UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF WIND TURBINE FOR CHARGING BATTERY USING WASTE ENERGY FROM AIR CONDITIONER COMPRESSOR

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

Tajuk: DEVELOPMENT OF WIND TURBINE FOR CHARGING BATTERY USING WASTE ENERGY FROM AIR CONDITIONER COMPRESSOR

Sesi Pengajian: 2019

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I hereby, declared this report entitled DEVELOPMENT OF WIND TURBINE FOR CHARGING BATTERY USING WASTE ENERGY FROM AIR CONDITIONER COMPRESSOR is the results of my own research except as cited in references.

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Date:

APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering 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

Turbin angin diklasifikasikan sebagai alat penjanaan kuasa yang digerakkan oleh tenaga kinetik angin. Tenaga kinetik ini akan diubah kepada tenaga mekanikal dan terus menghasilkan elektrik. Dari segi kos pemulaan projek ini, ia merupakan kos yang agak rendah berbanding dengan penjana kuasa yang lain. Projek ini juga akan menterjemahkan teori penjanaan turbin angin yang amat jarang digunakan di negara kita iaitu Malaysia. Seperti yang sedia maklum, terdapat tenaga terbuang dari udara yang berlebihan dikeluarkan oleh unit luar penghawa dingin. Daripada tenaga terbuang ini ada kemungkinan untuk membangunkan turbin angin ini. Untuk proses membuat model turbin angin, hampir 60% merupakan dari paip PVC bermula dari menara sehingga asas dan 20% daripada bahan CPVC yang digunakan untuk pembinaan bilah. Seterusnya, bahan yang digunakan adalah seperti pengunaan motor. Selain itu, beberapa komponen elektronik akan digunakan untuk menstabilkan dan menukar voltan keluaran dari motor penjana. Untuk menganalisis data seperti prestasi kelajuan angin yang berlebihan dan voltan keluaran semasa telah direkodkan. Bagi mencapai semua objektif Projek Sarjana Muda, semua eksperimen yang dibuat haruslah dilakukan dengan teliti dan betul dengan merujuk kepada skop projek.

ABSTRACT

Wind turbines are classified as a power generation driven by the kinetic energy of the wind. This kinetic energy will be changed to mechanical energy and continue to produce electricity. In terms of the cost of an initial project, it is a relatively low cost compared with other power generators. This project will also introduce the theory of the generation of wind turbines and it is very rarely used in our country, Malaysia. As we already know, there is the energy wasted from excessive air issued by the external unit air conditioning. This wasted energy from it is possible to develop this wind turbine. The process of making model wind turbines, almost 60% is from pipe PVC starting from the basic up and 20% of CPVC materials used for the construction of the blade. Furthermore, the materials that use in this project are DC generator motor. In addition, some electronic components will be used to stabilize and change the voltage output from the generator motor. To analyze performance, wind speed excess voltage and current output were recorded. For achieving all the objectives of the Bachelor Project, all experiments should be done carefully and linked with reference to the scope of the project.

DEDICATION

This project is dedicated with love and affection to my father and my mother, who always taught me that everything will be, accomplished even its harder. The most important things that I learn is be patient in every situation. Last but not least, I sincerely thanks to my project supervisor Madam Intan Mastura because without her early inspiration, coaching and enthusiasm none of this would have happened

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In the name of Allah, the Most Beneficent and The Most Merciful. It is deepest sense gratitude of the Almighty that give me strength and ability to complete this Final Year Project report

A special thank you I give to my project supervisor, Madam Intan Mastura binti Saadon, whose give me a good guidance and helped me to coordinate my project especially in writing this report.

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Last but not least, I would like to express my sincerely thank you to all staff of Universiti Teknikal Malaysia Melaka (UTeM) that gave me the permission to use all the equipment in the laboratory to finish my Final Year Project.

Thank You.

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LIST OF SYMBOLS

D, d	-	Diameter
F	-	Force
g	-	Gravity = 9.81 m/s
I	-	Moment of inertia
1	-	Length
m	-	Mass
N	-	Rotational velocity
P	-	Pressure
Q	-	Volumetric flow-rate
r	-	Radius
T	-	Torque
Re	-	Reynold number
V	-	Velocity
w	-	Angular velocity
x	-	Displacement
z	-	Height
q	-	Angle

LIST OF ABBREVIATIONS

DC	Direct Current
USB	Universal Serial Bus
MPP	Maximum Power Point
DCM	Discontinuous Conduction Mode
CCM	Continuous Driving Mode
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
BJT	Bipolar Junction Transistor
IGBT	Insulated Gate Bipolar Transistor
IC	Integrated Circuit
LED	Light Emitting Diode
HAWT	Horizontal Axis Wind Turbine
VAWT	Vertical Axis Wind Turbine
mAh	Miliampere hour
PVC	Polymerizing Vinyl Chloride
V	Voltage
A	Ampere
HP	Horse Power

CHAPTER 1

INTRODUCTION

1.0 Introduction

For this chapter, the project's introduction, background, statement of the purpose, problem statement, objective and scope of the project will be discussed. This project focuses on designing and invents a prototype of portable charger that can be used at anywhere that have air conditioner compressor. This project works by converting wind energy to kinetic energy and then converts to electrical energy. The purpose of the portable charger is to reuse the waste energy from compressor.

1.1 Background

There are two different types of energy in this world which is non-renewable energy and renewable energy. Renewable energy describe that energy source is not reduced. Furthermore, this renewable energy is considered to be important to control the fuel consumption that is notable to be renewed. Moreover, the emission of the greenhouse gases can be reduced. One of the ways to protect the earth from pollution is by reducing the emissions of the greenhouse gases.

Wind turbine has become one of the popular things related to renewable energy in Malaysia. But, the product had to be designed to suit with the condition in Malaysia. Wind energy also has many benefits for all users to reduce cost and also can generate energy. These wind turbines systems used the wind to create kinetic energy for useful power. The keys to manufacture wind energy with the other renewable energy are the cost of the blades.

Based on the Bloomberg New Energy Finance's latest report as shown in Figure 1.1, wind and solar technologies will dominate the future of electricity by 2040. Moreover, these technologies will make up to 48% of the world's installed capacity and 34% of electricity generation. In the development of technologies, due to the rapid reduction of the costs of wind energy, the greening of the global electricity system is unstoppable. The electricity generated from renewable energy will increase to 169% by 2040.

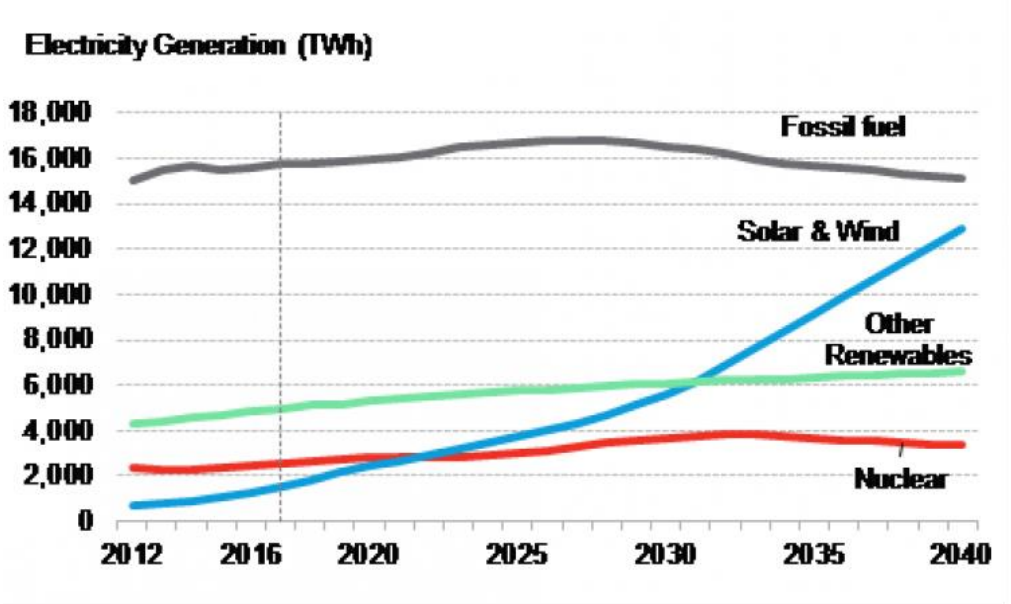

Figure 1.1: Global electricity generation mix to 2040. Source: Bloomberg New Energy Finance, New Energy Outlook 2017

1.2 Problem Statement

By 2020, a rapid global weather change is estimated to happen in the world including Malaysia. Due to global warming, our country is likely to happened high temperatures as in other countries. Over the past few years, the demand of air conditioner is increasing as air conditioners are being installed in each house or office building. Each building is uses estimated of 8-10 hours air conditioner every day. Air conditioner has compressor which release wind as its waste energy. The waste wind energy from the compressor can convert to electricity to store and using to charge the phone.

Based on the observation, most electricity is used for cooling the building. However, the waste energy from the compressor not used at all. The main problem faced is how to control the waste wind energy consumption. Some of the reason that contributes to the increasing of usage in cooling system is that the climate in Malaysia which is tropical climate that having hot and humid weather throughout the year.

Based on the statistics from average electricity consumption breakdown as shown in Figure 1.2, the cooling system demand 44.23% usage in Malaysia. From this statistics, the waste energy can use to convert to electric storage and used to others things such as charging the mobile phone.

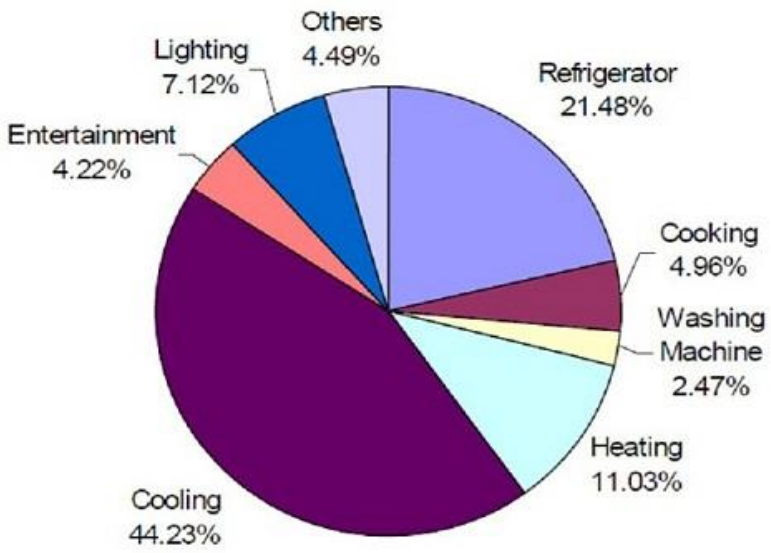

Figure 1.2: Average electricity consumption breakdown (%). Source: Concrete for energy efficient buildings

1.3 Objectives

The purpose of this project is to build a prototype of charging system storage by using wind energy. This wind turbine prototype is expected to be able to store and charge 5V battery. The objectives are:

1. To design and develop horizontal wind generator using DC generator motor from waste energy.
2. To develop a portable charger and store the energy in lithium polymer battery and universal serial bus (USB) as the output charge.

1.4 Scope of Project

This project is to convert the kinetic energy to electrical energy. The powers will store in the battery so that the user can use to charge the phone. From the waste energy which is air, the wind turbine will generate electricity using 12 DC generator motor. Next, the 12 DC motor will convert using boost converter to stable the voltage. The output will use USB 5V/1.0A to charge the phone.

1. Wind Turbine System

A wind turbine transforms the wind energy into electrical energy using the rotation of the rotor blades, which work in a similar way to the wing of an airplane or the blade of a helicopter.

2. Control System

Study and understand the function of boost converter. Analyze the circuit to control the output voltage and make the voltage stable. This converter is commonly used in the electrical system because easy to understand the circuit.