



The Utilization of Solar Cells and Water Turbine as Sourcing Voltage On Power Multi-Based Hydroponic

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ABSTRACT

Keywords

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The use of electric power is very important to supply water pumps which are usually obtained from PLN electricity. The utilization of electricity from new renewable energy such as solar panel electricity and water turbines has not been used too much in the cultivation of hydroponic plants. Therefore, a combination of combined electric power (hybrid) between solar cells and water turbines is needed to supply electricity on hydroponic technology in the context of conserving electrical energy for the future. Based on these problems, this study conducted various tests to create a design that could be used for energy use in hydroponic plants. The method used includes electrical and systematic design. The steps taken include the stage of literature study then designing, manufacturing hardware integrating the system and testing and analyzing the system. Considering these theories, can discover solar panels, solar, chargers, battery endurance, thief joule circuits, and water turbines. In this study using several tests, including testing of solar panels, solar chargers, battery endurance, thief joule series, and water turbines .. solar panels function to capture sunlight, solar chargers to store electrical voltage to batteries, battery endurance functions to find out how many batteries can store electricity, a series of thief joules to increase voltage and water turbines to produce voltage. From all daitas tests, the results of solar panels and water turbines are a source of voltage that will be stored by the battery via a solar charger and then from the battery it will be supplied to the hydroponic circuit as a source of voltage.

1. Introduction

Agricultural technology is currently developing very rapidly [1][2], more and more new innovations regarding agriculture are being created both in terms of the farming process, controlling process to the harvesting process that has used automation, not only in the main staple sector which is developed but in the vegetable and fruit sector have also been developed [3][4], one of the development effort on the vegetable sector could use hydroponic technology as a planting medium, using the hydroponic method itself is very suitable to be developed in urban areas that have limited land and very little labor [3][5]. Systems that use planting media in the form of pipes and water that are flowed to provide plant nutrition require continuous water pump power so that plants can grow well until they can be harvested [6]. The use of electric power is very important to supply water pumps which are usually obtained from PLN electricity. Utilization of electricity from new renewable energy such as solar panel electricity and water turbines has not been used too much in the cultivation of hydroponic plants. Therefore, it is needed a combination of combined electric power (hybrid) between solar cells and water turbines to supply electricity on hydroponic technology in the context of conserving electrical energy for the future [7][8].

Multi-control power in hydroponics uses solar cells and water turbines as a resource to blame hydroponics, storage and the appearance of its own power lies in the solar cell charge, to combine the power from the water turbine itself will be parallelized on the tool [9][10].





2. The Proposed Method/Algorithm

The method used in this research is electrical design, systematic, in order to obtain accurate data and information. In this design starts from collecting data, making design, making tools, testing and summarizing the results of the system. The following is a block diagram of a solar cell system and water turbine to charge the battery using Solar Charge Control.

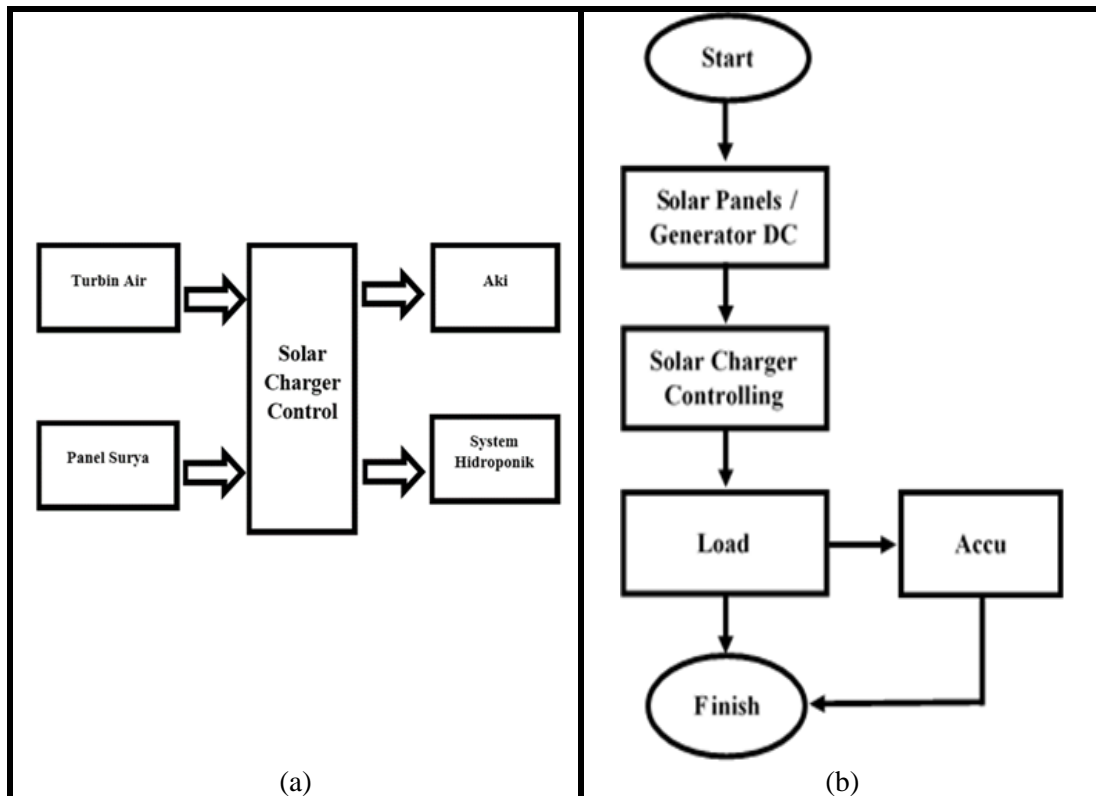


Fig. 1. (a) Planing Tools Diagram Block, (b) Sensor Reading Flowchart

1. Literature Study Stage

This literature study is taken from several data such as data *Sheet* and journals as a reference that is used as a basic source in processing data. Literature study in this thesis includes the following matters:

- Study on solar panel work systems and electric turbine generators;
- Study of multi-control on combining solar panels and electric turbine generators;
- Study of power distribution systems in hydroponics.

2. The Hardware Design and Manufacturing Stage

In this stage the design is adjusted to the function of the components that will be used, so that it can be realized and the system can run well.

3. Software Design and Manufacturing Stage

At this stage software has been made, before hardware and software are integrated into the whole system to run the system.

4. System Integration Stage

Integrate between hardware and software that has been compiled into a whole system to run the system itself to run well.

5. System Testing and Analysis Stage

Test the system that has been integrated as a whole for further analysis according to its function. Flowchart system design software work as shown in figure 1 (b).



3. Result and Discussions

3.1. Solar Panel Test Result

Testing of 10 wp solar panels with a voltage of 17.4 V, current 0.57 A, open circuit voltage 21.6 V, short circuit current 0.63 A is done to find out whether the 10 wp solar panel is able to function properly. This test is done by giving light to the 10 wp solar panel, then the output of the 10 wp solar panel is checked using a digital multimeter. After that it will be known how much voltage is generated.

To get good results in testing, the 10 wp solar panel testing process is given light indoors and outdoors. If the digital multimeter displays the voltage generated by the 10 wp solar panel, the 10 wp solar panel is functioning properly and ready to use.

3.2. Battery Voltage Test Result

Battery life testing is done to determine whether the battery is able to function properly. This test is done by checking using a digital multimeter. Then it will be known how much voltage is generated.

To get good result in testing, the battery durability testing process is changed first. If the digital multimeter displays the voltage generated by the battery, the battery will function properly and be ready to use.

3.3. Test results for the Thief Joule circuit

In the thief joule circuit is used to increase the voltage. Using the following components:

1. Resistor 100k Ω
2. Toroid with coil wire size 0.9 mm
3. Capacitor 100 μ f
4. TIP 41



Fig. 2. Thief Joule Circuit

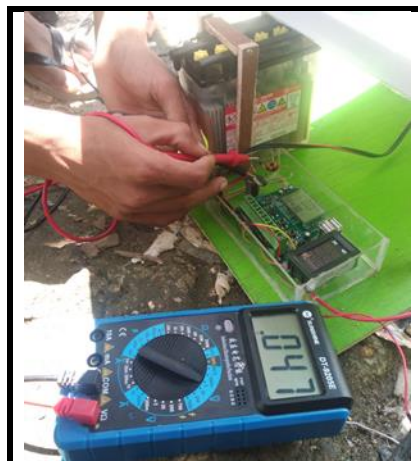


Fig. 3. Testing the Thief Joule Circuit



From the figure above it is known that the thief joule circuit testing uses a turbine with a voltage out of 4.7 v. in the figure looks 047 because on a digital multimeter is set at a reading of 20 v.

3.4. Water Turbine test result

Water turbine testing is done to determine whether the water turbine is able to function properly. Using 80V/12V/5V generator water turbine type, a maximum output voltage of 80V (1.2 Mpa), line resistance $10.5 \pm 0.5 \Omega$, maximum amperage output $\geq 220 \text{ mA}$ (12V), line resistance $10 \text{ M}\Omega$ (DC100), outlet closed maximum voltage 0.6Mpa, water outlet opens maximum voltage 1.2 Mpa, startwater pressure 0.05 Mpa, mechanical noise $\leq 55 \text{ dB}$, generator single volume 90g, life of generator $\geq 3000 \text{ h}$. This test is done by providing water flow to the water turbine, then the water turbine output is checked using a digital multimeter. After that it will be discovered how much voltage is generated.

To get good testing results, the water turbine testing process is given water flow. If the digital multimeter displays the voltage generated by the water turbine, the water turbine is functioning properly and is ready to use.



Fig. 4. Circuit Testing as A Whole

In this case, we will discuss the results of testing a series of devices including Solar Panel testing, Battery endurance testing, Thief joule testing, and Water turbine testing.

The test is done by providing a voltage input that utilizes sunlight and water flow, then from the solar cell will send the voltage to the solar charger to save the battery. Apart from solar cells, the voltage from the water turbine through the thief joule circuit to raise the voltage in order to be able to store the voltage on the battery through the solar charger.

On this system the main thing is to distribute the voltage from the battery to the hydroponic plant. In order to activate the water pump on the hydroponic plant. When the water flows on a hydroponic water reservoir, it also moves the water turbine.

An error occurs when both inputs (solar panel and water turbine) cannot produce a 10 volt voltage so it cannot charge. Then the occurrence of an error in the solar panel occurs if the solar panel is not cleaned from dust regularly because it can affect the incoming energy around 20% if the solar panel is covered with dust, the subsequent occurrence of an error in the water turbine is also influenced by water treatment in the reservoir, if the water reservoir





not cleaned periodically once a week so moss on the reservoir can affect the nets of water turbines and can cause traffic jams on water turbine motors.

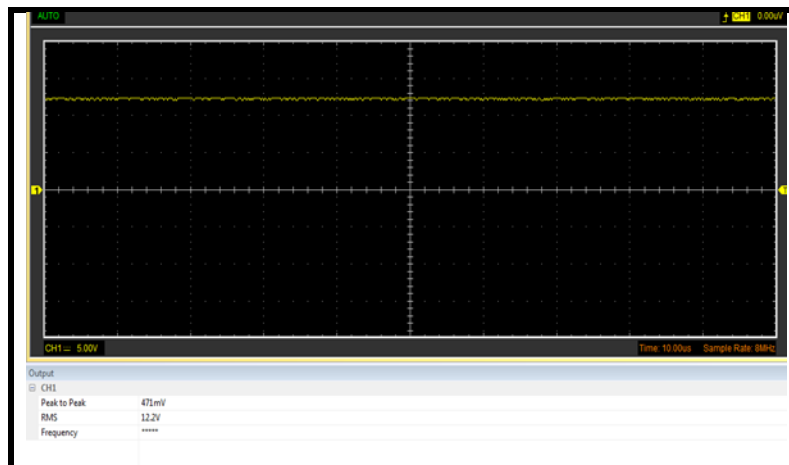


Fig. 5. Input Voltage Measurement Using Oscilloscope

At the power output of the water turbine and solar panel is measured using an oscilloscope and the voltage entered into the solar charger is 12,2 v. then the two voltages are parallel so they can provide an output in the form of a voltage to charge the battery.

4. Conclusion

The design of the utilization of solar cells and water turbines as a voltage source in multi-power based hydroponic power is designed using several components such as solar cells, water turbines, batteries, solar chargers, and integrated Thief joule circuit. So that solar cells and water turbines can store voltage for voltage sources in hydroponic plants. In the solar cell voltage obtained of 8.91 V in testing indoors and 18,65 V in testing outdoors. In water turbines, the average voltage is 3 V.

Solar charger functions by receiving input power from the process of voltage production by solar cells and water turbines, where the solar charger is used to store the voltage on the battery. The solar charge outputs a voltage of 11,5v – 13v for state 1 of the hydroponic pump running on consuming power of 0,20A,. for certain circumstances such as pumps turning on 3 pumps or 4 pumps at once can reach 0,70A.

Power multi control is a system of combining 2 electric energy generators into one so that they can be controlled and work continuously.

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