



ANALYSIS STUDY OF ANGLE EFFECT ON POWER IN SOLAR CELL OF HYBRID MODEL SOLAR CELL-PIEZOELECTRIC

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ABSTRACT

Indonesia is a tropical country, thus making Indonesia has two seasons namely the rainy season and the dry season. Utilization of nature as electrical energy in the dry season is utilized by utilizing solar heat as energy stored during the day and used or used as electricity at night. However, in the rainy season there is no utilization of energy that can be utilized or used as electrical energy. This case for the researchers intends to utilize the energy generated from the rainwater pressure that descends from the sky as compressed energy on the piezoelectric. The objective of the study was to determine the optimal conditions of the initial testing of the solar-cell part of the hybrid model. The research method used is experimental experiment on solar cell with angle and time variation to determine current, voltage and power. Results obtained by the amount of angle, time, current and voltage generated from the solar cell to be used in the hybrid model: effective time and angle that is at 12:00 clock and 180°, with a voltage (V) of 4.75 V, current (A) of 8.5 mA and power of 0.018921 W.

Keywords: solar cell, current, voltage, power, angle, hybrid.

1. INTRODUCTION

Indonesia is a tropical country, thus making Indonesia has two seasons namely the rainy season and the dry season. Utilization of nature as electrical energy in the dry season is utilized by utilizing solar heat as energy stored during the day and used or used as electricity at night. However, in the rainy season there is no utilization of energy that can be utilized or used as electrical energy [1-2].

For this case the researchers intend to utilize the energy generated from the rainwater pressure that descends from the sky as compressed energy on the piezoelectric. With the help of rainwater pressure on piezoelectric, piezoelectric can produce electrical energy that can be used for everyday purposes, such as lighting. In addition solar energy can be utilized with the help of other equipment that is by changing the radiation of the sun of another form. There are two kinds of ways to convert solar radiation into other energy, which is through solar cell and collector [3-5].

There is no doubt that solar energy is one of the most environmentally friendly and promising sources of energy in the future, since there is no pollution generated during the energy conversion process, as well as its widely available energy source in nature [6-7]. Therefore, the application of Solar Power (PLTS) technology to utilize the available solar energy potential in those locations is the right solution [8-10]

PLTS or better known as solar cells (Photovoltaic cells) will be more desirable because it can be used for various relevant purposes and in various places such as offices, factories, housing, and others. So it is deemed necessary to be studied further. In order to obtain a comprehensive technical review [11-14].

Solar cell XGY 42 X 42 is a commercial Solar cell used to recharge a small 1.5 volt battery. As for rain

power, pick up piezoelectric as being used as a translator vibration on the instrument into a flow of electricity that translated amplifier into one of the options for generating electrical energy for rain power. Because the collision energy in rain can be transformed into a vibration that can generate electricity by pick-up piezoelectric. [15].

In this research, the XGY 42x42 mm test is a part of hybrid model of solar cell and rain power. This is done to determine and determine the effective conditions of voltage, current and power generated.

2. RESEARCH METHOD

The methodology or approach that will be carried out is the initial test of solar cells used for piezoelectric hybrid models and solar cells as a medium for producing electrical energy. Methodological steps, as follows:

- Conduct literature studies and perform analysis based on preliminary data from research on solar cell design.
- Make a series of test equipment using solar cell as part of hybrid model.
- Conducting data analysis and final calculation, so obtained the initial test results from solar cells used in the hybrid model.

Research flowchart is shown in Figure-1.

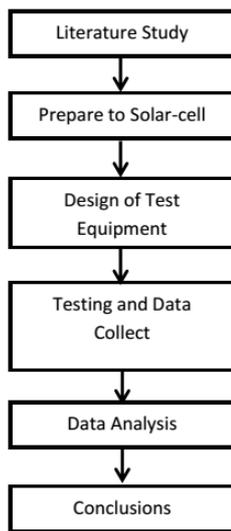


Figure-1. Flowchart of this research.

3. RESULTS AND DISCUSSIONS

The process of testing the hybrid model of solar cells and rain power is done gradually, that is done experiment on solar cell from hybrid model part first. As in the discussion below:

Testing power from XGY 42 X 42 solar cell part hybrid model

The first process in the design of Solar cell Hybrid and rain power begins with creating and analyzing the Solar cell used in the research process. Solar cell used is Solar cell Polycrystalline with specification, can be seen in Figure-2: Type: XGY 42x42 (Polycrystalline); Voltage (V): ± 2 Volt



Figure-2. Solar cell 2 volt XGY 42 x 42 mm.

Conducted some initial experiments in making the design planning of the hybrid model. In this case, the solar cell will be tested with some parameters required in the design process. The analysis process for solar cell begins with the stress analysis that occurs on the solar cell for different conditions (different times and angles).

Solar cell voltage test and analysis with time and angle parameters

Voltage analysis process is done with two experimental parameters that is time and angle on one

Solar cell polycrystalline mini 2 Volt. The experiment was conducted during the dry season.

Time and angle to be used are:

1. At 07.00 WIB, (At Angle 45o & 90o & 180o, can be seen Figure-3).
2. At 12.00 WIB (At Angle 45o & 90o & 180o, can be seen Figure-3).
3. At 17.00 WIB (At Angle 45o & 90o & 180o, can be seen Figure-3).

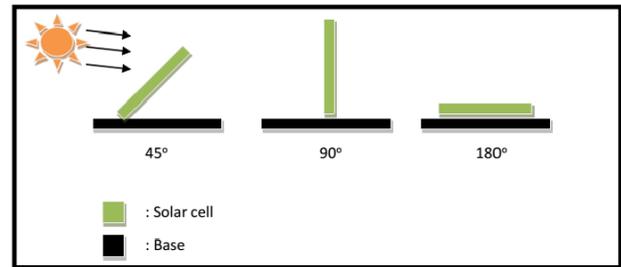


Figure-3. Solar experimental working area.

The position to adjust the angle can be seen in Figure-4 below:



Figure-4. Solar cell experiment area.

Data obtained from the test results performed with the parameters of solar cell angle change can be seen in Table-1.

Table-1. Experiments on 1 solar cell.

Hour \ Angle	45°	90°	180°
07:00	2.169 V	2.064 V	2.164 V
12:00	2.146 V	1.891 V	2.226 V
17:00	2.125 V	2.102 V	2.124 V



The process of analysis for the next solar cell is the current analysis that occurs on the solar cell in various conditions. In this case the research is done by dividing the experiment by testing the Solar Cell in different times and angles.

Solar cell current test and analysis with time and angle parameters

Unlike the Voltage experiment, current measurements use load addition to know the current flowing in the circuit. Therefore research is done by forming a circuit to get the current that is formed. The experiments were performed to turn on LEDs that have a working voltage of 3-6 Volts and Ampere requirement of up to 20 mA. Materials needed are:

1. LED 5 volts 2 pcs (to get current requirement up to 40 mA)
2. Solar cell 2 volt Polycrystalline 2 pcs (To get 3-6 Volt voltage)
3. Switch to turn off and turn on the LED
4. AVO-meter to measure current

The circuit used can be seen in Figure-5 and Figure-6.

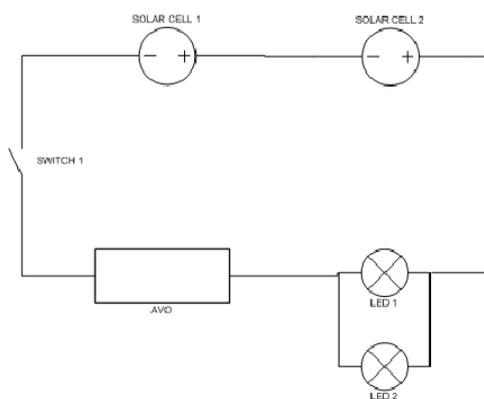


Figure-5. Circuits to detect ampere.

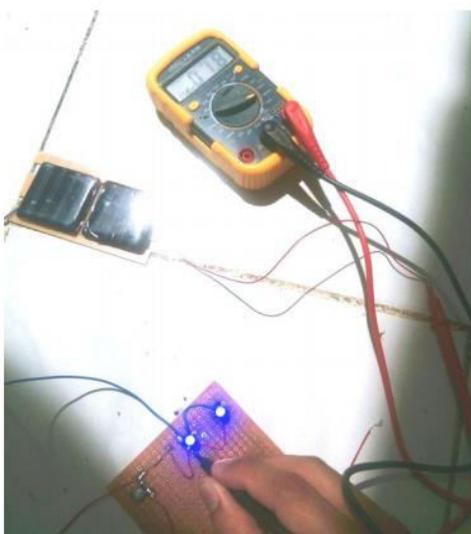


Figure-6. The experiment detects of ampere in solar cell.

Time and angle to be used are:

1. At 07.00 WIB, (At Angle 45o & 90o & 180o, can be seen Figure 3).
2. At 12.00 WIB (At Angle 45o & 90o & 180o, can be seen Figure 3).
3. At 17.00 WIB (At Angle 45o & 90o & 180o, can be seen Figure-3).

The data obtained from the test results performed with the parameters of solar cell angle change can be seen in Tables 2 and 3.

Table-2. Experimental voltage (V) used 2 series solar cell.

Hour \ Angle	45°	90°	180°
07.00	4.63	4.24	4.74
12.00	4.24	4.03	4.75
17.00	4.45	4.34	4.64

Based on the data in Table 2, the best Voltage at 12.00 and 180o Angle is 4.75 V.

Table-3. Experimental current (A) used 2 series solar cell.

Hour \ Angle	45°	90°	180°
07:00	7.5 mA	7.2 mA	8.4 mA
12:00	7.2 mA	7.1 mA	8.5 mA
17:00	7.3 mA	7.4 mA	7.3 mA

Based on the data in Table 3 obtained the best current on and 180o corner is 8.5 mA.

The process of analysis and experiments above can be obtained that the Solar cell analysis is:

- a) The most effective angle in the use of solar cell is 180o.
- b) The power produced by Solar cell XGY 42 x 42 is:

$$P = 2,226 \text{ V} \times (8.5/1000) \text{ A}$$

$$P = 0.018921 \text{ W}$$

4. CONCLUSIONS

Based on the results of research and testing, the conclusion is as follows: Initial tests performed to determine the angle, time, current and voltage generated from the solar cell to be used in the hybrid model: effective time and angle that is at 12:00 and 180o, with a voltage (V) of 4.75 V, the current (A) of 8.5 mA and power of 0.018921 W.



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