Overview of the Photovoltaic (PV) Potential Output Power Parameters of the Effect of Dust Contamination on the Surface, Tilt Angle and Use of Reflectors

Bambang Panji Asmara(✉)

Department of Electrical Engineering, Faculty of Engineering, State University of Gorontalo, Gorontalo, Indonesia
bambang@ung.ac.id

Abstract. The use of energy has helped the community a lot to meet their needs in various ways, one of which is the need for electrical energy for lighting, the use of electric tools to help work in the community, both in the government sector, the business world and industry. Abundant supply to be able to meet the electricity supply, with this research utilizing the energy source of sunlight with the use of a Photovoltaic system (solar panels) as an alternative energy source that is environmentally friendly (go green) by conducting a review test of the effect of dust on the surface of the panel, the angle of inclination and the use of reflector to determine the effectiveness of the output parameters of Photovoltaic, from this experiment can be a form of information that is a comparison to photovoltaic systems in solar panels.

Keywords: Dirt dust · tilt angle · reflector · Photovoltaic (PV)

1 Introduction

The modern era has considerably increased the usage of power appliance. The research community has shown growing concern over minimizing the cause of environmental hazardous and alternative source of energy resources [1]. The position of the Unitary State of the Republic of Indonesia (NKRI) is on the equator, which is usually called the equator jamrut, so that the Indonesian territory has the potential for abundant sources of sunlight and has a fairly long duration of solar radiation, ranging from ± 10 to 11 h per day in weather conditions. Good and bright. The increasing public need for electrical energy has become one of the basic needs in people's daily lives, but increasing energy reserve capacity requires economic factors to build new power plants plus the availability of oil and gas fuel reserves will decrease so that the problem of sustainable energy availability is needed. Thinking about the availability of alternative power plants. As one alternative solution is the use of solar panels (solar cells) that can generate electrical energy by using energy from sunlight which has a negative impact on the environment. This study focuses on observing how the use of solar panels can produce the effectiveness of the

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solar panel output parameter (Photovoltaic) from the impact of the influence of dust dirt on the surface, the layout of the tilt angle position of the solar panels and the use of reflectors on static solar panels so that this use can make the results concerning an effectiveness of the output parameters of solar panels for use as an alternative energy source for energy independence in the community from a better potential, the position of the Indonesian territory is very strategic from the use of this energy source.

2 Literature Review

Several studies that have been carried out related to this research are "Journals" of the results of research conducted by S. Tamimi and friends At the Proceedings of the 2016 SNF National Physics Seminar (E-Journal), Vol.5, October 2016 pISSN: 2339-0654, eISSN: 2476-9398 entitled "Optimization of the tilt angle of solar panels on an active solar tracking system prototype" [2]. Further research conducted by IB Kd Surya Negara et al., with the title "Comparative analysis of the output of electric power Solar panels tracking systems with solar reflectors" was published in E-journal SPEKTRUM vol 3 No 1, June 2016.

2.1 Solar Energy Definition

Solar energy is energy in the form of light and heat from the sun. This energy can be utilized by using a series of technologies such as solar heating, solar photovoltaic, solar thermal electricity and artificial photosynthesis [3].

2.2 Solar Cell

Photovoltaic system is equipment that converts solar energy into electrical energy. Photovoltaic consists of several solar cells, each of which is connected to each other in series or parallel to form a row of photovoltaic (PV) called Photovoltaic (PV) modules. The characteristics of photovoltaic systems are very non-linear which are influenced by external factors. Solar irradiation, temperature, and wind speed are the main environmental factors that affect photovoltaic [4].

2.3 Solar Modul

The solar module is a PLts component which is composed of several solar cells arranged in such a way, either in parallel or in series with the intention of producing a certain electrical power, arranged in one frame and given a protective layer [4].

2.4 Solar Panel

Solar panels are the main equipment of a solar power generation system that functions to convert sunlight energy into electrical energy directly [5] (Fig. 1).

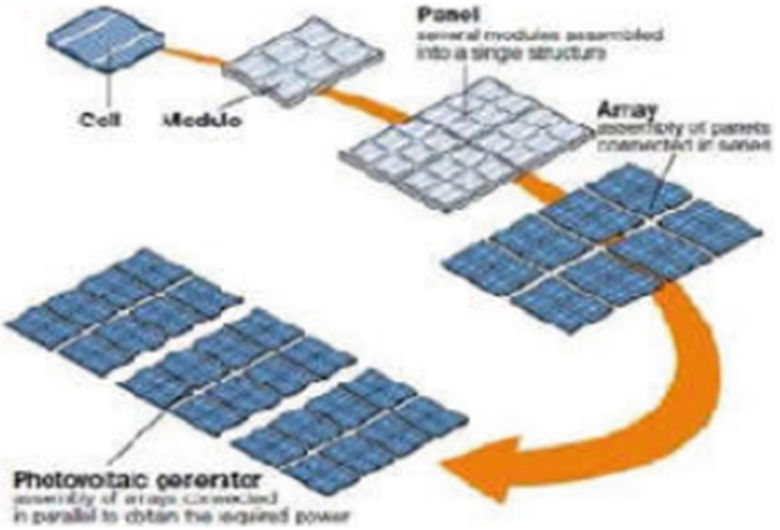

Fig. 1. Solar cell panel Modul.

2.5 Type of Solar Panels

This type of solar panel converts the intensity of sunlight into electrical energy.

1. Monocrystal (Mono-Crystalline). It was the most efficient panel produced with the latest technology and produces the highest unit area electric power. Monocrystals are designed for applications that require large electricity consumption in places with extreme climates and with very harsh natural conditions. Has efficiency up to 15%. The weakness of this type of panel is that it will not function well in a place where there is less sunlight (shade) its efficiency will drop drastically in cloudy weather [6].
2. Polycrystalline (Poly-Crystalline) Is a solar panel that has a random crystal arrangement because it is manufactured by a casting process. This type requires a larger surface area than the monocrystalline type to produce the same electrical power. This type of solar panel has lower efficiency than the monocrystalline type, so it has a lower price [6].
3. Thin Film Photovoltaic It is a solar panel (two layers) with a microcrystal-silicon and amorphous thin layer structure with a module efficiency of 8.5% so that the required surface area per watt of power generated is greater than that of monocrystals and polycrystals. The latest innovation is Thin Film triple Junction Photovoltaic (with three layers) can function very efficiently in very cloudy air and can produce up to 45% more electrical power than other types of panels with equivalent rated power [6].

3 Methodology Research

The method in this Research is to use an experimental method in the form of a prototype by taking measurements in the form of measurements on Photovoltaic with a dusty

surface and directly exposed to a direct sunlight source, then by adjusting the PV tilt angle, and using a reflector on the side opposite to the direction of the sun light source.

3.1 Research Time and Location

This research will be carried out in 2021 in the area of Gorontalo Province, within the Electrical Engineering environment, Faculty of Electrical Engineering, State University of Gorontalo in Gorontalo.

3.2 Tolls and Material Research

Tools and material were used in this Research as follow:

1. Types of Photovoltaic (PV)
2. Reflector
3. Using digital and analog multimeter measuring tools
4. Connection cable
5. Literature

3.3 Schedule Research

See Fig. 2.

4 Result

Result of measurement surface Solar cell panels with a dusty and without load (Tables 1, 2, 3 and 4).

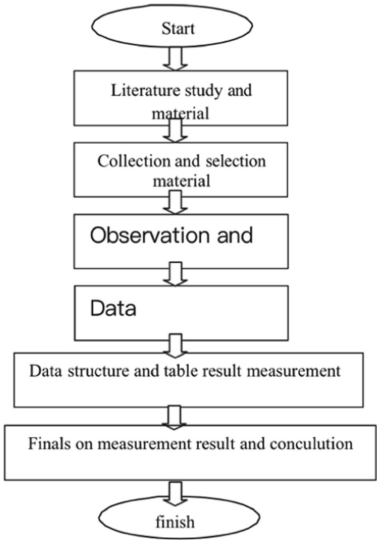

Fig. 2. Schedule research plan.

Table 1. Photovoltaic measurement results with a dusty surface with a tilt angle of 30^0 without reflector and without load.

No	Panels Type	Type of measurement (DC)	Time schedule of measurement											Σ average	Description
			7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	11/2 4	
1	Polycris talline	Voltage (V)	18,00 v	18,9 v	19,00 v	19,00 v	18,79 v	19,1 v	18,91 v	18,61 v	18,59 v	16,76 v	16,85 v	16,68 v	183,51/11
		Current (A)	0,14 A	0,14 A	0,29 A	0,24 A	0,15 A	0,18 A	0,24 A	0,21 A	0,05 A	0,02 A	0,01 A	1,661 A	1,67/11
		Power (Wp)	2,52	2,646	5,51	4,56	2,8185	3,438	4,5384	3,9081	0,9295	0,3352	0,1685	31,22 w	31,3722/11

Table 2. Photovoltaic measurement results with a dusty surface with a tilt angle of 45° without a reflector without a load.

No	Panels Type	Type of measurement (DC)	Time schedule Of measurement											Σ average	Description
			7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	11/24	
1	Polycris talline	Voltage (V)	18,31 v	19,46 v	18,81 v	18,43 v	18,77 v	19,52 v	18,76 v	18,59 v	18,12 v	17,56 v	16,64 v	18,45 v	202,97/11
		Current (A)	0,14 A	0,14 A	0,29 A	0,24 A	0,15 A	0,18 A	0,24 A	0,21 A	0,05 A	0,02 A	0,01 A	1,661 A	1,67/11
		Power (W)	2,5634	2,7244	5,4549	4,432	2,8155	3,5136	4,5024	3,9039	0,906	0,3512	0,1664	31,173 w	31,324/11

Table 3. Measurement results of dusty surfaces with load 7-W lamp and a tilt angle of 45° without a reflector

No	Panels Type	Type of measurement (DC)	Time schedule of measurement											Σ average	Description
			7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	11/24	
1	Polycristalline	Voltage (V)	8,98	11,01	11,12	10,32	10,2	11,4	10,1	10,4	9,27	8,63	8,31	9,996	109,95/11
2		Current (A)	0,03	0,18	0,20	0,11	0,13	0,16	0,10	0,14	0,03	0,02	0,01	1,1011	1,11/11
3		Power (W)	2,56	2,76	4,14	2,2602	1,7895	1,9907	3,819	2,308	0,3956	0,0832	0,0828	2,05	22,54/11

Table 4. Measurement results of dusty surfaces with load 7-W lamp and a tilt angle of 45^0 with a reflector

No	Panels Type	Type of measurement (DC)	Time schedule of measurement											Average and tilt angel (°)		Description
			7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	average	45°	
1	Polycristalline	Voltage (V)	11,60	12,76	14,02	13,70	13,12	12,8	11,9	10,75	8,80	8,31	8,11	11,448		125,93/11
2		Current (A)	0,23	0,31	0,32	0,38	0,36	0,33	0,24	0,15	0,03	0,01	0,01	0,215		2,37 A
3		Power (W)	2,666	3,9556	4,4864	5, 206	4,7232	4,5639	2,8632	1,6125	0,264	0,0831	0,0811	2,78		30,518/11

5 Conclusion

1. Result of the Research on photovoltaic measurements with a dusty surface with a slope tilt angle of 30° without a reflector and without a load with a maximum average output voltage measurement of 16.68 V, and an average current of 1.661 A, output power of 31.22 W, at an angle a slope of 30° using a Polycrystalline type solar cell panel, the results of photovoltaic measurements with a dusty surface with a tilt angle of 45° without a reflector without a load voltage of 18.45 V, current 1.661 A, output power 31.173 W.
2. Research with dusty Photovoltaic (PV) measurement results without using a reflector with a 7-W lamp load at a 45° angle obtained an average voltage of 9.996 V and a current of 0.101 A, and an output power of 2.05 W. From the results of a dusty surface with a load of 7 W and using a reflector with an angle of 45°, an average voltage of 11.448 V and a current of 0.125 A
3. Power of 2.78 W obtained can be concluded that the effect of the load on the solar panel greatly affects the photovoltaic output characteristics even though using the help of reflector to improve the performance of the angle of arrival of sunlight on the surface of the solar cell panel used. But with a reflector it can increase the voltage obtained.

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