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PLTS Design for Small Industry Needs

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ABSTRACT

The need for electricity both for industry, offices, as well as the general public and individuals is increasing. However, this increase in electricity demand is not accompanied by an increase in electricity supply. Based on these problems, solar energy was chosen as an alternative energy to produce electrical energy. The tool used here is a solar cell, because it can convert solar radiation directly into electrical energy (photovoltaic process). In order for solar energy to be used at night, during the day the electrical energy produced is stored in a battery controlled by the regulator. The regulator output is directly connected to the inverter from DC to AC current. The results of the solar module test (photovoltaic) show that the average output power reaches 38.24 Watt, and the current obtained is 2.49 A (Amperes). This is because the photovoltaic when following the direction of the sun's movement will always position the photovoltaic to remain facing the sun so that it will still be able to capture the sun's rays optimally.

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1. INTRODUCTION

Energy is power which could used for To do various process activity covers mechanical energy, heat , etc. Therefore, almost all the strife in this world, stems from scramble source energy. There is a number of energy natural as energy alternative which clean, no polluted,safe and supplies no limited which known with renewable energy (Akhmad, 2011). New and renewable energy sources in the future coming will the more have role which very important in Fulfill needs energy. Thing this caused by use ingredient burn fossil for generator – generator electricity conventional in period time which long will drain source oil earth, gas and stone coal which the backup it's getting thinner (Budget et al., 2014).

Dependency to energy electricity moment this the more increase sharp, good from sector industry, office, housing area and house ladder need electricity. Energy electricity a lot used for effort and support activity each like fishermen, farmers and gardeners who need lighting for support their work process. Electricity requirements above boat for fisherman very important To use make it easy process arrest fish in night day (Meat, I. ketut, *et al* , 2019).

Power generation system development with the use of energy other than materials burn required To use support needselectricity Public. System generator electricity solar power (PLTS) is a resolution in handle problem this. Utilization energy Sun this including to in energy renewable, friendly environment and no cause pollution (Indartono & Yuli Setyo, 2008; Manan & Saiful, 2009). Area tropical like Indonesia has great potential in change energy sun Becomes energy electricity because location geographical Indonesia

which is at in line equator so that Indonesia accept ray sun which continuously throughout the year. For convert sunlight into other energy our could utilise help tool which works based on the photovoltaic process, namely in the form of solar cell (cell Sun) nor collectors.

Generator electricity power Sun is something system generator electricity where solar energy is converted into electrical energy by utilizing technology *photovoltaic.* Cell *Photovoltaic* / Panel the sun is tool main which working as catcher, modifier, and producerelectricity. The size of this tool is only about 5 X 5 or 10 X 10 cm square but has the ability to convert or generate power of 1 - 2 Watt. This tool is assembled into several arrays of solar cells - referred to as solar panels - according to the amount of power which desired. Tool this produce energy electricity DC.

Controller serves to regulate the amount of voltage before it is supplied to the load, as well as working as charger for fill in battery with utilise energy too muchfrom PLTS. Inverter working for change voltage DC Becomes AIR CONDITIONING. This tool veryimportant because cell the sun produces energy the electricity in the form of DC.

kWh meter is a tool used by PLN to calculate the amount of consumer power consumption. This tool is very common in society. Main section of a KWH meter is a voltage coil, current coil, aluminum disc, permanent magnet whose job it is to neutralize the aluminum disc from the induced magnetic field and a mechanical gear that records the number of rotations of the aluminum disc. This tool works using the magnetic field induction method where the magnetic field drive a disc made of aluminum. The rotation of the disc will move counter digit as appearance amount kWh his. In planning PLTSthis, kWh meters which used is kWh meters export Import

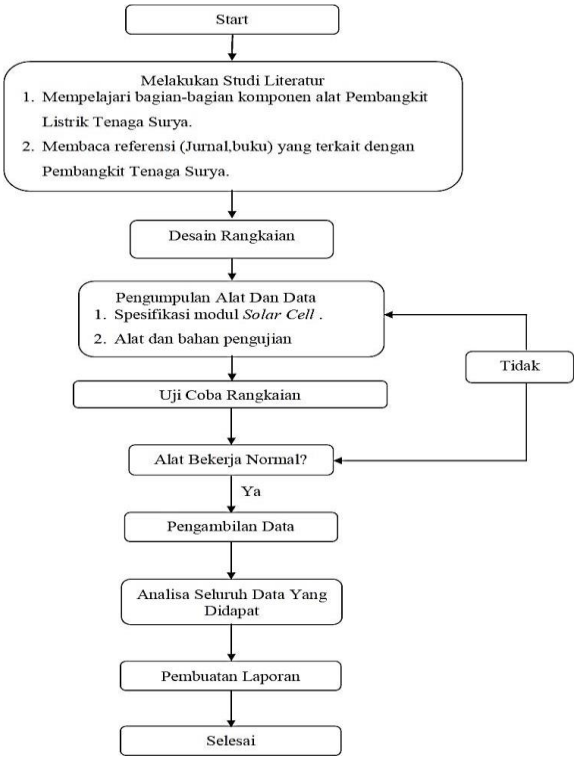
In study this will analyze designthe result of the design of the solar power generation system capacity 50 WP for small industry needs . With destination study for count characteristics power plants power Sun with use Solar Cell 50 WP and calculate the maximum power that generated by generator electricity power Sun which generated. So that it can be analyzed the performance of design system generator electricity power Sun for 50 capacity WP.

2. RESEARCH METHOD

Method which used in design A series of research steps were carried out, including:

1. Determination of the solar panels used, so that in its use does not cause damage to the solar panel that alone;
2. Determination component the regulator will used, so that in the app no occur error use which result in less good or can damage the solar panels or equipment electricity which installed later;
3. In terms of use components too considered aspect economical and condition which there is on the market, so that in the search for components did not experience difficulties.;
4. Egi _ aesthetics, design tool so that could made in such a way that it is neat, attractive and safe inits use;
5. Choose component which Graduated qualifications and according to system requirements, such as BCR and inverter (if there is AC load).

The flow of the PV mini-grid design research can be seen systematically in Figure 1 below:



Picture 1 . Diagram plot study

3. RESULTS AND DISCUSSIONS

Step beginning in study this is To do study literature and planning system which relating to cell power generation systems Sun as served in Figure 2

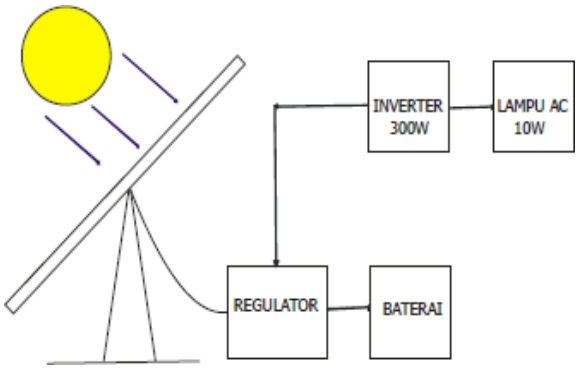


Figure 2 . Solar Cell Mounting Circuit

Based on Picture 2, diagram block PLTS which designed, then the working principle of Generating Simulation Solar Power (PLTS) made are as follows: following: the sun is shining, the radiation produced from light sun this then arrested by panel Sun photovoltaic. Panel Sun this is a combination from a number of cell Sun which the size is very small and thin both in series, parallel or a mixture (series and parallels), so that it becomes a panel Sun which enough big and could generate current and voltage which big also. The working principle of solar panels is that if light the sun hits the solar panel, the electrons which there is on solar cell will move from N to P, so that the output terminal

of the solar panel will be generate electrical energy. The amount of electrical energy that generated by panel Sun varies depending on from amount cell Sun which combined in panel Sun the. Output from panel this sun is in the form of electricity current unidirectional (DC) which big the output voltage depends on the number of solar cells installed in the solar panel and the amount of light the sun shining on the solar panels (Bansai, 1990).

Output from panel Sun this already could used directly to loads that require a source DC voltage with small current consumption. So that The electrical energy generated can also be used in conditions such as at night (conditions when panel Sun no irradiated light sun), so output from panel Sun this must in connect to a media storage *(storage)* , in Thing this is battery. But this no direct connectedso just from panel Sun to battery, but must connected to the Regulator circuit, where in Suite the there is Suite filler Battery automatic (*Automatic charger)* .

Connection battery with burden is connected parallel direct to burden. If battery the has filled with full. For protect battery due *to* overload or short circuit on burden, then before the battery is connected directly must pass through the circuit protection. Where function already enough clear, that is for protect or protect battery consequence existence burden which excessive *(over load)* or connect short on burden.

If wanted results output electricity from PLTSthis in the form of electricity current back and forth (AC) then PLTS capable of producing direct current (DC) electricity. must be connected to an electronic circuit / module 30 electronic which named *Inverter DC-AC* . Where *the DC-AC Inverter* serves to convert the current direct current (DC) into alternating current (AC). After direct electric current is converted into electric current back and forth, then the output from this inverter which has in the form of current back and forth this could direct used for feed equipment electricity and electronics which need current back and forth. the size voltage and power output which could connected burden later must in accordance with the capability of the *inverter* used and the size of the system storage which used (magnitude *ampere hour(AH)* or ampere o'clock from the battery).

In this study, the effect of angle of incidence of the sun to the output of the solar cell. Thing This aims to find out how much influence the angle of incidence of the sun and also how much influence corner the could ignored. Installation of a solar cell panel with a positionperpendicular to the direction of the sun's rays for knowing output maximum, whereas for knowing influence direction ray sun to output panel conducted with change the direction of the solar cell panel every 10 ^{o} until it reaches corner 45 to corner come sun. From steps the could is known influence direction ray sun to output cell panels Sun. Taking data position/angle sun very needed. It aims to find out how much big shift corner sun on hose time certain. Taking data this conducted o'clock 9.00 until 16.00. Test results can be seen in Table 1.

Table 1 . Voltage, current and power test results for various angle positions solar cells.

NO	JAM	POSISI TEGAK LURUS			POSISI BENTUK SUDUT		
		Tegangan (Voc)	Arus (A)	Daya Keluar (W)	Tegangan (Voc)	Arus (A)	Daya Keluar (W)
1	8.00	20,4	1,00	16,53	20,7	1,40	23,53
2	9.00	20,9	1,05	17,84	20,0	2,57	41,53
3	10.00	19,3	1,81	28,05	18,8	3,05	45,81
4	11.00	19,5	2,08	32,61	18,2	3,05	44,13
5	12.00	19,0	1,97	29,94	18,3	3,05	44,37
6	13.00	18,0	2,08	29,68	18,3	3,05	44,37
7	14.00	19,0	0,97	14,74	19,3	2,87	44,48
8	15.00	20,7	0,85	14,28	20,0	2,05	33,13
9	16.00	20,2	0,83	13,56	10,8	1,35	22,83
Rata - rata		19,67	1,40	21,91	18,27	2,49	38,24

With use data on Table 1 on could made chart connection Among voltage open circuit with respect to time, as in Fig 4.

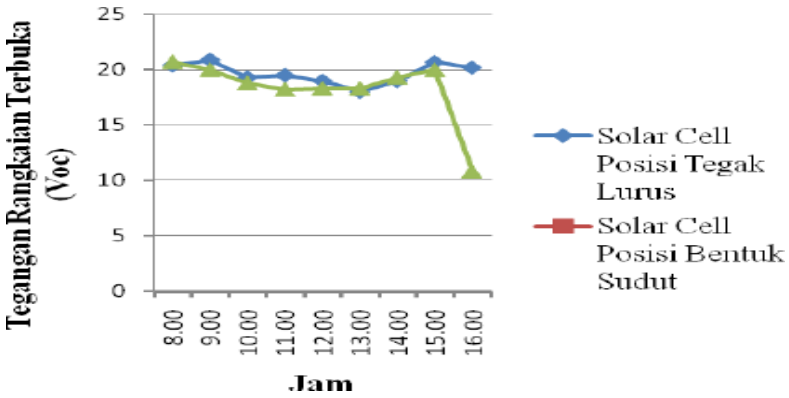


Figure 3 . Graph of the relationship between the circuit voltage open to time on cell Sun.

Based on Figure 3. explains that the value of measurement of the average open circuit voltage at solar module angular position of 18.27 V and obtained the average value of the short-circuit voltage at moment module Sun position upright (*horizontal*) as big as 19.67 V. Difference in open circuit voltage yield (Voc) which got because module Sun always positioned perpendicular to the sun so that the results obtained will be greater than with the solar module in an angled position. Furthermore, for knowing comparison current connection short to time could seen on Figure 4.

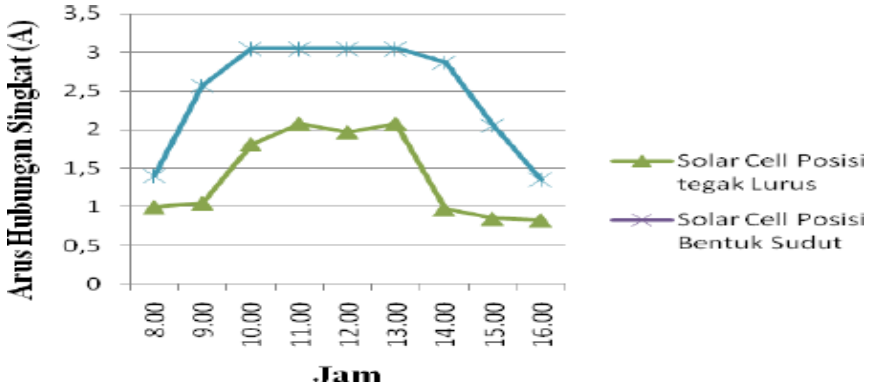


Figure 4. Comparison graph between relationship current short against time on cell Sun.

Picture 4 explain that current which generated by module Sun which shape corner greater than the current generated by the solar module in an upright (*horizontal*) position have nature static, Thing this occur because irradiation which arrested module Sun on position shape corner more big so that current which arrested on position shape corner more big because the greater it is score irradiation so the more big also score the irradiation. From the data from the measurements made then obtained the value of the average measurement of the current short on the solar module at an angle of 2.49 A and obtained the average value of the current short on moment module Sun position upright straight (horizontal) as big as 1.40 A. For knowing Learn more about the value of the power ratio the output against time on the solar cell, can be seen on picture 5.

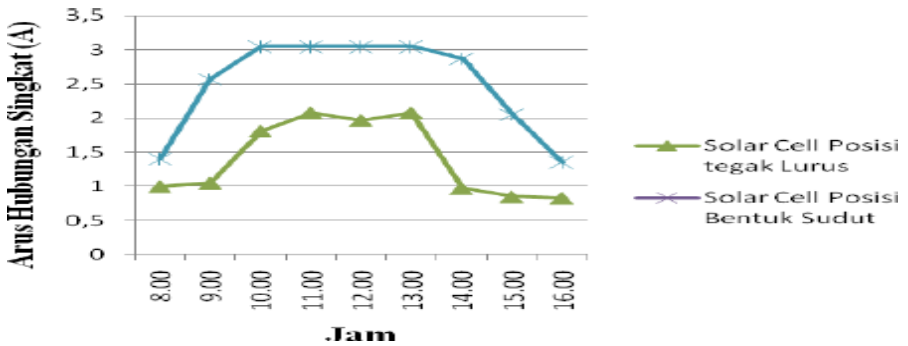


Figure 5 . Chart comparison Among power outputto time on solar cells.

From open circuit voltage (V_{oc}) and Current connect short (I_{sc}) which in get on moment testing so generated power output with multiply factor filler (FF) on module the sun so that the output power comparison graph is obtained at an angle with the solar module at moment position upright straight. Power output average which generated on moment module Sun position shape angle of 38.24 W and obtained the average value of power output on moment module Sun position upright straight (*horizontal*) of 29.6 W.

4. CONCLUSION

From results generator design analysis solar electricity in small industries can the following conclusions are obtained: (a). Characteristics from the Design, namely: the tilt angle position of the solar module when following the direction of movement of the sun produces open circuit average voltage (V_{oc}) 18.27 V and average short circuit current (I_{oc}) 2.49 A; and position perpendicular (*horizontal*) produces an average stress open circuit (V_{oc}) 19.67 V; Meanwhile, the average current flat connection short ($_{Ioc}$) _ 1.40 A; (b) Position corner the tilt of the solar module when following the direction of movement sun produce Power Output (*Pout*) _ as big as 38.24 W and position upright straight (*horizontal*) generate Power Output (P_{out}) 21.91 W

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REFERENCES

Ahmad, Khalid, (2011), Generator Electricity Power Sun and Application For Area Isolated, *Journal Dynamics engineering* , 1(1): 28-33

budget, IWGA, Kumara, INS, Giriantari, IAD,(2014), Study on Power Generation Performance Electricity Power Sun 1,9 _ kw In University Udayana Hill Jimbaran, Spectrum, 1(1): 118-122.

Bansai, NK, et al., (1990), *Renewable Energy Sources And Conversion Technology* , Tata McGraw-Hill Publishing Co. Limited, New Delhi .

Meat, I. ketut, et al. "Design Get up Generator Electricity Power Sun AsPower Source For Scale Fishing Vessel Small In Regency Pangkep, Sulawesi South." Journal marine and Fishery Applied (JKPT) 2.1 (2019): 33-40

Hassan, H., (2012), design Generator Electricity Solar Power on Saugi Island, *Research Journal and Marine Technology* , 10(2): 169-180.

Indartono, Yuli Setyo. "Crisis Energy in Indonesia: Why and Must How."*Magazine INNOVATION* 18 (2008

Karmiathi, NM, (2011), Solar Module Design Cell With Utilise Component photovoltaic Compatible , *Journal Logic* , 11.

Manan, Saiful. "Energy Sun, Source Efficient, Reliable and Alternative Energy Friendly Environment In Indonesia." *Echo technology* (2009).

Meilani, Hilma, and goddess Wuryandani. "Potency Hot Earth as Energy Alternative to Fossil Fuels for Generator Power Electricity in Indonesia." Journal Economy & Policy Public 1.1 (2010): 47-74.

Rahayuningtyas, A., Kuala Lumpur, SI, and Apriyanto, F., (2014), Studies Planning System Generator Electricity Power Sun (Plts) Scale House Simple In Area Rural AsAlternative Power Generation To Support Program Friendly Environment And Energy renewable, *Proceedings SnaPP 2014 Science,Technology, and Health* , pp. 223-230

Subandi, slamet Hani, (2015), Generator Electricity Solar Energy to Drive Water Pump With Use Solar cell, *Journal Technology Technoscientia* , 7(2): 157-163.

Ubaidullah, Suyitno, juwana, Authority Endra, (2012), Development Device Hybrid thermoelectric – Cell Sun As Generator Electricity House Ladder, Journal R&D Province Java Middle,10(2): 194-211.

Widodo, Djoko Adi, Suryono, Tatyantoro A, (2010), Empowerment Energy Sun As Energy Electricity Lamp Regulator Then cross, *Journal Electrical Engineering* , 2(2): 133-138