



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**A DEVELOPMENT OF PICO HYDRO GENERATOR  
FROM WATER FLOW FOR REDUCE ELECTRICITY  
CONSUMPTION**

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

by

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TECHNOLOGY

2019

**BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA**

Tajuk: A DEVELOPMENT OF PICO HYDRO GENERATOR FROM WATER FLOW  
FOR REDUCE ELECTRICITY CONSUMPTION

Sesi Pengajian: 2019

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## **ABSTRAK**

Malaysia kini menuju penggunaan tenaga boleh diperbaharui untuk kegunaan harian. Kebanyakan penduduk sekarang menggunakan salah satu tenaga boleh diperbaharui, tenaga solar untuk menghidupkan peralatan elektrik. Pico hydro adalah tenaga boleh diperbaharui yang tidak banyak digunakan di Malaysia. Dalam projek ini, matlamatnya adalah untuk membangunkan turbin jenis airwheel kos rendah untuk sistem hidro pico mudah. Sistem hidro pico ini akan menggunakan jenis turbin roda air menggunakan bahan kitar semula. Projek ini akan menggunakan turbin air kincir air sebagai penggerak utama dan mengalir air untuk menggerakkan penggerak utama atau turbin air kincir air. Oleh itu, projek ini menggunakan penjanaan elektrik rendah dan berskala kecil tetapi dapat menampung penggunaan peralatan elektrik, Projek hydro Pico yang telah dibangunkan dipercayai membantu sesiapa yang memerlukan dan pada masa yang sama membantu untuk mendapatkan banyak pengetahuan tentang tenaga hidro untuk masa depan.

## **ABSTRACT**

Malaysia is now heading for uses of renewable energy for daily use. Most residents now use one of renewable energy, solar energy to turn on electrical appliances. Pico hydro is a renewable energy that is not widely used in Malaysia. In this project, the objective is to develop a low-cost waterwheel type turbine for simple pico hydro system. This pico hydro system will use water wheel turbine type using recycle materials. This project will use the waterwheel water turbine as the prime mover and flowing of water to move the prime mover or waterwheel water turbine to turn generate electricity. Hence, this project uses a low cost and small-scale electricity generation but it can accommodate the use of electrical appliances. Pico hydro project that has been developed is believed to help anyone in need and at the same time help to get as much knowledge about the hydro energy for the future.

## **DEDICATION**

To my beloved parents Muhammad Zakiy Bin Muhammad Zakiy and Siti Aisah Binti Abbas for their support and pray. A full appreciation to my supervisor Puan Amalia Aida Binti ABD Halim for advising and helping through this project. Without the inspiration, drive, and support that have given to me, I might not be the able to done this project.



## **ACKNOWLEDGEMENTS**

Alhamdulillah, I would like to thanks to Allah S.W.T, the Most Merciful, and all praises to Allah for His blessing in completing this project. I would also like to show appreciation to my supervisor Puan Amalia Aida Binti ABD Halim her support, consultation and professional cooperation.

Special thanks to all University Technical Malaysia Malacca panels and staff members that may help upon for consultation, comments, opinion and assists to complete the project.

I would like to thankfulness to my family for the never ending supporting to finish this project. Also, thanks to all beloved friends specially Dian Nur Izzaty Binti Fatanah for their supporting and encouragement in completing this project. Thank you very much.

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## LIST OF SYMBOLS

<b>P</b>	-	Power(Watt)
<b>Q</b>	-	Flow rate(L/s)
<b>H</b>	-	Head(m)
<b>g</b>	-	Gravitational(9.81 N/Kg)
<b><math>\eta</math></b>	-	Efficiency
<b>AC</b>	-	Alternate Current
<b>DC</b>	-	Direct Current
<b>P</b>	-	Pressure
<b>T</b>	-	Torque
<b>r</b>	-	Radius
<b><math>\omega</math></b>	-	Speed(rad/s)
<b>N</b>	-	Force
<b>V</b>	-	Velocity
<b>w</b>	-	Angular velocity

# CHAPTER 1

## INTRODUCTION

### 1.1 Background

The use of renewable energy in the world became the most important for the worldwide natural energy. Sun, wind and streaming or stored hydro (water) was considered the most common renewable energy sources for this era. Renewable energy is energy generated by the energy of the environment such as water, wind, sun, rain and geothermal. This energy can reduce pollution that would occur when using non-renewable energy. It can also be a solution to global warming worldwide.

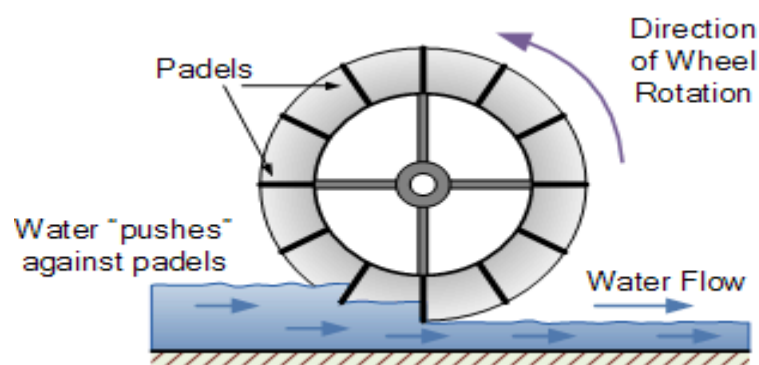
. In this way world directly is still dependent on non-renewable energy source sources (fossil powers, for illustration, coal, oil and common gasses, which are rapidly reducing and winding up dynamically more expensive, the portion of renewable energy source has been seen to be on a very basic level basic in reasonable future change. Hydro control may be a better than average case of renewable energy.

One of the medium to drive the following prime mover to deliver control was water. This is because the water is versatile. The water will not destroy the natures, cheap and easy to get and the water will control the hydro system. There were many type of hydro system such as, Pico, micro scale, mini and small. Pico hydro hydropower was one that can make output of electric more than five kilowatts. Hydro energy could be an advancement that progressions over water gushing into mechanical power (energy). The essential equipment was familiar to change over energy into power could be a water procedure since water turbines are reasonable open inside the

nineteenth century. Watermill was made from wood in observation of the separate among dynamic essentialness as of now. With the progression of weight driven outlining and with the imaginative texture and the shape and yield control, accuracy redesign waterwheel.

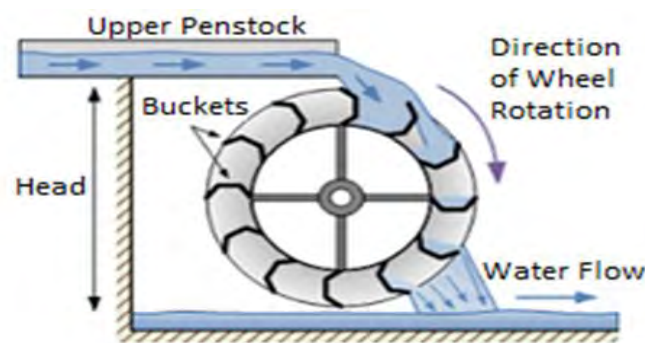
Hydro energy is a technology that converts water flowing into mechanical energy or electricity. The first equipment introduced to convert energy into electricity is a water mill because water turbines are only available in the 19th century. Watermill or waterwheel is constructed of wood because of the difference between potential and kinetic energy before. With the growth of hydraulic engineering and with the innovative material and the form and output power, precision upgraded waterwheel.

To produce power, kinetic energy is used. This can be obtained from the flow of water to the turbine then it will change to mechanical energy. After that, the turbine turns at the generator rotor will change the energy from mechanical energy into a kinetic energy. Since water is the underlying source of energy, we call this hydroelectric power. There were two common use types of waterwheels which are Undershot Waterwheel and Overshot Waterwheel and were shown in figure 1.1 and figure 1.2.



**Figure 1.1: The Undershot Waterwheel Design**

The undershot waterwheel is that always use and the most reasonable type of water wheel. It is because the cost is cheaper and easy to build it. In this kind of wheel design, the wheels are reasonable set especially into the stream that streams rapidly. The change of water underneath produces brutal movement against a submerged reel underneath the wheel which enables it to turn one path reasonable as a water stream heading.



**Figure 1.2: The Overshot Waterwheel Design**

The Overshot Water Wheel Plan is foremost broadly recognized sort of waterwheel plan. The overshot waterwheel is more complicated in its building and design than the previous undershot waterwheel because it employments buckets or small compartments to both capture and hold the water.. The gravitational weight of the water within the full buckets makes the wheel to turn around its central hub as the unfilled bucket on the inverse side of the wheel becoming lighter.

### 1.1.1 Pico Hydro

Pico hydro is the hydro power methods with the highest electric output of five kilowatts. The current change and developments in Pico hydro innovation have made it an effortlessly accessible source of power even at remote places in the world. This is an exceptionally flexible power source that could be utilized to produce AC power. Light, radio, TV and other comparative electronic gadgets can be effortlessly worked by utilizing the Pico hydro control.

The Pico hydropower function is relies upon the essential thought of hydropower. When there is moving water, it will make the prime mover that will drive the generator and will produce the power. There were two main parameter that need to know in Pico hydro, which is head and stream of water. This can be seen and were listed in table 1.1.

**Table 1.1: Water Head and Flow Rate**

<b>Water Head (h)</b>	<b>Water Flow (q)</b>
Water Pressure	Water Flow Rate
Vertical Drop of Water	Water Quantity
Low Head < 10 m	Volume Per Time

The water head for the system can choose the vertical water drop. Water heads are formed when there is a distinction in stature between water admission and turbine. Meanwhile, the flood of water to the measure of water per unit of time, or for the most part packs the measure of water that passes the turbine at whatever point and it can be

passed on as the sum each time. Pico Power Plant is small, uses arranged accessible parts and which is costless.

### **1.1.2 Water Turbine**

The water turbine is the most important thing in any hydropower plant. It contains of a few steel or plastic edge mounted on turning shaft in the center. Water coursing through a shut case turbine, the turbine sharp edge will deliver torque assaults and make a pivoting shaft because of the speed and weight of water. For example, turbine sharp edges are pushed by the water, which decreases the speed and weight (energy losses) as it turns a turbine shaft.

There were numerous distinctions in the outline of water turbines utilized today. Each system has its own focal points and detriments relying upon their operational needs. Choice of a water turbine configuration is vital for any scale hydropower frameworks . The viability of the mechanical power energy of the turbine shaft turns relying upon the height of the head, the measure of stream and weight of water entering the turbine edges, which must be accomplished by choosing the correct kind of water turbine and fit the prerequisites for a given establishment.

An impulse turbine: High velocity flow was use to driven it.

A gravity turbine: The weight of the water will drive it for example it will enter the upper part of the turbine and drops is at the bottom.

A reaction turbine: Reaction and pressure of the turbine blades to move it.

**Table1.2: The Classification of the Turbine**

	<b>Gravity</b>	<b>Reaction</b>	<b>Impulse</b>
Low (More than 10m)	1. Overshoot water wheel 2. Archimedes Screw	1. Propeller 2. Francis 3. Kaplan	1. Undershoot water wheel. 2. Crossflow.
Medium (Between 10m to 50m)		1. Francis	1. Multi-Jet Piston. 2. Crossflow 3. Turgo
High (more than 50m)			1. Turgo 2. Pelton

## **1.2 Statement of Purpose**

The purpose of this experiment was to focus in the potential energy of the water flow, water flow that can be used as an alternative option for sustainable energy sources. Flowing of water had the possible of dynamic energy to convert small turbines to generate the power. This power can also be produced without interrupting normal activities, for example, bathing, clothing, and others. From this project, consumer can save the money from the bill electric.

This project is mainly focus on high and medium head of turbine such as Pelton, Turgo, Francis, Propeller and Crossflow. It was costly to build and it was also