

**ENERGY EFFICIENT LIGHTING SYSTEM FOR BUILDING**

**PREPARED BY:**

**WAN NORSYAFIZAN W. MUHAMAD  
ZULZILAWATI JUSOH  
MOHAMAD YUSOF BIN MAT ZAIN**

**JANUARY 2010**

## ACKNOWLEDGEMENT

All praise is to Allah, Lord of Universe, the Merciful and Beneficent. Salam to Prophet Muhammad S.A.W, his companions, his friends and the people who follow his path. My everlasting thank to Allah for granting me patience and hope in completing this thesis.

The authors would like to thanks to their parents for the prayers and moral supports. Without their supports, maybe this project unable to complete.

Thanks also to our friends and colleagues who always share the ideas and help to make this project a reality. To those who contribute so much effort, whether direct or indirect, we would like to express our highest appreciation.

Thank you.

## ABSTRACT

This project presents the design of efficient lighting systems. The main objective of this project is to analyze the energy management in a building and proposed an efficient lighting design. This project was focusing on lighting design, due to lighting contribute the highest amount of electricity usage in a building. Generally, lighting will consume from 20% until 50% of the electricity consumption. Thus, this project will help people to reduce the electricity usage that consumed by the lighting. In this project, there is new software that has been developed by using MATLAB Graphical User Interface (GUI). This software will help user to determine the ideal number of luminaries or lamps needed in a specific place. There are many factors that affect the lighting quality in order to minimize the quantity of lamps. The second part of the software development is the design for improvement of current lighting system. It is called Lamp Replacement which focused on energy efficiency and to the objective is to minimize the operating costs. The determination of saving cost is based on comparison between the old and new (suggested) lighting designs. Thus, from this software it can help users to minimize their electricity usage according to lighting design in a building. Moreover, users are able to determine the minimum lamps used in certain room or area without reducing the quality of lighting at that place.

# TABLE OF CONTENTS

	<b>PAGE</b>
<b>ACKNOWLEDGEMENT</b>	i
<b>ABSTRACT</b>	ii
<b>TABLE OF CONTENTS</b>	iii
<b>LIST OF FIGURES</b>	
<b>LIST OF TABLES</b>	
<b>CHAPTER 1 INTRODUCTION</b>	1
1.1 Project Background	1
1.2 Objectives of Project	3
1.3 Scope of Project	4
1.3.1 Lighting	4
1.3.2 Proposed Software	5
<b>CHAPTER 2 LITERATURE REVIEW</b>	6
2.1 Energy Management	6
2.1.1 Important of Energy Management	6
2.1.2 Energy Management Approaches	7
2.1.3 Energy Management System (EMS)	8
2.2 Malaysia's Energy Management	10
2.3 Energy Efficiency	11
2.3.1 Energy Efficient for Lighting	11
2.3.2 Energy Efficient for Building Design	12
2.3.3 Energy Efficient for Industry	13
2.3.4 Energy Efficient for Vehicles	14
2.4 Electrical Lamps	15
2.4.1 Fluorescent Lamp	17
2.4.2 Incandescent Lamp	23
2.4.3 High Intensity Discharge (HID) Lamp	27
<b>CHAPTER 3 METHODOLOGY</b>	34
3.1 Lighting Design	34
3.1.1 Mathematical Model	34

3.1.2	Zonal Cavity Model	35
3.1.3	Computer Model	35
3.1.4	Concept of Lighting Design	35
3.2	Lighting Terms	37
3.3	Energy Efficient Lighting Design	40
3.3.1	MATLAB Graphical User Interface (GUI)	41
3.3.2	Software's Design	47
<b>CHAPTER 4</b>	<b>RESULTS AND DISCUSSIONS</b>	<b>52</b>
4.1	Case Study 1 (Number of Luminaries)	52
4.2	Case Study 2 (Lamp Replacement)	54
4.3	Project's Investigation	58
4.3.1	Analysis of Lamp's Luminous Flux	59
4.3.2	Analysis of Room's Dimension	61
4.3.3	Analysis of Lamp Replacement	64
<b>CHAPTER 5</b>	<b>CONCLUSION</b>	<b>67</b>
<b>CHAPTER 6</b>	<b>RECOMMENDATIONS FOR FUTURE WORK</b>	<b>69</b>
<b>REFERENCES</b>		