UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF PICO TURBINE SYSTEM ON THE DOWNSPOUTS USING RAIN WATER

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours.

by

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I hereby, declared this report entitled Development of Pico Turbine System On The Downspouts Using Rainwater is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Maintenance) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Tenaga boleh diperbaharui merupakan tenaga yang dihasilkan daripada sumber yang tidak terhad atau sumber yang boleh dikitar semula seperti tenaga solar, angin dan air. Tujuan utama tenaga boleh diperbaharui adalah untuk mengurangkan pengeluaran karbon untuk mengelakkan pemanasan global. Ini bukan hanya untuk masa sekarang, tetapi termasuk untuk masa hadapan anak muda. Tenaga boleh diperbaharui adalah proses dimana tenaga daripada sumber dijadikan tenaga elektrik. Dalam erti kata lain, tenaga boleh diperbaharui merupakan kitaran tenaga. Walau bagaimanapun, dalam projek ini menggunakan sumber air iaitu air hujan daripada longkang bumbung untuk menghasilkan tenaga elektrik dengan menggunakan turbin air mini. Oleh itu, pendekatan ini adalah untuk membangunkan turbin air untuk menjimatkan penggunaan elektrik daripada menggunakan tenaga solar. Keamatan air hujan akan mengubah hasil akhir eksperimen ini.

Semakin tinggi kelajuan air melalui turbin, maka semakin tinggi tenaga dapat dihasilkan. Daripada data yang didapati, air pada kelajuan 0.037 L/s menghasilkan 0V. Hal ini kerana kelajuan dan tekanan air terhadap turbin tidak cukup untuk menghasilkan tenaga elektrik. Kelajuan air minimum untuk menghidupkan turbin adalah 0.055 L/s. Tambahan lagi, daripada data menunjukkan kelajuan air pada 0.335 L/s dan 0.454 L/s menghasilkan kadar tenaga yang sama. Hal ini kerana tahap maksimum turbin ini dapat hasilkan tidak melebihi 17V walaupun kelajuan air semakin tinggi. Sebagai penutup, tenaga elektrik dapat dihasilkan daripada air hujan dengan menggunkan turbin air.

ABSTRACT

Renewable energy is a energy that generated either from a source that are unlimited or from a source that can be recycled such as from the natural sources which is solar, wind and water. The main purpose of renewable energy is to reduce the carbon emission to avoid global warming. This is not only for present time, but its include future of the children. Renewable energy is the process where to generate energy in the form of electricity from treatment of waste or natural sources. In other words, renewable energy is a energy cycle. However, this project will use water as a source of energy to generate electricity using mini turbine system which is by using rain water from the house's gutter and downspouts. Thus, this approach is to develop the hydro turbine power to save more electricity instead of using solar power only. The level of rainfall intensity will affect the result of the experiment due to the rainwater is the source of energy that had been used to transfer the mechanical energy to the turbine before its changed to electrical energy.

The higher the flowrate pass through the turbine, the higher the voltage had been produced by the turbine. From the result shows that the flowrate at 0.037 L/s currently giving 0V. This is due to the speed and pressure of the water does not enough for the turbine to generate the power. Flowrate needed to generate power was at least higher than 0.055 L/s. Furthermore, from the result shows that the highest voltage recorded was about 17.14V even though the flowrate are not the same which is 0.335 L/s and 0.454 L/s respectively. This is due to the power of the turbine had been limited to maximum of 17V even the flowrate of the water increase but the turbine only can supply absolutely at 17V maximum voltage. As conclusion, electricity can be produced or collected by using the rainwater.

DEDICATION

I would like to dedicate this to my family where my mother was a strong and gentle sould that taught me to believe in Allah, in hardwork and so much could be done with a little action. To my father, which supporting and encouraging me to believe in myself on everything that I do.

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LIST OF SYMBOLS

CO_2	-	Carbon Oxide
°F	-	Farenheit
°C	-	Degree Celcius
mA	-	milliampere
Ω	-	Ohm
Mpa	-	Mega Pascal
L	-	Litre
Mm	-	Millimetres
Inch	-	Inches
W	-	Watt
K	-	Kilo
V	-	Voltage
AH	-	Ampere per Hour
Ft	-	Feet
l	-	Length
P	-	Power
Kg	-	kilogram
ρ	-	Density
g	-	Gravity = 9.81 m/s
$\dot{m}$	-	Mass flow rate
H_{net}	-	Net head
H_{gross}	-	Gross head
η	-	Product of efficiencies

LIST OF ABBREVIATIONS

GHE	Green House Effect
SREP	Small Renewable Energy Power Programe
PV	Photovoltaic
CSP	Concentrated Solar Power
PVC	Polyvinyl chloride
AC	Alternating Current
DC	Direct Current
emf	Electrical Potential
LED	Light Emitting Diode

CHAPTER 1

INTRODUCTION

1.1 Project Background

Renewable energy is a energy that generated either from a source that are unlimited or from a source that can be recycled such as from the natural sources which is solar, wind. And water. However, this is not the only types of renewable energy. Nowadays, energy are important in this modern century where there is many types of technology that need an energy to operate for example an electronic devices which required electricity or a transportation which need gasoline to move.

Most of the energy comes from fossil fuel, however the fossil fuel is not an unlimited source compare to renewable energy which is limitless. Even though fossil fuels can be made by implementing dead tree or plant, according to (Chris Wooford, 2017), the author say that "It takes about 400 million years to form a planet's worth of fossil fuel but it only takes 60 years to use 80 percent of the fossil fuel". This means that the fossil fuels was totally running out, this will increase the price of the fossil fuels due to the high demand. Furthermore, the fossil fuel will cause environmental impact to the earth.

The main purpose of renewable energy is to reduce the carbon emission to avoid global warming. This is not only for present time, but its include future of the children. Global warming also known as climate change or the rise in average temperature of the earth. Overall, renewable energy is a energy cycle. However, this project will use water as a source of energy to generate electricity using mini turbine system which is by using rain water from the house's gutter and downspouts.

1.2 Problem Statement

In Peninsular Malaysia, the rate of charge for the electricity had increased. According to (Ministry of Energy Green Technology and Water (KeTTHA), (2014) shows that the charge for electricity in Peninsular Malaysia had increased include the residential area which the increases will give higher bill to the community as shown in Appendix 1. Malaysia energy supply was increased significantly over last 20 years. Based on (Suruhanjaya Tenaga (Malaysian Energy Comission), 2010), "Electricity from the residential sector had increased by 3.8 percent compared to the previous year while electricity consumption in commercial sector had increased 2.6 percent from previous year. Energy consumption in the industry sector recorded an increase of 2.9 percent. Overall, the total electricity consumption increase 3.0 percent compared to previous year.". Malaysia electricity generation is primarily using depleting fossil fuel resources.

Fossil fuel is being used to generate energy to supply in every place especially in a city. In case of the impact of the fossil fuels to the environment is that, Malaysia's electricity generation is heavily dependent on depleting fossil fuel which emits CO_2 that contributes to global warming due to green house effect (GHE). In addition, national policy and law-related Malaysia give commitment during COP 15 based on (Hon. Douglas Uggah Embas, 2011), "Prime Minister of Malaysia, Datuk Seri Najib Tun Razak annouced Malaysia will have reduction of 40% in carbon emission need to be achieved through energy efficiency, energy conservation and renewable energy".

In economy perspective, by implementing energy efficiency, energy consumption can be reduced. The benefits for the country is that the profit of the county will increase. On this project, pico hydro turbine will be used to generate electricity from

rainwater. Installations below 5 kW are called pico hydro. Pico hydro is the lowest generating cost amongst off grid energy options.

According to (Ho-Yan, 2011), "Hydro power is driven by extracting the potential energy from water over a height difference. The water energy is converted to mechanical energy when passing through the turbine blade and whether to be use directly or convert it into electrical energy by means of a generator." These type of hydro power installations can provide electricity to home even in a small amount of electricity. There are many of these installations had been used around the world, especially to the nations that provide an renewable energy without the purchase of fuel.

1.3 Objectives

- To develop the mini turbine system using low cost material and rainwater.
- To apply the conversion of energy from turbine system to produce energy power from rain water.
- To charge the rechargeable battery by using the mini turbine system for future use.

1.4 Scope

This project is to develop turbine system in house located in Taman Muzaffar Height, Ayer Keroh, Melaka. Data of this project will be collect based on the rainy day which the rain water will be the source to generate the pico turbine system. This research will focus on the capability and capacity of the pico turbine system to produce electricity. The purpose is to supply energy to light up a bulb located at car porch. Energy from the pico turbine will give electricity to light up the bulb during the midnight which will give benefit to every household.

Figure 1.0 : Map of Melaka

Source : https://www.bacalahmalaysia.com/2018/01/11/pembahagian-kerusi-parlimen-melaka-percaturan-cacat-pembangkang/

1.5 Rational of Study

The reason to study this project is based on the today environment where the electricity are increased due to limitation of fossil fuel to generate the electricity and the climate change where the increase in temperature that caused by carbon emission due to burning the fossil fuels.

1.6 Expected Result

- The mini turbine system works efficiently in supplying electricity from the waste water.
- The light bulb will turn on after generating the power from the mini turbine system.