The Impact of Air Infiltration And Natural Ventilation On Annual Air Conditioning Load

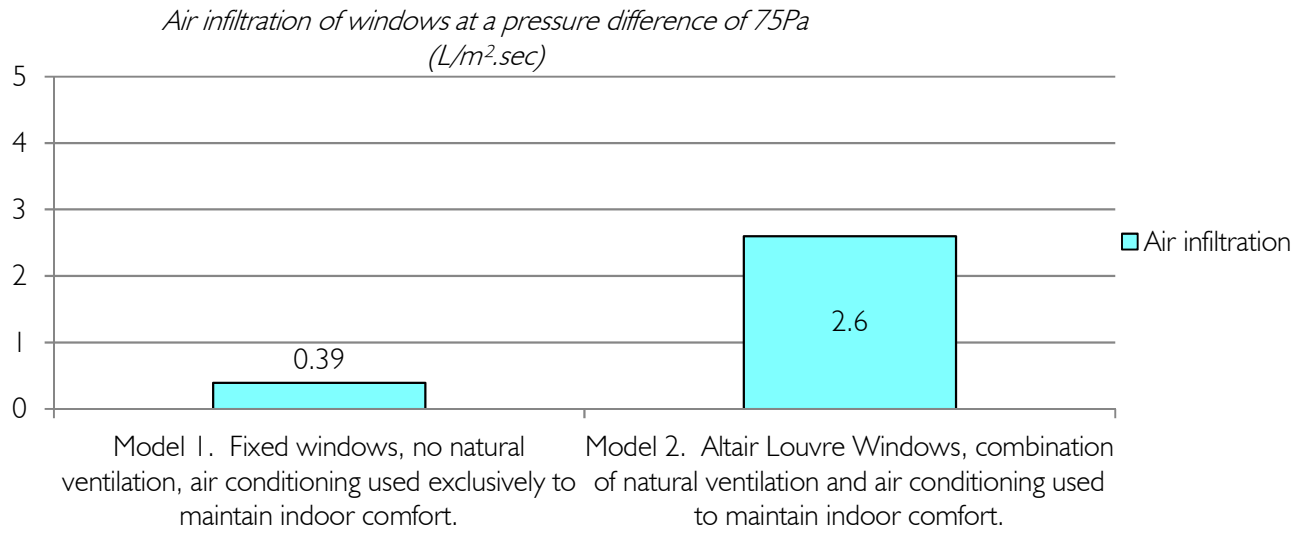
Breezway Technical Bulletin

In response to robust science showing significant decreases in energy consumption when natural ventilation is used to meet the cooling needs of buildings, specifiers are increasingly incorporating Altair® Louvre Windows into their designs as Altair Louvre Windows offer the highest ventilation rates in relation to the overall window size. Concerns are sometimes raised by HVAC (heating, ventilation & air conditioning) engineers regarding the reduced efficiency of their HVAC systems due to the air infiltration rates of Altair Louvre Windows being above 1.0 L/m^2.sec (around 2.6 L/m^2.sec). In response to these concerns Breezway commissioned an analysis by an independent sustainability consultancy to assess the impact of reduced HVAC efficiency compared to the reduced running hours of the HVAC system.

Research Methodology

Breezway engaged Vim Sustainability to model the annual energy consumption of two identical buildings in Sydney, one having fixed windows and the other having Altair Louvre Windows. All physical aspects of the buildings are identical with the exception of the amount of ventilation possible through the windows and the air infiltration of the windows.

During the occupied hours, the building with the Altair Louvre Windows uses natural ventilation for cooling when outside conditions are appropriate and air conditioning when outside conditions are too hot or too cold to make use of natural ventilation. The building with the fixed windows uses only air conditioning to maintain indoor comfort.

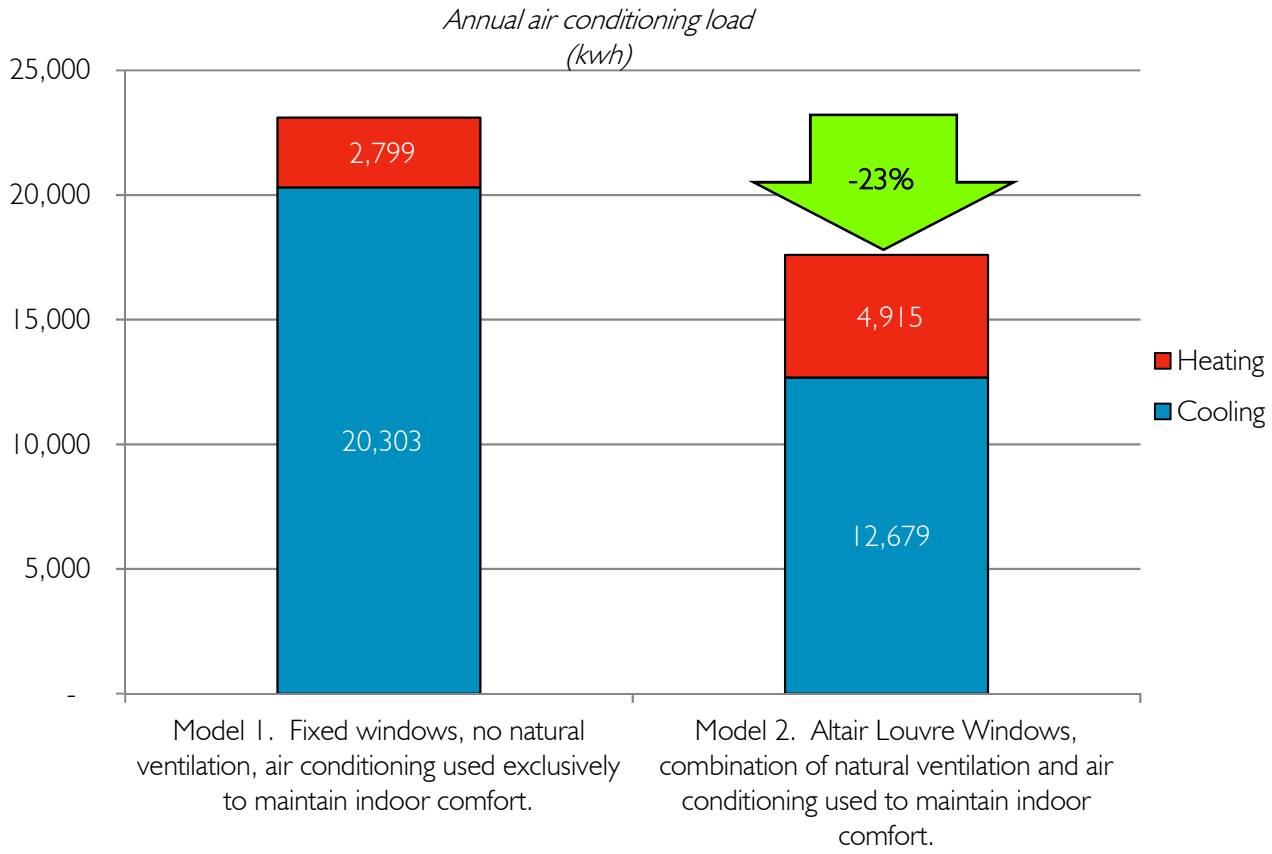


Note: The air infiltration of the fixed window is the average air infiltration rating sourced from www.wers.net of 9 different fixed windows from 4 different manufacturers,

Research Results

The results of the modelling showed that the model with Altair Louvre Windows that utilises natural ventilation requires 37% less cooling energy over the course of a year due to the reduced hours that the air conditioning system must be operated. The higher air infiltration of the Altair Louvre Windows results in the model with Altair Louvre Windows requiring 76% more heating energy over the course of a year, but this is off a small base.

The total annual energy consumption (for both heating and cooling) of the model with the Altair Louvre Windows is 23% lower than the total annual energy consumption of the model with the fixed windows.



The results of this independent modelling study show that the energy reductions due to the use of Altair Louvre Windows that enable cooling natural ventilation far outweigh the reductions in air conditioner efficiency due to the air infiltration rate of the Altair Louvre Windows.

The full research report is available on request.

Applicability To Other Windows

The results of this modelling cannot be claimed as being relevant to other window types for the following reasons:

- The ventilation openings of other window types are different to the ventilation openings of Altair Louvre Windows. Different ventilation opening areas will affect the extent to which ventilation can be used for cooling.
- The air infiltration of most other louvre windows is significantly higher than the air infiltration of Altair Louvre Windows. Higher air infiltration rates will decrease the efficiency of the air conditioning and increase the annual air conditioning load.
- The U-values of other louvre window with low air infiltration rates are significantly higher than the U-values of Altair Louvre Windows. Higher U-values will increase the amount of heat transferred through the windows and will increase the annual air conditioning load.

Applicability To Other Locations

The modelling that forms the basis of this study was conducted in Climate Zone 5 as defined by the Building Code of Australia. Similar results would be experienced if this modelling was run in other locations within Climate Zone 5. Major Australian cities within Climate Zone 5 include:

- Sydney
- Perth
- Adelaide
- Newcastle
- Wollongong
- Toowoomba

Around 40% of Australia's population lives within Climate Zone 5.

Other Benefits Of Natural Ventilation

Besides the decreased energy consumption and therefore decreased electricity bills shown by this report, the following additional benefits of natural ventilation have been documented:

- Occupants of naturally ventilated buildings are more comfortable than, or at least as comfortable as, occupants of air conditioned buildings.
- Decreased sick leave
- Improved learning outcomes
- Improved productivity

More details are available in the Breezway Technical Bulletin "A Selection Of Documented Benefits Of Ventilation".