PRELIMINARY ASSESSMENT USING HOMER SOFTWARE FOR HARNESSING RENEWABLE ENERGY FROM SEWAGE TREATMENT PLANT

NOR AZAM AZIZ BOGAL

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Universiti Teknologi Malaysia

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Dedication to my beloved late father, Hj Bogal Hj Japar, my mother Hjh Ismingaton Ishak and my wife Aliza Ahmad whom support me, physically, mentally and emotionally, throughout my Master's study.

My love of this world,Nurin Batrisyia, Amirul Akmal,Awwal Irsyad,Hijzai Imtihan & Sarjana Al Fateh,

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ABSTRACT

The thesis highlighted on the potential of sewage as a renewable source of energy. The objective is to simulate the harvested renewable energy from sewage treatment system using Homer software which is practical and user friendly. Based on case study in Malaysia particularly in Klang Valley; where the source of sewage is abundant due to high population, the sewerage treatment plant Pantai 1 and Bunus have been simulated using Homer and produce positive result with electricity generation of 1,314,000kWh/year and 2,134,500 kWh/year constitute 33% and 55% of the plant electricity consumption. It shows that there is a huge potential energy generation from waste sources in Malaysia and further analysis on the techno economic also presented

ABSTRAK

Tesis ini menekankan tentang potensi sisa kumbahan sebagai sumber tenaga yang boleh diperbaharui. Objektifnya adalah untuk mensimulasikan tenaga boleh diperbaharui yang diperolehi dari loji rawatan kumbahan menggunakan perisian Homer yang praktikal dan mesra pengguna. Berdasarkan kajian kes di Malaysia terutamanya di Lembah Klang; di mana sumber sisa kumbahan yang banyak kerana penduduk yang padat, loji rawatan kumbahan Pantai 1 dan Bunus telah disimulasi menggunakan Homer dengan keputusan yang positif dengan penjanaan elektrik berjumlah 1,314,000 kWj / tahun dan 2,134,500 kWh / tahun yang merupakan 33% dan 55% daripada penggunaan elektrik loji tersebut. Ini menunjukkan bahawa terdapat potensi yang besar bagi penjanaan tenaga daripada sumber sisa buangan di Malaysia dan analisis lanjut mengenai tekno ekonomi turut dibentangkan

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LIST OF ABBREVIATION

SYMBOL/ABBREVIATION	DESCRIPTION
RE	-Renewable Energy
STP	-Sewerage Treatment Plant
MW	--Megawatt
Mt	-Million
CO2	-Carbon Dioxide
kW	-kilowatt
BOD	-Biochemical Oxygen Demand
kWh	-kilowatthour
UK	-United Kingdom
US	-United States
H2S	-Hidrogen Sulfida
MWh	-Megawathour
GHG	-Green House Gas
kJ/m3	-Kilojoule per cubic meter
IWK	-Indah Water Konsortium
FiT	-Feed In Tariff

CHAPTER 1

INTRODUCTION

1.1 Introduction

With the recent volatility of oil prices and public awareness on the environmental destruction caused by greenhouse gas emission (GHG) have escalate the demand of clean and green energy.

According to the World Energy Outlook 2013,the global energy demand will set to increase with renewable energy (RE) shares increase to 30% of the energy produce by 2035.

Locally, Malaysia have strive to reduce 40% of its carbon intensity by the year of 2020.As such ,Malaysia have come up with National Green Technology in 2009 and subsequently National Renewable Energy policy in 2010 to fulfil national aspiration for sustainable development of renewable energy

It was reported that as of December 2013, 131MW of RE has been commissioned and connected to the grid.At this rate, the nation is targeting for 2,080MW of cumulative RE capacity by 2020, contributing to 11% of the national energy mix and saving of 42.2Mt of CO2 emission

RE is an important alternative source of energy to complement conventional sources of energy comprising natural gas, coal and oil. The utilisation of RE, which is more environmental friendly, can also improve energy security as well as reduce dependency on fossil fuels.

Thus, government have been supportive in effort to promote the utilization of RE across all sector that is driving the national economic growth
One of the potential RE project yet to be explored is from waste water industry or sewage treatment plant

Albert Einstein once quoted " *Energy cannot be created or destroyed. It can only be changed from one form to another*" .Food which consumed by human is in a form of energy while the waste sludge is in another. The methane which have been extracted through anaerobic digestion of the waste sludge will then feed out to biogas generator to produce electric energy. The potential of energy resources from waste is endless as it is availability likely to be proportionate with human population.

1.2 Background Of Studies

Electricity generation from sewage treatment seems awkward and unheard especially in Malaysia. But with the availability of latest technology and industry

interest to harness renewable energy, pilot project have been successfully implemented in Penang's Jelutong Sewage Treatment Plant. The 180kW Biogas Generator set will be utilise for the Plant's Compound Lighting and if proven reliable will be extended to supply power for the Plant's other essential equipment. Other than that; a few project still in the pipeline including the renewable energy project at STP Pantai 1, proposed STP Pantai 2 with an underground STP facility utilizing green and renewable energy while the area above the STP will be developed as a leisure park with sports, recreational, administration building and community facilities for the local resident.

The current practice of Malaysia STP operator in managing biogas generated by anaerobic digesters is by flaring off the gas. Flaring is necessary in order to relief the pressure in the digesters due to biogas generated.
Instead of flaring, the biogas generated by the anaerobic digesters has the potential to be use to generate electricity, which can be utilise by the sewage treatment plant itself.

In Malaysia, energy conversion from the bio gradable source is still in infancy stages . The potential for waste energy generation in Malaysia depends on the availability of the specific resources at the designated place as it will require proper planning and huge investment. Understanding the chemical reaction and waste handling is a crucial step in planning a waste to energy project. Detailed knowledge of chemical reaction of waste is needed to estimate the quantum of a biogas energy project. This first requires a general assessment of the available energy potential from waste sludge.

This thesis project presents the technical feasibility assesment of biogas generated from sewage in Malaysia particularly in KlangValley. The evaluations is a based on existing similar methods but utilizing Homer as software based due to it user friendly graphical user interface.The sizing of a biogas generator producing

electricity requires a detailed calculation on methane output .The idea is to utilize the methane instead of flared to atmosphere as the current practise.

1.3 Problem Statement

Nowadays, the need for new source of renewable energy have become pressing issue. In Malaysia particularly, the effect of sudden world oil price hike in 2004 is a wakeup call for not too dependent on fossil fuel. In this proposal, a new approach by harnessing renewable energy from sewage treatment plant is proposed

1.4 Objective

The overall objective of this research work is to propose a new available source of renewable energy from sewage treatment plant. The specific objectives are as follow:

1. To provide preliminary assessment on harnessing renewable energy from sewage treatment system (STP).

2. To simulate the potential of biogas using Homer.

3. The evaluate the comparison between simulation and available real data

4. To evaluate the financial economic viability of the proposed system in Malaysia.

1.5 Scope Of Studies

The scope in this project work will be emphasizes on the simulation of renewable energy harnessed from sewage treatment plant particularly from biogas. Micro hydro has been excluded in the initial stage due to insignificance contribution of renewable energy.

The quantified value of electricity generated from the plant biogas production
Homer software then will be used to get a realistic projection of the capital, operating expenses and finally determines the economic feasibility of the system.

1.6 Thesis Report Outline

In general, this report mainly consists of five (5) main chapters; introduction, literature review, economic evaluations and simulation using Homer software, simulation results analysis and conclusion.

Chapter one discussed the research project in collectively. This chapter explained the crucial aspect of the research work such as background studies, objectives, research scopes and methodology as well the thesis outline will also be discussed .

Chapter two completely dedicated to literature review about the biogas from the sewage treatment system. This chapter will be in detail discussing on what is the sewage treatment system all about, principle of sewage treatment system, anaerobic digestion, methane and biogas extraction. In this academic literature, the factor in contributing to the output power of the system will also be elaborated.

Chapter three explains mathematical formula and calculation to determine the generated electricity output of the sewage treatment based on case study in Pantai 1 and Bunus and how to simulate based on available data using the Homer simulation.

Chapter four discussed in depth on the obtained simulation results. The result will be further analysed based on electricity generation production, payback period and CO2 reduction perspective. Conclusion and suggestion in improvising this research work shall be detailed out in Chapter five.

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