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Utilization of Solar Power Generating for Water Circulation in Hydroponic Plants

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ABSTRACT

Indonesia has the potential for natural resources that are very abundant, one of which is the use of solar energy which can be developed into a Solar Power Plant. Where the advantage of using solar electricity is that it is environmentally friendly so that it can reduce the effect of the greenhouse, therefore this energy source is very suitable for use for hydroponics. So the purpose of this study is to design a solar power plant as a source of electricity for hydroponic plant water circulation. For this design system, starting with data collection, references and other sources that can support the manufacture of this tool. Then the components and equipment will be selected for the design to be made. After that, the tool design and testing will begin to find out whether the tool is working according to the design. The results of testing the tool have worked well, it is proven by the functioning of all the components used and the growth of hydroponic plants.

Keywords: Panel, SCC, Battery, Pump, Hydroponic.

Introduction

Indonesia has very abundant natural resource potential, one of which is the use of solar energy which can be developed into a Solar Power Plant. The advantage of using solar electricity is that it is environmentally friendly so it can reduce the greenhouse effect. Because this utilization process does not produce pollution that disturbs the ecosystem, it can also provide electricity easily and does not require special costs for maintenance. That is why solar electricity processing has enormous potential. Agricultural technology using the hydroponic method is very suitable to be developed in urban areas where there is limited land and very little labor, especially with the current epidemic, it is very suitable to do so. A system that uses a planting medium in the form of pipes and flowing water to provide nutrition to the plants requires continuous water pump power so that the plants can grow well until they can be harvested and to rotate the water pump using a Solar Power Plant

2. Theoretical Fundations

Solar Cells or Solar Cells are devices that can convert solar light energy into electrical energy using the principle of the Photovoltaic effect. What is meant by the Photovoltaic Effect is a phenomenon in which an electric voltage appears due to the connection or contact of two electrodes connected to a solid or liquid system when it gets light energy. Therefore, solar cells or solar cells are often also called photovoltaic (PV) cells.

Types of Solar Panels

- **Mono-crystalline**

This is the most efficient panel produced using the latest technology & produces the highest electrical power per area. Monocrystals are designed for applications that require large electricity consumption in places with extreme climates and very harsh natural conditions. Have an efficiency of up to 15%. The weakness of this type of panel is that it will not function well in places with less sunlight (shade), its efficiency will drop drastically in cloudy weather.

Mono-crystalline

Poly-Crystalline

Figur 1, Types of Solar Panels

- **Poly-Crystalline**

It is a solar panel that has a random crystal arrangement because it is manufactured using a casting process. This type requires a larger surface area compared to the monocrystalline type to produce the same electrical power. This type of solar panel has lower efficiency than the monocrystal type, so the price tends to be lower.

Solar Charge Controller

Solar Charge Controller is an electronic device used to regulate direct current to the battery and from the battery to the load. The solar charge controller regulates overcharging (excess charging when the battery is full) and excess voltage from the solar panel / solar cell. The solar charge controller applies Pulse width modulation (PWM) technology to regulate the battery charging function and release current from the battery to the load. So without a solar charge controller, the battery will be damaged by over-charging and voltage instability.

Figur 2, Solar Charge Controller

Battery

Battery (accumulator) is a device that can store energy (generally electrical energy) in the form of chemical energy. Examples of accumulators are batteries and capacitors. The battery is a cell that we encounter a lot because it is widely used in motorbikes and cars. The battery is a secondary cell, because apart from

producing electric current, the battery can also be filled with electric current again. In simple terms, a battery is a cell consisting of a Pb electrode as an anode and PbO2 as a cathode with an H2SO4 electrolyte.

Figur 3, Battery

Pump

Pump is a device used to move a liquid from one place to another by increasing the pressure of the liquid. The increase in fluid pressure is used to overcome flow obstacles. Flow obstacles can be in the form of pressure differences, height differences or frictional resistance. In principle, the pump converts the mechanical energy of the motor into fluid flow energy. The energy received by the fluid will be used to increase the pressure and overcome the resistance contained in the channel through which it passes.

Figur 4, Pump

Hydroponic

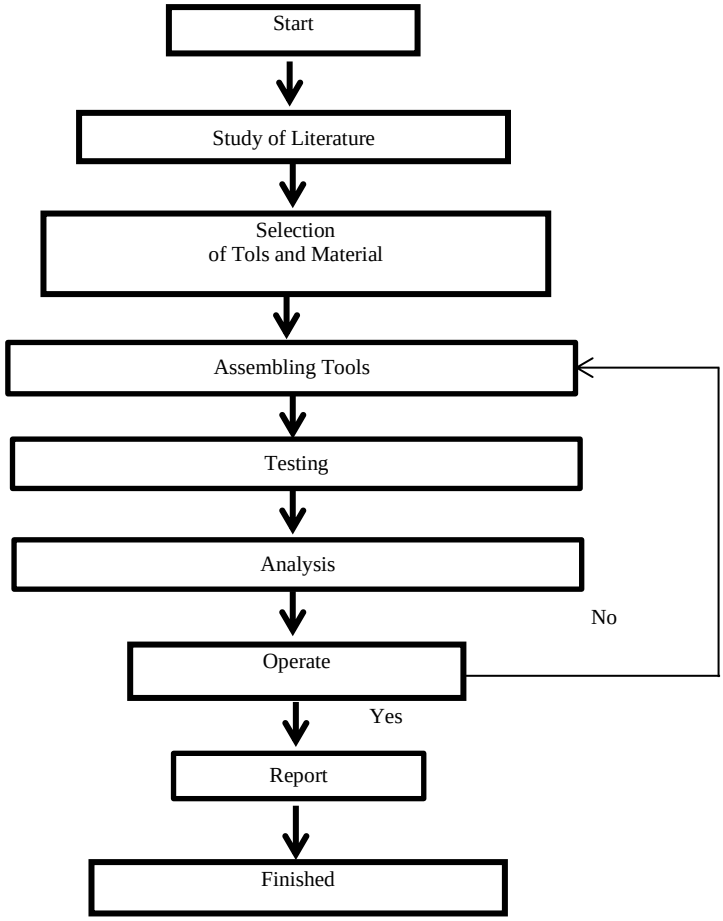
Hydroponics comes from the Greek words hydro which means water and ponos which means power. Hydroponics is also known as soilless culture or means cultivation without soil. So hydroponics means cultivating plants that utilize water without using soil as a planting medium. Providing the right nutrition and appropriate dosage is one of the factors that influences plant growth and development. The nutrition provided can be made yourself or can be obtained at agricultural shops.

Figur 5, Hydroponic

3. Methodology

This research begins with data collection, using two methods, namely:

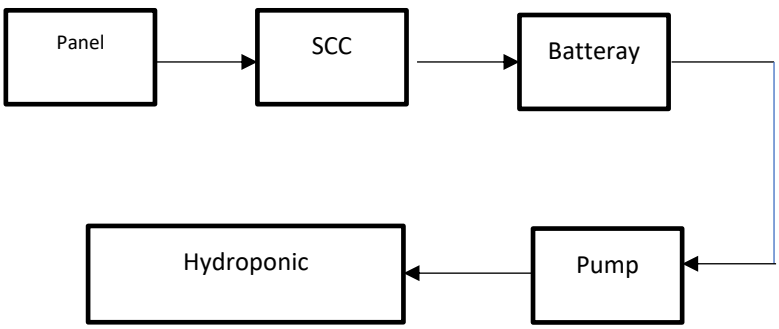
a. Observation is making direct observations at the research location of the objects to be researched and discussed and collecting as much data or information as possible related to the problem to be researched
b. Literature study is to obtain information that is used as initial data for determining system and component design needs for conducting design and research



Flow Chart

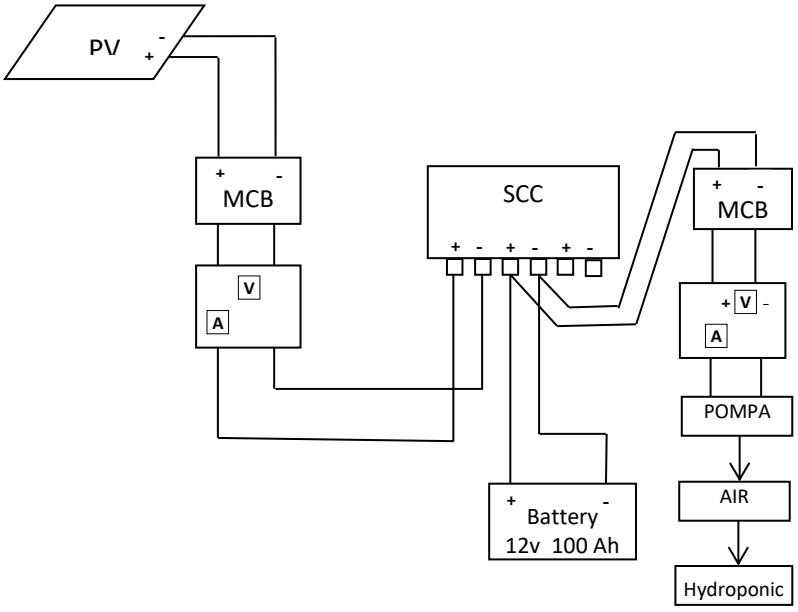
Figur 6. Flow Chart

Blok Diagram



Figur 7. Block Diagram

Wiring Diagram



Figur 8. Wiring Diagram

Sunlight is converted into electrical energy using solar panels. This electrical energy will be stored in the battery. Before entering the battery, the energy first passes through the Solar Charger Controller to control the electric current flowing from the panel to the battery so that battery charging will be stable and the battery will not be damaged quickly. For AC electricity needs, an inverter is needed to convert DC voltage to AC voltage. The electricity that has been stored in the battery will be channeled to a DC motor which will circulate the water in the hydroponic plants.

4. Result and Discussion

1. Measurement Of Charging From Solar Panels To Batteries

Table 1. Voltage and Current of Solar Panels from SCC

Time	Current	Voltage	Time	Current	Voltage
08.00	0	12,00	13.00	4,5	13,25
08.30	0,5	12,00	13.30	4,5	13,25
09.00	0,75	12,10	14.00	3	13,20
09.30	1	12,15	14.30	3	13,15
10.00	1	12,16	15.00	2,5	13,15
10.30	2	12,16	15.30	2,5	13,10
11.00	3	12,30	16.00	2	13,10
11.30	4	12,30	16.30	1	13,05
12.00	4	13,00	17.00	0,5	13,05
12.30	4	13,00	17.30	0,5	13,05

From the results of the test data in table 1, it is found that the Voltage and Current of the solar panels are influenced by the varying intensity of sunlight.

a. Voltage Versus Time

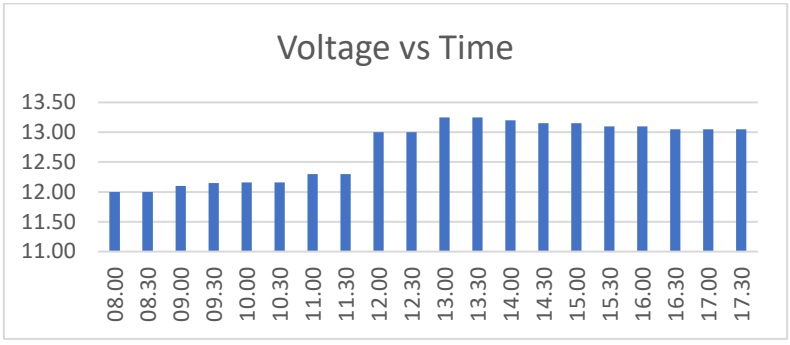


Chart 1. Voltge Versus Time

From the data in Chart 1, it can be seen that the voltage produced varies depending on the intensity of sunlight, weather, and time of day, as evidenced by the fact that at 09:00 the voltage produced was 12.10 Volt, at 09:30 the voltage produced was 12.15 Volt, while at 13:00 the voltage produced is 13.25 Volt and at 13.30 the voltage produced is 13.25 Volt

b. Current Versus Time

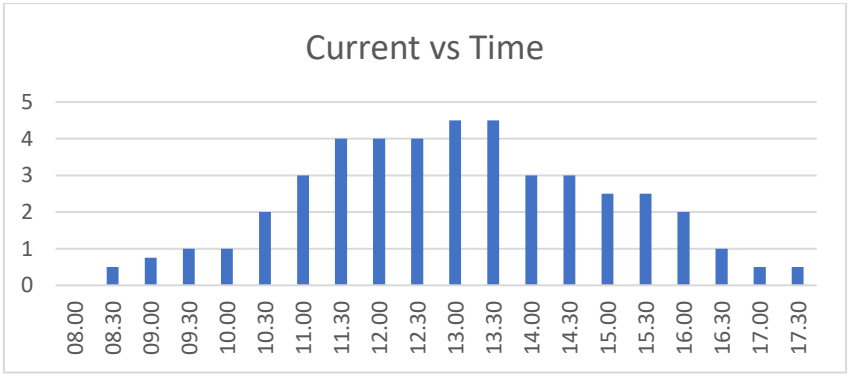


Chart 2. Current Versus Time

From the data in Chart 2, it can be seen that the current is also influenced by the intensity of sunlight, weather and time of day, as proven at 09:00 the current produced is 0.75 Ampere, at 09:30 the current produced is 1.00 Ampere while at 13:00 the current The resulting current is 4.5 Ampere and at 13:30 the current produced is 4.5 Ampere.

2. Measurement Of Electricity Usage From Battery To Pump

Table 2, Battery Voltage and Current To DC Pump

Time	Current	Voltage	Time	Current	Voltage
08.00	1,7	12,00	19.30	1,83	13,05
08.30	1,8	12,00	20.00	1,82	13,00
09.00	1,8	12,10	20.30	1,82	12,85
09.30	1,81	12,15	21.00	1,82	12,85
10.00	1,81	12,16	21.30	1,82	12,85
10.30	1,81	12,16	22.00	1,81	12,70
11.00	1,82	12,30	22.30	1,81	12,70
11.30	1,82	12,30	00.00	1,81	12,70
12.00	1,85	13,00	00.30	1,81	12,70
12.30	1,85	13,00	01.00	1,8	12,65

13.00	1,88	13,25	01.30	1,8	12,65
13.30	1,88	13,25	02.00	1,8	12,65
14.00	1,87	13,20	02.30	1,8	12,65
14.30	1,86	13,15	03.00	1,8	12,50
15.00	1,86	13,15	03.30	1,8	12,50
15.30	1,84	13,10	04.00	1,8	12,50
16.00	1,84	13,10	04.30	1,78	12,40
16.30	1,83	13,05	05.00	1,78	12,40
17.00	1,83	13,05	05.30	1,75	12,30
17.30	1,83	13,05	06.00	1,75	12,30
18.00	1,83	13,05	06.30	1,7	12,15
18.30	1,83	13,05	07.00	1,7	12,15
19.00	1,83	13,05	07.30	1,7	12,00

From the test data results in table 2, it can be seen that if the voltage is greater, the current will be greater too.

c. Voltage Versus Time

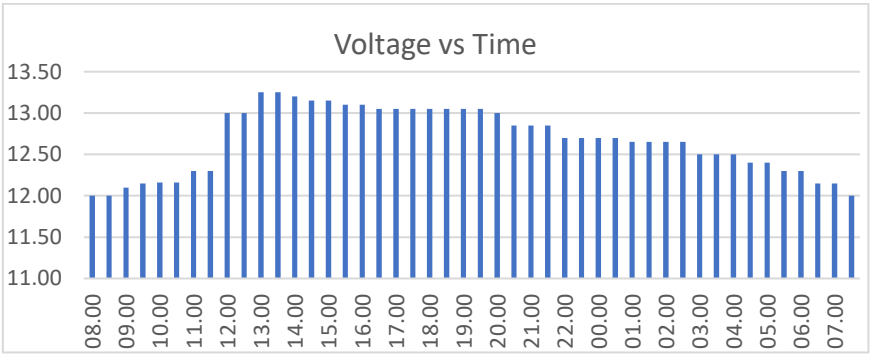


Chart 3. Voltge Versus Time

From the data in Chart 3, it can be seen that there has been a significant change in voltage increase over time as evidenced by the fact that at 09:00 the voltage produced was 12.10 Volt, at 09:30 the voltage produced was 12.15 Volt, while at 13:00 the voltage produced 13.25 Volt is produced and at 13.30 the voltage produced is 13,25 Volt.

d. Current Versus Time

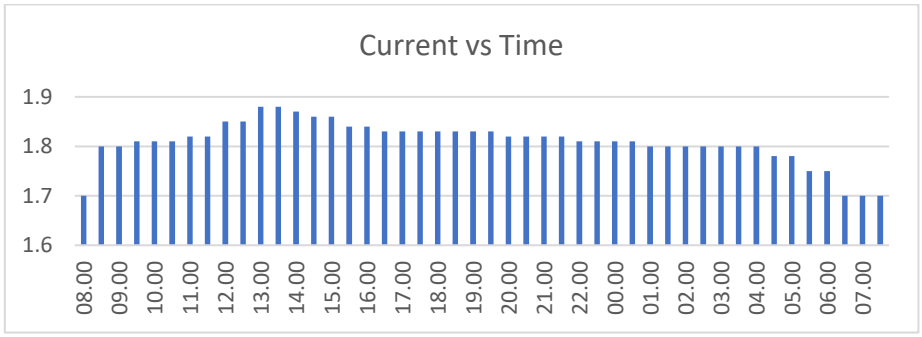


Chart 4. Current Versus Time

From the data in Chart 4, it can be seen that the greater the voltage, the greater the current as evidenced inat 09:00 the current produced was 1.80 Ampere, at 09:30 the current produced was 1.81 Ampere while at 13:00 the current produced was 1.88 Ampere and at 13:30 the current produced was 1.88 Ampere.

4. Conclusion

Based on the picture above, it is explained as follows:

1. Using 2x100 wp Solar Panels and installed in a parallel system
2. Then connect it to the MCB and digital ammeter voltmeter to determine the voltage and current. After that, connect it to the 12 Volt 20 Ampere SCC which functions to regulate overcharging (excess charging because the battery is 'full') and excess voltage from the solar cells.
3. After that the SCC is connected to the MCB to protect the electrical circuit from excessive current and to determine the voltage and current a digital ampere voltmeter is installed then connected to a 100 Ah battery then to a 12 Volt DC pump.
4. The 12 Volt DC pump is inserted into the bucket which is already filled with water and also the bucket as a water reservoir so that water circulation occurs.
5. After everything goes well, the hydroponic plant seeds are transferred to the pipe to provide nutrition so that the hydroponic plants can grow.

5. References

1. Ama, Idham. dkk. “, Future Water Tourism Attractions”. In the Morning Daily Fajar Makassar, September 7, 2014. Makassar. DOI : http://dx.doi.org/10.31963/sinergi.v16i1.1202 SINERGI NO. 1, TAHUN 16, APRIL 2018 62
2. Astuti, Septin Puji. 2013. “If a Country Depends Only on Petroleum” Kompasiana, April 11, 2013. Jakarta. Apollo, 2011.
3. Anonimous, Energy Generation System Teaching Materials 3. Ujung Pandang State Polytechnic. Bintaro, cart battery team. 2014. The Correct Way to Choose a Good Battery. (Online), akses, Oktober 7, 2014). IEA. 2008.
4. World Energy Outlook 2008, Paris. Ikawati, Yuni. 2011. “Developing Hybrid System Ships”. In Kompas, April 14, 2011. Jakarta. Kristian, Arianto Limbu et al. 2012. Final Report, "Design of Solar Cell Panels Using Transistors". Lukman, et al. 1993.
5. Thesis, “Making Solar Electric Cars”. Nardi, Adi dkk. 2011. Finalt Report, “Performance Test of a Hybrid Power Plant System with Solar Energy and Wind Energy On a Fishing Boat”.
6. Rocky Alfanz, F. M. (2015). Design and Construction of a Hybrid Electric Energy Provider (PLTS-PLTB-PLN) to Help Supply Residential Electricity. STORM, 4(2), 34-42.
7. Sham, Hardy. 1994. Basics of Flat Flow Electrical Engineering. PT. Rineka Cipta : Jakarta. Vries de Pieter, et al. Renewable Energy Handbook. Contained Energy Indonesia. Wibowo, Abdi. 2012.
8. Alternative Energy Teaching Materials. Ujung Pandang State Polytechnic. Yusuf, Muh. et al. 2013. Tips for Choosing a Battery (Online), (abuiramnews.wordpress.com/2013/11/25/tips-choosing-mobil-battery/, accessed October 7, 2014)