Faculty of Electrical and Electronic Engineering Technology

ASSESSMENT OF WIND ENERGY RELIABILITY FOR SMALL LIGHTING PURPOSES

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Bachelor of Electronics Engineering Technology with Honours

2022

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A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Assessment Of Wind Energy Reliability For Small Lighting Purpose

Sesi Pengajian : 2022 / 2023

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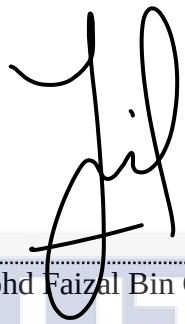
I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours

Signature : 

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DEDICATION

To my beloved mother, Puan Foziah Binti Ali, and my beloved father, Mazlan Bin Abdul Rashid.

ABSTRACT

The amount of electricity generated by a turbine is mostly determined by wind speed. Because greater winds allow the blades to rotate faster, higher wind speeds provide more power. More mechanical and electrical power from the generator comes from faster rotation. This project is about wind turbines that generate electricity from a direct current (DC) motor generator, then flow and be provided to a light-emitting diode (LED) to simulate the output of a lighting system. LED lighting as an indicator of the strength of power generation by the wind turbine. The data was collected for wind speed at various locations in Kemaman, Terengganu, by using a pitot tube anemometer because there are a few locations that have the potential to get higher wind speeds, and it can be said that small wind turbines could be used to provide power during the monsoon season, such as at Pantai Penunjuk Kijal, the tower at Pantai Teluk Kalong, Pantai Teluk Kalong, Pantai Marina (Telaga Simpul), Jetty Starcruise Awana Kijal, Pantai Kemasek. Pantai Kuala Kerteh and Kampung Pantai Kemasek. Then, from the actual wind speed that was collected and simulated using an industrial stand fan. In this project, vertical axis wind turbines (VAWT) are suitable where wind speeds in Malaysia are lower and the wind direction is not constant. All data, including voltage, current, and power, have been compared between three and five blades. The data has been monitored and stored inside the Arduino, and the recorded data may subsequently be displayed on a liquid crystal display (LCD). Five blades provide more power than three blades, according to the project's results, because more mechanical and electrical power from the generator comes from faster rotation. Thus, an average wind speed below 2 m/s can still be useful for small lighting purposes. Furthermore, the analysis demonstrates that the number of blades and wind speed have an effect on wind turbine performance.

ABSTRAK

Jumlah tenaga elektrik yang dihasilkan oleh turbin kebanyakannya ditentukan oleh kelajuan angin. Kerana angin yang lebih besar membolehkan bilah berputar lebih cepat, kelajuan angin yang lebih tinggi memberikan lebih kuasa. Lebih banyak kuasa mekanikal dan elektrik daripada penjana datang daripada putaran yang lebih pantas. Projek ini adalah mengenai turbin angin yang menjana elektrik daripada penjana motor arus terus (DC), kemudian mengalir dan dibekalkan kepada diod pemancar cahaya (LED) untuk mensimulasikan keluaran sistem pencahayaan. Pencahayaan LED sebagai penunjuk kekuatan penjanaan kuasa oleh turbin angin. Data tersebut dikumpul untuk kelajuan angin di pelbagai lokasi di Kemaman, Terengganu, dengan menggunakan alat pengukur tiub pitot kerana terdapat beberapa lokasi yang berpotensi untuk mendapatkan kelajuan angin yang lebih tinggi, dan boleh dikatakan turbin angin kecil boleh digunakan untuk memberi tenaga pada musim tengkujuh seperti di Pantai Penunjuk Kijal, menara di Pantai Teluk Kalong, Pantai Teluk Kalong, Pantai Marina (Telaga Simpul), Jeti Starcruise Awana Kijal, Pantai Kemasek. Pantai Kuala Kerteh dan Kampung Pantai Kemasek. Kemudian, daripada kelajuan angin sebenar yang dikumpul dan disimulasikan menggunakan kipas berdiri industri. Dalam projek ini, turbin angin paksi menegak (VAWT) sesuai di mana kelajuan angin di Malaysia lebih rendah dan arah angin tidak tetap. Semua data, termasuk voltan, arus dan kuasa, telah dibandingkan antara tiga dan lima bilah. Data telah dipantau dan disimpan di dalam Arduino, dan data yang direkodkan kemudiannya boleh dipaparkan pada paparan kristal cecair (LCD). Lima bilah memberikan lebih kuasa daripada tiga bilah, mengikut keputusan projek, kerana lebih banyak kuasa mekanikal dan elektrik daripada penjana datang daripada putaran yang lebih pantas. Oleh itu, kelajuan angin purata di bawah 2 m/s masih boleh digunakan untuk tujuan pencahayaan kecil. Tambahan pula, analisis menunjukkan bahawa bilangan bilah dan kelajuan angin mempunyai kesan ke atas prestasi turbin angin.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, Encik Che Wan Mohd Faizal Bin Che Wan Mohd Zalani and co-supervisor, Ts. Ramlan Bin Latip for their precious guidance, words of wisdom and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) for the financial support which enables me to accomplish the project. Not forgetting my fellow colleague, Nur Iesha for the willingness of sharing her thoughts and ideas regarding the project.

My highest appreciation goes to my parents, and family members for their love and prayer during the period of my study. An honourable mention also goes to siblings for all the motivation and understanding. And to Encik Adlan thanks for helping setup for hardware.

Finally, I would like to thank all the staffs at the UTeM, fellow colleagues and classmates, the faculty members, as well as other individuals who are not listed here for being co-operative and helpful.

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Ω - Ohm

-

LIST OF ABBREVIATIONS

V	-	Voltage
R	-	Resistor
A	-	Ampere
W	-	Watt
m/s	-	Meter per second
DC	-	Direct current

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CHAPTER 1

INTRODUCTION

1.1 Background

Majority of countries in the worlds are depending on power grid that generate by fossil fuel sum of coal, oil and gas. Years by years, giant country such as China, United States and Germany developing wind energy that can fully exploit the renewable energy. As a result, demand for power in renewable energy will continue to rise as a solution to overcome the earth's limited resources.

Wind energy is one of the branches of renewable energy. The concept of wind energy is to convert the kinetic energy of the wind into mechanical energy. The blades of the turbine are turned by the wind, which spins the shafts flowing down the tower, which are connected to a generator. The operating of the shafts and the friction of the turning shafts connect to the generator, which turns the energy produced by the wind turbine into usable electricity to be used for home and commercial purposes. Wind energy provides an efficient power alternative that is clean, abundant, and completely environmentally friendly. This means that natural resources are used to produce clean, environmentally friendly power.

The study has been carried out on the east coast in Kemaman, Terengganu. The data was collected for wind speed by using a pitot tube anemometer at eight locations that have the potential to get higher wind speeds, and it can be said that small wind turbines could be used to provide power during the monsoon season. The data were collected in the morning (8.00–11.00am), evening (16.00–19.00pm), and night (20.00–23.00pm) to observe different times and locations of wind speed. From the actual wind speed that was collected by using

a pitot tube anemometer, the data will simulate using an industrial stand fan to get a constant wind speed. The wind speed was adjusted based on distance, speed control, and the angle of the fan that must be directed at the wind turbine to get a similar wind speed to the actual wind speed. The data, including voltage, current, and power, was then compared between three and five blades to determine which one performs better in terms of wind energy reliability for small lighting purposes.

1.2 Problem Statement

Fossil fuel is the main power source that drives the world. The limited source of fossil fuel is the main problem to be overcome. In terms of transportation, petroleum and natural gas are used to generate power for vehicles that produce carbon dioxide (CO2), which is created by the burning of fossil fuels in internal combustion engines and can affect greenhouse gases.

By the time, fossil fuel will be run out. Wind energy is one of the solutions to decrease dependence on the limited source and reduce greenhouse gas emissions. However, the average annual wind speed in Malaysia is less than 2 m/s, and the wind does not blow at the same speed all around the Malaysia but it still worth for small lighting purpose [1]. In wind energy, small outputs of power can back up electronic devices such as radios and cameras. Wind energy can be used in many different ways and variables, as the different types of wind turbines and wind speeds will produce different power outputs. However, in this study, the type of wind turbine used is vertical axis wind turbines (VAWT). This type of wind turbine is the most efficient for generating electricity where wind speed are lower and the wind direction not constant. The amount of power is mostly determined by wind speed because stronger winds allow the blades to rotate faster and higher wind speeds

provide more power. More mechanical power and electrical power from the generator result from faster rotation.

1.3 Project Objective

The main aim of this project is to assess the wind energy reliability for small lighting purposes in Malaysia. The specific objectives are as follows:

a) To study the wind energy potential of various locations.

b) To identify the design needs based on criteria, materials, and constraints that affect the design.

c) To develop an effective and reliable methodology for wind turbines that can be used for small lighting purpose.

d) To assess the best performance of wind turbines to generate electricity for small lighting purposes.

1.4 Scope of Project

The scope of this project is to study the wind energy potential of various locations in Kemaman, Terengganu, such as Pantai Penunjuk Kijal, tower at Pantai Teluk Kalong, Pantai Teluk Kalong, Pantai Marina (Telaga Simpul), Jetty Starcruise Awana Kijal, Pantai Kemasek. Pantai Kuala Kerteh and Kampung Pantai Kemasek. This project only focuses on the testing that was executed to calculate voltage, current, and power output from the turbines at different wind speeds. This project chose the vertical axis wind energy (VAWT) category and compared three and five blades. The Savonius design, which consists of two half-cylinders, was chosen. Savonius turbines function by diverting wind into the inside of the convex side of the cylinder on one side and the rear of the concave side on the other. The

wind is directed between the semi-cylinders, which causes it to move and rotate around the associated vertical shaft. The blades used in the turbines were made of polyvinyl chloride (PVC), and the connecting shaft was made of stainless steel. This project uses an Arduino Uno that acts as a regulator and controller for the processing of input and output data, DC motor, current sensor (5 A), voltage sensor DC (0–25 V), liquid-crystal display (LCD), and light-emitting diode (LED).