UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF HYDROELECTRIC GENERATOR BY USING PIPING SYSTEM IN EMERGENCY SITUATION

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Industrial Power) (Hons.)

By

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2016

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Development of Hydroelectric Generator By Using Piping System In Emergency Situation**

SESI PENGAJIAN: **2015 / 2016 Semester 2**

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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 Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

……

(Project Supervisor)

ABSTRACT

Nowadays, hydropower is one of the significant renewable energy that most developed. This source of energy is hugely known as an environmental friendly operation put it as a main choice among other salvage source of energy. The objective of this project is to develop the hydroelectric generator by using piping system in emergency situation like blackout or natural disaster and also can reduce the environment degradation. Besides that, the purpose of this project also to build a useful, effective, convenience, reliable, environment friendly and to store the generated power by means of battery charging for future use particularly during electricity blackouts. The project scopes were to design, develop, analyse and install it at house. This hydro generator is very easy to install and only need a low cost to build it. Besides that, this project focuses on hydroelectric generator using piping system and the project development based on the large hydroelectric generator. The system has function properly when the water from the main tank flow through pipeline to rotate the turbine to generate the electrical energy.

ABSTRAK

Pada masa kini, kuasa hidro adalah salah satu tenaga boleh baharu yang paling maju. Sumber tenaga ini sangat dikenali sebagai operasi mesra alam sekitar ia diletakkan sebagai pilihan utama di kalangan sumber tenaga semulajadi yang lain. Objektif projek ini adalah untuk membangunkan penjana hidroelektrik dengan menggunakan sistem paip dalam keadaan kecemasan seperti blackout atau bencana alam dan juga boleh mengurangkan kemusnahan alam sekitar. Selain itu, tujuan projek ini juga untuk membina system pelbagai guna, berkesan dan mesra alam sekitar dan dapat menyimpan kuasa yang dijana melalui bateri tanpa mengenakan bayaran bagi kegunaan masa depan dan bole digunakan semasa teputus bekalan elektrik. Skop projek adalah untuk mereka bentuk, membangun, menganalisis dan memasangnya di rumah. Penjana hidro ini sangat mudah untuk dipasang dan hanya memerlukan kos yang rendah untuk membinanya. Selain itu, projek ini memberi tumpuan kepada penjana hidroelektrik menggunakan sistem paip dan pembangunan projek berdasarkan penjana hidroelektrik yang besar. Sistem ini mempunyai fungsi apabila air dari aliran tangki utama melalui saluran paip untuk memutarkan turbin untuk menjana tenaga elektrik. Projek ini mempunyai dwifungsi system untuk turbin dan aktiviti rutin.

DEDICATION

To my beloved parents

ACKNOWLEDGEMENT

Prise to Allah, Lord of Universe, His Grace, peace and blessing be upon his generous messenger for giving me the strength to complete this project.

Firstly, I would like to express my deepest gratitude and appreciation to my supervisor, Mr Mohd Yunos Bin Ali for his attention, continues comment, guidance and generous advices. It is impossible for me to finish my project without his guidelines to complete this project.

I also want to thanks all the FTK lecturers for their motivation, support and teach the fundamental theory and idea to design and develop this project. Besides that, thanks are extended to my friends BETI 2/1 for sharing their knowledge, moral support and positive critics to finish this project. I am also to thanks my parents and my family for their supporting in financially to me to finish this project. Lastly, I would appreciation to those who involved in completing this project.

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LIST OF SYMBOLS AND ABBREVIATIONS

CNG	Compressed Natural Gas
LPG	Liquefied Petroleum Gas
MW	Mega Watt
KW	Kilo Watt
m	Meter
AC	Alternate Current
DC	Direct Current
PMHS	Pico Micro Hydro System
V	Volt
LED	Light Emitting Diode
mAh	Miliampere hour
DMM	Digital Multimeter
W	Watt

CHAPTER 1

INTRODUCTION

1.0 Introduction

The hydroelectric generator is basically electrical energy that has been generated using natural force such as gravity or flowing water. It is usually produced by dams because dam can store and direct large volumes of water. Hydroelectric power is the most green energy source. Hydroelectric power is unlike with other power plant it's don't produce carbon dioxide and it is also a lot cheaper to because it can be fully automated, saving labour costs, and its facilities don't need to be repaired frequently. Hydro have range in size from Pico that power only a few homes to giant dams that provide electric for thousands of people. Hydro power is the one of the oldest form of energy generation it produce electric by changing kinetic energy in water to mechanical energy to turn machinery or to turn a generator and produce electricity usually via a turbine. There are three type of hydropower station:

i. Run of river – the electricity is generated through the flow of a river.
ii. Reservoir – The power is generated through the release of stored water.
iii. Pumped storage – The stored water recycled by pumping it back to a higher reservoir in order to be released again.

1.1 Project Background

The hydroelectric generator by using piping system in emergency is the smallest scale of hydropower plant. The output of this project maybe in range less than 5KW it also can call as Pico hydro generator. This hydroelectric generator have the benefit in term of cost and simplicity from different approaches in the planning, design and installation than another hydro power. The hydroelectric generator by using piping system is the suitable way to overcome the problem of energy crisis in the area there are do not have electricity supply and in emergency situation like black out or natural disaster.

An electricity can be produce enabling standard electrical appliance to be used and the electricity can be distributed to a many consumer. The hydroelectric generator can be powered the some device like light bulbs, television, radio, mobile charger, and etc. This project also can use for machinery direct drive such as mechanical tools, grain mills and other equipment. This report will explains how to develop the hydroelectric generator by using piping system and install it.

The system of the hydroelectric generator by using piping system will operate using reservoir type which is the power will generated through the release of stored water. Water tank in house will be used as a main power source to generate the hydroelectric generator in this project. From the tank, water will flow downhill through the piping system. The downhill distance is called as “head” and water will be allow to accelerate for prime moving the system. Thus, the turbine will rotate the alternator to produce electric energy. To operate the one-nozzle turbine, 2’’ diameter pipe can be used and 4’’ diameter pipe can be used to operate a large 4 nozzle turbine. This is very important to allow sufficient water flow to reach the generator well.

1.3 Problem Statement

The increasing population and advancement in science and technology cause the energy demand in the World increasing day by day. But in present era there are too many obstacles which decrease the consumption of electricity for common peoples, high cost of fuel, high demand and low supply of fuel like:

a) Coal
b) Petroleum
c) CNG
d) LPG
e) Nuclear energy

All of fuels are depleting day by day and also degrades our eco-system. Installation cost of large hydro power project are very high and cannot be installed anywhere.

Based on the scenario in Malaysia, every year natural disaster like float always happen in this country. When its happen electric supply from TNB will disconnected. To overcome this other alternative must be considered to supply the electric energy.

1.4 Objective

The aim of this project is to build and design the hydroelectric generator using piping system which gives electricity at low cost, which must be eco-friendly, easy to use and to store the generated power by means of battery charging for future use particularly during electricity blackouts and emergency situation.

1.5 Scope

The scope for this project has only two parts, hardware and natural source. Hardware is divided in three part pipeline, brush permanent magnet DC generator and turbine. Natural source is only use water. This project only focus on the development of hydro generator using the piping system.

1.6 Report Organization

This report consist of five chapter. The first chapter is the introduction about my project that consist of problem statement, objective and the scope of this project.

Second chapter is about the literature review of this project. All of the fundamental application that need to be understand must list in this part.

Third chapter is about methodology of the project. This part must consist the flow of the project run. There are consist of calculation or simulation about hydro electric generator.

Fourth chapter is the output from the project. All data based on the calculation and simulation must consist in this part.

Fifth chapter is conclusion and the recommendation of the project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Hydro power is one of the oldest form of energy generation in the world. It uses the kinetic energy in water to turn machinery or to turn a generator and produce electricity via a turbine. The 20 % of the world total power consumption is come from hydro power and china is a leader of hydro power in Asia pacific. The hydropower cannot be considered as renewable if it can generate more than 1MW. This is due to factors which reducing its capacity after a number of year. The hydroelectric generator have some classification which are:

Table 2.1: The classification of Hydropower (Micro et al. n.d.)

Classification	***Capacity***
Pico-hydro	less than 5 KW
Micro-hydro	5 – 100 KW
Mini-hydro	100 – 1000 KW
small-hydro	1-15 MW
medium-hydro	15 – 100 MW
Large-hydro	above 100 MW

All of the classification of hydroelectric generator are use same basic design and application but differ in the size of generator. For the Pico-hydro and Micro-hydro can using consuming water distributed to houses as an alternative electrical energy source for residential use. This system is beneficial than other large hydro system as it have low cost, can be installed anywhere, eco-friendly and easily available to people (Paish 2002).

In generally, hydroelectric generator by using piping system can only generated 5KW – 100KW. Based on the table 2.1 it is in Pico and micro hydro classification. The Pico hydro can only generated electrical output of five kilowatts. This size is benefit in term of cost and simplicity in the design. Ac electricity can be produce enabling standard electrical appliances to be used. There are many factor to determine the feasibility and achievability of Pico hydro:

i. The amount of power available from the water flow
ii. The turbine type and availability of required generator type and capacity
iii. The type of capacity of electrical load
iv. The cost developing and operating system

2.2 Head

The head pressure can be determined by the vertical distance the water fall. To determine head gross (static head) and net (dynamic head) must be considered. Gross head is the distance vertically between the top of the penstock and the point where water to flow to the turbine. Net head is the gross head minus the head losses (pressure) due to turbulence and friction in the penstock (Zainuddin et al. 2009).

The net head can be computed by simply subtracting the losses along in path, such as open channel loss, trash rack loss, intake or inlet to penstock loss, gate or valve loss and penstock friction loss (Nasir 2014).

2.3 Turbine

Turbine can be classified according to their operating head or their principal of operation. A water-head turbine is the most generally used system. The rotation of turbine is converting the potential energy of water to the kinetic energy. That have two term that will be used in designing the turbine in hydro system head and flow. There are two type of turbine impulse turbine and reaction turbine (Micro et al. n.d.).

The impulse turbine is operates in air. The water pressure is converted into kinetic energy by a nozzle before entering the rotation part. The reaction turbine is operates fully immersed in water and in closing pressure casing. Water flows over the blades in the casing this will causes a pressure drop across the blade and causes the runner to turn in a similar way to windmill (Vineesh & Selvakumar 2012).

The impulse and reaction turbine are commonly used for small scale hydropower. The selection of the both type must depending on the head and flow rate condition site. The head of this type have a several classification, low, medium, and high (Paish 2002).

Table 2.2: Impulse and reaction turbines
(Zainuddin et al. 2009)

Turbine type classification	Head		
	High (>50 m)	Medium (10–50 m)	Low (<10 m)
Impulse	Pelton Turgo Multi-jet Pelton	Cross flow Turgo Multi-jet Pelton	Cross flow
Reaction (open-flume)		Francis (spiral case)	Francis Propeller Kaplan

Figure 2.1 show that the convenient methods for selecting a turbine for particular hydro system. The power capacity and speed range of alternator is used to selecting the type of turbine to be used.

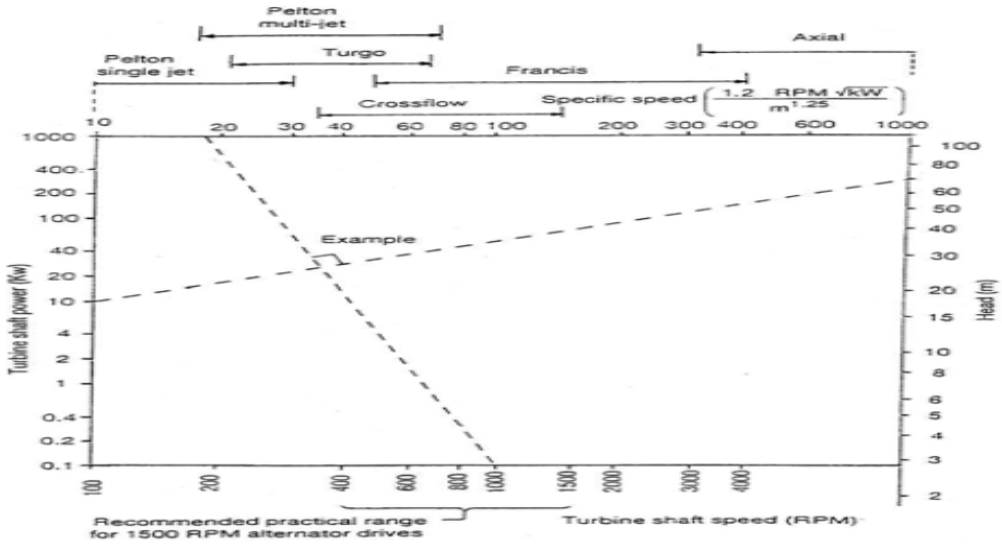

Figure 2.1: Nomogram for selection of a turbine for hydro site
(Zainuddin et al. 2009)