UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

POTENTIAL STUDY : DEVELOPMENT OF RAINFALL'S GRAVITATIONAL FORCE BASED ON POWER GENERATION FOR URBAN AREA IN MALACCA.

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

by

NURUL SAADAH BINTI ABDULLAH
B071310831
920513-10-6102

FACULTY OF ENGINEERING TECHNOLOGY
2016

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: Potential study : Development of Rainfall's Gravitational Force Based on Power Generation for Urban Area in Malacca

SESI PENGAJIAN: **2015/16 Semester 2**

Saya **NURUL SAADAH BINTI ABDULLAH**

mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (✓)

☐	SULIT	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)
☐	TERHAD	(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☑	TIDAK TERHAD	

Disahkan oleh:

Alamat Tetap:

NO. 65 Jalan Haruan 17/35,

40200 Shah Alam,

Selangor

Tarikh: 24/1/2017

Cop Rasmi:

MUHAMMAD FAIZAL BIN YAAKUB
Pensyarah
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan
Universiti Teknikal Malaysia Melaka

Tarikh: 24/1/2017

** Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I hereby, declared this report entitled "Potential Study : Development of Rainfall's Gravitational Force Based on Power Generation for Urban Area in Malacca." is the results of my own research except as cited in references.

Signature	:	.....
Author's Name	:	Nurul Saadah Binti Abdullah.
Date	:	29/1/2017

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

.....

(En Muhamad Faizal Bin Yaakub)

ABSTRAK

Projek ini adalah bertujuan mengkaji kuasa terhasil melalui daya graviti yang dihasilkan oleh hujan bagi kawasan bandar di Melaka.Bahan utama yang digunakan dalam projek ini adalah penjana untuk menghasilkan elektrik, Arduino untuk membaca nilai aliran air menggunakan sensor aliran, 40mm diameter paip, tangki untuk mengumpul air untuk dan tolok tekanan untuk membaca tekanan di dalam paip. Tesis ini menganalisis kuasa yang dihasilkan dengan menggunakan dua kaedah perbezaan. Kaedah pertama adalah menggunakan tiga penjana secara serentak. Voltan, arus, kuasa, kadar aliran, tekanan akan direkodkan. Bagi kaedah kedua, penjana akan berjalan satu demi satu dalam satu masa. Voltan, arus, kuasa, kadar aliran, tekanan juga akan direkodkan dan analisis akan dijalankan. Berdasarkan keputusan itu, ia menunjukkan bahawa kaedah dua menghasilkan lebih voltan, arus, kuasa dan lebih cekap berbanding dengan kaedah satu. Ia disebabkan oleh kurang rintangan kerana diameter masuk dan keluar pada penjana adalah kecil. Salah satu langkah untuk kerja-kerja masa hadapan adalah menukar diameter keluar dan masuk kepada diameter yang lebih besar supaya ia lebih cekap

ABSTRACT

This project presented a potential study on the rain fall gravitational force based on power generation for urban area in Malacca. The main material that using in this project are generator that generate an electricity, flow sensor to read the flow rate that interface to Arduino, 40mm diameter of pipe, tank to gather the water to and pressure gauge to read the pressure in the pipe. This project analyze on power generated by using two difference method. The first method are about conducting an experiment by using three generator simultaneously. The voltage, current , power, flow rate, pressure will be recorded. For the second method, the generator will run one by one in a time. The voltage, current , power, flow rate, pressure are also will be recorded and the analysis will be conducted. Based on the result, it shows that method two produce more voltage, current, power and more efficient compared to method one. It may cause by less resistance due to small diameter of inlet and outlet on the generator. For the suggestion for future work, this potential study can be more efficient by changing the diameter inlet and outlet of the generator.

DEDICATION

To my beloved parents Mr. Abdullah Bin Abd Ghani and Mrs. Saamah Binti Mohd Jelas for their support and pray. A full appreciation to my Supervisor Mr Muhamad Faizal Bin Yaakub and to Mr Ir Mohd Farriz Bin Hj Md Basar for advising and helping me through this project.

ACKNOWLEDGEMENT

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 Mr. Muhamad Faizal Bin Yaakub for his support, consultation and professional cooperation.

Special thanks to all other University Technical Malaysia Malacca panels and staff members that may help upon for consultation especially Mr Ir Mohd Farriz Bin Hj Md Basar ,Mr Irianto and Mr Asri Bin Din for the comments, opinion and assist to completed the project.

I would like to thankfulness to my family for the never ending supporting to finish this project. Also my thanks to all beloved friends for their supporting and encouragement in completing this project.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

P	-	Power (Watt)
m	-	flow rate (L/s)
H_{net}	-	gross head (m)
g	-	gravitational (9.81 N/kg)
η	-	efficiency.
NEM	-	Northeast Season
SWM	-	Southwest Season
MA	-	March April Inter-monsoon Season
SO	-	September October inter-monsoon Season

CHAPTER 1
INTRODUCTION

1.0 Introduction.

In this chapter will explain the introduction of the project consist of project overview, problem statement, objectives and scope of the project.

1.1 Project Overview.

This project presents a potential study and development of power generation by rainfall for domestic or household and urban area in Malacca. Study and development focus on gravitational factor and pico hydro energy conversion method. Nowadays, demand for electricity is experiencing a strong growth. Therefore, to solve these problems, renewable energy is sustaining the reverse natural sources for our generation and power generation module by rainfall was developed. Water flow rate and pressure of water flow are proportional to the power generated. The higher the building that attached the drainage system,the higher potential of the kinetic energy which produced by water flow rate and pressure of water that will turn the turbine to generate electricity. The generator's shaft coupled to the turbine begin to move and subsequently change the kinetic energy to the electrical energy. Power generation module can be completely used to deliver power from the water inside the drainage pipeline and reduce the burden on the consumer because of the demand for electricity is experiencing a strong growth.

1.2 Problem Statement

Supply from natural resources like coal, gas and oil is depleting and will run out if it is not used prudently(TNB 2016). Starting from January 2014, for domestic tariff using from 301 until 600 kWh per month cost 51.60 cents compared to June 2011 only cost 40 cents per kWh (Kettha 2016). Because of these problems, demand for electricity is experiencing a strong growth in Malaysia (T. C. Yan 2011). It shows that this issues will put a burden on the consumer. Therefore, to solve this problem, renewable energy is sustaining the reverse natural sources for our future generation.

Huge supply or dam prompts to natural harms and expels individuals from their origin. Furthermore, the capacity of this large plant will be reduced after a number of years due to sedimentation build up (Yuttachai Keawsuntia 2012)

Based on Meteorological department, the rate of rainfall is about 100mm to 200mm per year in 2015 (Average Weather and climate in Malaysia 2016). Power generation module can be completely used to deliver power from the water inside the drainage pipe line by using rainfall. This power generation will be applied to the urban area in Malacca.

1.3 Project Objectives

1. To develop rainfall power generation module in an urban area.
2. To analyze the output power.
3. To analyze the efficiency.

1.4 Project Scope

The scope of this project is about the design of rainfall's gravitational force based on power generation module. This project will focus on field data collection and field study in the urban area or commercial buildings area in Malacca. The higher the building that attached the drainage system,the higher potential of the kinetic energy which produced by water flow rate and pressure of water that will turn the turbine to generate electricity.(T. C. Yan 2011)

The material chosen for this project is a pico hydro generator, DC generator, submerged turbine, flow sensor and difference height of drainage system. Output power that will produce by using a pico hydro generator is less than 100 watts (Yuttachai Keawsuntia 2012). It is suitable for the domestic consumer for small usage. DC generators function as changing energy from mechanical energy to electrical energy. The process changing of energy need submerge turbine to rotate the shaft of DC generator. Flow sensor is functioned to determine the rate of rainfall that flows through the drainage system. The variable of this project is height of the drainage system. The difference height of the drainage system can cause difference output power produced by the DC generator. MATLAB simulation is used to determine the mathematical modeling.

The limitation of this project is the focus area is in Malacca only. Therefore, to expand the application of the module/project to the other countries, further investigation is required on the rainfall rate for that particular new location. Furthermore, this project is module system and the scope of this project focuses on the height of the drainage system.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

The extended study on the rate of rainfall, height of the and efficiency of the generator is the core in this research. An analysis will be conducted to generate useful amounts of power for a multi-storey building. Basic equations from the research are:

$P = m\ x\ g\ x\ Hnet\ x\ \eta$ (S. Martin, K. K. Shrivastava 2013)

Where, P = Power (Watt)

m = flow rate (L/s)

H_{net} = gross head (m)

g = gravitational (9.81 N/kg)

η = efficiency.

2.1 Rate of rainfall

Study and investigation on rainfall rate at particular research location is really important to get clear picture on precipitation amount. Further elaboration on collected data will be describe in details in the following section.

2.1.1 Rate of rainfall in Malaysia.

Based on the research, trend in hourly extreme rainfall in the year 1975 to 2010 across the peninsula Malaysia was analyzed. There were four monsoon which is northeast monsoon (December-February (NEM)) , Southwest monsoon (May-August (SWM)), and inter-monsoon (March-April (MA)) and (September-October(SO)).Several extreme rainfall indices were calculated at the station level. The total amount of rainfall received during NEM is higher compared to rainfall received during inter-monsoon season. However, intense rainfall is observed during the inter-monsoon season with higher hourly total amount of rainfall. The eastern of peninsular was not affected by stratiform rains, while convective rain contributes more precipitation to areas in the western part of the peninsula. A. (H. Syafrina & M. D. Zalina & L. Juneng 2015)

Table 2.1.1 : Rainfall stations

No	station	Name of station	Long(°)	Lat (°)
1	1737001	Sek. Men. Bukit Besar, Kota Tinggi Johor	103.72	1.76
2	2224038	Chin Chin (Tepi Jalan) Melak	102.49	2.28
3	2719001	Setor JPS Sikamat Seremban	101.54	2.73
4	2815001	Pejabat JPS Sungai Mangga Selangor	101.54	2.82
5	2818110	SMK Bandar Tasik Kesuma, Semenyih Selangor	101.87	2.89
6	2913001	Pusat Kawalan P/S Telok Gong Selangor	101.39	2.93
7	3117070	JPS Ampang, Selangor	101.75	3.15
8	3118102	Sek. Keb. Kg. Lui Selangor	101.87	3.17
9	3314001	Rumah Pam JPS Jaya Setia Selangor	101.41	3.36
10	3411017	Stor JPS, Tg Karang Selangor	101.17	3.42
11	3516022	Loji Air Kuala Kubu Bharu Selangor	101.45	3.57
12	3613004	Ibu Bekalan Sg. Bernam Selangor	101.35	3.69
13	3710006	Rumah Pam JPS Bangunan Terap, Selangor	101.08	3.72
14	4908018	Pusat Kesihatan Kecil, Batu Kurau Perak	100.80	4.97
15	2831179	Kg. Kedaik, Pahang	103.18	2.88
16	3533102	Rumah Pam Pahang Tua, Pekan	103.35	3.56
17	3924072	Rumah Pam Paya Kangsar, Pahang	102.43	3.90
18	4234109	JPS Kemaman, Terengganu	103.42	4.23
19	4734079	Sek. Men. Sultan Omar Dungun, Terengganu	103.41	4.76
20	4819027	Gua Musang, Kelantan	101.99	4.87
21	4930038	Kg. Menerong, Terengganu	103.06	4.94
22	5331048	Setor JPS, Kuala Terengganu	103.13	5.31
23	5504035	Lahar Ikan Mati Kepala Batas, Penang	100.43	5.53
24	6207032	Ampang Pedu, Kedah	100.77	6.24
25	6401002	Padang Katong, Kangar	100.18	6.44

Figure 2.1.1(i) : Rainfall station

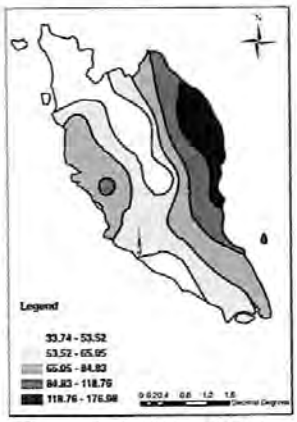

Figure 2.1.1(ii) : NEM

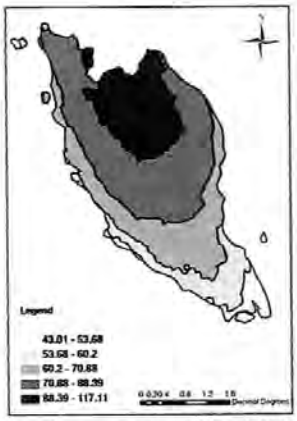

Figure 2..1.1(iii) : SWM

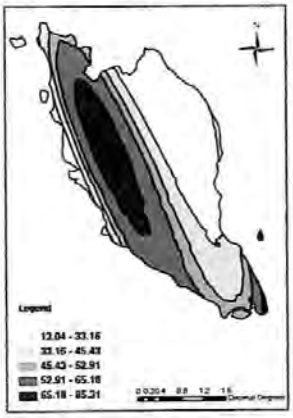

Figure 2.1.1(iv) : MA

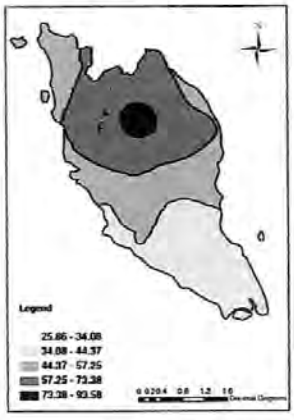

Figure 2.1.1(v) : SO

Figure 2.1.1(ii) shows that Northeast Season (NEM) in Malaysia. East Malaysia recorded highest rate of rainfall between 118.76 – 176.98mm and South Malaysia recorded least rate of rainfall between 33.74 – 53.52mm. it is shown that in Malacca, power generation by rainfall is not suitable to be applied. In Figure 2.1.1(iii) shows Southwest Season (SWM). North Malaysia recorded highest rate of rainfall between 88.29-117.11mm and South Malaysia recorded least rate of rainfall between 43.01-53.68mm. In Malacca recorded 53.68-60.2mm. In Figure 2.1.1(iv) shows Inter-monsoon Season (MA). West Malaysia recorded the highest rate of rainfall between 65.18-85.31mm. In this season, power generation is suitable to be applied. Finally in Figure 2.1.1(v) shows inter-monsoon Season (SO) indicate that North Malaysia recorded highest rate of rainfall between 73.38-93.58mm and South Malaysia recorded least rate of rainfall between 34.08-44.37mm.(A.H Syafarina 2015)

2.1.2 Rate of rainfall in Malacca

Weather and climate website shows that average precipitation of rainfall in Malacca is between 100mm to 200mm per year in 2015. The higher volume of rainfall is in November which is 200mm and January state that the lowest 100mm volume. Figure 2.1.2 shows that average monthly precipitation over the year in Malacca. (Average Weather and climate in Malaysia 2016)

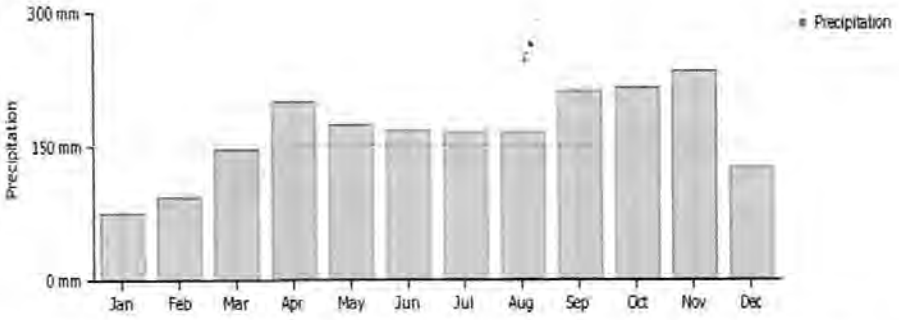

Figure 2.1.2: Average monthly precipitation over the year in Malacca.

2.2 Power Generation From Rainfall

2.2.1 Micro Hydro Potential in West Malaysia

In Malaysia, hydro power utilization for electricity generation started in July 1900 when a small hydroelectric plant was constructed on the bank of Sempam River near Raub, Pahang by the Raub-Australian gold mining company. Bakun project is another large-scale hydro power plant in progress with a total generating capacity of 2400 MW. In total, Malaysia has hydro power electricity generating a capacity of about 18,500 MW and this represents about 20% of Tenaga Nasional Berhad (TNB), the largest power utility company in Malaysia, total generation capacity. Reconnaissance studies carried out to identify the picohydro potential in West Malaysia. In this study, the topography maps and hydrology data were used to identify the heads and the mean annual flow rate of the sites. With an average rainfall of 2540 mm in Peninsula, 2630 mm in Sabah and 3850 mm in Sarawak, Malaysia is blessed with abundant streams and rivers flowing from the highland areas created by these ranges. From the physiographic characteristics, the sites having picohydro potential were predicted. suitable catchment areas which may have picohydro potential were identified by considering three main factors which are the energy demand, accessibility and river profile. The catchment water balance methodology was used to estimate mean annual flow, Qm. The estimated Qm values gave an indication whether the flow at the identified site is adequate for micro hydro power generation or not. As a conclusion, from the reconnaissance studies, a total of 109 sites having a pico hydro potential of 20.4 MW were identified in Peninsula Malaysia. The sites were identified based on terrain characteristics and accessibility. (Nathan R. 2009)