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ENERGY SAVING STRATEGIES AND
IMPLEMENTATION IN SELECTED AIRPORT
TERMINALS IN MALAYSIA-TOWARDS
EFFECTIVE ENERGY MANAGEMENT POLICY

BY

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A dissertation submitted in partial fulfilment of the
requirements for the degree of Masters of Science in
Building Services Engineering

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International Islamic University
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ABSTRACT

Airport terminals are one of the most energy intensive building types due to its size, design, occupants' activities and twenty four hour operation. Due to recent development trends in airport design such as large expanse of glass and large air-conditioned volumes, energy issues have emerged as an area of concern. In a tropical climate such as Malaysia, reduction in cooling load and energy management have come to the fore due to rising energy costs. This dissertation attempts to shed some lights on energy consumption pattern and load trends in large Malaysian airports with a focus on three case studies representing three categories of high passenger movement. During this study the general passive and active energy related features were assessed. Energy data was collected from these terminals by means of data loggers, documents and personal communications. Using the collected energy data, the relevant analysis was made to propose potential energy saving mechanisms and strategies. Among the obtained results include the load apportioning, building energy intensity, and load profile for these terminals. It is hoped that this study can contribute to the energy policy recommendations developed for Malaysian airports. This study can contribute to start implementation of energy efficiency policies and focus on the energy saving in terminal buildings which bring towards long-term operational cost savings and international recognition in sustainable design.

APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Science in Building Services Engineering.

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

Abdul Matheen Mohamed

Signature

Date

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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SELECTED AIRPORT TERMINALS IN MALAYSIA -TOWARDS
EFFETIVE ENERGY MANAGEMENT POLICY**

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LIST OF ABBREVIATIONS

AHU	Air Handling Unit
ASHRAE	American Society for Heating Refrigerating and Air-Conditioning Engineers
BAS	Building Automation System
BEI	Building Energy Index
BMS	Building Management System
CAV	Constant Air Volume
CFL	Compact Fluorescent Light
CP	Contact Pier
CT	Current Transformer
EMS	Energy Management System
FIDS	Flight Information Display System
GDC	Gas District Cooling
HVAC	Heating Ventilation and Air-Conditioning
IES	Illuminating Engineering Society
KLIA	Kuala Lumpur International Airport
kWh	Kilo Watt Hour
LED	Light Emitting Diodes
LEED	Leadership in Energy and Environmental Design
LEO	Low Energy Office
MAHB	Malaysian Airports Holding Berhad
MTB	Main Terminal Building
MVAC	Mechanical Ventilation and Air-conditioning System

OTTV	Overall Thermal Transfer Value
PAHU	Primary Air Handling Unit
PLB	Passenger Loading Bridge
PTM	Pusat Tenaga Malaysia
PV	Photo Voltaic
RTTV	Roof Thermal Transfer Value
SCADA	Supervisory Control and Automatic Data Acquisition
TAM	Total Airport Management
TNB	Tenaga Nasional Berhad
UPS	Un-Interruptible Power Supply
VAV	Variable Air Volume
VFD	Variable Frequency Drive
VSD	Variable Speed Drive
WWR	Window to Wall Ratio
LT	Light Transmittance
LR	Light Reflectance
ST	Total Solar Radiant Heat Transmittance
SC	Total Shading Coefficient
UV	U-Value

LIST OF SYMBOLS

Ar	Opaque roof area (m^2)
Ur	Thermal transmittance of opaque roof area (W/m^2K)
TDeq	Equivalent temperature difference (K)
As	Skylight Area (m^2)
Us	Thermal transmittance of skylight area (W/m^2)
ΔT	Temperature difference between exterior and interior design conditions (5K)
SC	Shading coefficient
SF	Solar factor (W/m^2)
Ao	Gross roof area (m^2)
CF	Correction Factor with reference to the orientation of the roof and the pitch angle of its skylight
Aoi	Gross exterior wall area for orientation i
α	Solar absorptivity of opaque wall
Uw	Thermal transmittance of opaque wall (W/m^2K)
oi	Orientations of the building
A	Ampere
V	Voltage
k	kilo (One Thousand)
VA	Volt Ampere
VAr	Volt Ampere Reactive
W	Watt
M	Mega (One million)