"I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of the scope and quality for the award of the degree of Bachelor Degree of Mechanical Engineering (Thermal-Fluids)".

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Date : 9 JUNE 2006

THE EFFECT OF DIFFERENT TYPE OF FAN IN CONVERTING AIR FLOW TO ELCTRICITY.

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This thesis is submitted to Mechanical Engineering Faculty
in partial fulfillment of the requirements for the award of the degree of
Bachelor Degree in Mechanical Engineering (Thermal-Fluids).

Faculty of Mechanical Engineering
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May 2006

"I hereby declare that this thesis entitled "The Effect of Different Type of Fan in Converting Air Flow to Electricity" is the result of my own research except as cited in the references"

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Date : 9 JUNE 2006

This thesis is dedicated to my Mom, *Nahariah Binti Abu Bakar* and Dad, *Alias Bin Salleh*, for their love, and dedication to my family, *Kamsah Binti Abu Bakar* and *Zaipah Binti Abu Bakar* for their support.

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ABSTRACT

This report consists of explanation about the method of converting air flow to electricity. Besides that, this report also includes the objective of the study. The objective is to find suitable fan of converting air flow around car's body to produce electric power and to get the data for each case in term of electric power, speed of rotation and air flow velocity. In this study, dynamo has been used to produce electric power. There are two experiments in this study. For experiment one, fan that has been used is made from plastic and the number of blade is three. In this experiment, it was three different sizes of fan. So, it was divided to three cases. While in experiment two, the fan that has been used is made from aluminium and the number of blade is five. It also was divided to three cases. Both of the experiment is used same procedure to produce electric power. The expected values from this experiment are electric current, speed of rotation and air flow velocity. The purpose of conducting this experiment is compare different size and types of fan that can produce the high electric power. From both of the experiment, fan that was made from aluminium with a small size of fan can produce high electric power compare to the other.

ABSTRAK

Laporan ini mengandungi penerangan mengenai kaedah untuk menukar udara yang bergerak kepada tenaga elektrik. Selain itu, laporan ini juga mengandungi objektif kepada kajian ini. Objektif kajian ini ialah untuk mencari kipas yang sesuai yang dapat menukar udara yang bergerak di sekeliling kereta bagi menghasilkan kuasa elektrik dan juga untuk memperolehi data kuasa elektrik, halaju pusingan dan halaju angin. Di dalam kajian ini, dinamo telah digunakan untuk menghasilkan tenaga elektrik. Terdapat dua eksperimen yang dilakukan di dalam kajian ini. Untuk eksperimen yang pertama, kipas yang digunakan diperbuat daripada plastik dan bilangan bilah ialah tiga. Bagi eksperimen ini juga, saiz kipas yang digunakan adalah berbeza. Eksperimen ini telah dibahagikan kepada tiga kes. Eksperimen dua pula menggunakan kipas yang diperbuat daripada aluminium. Kipas yang digunakan juga berlainan saiz. Eksperimen ini juga telah dibahagikan kepada tiga kes. Kedua-dua eksperimen menggunakan kaedah yang sama bagi menghasilkan tenaga elektrik. Daripada eksperimen yang dilakukan, kipas yang dapat menghasilkan nilai tenaga elektrik yang tinggi merupakan kipas yang terbaik. Data yang akan diperolehi daripada eksperimen ini ialah tenaga elektrik, halaju pusingan dan halaju angin. Tujuan eksperimen ini dijalankan ialah untuk mencari saiz dan jenis kipas yang sesuai digunakan untuk menghasilkan tenaga elektik yang paling tinggi. Perbandingan daripada kedua-dua eksperimen, kipas daripada aluminium dengan saiz yang kecil dapat menghasilkan kuasa elektrik yang tinggi.

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LIST OF SYMBOLS

SYMBOL	DEFINITION
Re	Reynolds Number
D	Characteristic Length
KE	Kinetic Energy
m	Mass
V	Velocity
A	Area
x	Thickness
Cp	Power Coefficient
P	Power
T	Torque
V	Voltage
I	Current
R	Resistance

GREEK LETTER	DEFINITION
ρ	Density
υ	Velocity
μ	Dynamic (absolute) Viscosity
ω	Angular Speed of Rotation

SUBSCRIPT	DEFINITION
P_w	Power in the Wind
P_{ex}	Power Extractable

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CHAPTER 1

INRODUCTION

Nowadays, wind energy is one of the fastest growing industries. Wind power is the concept of converting mechanical wind energy into electricity through the use of wind turbines. So, this concept of windmill can be used around the car. The air flow around the car's body can be use to produce electric power. One of the methods of converting air flow to electric power is using dynamo. In this study, different size and type of fan are used to compare which one of fan can produce high electric power. Blades can collect the winds kinetic energy then convert to the electric power

The use of wind energy to generate electricity is now well accepted with a large industry manufacturing and installing thousands of MWs of new capacity each year. Although there are exciting new developments, particularly in very large wind turbines, and many challenges remain, there is a considerable body of established knowledge concerning the science and technology of wind turbines. Its low operating costs and short construction lead times mean it can provide low cost, clean energy quicker and more conveniently than traditional power plants.

1.1 Objective.

- To find suitable fan of converting air flow around car's body to produce electric power.
- To get the data for each case in term of electric power, speed of rotation and air flow velocity.

1.2 Scope.

- Conduct experiment by using different types of fan in order to get velocity and electricity profile.
- Suggest the size and type of fan to apply on the car's body.

1.3 Problem Statement.

According to the title of the study, 'different method of converting air flow to electricity', the main source of converting air flow to electricity is wind. The study is about converting air flow to electricity around car's body. In this study, the function of the using the fan is to collect the wind's kinetic energy. The fan is connected to a drive shaft that will rotate the friction driver of dynamo. This causes the magnet to spin, near the wire coil around the iron core. Electricity is generated in the wires as a result of the change in magnetic field. So, the experiment must be conducted at the suitable place.

Wind power is the concept of converting mechanical wind energy into electricity through the use of wind turbines. So, using wind energy, there can make the world safe from pollution, environmentally clean and is infinitely renewable.

From this study, the method of converting air flow to electricity can be use in the industry if there is no fuel. The objective of this study is to conduct the experiment using different number of blades and sizes of fan. This study is divided to two experiments. For experiment one, the fan that had been used is made from plastic while in experiment two the fan is made from aluminium. Both of the experiment has divided to three cases. Each case has its own size of fan. All of the cases are use the same dynamo and same procedure. The velocity of air flow is 70km/h – 110km/h. So, from this experiment, it will compare which fan can give the high power of electric.

CHAPTER 2

LITERATURE REVIEW

Many windmills are used today. Ever since the energy shortages of the 70's, the growing concern of pollution due to the burning of fossil fuels and the depletion of natural resources, windmills have been greatly studied and developed. Windmills are used to operate sawmills and oil mills in Europe. They are used in mining to extract minerals, to pump water, to generate electricity, and to charge batteries. Windmills have been used on buoys moored far out in the ocean, the power being used for the collection and transmission of oceanographic and weather data. Many new wind turbine models are being built. The wind turbine holds much promise for energy production in the years to come.

2.1 The History of wind.

Throughout history, people have harnessed the wind in many ways. Over 5,000 years ago, the ancient Egyptians used wind power to sail their ships on the Nile River. Later, people built windmills to grind their grain. The earliest known windmills were in Persia (Iran). These early windmills looked like large paddle wheels. Centuries later, the people of Holland improved the basic design of the windmill.

American colonists used windmills to grind wheat and corn, pump water, and cut wood. As late as the 1920s, Americans used small windmills to generate electricity in rural areas without electric service. When power lines began to transport electricity to rural areas in the 1930s, local windmills were used less and less, though they can still be seen on some Western ranches. The oil shortages of the 1970s changed the energy picture for the country and the world. It created an environment more open to alternative energy sources, paving the way for the re-entry of the windmill into the American landscape to generate electricity. (Burton T. et al, 2001)

2.2 Windmill.

The wind turbine, also called a windmill, is a means of harnessing the kinetic energy of the wind and converting it into electrical energy. This is accomplished by turning blades called aerofoil, which drive a shaft, a motor (turbine) and are connected to a generator. The total energy of the winds fluctuates from year to year. Windmill expert Richard Hills said that the wind really is a fickle source of power, with wind speeds to low or inconsistent for the windmill to be of practical use. (Burton T. et al, 2001)

However, that hasn't stopped windmill engineers from trying. Today, there are many kinds of windmills, some of which serve different functions. They are a complex alternative energy source. There are a number of types of windmills. Windmills are divided into Horizontal-Axis and Vertical-Axis types. Low speed horizontal-axis windmills are used for water pumping and air compressing. Southern Cros windmills are an example. Earlier windmills such as the ones in England and Holland build a couple hundred years ago are another example. (Burton T. et al, 2001)

The horizontal-axis was invented in Egypt and Greece in 300 BCE. This specific type of windmill became popular in Portugal and Greece. In the 1200's, the crusaders built and developed the post-mill, which where used to mill grain. It was first used to produce electricity in Denmark in the late 1800's and spread soon after to the U.S. In America, windmills made the great plains. Americans were used to pump water and irrigate crops. During World War I, farmers rigged windmills to generate 1 kW of DC current. Americans mounted the windmills on the tops of buildings and towers.

High-speed horizontal-axis types are used for many purposes, come in many sizes. These include the typical windmills on windmill farm and any other wind turbines in which the shaft turned by the aerofoils is horizontal. High-speed horizontal types may have 1, 2, 3, 4 or many aerofoils. Low-speed types such as European ones have much larger aerofoils in relation to their height above the ground. Low speed types such as western Queensland ones are usually a pinwheel, with many small blades encircled with an outer frame like a wheel. (Burton T. et al, 2001)

Vertical-axis windmills were first developed in the Persians in 1500 BCE to mill corn and were still in use in the 1970's in the Zahedan region. Sails were mounted on a boom, which was attached to a shaft that turned vertically. By 500 BCE, the technology had spread to Northern Africa and Spain. Low-speed vertical-axis windmills are popular in Finland. It was about 150 years old. The Finland people consist of a 200L oil drum split in half. The purposes of this windmill are to pump water and aerate land. High-speed vertical-axis windmills include the Darrieus models. These have long, thin, curved outer blades, which rotate at 3 to 4 times the wind speed. These have a low starting torque, a high tip-speed ratio, inexpensive and are used for electricity generation and irrigation. (Burton T. et al, 2001)

There are three types, the delta, chi, and gamma models. All models are built on a tripod. The advantages to a Darrieus-windmill are that it can deliver mechanical power at ground level. The generator, gearbox, and turbine components are on the ground, instead of at the top of a tower as in horizontal-axis windmills. They cost much less to construct, because there is less material, and the pitch of the blades does not have to be adjusted.

The Savonius model, which originated in Finland in the 1920's, is S-shaped blade, which rotates and turns a vertical shaft. Today, these types of windmills are very popular with scientists and their technology is being developed. Wind machines can easily be separated into two broad categories based on general design whish is horizontal-axis machines and vertical-axis machines. (Burton T. et al, 2001)

The distinction between the two is very obvious. The horizontal-axis machines are those machines whose wind-driven mechanisms are mounted on a horizontal drive shaft, while the vertical-axis machines have their mechanisms mounted on vertical drive shafts. Figure 2.1 illustrates a few of the more popular horizontal-axis machines. In these designs, the generator unit is mounted on top of a tall mast or tower. Gearing is generally used to increase shaft rpm from the wind turbine to the generator itself. A special swivel mount is needed to allow the generator unit to turn freely with the wind, and permit electrical energy to be transferred to the wiring in the stationary supporting structure.

Horizontal-axis wing turbine must be forced to face the wind using a large wind vane for guidance or in the case of many commercial units, they can be directed downwind by the natural wind loading of the huge blades, or they can be electrically or hydraulically positioned.

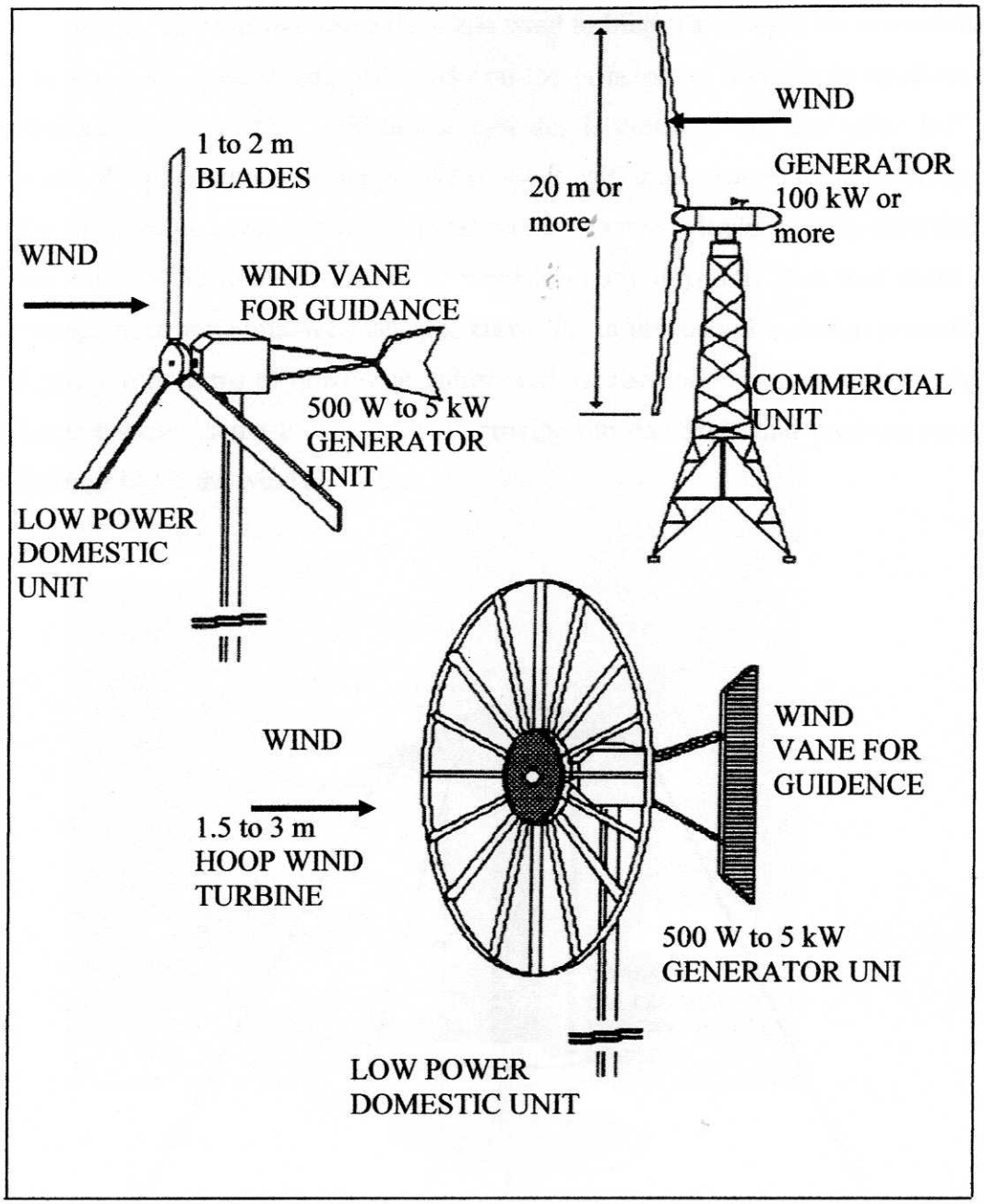

Figure 2.1 : Horizontal-axis wind turbines. (Hazen M.E. et al, 1996)