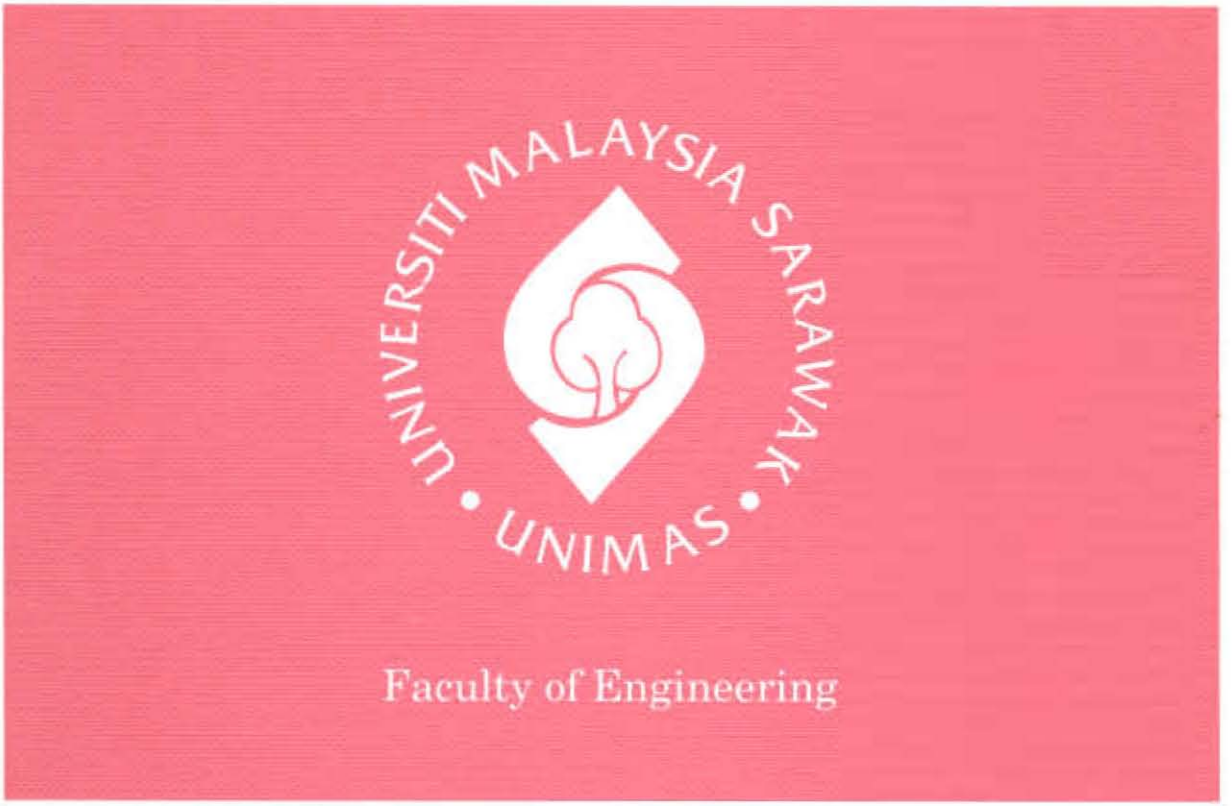

DESIGN AND CONSTRUCTION OF MINI WIND GENERATIOR

Asrul Effendy Bin Ismail

Bachelor of Engineering with Honours
(Mechanical Engineering and Manufacturing Systems)
2005

Universiti Malaysia Sarawak

BORANG PENYERAHAN PROJEK TAHUN AKHIR

Judul: **Design and Construction of Mini Wind Generator**

SESI PENGAJIAN: 2000-2005

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Approval Page

The project report attached here, entitled "Design and Construct of Mini Wind Generator " prepared and submitted by Asrul Effendy Bin Ismail in partial fulfillment of the requirement for Bachelor of Engineering with Honours in Mechanical Engineering and Manufacturing System is hereby read and approved by:

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Dr. Mohammad Omar Abdullah

Supervisor

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Date

DESIGN AND CONSTRUCTION OF MINI WIND GENERATOR

ASRUL EFFENDY BIN ISMAIL

This project is submitted in partial fulfilment of
the requirements for the degree of Bachelor of Engineering with Honours
(Mechanical Engineering and Manufacturing System)

Faculty of Engineering
UNIVERSITI MALAYSIA SARAWAK
2005

Dedicated To My Beloved Family

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ABSTRACT

The purpose of this study was to produce electricity generate by wind energy for education purpose. The system has been focused on both mechanical design and electronic system design. In mechanical design, the task carried out includes designing, fabrication, installation, testing and analysis. The prototype built enables the study at the entire system as well as the individual part. In addition, it allowed hands-on experience during undergraduate study. The Wind Generator modules constructed in this project apply similar in concept as in the module that can be found in the real electricity generator. Construction of entire system includes sawing and filing process, drilling, milling, welding and ends up by finishing process. The geometry size of the model, weight of model and component used were analyzed and implemented according to the detailed design. The result for typical out for instance current, voltage, power output and others are obtained and discussed.

ABSTRAK

Projek ini adalah bertujuan untuk menghasilkan elektrik yang dijana menggunakan tenaga angin untuk tujuan pembelajaran. Fokus utama projek ini pada bahagian mekanikal dan bahagian sistem elektronik. Bagi bahagian mekanikal, perkara yang terlibat termasuklah mereka, mengfabrikasi, pemasangan, percubaan dan analisis. Dengan adanya pembinaan model, ini memberi peluang kepada pelajar untuk mempelajari lebih lanjut dan memahami keseluruhan sistem termasuk setiap komponen yang terlibat. Selain itu, dengan adanya model ini, juga dapat memberi peluang kepada pelajar untuk mendapatkan pengalaman semasa di peringkat pengajian lagi. Di dalam laporan projek ini, proses mereka modul Wind Generator yang digunakan untuk dibina mengikut konsep yang sama seperti yang terdapat di dalam generator elektrik sebenar. Proses-proses yang terlibat dalam membina sistem ini adalah proses pemotongan, memesin, membina, menggerudi, welding dan diakhiri dengan proses penyudahan. Saiz geometri model, berat model dan komponen-komponen yang digunakan akan dianalisa serta diimplikasikan mengikut rekaan yang terperinci.

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Chapter 1

INTRODUCTION

1.1 General Overview of Mini Wind Generator

As global economy expands to meet the aspiration of countries around the world, energy demand is increasing even if strenuous efforts were made to increase the efficiency of energy use. Given adjacent support to the demand, renewable technologies can meet much of the growing demand at lower prices then those usually forecasted for conventional energy. From the research done by the mid of 20st century, renewable energy sources could account for three-fifths of the world electricity market (see figure 1.1) and two-fifths of the market for fuels used directly. However, making a transition to renewable intensive energy economy would provide environmental and other benefits not measured in standard economic accounts

Such renewable energy sources is wind. Wind is created when air that has been warmed over sun-heated land rises, leaving a vacuum in the space it once occupied. Cooler surrounding air then rushes in to fill the vacuum. This movement of rushing air is what we know as wind.

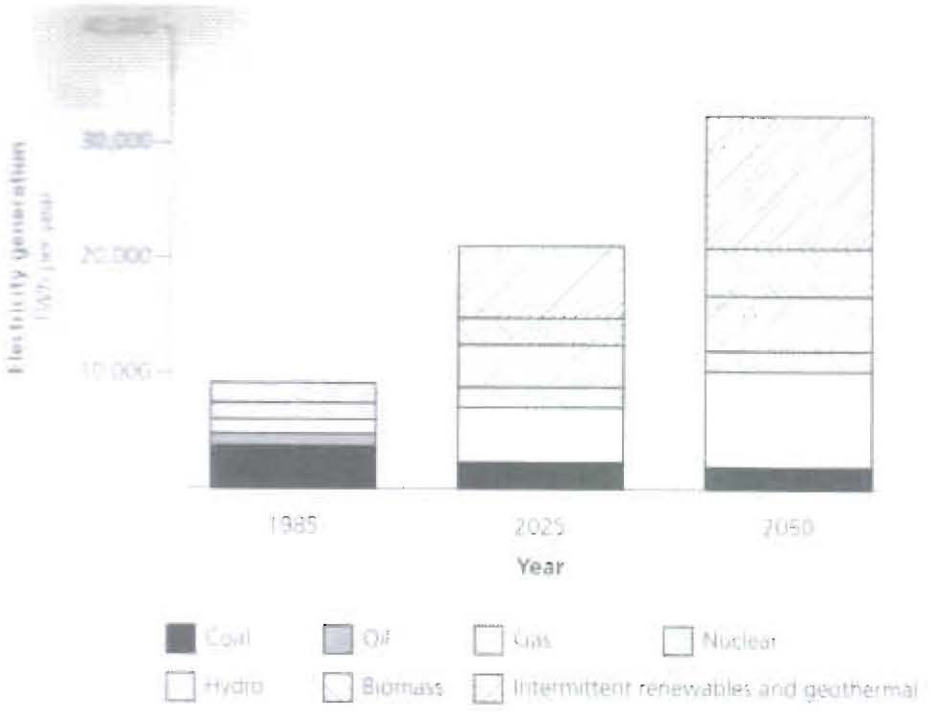

Figure 1.1: Electricity generations for the renewable intensive global energy scenario

(Source quoted from Johansson. T.B, Kelly. H, Reddy A.K N, Williams R.H, Burnham. L (1993). "Renewable Energy." Island Press. (P.2)

During the past 20 years, outstanding progress has been made in the technology used to convert wind energy to electrical energy. More than 150000 wind turbines in California and 2800 in Denmark have been integrated into existing utility grids and are routinely operated in conjunction with conventional sources such as hydroelectric, fossil fuel fired, nuclear generating stations and so on. Wind Energy, energy contained in the force of the winds blowing across the earth's surface. When harnessed, wind energy can be converted into mechanical energy to peform work such as pumping water, grinding grain, and milling lumber. By connecting a spinning rotor (an assembly of blades attached to a hub) to an electric generator, modern wind turbines convert wind energy, which turns the rotor, into electrical energy.

Wind energy has become one of today's lower cost renewable energy technologies. The potential of wind generator to contribute to a better standard of living in the modern world may come as somewhat of a surprise, perhaps due to its absence from contemporary industrialized societies. More over because the size of most wind generator equipment is small, wind generator can advance at faster pace than conventional technologies. While large energy facilities require extensive construction in the field, where labor is costly and productivity gains difficult to achieve, most wind generator equipment can be constructed in factories and offshore as alternative energy or back up energy, where it is easier to apply modern manufacturing techniques that facilitate cost reduction. The small scale of the equipment also makes the time required from initial design to operation short, so that any improvements can be identified by field testing and quickly incorporated into the modified design. In this way many generations of wind generator technology could be introduced in short periods and develop. Wind generator is expecteded to bring competition with the conventional energy and others sources of renewable energy.

However, the application wind generators at Kuching, Sarawak are suppose tough if we considering the low and unconsistent wind speed in Sarawak. Thus, the wind generator is much more suitable for smaller application which produces energy around 200 W.

1.2 Analysis about Wind

Wind is created when air that has been warmed over sun-heated land rises, leaving a vacum in the space it once occupied. The wind is a by product of solar energy. Around 2% of the sun's energy that reaches the earth is converted into wind energy. We can look at the surface of the earth heats and cools unevenly, creating atmospheric pressure zones that makes air flow from high to low pressure areas. This movement of rushing air is cause of different pressure in what we know as wind. By the alternating stormy and fair weather, wind speeds can range from gale force to total calm within a 24-hour period. Daily and monthly changes are important considerations for using where electricity use is time-dependent. Seasonal winds in Kuching are not too strong. To make the most efficient use of the energy supplied by the wind generator, we should adjust its energy consumption to match the availability of the wind. Weather forecasts are valuable in planning for high and low wind periods.

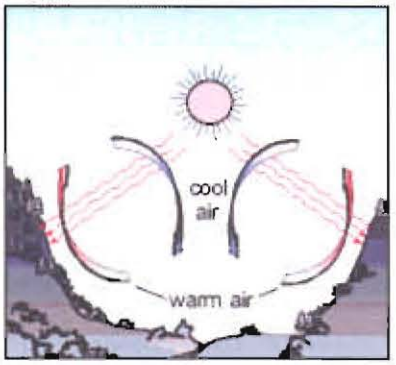

Fig 1.2: condition wind at day time

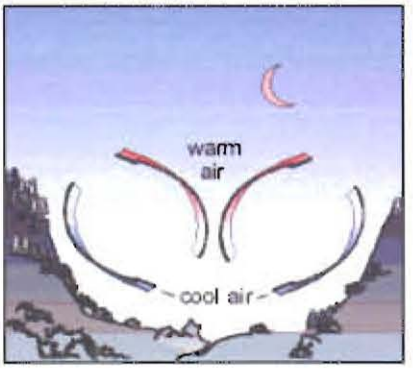

Fig 1.3: condition wind at night time

1.2.1 Wind and Geography

Before we are build the wind generator the first thing we must study is about general wind in order to gather optimum electricity result. If we are to assume of Kuching being consisted of flat and smooth land, there would be little wind variation from place to place. However this thing is impossible to happen. But the reality is that Kuching consisted with the addition of hills, valleys, river bluffs and lakes, thus a complex and highly variable wind regime is created. It includes trees and buildings which adds to the complexity of the wind on a smaller scale.

Hills, valleys, which are lower and sheltered, generally have lower wind speeds. However, all valleys are not necessarily poor wind sites. When the orientations is parallel to the wind flow, valleys may channel and improve the wind resource. A constriction to the valley may further enhance wind flow by funneling the air through a smaller area. This is often the case in narrow mountain passes or gaps that face the wind.

Valleys often experience calm conditions at night even when adjacent hilltops are windy. Cool, heavy air drains from the hillsides are collected in the valleys. The resulting layer of cool air is removed from the general wind flow above it to produce the calm conditions in the lowlands. Because of this, a wind turbine located on a hill may produce power all night, while one located at a lower elevation stands idle. This phenomenon is more likely to occur on higher terrain features that reach at least several hundred feet above the surrounding land. High terrain features can accelerate the flow of wind. An approaching air mass is often squeezed into a thinner layer so it speeds up as it crosses the summit. Over a ridge, maximum acceleration occurs when the wind blows perpendicular to the ridge line. Isolated hills and mountains may

accelerate the wind less than ridges because more of the air tends to flow around the sides.

Land areas adjacent to large bodies of water may be good wind sites for two reasons. First, a water surface is much smoother than a land surface, so air flowing over water encounters little friction. Second, when regional winds are light, local winds known as sea or lake breezes can develop because the land and water surfaces heat up at different rates. Here, land heats more quickly than water, the warm rising air over the land is replaced by the cooler air from over the water. At night the breeze stops or reverses the direction, as the land cools more quickly.

1.2.2 Trees and Buildings Disturbance

Trees and buildings are the most familiar factors to wind in the vicinity of a potential wind turbine site. They act to disturb the air both upwind and downwind of the obstruction by reducing wind speed.

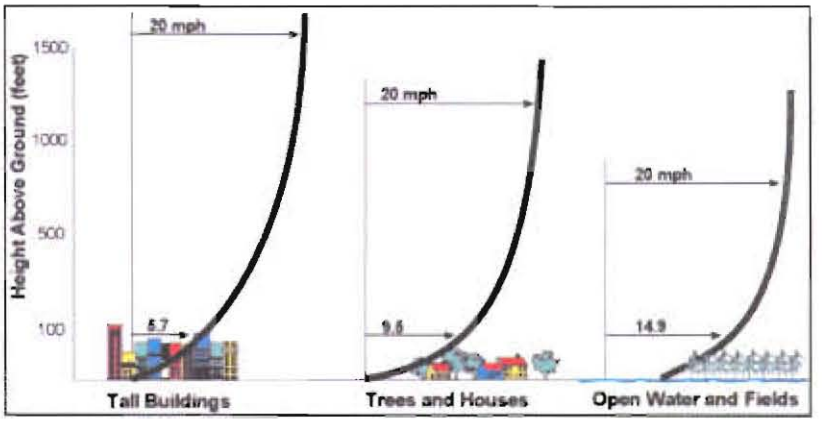

Figure 1.4: Disturbance of the air both upwind and downwind of the obstruction