

**CASE BASED ANALYSIS ON POTENTIAL BENEFITS
OF CHANGING SRI LANKAN OFFICE BUILDINGS
TOWARDS GREEN RATED BUILDING DESIGNS**

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Degree of Master of Science

Department of Civil Engineering

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgment any material previously submitted for a degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where the acknowledgment is made in the text.

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Date:

The above candidate has carried out research for the Masters under my supervision.

Name of the Supervisor: Prof. R. U. Halwatura

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Name of the Supervisor: Dr. Nina Danilina

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ABSTRACT

Office buildings are one of the main categories of buildings which possess a rapid growth rate in the context of urbanization. They contribute to a major part of energy consumption in commercial building sector. Even though, the need of adopting energy-efficient features arises, the higher initial construction cost and the myth of longer payback period have been made barriers to this movement. Hence, this study focuses on identifying possible energy-efficient strategies, and their economic performance during the life cycle of the building, to perform an Life Cycle Cost (LCC) to compare the total costs incurred in the conventional office building and a green building and to select the best design that ensures the lowest overall cost with high-quality functions.

This study consists of 10 randomly selected low-rise office buildings located in the commercial capital of Sri Lanka, Colombo. Followed by the preliminary survey conducted, it was recognized that high initial cost and the longer payback period was the main two hurdles for the office building owners to move towards the energy-efficient buildings. A conventional office building possesses a 140,000-200,000LKR/m² of LCC, and a Building Energy Index (BEI) of around 250 kWh/m². Thereafter, based on a defined energy efficient strategy these buildings were developed as energy efficient buildings in 4 stages.

Accordingly, it was concluded that stage 4 platinum level energy efficient building is the best design for a low life cycle cost, and it results in a payback period of 3-4 years, 20%-30% of increment in initial construction cost, 30%-40% increment of maintenance cost and 20%-25% reduction of building LCC compared to the conventional office building design.

Keywords: Building Energy Index, Energy, Energy-efficiency, Life Cycle Cost, Office Buildings

DEDICATION

This dissertation is dedicated to my loving parents, siblings, and my husband.

For their endless love, support, and encouragement given during this journey

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This research consists of an extensive literature survey and a background study of green buildings and sustainable construction. I owe my gratitude to a long list of researchers who shared their work in numerous ways. Most importantly, I am very much grateful to the management of the office buildings and those who decided to be a part of my research and share their ideas which made my research a success.

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TABLE OF CONTENT

Declaration	i
Abstract	ii
Dedication	iii
Acknowledgement	iv
Table of content	v
List of figures	ix
List of tables	x
List of abbreviations	x
List of Appendices	xi
1 Introduction	1
1.1 General	1
1.2 Research gap	1
1.3 Aims and Objectives	2
1.4 Methodology	2
1.5 Main findings	3
1.6 Dissertation Structure	3
2 Literature Review	4
2.1 General	4
2.2 Impacts on the environment by the building sector	4
2.3 Operational energy demand by buildings	5
2.4 Office buildings and environmental impacts	8
2.5 Sustainable construction	11
2.6 Life cycle costing of buildings	13
2.7 What hinders to move toward green building construction	15

2.8	Life cycle cost analysis of green buildings	19
2.9	Summary	21
3	Development of an energy-efficient office building for a low life cycle cost	22
3.1	General	22
3.2	Identification of the research sample	22
3.2.1	Focused building sector and the region	22
3.2.2	Selection of building design typology	23
3.3	Sample selection	24
3.4	Face-to-face interviews held with conventional office buildings	24
3.5	Employee perception of converting an existing office building into a green building	24
3.6	Life Cycle Cost (LCC) calculation of conventional office buildings	26
3.6.1	Definition of the system boundary	26
3.6.2	LCC Calculation	27
3.6.3	Assumptions based on the LCC calculation	27
3.7	Energy simulation of conventional office buildings	28
3.8	Assessing the current green building state of conventional office buildings	31
3.9	Development of the energy-efficient strategy to improve conventional buildings to energy-efficient buildings	31
3.9.1	Identification of energy-related features in the GREEN ^{SL} ® rating tool	31
3.9.2	Development of the stage-wise case development schedule	34
3.10	Cost calculation for the newly adapted features of the energy-efficient building	36
3.11	Construction cost variation at four (4) stages of energy-efficient office buildings	36

3.12	Cost-saving by energy-efficient features at four (4) stages of energy-efficient office buildings	37
3.13	Payback periods at the four (4) stages of energy-efficient office buildings	38
3.14	Variation of the annual expenses of the best energy-efficient office building design	39
3.15	Life Cycle Cost (LCC) calculation of the best energy-efficient office building design	39
3.16	Summary	39
4	Performances of developed energy-efficient office building designs	41
4.1	General	41
4.2	Face-to-face interviews held with conventional office buildings	41
4.3	Employee perception of converting an existing office building into an energy-efficient building	42
4.4	Life Cycle Cost (LCC) calculation of conventional office buildings	42
4.5	Energy simulation of conventional office buildings	46
4.6	Assessing the current green building state of conventional office buildings	48
4.7	Construction cost variation at four (4) stages of energy-efficient office buildings	49
4.8	Cost-saving by energy-efficient features at four (4) stages of energy-efficient office buildings	50
4.9	Payback periods at the four (4) stages of energy-efficient office buildings	53
4.10	Variation of the annual operating expenses of stage 4: platinum rated energy efficient office buildings	55
4.11	Life Cycle Cost (LCC) calculation of stage 4: platinum rated energy efficient office buildings	58
4.12	Summary	61

5	Conclusions	63
5.1	Conclusions and recommendations	63
5.2	Future work	65
	References	66
	Appendix	71

LIST OF FIGURES

Figure 2.1: Portions of buildings and construction in world energy and energy-related CO ₂ discharges	6
Figure 2.2: Diversion of global trend drivers in building energy and emissions from 2010-2020	7
Figure 2.3: Life cycle of a building	13
Figure 2.4: Distribution of life cycle cost of an office building	20
Figure 3.1: Dispersion of office building stock in Colombo Metropolitan Region	23
Figure 3.2: System boundary of the study	27
Figure 3.3: Cost analysis guideline for the energy efficient building	38
Figure 4.1: Type I variation from the general distribution of LCC	45
Figure 4.2: Type II variation from the general distribution of LCC	46
Figure 4.3: Variation of the annual maintenance cost of the conventional building vs. stage 4: platinum rated energy efficient office buildings (in LKR/m ²)	58

LIST OF TABLES

Table 2.1: CO ₂ emissions by sector during the year 2019	5
Table 2.2: Distribution of BEI ranges of the Colombo office building stock	10
Table 2.3: Construction costs by BREEAM rating tool (cost per gross m ²)	16
Table 2.4: Obstacles encountered during green buildings project management	18
Table 3.1: Construction tab - Data collection for the energy simulation	29
Table 3.2: Activity tab - data collection for the energy simulation	30
Table 3.3: Direct features that are affecting the energy consumption of the building	32
Table 3.4: Indirect features affecting the energy consumption of the building	33
Table 3.5: Case development schedule	34
Table 3.6: Application of the case development schedule	34
Table 4.1: LCC of conventional office buildings	43
Table 4.2: Energy utilization costs during the life cycle of an office building	43
Table 4.3: LCC of conventional office buildings variation	44
Table 4.4: Modeled conventional buildings using the DesignBuilder software	47
Table 4.5: BEI values of the conventional building cases	48
Table 4.6: Summary of the current green ratings of conventional office buildings	48
Table 4.7: Variation of construction cost with stages of energy efficiency	49
Table 4.8: Construction cost variation at 4 stages of energy-efficient office buildings	51
Table 4.9: Annual cost savings at 4 stages of energy-efficient office buildings (in millions)	52
Table 4.10: Payback periods at the 4 stages of energy-efficient office buildings (in years)	53
Table 4.11: Variation of payback period at 4 stages of energy-efficient office buildings (in years)	54
Table 4.12: Variation of the annual operating expenses of stage 4 platinum-rated energy-efficient office buildings (in LKR)	56
Table 4.13: Variation of LCC between conventional office building vs. stage 4: platinum rated energy efficient office buildings	59
Table 4.14: Variation of LCC between conventional office buildings Vs. stage 4: platinum rated energy efficient office buildings (LKR/m ²)	60

LIST OF ABBREVIATIONS

Abbreviations	Description
ANOVA	Analysis of Variance
BEI	Building Energy Index
EFA	Exploratory Factor Analysis
GB	Green Building
GBCSL	Green Building Council of Sri Lanka
LCC	Life Cycle Cost
PCA	Principal Components Analysis
SEM	Structural Equation Model

LIST OF APPENDICES

Appendix A	Online survey on “what hinders converting your existing office building to a green building?”
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