SUPERVISOR ENDORSEMENT

"I hereby declare that I have read through this report entitle "Investigation to maximize the energy output of single axis photovoltaic solar tracking system" and found that it has comply the partial fulfilment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation, and Automation)".

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Supervisor's Name : DR. CHONG SHIN HORNG

Date : 23/6/2016

INVESTIGATION TO MAXIMIZE THE OUTPUT ENERGY OF SINGLE AXIS PHOTOVOLTAIC SOLAR TRACKING SYSTEM

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A report submitted in partial fulfilment of the requirements for the degree of

Bachelor in Electrical Engineering (Control, Instrumentation, and Automation)

Faculty of Electrical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DECLARATION

I declare that this report entitle "Investigation to maximize the energy output of single axis photovoltaic solar tracking system" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : ....

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Date : ....23/6/2016..........................

DEDICATION

To my beloved parents that has never failed in inspiring and mapping my steps with purpose.

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First of all, I would like to thank almighty God for the strength and blessings. I would also like to express my deepest gratitude to my supervisor, DR. CHONG SHIN HORNG for guiding me throughout my final year project development. Knowledge and extra input given by her has highly motivated me to successfully complete this project. The information, suggestions and ideas given by them played huge role in developing a fully functional project.

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ABSTRACT

Major depletion of fossil fuel and the increase of greenhouse gasses such as carbon dioxide, chloroflurocarbons (CFCs), hydrofluorocarbon(HFCs), perfluorocarbons(PFCs) and sulphur hexafluoride(SF_6) worldwide are the catalyst for the interest of many countries towards renewable energy. The rising cost of electricity due to higher demand and less resource also led to the renewable energy venture. One of the most famous renewable energy is solar energy. Unfortunately, renewable energies are dependent on environmental conditions. One of the major problem that affects the output energy of the solar panel is the cloud shadowing problem. Photovoltaic solar and wind hybrid systems are developed to reduce the effects of the cloud shadowing by harvesting two different energy resources. This project focuses on the research to maximize the laboratory-scale single axis photovoltaic solar tracking system. The first objectives of this project is to investigate the influence of cloud shadowing on the output energy of the solar panel and the possibilities of hybrid photovoltaic and wind system in Malaysia. The first accomplished by conducting a series of experimentation using a polyethylene sheet to represent the cloud shadowing. The hybrid system's possibilities in Malaysia are determined by analysing the availability of wind energy as a stable energy resource in Malaysia. This is determined by researching the availability of wind in Malaysia and Melaka using previous research paper and journal's findings. Solar harvesting in Malaysia can be done as the solar irradiance level in Malaysia is good but to hybrid it with wind source, the wind have to be consistent, only then the hybrid system will be effective. The second objective is to propose a photovoltaic solar array in the laboratory-scale single axis solar tracking system to maximize the output energy of the solar panel. The solar panel number is increased to construct a solar panel array. The investigation of the cloud shadowing's effects on the solar panel array is done to choose the best configuration for the array. The final objective would be to validate whether the solar panel array has maximized the output power of the laboratory scale solar tracking system. Validation is done by experimentation and comparing the output power.

ABSTRAK

Pengurangan utama bahan api fosil dan peningkatan gas-gas rumah hijau seperti karbon dioksida, chloroflurocarbons (CFCs), hydrofluorocarbon(HFCs), perfluorocarbons(PFCs) dan heksafluorida (SF6) sulfur di seluruh dunia ialah pemangkin untuk kebanyakkan negara untuk menujukan tenaga dalam usaha mengeksplorasi tenaga boleh diperbaharui. Kenaikan kos bekalan elektrik disebabkan permintaan lebih tinggi dan kekurangan sumber juga menjadi pemangkin kepada usaha untuk mengeksplorasi tenaga boleh diperbaharui. Satu daripada tenaga boleh diperbaharui yang paling terkenal ialah tenaga suria. Malangnya, tenaga boleh diperbaharui bergantung kepada keadaan persekitaran. Salah satu masalah utama yang menjejaskan tenaga output panel suria ialah awan yang menghalang cahaya dan sinaran matahari kepada panel suria. Sistem hibrid fotovolta suria dan angin dibangunkan untuk mengurangkan kesan awan yang membayangkan dengan menuai dua sumber tenaga lain. Projek ini berfokus kepada penyelidikan untuk memaksimumkan sistem fotovolta penjejakan suria berpaksi tunggal skala makmal.Objektif pertama projek ini adalah untuk menyiasat pengaruh pembayangan awan kepada tenaga output panel suria dan kemungkinan hibrid fotovolta dan sistem angin di Malaysia. Satu siri experiment dijalankan mengunakan helaian polietilena mewakili pembayangan awan. Kesesuaian sistem kacukan di Malaysia ditentukan dengan menganalisis samaada tenaga angin adalah satu sumber tenaga stabil di Malaysia. Ini ditentukan dengan mengkaji ketersediaan angin di Malaysia dan Melaka menggunakan penemuan kertas penyelidikan dahulu dan jurnal. Menghasilkan tenaga dengan tenaga suria di Malaysia boleh dilakukan kerana sinaran suria dan irradian solar di Malaysia baik tetapi kesesuaian sistem hibrid perlu ditentukan oleh sumber angin, angin perlu konsisten. Jika tenaga angin didapati kuat dan konsisten, maka sistem kacukan akan berkesan. Matlamat kedua adalah untuk mencadangkan satu peningkatan bilangan panel kepada sistem fotovolta penjejakan suria berpaksi tunggal skala makmal untuk memaksimumkan tenaga output panel suria. Bilangan panel suria dinaikkan untuk membina tatasusunan panel suria.

Siasatan kesan pembayangan awan di tatasusunan panel suria dibuat untuk memilih tatarajah terbaik untuk tatasusunan. Matlamat terakhir adalah untuk mengesahkan sama ada tatasusunan panel suria telah memaksimumkan kuasa keluaran sistem penjejakan suria skala makmal. Pengesahan dibuat oleh percubaan dan membandingkan kuasa keluaran. Cara experiment dibincangkan dalam bab 3 dan penemuan dianalisiskan dalam bab 4. Chapter 5 akan berakhir kerja projek ini.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

Many countries throughout the world have set their goals in providing reliable, environmentally friendly and affordable energy. The rising consumption of energy and falling accessibility of natural resources such as fossil fuels are increasing the cost of electricity. As the world industries such as manufacturing, develop, the emission of greenhouse gasses are becoming a threat to the natural ecosystem. Due to this, the renewable energy has received tremendous attention, be it the developed or the developing nations [1]. Another major reason is the rapid depletion of fossil-fuels worldwide, that has became the catalyst to urge the search for alternative energy resource and renewable energy [2].

Countries across the globe are currently showing interest towards harvesting renewable energy resources. Renewable energy resources such as solar and wind energy have enough potential to become an important source for power generation in the future due to environmental, social and economical benefits [3]. A growing interest in renewable energy resources had been observed for several years where the sources are non-polluting, free in their availability and continuous. A system that combines different sources of energy is called a hybrid system. Wind and photovoltaic generators are utilized in remote and far from conventional power system and hybrid system of wind and photovoltaic is