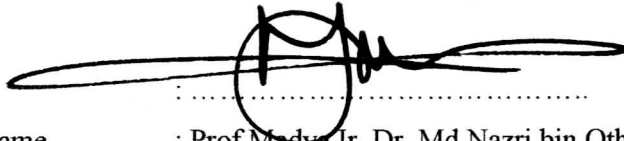


“ I hereby declare that I have read through this report entitle “Energy Performance Analysis on Water System at Syarikat Air Melaka Berhad in Loji Air Bertam, Melaka” and found that it has complied the partial fulfilment for awarding the degree of Bachelor of Electrical Engineering (Industrial Power)”

Signature



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Date

: 18th May 2018

**ENERGY PERFORMANCE ANALYSIS ON WATER SYSTEM AT
SYARIKAT AIR MELAKA BERHAD IN LOJI AIR BERTAM, MELAKA**

NURUL SYAFIQAH BINTI ABDULLAH

**A report submitted in partial fulfilment of the requirement for the degree of
Electrical Engineering (Industrial Power)**

**Faculty of Electrical Engineering
UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

MAY 2018

I declare that this report “Energy Performance Analysis on Water System at Syarikat Air Melaka Berhad in Loji Air Bertam, Melaka” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in the candidature of any other degree.

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DEDICATION

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

To my beloved parents, Abdullah bin Mat Husin and Manirah Ainun binti Mokhtar Ahmad for nursing me with affection and love and their dedicated partnership for success in my life.

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To my future soul mate.

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ABSTRACT

Increasing energy cost and concern about global climate change highlight the need to realize energy self-sufficient in water distribution and treatment plant. A study on energy performance was conducted at Syarikat Air Melaka Berhad (SAMB) specification at Loji Air Bertam at Melaka to identify the most energy consumption system and proposed a method to reduce the energy consumption and to increase the system efficiency. Energy self-sufficient water system plant have been studied to reduce operation costs, energy consumption and system efficiency. By analysing the existing system in SAMB, the most energy contribution system is identified. After analysing the transformer's load distribution and energy consumption, the inefficient performance of transformer is because of the low amount of load running by each transformer. The role of transformer is to step down the voltage and provide isolation between primary and secondary. High distribution voltage levels is then passed through distribution transformer before going down to end-use levels. The programming language used in this study is Matlab. By doing analysis on effect load on transformer, combination of load is a great way to achieve energy savings as the efficiency is increase. Future recommendation is proposed in this project.

ABSTRAK

Kadar kenaikan kos tenaga dan keprihatinan terhadap perubahan iklim seantero telah memperjelaskan lagi keperluan untuk menyedari tenaga yang memadai di dalam penyaluran air and rawatan air Satu kejian terhadap terhadap prestasi tenaga telah dijalankan di Syarikat Air Melaka Berhad (SAMB) spesifikasi di Loji Air Bertam di Melaka untuk menilai system yang menggunakan tenaga yang paling banyak dan mencadangkan satu cara bagi mengurangkan penggunaan tenaga dan meningkatkan efisiensi. Tenaga yang memadai di dalam system air telah dikaji untuk mengurangkan kos operasi, tenaga penggunaan dan system efisiensi. Dengan menganalisa system yang sedia wujud di SAMB, system yang menggunakan tenaga yang paling banyak telah dikenal pasti. Setelah menanalisa pengagihan beban transformer dan penggunaan tenaga, prestasi transformer tidak cekap adalah kerana jumlah beban yang rendah yang dikendalikan oleh setiap transformer. Peranan transformer adalah untuk menurunkan voltan yang tinggi and membekalkan pengasingan antara bahagian pertama dan kedua. Voltan yang tinggi kemudiannya disalurkan melalui transformer pengedaran sebelum diagihkan ke pengguna terakhir. Bahasa program yang digunakan di dalam kajian ini adalah menggunakan perisian *MATLAB*. Melalui analisis yang dilakukan terhadap kesan beban terhadap transformer, penggabungan transformer adalah cara yang berkesan untuk mencapai penjimatan tenaga dengan meningkatnya efisiensi. Cadangan masa hadapan diteruskan dan dibincangkan di dalam projek ini.

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LIST OF ABBREVIATIONS

NO	SHORT FORM	STAND FOR
1	SAMB	Syarikat Air Melaka Berhad
2	EPA	Environmental Protection Agency
3	LAB	Loji Air Bertam
4	LAD	Loji Air Daf
5	FYP	Final Year Project
6	C-BT	Colorado-Big Thompson Project
7	UV	Ultra Violet
8	DAF	Dissolve Air Floatation
9	UFM	Ultra Filtration Membrane
10	PRV	Pressure Reducing Valve
11	SCADA	Supervisory Control and Data Acquisition
12	U.S	United State
13	GHG	Green House Gases
14	MG	Million Gallons
15	O&M	Operating and Maintenance
16	PV	Photovoltaic systems
17	kW	Kilo Watt
18	EAM	Engineering Asset Management
19	DAG	Dissolved Gas Analysis
20	IEEE	Institute of Electrical and Electronics Engineers
21	IEC	International Electrotechnical Commission
22	kA	Kilo Ampere
23	TNB	Tenaga Nasional Berhad
24	LV	Low Voltage
25	TX	Transformer

LIST OF SYMBOLS

I_S	Full load current
S_{rated}	Power rated
V_S	Secondary voltage
Z_k	Impedance on short circuit
$Z(\%)$	Percent impedance
I_{sc}	Short circuit current
θ_{sc}	Short circuit power factor degree
P_{SC}	Short circuit power
V_{SC}	Short circuit voltage
Z_{SE}	Series impedance
R_{eq}	Equivalent resistance
X_{eq}	Equivalent reactance
P_{core}	No load (Core Losses)
V_P	Primary Voltage
a	Ratio of Primary voltage with Secondary voltage
R_c	Resistance R_c
P_{cu}	Load (Copper Losses)
P_{out}	Power output
θ	Degree of power factor
VR	Voltage regulation
η	Efficiency
PF	Power factor

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CHAPTER 1

INTRODUCTION

1.0 Overview

This chapter will focus more on research background, problem statement about what is going on with this project, what is really motivating to do this project, the overall scope on this project and most vital is the objective of this project.

1.1 Research Background

Syarikat Air Melaka Berhad (SAMB) is a company pledged in the management of water supply for Malacca state which are pledged for the treatment and responsible for portable water delivery in Malacca. Government have trusted and give a part to SAMB without negotiate the activity of Perbadanan Air Melaka. Government has a greater responsibility to manage and deliver an efficient water supply to the people in this country. There are three dams which are Durian Tunggal, Jus and Asahan which are built in order to fulfil the need of people in Malacca that can sustain maximum capacity of 75 billion cubic litres of water. In the other hand, Malacca has total of three main reservoirs which are Kesang Satu, Kesang Dua and Tasik Ayer Keroh and other smaller reservoirs and water facilities. For knowledge, the state are receiving 300

million litres of raw water from Sungai Malacca, and daily, it receives around 100 million litres from Sungai Gerisik in Muar and 54 million litres from Sungai Kesang.

Water can be allocate to have a portion of amount about 1360 million km^3 on the surface of earth and most of it sources are from seas and ocean up to 97%. About 37 million km^3 of total is fresh water [1]. All the water mostly are placed in inaccessible ground water around 8 million km^3 and lakes, streams and reservoir about 0.126 million km^3 [2].

The idea of the water system is to ship water from water treatment facility to consumers for use in domestic environment. Water system has two basic function which is primarily it needs to transfer enough amounts of water for consumer consumption requirements and secondly water system needs to be reliable which is the amount of water needed to be available 24 hours a day, 365 days a year. Every municipal water system need to have water supply source that is both adequate and reliable for the city to be served. The primary water source of water for area Ayer Keroh in Melaka is the dam located at Durian Tunggal.

People around the nations involve in many social activity and by receiving clean and safe water, they can having a secure life style and that is the reason why sustainable water management is vital. With the growing population, there will also be an increases in demands for drinking supply as water is essential in life and for other social needs too.

Reservoirs are refilled by many sources including stream flow, groundwater, snow, and/or rainfall. Various activity involve in daily life in social lifestyle including hydropower, irrigation, potable supplies, fishing and recreation that is the primary purposed of water storage and also to reduce the risk of flood and droughts [3]. The two reservoirs fund the water to a treatment plant which is impurities removal and chemical adding process take place to bring the water into compliances with the Environmental Protection Agency (EPA) regulations on clean water for domestic use. Then, the purified water is pumped to several different storage basins around the city for release into the delivery system piping network on demand for consumers use. To maintain adequate pressure in the water system during varying

periods of consumers use, additional pumping stations are provided. Water are then flows to the primary, secondary and distributor main to supply services lines to individual water consumer.

Other than that, several steps are used to produce a supply of portable water. It need to be bear that each water supply has its own precise specification for organising portability. Step one is screening which is the water is passed through a series of screens built to get rid of debris and other foreign matter. Usually screens is used to prevent clogging and essentially removed for cleaning and backwashed from high pressure pumps. Step two is pre sedimentation which is while the water moves along each reservoir, the sediment such as sand and salt settles to the bottom. Step three is coagulation which is a coagulant (aluminium sulphate), is added to the water while it flows to the sedimentation basins.

1.2 Problem Statement

Human needs water. As do all the living life. Water for human consumption comes from some basic sources. Some of water comes from well to supply and individual residence, small public sector properties and small commercial enterprises and some of it also comes from municipal water systems that provide portable water to a wide array of commercial property and domestic use buildings. This project uses the Loji Air Bertam, Durian Tunggal as an example in order to introduce concepts associated with a fundamental understanding of water delivery systems detailed in water treatment plant and the energy performance of the system.

As the water reticulate daily for consumers demand, efficient transformer system for water treatment design had progressively been (growing) in importance as the usage of water resources increase as the population and industrial development rises. In the connection, the energy cost are growing rapidly. Based on energy consumption in transformer system with low operating load, step need to be taken as to reduce the energy cost. Analysis based on the existing system is taken and the

suggestion for better transformer system operation is suggested. There are several problems in water pumping system which can bring effect to energy efficiency of water pump including unreasonable amount of load being transferred by each transformer in SAMB contribute to high amount of electric consumption generated in return brings effect to energy efficiency of water transfer system. In accordance, unsuitable amount of load in each transformer which in accordance creates a lot of losses in it makes cost maintenance higher, hence SAMB will increase the rate of bill to the consumer. To reduce the electricity consumption for energy intensive operation, the energy efficiency strategies are required and many methods have been proposed from experts.

Many electrical facilities in the power distribution systems that are extremely sensitive and above all is distribution transformer which plays a specific and vital role in joining electric lines and client appliances. Inconsiderable number of distribution transformer contribute from sloppy mainframe of distribution transformer surge to problems in the economic operation of power systems [51].

1.3 Objective

The objectives of this project are:

1. To study the overall energy calculation usage on water system.
2. To study the behaviour of most energy contribution in clear water system and transformer performance.
3. To recommend the potential improvement for transformer's efficiency and operating cost.

1.4 Scope

The project to be done at Syarikat Air Melaka Berhad, Loji Bertam Melaka. The data for the overall system performance are obtained from the Syarikat Air Melaka Berhad (SAMB) Malaysia. The premise referred as SAMB LAB.

The scope of work is to study closely the existing system operation occur in the premise and make observation about the energy wastages. The project will describe the overall system of the premise. Based on the overall description, the transformer performance system will be focused on and analyse in detail. The system of transformer is following the standard provided by SAMB. The efficiency affect the system performance and eventually low efficiency will give the high energy demand and contribute to an increase in overall cost.

Eventually, the purpose of this research is to estimate the load at a specific transformer capacity in the future, calculate the efficient load for optimizing the performance of transformer, calculate the cost consumption on existing transformer load and saving that can be achieved and operate the transformers in balanced and conscientious manner without failure.

1.5 Project Outline

The remainder of this project is organised as follows:

Chapter 2: Literature Review

The theoretical part about this project will be covered and discussed with detail about the water supply system performance. An intensive review on behaviour of system performance has been made along with the explanation.

Chapter 3: Methodology

In this part, it will covered with all project flow during to complete this Final Year Project (FYP) report. Overall of this chapter will be a milestone before start any of the experiment.

Chapter 4: Result and Discussion

All the report that has been recorded along the experiment are stated in this chapter.

Chapter 5: Conclusion

The conclusion on the project is made based on the objective.