UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND PERFORMANCE EVALUATION OF AN OFF-GRID SOLAR SYSTEM FOR SMALL APPLICATION

Submitted in accordance with the requirement of the University Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering

by

SITI NUR SYAZWANI BT KUNYAHAMU

B051510134

960330-11-5504

FACULTY OF MANUFACTURING ENGINEERING

2019

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: **DESIGN AND PERFORMANCE EVALUATION OF AN OFF-GRID SOLAR SYSTEM FOR SMALL APPLICATION**

Sesi Pengajian: **2018/2019 Semester 2**

Saya **SITI NUR SYAZWANI BINTI KUNYAHAMU (B051510134)**

mengaku membenarkan Laporan Projek Sarjana Muda (PSM) ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. *Sila tandakan (√)

☐ SULIT (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysiasebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)

☐ TERHAD (Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/ badan di mana penyelidikan dijalankan)

☒ TIDAK TERHAD

Disahkan oleh:

Alamat Tetap:
LOT 6108 JALAN TEPI ASRAMA SMKTIZ,
23000 DUNGUN TERENGGANU.

Tarikh: 26/6/19

Cop Rasmi:
Dr. Mohd Najib Bin Ali Mokhtar
Pensyarah Kanan
Fakulti Kejuruteraan Pembuatan
Universiti Teknikal Malaysia Melaka (UTeM)
Hang Tuah Jaya, 76100 Durian Tunggal, Melaka

Tarikh: 26/6/19

*Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I declared this report "Design and Performance Evaluation of an Off-Grid Solar System for Small Application" to be the results from my own fieldwork except where mentioned in references.

Signature : 

Author's Name : SITI NUR SYAZWANI BT KUNYAHAMU

Date : 24 DECEMBER 2018

APPROVAL

This report is submitted to UTeM's Faculty of Manufacturing Engineering as a partial compliance with the Bachelor of Manufacturing Engineering (Hons.) requirements. The supervisory member is as follows:

.....

Dr Mohd Najib bin Ali Mokhtar

(Project Supervisor)

Dr. Mohd Najib Bin Ali Mokhtar
Pensyarah Kanan
Fakulti Kejuruteraan Pembuatan
Universiti Teknikal Malaysia Melaka (UTeM)
Hang Tuah Jaya, 76100 Durian Tunggal, Melaka

ABSTRACT

This research addresses the evaluation of a solar powered with high powered led. The goal of this research is to conduct within attempt to evaluate a solar system from different electrical component and propose a better power lighting system. Throne the evaluation of the problems is usually lighting using high power LED from solar system can be operated normally for 3 to 4 hours only. This research is need to study and identify the basic components of electrical that can be used in solar circuit. Therefore, the objectives of this research are to study and identify the energy efficiency of different components within solar system and to study the performance of the solar system for lighting application.

ABSTRAK

Kajian ini bertujuan untuk membuat penilaian penjanaan kuasa yang dihasilkan dari solar tehadap lampu LED. Matlamat kajian ini adalah untuk menjalankan dalam tempoh percubaan untuk menilai satu sistem solar dari komponen elektrik yang berbeza dan mencadangkan sistem lampu kuasa yang lebih baik. Kebiasanya, lampu menggunakan kuasa tinggi LED dari sistem suria boleh dikendalikan biasanya selama 3 hingga 4 jam sahaja. Kajian ini adalah perlu untuk mengkaji dan mengenal pasti komponen asas elektrik yang boleh digunakan dalam litar Suria. Oleh kerana itu, objektif kajian kali ini demi mengkaji turut mengenalpasti kecekapan tenaga komponen-komponen yang berbeza dalam sistem suria dan kajian prestasi sistem solar untuk lampu permohonan.

DEDICATION

For loving, helping and supporting my cherished parents, siblings and friends

ACKNOWLEDGEMENT

First of all, I want to say thank you to my supervisor at PSM, Dr. Mohd Najib bin Ali Mokhtar for his kindness, guidance, experience, advice, constructive ideas, and spending time for discussion regarding this project. He has been "turned me on, turned me around, and boosted me up" with the gift of believing in myself.

Furthermore, to my fellow course mates of 4BMFG who never has been bored to share ideas and state of mind regarding my project; thanks for your time, effort, and opinions. Last but not least, this also goes to my family at home who never stop giving me moral and financial support, especially my parents. The best education starts at home.

TABLE OF CONTENT

CHAPTER 3: METHODOLGY

CHAPTER 4: RESULT AND DISCUSSION

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

In this chapter, the overall assessment of the study explains what the project is about, the purpose of the research on this project and the restrictions of the respected study. The overall report framework of the field of study is discussed briefly in order to achieve a proper visualization of the successions of the entire report of this project.

1.1 Background of Study

With the escalation of the worldwide energy crisis, all countries are trying to find the best ways to fix this major concern. Energy resources nowadays come from hydrocarbon fuel, which is a limited resource and one of the main causes of international conflict. One way to resolve this crisis is by finding the new renewable energy and using that renewable energy.

Solar technology is an alternative for the replacement of non - renewable sources of fuel. It is also one of the most attractive alternative energy resources for many countries, including oil-producing countries in order for reducing energy consumption, and improving utilization efficiency of energy. Many applications such as solar car, solar heater and solar street light have been produced using solar technology.

A device capable of transforming electrical energy into visible light, Light Emitting Diode (LED) can plays as a basic role in energy conservation and environmental sustainability in the lighting market sector. Up to 80% more efficient the LED lamp than the traditional lighting lamp for example, fluorescence and incandescent lamps. LED is one of the solid state semiconductor devices that have a long service life,

LED can provide more than 50000 hours of life span, which it is one of the best way in reducing the maintenance costs. It is also can be energy saving device because by suing the white LED based lighting systems it can give more than three times of luminous efficiency of the incandescent lighting lamps. It is also characterized as a small size device, environmental protection and durance. (How Energy-Efficient Light Bulbs Compare with Traditional Incandescents)

A solar powered with high-power LED package is the perfect solution for facing the energy crisis. Solar energy is generated by sunlight and converted into electricity by the solar cell panels. Solar cell is the electrical device that directly transforms sunlight to photovoltaic electricity. The major focus of this project is to design and performance evaluation of an off-grid solar system for small application that can give more environmentally friendly materials and powered is generated by solar panel.

This project consists of the four main elements of electric components which are solar panel, rechargeable battery, solar charge controller and LED package as a load. The usage of solar panel is to absorb the light energy which is the photons from the sun will create the electric charge by the photovoltaic impact. So, the electricity source is directly come from the changes of light energy to electric energy. Next, the rechargeable battery is use as the storage of electric energy to supply the power to the application used in the straight lighting. The solar charge controller is the charge controller that can prevent overloading of the battery. It can maximize the charging of voltage and current output from the solar array, and it will controls when the light is operated. Lastly LED is one of the attractive alternative to produce the light.

1.2 Problem Statement

Main problem statement: Lighting using high power LED from solar system can be operated normally for 3 to 4 hours only. This study is undertaken within attempt to evaluate a solar system from different electrical component and propose a better power lighting system.

Generated power in Malaysia is mainly the result of the burning of restricted fossil fuels, including such oil, coal or natural gas, which have enormous environmental impacts. Electricity energy in Malaysia depends heavily on fossil fuels, including oil, gas and coal. Malaysia has successfully diversified its energy structure in the last 30 years by introducing more natural gas and coal into its generation of energy. (hinhao Chong, Weidou Ni, Linwei Ma *, Pei Liu and Zheng Li, 2014)

Today, Malaysia is a fast growing country in East Asia, whose goal is to achieve the highest-income nation position by 2020, and that is its economic development, depends heavily on its reliable energy resources, particularly natural gas and crude oil. As Malaysia's economy develops, demand for electricity has increased over the past decade, almost increasing with overpopulation, hitting 134 billion kWh in 2012, based on the most recent Malaysia Energy Information Hub data. (MEIH).

On the downside, the power plants for generating the electricity energy can create pollution. Even electricity is a clean and relatively safe form of energy, power production and distribution affect the climate. Almost all categories of power stations have an environmental impact, however some power stations have far more implications than some others.

There are a lot of side effects of power plants. First, the negative impacts of power plants on the landscape, since so many power stations required land clearance to construct the power station. Fossil fuel plants burning solid fuels may even have larger areas for storing ash from combustion. Many fossil fuel plants are huge systems which

modify the graphical ecosystem. Broadly speaking, the greater the structure, the worse the commonly it will influence the power station's graphical landscape. Next, effect of fossil fuel, biomass, and waste burning power plants to earth. Sulfur dioxide and nitrogen oxides, two undesirable contaminants, are released into the atmosphere by power stations that burn biomass. Power stations which burn carbon dioxide from fossil fuel nozzles into the atmosphere. Carbon dioxide is a greenhouse gas, which increases the temperature of the earth. Finally, some power plants also produce liquid and solid wastes that will effected the environment. The ash comprises all the hazardous chemicals that the environmental protection technologies capture. In retention ponds, several coal-fired power stations store ash sludge which are ash mixed with wate). Almost all of these pools have exploded, allowing severe damage and environmental damage. Any coal power plants submit ash to wastewater or advertise ash to make concrete blocks or asphalt. Malaysia pays more attention to that of the development in the future of alternative energy, clean technology and energy production in terms of meeting the obstacle of global climate change in the rapidly expanding consumption of fossil fuels in later part-use regions.

Electricity is fundamental to the standard of living, and it relies heavily with almost everything we do for our regular daily. Generally residence use electricity every minute of every day, yet few of the understanding in the major uses of electricity in our homes. Industry is one of the most in sector of consuming the electricity energy followed by households, commercial sector and transportation. The effect of consuming high value of electricity energy is our electricity bill will be so high.

There are a lot of reasons why, that the electricity bill will become so high. Firstly, the appliances and light bulbs are not energy efficient. This is because the appliances account for one of the biggest chunks of the electricity bill. Next, keep too many devices in standby mode. For example, always only turn off the computer, DVR, PlayStation, and other devices usually go into standby mode instead of completely powering off. Which means, the device are not in sleep mode. The electric device are regularly performing updates, downloading content, and wasting energy while are not using them. Lastly, using old appliances is probably one of the bigger reasons why

paying more on the electric bill. The fact is that old appliances simply use more energy than new models that are energy efficient.

All of these problems will the effect the increase of electricity bill by consuming a large amount of electricity energy. Unless generate the own power using a source such as solar, that should probably pay a monthly utility bill that varies between regions. If get the electricity from the own solar source, so have no monthly fees.

1.3 Objectives

1. To study and identify the energy efficiency of different components within solar system.
2. To study the performance of the solar system for lighting application

1.4 Scope

This project will focus on evaluation of a solar powered high-power package. The study of this project needs to do some research on basic components used in the installation of our proposed solar system. There are also the descriptions of some of the components such as photovoltaic solar panels, batteries, LED lightning, poles, charge controller and inverters and explanation on how this project can perform their tasks based on the experimentation on the product. Besides, on this project it can prove with the data analysis this project can save the electricity consumption also based on the calculation of the current flow and data analysis of the project.

This study will use multiple existing Google Patent inflatable paddings, internet and experimentation to analyse and used them as one of data to design and performance evaluation of an off-grid solar system for small application. The basic components of electronic that are chosen is based on their performance in save of the consumption of electricity energy and that can fulfil the criterion of the project based on experiment.

1.5 Important of Study

It is more important than ever to know the solar system. It is attempting to help us to appreciate the earth. It brings us opportunities to maintain and respect our natural resources. Researching the solar system can help people understand important problems, along with how climate change affects the Earth rather than how life in our world originated. Solar power is a major source of renewable energy that can meet many of the world's challenges.

Solar is a safe alternative that can replace current fossil fuels, such as coal and gas, with electricity generating pollution from air, water and land while electricity generation from fossil fuels causes air pollution leading to acid rain, damaged forest areas and a worldwide loss of billions of dollars in agricultural production. Using Nuclear energy pollutes water and land, causing environmental disasters. These unsafe, unclean consequences of using conventional fossil fuels will be eliminated through the use of solar energy. Solar power is also known as " eco - friendly, " as toxic gasses are not emitted into the environment. Too many gasses and by-products are already circulating in the atmosphere. The last thing that we have to do is add to it.

1.6 Organisation of Report

Table 1.1 below shows the chapter-based report organization which is chapter 1 will covering the background, problem statement, objective, scope and study significance of the project. Chapter 2 is Review of the Literature, Chapter 3 Methodology, Chapter 4 Result and Discussion, and finally Chapter 5 will cover the conclusion and recommendation.

Chapter	Subtopic	Description
Chapter 1	Project Background	Develop the background of the project where the topic is covered
	Problem Statement	Describe the problem that lead for study project
	Objective	Describing the aim of the study
	Scope	The scope that involve the scope of study, place and users.
	Important of Study	Explaining about the importance of study that need to be conducted
Chapter 2	Literature Review	Review the previous study or project that has been done from the source
Chapter 3	Methodology	Explain about the process and the method used for the project
Chapter 4	Result and Discussion	A detail explanation on results achieved and the discussion
Chapter 5	Conclusion and Recommendation	To conclude the project and recommendation for the future

Table 1.1 Organization of Report

1.7 Summary

To summarise this chapter, it gives the upper layer of understanding on what this study all about. This chapter gives the rough view to the study and get the point. The important of this study are the objectives that need to be achieved and the project scopes in order to success in the study.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The literature review in this chapter explores the dominant themes of studies and research from various published materials. The materials are used as guidance for the next phase of the project, including journals, articles, books and online resources. In addition, this chapter also contains a discussion of the differences identified in the current literature and also the briefly explained specifics to defend the study. Strictly, this chapter may cover solar energy details, which include the solar energy process principle and details of basic components such as solar panel, battery, controller, switch and LED package. There is also some calculation on the circuit system in this chapter.

2.1 Solar Energy

Solar energy is the light that comes from the sun which is the most freely available source throughout the face of this earth. The emit photons an extraordinary amount of time every day, that also calls for solar energy. In one day, it produces more energy than the country uses in a year. This energy comes from the sun on its own. Like most stars, the sun is a large hydrogen and helium gas ball. The emit photon energy in its central core in a process known nuclear fusion. It takes about eight minutes to travel from 93 million miles to Earth from the sun. Solar energy is moving at light speed, or 186,000 miles per second, or 3.0 x 108 meters per second. (Kao Circle, 2017) Only a small part of the sun's rays radiate from visible light to sunlight emanating into space that has ever reached Earth, but this is more than enough to supply all our energy needs. This is because for every hour is enough for sun to supply the solar energy to earth for we use that energy. Solar energy is considered a renewable energy source.