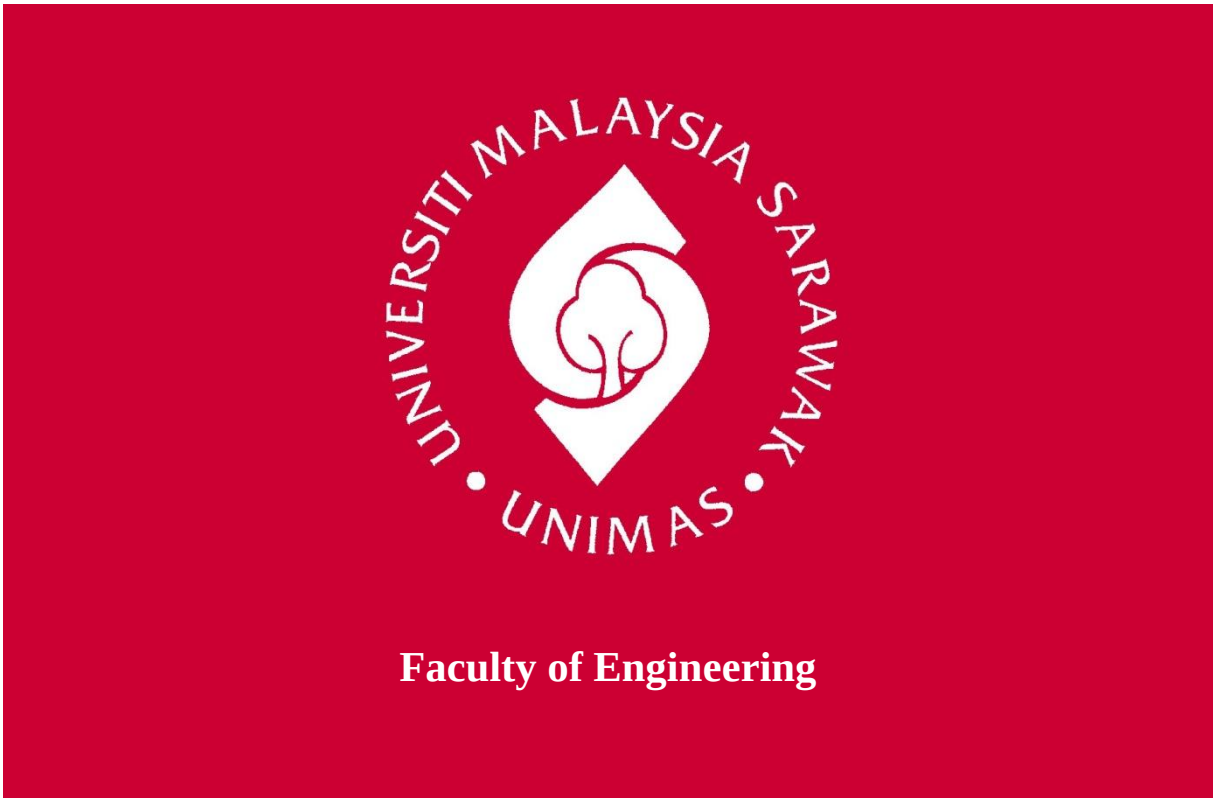

DESIGN OF THE MICRO HYDRO POWER RESERVOIR AT KPG SEMULONG ULU

Lau Sie Huang

Bachelor of Engineering with Honours
(Civil Engineering)
2010

UNIVERSITI MALAYSIA SARAWAK

BORANG PENGESAHAN STATUS TESIS

Judul: **DESEIGN OF THE MICRO HYDRO POWER RESERVOIR AT KPG. SEMULONG ULU**

SESI PENGAJIAN: 2006 – 2010

Saya **LAU SIE HUANG**

mengaku membenarkan tesis * ini disimpan di Pusat Khidmat Maklumat Akademik, Universiti Malaysia Sarawak dengan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hakmilik Universiti Malaysia Sarawak.
2. Pusat Khidmat Maklumat Akademik, Universiti Malaysia Sarawak dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Membuat pendigitan untuk membangunkan Pangkalan Data Kandungan Tempatan.
4. Pusat Khidmat Maklumat Akademik, Universiti Malaysia Sarawak dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
5. ** Sila tandakan (✔) di kotak yang berkenaan

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

Disahkan oleh

(TANDATANGAN PENULIS) (TANDATANGAN PENYELIA)

Alamat tetap: No 34-B, TINGKAT 1,
JALAN HUA KIEW ,
96000 SIBU SARAWAK.

PROF.DR. SALIM SAID
(Nama Penyelia)

Tarikh: 19 April 2010 Tarikh:

CATATAN
***** Tesis dimaksudkan sebagai tesis bagi Ijazah Doktor Falsafah, Sarjana dan Sarjana Muda.
****** Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh tesis ini perlu dikelaskan sebagai SULIT dan TERHAD.

The Following Final Year Project:

Title : Design of The Micro Hydro Power Reservoir at Kpg Semulong Ulu

Author : Lau Sie Huang

Matric number: 16494

has been read and certified by:

_____ _____

Prof. Dr. Salim Said Date
(Supervisor)

DESIGN OF THE MICRO HYDRO POWER RESERVOIR AT KPG SEMULONG ULU

Lau Sie Huang

This project is submitted in partial fulfillment of
the requirements for the Degree of Bachelor of Engineering with
Honours (Civil Engineering)
2010

To my beloved parents and cherished friends

ACKNOWLEDGEMENT

This study has been made possible as a result of the co-operation and support rendered by several individuals. While it is impossible to list down all of them, I am very grateful for their assistance.

First and foremost, the author would like to express sincere gratitude to his supervisor, Professor Dr. Salim Said for his numerous advise, guidance and ideas, that enabled the completion of this project.

Gratitude and acknowledgement is forwarded to the Head of Department, Civil department, Madam Rosmina Ahmad Bustami, for her support and cooperation by leading us in making this project possible. Many thanks are also due to his friends, who shared their concerns, views and advices.

Last but not least, the author expresses his cordial thanks to all who contributed intellectually, materially and morally, in words and in deeds, to the successfulness of this project.

ABSTRAK

Dengan pembangunan Malaysia, permintaan elektrik meningkat kerana orang-orang di kawasan luar bandar meningkatkan kesedaran untuk mendapatkan bekalan elektrik adalah penting dalam meningkatkan kualiti hidup mereka. Eksploitasi potensi sumber yang cukup besar untuk penjanaan elektrik tenaga air dari sungai yang berpotensi dengan mudah dapat dijumpai berhampiran dengan kampung adalah prospek yang menarik akan menjadi sumber untuk menghasilkan elektrik. Tujuan dari projek ini adalah untuk merancang reservoir untuk menggantikan tenaga air mikro reservoir yang ada di Kpg. Semulong Ulu berdasarkan data penngumpulan dari lokasi projek.Laporan ini menyajikan data penemuan dalam mikro hidro sistem dan desain yang dicadangkan dari reservoir sebagai penyelesaian untuk membina Tenaga air yang berterusan dan mengurangkan kesan negatif untuk persekitaran kampung. Perbincangan tentang desain pada setiap jenis desain yang dicadangkan untuk mencari rekaan yang paling sesuai untuk menggantikan reservoir yang ada.

ABSTRACT

With development of Malaysia, electricity demand increase due to people at the rural area increased awareness for having electricity supply is important in improving their life quality. Exploitation of the considerable potential for hydro power generation recourses from the potential stream where can easily find near to the kampong is an attractive prospect will be a sources for generate power supply. The objective of this project is to design reservoir for replace the existing micro hydro power reservoir at Kpg. Semulong Ulu based on the data finding from the project site. This report present the data finding at the micro hydro system and the proposed design of the reservoir as solution for construct a sustainable and less environment impact reservoir for the villagers. Discussions on the design of the each type propose reservoir designs are done for recommend the most suitable design for replace the existing reservoir.

CONTENTS

List of Abbreviations

CDM	Clean Development Mechanism
EFB	Empty Fruit Bunches
HDPE	High Ductile Polyethylene
kW	kilowatt
MW	Megawatt
MSW	Municipal Soild Waste
PKS	Palm-kernel Shells
PTM	Pusat Tenaga Malaysia
POME	Palm Oil Mill Effluent
R&D	Research and Development
uPVC	Unplasticized Polyvinyl Chlorine

List of Tables

List of Figure

CHAPTER 1

INTRODUCTION

1.1 Introduction

As we move into the twenty-first century, global economic prosperity is driving the consumption of energy to record levels, with electricity consumption anticipated to increase at rates faster than overall energy supply. Malaysia, a fast-developing country also cannot exceptional from this cosmopolitan energy resources issues. In Malaysia there still have a lot of community is still underserved with certain basic welfare, especially in rural area of Sarawak and Sabah. Electric power is one of the most important supplies that the underserved community should have for connecting to the outside world.

Malaysia is located at the tropical zone with average annual rainfall amount of 990 billion m^3 (River Basin Initiative Malaysia, 2009) cause the river system in Malaysia are integral part of the water resources system. There are more than 100 river systems in Peninsular Malaysia and more than 50 river systems in Sabah and Sarawak (Malaysia, River Basin Initiative Malaysia, 2009). There is a lot of potential river in Malaysia have

the potential for generating the hydro power with having a lot of the natural water resources.

Hydro power on a small-scale is one of the most cost-effective renewable energy technologies to be considered for generating electric in rural area. It is also the main perspective of hydro developments in the world prospects. Construct big scale hydro power system is no more an issue; building up big scale hydro power now is considered environmentally unacceptable and was opposition by the environmentalist. The technology of hydro power is come in with times, the small scale hydro technology is use for transform the kinetic energy of river to the electric power. The small scale hydro power is extremely durable, and the systems can last for 50 years or more with little maintenance (Paish, 2002). Small scale hydro power also one of the most environmentally benign renewable energy technologies available.

While in the 20th century, the development of hydro-electricity was usually associated with building up of large dams. A large area land is clear to build up the hydro power; massive barriers made by concrete, rock and other materials were placed across river will create huge non-natural lakes that destroyer of the area. Reservoir dams will create a major, reliable power supply, plus irrigation and flood control benefits, the dams necessarily flooded large areas of fertile land and displaced many thousands of local inhabitants. In many cases, rapid silting up of the dam has since reduced its productivity and lifetime. There are also numerous environmental problems that can result from such major interference with river flows.

Develop of small-scale micro-hydro power might need not need large buildings and large lands for construct that will cause big damage to environments, but any construction that on natural land still bring impact to surround environment.

1.2 Background

Hydro power is currently the widest use of modern from renewable energy and is derived from natural waterfalls, dams, rivers and stream. The hydro power is the cheapest among the renewable energy and with much matured technology supported. Nowadays, because of pollution control regulation, people starting to build small scale hydro power. Small scale hydro projects can avoid bringing environmental impacts and social impacts to construction area for provide rural energy needs.

Small scales hydro power has various degrees of 'smallness'. There is no universally accepted definition of 'small' scale hydro; but in general it means that there are low environmental impact, it use a run-off river basin, or it has a small impoundment with little flooding of land. These are arbitrary division and many of the principle involved apply to both smaller and larger schemes. Commonly accepted thresholds for hydro power system are show in **Table 1.1.**

Table 1.1: Classification of hydro power Source: (Anderson et al., 1999)

Type	Capacity
Large hydro	>100 MW
Medium hydro	10 – 100 MW
Small hydro	1 -10 MW
Mini hydro	100 kW – 1 MW
Micro hydro	5 – 100 kW
Pico hydro	< 5 kW
kW (kilowatt) = 1000 Watts. MW (Megawatt) = 1,000,000 Watts)	

1.3 Objective

Different scales of the hydro power will need the different size weir of reservoir to keep the system for running. The objectives of this study to determine the impact of the weir of reservoir to the environment, social and economy of a project site. From the data finding, determine the suitable design of the weir and reservoir for micro-hydro power project with minimum impact to the environment, social and economy of the rural area community.

1.4 Scope of Study

The scope of this study is focused on the different type of the weir for reservoir design that construct for keeping the micro-hydro power electric plant running. This study will base on the micro-hydro power project site at Kpg. Semulong Ulu at district Sri Aman, Sarawak. Site investigation and data collection of the micro-hydro power site will be conduct. The water samples are collect from the site at different time and bring back to do laboratory test for finding the water quality.

1.5 Structure of Report

This report is divided into five chapters and each can be generally summarized as bellow:

a) Chapter 1 includes an introduction and background of the micro-hydro power. It also consist objectives and scope of study for this studies.

b) Chapter 2 describes types of major renewable energy recourses and the planning for micro-hydro power. It also consist civil works and component and installing, operating, maintaining of a micro-hydro power system.

c) Chapter 3 explains the methodology for the study and includes the case study, interviews, data collection.

d) Chapter 4 is the result and data analysis from site data findings. The design of the reservoir based on the data collection will be analyzed and illustrated in the proper manner. Discussion on some problem faced onsite and will be explained in this chapter.

e) Chapter 5 will conclude type of reservoir design for the site and the suitable design for minimize the impact bring to the Kpg. Semulong Ulu. The limitations of study were discussed and the future works for this method were proposed.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Climate changes are the most popular issue around each country since last century. Consumption electricity increase since industrial revolution at each country, a lot of energy plant had build to meet the demand of electricity. Development of the electric plant, such as the super structure Hydro-Power and the Nuclear Power had brought lot of sub effect to the environment and human mankind. For resolve the environment impact assessment of the energy plant, Clean Development Mechanism will be the future development constituent. The Kyoto Protocol's Clean Development Mechanism (CDM) sets agentive for the dissemination of low-emission technology and practices in developing countries and should therefore be able to help to overcome some off the barriers that impede the increase use of renewable energy sources in developing countries.

2.2 Major Renewable Energy Resources

2.2.1 Hydro

The potential of hydroelectric is very considerable renewable energy can be provided to the rural community. According to the National Energy Balance 2001((PTM), 2001), the hydroelectric potential amounts to 29,000 MW, and total of the energy 2/3 is in Sarawak. In comparison, the current installed central electricity generating capacity is 18,500 MW (Davis, 2005). For the time being, hydroelectric is widely used all over the world, and it contributes 20% of world's electricity.

Hydro power is the generation of electrical energy by harnessing water's kinetic energy created by gravity. Hydro power is centered on the efficiency of the water's kinetic energy converting to electrical energy. In hydro power, the kinetic energy of the water depends on two aspects, head and flow. The head refers to the vertical distance the water travels and the flow refers to the volume of the water that passes through the turbine in a given amount of time(Rachel Beckett, 2006) . The head of a site is the vertical distance from the source, the surface, to the point of the water's outflow (Development, 1989). When evaluating a potential site, head is usually measured in feet, meters, or units of pressure. Head also is a function of the characteristics of the channel or pipe through which it flows. The flow of the site is a volume of fluid that passes through a given area per unit of time(Development, 1989). The flowing water moves through the system and pushes the turbine to make it spin. The spinning of the turbine is turned into electricity by means of a generator. The electrical energy created is usually stored in a battery which can then power electrical objects in house, such as appliances

and lights. When looking at the full process of micro hydro power and the transference of energy from one form to another, one must also take into account that there are no toxic emissions because micro hydro is a very environmentally friendly source of power (Rachel Beckett, 2006).

However, the problems of land-use, effect of socio-economics, and the environment impact in general make it under consider of whether all of this potential can be harvested.

2.2.2 Biomass

The biomass-to-energy potential mainly produces from the biomass residues in the oil palm industry, rubber wood industry, and rice farming. Currently, the focus is primarily on how to utilize biomass residues in the form of palm-oil residues such as fibres, palm-kernel shells (PKS), and empty fruit bunches (EFB) from the world's leading oil palm industry. Residues in the form of fibres and PKS are already utilized to some degree for various purposes, while EFB is under-utilized and represents a major biomass-to-energy potential, in particular if processed into a low-humidity fibrous fuel. However, some uncertainty exists as to the long-term availability of biomass-to-energy resources, as new uses continue to emerge as a result of research and development (R&D) activities. While fibres are mostly used for electricity and steam generation for the mills' own needs, PKS has found a market in the cement industry, where it has a high market value in areas close to cement producing plants, and EFB is increasingly being used as a

source of organic fertiliser and mulch in palm oil plantations. In particular, this uncertainty carries challenges in relation to fuel purchase and power sale agreements.

2.2.3 Solar

Solar energy can be considered one of the oldest renewable energy used is in the world.Most of the time, solar is use for heating for industrial and commercial applications, by which electricity and fossil fuels currently used for process heating and hot water heating may be substituted. The industrial applications include pre-heating and drying in industrial heating processes, and would particularly target food processing and dairy product industries, textile industries, agriculture and aquaculture. In commercial and residential areas, the growing demand for hot water represents a significant potential for substituting electricity and fossil fuels.

Solar energy can be converted into electricity in two ways; using photovoltaic devices or solar power plants. Photovoltaic or solar cells can change sunlight directly into electricity and usually used in remote locations, mostly places that are not connected to electricity grid. Some gadgets out there use photovoltaic to replace the battery, such as power watches, calculator and lighted road signs. Contrary to photovoltaic, solar power plants generate electricity differently. Heat from sun will be collected using solar thermal collectors, and later on it will heat a fluid, which will produce steam that is used to power generator.

Solar energy seems with a potential of solution for replace the current methods of generating electricity in rural area. But there is some limit of this method that had made