



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DESIGN AND DEVELOPMENT OF ENERGY HARVESTER
DEVICE FOR THE APPLICATION IN DOMESTIC
PIPELINE**

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

by

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DECLARATION

I hereby, declared this report entitled “Design and Development of Energy Harvester Device For The Application In Domestic Pipeline” 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 Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours. The member of the supervisory is as follow:

.....
(Project Supervisor)

ABSTRAK

Projek ini adalah bertujuan ke arah pembuatan penuai tenaga untuk diaplikasikan dalam saluran paip domestik. Tujuan projek ini adalah untuk mereka bentuk dan membina satu mekanisme penuai tenaga untuk diaplikasikan dalam saluran paip domestik. Selain itu, ia bertujuan untuk menguji dan menganalisis tenaga kinetik yang boleh ditukarkan kepada tenaga elektrik. Dalam kajian ini, kaedah ujian projek ini adalah dengan menggunakan multimeter, tolok tekanan, dan takometer. Kuasa kinetik yang dihasilkan oleh pergerakan air boleh menggerakkan bilah kipas dimana pusingan motor dapat menghasilkan tenaga elektrik dan akan digunakan untuk menyimpan tenaga dalam bateri. Topik yang dipilih dalam kajian literatur lebih memberi tumpuan dari segi reka bentuk bilah kipas dan juga muncung jet. Alat penuaian tenaga yang mampu menukarkan tenaga kinetik kepada tenaga elektrik yang akan digunakan dalam saluran paip domestik akan menjadi kenyataan. Tenaga elektrik yang dijana akan disimpan dalam bank bateri.

ABSTRACT

This project is point towards on the fabrication of energy harvester for application in the domestic pipeline. The purpose of this project is to design and fabricate a mechanism of energy harvester for application in the domestic pipeline. Besides that, it also to test and analyze the kinetic energy that can be converted to electrical energy. In this study, the method of testing the project is by using a multimeter, pressure gauge, and tachometer. Kinetic power that generated by the movement of water can move the propeller blade where the motor can produce electricity and will be used to store energy in a batteries. The topic that selected in literature review more focusing in term of the design of propeller blade and also nozzle. An energy harvesting device that is capable of converting the kinetic energy into electrical energy to be used in the domestic pipeline will be realized. The electricity generated will be stored in the battery bank.

DEDICATION

To my beloved parents,
My respectful lecturers,
Also my faithful friends,
Your prayers always with me every way that I went.

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I would like to thank to the almighty Allah for his blessing. All the process of idea, concept, design and everything which in this project making is cannot be done without his blessing.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

This paper is point towards on the fabrication of energy harvester for application in domestic pipeline. Energy harvester occurs when there has a small amount of energy that called as energy waste. Energy waste could be useful for future life if captured and apply it to convert as energy harvester.

Water that flow in domestic pipelines is a wasted energy. It called as waste energy because after the users open the valve pipe, the water direct flow into the house piping system but there has no any saving that occur in the process but it's only wasted energy.

This project especially for application in domestic pipeline because is due to create a mechanism that can be used to produce energy cycle of replacement of the water used in every house. This project can decrease wasted energy used every day, and can generate electrical energy from futile energy cycle and the stored electrical energy can be used in the future. The wasting energy can be utilized for more benefit to the domestic applications.

The concepts of this project is a large flow of water with a pressure and a gravity set through a narrow tip to create a force to move a propeller blade in which turn a motor that convert and store the energy in a battery bank that can future used for electricity applications.

1.1 Problem Statement

Problem that triggered the research and design of this project is wasted energy per litre of water that flow in domestic pipelines never been converted to be utilize as beneficial. Water used by households will only be through the pipes and into the house piping system then it will just flow to be use by user and there has no process that make energy savings of the water flow in domestic pipeline.

Besides, another thing that motivates to create this project is to promote and expands the production of green technology and renewable energy. This project will allow the water that flow in domestic pipelines can be recycled and refurbished to be converted into electrical energy that can be used in the future.

1.2 Objective

The objective of this study is listed below:

1. To design a mechanism of energy harvester for application in domestic pipeline.
2. To fabricate a mechanism of energy harvester for application in domestic pipeline.
3. To test and analyze the kinetic energy that can be converted to electrical energy.

1.3 Scope

In order to achieve the objective the scopes are prepared as shown below:

1. The energy that can generate from the water flow in domestic pipeline at residential area in Taman Angsa Mas Durian Tunggal Melaka.
2. Design and fabricate of energy harvester for application in domestic pipeline.

1.4 Expected Outcomes

An energy harvesting device that is capable of converting the kinetic energy into electrical energy to be used in the domestic pipeline will be realized. The electricity generated will be stored in the battery bank.

CHAPTER 2

LITERATURE REVIEW

2.1 Type of Energy

2.1.1 Non-Renewable Energy

There are several sources of non-renewable energy such as coal, oil and natural gas, which supply a vast majority of world's electricity demand (Porter, 2015). Energy derived from static energy that remains in the underground except the energy was released by human interaction (Twidell, 2006).

Sources available for non-renewable energy are the resources that are limited and it is extinct or reduced such as coal, oil, derivatives of coal, natural gas and radioactive materials (plutonium, uranium) and as well as the resources are mostly produces a lot of harmful waste (Sivaramakrishna, 2013).

A natural resource such as fossil plants were converted to coal is one example of a non-renewable resource, it has certain conditions, and it will take several generations to reproduce or regenerate it. The source also limited and sometimes it cannot be reproduced in a short time (Appalachian, 2014).

2.1.2 Renewable Energy

This is a renewable energy source such as wind, hydro, geothermal, solar photovoltaic and biomass. Renewable sources are an attractive option because it has

a low carbon impact. Moreover, these sources have an unlimited supply for example solar photovoltaic using sunlight to generate electricity. It is also beneficial to the national economy and price stability in the energy market (Porter, 2015).

The usage of renewable sources is to ensure that all developing regions acquire sufficient supplies of electricity generation and stable costs for the long term in the future. In addition, the hydroelectric power can also be used for energy captured. Renewable energy is distributed in a wide geographic area and it will not be depleted over time. Besides that, through natural processes, the sources can be updated or quickly renewed. This energy can be drawn for decades without harm to the environment by making the investment (Alrikabi, 2014).

Almost there have no greenhouse gas emissions that occur in the presence of this renewable energy technology. In addition, the technology of renewable energy is also addressing the issue of climate change. Earth atmospheric disturbances pose the biggest threat to humans in these lifetimes if not treated or unchecked (Deluchi, 2013).

2.2 Type of Renewable Energy

2.2.1 Solar Power

Solar energy is a high potential to provide usable, safe, clean energy and also can generate electricity. Sunlight is used in the solar system for generating electricity and it has many benefits in the form of commercial and industrial. Solar energy is divided into two categories which is passive solar and active solar energy. The usage of heat energy extract from the sun, either directly or indirectly known as passive solar energy. Whereas, solar electric power generation, it used electromagnetic radiation known as active solar energy (Alrikabi, 2014).

Photovoltaic panels can be used directly for generating solar electricity. Besides that, photovoltaic panels are commonly used on the roof of a house or building to get sufficient sunlight. The growth in photovoltaic panel manufacturing

companies has been increasingly by incentives from the government to subsidize the cost of electricity and spur technological innovation (Ekins-Daukes, 2009).

Alternative energy sources and renewable energy can be used to address long-term issues. Moreover, the source of solar energy can also be beneficial to the environment and to the betterment of the economy of developing countries (Devabhaktuni et al., 2013).

2.2.2 Wind Power

One of the fastest growing technologies in the power generation industry is wind power. The wind is a natural phenomenon caused by differential solar heating of the earth's surface; it is related to the movement of air masses. Moreover, the wind is also a stochastic variable and therefore, wind power cannot be controlled, but it can be managed. When the wind speed has reached a certain threshold, then wind power will be available (Agbetuyi, 2012).

Wind energy is an environmentally friendly, renewable energy and it also generates electricity. Wind power also can be widely used because it is easy to obtain wind resources. Wind resource is something that never runs out and it's clean and free. The uses of wind turbines require no fuel source. Moreover, it does not pose a risk to the environment (Jaber, 2013).

A very important factor is the area or the location of wind turbines because they affect the performance of the machine. Windmill has two axes which is horizontal and vertical axes. The basic mechanism for the both axes is the same (Alrikabi, 2014).

2.2.3 Biomass

Biomass is organic material that assists those plants. Biomass can also be used to produce electricity. Besides that, it also can produce fuel or chemicals.

Furthermore, organic compounds and water also contains hydrogen and if these elements are separated, the hydrogen can be replaced as a fuel or converted into electricity (Alrikabi, 2014).

Thus, biomass will be burned in furnaces to decipher arrested. The resulting heat is used to heat and boil water. Electricity can be generated when the turbine turns by using steam from the boiling water (Appalachian, 2014).

Important in the boiler design and operation are the attributes and characteristics of the fuel. Each of the boilers has a unique fuel requirements and design. The main parameters considered by the designer is the percentage of volatile boiler, heating value, moisture content, total ash, ash constituents and also size of particle (Gami, 2012).

2.2.4 Geothermal Power

The word of geothermal comes from the Greek words geo means earth, while the thermal mean heat. Moreover, in the earth's crust have hot water and steam, it is used to heat businesses and homes and also generate electricity effectively and clean. The generator can produce electricity by using steam to drive a turbine generator (Appalachian, 2014).

Geothermal energy is one of the sources that can reduce the need for imported fuel and it also emits almost no greenhouse gasses. Furthermore, the practically unlimited source of natural heat within the earth (Rabbee, 2013).

Heat flow from the interior of the earth and the rays of the sun absorbed by the soil and because of that the heat stored in the ground. Ability to remove heat from the ground to the heat pump is owned by all state. Energy has been extracted normally used directly for heating and it will not be used to generate electricity (Jacobson et al., 2015).

2.2.5 Hydro Power

The flowing water will produce energy that can be changed or generated into electricity and it's known as hydroelectric power or hydropower. Hydropower is energy generating methods that are environmentally friendly and clean, it also known as green technology. In addition, the hydropower will get extra energy when gain a lot of water during the rainy season (Md. Abdul Wadud et al., 2013).

Besides that, a hydroelectric plant turns the turbine generator using the water falling from the dam to generate electricity (Appalachian, 2014). Hydroelectric engineering is concerned about the efficient and economical conversion of energy readily available or in another name is freely available. Energy economy readily available is available from the water stored in the corresponding head by the action of evaporation and precipitation cycle generated by the effect of solar radiation (Iet, 2014).

Water bucket wheel design has been used from the earliest time of direct conversion by gravitational potential energy existing in the difference in the height of the water level. The system of water wheels does not have high conversion efficiency due to overflow from the bucket before it reaches the lowest part of travel. In addition, the speed limit can be increased by using a paddle undershot water wheel for water attacks only occur on the bottom of the wheel, and the water falling down to the channel or flume. Therefore it gives more power to pull the buckets. From the conversion of potential energy of water, hydroelectric plants can also generate electricity. Through the water cycle of the turbines and rotating electrical machinery, the Electrical energy can be generated. Power generated from these cycles is caused by several things, namely the height of the water level, water flow rate and the conversion efficiency of the water turbine (Iet, 2014).

2.3 Type of Hydro Power

2.3.1 Run of River Hydro Power

A facility that channels the flowing water from a river through a canal or penstock is to spin a turbine. Typically a run-of-river project will have little or no storage facility. Run-of-river provides a continuous supply of electricity (base load), with some flexibility of operation for daily fluctuations in demand through water flow that is regulated by the facility (Schei, 2013).

Run-of-river hydroelectric generation is a type that uses the natural flow and elevation drop of the river used to generate electricity. Steady flow regulated for down-river stations available due to this type of power station built on the river with a consistent and steady flow, either naturally or through the use of a large reservoir at the head of the river. The large reservoir power stations required by the rivers with great seasonal fluctuations to operate during the dry season.

While it flows downstream through the penstock, the potential energy of water is transformed into kinetic energy. Then, the kinetic energy is converted into electrical energy through a rotating speed of the turbine. In addition, all diverted water is returned to the stream below superpower. Therefore there has no change in the downstream flow (Schei, 2013). There is a several advantages of run-of-river hydro power plants such as it generating a clean and non-polluting energy with less environmental impacts which serve National Environmental & Energy policy objectives (Mathi, 2016).

2.3.2 Pumped Storage Hydro Power

The pump storage hydroelectric energy has been used in most places around the world because it is the technology of large-scale commercial and utility -scale technology. Moreover, to pump water from the reservoir to another reservoir at a higher altitude, hydro pumps are using off-peak electricity.