



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DEVELOPMENT OF PORTABLE SOLAR TRAINING KIT  
FOR EDUCATIONAL PURPOSES**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Power) with Honours.

by

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**BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA**

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Sesi Pengajian: **2019**

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I hereby, declared this report entitled “Development of Portable Solar Training Kit for Educational Purposes” 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 and Electronics Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

Signature: .....

Supervisor: Intan Mastura Binti Saadon

## **DEDICATION**

Specially dedicate to my supportive parents, family and friends.

Not to forget, my BDP I supervisor, Puan Emy Zairah Binti Ahmad, BDP II supervisor, Puan Intan Mastura Binti Saadon and my panels, Encik Adam Bin Samsudin and Encik Mohamad Haniff Bin Harun.

## **ABSTRACT**

Nowadays, the rising cost of fossil fuels and the threat of greenhouse effect warm the global in a last decade. There are various of renewable energy sources that increasingly used in generating power and one of them is solar system technology. This project presents the design and development of a portable solar training kit for educational purposes. The aim for this project is to create awareness to the people from young age especially school community about renewable energy. This project is about a training kit for the school community so that the learning process about the solar system technology can be held. Next, the project is portable so that the learning process can be done under real conditions. This project is designed to supply DC and 230 AC load as well. Portable Solar Training Kit has been developed for communities need and believe can provide new knowledge about the solar system technology for communities from the young age.

## **ABSTRAK**

*Pada masa kini, dengan meningkatnya bahan bakar fosil dan ancaman rumah hijau menyebabkan pemanasan global dalam sedekad ini. Terdapat pelbagai jenis tenaga yang boleh diperbaharui yang semakin meningkat penggunaannya dalam menjana kuasa dan salah satunya adalah teknologi sistem solar. Projek ini membentangkan reka bentuk dan pembikinan kit latihan solar mudah alih untuk tujuan pendidikan. Projek ini bertujuan untuk mewujudkan kesedaran kepada orang ramai dari golongan muda terutamanya komuniti sekolah tentang tenaga yang boleh diperbaharui. Projek ini berkaitan tentang kit latihan untuk komuniti sekolah supaya proses pembelajaran tentang teknologi sistem solar dapat dijalankan. Seterusnya, projek ini mudah alih supaya proses pembelajaran boleh dilakukan dalam keadaan sebenar. Projek ini direka untuk membekalkan arus terus (DC) dan 230 V arus ulang balik (AC) beban juga. Kit latihan solar mudah alih dibangunkan untuk keperluan masyarakat dan dipercayai mampu untuk memberikan ilmu baru tentang teknologi sistem solar untuk masyarakat bermula dari golongan muda.*

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## LIST OF SYMBOLS AND ABBREVIATIONS

<b>RE</b>	:	Renewable energy
<b>PV</b>	:	Photovoltaic
<b>DC</b>	:	Direct current
<b>AC</b>	:	Alternating current
<b>TNB</b>	:	Tenaga Nasional Berhad
<b>FiT</b>	:	Feed-in Tariff
<b>kWh</b>	:	Kilowatt hour
<b>BOS</b>	:	Balance of System
<b>CIGS</b>	:	Copper Indium Galium deselenide
<b>CdTe</b>	:	Cadmium Telluride
<b>BDP</b>	:	Bachelor Degree Project
<b>PSH</b>	:	Peak Sun Hour
<b>3D</b>	:	Three Dimensional
<b>PWM</b>	:	Pulse Width Modulation
<b>MPPT</b>	:	Maximum Power Point Tracking
<b>Ah</b>	:	Ampere Hour
<b>BoM</b>	:	Bill of Materials
<b>MOE</b>	:	Ministry of Education
<b>IoT</b>	:	Internet of Things

# CHAPTER 1

## INTRODUCTION

### 1.0 Introduction

In this chapter, a brief introduction about this project will be discussed. It contains project background, problem statement, objectives, scope and project's organization.

### 1.1 Background

Technologies invention has becoming something that most of a person would ever need in their daily life especially in power generation due to their functions that are rapidly used in various fields and even in our daily life. The high demand of the electricity has led to global warming and environmental problem. The problem has led all the engineers to find new source to create power and the renewable energy (RE) has been introduced.

The introduction of RE can make one a transformation especially in power distribution area. One of the famous sustainable energy power distribution is solar energy. Solar is widely used in Malaysia since the source is readily available. It is because Malaysia is located on the Equator Line and from there Malaysia can get the sunlight for the most of time. The word photovoltaic (PV) is a combination of the word “photo” in Greek which means light and “volt” attributed to Alessandro Volta, who did pioneering work in electricity. In Malaysia, the first recorded use of PV technology was in the middle 1970's

for marine navigational purposes as well as some donated PV modules for a water pumping demonstration system.

The invention of Portable Solar Training Kit for Educational Purposes is an alternative way to learn how the solar system technology works. It focuses on school community so that the knowledge about solar system technology can be grabbed.

## **1.2 Problem Statement**

Nowadays, power generation has becoming one of the most important things in this world. It is because without the presence of the electricity, the advancement or the development of the technology will grow less effectively. Now, the world is more focusing on RE since non-renewable energy will be vanished if there is no control of using it in a few years.

In RE, solar system technology is widely used in power generation system. Parts of the problem that has been faced nowadays is lack of awareness to the school community regarding the solar system technology. This community need to be exposed deeply about this technology since power generation by using solar is growing rapidly in Malaysia.

Apart from that, the knowledge about solar system technology to the school community is quite low. From the construction of Portable Solar Training Kit for Educational Purposes, it can give basic knowledge about the solar technology system and the school community can learn and analyse the performance of the different types of solar panels.

### **1.3 Objectives**

The main aim of this project is to create awareness to the people from young age especially school community about renewable energy.

The objectives of this project are as follows:

- To develop a portable solar training kit for educational purposes.
- To analyse the different types of solar panel and its performance.

### **1.4 Scope**

This project is focusing on power generation by using solar energy which consists different type of solar panels to differentiate the performance of solar panels, the battery will acts as the power storage and solar charge controller that will function to regulate the amount of charge coming from the panels that flows into the sealed lead acid battery bank in order to avoid the batteries being overcharged. Since this project requires a converter that change from direct current (DC) to alternating current (AC), so an inverter will be used. The AC voltage is needed to power up the AC loads.

## **1.5 Organization**

This reports most importantly start with Chapter One where the technology and features of the technology to be known. It is specific all the matters in objectives, scope and organization with the short describes of the information and knowledge. Then, the literature review will be written in the Chapter 2. In this section, lots of read from the related journals are required to analyse for the improvement of the project. Furthermore, in Chapter Three, the method and procedure as the guide and apparatus is stated with clear flow of this research. Next, in Chapter Four, with all the findings of the result and discussion from this research is being concluded clearly. Finally, in Chapter 5, with understanding the whole research, the conclusions and recommendation are discussed in this chapter view.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

This chapter will focus on research and gather the related information about the project from the internet and journals that has been approved by IEEE.

#### **2.1 Renewable Energy**

What is renewable energy? Renewable energy is created utilizing common assets that are always replaces and never run out. Nowadays, there such a large number of natural resources with the goal that their supportable energy technologies. The most famous and well known of this energy is solar energy. Apart from that, there are other types of renewable energy that can be featured which are wind power, geothermal, hydropower and tidal wave. Hydropower is known as the oldest renewable energy while the wind power is the most widespread. Renewable energy is important to use in a large scale in this power generation industries. It is because it can give more benefits especially in environmental. The source from this sustainable energy is clean and have lower environmental impact.

According to (Destouni & Frank, 2010), Energy Committee's estimated for future renewable energy contributions to the world energy system. The energy research and development make the international coordination and investment crucial as to increase the dependency of renewable energy sources in the future with minimal used of fossil fuel.

Quaschnig (2016) has extra expressed that energy sources are viewed as sustainable on the off chance that they are boundless inside a time period applicable for humankind. The yearly supply of sustainable power source is extents more prominent than worldwide energy request. Hypothetically, renewables could without much of a stretch spread worldwide energy request, however a progress won't really be smooth. Or maybe, if the utilization of renewables on an expansive scale, it should be set up a totally unique energy division from the one built in the previous couple of decades. Interestingly, a few types of sustainable power source, for example, solar power and wind control, change impressively. On the off chance that the energy segment runs totally on renewables, the spotlight not able be just on changing over one type of energy into another, yet additionally on guaranteeing the accessibility of energy.

### **2.1.1 Solar Power**

Solar power is created by gathering daylight and changing over it into power. With the utilization of solar panel, which are expansive level boards comprised of numerous sun-based cells. It is widely used in rural area since the cost of build the transmission lines and electrical substations quite high. Solar power is getting famous in urban area since it is a renewable energy and people can used it freely. There is only disadvantage of solar power which is stop generate electricity when the surrounding become dark or night.

### **2.1.2 Wind Power**

Wind is created on Earth when a difference in atmospheric pressure exists between two geographical points. Generate electricity by using wind is called as wind power. The kinetic energy is captured by using wind turbine and create electricity. Energy from wind has been used for power for at least 5,500 years for tasks such as pumping water, grinding grain, sailing ships, powering machinery and driving natural ventilation in buildings.

As shown by (Wizelius, 2015), the development in the wind turbines has made in a couple of various ways. The control structures have ended up being more affordable and further grown, new profiles for the rotor cutting edges can isolate more power from the wind, and new power electronic apparatus makes it possible to use variable speed and to upgrade the farthest point of the turbines.

An issue with the wind as an energy source is that the wind constantly changes. Exactly when the wind conservatives or stops, control must be made by other power plants. This could incite the end that it will reliably be critical to have a back-up point of confinement with other power plants with a comparable breaking point as the wind control related with the power structure. If this were substantial, wind power would be super costly. In any case, since wind control just builds up one area in a generous power system, this isn't crucial in any capacity. A moderate idea of wind control in a structure does not require any back-up farthest point at all, since it is starting at now exists in the power system.



**Figure 2.1: Wind Turbine**

### **2.1.3 Hydro Power**

Hydro power or water control is control gotten from the vitality of falling water and running water, which might be outfit for helpful purposes. Hydroelectricity is the term