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Electric Power Optimizing Of Solar Panel SystemThrough Solar Tracking Implementation; A Case Study in Pekanbaru

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***Abstract*—**Observations and measurements have been conducted towards a solar panel electric power output that is utilized by a solar tracking system. The electrical power output depends on the position of the sun and time and the direction of the panel surface against the angle of the incident light. For power optimization, the solar panel surface should always be directed perpendicular to the direction of the sunlight falling to the surface of the panel. The application of the solar tracking system controlled by a micro controller gives the expected results. The electrical power output of a static solar panel mounted on a fixed position becomes the benchmark of the output electric power value in this study. The measurement results of the electric power output of the solar panel with sun tracking system shows a significant increase in sunny weather conditions.The average increase of that is about 57.3%.

Keywords*:* LDR, micro controller, optimal power output, performance improvment, sun tracking,

I. INTRODUCTION

Demand of electric power is increasing so high in Indoneia. Meanwhile electric power production is growing slowly. Since that the use of photo voltaic or solar panel to produce electricity grows rapidly during last few years. It is and alternative electricity source [1] particularly at remote areas which there is no near by power plant. In addition, solar energy is environmental friendly as compared with other energy sources. Although it has being widely used for supplying electricity, solar panels however are mostly fix installed. The application of that is usually mounted on static structure. It means that incident sun rays will not be able alway to perpendicular to the panel surface. So that the angle of coming sun rays to panel surface vary ith sun position. The optimum power output will be achieved only if sun position exactly perpendicular to panel surface. Regarding that manner, it is nesessary to apply sun tracking method to solar panel system. Sun tracker detect the sun position and control the panel [1, 2]. Sun-tracker drives the solar panel and keeps the panel surface remains perpendicular to the sun position. It will be able to gain desired optimum power output of the solar panel.

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II. METHODOLOGY

A. Experimental mechanism

This study implements an experiment and measurement based upon build and design methodology. The structure of the system is composed based on two degree of freedom movements. The panel is able to move toward – backward, left – right in 180º range. So the panel surface can be kept always in perpendicular against to the the sun rays. Light dependentresistor (LDR) and a micro controller are utilized the solar panel through motor drives system.

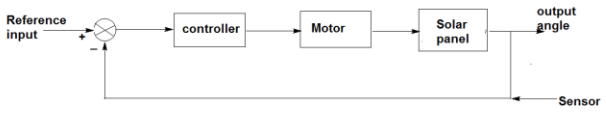

Fig 1. Sun tracker control diagram

The observation and measurement to the system take place at 8.00 a.m. – 5.00 p.m.
A set of LDR is sensing element responsible for working system of the sun tracking. The position of the LDRs are

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critical here and the set of LDR which corresponds to this vertical plane movement is so positioned that it senses the sun light accurately and tries to keep the panel perpendicular to the sun rays by moving the motor in the appropriate direction through a definite number of stepped rotations. The LDR sensing is actually accurately received and interpreted by amicrocontroler.

B. Measurement And Data Collection

Two solar panels from same type are prepared. One panels is supported by a sun tracker. So that this panel is dynamic or mobile system. The another one is not supported by a sun tracker so it is immobile or static. Measurement procedure is described on the following flowchard (Figure 2).

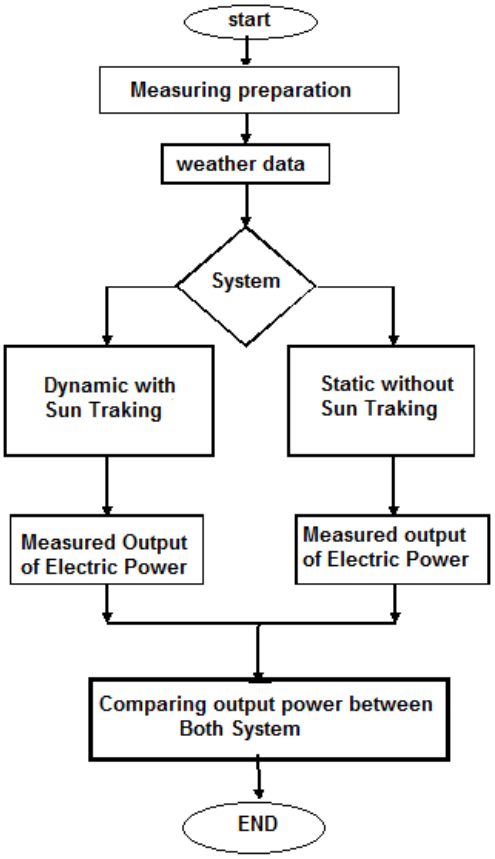

Fig 2. Flow chart of measurement procedure of electric power output for two sytems, dynamic and static system.

Data of daily weather condition are crecorded which include temperature, humidity and sky clearness before measuring electric power output of both system. Their electric current output are simultaneously measured. The measurement of those are run based upon 15 minute interval start from 8.00 a.m. to 5.00 p.m.By setting up constant voltage , the electric power output is obtained.

The associate power output is computed by utilizing the following equation;

$$P = I \times V \qquad \text{in Watt.} \qquad (1)$$

Where P is produced electric power, I is output current and V is voltage.

Performance improvement can be computed using the following formula,

$$\eta = \frac{P_D}{P_D + P_S} \times 100\% \qquad (2)$$

The following chart presents output current of the panels either with sun tracker or without sun tracker.

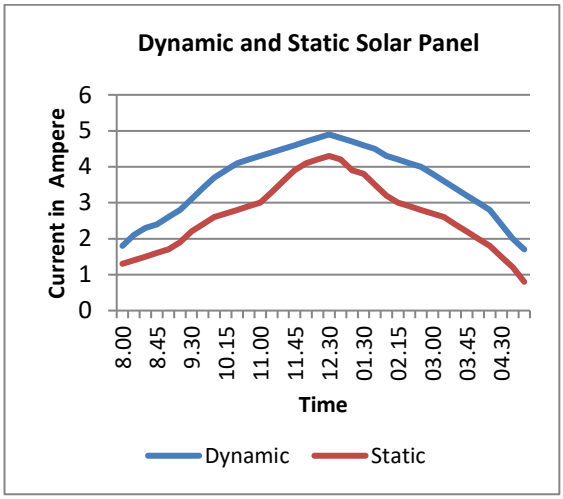

Fig 2. The output currentgeneration comparison of applied tracking system and fixed angle system.

III. RESULT AND DISCUSSION

Output power of both systems, dynamic and static system are computed based on average current.

Using equation(1)in previous section under 12 Volt electricity voltage, it gives the following result; Average Power for dynamic solar panel is equal to 43 Watt and the average power for static of that is equal to 32.03 Watt. Implementation of sun tracking to solar panel system instalation by using equation (2) has improved the output power equals to 57,3 %. The improvement of solar panel generator through sun tracking implementation give advantages not only for electricity sources development erspective but also for environment perspective.

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IV. CONCLUSION

The implementation of sun tracking system makes the system capable of adjusting panels surface always to be perpendicular against sun position. As a result optimum output power is obtained. Performance improvment equals to 57.3 % is a great value. Sun tracking system is considered so powerful to gathering solar energy and give promisse for future energy supply development.

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