



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

HYBRID SOURCE UNINTERRUPTIBLE POWER

SUPPLY

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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This report is submitted to the Faculty Technology Electric and Electronic 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:

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ABSTRAK

Bekalan kuasa tidak terganggu merupakan suatu elemen yang sangat penting dalam sektor perindustrian untuk memastikan proses berterusan dapat dikekalkan dalam mengekalkan mutu pengeluaran yang optimum. Sejar dengan kemajuan sumber tenaga yang boleh diperbaharui sekarang, perkara ini merupakan satu pilihan yang menarik untuk menggabungkan bersama-sama konsep bekalan kuasa tradisi seperti bateri. Justeru, projek ini bertujuan untuk menghasilkan bekalan kuasa tanpa gangguan hybrid untuk kuasa elektrik motor. Sistem ini menggabungkan bateri simpanan dan solar fotovoltaik (PV). Tujuan utama bagi solar PV adalah untuk mengecas apabila berlaku kadar penurunan voltan kurang daripada nilai yang ditetapkan. Penukar arus terus dua arah antara arus terus (DC) ke arus terus (DC) sangat diperlukan untuk untuk membolehkan process ini dilaksanakan. Berdasarkan pengkajian orang lain yang sebelum ini, keseluruhan sistem ini direka bentuk dan disimulasikan dengan menggunakan perisian PSCAD dalam PSM1 ini. Di bahagian perkakasan pula, projek ini telah berjaya di implimenkan dengan baik 'Hybrid Uninterruptable Power Supply' ini sesuai untuk digunakan pada peralatan dengan sumber kuasa arus terus dimana projek ini dapat mengekalkan penggunaan peralatan sekiranya bekalan kuasa daripada grid utama terputus.

ABSTRACT

An uninterruptible power supply is an important element in industrial sector to make sure continuous process can be maintained in order to sustain optimum production. In line with the advancement of renewable energy nowadays, it is an attractive option to combine it with the traditional power supply such as battery. Thus, this project aimed at designing a hybrid uninterruptible power supply system to power an electrical motor. This system is a combination of a battery storage and solar photovoltaic (PV). The main purpose of the solar PV is to charge the battery whenever its voltage level dropped below the required value. A bidirectional DC to DC converter is needed to enable this process. Based on the previous work of others, the whole system is designed and simulated with PSCAD software in PSM1. The results gathered shows the basic functionability of the system. At the hardware part, this project are successfully be implement with good. Hybrid Uninterruptible Power Supply suitable to use for DC source. This project can be used to help the equipment to maintains their performance during the failure happened to the main grid at the certain time.

DEDICATION

Thank you to my loving parents, family, supervisor, lecturer and my kind friends.

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LIST OF SYMBOLS

I	-	Current
Q	-	Coulomb
R	-	Resistor
t	-	Time Taken
V	-	Voltage
W	-	Watt
Hz	-	Hertz
Te	-	Torque
Wh	-	Watt-hour
ppmV	-	Part per million volume

LIST OF ABBREVIATIONS

MPPT	Maximum Power Point Tracking
PSCAD	Power System Computer Aided Design
PWM	Pulse Width Modulation
UPS	Uninterruptible Power Supply
IGBT	Integrated Gate Bipolar Transistor
EMI	Electromagnetic Interference

LIST OF PUBLICATIONS

CHAPTER 1

INTRODUCTION

1.1 Background

Energy are the amount of the work a physical system is capable of performing. It can be convert and transfer to other forms. It is a product of power and time, that also be measure by Watt-hours (Wh). The flow of energy at any one time and measured in Watt call Power.

1.1.1 Uninterrupted Power Supply

Uninterrupted Power Supply (UPS) are common use as uninterrupted, reliable and use as high quality power for vital loads. In is known as the backup power supply without change the quality same as the main power supply. An uninterrupted power supply are need to provide the power while there are provide the simultaneously necessary power condition for any suitable applications (Ali Emadi, 2005) UPS should keep the transient lines and harmonic disturbance.

Nowadays many type of UPS applications that use include life support system, computer and data storage system, emergency equipment, medical facilities, online management system and industrial processing so on.

For the good characteristic of UPS, it should:

- i. On-line operation, where there should do zero switching time from normal to backup mode and vice versa.
- ii. Bypass the redundant source of the power while the failure occurs to the system.
- iii. Low electromagnetic interference (EMI) and acoustic noise.

1.1.2 Solar Energy System

Energy consumption are at the high demand today. This growing of energy production will be one of the top problem that human need to face related to the natural resources day by day become reduced. A major of create electric energy power are by burning fossil fuels, oil and gas. This thing get the higher request from the industry and other consumer.

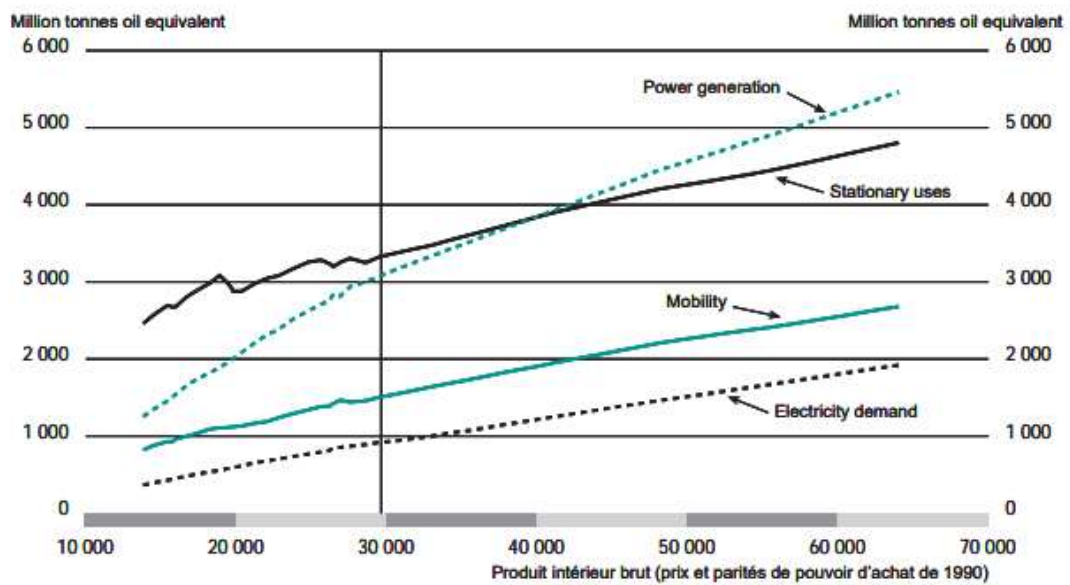


Figure 1.1: World energy related services, 1971-2020 (Energy, 2019)

From the book *Energy: The Next Fifty Years, World Energy Prospects to 2020: Issues and Uncertainties* by Jean-Marie Bourdairé take from Kyoto said if the current policies remain in place, the outcomes from energy consumption, supply and prices are expected to fall an uncertainly band around the business-as-usual projection (Energy, 2019). The using of another renewable source are needed by the way to control of the higher demand of this energy.

The system of solar are look to be match for the controlling this problem. The using of natural nuclear reactor that are produce from the sun and turn into the electricity

are another way to control this problem. It is carry by the photon which are enough to generate solar energy by theoretically needed for an entire year (Solar School, 2019). This power of solar can be harness and converted to use this energy by using solar thermal collector or the photovoltaic. It is use to convert the light into the electricity. From this give, we need to take this advantage to use it besides it is clean and can be generate at many place impacted to the light from sun.

The figure 1.2 show that the statistic production of the sources under assumption that are emission of the CO₂ will be held under 440 ppmV.

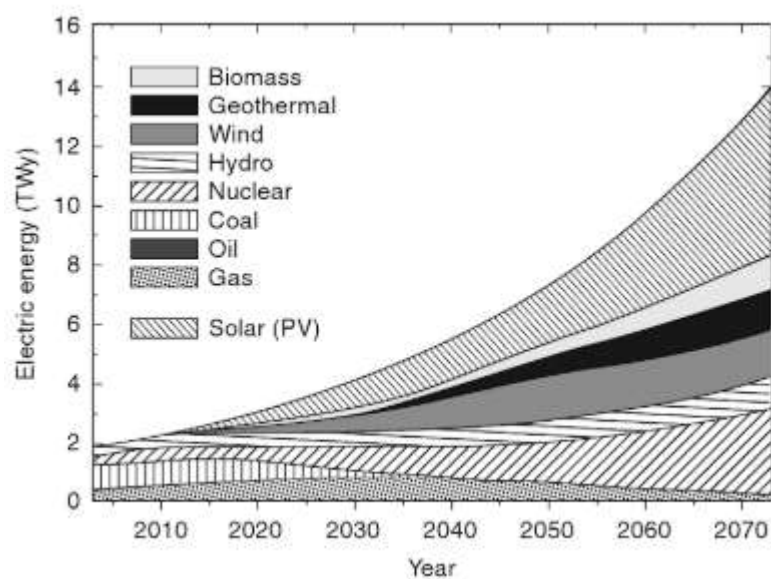


Figure 1.2: Predicted production of electrical energy in the next 60 years (P. Jayarama Reddy, 2012)

1.2 Statement of the Purpose

The purpose of the project is to investigate and create the system of uninterruptible power supply by using the renewable energy as the backup while the power failure happened to the primary line.

1.3 Problem Statement

Industry can be defined as the companies and the activities involves in the process of producing goods for sale, especially in a factory and special area. It technically produce in a particular field, country, region or economy. Nowadays there are many company grow in the type of industrial area. From the statistic that have been issued by tradingeconomics.com (Suruhanjaya Tenaga, 2015), we can see that an existence of this field are increase 3.2 percent in January 2019 even there are slowing from the December 2018 with are 3.4 percent. Although that, we expected it will be increase year by year from because of the higher request of economic growth in the country (Sun power, 2019).

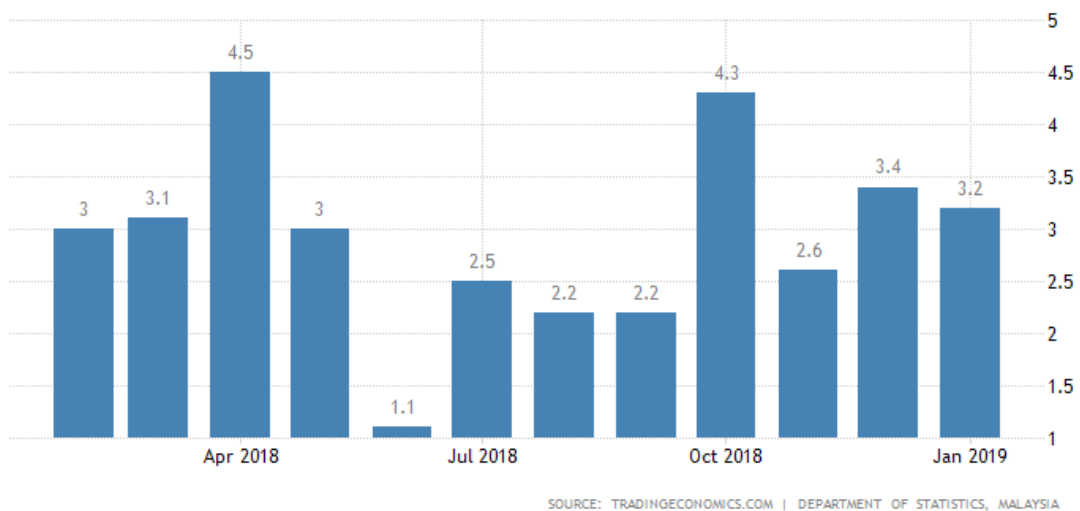


Figure 1.3: Industrial Production in Malaysia
(Suruhanjaya Tenaga , 2015)

From these proof of research, we can see these higher growth will also make higher requirement of the power consumption. As we known the industries field are the higher sector that use the electricity. By the statistic that have been produce by National Energy Balance, 2013 industrial sector are at the second place by 26.2 percent that require the energy consumption after the transportation 43.3 percent. That needed are looking serious related to the fact of the growth of industrial production.