

**REDUCE THE ENERGY CONSUMPTION AND  
IMPROVING THE THERMAL COMFORT OF  
COMMERCIAL BUILDINGS BY NIGHT  
VENTILATION**

S. K. Kodithuwakku

208899D

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Department of Mechanical Engineering

University of Moratuwa

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## **ABSTRACT**

Mechanical Ventilation and Air Conditioning (MVAC) systems in commercial buildings in hot and humid climates consume more than 60% of the total building energy to provide the required thermal comfort and indoor air quality (IAQ) for the occupants. Even if the MVAC systems of these buildings are operated according to the instructions and the recommendations of the consultants and the MVAC system manufacturers, the occupants of the buildings frequently report that they feel much warmer and thermally discomfort during the early morning hours as a result of thermal inertia of the buildings, slowly releases the absorbed heat to the indoor environment and the outdoor environment overnight. Therefore, indoor air temperature increases with the absence of the air conditioning systems at night and the heat is accumulated in the indoor environment of the building.

This thesis covers various passive ventilation approaches that can be utilized to save energy in commercial buildings before recommending an appropriate ventilation system for them. The Road Development Authority building was used to investigate the possibilities of night ventilation. Initially, it was evaluated utilizing a post-occupancy evaluation system. Following that, three loggers were installed in the aforementioned building, and data was collected for three and a half months for experimental purposes. Following data collection, graphs are utilized to obtain the desired outcome. After analyzing the results, it was determined that early fresh air supply saves energy because fresh air supply to the selected building begins about 9.30am. Energy saving hours range from 1am to 7am, with the optimal time period being 5am to 6am. The possibility of night ventilation in buildings in equatorial nations can be tested after modeling the buildings.

**Keywords:** Mechanical ventilation, Thermal mass, Night Ventilation, Passive energy saving techniques

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# TABLE OF CONTENT

DECLARATION OF THE CANDIDATE AND THE SUPERVISOR.....	i
ABSTRACT.....	ii
ACKNOWLEDGMENT.....	iii
TABLE OF CONTENT .....	iv
LIST OF FIGURES .....	vii
CHAPTER 1 .....	1
1    INTRODUCTION .....	1
1.1    Background.....	1
1.2    Introduction to chapters .....	2
1.3    Aim .....	2
1.4    Objectives .....	2
1.5    Methodology.....	3
CHAPTER 2 .....	4
2    LITERATURE REVIEW.....	4
2.1    Energy Usage in Buildings in the world.....	4
2.2    Energy Usage in Singapore buildings.....	5
2.3    Energy Usage in buildings in Sri Lanka .....	9
2.4    Energy Consumption Benchmark Analysis in Sri Lanka .....	9
2.5    Greenhouse Gas (GHG) emissions .....	13

2.6	Urban heat Island phenomenon .....	15
2.7	Fundamentals of Thermal mass .....	18
2.8	Effect of thermal mass for Air Conditioning.....	20
2.9	Passive Energy Saving Techniques in Buildings.....	29
2.9.4	Night ventilation .....	33
CHAPTER 3 .....		46
3	METHODOLOGY.....	46
3.1	Problem statement.....	46
3.2	Methodology.....	46
3.3	Format of the occupants' survey.....	49
3.4	Target group of the occupants' survey .....	50
3.5	Analyzing the quantities of the collected questionnaire .....	51
3.6	Analyze the result of the questionnaire.....	53
3.8	Experimental study .....	56
CHAPTER 4 .....		58
4	RESULTS .....	58
4.1	Output of the Data Loggers .....	58
4.2	Summary of the graphs for Temperature, Relative Humidity and Enthalpy 105	
4.3	Outdoor enthalpy difference .....	109
4.4	Energy saving due to fresh air supply.....	117

4.5 Analysis of the results.....	120
CHAPTER 5 .....	121
5 Conclusion .....	121
REFERENCES.....	123

## LIST OF FIGURES

Figure 2-1: Analyzing the EU, China, and US ultimate energy consumption by fuel type [1] .....	4
Figure 2-2: Building energy end-uses in the EU, China, and the US broken down ....	5
Figure 2-3: Annual Electricity Consumption (GWh) by Building Types in Singapore[3].....	6
Figure 2-4:Sector wise Electricity consumption in India [4] .....	8
Figure 2-5: Energy usage of office buildings in India [5].....	8
Figure 2-6:Electricity demand in sector wise in Sri lanka in year 2021[6] .....	9
Figure 2-7: Specific electricity consumption – kWh/m <sup>2</sup> .year [7] .....	11
Figure 2-8:Total regional GHG emissions trends [9] .....	15
Figure 2-9:Total global GHG emissions trends[9],.....	15
Figure 2-10:Generalized cross-section of a typical Urban heat Island [10].....	17
Figure 2-11 : Thermal mass phenomenon.....	19
Figure 2-12: Concrete as a thermal mass material [11] .....	19
Figure 2-13 : Outside and inside temperature versus time [11].....	20
Figure 2-14 :Heat transfer in day and night at normal room and air conditioned room [12] .....	23
Figure 2-15 : Temperatures measured on the inside of a solid-wall (blockwork) structure and a timber building [12].....	23
Figure 2-16 : Earth-to-air heat exchanger schematic and principle. [18] .....	31
Figure 2-17 :Atrium [19].....	32

Figure 2-18:Solar Thermosyphonic system [17] .....	33
Figure 2-19 :Image of a Building model[20] .....	35
Figure 2-20 :Cross section of the wall structured investigated .....	37
Figure 2-21: Monthly energy usage of the simulated and experimental models [21] 39	
Figure 2-22: The effect of PCM melting temperatures on the yearly cooling demand of the model[21] .....	41
Figure 2-23: The influence of maximum external air temperature, to start night ventilation, on annual cooling load for a) 27°C, and b) 29°C melting temperature PCMs [21] .....	42
Figure 3-1:Front Elevation of the RDA Head Office.....	47
Figure 3-2:Second Floor Plan After Glass Partion Work .....	48
Figure 3-3:Building 6 <sup>th</sup> floor partition plan.....	57
Figure 4-1 Temperature distribution on 26/5/2022.....	60
Figure 4-2 Relative Humidity distribution with time on 26/5/2022 .....	61
Figure 4-3 Enthalpy distribution with time on 26/5/2022.....	62
Figure 4-4 Temperature distribution with time on 30/5/2022.....	63
Figure 4-5: Relative Humidity distribution with time on 30/5/2022 .....	64
Figure 4-6:Enthalpy distribution with time on 30/5/2022 .....	65
Figure 4-7 Temperature distribution with time on 10/6/2022.....	66
Figure 4-8 Relative Humidity distribution with time on 10/06/2022 .....	67
Figure 4-9 Enthalpy distribution with time on 10/06/202.....	68

Figure 4-10 Temperature distribution with time on 20/06/2022.....	69
Figure 4-11 Relative Humidity distribution with time on 20/06/2022 .....	70
Figure 4-12 Enthalpy distribution with time on 20/06/2022.....	71
Figure 4-13 Temperature distribution with time on 27/06/2022.....	72
Figure 4-14 Relative Humidity distribution with time on 27/06/2022 .....	73
Figure 4-15 Enthalpy distribution with time on 27/06/2022.....	74
Figure 4-16 Temperature Distribution with time on 11/07/2022.....	75
Figure 4-17: Relative Humidity Distribution with time on 11/07/2022 .....	76
Figure 4-18:Enthalpy Distribution with time on 11/07/2022.....	77
Figure 4-19:Temperature Distribution with time on 27/07/2022.....	78
Figure 4-20:Relative Humidity Distribution with time on 27/07/2022 .....	79
Figure 4-21 Enthalpy Distribution with time on 27/07/2022.....	80
Figure 4-22 Temperature Distribution with time on 03/08/2022.....	81
Figure 4-23 Relative humidity with time on 03/08/2022.....	82
Figure 4-24 Enthalpy Distribution with time on 03/08/2022.....	83
Figure 4-25 Temperature Distribution with Time on 11/08/2022 .....	84
Figure 4-26 Relative humidity Distribution with Time on 11/08/2022 .....	85
Figure 4-27: Enthalpy Distribution with Time on 11/08/2022 .....	86
Figure 4-28: Temperature Distribution with Time on 20/08/2022 .....	87
Figure 4-29: Relative Humidity Distribution with Time on 20/08/2022 .....	88

Figure 4-30 Enthalpy Distribution with Time on 20/08/2022 .....	89
Figure 4-31 Temperature Distribution with Time on 30/08/2022 .....	90
Figure 4-32 Relative Humidity Distribution with Time on 30/08/2022 .....	91
Figure 4-33: Enthalpy Distribution with Time on 30/08/2022 .....	92
Figure 4-34 Temperature Distribution with Time on 04/09/2022 .....	93
Figure 4-35 Relative Humidity Distribution with Time on 04/09/2022 .....	94
Figure 4-36 Enthalpy Distribution with Time on 04/09/2022 .....	95
Figure 4-37 Summery of the Outdoor Temperature Distribution .....	96
Figure 4-38 Summery Of the indoor(location 2) Temperature Distribution.....	97
Figure 4-39 Summery of the Indoor (location 1) Temperature Distribution .....	98
Figure 4-40 summry of the outdoor Relative humidity .....	99
Figure 4-41Summery of the Indoor(location 2) Relative Humidity Distribution...	100
Figure 4-42 summary of the Indoor(location 1) Relative Humidity Distribution....	101
Figure 4-43 Summery of the outdoor Enthalpy Distribution .....	102
Figure 4-44 summery of the Indoor(location 2)Enthalpy Distribution .....	103
Figure 4-45 Summery of the indoor(Location 1) Enthalpy Distribution .....	104
Figure 4-46:Energy Saving Due to Early Fresh Air Supply .....	119

#### LIST OF TABLES

Table 2-1:Building Benchmarks for commercial Buildings in Singapore, in year 2022[3] .....	7
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Table 2-2: Specific energy consumption levels for commercial buildings in Sri Lanka[7] .....	10
Table 2-3: Energy consumption benchmarks for Commercial Buildings[7] .....	10
Table 2-4: Criteria for the building envelope in the "warm-humid" climate zone ....	12
Table 2-5:Minimum efficiency requirement MVAC equipment .....	12
Table 2-6: Minimum efficiency requirement for electrically operated unitary air conditioners and condensing units .....	13
Table 2-7:Data table .....	22
Table 2-8:Façade characteristics .....	36
Table 2-9 Specifications of the building elements[21] .....	40
Table 3-1: Evaluation methods .....	46
Table 3-2: Questionnaire answered by selected occupants.....	49
Table 3-3:Occupants Selection .....	50
Table 3-4:Collected quantities of the questionnaire.....	51
Table 3-5:Building walk through by maintenance team on 04/6/2022.....	52
Table 3-6:Result of the questionnaire .....	53
Table 3-7:Results of the questionnaire.....	53
Table 3-8 Summery of occupants’ comments during the interviews (only ten occupants comments mentioned below) .....	55
Table 4-1:Table of Figures.....	59
Table 4-2:summery of the graphs .....	105

Table 4-3: Outdoor and Indoor CO <sub>2</sub> level Calibrations .....	108
Table 4-4:Enthalpy tables .....	109
Table 4-5:Outdoor Enthalpy Difference ( 1Am and 9.30Am) .....	110
Table 4-6:Outdoor Enthalpy Difference (2Am and 9.30Am).....	111
Table 4-7:Outdoor Enthalpy comparison (3Am and 9.30Am) .....	112
Table 4-8:Outdoor Enthalpy comparison ( 4Am and 9.30Am) .....	113
Table 4-9:Outdoor Enthalpy Difference (5Am and 9.30Am).....	114
Table 4-10:Outdoor Enthalpy Difference (6Am and 9.30Am).....	115
Table 4-11:Outdoor Enthalpy Difference (7Am and 9.30Am).....	116
Table 4-12: Average Enthalpy Difference Compare with Outdoor air at 9.30AM .	118

## LIST OF NOMENCLATURE

Abbreviation	Description
NV	Night Ventilation
AC	Air Conditioner
COP	Coefficient of Performance
BMS	Building Management system
IIoT	Industrial internet of things
RH	Relative Humidity
RDA	Road development Authority
EAHE	Earth to air Heat exchanger
GHG	Greenhouse Gas
EUI	Energy use intensity
GFA	Gross floor area
PCM	Phase Change Material
<b>Subscripts</b>	<b>Description</b>
CO <sub>2</sub>	Carbon Dioxide
$\alpha$	Thermal Diffusivity
K	Thermal Conductivity
C	Specific Heat Capacity