RP1015

COMBINING A BUILDING INTEGRATED PVT SYSTEM WITH A LOW TEMPERATURE DESICCANT COOLER TO DRIVE AFFORDABLE SOLAR COOLING

Research Question

The fundamental question of my research is how to reduce the energy used for space cooling/heating without reducing the comfort level.

Can cooling in summer and heating in winter be achieved using solar thermal energy from a PV/T and a desiccant air system?

Figure 1: Photo taken on the roof of the monitoring room

Methodology

A TRNSYS model including the building (monitoring room 401), PV/T, desiccant wheel and internal evaporative cooler (IEC) has been established for determining each parameter of the system and simulation. With partners CSIRO and BlueScope, a prototype system consisting of a PV/T air array, a desiccant wheel cooling system has been designed, and is being installed and will be operated on the roof of Tyree Energy Technologies Building (TETB), UNSW recently. This system can provide us with the required data to experimentally investigate whether the PV/T and desiccant system can meet the cooling and heating requirements for the room. In order to explore the commercial application potential of this system, a model based on the dimensions of the Forestway shopping centre has been created.

Results

IR images of the monitoring room were taken to help us create a steady state model to explain the solar-air temperature effects. The detailed modelling of the walls resulted in increasing accuracy of the simulation results.

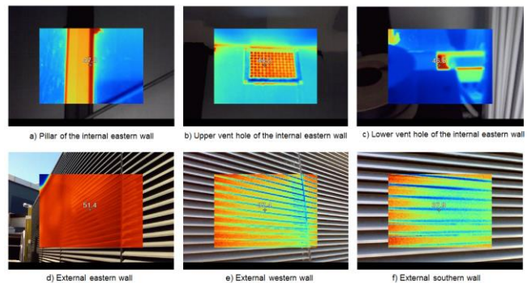

Figure 2: IR images of the monitoring room.

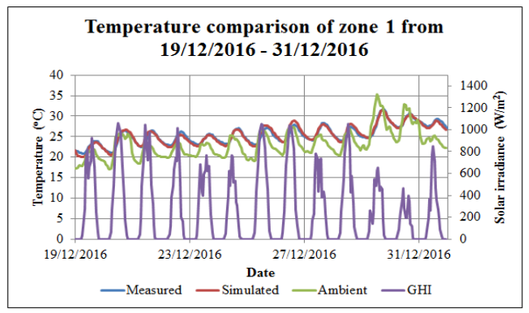

Figure 3: Measured and simulated temperature comparison.

On the other hand, the simulation results of the shopping centre model with solar thermal HVAC system show the potential of supplying cooling and heating in summer and winter separately.

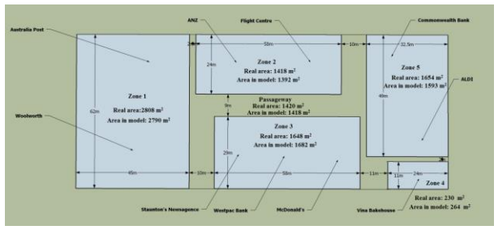

Figure 4: Dimensions of the shopping centre model established.

The frequency of the base building temperature in both summer and winter during working hours from 9:00 to 17:30 have been shown in the following figures.

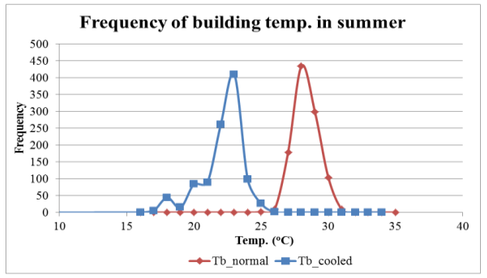

Figure 5: Frequency of base building temperature in summer (hourly, 1 degree bins).

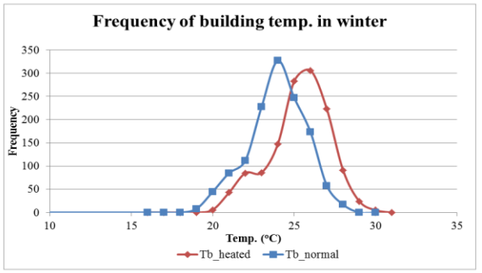

Figure 6: Frequency of building temperature in winter (hourly, 1 degree bins).

Conclusions

A good accuracy of the monitoring room model can increase the confidence of the combined TRNSTS model for monitoring and analysis of the proposed cycle. Simulation results of the shopping centre model, show adequate cooling and heating performances of the base building in summer and winter separately. Based on these preliminary results, this design can meet the requirement quite well to achieve the balance of between cost and performance.

Anticipated impacts

Since space cooling and heating is one of the highest energy consuming loads in modern society and the energy crisis is looming ahead, with this novel technology we can enjoy the indoor comfort, with the same time, be environmentally friendly and potentially lower the cost of air-conditioning. Our next generation system will assist sustainable development through this energy efficiency technology.

Further information

More information could be found in the following website:

http://www.lowcarbonlivingcrc.com.au/research/program-1-integrated-building-systems/rp1015-combining-building-integrated-pvt-system-low-0

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