

ABSTRACT

This study provides an insight into the energy performance of a mixed-mode ventilated mall under two scenarios; 1) while operating under mixed-mode ventilation, and 2) while operating as fully air-conditioned. This was done in order to compare the energy performance under the two different modes of ventilation.

The results revealed that while operating under mixed-mode ventilation, the case study mall consumed less energy compared to when operation as fully air conditioned. This study intends to highlight the importance of energy savings in energy efficient retail building design.

INTRODUCTION / OBJECTIVES / BACKGROUND

Energy consumption in shopping malls is on a growing increase, and this is majorly due to the cooling and lighting loads coupled with the variety of services rendered in the mall that relies on energy. Compared to other energy consuming sectors, limited attention is been given to the study of energy consumption in shopping malls (Stensson et al., 2009; Stensson, 2014). But, due to high energy consumption and the ever-increasing number of malls, the actual energy consumption analyses and development of sustainable energy concepts for this kind of buildings are crucial.

This study provides an insight into the energy performance of a mixed-mode ventilated mall. The energy performance was evaluated under two scenarios in order to compare the energy performance under the two different modes of ventilation. With this, the percentage reduction in energy consumption for cooling of the mall while operating under the two different modes of ventilation was revealed.

This study was conducted under the following objectives:

1. To evaluate the energy performance of a mixed-mode ventilated mall while operating as mixed-mode and also as fully air-conditioned.
2. To compare the energy consumed for cooling in the mall under the two different modes of ventilation.

METHOD

Computer simulation has been widely used for evaluating and predicting energy performances in different types of buildings (Daniela et al., 2015; Lisa et al., 2015; Zaatari et al., 2016). For this study, Integrated Environmental Solutions (IES<VE>) version 2015 was used. All building materials properties used for the study was sourced from Building Energy Intensity Tool (BEIT) database. All building's underground elements were excluded.

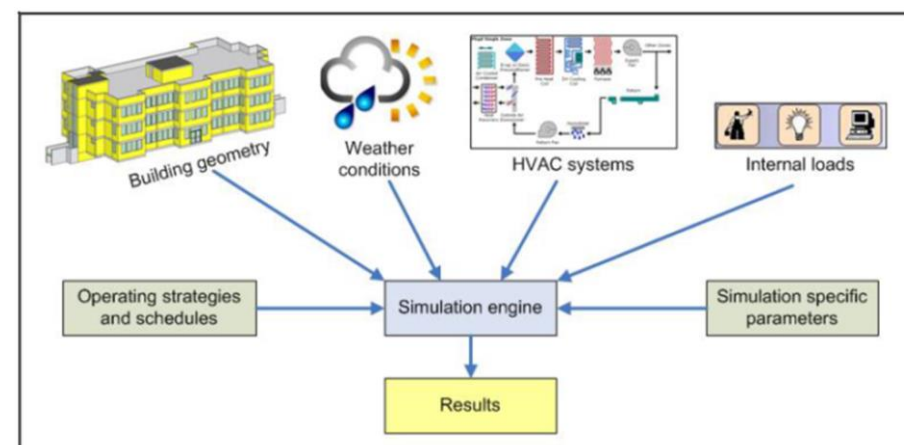


Figure 1. General data flow of energy simulation tools (Maile et al., 2007) pg3.

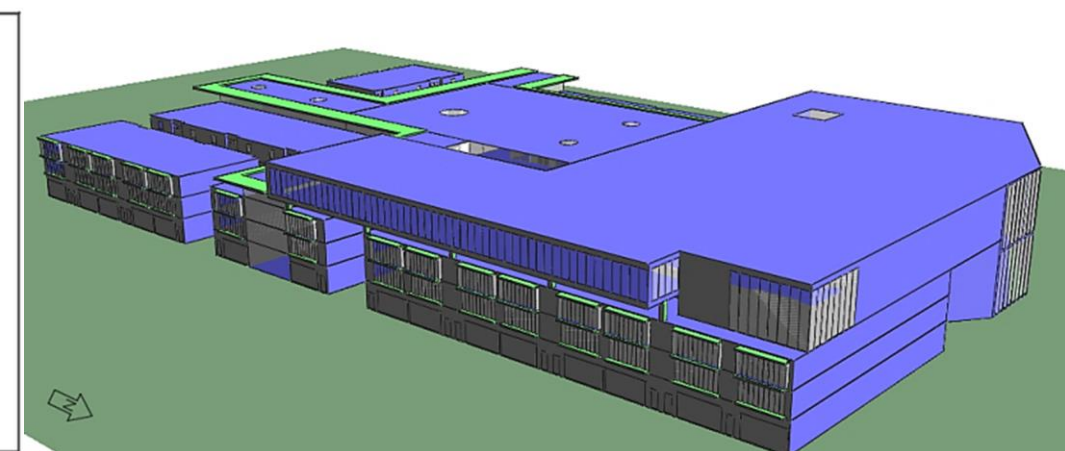


Figure 2. Case study building geometry

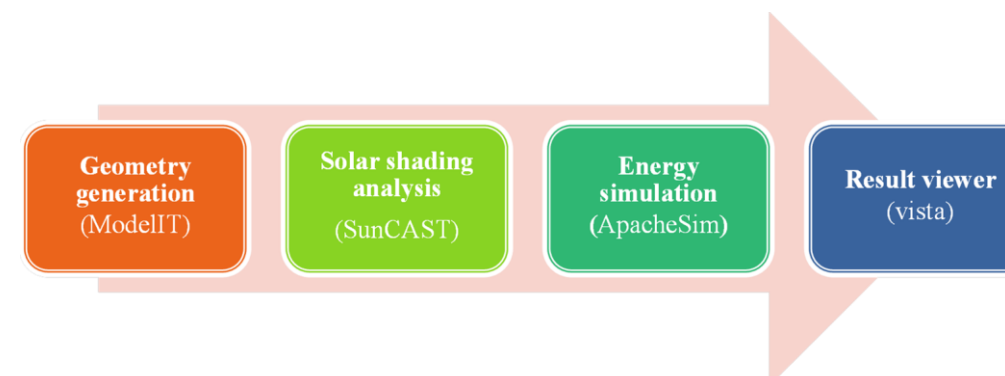


Figure 3. Simulation flow in <IESVE>

RESULTS AND DISCUSSION

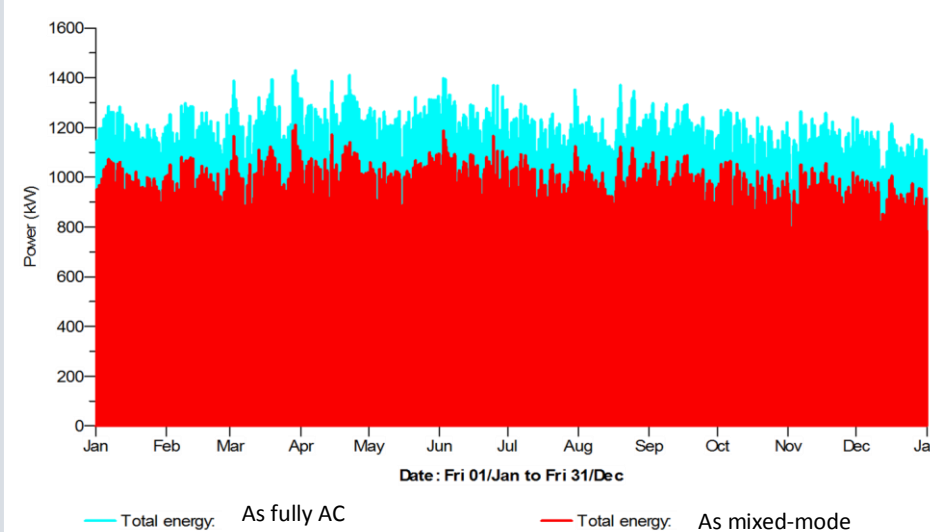


Figure 4. Monthly total energy uses while operating on both modes of ventilation

Table 1. Energy consumption in MWh for cooling while operating as both mixed-mode and fully AC.

Months	As mixed-mode	As fully AC
January	163.3	228.3
February	151.1	210.4
March	176.8	243.8
April	172.8	237.2
May	175.1	240.9
June	177.5	241.2
July	171.7	236.5
August	168	232.7
September	164.7	228.1
October	159.5	223.8
November	153.5	215.5
December	150.7	213.5
Total energy consumption for cooling (MWh)	1984.8	2,751.90
Percentage savings		27.9%
Total annual savings		767.1 MWh

CONCLUSIONS

This study has revealed the difference in energy consumption in a mall while operating under two different modes of ventilation (mixed-mode ventilation and AC). While operating on mixed-mode ventilation, the mall performed better compared to when operating as fully AC. When the energy consumption used for cooling under the two modes of ventilation was compared, 27.9% in energy savings was realised.

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ACKNOWLEDGMENTS OR CONTACT

This work is financially supported by the Universiti Putra Malaysia research grant (Putra IPS: GP-IPS/2015/9455800). The authors also acknowledge the support by means of scholarship from Malaysian International Scholarship (MIS), 2014.