48.53. Observation data of solar panels without reflectors and solar panels with reflectors are shown in Table 2.

Table 2. Observation Data Solar panels without reflectors and solar panels with reflectors.

| No | Time | Solar Panel Without Reflectors | Solar Panel With Reflector |
|----|------|-------------------------------|---------------------------|
|    |      | V    | A   | P   | V    | A   | P   |
| 1  | 8.00 | 9.22 | 0.37| 3.41| 12.37| 0.42| 5.20|
| 2  | 9.00 | 12.82| 0.50| 6.41| 14.93| 0.63| 9.41|
| 3  | 10.00| 16.39| 1.12| 18.36| 18.72| 1.31| 24.52|
| 4  | 11.00| 18.79| 1.32| 24.80| 21.38| 1.56| 33.35|
| 5  | 12.00| 21.34| 1.47| 31.37| 23.41| 1.68| 39.33|
| 6  | 13.00| 19.95| 1.62| 32.32| 25.72| 1.82| 46.81|
| 7  | 14.00| 20.74| 1.71| 35.47| 23.48| 1.79| 42.03|
| 8  | 15.00| 13.79| 1.43| 19.72| 18.76| 1.58| 29.64|
| 9  | 16.00| 12.87| 0.94| 12.10| 16.91| 1.24| 20.97|
4. Conclusion

Solar panels designed with a reflector produce minimum output power at 8:00 a.m. 12.37 V and produce a voltage of 5.20 and a current of 0.42 A while the solar panel without a minimum power reflector is 9.22 V, current 0.37 and Voltage 3.41. The highest voltage output of a solar panel with a reflector at 1:00 p.m. is 46.81 and the highest current output is 1.82 A at a power output of 25.72 V while a solar panel without a reflector occurs at 2:00 p.m. with an output power of 20.74, a current of 1.71 and a voltage of 35.47. The solar panel can produce a maximum voltage output if it continues to be developed and reduce the weaknesses of the solar panels and the output currently utilizing the help of the reflector to maximize lighting.

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