UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN OPTIMIZATION OF 250WP STAND ALONE PORTABLE SOLAR PV FOR REMOTE AREA APPLICATION

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electrical Engineering Technology(Power Industrial)

by

NOR SUHAIDAH BINTI SAPIEI
B071210181
901205016240

FACULTY OF ENGINEERING TECHNOLOGY
2015

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **DESIGN OPTIMIZATION OF 250WP STAND ALONE PORTABLE SOLAR PV FOR REMOTE AREA APPLICATION**

SESI PENGAJIAN: **2014/15Semester 2**

Saya **NOR SUHAIDAH BINTI SAPIEI**

Mengaku membenarkan Laporan 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 TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☐	TERHAD	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)
☑	TIDAK TERHAD	

Disahkan oleh:

AlamatTetap:

No. 82 JLN CIKU 33

Taman KOTA MASAI

81700, PASIR GUDNG JOHOR

Cop Rasmi:

** 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.

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) (Hons.). The member of the supervisory is as follow:

EMY ZAIRAH BT AHMAD
Pensyarah
Jabatan Teknologi
Kejuruteraan Elektrik
Universiti Teknikal Malaysia Melaka

.....

(Project Supervisor)

DECLARATION

I hereby, declared this report entitled "Design Optimization Of 250wp Stand Alone Portable Solar PV for Remote Area Application" is the results of my own research except as cited in references.

Signature : .....

Name : NOR SYUHAIDAH BINTI SAPIEI

Date : 12/01/2016

ABSTRACT

Rural electrification is vital especially to farfetched electricity such as mountain, and island. Since long ago, the electricity source look forward by those a needy such as aborigine. This paper focus on the aborigine community in Kampung Sungai Lah, Tapah, Perak which have 40 villages that lack of the electricity. The project is aimed to design the 250WP stand-alone portable solar PV that can be used for rural communities and to identify the capacity of battery and sizing for design the product. The stand-alone system and PV module (Mono-crystalline) is being used. To design this product, software AutoCAD has been used.

The system is basically consist of 250Wp Mono Crystalline solar panel that is directly connected to the 2 of 12 Volt of deep cycle lead acid battery with capacity of 67Ah for each through the solar charge controller (SCC) and 200W inverter. The product basically has a handling and wheel. The solar panel is mounted at 15^{o} indicated angle for optimized performance.This report is completely has done with calculation of energy by using software and manually. PVGIS software has been used to identify the percentage of day battery fully charge and discharge. PVGIS is software of Photovoltaic Geographical Information System whereby user can identify the performance of solar panel that want to used before install it in real life such as obtained how much energy that solar panel can capture for one year with own characteristic that user want. To collect the data of insolation($kWh/m^2/day$), temperature(^{0}c)and wet day for a complete a cycle for one year Gaisma software has been used whereby this software is a tool that can user use to identify the time for sunrise, sunset, dawn and dusk time around the world. The location also can cover for all places in the world.

ABSTRAK

Bekalan elektrik luarbandar adalah penting terutama kepada kawasan pedalaman seperti di bukit, hutan, pantai. Sejak dahulu lagi, sumber elektri sangat diharapkan oleh orang-orang yang memerlukan seperti orang asli. Fokus utama kertas kerjainikepadamasyarakat Orang Asli di Kampung Sungai Lah, Tapah, Perak yang mempunyai 40 kampung kekurangan bekalan tenaga elektrik. Projek ini bertujuan untuk merekabentuk 250wp *"Stand Alone PV Solar"* yang boleh digunakan untuk masyarakat luar Bandar dan untuk mengenalpasti keupayaan bateri. Projek ini menggunakan sistem "*stand–alone*" dan PV modul (Monokristal). Untuk mereka bentuk produk ini, perisian AutoCAD telah digunakan. Sistem ini pada dasarnya terdiri daripada panel solar 250WP Mono kristal yang bersambung secara langsung dengan 2 bateri asid plumbum dalam kitaran 12 volt dengan kapasiti 67Ah untuk setiap melalui caj pengawal solar dan penyongsang 200W.

Produk ini pada dasarnya mempunyai pengendalian dan roda. Panel solar yang dipasang pada sudut 15^{o} bagi tujuan prestasi yang optimum. Bagi mengetahui peratusan bateri penuh di cas atau di nyahcas software PVGIS telah digunakan. PVGIS ini merupakansatu software *"Photovoltaic Geographical Information System"* dimana para pengguna boleh mengetahui terlebih dahulu kemampuan panel solar sebelum diaplikasikan secara realiti seperti berapa jumlah tenaga yang panel solar tersebut dapat hasilkan selam asetahun dengan beberapa ciri-ciri yang pengguna perlukan. Gaisma telah digunakan untuk mendapatkan data seperti "insolation"($kWh/m^2/day$), suhu(^{0}c) dan taburan hari hujan bagi satu kitaran lengkap untuk setahun. Gaisma ini juga merupakan satu alat bantuan yang membolehkan pengguna mengetahui masa terbitnya matahari, senja di seluruh tempat di dunia. Lokasi ini termaksuklah disemua yang tempat yang ada di dalam dunia.

DEDICATIONS

To my beloved parents

FATHER

Sapiei Bin Hj Kasah

MOTHER

Hamidah Binti Abd Hamid

My sibling and friends

Thank you for the patients, support and encouragement due to completed my report.

ACKNOWLEDGEMENT

I am grateful and would like to express my sincere gratitude to my supervisor Mrs. Emy ZairahBt Ahmad and co-supervisor Mrs. Amalia Aida Binti Abd Halim for her invaluable guidance, continuous encouragement and consistence support in making this research possible. I really appreciate her guidance from the initial to the final level that enabled me to develop an understanding of this research thoroughly.

I am extremely thankful to my panel Mr Engr Asri Bin Din and Mrs. Nurul Ashikin Binti Mohd Rais and all faculty members for their coordination and cooperation and for kind guidance and encouragement.

Lastly, acknowledge my sincere indebtedness and gratitude to my parents for their love, dream and sacrifice throughout my life. I am really thankful for their sacrifice, patience, and understanding that were inevitable to make this work possible. I also thank to all my friends who give contributed to the preparation of this project.

TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER 1
INTRODUCTION

This section will cover or describe clearly about the product, the objective that need to achieve, the limitation of this product, the problem statements and solutions to overcome the problem.

1.0 Background of Study

Today there are many types of green energy that is introduced such as biomass, solar, thermal and hydro. According to Alphousseyni *et.el*,(2014), defines the primary oil resources are becoming increasingly scarce and expensive, while world energy demand is continuously increasing, therefore the constraint is to use economical renewable energies such as electricity generation from wind or solar radiation

The development of a renewable energy sources has attracted a lot of attention from both the research and industrial community since last decades (M.A. Islam *et.el*, 2014). Solar is the most recognizable green energy and always used as an alternative way to provides or supply the electricity. In Malaysia, there is having some place that lack source of the electricity such as remote area. Remote area is a location far away from the places where most people live and often lack grid power supply (Vincent, 2014).

Providing grid electricity in remote areas is often associated with higher costs to the grid supplier (Vincent, 2014). Noridzuan Idris *et.al* (2010) defines the grid extension to remote and an inaccessible area is not a cost effective option and sometimes technically not practicable, thus a good option is to use Stand Alone Photovoltaic Power System (SAPVPS). According to M.A. Islam *et.el*, (2014) defines out of many potential renewable energy sources, PV technology clearly distinguished itself from the other because of its popularity.

As the solution, this product would replace the traditional direct power generator. Portability of the system permits usage in rural applications. Therefore, the purpose of this paper is to design optimization of 1kwP stand alone portable solar PV for a remote applications. For the design part, the system need PV module, Inverter, Battery and Solar Control Circuit. The PV module is connected to solar control charger and passes through battery and inverter. From the battery its will connected to the DC load and the inverter to the AC load.

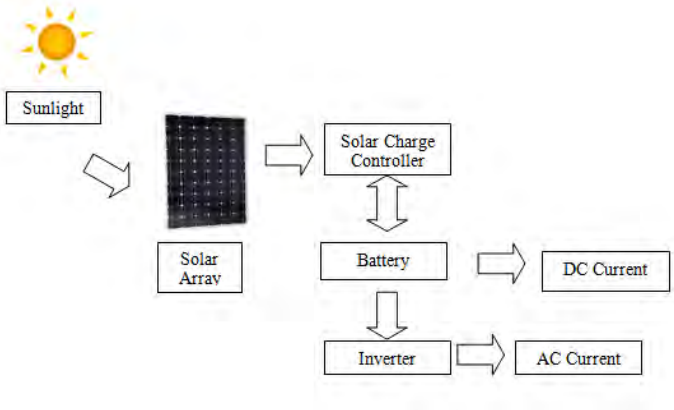

Figure 1.1: Solar System

1.1 Problem Statements

Energy is the ability to do work, where it done when force moves an object. The energy can't be touch or see but can see the effect of the energy such as work done. The electrical energy is energy that stored in charged particles within an electric field. Today, electricity is an important resource whereby from a source the electrical home appliances such as fans, lights, televisions and etc can be used or functions.

As we know all of energy sources that come only from Tenaga Nasional Berhad (TNB). From the previous study at Kampung Sungai Lah, Tapah Perak, some problem has been obtained, first there are have 40 villages that lack sources of electricity and some of them for used a generator as a supply. At night, most of the residents are using candles or kerosene lamps as a lighting resource.

This can contribute to negative factors such as can cause of death or fire. Lastly, the resident has a fully equipment such as a distribution board and household equipment but don't have any supply of electricity.

With the electricity supply, their lives would be more comfortable for example among children who want to do their revision at the night and could use the fan especially on daytime which is the daytime is increasingly hot and can dry clothes or shoes when the rain by using a fans.

1.2 Scope Project

There are has several objective need to achieved, it has some scope and limitation. As there are many types of solar panel, for this research using PV solar (Mono Crystalline). This paper focuses on the design portable solar with 30^0 inclination angle that can used for aborigine community at Kampung Sungai Lah, Tapah, Perak on facilitates basic usage such as lighting, fan, and socket).

1.3 Objective

For this paper there are have some objective that need to be achieved and overcome for this problem:

i. To design the 250wp stand-alone portable solar that can be used by this community.
ii. To determine the capacity of battery and sizing the component for these prototype.
iii. To implement the study about renewable energy such as type of solar photovoltaic and comparison the connection between stand alone system and on grid system.

CHAPTER 2
LITERATURE REVIEW

This chapter briefly expalain about the history renewable energy, the type of solar panel, the components that consist at the stand alone system. This parts also tell the previous study from other author or jurnals about the system.

2.0 Solar Systems

Renewable energy is an energy produced from natural resources such as sunlight, geothermal heat, tides and wind. Renewable energy technologies range from solar power, wind mill, hydroelectricity or micro hydro, biomass, and bio fuels for transportation. Solar is one of the good alternative ways to get the supply for some place that lack of source electricity especially in rural area. Solar panel has four type which; Polycrystalline, Mono Crystalline, Hybrid and Thin Film.

PV panel or modules are to convert the sunlight into electricity whereby its capture and convert sunlight into direct current (DC) electricity. From the sources it fed to the inverter, which converts the DC electricity to alternating current (AC) electricity. AC electricity is what powers lights, air conditioning, and other electric appliances.

The power output from photovoltaic (PV) modules depends on environmental conditions and geographical location (Pooja *et.el*, 2014). According Pooja *et.el*, (2014), currently the c-SI (robust) and thin film (flexible) PV cell are the two major technologies in wide use. For this project, Monocrystalline type has been chosen compared to other type depends on advantage reasons itself.

The solar system is classified into two type On Grid system and Off Grid system. According to Mfon *et.el* (2013), development of a solar energy research programmed, must always start with a study solar radiation data at the site region of interest. For this paper Tapah, Perak is the location that has been chosen

2.1 Type of Photovoltaic (PV) Modules

2.1.1 Polycrystalline

Polycrystalline panel are made up from the silicon off cuts, mounded to form a blocks. From the process it creates a cell made up of several bits of pure crystal. The appearances also differences which is for this type has a random crystal arrangement and the panel look a little blue cause of reflect some of the light. The size, price and performances are very similar to mono-crystalline type. For the performances, the both type is less efficient caused of the method that produce them and performs slightly better than mono-crystalline in low lighting conditions. Polycrystalline is easy susceptible to shading like a mono-crystalline type.

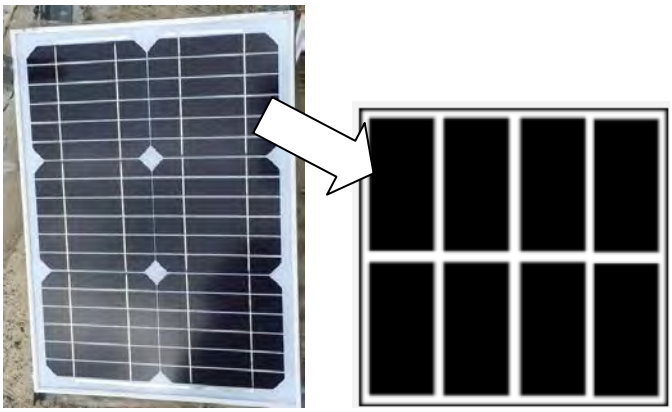

Figure 2.1: Polycrystalline Panel

2.1.2 Mono crystalline

Mono crystalline is the first generation solar technology; it has providing evidence of their durability and long life. The solar cells in mono-crystalline panels are slices cut from pure drawn crystalline silicon bars. As PV panel made of single crystal silicon cell manufacturing process they are one of the most complex and expensive. The entire cell is aligned in one direction, which means when the sun is shining brightly on them at the correct angle, they are extremely efficient. This PV panels are able to convert the highest amount of solar energy into electricity of any type of flat solar panel.

This type have a uniform blacker colour because they are absorbing most of the light. PV panel from Mono crystalline type endure a reduction in output once the temperature from the sunlight reaches around 50^{o}C or 15^{o}F and the losses of efficiency is lower than PV panel made from polycrystalline cells.

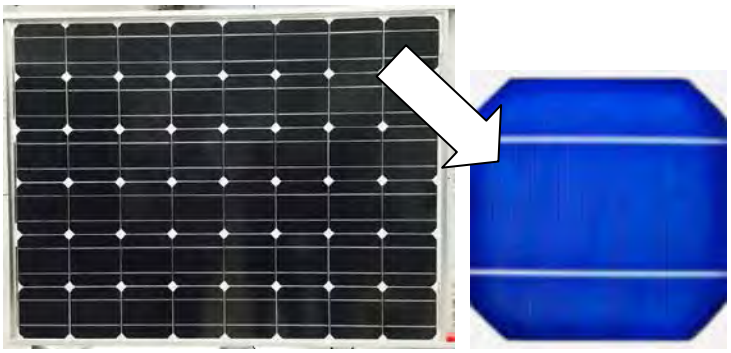

Figure 2.2: Mono crystalline Type

2.1.3 Hybrid

This module has a thin layer of amorphous solar film behind the mono crystalline cells. The extra amorphous layer will extracts even more energy from the available sunlight, particularly in low light conditions. Hybrid panel is more expensive than mono or poly-crystalline panels; it will affect the energy produced. The hybrid type also can generate a large power from a smaller area. These types is a water-drainage frame where the frames helps to keep modules clean even in low-angle installations and has high efficiency which means module efficiency is 19% and a cell conversion efficiency is about 21.6%.

Figure 2.3: Hybrid Type
Sources:www.alternegy.co.uk