UNIVERSITI TEKNIKAL MALAYSIA MELAKA

INVESTIGATION OF HEAT DISPERSION VIA PASSIVE COOLING TECHNIQUE ON SOLAR PANEL

This report is submitted in accordance with the requirements of the University Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Electronic Industry Technology (BEEI) with Honours.

by

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I hereby, declared this report entitled INVESTIGATION OF HEAT DISPERSION VIA PASSIVE COOLING TECHNIQUE ON SOLAR PANEL is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Electrical Industry Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Electronic Industry Technology (BEEI) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Penggunaan Sistem suria digunakan secara menyeluruh di dunia sebagai bahan tenaga yang boleh diperbaharui, kerana tenaga suria mudah didapati di dunia ini. Suhu yang bersesuaian untuk panel PV ialah 25°C. Di Malaysia berdasarkan usaha peyelidikan yang teliti, suhu sekitar kira-kira 34°C. Fenomena ini nampaknya tidak berbaloi dengan kos yang tinggi yang dilaburkan untuk panel PV kerana tidak mungkin untuk mencapai 25°C di Malaysia. Kecekapan tenaga eletrik akan berkurangan apabila suhu operasi panel PV meningkat, Apabila panel PV menyerap radiasi sinaran matahari, suhu operasi panel PV akan meningkat. Ojektif untuk projek ini adalah untuk menambahbaik kecekapan tenaga panel PV dengan menggunakan teknik penyejukkan secara pasif. Aluminium dan silikon dipilih sebagai bahan untuk dijadikan *heatsink* untuk sistem penyejukkan. Dengan mengukur arus eletrik dan voltan menggunkan meterpelbagai, analisis berkaitan kecekapan tenaga terhadap panel PV dapat dilakukan. Jangkaan keputusan akhir projek ini, suhu optimum dapat dicapai dengan menggunakan *heatsink* sebagai bahan untuk sistem penyejukkan secara pasif. Perbandingan antara aluminium dan silikon akan dilakukan dari segi suhu, voltan dan arus elektrik. Projek ini akan memberikan manfaat terhadap industri suria dengan melakukan penigkatan untuk sistem suria.

ABSTRACT

Solar system is the most widely used in the world as renewable energy source, even there are many renewable energy source, solar energy source is easy to get in this world. The optimum temperature for PV panel is 25°C. In Malaysia the ambient temperature around us is about 34°C based on the meticulous effort of research. This phenomenon doesn't seem worth it with the high cost invested on PV panel because in Malaysia it's impossible to reach the 25°C. The efficiency of PV panel will decrease when the PV operating temperature increases. The working temperature of the PV panel will be raised as the PV panel receives excess solar radiation. The objective for this project is to improve the efficiency of solar panel by using passive cooling system. Heatsink aluminium and silicone are selected to be the material for cooling system. To analyze the effectiveness of cooling system on PV panel by measuring specific parameter like current, voltage and temperature by using multimeter. The expectation result for this project is PV panel will reach the optimum temperature with heatsink aluminium and silicone as the passive cooling system material for PV panel. Material aluminium and silicone will be compared in term of temperature, voltage and current. This project is very useful for solar industry as it introduced a better improvement to the solar system.

DEDICATION

I would like dedicate this to my beloved parents

ACKNOWLEDGEMENTS

Alhamdulillah and thanks to ALLAH because give opportunity to do this project and give opportunity to use some ideas to complete Final Year Project (FYP) and this report. Secondly, I would like to thanks to my supportive and helpful supervisor, Encik Zaihasraf Bin Zakaria for guide, give some advices and criticism during the final year project progress. This report could not accomplished without the splendid support and cooperation by him. Lastly, I would like to thank to my family especially my parents that support the budget for this project and friends those who working with us, encourage us, support and help us in completing this final year project.

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A	Ampere
V	Volt
°C	Temperature in Degree Celsius
W/m^2	Ambient Radiation

LIST OF ABBREVIATIONS

PV	Photovoltaic
PSPV	polycrystalline silicon photovoltaic
AC	Alternating current
DC	Direct current
V	Voltage

CHAPTER 1

INTRODUCTION

This chapter briefly introduced and explained about student's project and any issues related to the function of solar panel or photovoltaic system towards society and industries. Following the overview of the project, this chapter presents the statements of problem that defined the problem into the context of the project. The objectives of the project also presented in order to describe the direction of this project. The limitation or scope of the project also presented briefly in this chapter. The following details are consists of the background of project overview, problem statement, project objectives, project scope and outcome of the project regarding the topic of the project Design of Passive Cooling system Technique on Solar Panel.

1.1 Background

Renewable energy has become the alternative clean energy that has been used in Malaysian. One of the renewable energy that has become increasingly used in Malaysian is solar. The weather in Malaysian, make solar as a perfect choice to use as renewable energy but need to use a cooling system for solar to get the maximum efficiency. The spectrum of solar that coming from the sun will cover about 250 nm to 2500 nm in wavelength.

1.2 Objective

1. To improve the efficiency of solar panel by using passive cooling
2. To monitor the temperature on PV panel during sunny day.
3. To analyze the effectiveness of cooling system on PV panel efficiency

1.3 Problem Statement

The PV panel is device that convert solar radiation into electricity. However, during the operation of PV panel, only certain percentage of solar radiation converted to electricity but the rest of solar radiation converted into heat. The main problem about PV panel is the efficiency will be reduced when temperature increasing. The ideal temperature to get the highest efficiency of PV panel is 25°c.

Since, the temperature in Malaysian is 35°c, the efficiency of PV panel will reduce and impossible to achieve 25°c for PV panel to operate in ideal temperature. This phenomenon will effects the PV panel efficiency and not worth with high cost because it is impossible to get the ideal temperature due the temperature in Malaysian.

The main problem for this research is how to cooling system for PV panel using heat sink to heat transfer from PV panel. So, when the PV panel operate using this cooling system the temperature will reduce and the efficiency of PV panel will increase. Consumer will get the maximum output of PV panel. Direct current (DC) electricity is what solar panels produce, and electricity is the type used on the grid and in most household appliances while alternating current (AC).

1.4 Scope project

This project purpose is focuses on solar maximum output efficiency during days on sunny day using cooling system that using heat sink. The heat sink that will using during this project is aluminium and silicon. The reason of using two material is to compared which is the best material to heat transfer. Next, this project will use different construction of heat sink to get the best air flow to get the maximum heat transfer and reduced the temperature. When, the temperature reduced, the vital parameter will measure using multimeter.

1.5 Project methodology

1. Study the problem statements and the effectiveness of heat sink as a new cooling system method.
2. Develop the cooling system for photovoltaic panel using heat sink
3. Design and construct the heat sink design to applied on photovoltaic panel.
4. Data measurement according to the output parameters.
5. Analysis the data measurement regarding the generated output parameters.
6. Overall discussion on the capability and effectiveness of heat sink to reduce temperature on photovoltaic panel as new method of cooling system for photovoltaic panel.

1.6 Expectation Result

The expectation of the project is to reduce the temperature on the PV with cooling system that using a heat sink as the heat transfer using sunny days because impossible to achieve the maximum efficiency output of solar energy in Malaysia due the weather temperature in Malaysian is 35°c and the ideal temperature for solar panel is 25°c. Beside that, consumer will get the maximum efficiency output of solar energy. Consumer will save their money. However, all of the expectations result is depended on the construction and the material use in this project. This project is very useful and can generate more electrical power

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter is literature review section, this section will cover about the temperature effect on the photovoltaic (PV) panel efficiency and this section also will be explaining about the solar radiation, output efficiency and will be described about the material that will be use for the heat sink. The construction of heat sink will affect the temperature on the PV panel due to the air flow will pass through and reduced the temperature with using heat transfer. So, this section will compare all the article and report and cooling system.

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2.2 Temperature Effect on The Photovoltaic (PV) Panel Efficiency

As the photovoltaic panel temperature increases, its output current rises exponentially, while the output voltage and efficiency are reduced linearly. In fact, the reduction in voltage is so predictable that it can be used very well to accurately measure temperature. As a result, heat can severely reduce the power output of the photovoltaic panel [1] The steady-state power balance determines the temperature of the PV plate. Under temperature changes, solar cells differ; the temperature rise will influence the strength, the output from the cells. A relationship between efficiency, sun radiation and temperature is proposed in this paper and simulated under a gloomy atmosphere and the ambient temperature PV module can be obtained for the desired efficiency [2].