UNIVERSITI TEKNIKAL MALAYSIA MELAKA

PORTABLE POWER GENERATOR FROM RENEWABLE ENERGY

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Department of Electronics & Computer Engineering Technology) (Hons.)

by

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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 Engineering Technology (Department of Electronics & Computer Engineering Technology) (Hons.). The member of the supervisory is as follow:

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EN. KHAIRUL ANUAR BIN A RAHMAN

ABSTRACT

Solar and wind exists everywhere on the planet, and in some places with considerable energy density. This portable power generator is useful for emergency case such as when travelling, camping, power your construction site or keep your home running during a power outage. The project prototype should be small in the size, easy to transport and also can produce power from direct sunlight to solar panels. Solar power was chosen as the main source of renewable energy for the portable power generator. The system is consists of solar panel, battery, solar charger controller and inverter to running the system. A solar panel, PV module converts sunlight into electricity. PV module is connected to a 12V/18AH battery for storage of excess power and inverter converted DC load to AC load. Meanwhile, to prolong the operational life of battery, a solar charge controller will be employed to regulate the charging current flowing to the battery from the PV module and limits the battery to its fully charged voltage. In additional, when is not enough sunlight, the role of the PV module will be taken over by the battery until such time when the solar irradiance increase again and allowing the PV module to charge and supply the power to the end users. From analysis is the charging hours versus power output in volts which is shown the percentage of battery. The longer the charging process, the higher the power output of the battery. The charging process also depends on the sunlight, when at peak hours, the charging process will be faster.

ABSTRAK

Angin dan suria wujud di mana-mana di dunia ini, dan di beberapa tempat dengan kepadatan tenaga yang besar. Penjana kuasa mudah alih adalah berguna untuk kes kecemasan seperti apabila perjalanan, perkhemahan, kuasa tapak pembinaan atau rumah anda semasa gangguan bekalan kuasa. Prototaip projek hendaklah bersaiz kecil, mudah untuk pengangkutan dan juga boleh menghasilkan tenaga daripada cahaya matahari terus untuk panel solar. Tenaga solar telah dipilih sebagai sumber utama tenaga boleh diperbaharui untuk penjana kuasa mudah alih. Sistem adalah terdiri daripada panel solar, bateri, pengecas pengawal solar dan inverter untuk menjalankan sistem.Panel solar, modul PV menukarkan cahaya matahari kepada tenaga elektrik. Modul PV disambungkan kepada bateri 12V / 18AH untuk menyimpan kuasa yang berlebihan dan inverter menukar masukan DC ke keluaran AC. Sementara itu, untuk memanjangkan jangka hayat operasi bateri, pengawal caj solar akan digunakan untuk mengawal selia arus yang mengalir ke bateri daripada modul PV dan menghadkan bateri untuk voltan dicas sepenuhnya. Tambahan itu, apabila tiada cahaya matahari yang mencukupi, peranan modul PV akan diambil alih oleh bateri sehingga peningkatan sinaran suria dan membenarkan modul PV untuk mengenakan dan membekalkan kuasa kepada pengguna akhir. Daripada analisis adalah jam mengecas berbanding output kuasa dalam volt yang menunjukkan peratusan bateri. Semakin lama proses mengecas, semakin tinggi kuasa keluaran bateri. Proses pengecasan juga bergantung kepada cahaya matahari, apabila pada waktu puncak, proses pengecasan akan lebih cepat.

DEDICATIONS

To my beloved parents

My friends

My lecturers

For making me the person that I am today,

and for making my life in UTeM a very wonderful one.

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Praise is to Allah, lord of the Universe, and peace be upon Muhammad the prophet; praise befits His might and suffices. His Grace, peace and blessing are upon His generous Messenger, his family and companions, for giving the strength to complete this thesis.

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V	=	Vollt
DC	=	Direct Current
AC	=	Alternate Current
VDC	=	Direct Voltage
VAC	=	Alternate current
W	=	Watt
AH	=	Ampere/hour
H	=	hour
RM	=	Ringgit Malaysia
Wh	=	Watt hour
PV	=	Photovoltaic
Voc	=	Open circuit test
Isc	=	Short circuit test

CHAPTER 1
INTRODUCTION

1.0 Introduction

Solar energy is radiant light and heat from the sun harnessed using a range of ever-evolving technologies such as solar heating, solar photovoltaic, solar thermal energy, solar architecture and artificial photosynthesis.

It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on the way they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favourable thermal mass or light dispersing properties, and designing spaces that naturally circulate air.

The main objective of this project is to produce a working prototype of a portable power generator, which will be designed based on the established project scopes. Thus it is vital to understand the theory and characteristic in portable power generator.

1.1 Problem Statement

Nowadays, there are many sources of energy that are renewable and considered to be environmentally friendly and harness natural processes. These sources of energy provide an alternate better source of energy, helping to reduce a certain forms of pollution. All of these power generation techniques can be categorized as renewable since they are not depleting any resource to create the energy. While there

are many large-scale renewable energy projects and production, renewable technologies are also suited to small portable generator that can be used in rural and remote areas, where energy is often crucial in human development.

This portable power generator are needed to us because it is useful for emergency case such as when travelling, camping, power your construction site or keep your home running during a power outage.

1.2 Objective

The objectives of this project are to:

1) To develop portable power generator from renewable energy.

2) To of the developed portable power investigate the performance generator.

3) To investigate the effectiveness of renewable energy in daily life

1.3 Scope Of Project

The idea of this project is to produce a portable generator from renewable energy that can generate electrical power to power up a limited number of devices for emergency usage. Batteries will also be included in the generator to store electricity generated by the renewable energy to extend the performance of the generator. The generator is expected to produce electricity of 12VDC and VA.

CHAPTER 2
LITERATURE REVIEW

2.0 A Introduction

literature review is a text of a scholarly paper, which includes the current knowledge including substantive findings, as well as theoretical and methodological contributions to a particular topic. The purpose of this study is to clarify and gain more knowledge about the device that that will be made. Apart from that it is also important to collect data and information in the study..

2.1 Solar Energy

Solar energy i.e. energy from the sun provide consistent and steady source of solar power throughout the year. As our natural resources set to decline in the years to come, it‟s important for the whole world to move towards renewable sources. The main benefit of solar energy that it can be easily deployed by both home and business users as it does not require any huge set up like in case of wind and geothermal power stations. Solar energy not only benefits individual owners, but also benefit environment as well.

2.1.1 Advantages and Disadvantages of solar energy

2.1.1.1 Advantages of solar energy :

1. No Pollution : Solar energy is non-polluting, clean, reliable and renewable source of electricity. It does not pollute the air by releasing harmful gases like carbon dioxide, nitrogen oxide and sulphur oxide. Solar energy does not require and fuel and thus avoid the problems of transportation of fuel or the storage of radioactive waste. Image processing has been intensively studied and there are a lot of different ways and methods available to be choose from, each with their own pros and cons.
2. Long lasting solar cells : Solar cells make no noise at all and there are no moving parts in solar cells which makes them long lasting and require very little maintenance. Solar energy provides cost effective solutions to energy problems where there is no electricity at all.
3. Renewable Source : Solar energy is a renewable source of energy and will continue to produce electricity as long as sun exists.
4. Low maintenance : Solar cells generally doesn‟t require any maintenance and run for long time. More solar panels can be added from time to time when needed. Although, solar panels have initial cost but there are no recurring costs. Initial cost that is incurred once can be recovered in the long run.

5. Solar panels does not create any noise and does not release offensive smell.

6. Easy Installation : Solar panels are easy to install and does not require any wires, cords or power sources. Unlike wind and geothermal power stations which require them to be tied with drilling machines, solar panels does not require them and can be installed on the rooftops which means no new space is needed and each home or business user can generate their own electricity. Moreover, they can be installed in distributed fashion which means no large scale installations are needed.

2.1.1.2 Disadvantages of solar energy :

1. Location : The location of solar panels is of major importance in the generation of electricity. Areas which remains mostly cloudy and foggy will produce electricity but at a reduced rate and may require more panels to generate enough electricity for your home. Houses which are covered by trees, landscapes or other buildings may not be suitable enough to produce solar power.
2. Pollution : Most of the photovoltaic panels are made up of silicon and other toxic metals like mercury, lead and cadmium. Pollution in the environment can also degrade the quality and efficiency of photovoltaic cells. New innovative technologies can overcome the worst of these effects.
3. Inefficiency : Since not all the light from the sun is absorbed by the solar panels therefore most solar panels have a 40% efficiency rate which means 60% of the sunlight gets wasted and is not harnessed.
4. Reliability : Unlike other renewable source which can also be operated during night, solar panels prove to be useless during night which means you have to depend on the local utility grid to draw power in the night. Else you can buy solar batteries to store excess power which you can later utilize in the night.
5. Installation area : For home users, a solar energy installation may not require huge space but for big companies, a large area is required for the system to be efficient in providing a source of electricity.

2.2 Solar Photovoltaic

Solar energy is one of the alternative energy sources and definitely will not run out until the sun was at the end of its life. The sun is said to be the center for nearly 99.9 percent of energy due to the energy of sunlight reaching the earth's surface. Overall average solar energy that reaches the surface of the earth is approximately 1353 kW per square meters The photovoltaic cell, or PV cell, is the technology that converts energy in sunlight to electricity, using an adaption of the electrical semiconductor used in computers and other types of information technology. PV cells are designed to transfer the energy contained in individual photons penetrating the panel to electrons that are channeled into an external circuit for powering an electrical load. This function is achieved through both layout of molecular structure

at the microscopic level, and the arrangement of conductors at the edge of the cell at the macroscopic level.

2.2.1 Photovoltaic Materials

Manufacturing of PV panels can be broadly divided between crystalline and thin-film approaches. The former entails creating a silicon wafer that harnesses the photovoltaic effect and can be further divided between monocrystalline and polycrystalline solar cells, depending on whether the individual PV cell is fabricated from a single crystal or multiple crystals.

Monocrystalline cells are more efficient than multicrystalline in terms of converting sunlight into electrical output, but it is also more difficult to manufacture and hence more expensive per unit of surface area covered.

Thin film panel manufacturing entails a fundamentally different process, namely, laying down a thin layer of photovoltaic effect capable materials, either amorphous silicon or some non-silicon combination of metals, on backing materials. Thin-film cells use a mass-production process that is easier to scale up than the growing and cutting of crystals, and therefore the cheapest to produce but have the lowest efficiency per unit of surface area.

Both manufacturing cost per unit area and average efficiency have been improving in recent years. Most solar cells are made of a form of silicon. This is a hard material that is either dark blue or red in appearance. The blue cells are made as thin discs or squares in which are quite fragile. The red type of silicon is coated on to glass as a thin film.

As sunlight shines on surface of the silicon, electricity is generated by a process known as the photoelectric effect, as in physics. Nevertheless, crystalline based PV sales have been growing in absolute amount as well, even while conceding part of the market to thin film, so for the time being both remain competitive in the marketplace. The differences between three photovoltaic is shown in table 2.1 below.

Table 2.1: Differences between Three Photovoltaic Materials

	Materials	Market Price	Efficiency
Monocrystalline panels	Crystals are repeated in a regular pattern from layer to layer	The most expensive to produce	It offers the highest efficiency, 19%
Polycrystalline panels	Small crystals are arranged randomly, similar to shattered glass	Less expensive to produce	Less than monocrystalline, 15%
Thin-film panels	Materials in these panels have no crystalline structure	The low manufacturing cost lost and versatility	Less efficient, 10%

2.2.2 Operation of Photovoltaic systems

PV systems are like any other electrical power generating systems, the equipment used is different than that used for conventional electromechanical generating systems. However, the principles of operation and interfacing with other electrical systems remain the same, and are guided by a well-established body of electrical codes and standards.

Although a PV array produces power when exposed to sunlight, a number of other components are required to properly conduct, control, convert, distribute, and store the energy produced by the array. Depending on the functional and operational requirements of the system, the specific components required may include major components such as a DC-AC power inverter, battery bank, system and battery controller, auxiliary energy sources and sometimes the specified electrical load (appliances).

In addition, an assortment of balance of system (BOS) hardware, including wiring, overcurrent, surge protection and disconnect devices, and other power

processing equipment. Figure 1 below show a basic diagram of a photovoltaic system and the relationship of individual components.

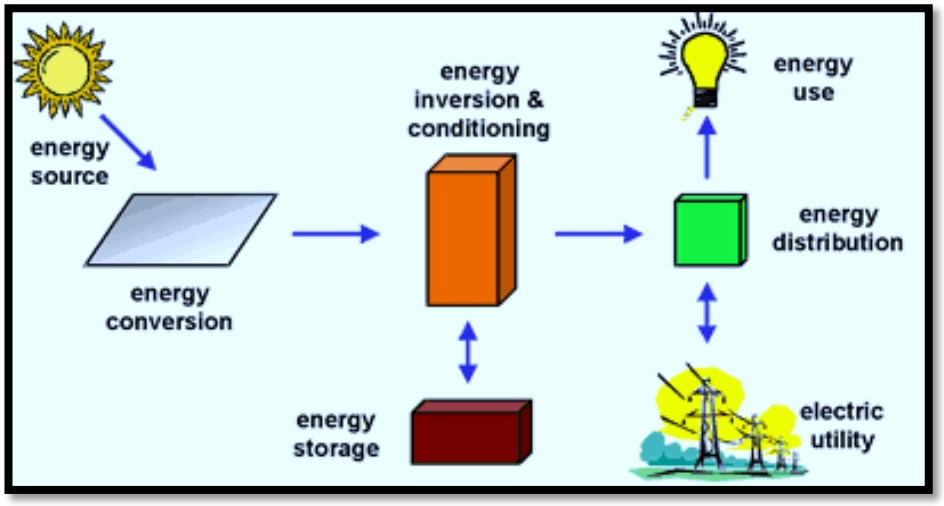

Figure 2.1: Major photovoltaic system components

2.2.2.1 Why are batteries used in some PV systems ?

Batteries are often used in PV systems for the purpose of storing energy produced by the PV array during the day, and to supply it to electrical loads as needed (during the night and periods of cloudy weather). Other reasons batteries are used in PV systems are to operate the PV array near its maximum power point, to power electrical loads at stable voltages, and to supply surge currents to electrical loads and inverters. In most cases, a battery charge controller is used in these systems to protect the battery from overcharge and over discharge.

2.2.3 Advantages and Disadvantages of photovoltaic systems.

2.2.3.1 Advantages of Photovoltaic Systems :

1. Photovoltaic (PV) systems provide green and clean renewable power from solar energy.
2. Using PV panels will require minimum operating or maintenance costs. Regular cleaning of the panel surface is adequate to keep them operating at highest efficiency levels as stated by the manufacturers‟ specifications.