UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF SMALL WIND TURBINE USING WASTED ENERGY FOR DOMESTIC APPLICATION

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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I hereby, declared this report entitled DEVELOPMENT OF SMALL WIND TURBINE USING WASTED ENERGY FOR DOMESTIC APPLICATION is the results of my own research except as cited in references.

Signature: .....

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic 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 : Amalia Aida binti Abd Halim

ABSTRAK

Kuasa angin menukar tenaga kinetik angin untuk menjana tenaga elektrik. Ini dilakukan dengan menggunakan turbin angin besar yang biasanya terdiri daripada bilah-bilah dan turbin boleh disambungkan kepada penjana untuk menjana elektrik. Kuasa angin dan kuasa solar biasanya lebih murah daripada arang batu baru, gas asli, atau penjana kuasa nuklear. Idea projek ini adalah untuk membangunkan turbin angin paksi mendatar (HAWTs) untuk menjana tenaga elektrik dari udara yang dibuangkan ke luar daripada penghawa dingin. Selain itu, kajian ini membentangkan satu eksperimen dengan menjalankan pembinaan sederhana turbin angin kecil. Untuk proses pelaksanaan ini, kebanyakan bahan yang digunakan dalam pembinaan turbin angin ini adalah dari paip PVC terutamanya di bahagian menara dan tapaknya. Bahagian sambungan bilah dan bilahnya adalah plastik dan UPVC untuk menahan suhu yang tinggi. Bahagian lain mengandungi motor sebagai penggerak dan komponen elektronik yang digunakan untuk menstabilkan dan menyaring voltan keluaran dari penjana. Prestasi kelajuan udara yang dikeluarkan, voltan keluaran, dan arus keluaran dicatat untuk tujuan analisis data. Oleh itu, untuk memastikan semua objektif Projek Sarjana Muda dicapai, eksperimen dan prosedur perlu dilakukan dengan betul dengan merujuk skop projek.

ABSTRACT

Wind power converts the kinetic energy in wind to generate electricity. This is done by using a large wind turbine usually consisting of propellers and the turbine can be connected to a generator to generate electricity. Wind power and solar power are typically cheaper than new coal, natural gas, or nuclear power generators. The idea of this project is to develop a horizontal axis wind turbines (HAWTs) to generate electricity from the wasted discharged air from outdoor unit of air-conditioner. Moreover, this study presents an experiment by running a simple construction of small wind turbines. For this process of implementation, most of the materials used in the construction of this wind turbine are from PVC pipes especially at the part of the tower and its base. The blades and blade connection sections are both plastic and UPVC for high-temperature resistance. The rest part contains motor as a drive and an electronic component used to stabilize and filter the output voltage from the generator. Performance of the speed of wasted discharged air, output voltage, and output currents readings are recorded for data analysis purposes. Therefore to make sure all the objectives of the Bachelor Degree Project is achieved, the experiment and procedures should be done properly by referring the scope of the project.

DEDICATION

I dedicated this project to all humble beings who have aided me in any way to complete this project. Whose scarifies seeded my success, especially my beloved parents who always support me during completing this project. I deem them as a divine source of inspiration.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF SYMBOL & ABBREVIATIONS

DC	- Direct current
AC	- Alternating current
rpm	- Revolutions per minute
m/s	- Metre per second
HAWT	- Horizontal Axis Wind Turbine
VAWT	- Vertical Axis Wind Turbine
kW	- kilo watt
V	- volt
A	- ampere
mA	-mili ampere
PVC	- Polyvinyl chloride
UTeM	- Universiti Teknikal Malaysia Melaka

CHAPTER 1

INTRODUCTION

1.0 Background

Energy is the ability to do every type of work. Nowadays, the energy required in powering every sector such as manufacturing and transportation of goods and services. There are different ways exists in collecting the abundance of energy around us and it can be stored, converted, and amplified for our daily use. Energy comes in different forms and can be stored also be transformed from one type to another. The energy sources from which we gain energy are classified into two groups namely renewable and non-renewable. Renewable energy is defined as energy collected naturally where the energy source is not reduced or can be replenished within a human life like solar energy. Examples of renewable resources can be seen daily around the world such as wind, solar, hydropower, geothermal and biomass.

Wind is caused by uneven heating of the earth's surface by the sun. This thing happens because the earth's surface is made up of different types of land and water, it absorbs the sun's heat at different rates. Human has been harnessing the wind's energy for hundreds of years. In the past, windmills have been used for pumping water or grinding grain. Today, the windmill's modern equivalent to a wind turbine which can be used to generate electricity from the wind's energy. Nowadays, wind turbines used as stand-alone applications, or they can be connected to a utility power grid or even combined with a photovoltaic system. For utility-scale sources of wind energy, a large number of wind

turbines are usually built close together to form a wind farm. A wind turbine is a device that is equipped with a blade, working to convert the kinetic energy into rotational motion to turn the electrical generator and produces electricity.

Wasted energy or wasted discharged air are the source produced from a cooling tower, air ventilation system, humidification plant or any system that produces strong and consistent winds. Cooling tower is one of the most common exhaust air systems that is used to dissipate heat from power generation units, water-cooled refrigeration, air conditioning and industrial processes. It is a device used to transfer waste heat to the atmosphere. Typically, large office buildings, hospitals and schools install one or more cooling towers for the building ventilation system. A blower also one of the cooling system that used in Malaysia industrial. It is mostly used to suction air out of a room and really good at blowing large amounts of air. This rotating motion of the fan blades sucks in air from the back of the fan to blow it to the front of the fan. A faster blade rotation will mean that air is blown faster and stronger out of the other end.

1.1 Problem Statement

Wind Power is a major energy source of high interest in European countries due to the high average wind speeds there and they are more concerned with the environment without damaging it. However, limited natural resources in Malaysia are a major problem when dealing with renewable sources of electricity. Malaysia experiences two monsoon seasons namely, the southwest monsoon which is happening in June to September and northeast monsoon in November to March and two inter-monsoon seasons in October and April to May. Wind turbines are mounted on a tower to capture the most energy. At 30

meters or more aboveground, they can take advantage of the faster and less turbulent wind. Turbines catch the wind's energy with their propeller-like blades. Therefore, HAWT usually has a higher cost than VAWT in terms of construction and maintenance as it must be installed on long towers to maximize energy efficiency without any hindrance.

1.2 Objective

The project focuses on the following two objectives:

i. To develop a model of wind turbine generator by reuse wasted energy from a cooling system.

ii. To produce electricity from wind speeds released by the cooling fan system.

1.3 Scope Project

Scope of the project is to design a small wind turbine by using wasted energy from discharged air produced by a cooling system to charge the battery for domestic purposes. This project will focus on generating electricity using a design of three blades wind turbine which is a type of horizontal-axis wind turbine (HAWT). The selection of materials and design for all three blades that are extremely efficient for transferring kinetic energy to mechanical energy.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter was related to the material of reading for the literature review that will be discuss about the types, history and more about wind turbine. Besides that, we able to discuss the components used and also the operation of wind turbines. The information obtained from this literature review will be used to assist the implementation of the next process.

2.1 Wind Turbine

Wind turbines are used to generate electricity from the kinetic power of the wind. Historical they were more frequently used as a mechanical device to turn machinery. Nowadays, power of wind gets highly attention because it has more advantages compared to oil and coal for energy sources non-renewable. Constraints of this energy source, they will run out eventually and become exhausted, since it cannot be replenished in a short period of time.

Anderson P.D. has conduct studies about the conventional and modern utilization of wind power. Wind is one of the renewable energy sources which do not have any fuel costs. The power output produces by the wind generator may be categorized into two parts through the use of mechanical shaft power directly which is a gearing ratio or by allowing the wind turbine power generators and the electrical power generated as power.

Latest technology of wind winding has shown many modern application such as reconstruction of the wind turbine design, hybrid energy, water pumping and battery charging and heating. This non-conventional energy sources are well accepted among consumers.

2.2 Types of wind turbine

There are two main kinds of wind turbine, those with a vertical axis, and those with a horizontal axis. The concept and function still the same, which distinguish the two wind turbines are in terms of efficiency, noise factor, axis rotation of rotor shafts and the construction cost.

2.2.1 Horizontal Axis Wind Turbine (HAWT)

A HAWT wind turbine was actually modified to be more modern in factor of looks and efficiency from the windmill designs that have been around for many years. The cover housing for all of the generating components in a wind turbine is called nacelle. For HAWT, the nacelle will be install perpendicular to the turbine tower. A horizontal wind turbine is the model that usually used in collecting energy from the wind because it offered many advantages. The main parts or components used in HAWT are the main rotor shaft, an electrical generator, the gearbox and the turbine blades. (Moh Saad and Asmuin, 2014)

The main advantages of HAWT is, it is high generating capacity, the efficiency is improved, having a variable pitch blade capacity, and tall tower in order to capture more wind energy due to its high altitude that has no obstacles. But there are also the disadvantages for horizontal wind turbine option such as having a consistent noise, killing