LIGHTING STRATEGY FOR BUILDING ENERGY SAVING

NOOR ATIQAH SYAHIRAH BINTI KAMARUDIN

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIGHTING STRATEGY FOR BUILDING ENERGY SAVING GROUND FLOOR OF CAMPUS TECHNOLOGY UNIVERSITI TEKNIKAL MALAYSIA MELAKA UTeM

NOOR ATIQAH SYAHIRAH BINTI KAMARUDIN
B041310151
BMCT
Email:nooratiqahsyahirah_kamarudin@yahoo.com

Draft Final Report
Projek Sarjana Muda II

Supervisor: ENCIK MUHAMAD FIRDAUS BIN SUKRI
2nd Examiner:DR MD. ISA BIN ALI

Faculty of Mechanical Engineering
Universiti Teknikal Malaysia Melaka

MAY 2017

DECLARATION

I declare that this project report entitled "Lighting Strategy for Building Energy Saving" is the result of my own work except as cited in the references

Signature : .....

Name : NOOR ATIQAH SYAHIRAH BT KHAIRUDIN

Date : 12/7/19

APPROVAL

I hereby declare that I have read this project report and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Thermal-Fluid).

Signature : .....

Name of Supervisor : .....

Date : 17/7/2017

DEDICATION

I dedicate this report to my loving mother, Mrs. Nor Mahani binti Sanap

ABSTRACT

Inefficient used of energy is already part of the main problem nowadays especially in developing country thus leading towards the highly increasing of energy demand. However, as the energy demand is growth it will put the global fuel consumption become lower. To resolve this problem, many developing country try recreating energy using renewable energy. Despite that, the renewable energy is very costly and still insufficient to become alternatives ways. A ground floor in Campus technology is the engaging place for students because of the present of Bilik Kuliah. The power consumption in ground floor is large. To restrain the increasing of energy cost, this project is to propose an idea to reduce lighting energy on the targeted floor.

ABSTRAK

Penggunaan tenaga yang tidak merupakan masalah yang telah berlaku pada masa sekarang dan telah mengakibatkan permintaan penggunaan tenaga yang sangat tinggi. Hal ini secara tidak langsung meningkatkan permintaan tehadap bahan api untung menampung keperluan tenaga yang sangat tinggi. Bagi menyelesaikan masalah ini, banyak pihak telah melakukan pelbagai kajian untuk menggantikan bahan api yang sedia ad kepada bahan yang boleh diperbaharui. Namun begitu, tenaga yang boleh diperbaharui masih tidak cukup untuk menampung keperluan yang sangat tinggi dan harganya yang masih tinggi. Aras bawah di Kampus Teknologi merupakan tempat tumpuan pelajar kerana terdapat banyak Bilik Kuliah yang digunakan bagi pembelajaran seharian para pelajar. Oleh itu, penggunaan tenaga di kawassan tersebut agak tinggi. Bagi mengelakkan pernambahan tenaga yang semakin meningkat, projek ini adalah untuk mencadangkan strategi bagi menyelesaikan masalah ini.

ACKNOWLEDGEMENT

In The Name of Allah the Most Gracious the Most Merciful

All praises to Allah to Him alone. Every nerve ending, joint, limb, organ and faculty of mine are indebted to Allah (S.W.T) for all the bounties He bestowed me to enable finish mechanical engineering practices training. Praise to be Him; I finally successfully finish this practice report.

My appreciation and gratefulness goes to the supervisor En Muhamad Firdaus bin Sukri for the unending and invaluable guidance, assistance, advice and constructive comments throughout under graduated project II period in order for me to complete this course.

Special thanks to all my family members for all their prayer, love, warmth and patience. I am thankful for the blessing of such a wonderful and truly amazing family.

Lastly, my deepest appreciation and gratitude to each and every person directly or indirectly helping me to successfully finish my under gradated project II report.

CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBEREVATIONS

CO2	Carbon Dioxide
OECD	Organisation for Economic Co-operation and Development
TNB	Tenaga Nasional Berhad
GST	Government Service Tax
LED	Light Emitting Diode

CHAPTER 1

INTRODUCTION

1.1 Background

Inefficient of lighting energy will increase the consumption of electricity cost. Based on Organisation for Economic Co-operation and Development (OECD) has gave out a warning that energy-related emission will increase in 2050 by 70 percentages. Thus, it can increase the negative outcome of climate change, including the elevated temperatures and an increase in the distribution of risky weather events. (*OECD Environmental Outlook to 2050*, 2012)

Inefficient energy can increase the amount of carbon footprint. Carbon footprint is the total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO2). (Time for change, 2016).To avoid this problem a small changes can be made such as turning off the unused plugged devices or turn of unused fan or lamp. CO_2 is an important greenhouse gas, which is released through human activities such as deforestation and burning of fossil fuels, as well as natural processes such as respiration and volcanic eruption .The following Figure 1.1 shows the increasing of carbon dioxide has increased every years.

Figure 1.1: Concentration of CO_2 by Years (Concentration of Carbon Dioxide by Years, 2016)

Oil and natural gas are commonly used as the main source of energy production in Malaysia. Approximately, (National Grid, 2016) Malaysia only has 13GW of electrical generation capacity yearly. According to (Suruhanjaya Tenaga, 2008) Malaysian National grid that connected to power generation capacity is 19 023 MW with the highest demand used is on July 2007 which is 13 340 MW. In 2007, Malaysia has consumed 514 thousand barrels of oil daily against a production of 755 thousand barrels per day (BP Global, 2016). The generation of mix fuel is 62.6% gas, 20.9% coal, 9.5% hydro and 7% from other forms of fuel. (National Energy Balance, 2016).

Tenaga Nasional Berhad (TNB) has been issued the electricity tariff pricing every year. The tariffs have been categorized into the following aspect. (TNB, 2016)

i. Tariff A – Domestic Tariff
ii. Tariff B – Low Voltage Commercial Tariff
iii. Tariff C – General Commercial Tariff
iv. Tariff D – Low Voltage Industrial Tariff
v. Tariff E – General Industrial Tariff
vi. Tariff F – Mining Tariff
vii. Tariff G – Street Lighting Tariff
viii. Tariff H – Agriculture Tariff

Table 1.1: Tariff and Pricing (TNB, 2016)

5.	**Tarif D – Tarif Perindustrian Voltan Rendah** / *Tariff D – Low Voltage Industrial Tariff*		
	200 kWj pertama (1-200 kWj) sebulan / *For the first 200 kWh (1-200 kWh) per month*	**sen/kWj** *sen/kWh*	38.00
	Setiap kWj berikutnya (201 kWj ke atas) sebulan / *For the next (201 and above) per month*	**sen/kWj** *sen/kWh*	44.10
	Caj minimum bulanan / *Minimum monthly charge*	***RM***	*7.20*
	Tarif Ds – Tarif Perindustrian Khas (untuk pengguna yang layak sahaja) / *Tariff Ds – Special Industrial Tariff (only for qualified consumers)*		
	Bagi semua kWj / *For all kWh*	**sen/kWj** *sen/kWh*	42.70
	Caj minimum bulanan / *Minimum monthly charge*	***RM***	*7.20*

However, these costs have increase in 2015 because of the implementing of 6% of Government Service Tax (GST). Remarkably, with the implying of this term, the home energy cost also will be increases. The usage of electrical must be minimized and optimized to avoid paying unused electrical consumption.

A spontaneous result of inefficient energy usage will increase the operation cost. Subsequently, the consumers will be paying extra without a significant return on consumer's investment. Therefore, by using electrical appliances wisely also save the long-term of saving energy cost.

1.2 Problem Statement

Most of the developing countries are experiencing significant energy demand growth which puts pressure on global fuel consumption thus making high environmental degradation on fuel extraction. The developed countries had creating the system and infrastructure that resistance towards the renewables energy. Even the developing country had found ways to use alternative energy to accommodate consumers daily used. However, cost of energy from

renewable are often higher than current energy prices. The current incentives alone are insufficient to instill energy conservation initiatives. On the other hand, many renewable energy sources are rarely competitive with conventional energy sources. Public also does not taking part of awareness in climate change causing them to use energy inefficiently.

In Malaysia, many researchers have developed energy procreation to produce electricity using, hydro power plant, thermal stations and co-generation system. Besides that, there is also a renewable energy made from oil palm as a new source. This renewable energy is one of the solutions to replace oil, diesel and gas and even coal if the source of this renewable source is run out. The advantages current energy will emit greenhouse gas thus increasing the CO_2 in the atmosphere and lead to the global warming. Indefinitely to prevent of the increasing of CO2 consumers must use the energy efficiently.

A ground floor is the engaging place for students because of the present of Bilik Kuliah. Therefore, the ground floor will most probably be the largest energy consumption. To restrain the increasing of energy cost, this project is to propose an idea to reduce lighting energy on the targeted floor.

1.3 OBJECTIVE

The objectives of this project are as follow:

1. To determine the actual lighting power consumption of a selected building
2. To develop a lighting strategies for building energy saving.
3. To justify the suitability of the strategy in terms of cost (economic analysis) and operation

1.4 Scope of Project

The scopes of this project are:

1. This study only focusses on ground floor of the Technology Campus, UTem located in Taman Tasik Utama, Ayer Keroh.
2. This project is an experimental project that proposes the solution to reduce lighting power consumption on targeted floor.
3. The solution of this project is practical in a college building.

CHAPTER 2

LITERATURE REVIEW

2.1 Energy Efficiency

Lighting energy is consuming a large amount of electrical energy in especially in a building. (EIA, 2017) declared a 38% of the electrical energy is used in commercial office building. Brounen et al (2012) stated that about one-fifth of global energy consumption is caused by residential dwellings via heating, cooling and lighting. The lighting energy is necessary especially for commercial building. Due to the inefficient used of energy can lead of increasing the energy cost. Despite the problem occurring lighting, it is also assisting individual working in a better environment because lacking of good lighting can inhibit someone works less efficient (Angela, 1989). Therefore, to maintain the efficiency of worker and at the same time reducing the energy cost, a better strategy in lighting operation is demanded. Besides that, lighting energy efficiency is another form of alternative investments as economic and financial crisis. Finding solution for energy saving have increasing in each year because of environmental issues such as global warming and changing in climate (Tompros, 2009). Even though lighting energy efficiency is not even widespread and been practical it is a good beginning step to make a better investment with the positive outcome. Lighting energy efficiency has many benefits such as;

a) Lowering an operating
b) Increasing a property value
c) Attracting energy conscious tenant
d) Improving workplace conditions

2.1.1 LED Lighting Strategy

Light-emitting diode (LED) is a semi-conductor device which enables it to produce a visible light when there is a present of electric current when passing through it (Rouse, 2016). The beneficial of LED are:

a) Requiring low power and mostly can be operated only with battery power supply.

b) Most of the LED is high efficiency because it is produce minimal heat energy.

c) LED is functioning for decades once it is installed properly.

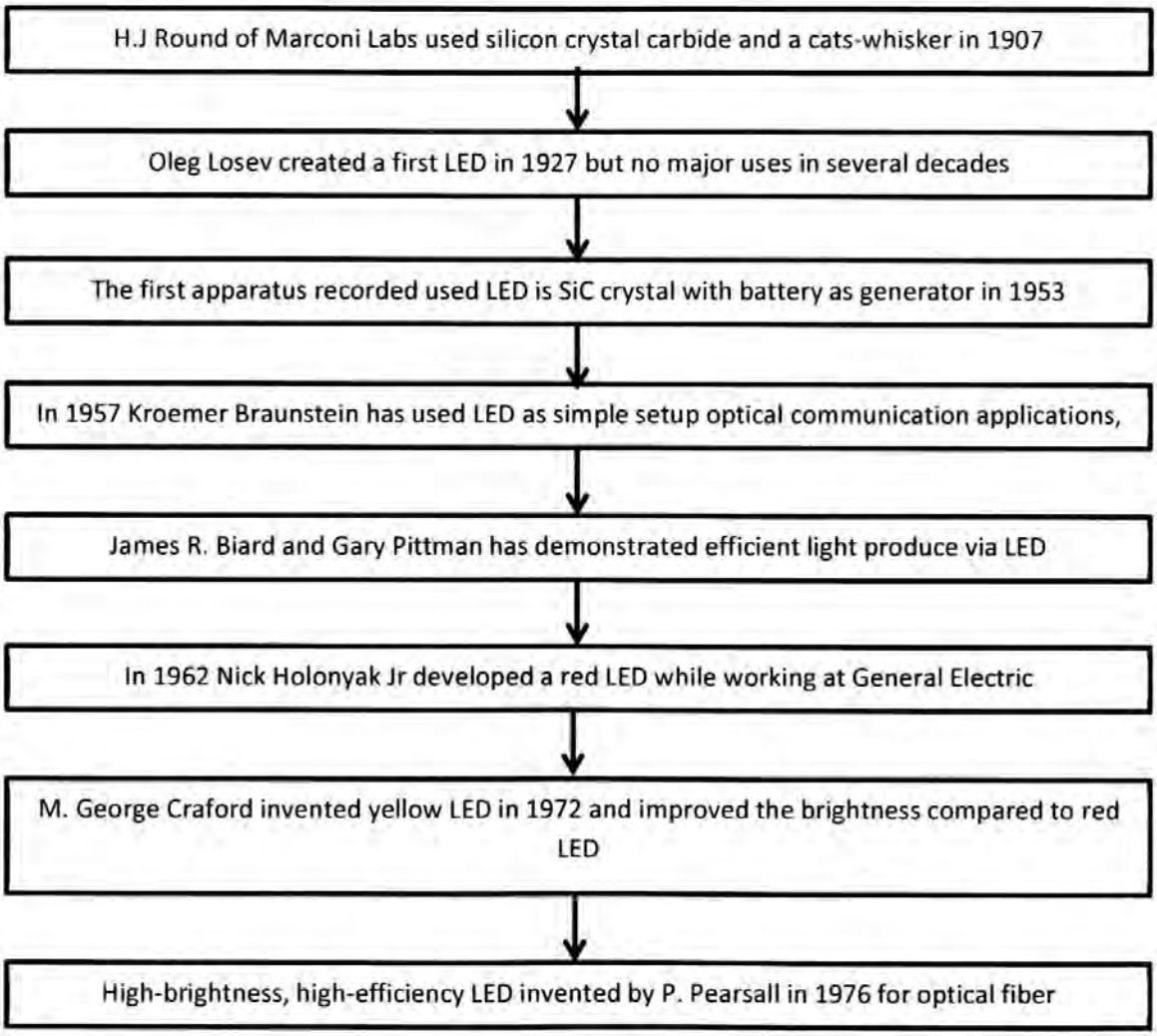

Figure 2.1: LED History (Rozenfield, 2017)

Malaysian used lighting as one of the major electricity energy in daily life approximately 17% (Suruhanjaya Tenaga, 2004). Thus, the normal fluorescent tubes are unsuitable in a financials perspective because it is consuming more power. If the fluorescent lamps are changed with the LED light source, one can alleviate the light energy consumption into 24-74% average in a year (David, 2012). According to the Carbon Trust, in UK the concentration of CO_2 from light emission is 24 million tonnes produce in a year (Durga, 2014). Therefore, LED will provide considerable opportunity for electricity saving and reduces CO_2 emissions.

From the recent years, studies have shown that LED and its efficiency are much more higher compared to conventional fluorescent lamps. Base on the research, (Gan, Sapar, Mun, & Chong, 2013) the input power required to ignite the LED of 18W equivalent to 36W for fluorescent tube only needed 45% of energy compared to the fluorescent tube. Following is LED versus Compact Fluorescent light comparison table (Soori & Vishwas, 2013).

Table 2.1: LED vs. CFL (Soori & Vishwas, 2013)

Particulars	**Light Emitting Diodes (LED)**	**Compact Fluorescent (CFL)**
Life Span(avg)	50 000 hours	8 000 hours
Watts Of Electricity (equal to 60W bulb)	6-8 W	13-15 W
KW Of Electricity Used (equal to 60W bulb/year)	328 KWh/yr	767 KWh/yr

However, there is setback when used the LED such as:

a) The increasing of total harmonic distortion (THD) in the current waveform unsuitable for the electricity system.
b) The cost price is much more higher than conventional lamps

Volatility of LED products are becoming much more as the years passing. As long as the years passed, all the setback of LED can be minimize and the performances of LED also increase. Therefore, the high efficiency is an important trait for energy saving.

2.1.2 Daylighting Strategy

Another simpler way to express day lighting is the light exposure of building via natural light. This strategy can be achieved when using of windows, glass roof any anything that light can penetrated or reflected into the building without any hindrance. All of this medium can offer effective internal lighting thus resulting of energy saving. Natural light is free of charge and electrical light can be reduce to 70-80% per day causing money and energy saving because in the office building, lighting energy jeopardized 20-45% of the energy consumption(de Bakker et al, 2016). A Daylighting strategy is one of the strategies that promoted used in energy efficiency beside of LED.

In 1950s, open-plan offices were developed and in the next several decades this designed are enacted by many companies (Brennan et al, 2002). (Veitch et al, 2007) found that only the new model building is suitable to use daylighting because old model building does not have sunspace. Therefore, to carry out this plan will be facing some challenges such as building layout, occupant's capacity and many more. Hence, occupancy habit will differ in everyday and causing the difficulty task to fully comprehend optimal lighting use with the real life occupancy.