

CERTIFICATION OF APPROVAL

Study on the Air Conditioning Cooling Load and Operational Practices within Glazed
Buildings in Universiti Teknologi PETRONAS

by

Ahmad Hadi Bin Hassan

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Approved by,

(Ir. Dr. Shaharin Anwar Sulaiman)

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TRONOH, PERAK

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

AHMAD HADI HASSAN

ABSTRACT

The centralized air conditioning system in Universiti Teknologi PETRONAS is a large scale air conditioning application, in which the average monthly consumption reaches as high as 850,000 RTh. For such a huge amount of energy consumption, the system has vast potential for energy and cost saving. Therefore, a thorough study on the cooling load of the whole system should be performed to identify potential areas for energy and cost saving. The objective of the present study is to investigate the potential energy savings within the air conditioning system. The study is conducted by analyzing the system's cooling load and the operational practices, both manually and by software simulation. For cooling load analysis, the effect of several design and operational variables towards building annual cooling energy are analyzed in terms of the building orientation, thermal insulation, night ventilation, window shading devices, infiltration and overcooling towards building annual cooling energy. On the operational side, building occupancy pattern is investigated. This involved analyzing the occupancy pattern during weekday and weekend as well as estimating the energy saving by isolating the unoccupied spaces. From the simulations' results, implementation of windows blinds and shadings as well as providing night ventilation give a significant reduction of buildings' annual cooling energy. For the operational practices, implementation of rooms' scheduling for the air conditioning system will also result in a substantial reduction of building cooling load.

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ABBREVIATIONS AND NOMENCLATURES

| | |
|--------|---|
| AHU | Air Handling Unit |
| ASHRAE | American Society of Heating Refrigeration and Air Conditioning Engineer |
| BLAST | Building Loads Analysis and Systems Thermodynamics |
| CFD | Conduction Finite Difference |
| CFM | Conduction Transfer Function |
| CLF | Cooling Load Factor |
| CLTD | Cooling Load Temperature Difference |
| CTF | Cubic Feet per Minute |
| DB | Dry Bulb |
| GLF | Glass Load Factor |
| HB | Heat Balance |
| HVAC | Heating Ventilation and Air Conditioning |
| SC | Shading Coefficient |
| SHGF | Solar Heat Gain Factor |
| TFM | Transfer Function Method |
| UTP | Universiti Teknologi PETRONAS |
| VAV | Variable Air Volume |
| VSD | Variable Speed Drive |
| WB | Wet Bulb |