



KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN  
MALAYSIA

**The Suitability of Wind Generated  
Power for Home Power Generation in  
Malaysia**

Thesis submitted in accordance with the requirements of the  
National Technical University College of Malaysia for the Degree of  
Bachelor of Manufacturing Engineering (Honors) (Manufacturing Process)

By

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Faculty of Manufacturing Engineering

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**BORANG PENGESAHAN STATUS TESIS\***

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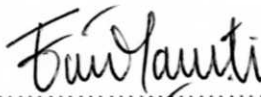
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## ABSTRACT

Nowadays, energy can be generated from several sources such as petroleum (fossil fuel), nuclear, hydroelectric and renewable energy. But today, the ambitious to produce clean energy had cause the observation on renewable energy. Therefore, the objective of this project is to make an observation on the wind energy in Malaysia in generating energy other than had mention above. Wind is one type of renewable energy that can be developed to generate free and clean energy replacing the one that cannot be renewed and cause the pollution such as fossil fuel. Therefore, the purpose of this research is done to determine whether it is suitable for Malaysia to used wind as alternative source to generate energy in replacing the used of petroleum in the future.

Wind energy can be extracted by using the suitable wind generator that is suitable with the current wind speed at observe location which is Mersing. The wrong selection of turbine will cause damage to the turbine itself and would not get the required output. Generally, Malaysia has a potential to use the wind as alternative energy in generating electricity because of sometimes the wind speed in Malaysia can reached until 12 m/s. This occurred when during the monsoon season. Therefore, it is one of the advantage for Malaysia because of in theoretical the minimum wind speed that required to spin the wind blade is equal to 4m/s. Therefore, the other motive of this project is to design the wind turbine emphasis to its wind blade that is suitable with the current wind speed at Mersing through the analysis that had been performed using SOLIDWORK software.

## ABSTRAK

Secara umumnya, tenaga boleh dihasilkan daripada pelbagai sumber seperti, petroleum, nuklear, hidroelektrik dan tenaga daripada sumber yang boleh diperbaharui. Tetapi, pada hari ini, keinginan untuk menghasilkan tenaga yang bersih telah mendorong kajian terhadap sumber tenaga boleh diperbaharui dilaksanakan. Oleh itu, tujuan utama projek ini adalah untuk menjalankan kajian terhadap sumber angin di Malaysia dan potensi penggunaan angin dalam menghasilkan tenaga. Angin adalah salah satu jenis tenaga yang boleh diperbaharui dan mempunyai potensi untuk menghasilkan tenaga yang bersih menggantikan tenaga yang tidak boleh diperbaharui yang boleh menyebabkan pencemaran seperti penggunaan bahan bakar seperti petroleum. Oleh itu, tujuan kajian ini adalah untuk menentukan samaada tenaga angin sesuai atau tidak digunakan di Malaysia sebagai sumber alternatif untuk menghasilkan tenaga di masa akan datang.

Tenaga angin boleh dihasilkan dengan menggunakan penjana angin yang sesuai dengan kelajuan angin di kawasan kajian iaitu Mersing. Kesalahan dalam pemilihan penjana boleh menyebabkan kerosakkan pada penjana itu sendiri dan kuasa yang diperlukan tidak akan dihasilkan. Kelajuan angin di Malaysia boleh mencecah sehingga 12 m/s pada musim mooson dan keadaan ini boleh dijadikan sebagai kelebihan bagi Malaysia untuk menggunakan tenaga angin. Oleh itu, keseluruhan kajian ini akan tertumpu kepada rekabentuk penjana angin iaitu rekabentuk bilah kincir angin yang sesuai dengan kelajuan angin di Malaysia melalui analisis yang dibuat menggunakan perisian SOLIDWORK.

## **DEDICATION**

*For My father, mother and family.*

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**LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED  
NOMENCLATURE**

CETDEM	-	Center for Environment, Technology & Development, Malaysia
Cp	-	Coefficient of Performance
FEA	-	Finite Element Analysis
F lift	-	Lift force
F drag	-	Drag force
FOS	-	Factor of Safety
HAWT	-	Horizontal Axis Wind Turbine
kWh	-	Kilowatt per hour
m/s	-	Meter per second
mph	-	Meter per hour
mW	-	Megawatt
TNB	-	Tenaga Nasional Berhad
TSR	-	Tip Speed Ratio
VAWT	-	Vertical Axis Wind Turbine



## **LIST OF APPENDICES**

- A Blade Design Spreadsheet for Angle of Attack Equal to 5, 10 and 15 Degrees
- B Schedule for PSM I and PSM II

## CHAPTER 1

### INTRODUCTION

This project is about the observation of using a renewable energy emphasis on wind energy as alternative source in facing the depletion of fossil fuel source such as coal, wood and petroleum and its suitability to use the wind energy in generating power in Malaysia.

Malaysia is a tropical country and it has annual southwest and northeast monsoons which are occurred on April to October and October to February each for every year. During this time, the total wind speed can reach until 12 m/s. Generally, Malaysia has calm wind with annual wind speed below than 0.3 m/s in every day. Therefore, prospects for electricity generation from wind seem poor in Malaysia if Malaysia desired to use wind turbine as major source of power but the wind energy can still be used especially during the monsoon season as extra source. It is because of the electricity generation needs at least 4 to 4.5 m/s or 9 to 10.2 mph of total wind speed. Generally, Malaysia wind is relatively calm for almost 30% to 50% of the year [16].

Wind is a clean and free energy that can be used to generate power. Besides that, the energy can be used with other energy such as energy from solar when the wind is not blowing. This system is called as hybrid system. Besides that, the energy from wind can be used directly without the grid connection which can reduce the received power.

This thesis consists of 8 chapters. Chapter 1 is a briefing about the project including its problems statement, objectives and scope of the project. Chapter 2 is more on the project background and literature review about the existing wind turbine that had been used in certain country in the world including its types of turbine, design of the turbine for home, the suitable place for sitting wind turbine, the components of turbine and the mechanism of wind turbine. Chapter 3 is about the mathematical calculation. In this chapter, it would focus on the energy that can be generated from the wind and the amount of electricity that we can generate from the wind.

Chapter 4 would emphasis on the current wind speed in Malaysia and the previous research that had been done before on the similar topic. Chapter 5 is more on the methodology that had will be used in completing this thesis including the idea if the research is successfully and the backup idea if the research cannot be done successfully. The method use is studying the previous research, the characteristic of wind turbine, the geographical and climate in Malaysia including the desired final design of wind turbine. Chapter 6 is about the parameters that need to be considered when determining the shape of wind blade while Chapter 7 is more on the analysis of wind blade based on the parameters that had been selected and the shape that will be produced from the value of the parameters using Excel spreadsheet, MATLAB and AIRSCREW 2000. Chapter 8 is about finite element analysis that had been performed on the selected design of wind blade using COSMOSXpress from SOLIDWORK 2005 software. Lastly, Chapter 9 is a discussion about the overall findings and result through this research.

## **1.1 Problem Statement**

Energy that is generating from fossil fuel would produce the bulk of toxic chemical in to the atmosphere. Based on the article from science world, burning fossil fuel account for 67% of the nation's sulfur-dioxide emissions, which cause acid rain and also worsen respiratory and cardiovascular illnesses, 23% of nitrogen-oxide emissions, which react with sunlight to create lung-irritating ground-level ozone and 40 % of human-made carbon dioxide, a global warming greenhouse gas [31].

Nowadays, the generating energy from the fossil fuel becomes a big problem because the lack of fossil source increased and also it caused air pollution. Therefore, the government has set ambitious targets to generate a sustainable energy and wind energy would form a key role in this besides to achieve the demand of non-polluting energy. Therefore, there are several factors need to be examined such as location, turbine size and interaction with national researches.

## **1.2 Objectives of the Research**

The objectives of this project are:

- 1) To study about the Malaysia geographical and its weather emphasis on its annual wind speed of selected locations for determining the suitable place that can be placed a wind turbine for harness the wind to generate electricity.
- 2) To look at the issues surrounding the available design of the wind turbine in market and the practicality of such turbine to use in Malaysia.
- 3) The project would be focused on the blade design that is suitable to use with the current wind speed that available in Malaysia. The design of the blade and number of blade with that design must be suitable to harness the required power that used by consumer for each year. This research will also focus on the analysis of the blade in determining the best lift force for the blade.

### **1.3 Scope Project**

The scope of project would involve several aspects that need to be focused. The project would cover the wind turbine that used to generate power for home. This project will be focused more on the blade design that suitable to harness energy from the current wind speed, including the blade parameters, the design from the selected value for each parameter and lastly the loading analysis using finite element analysis. All this aspects would be studied in detail for determining the suitable of wind turbine to use in Malaysia.

Other than that is this project will also covered the design of wind turbine especially the anatomy of its blades, which is the main part in wind turbine. The theory of existed blades will be observed. At the same time, the current wind speed in Malaysia will be inspected and the result that had been gain will be compared with the theory that been learned before.

## CHAPTER 2

### PROJECT BACKGROUND

#### **2.1 Wind Power Generation**

Wind is one types of renewable energy other than solar, water, nuclear and biomass. Wind is called a renewable energy source because wind will continually be produced as long as the sun shines on the earth. Today, wind energy is mainly used to generate electricity. It can be used to extract clean energy and to replace the energy from fossil fuel that mostly used to generate energy today. Wind is an alternative ways in generating energy. The energy from wind can be extracted by using large or small wind turbines. The energy that had been extracted can be used to charge batteries for low energy devices such as lighting, radio and television and supplied power to remote locations such as boats and yachts.

##### **2.1.1 History of Wind Energy**

Wind energy had been used for many centuries but the discovery of the internal combustion engine and development of electrical grids had reduced the use of wind energy to generate electricity or useful energy. Wind energy is usually used for water supply and irrigation using the wind pumps, and electrical generation using wind generators.

## CHAPTER 2

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