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 consumption on space cooling/heating without reducing the comfort level.

This research can be presented as an example of providing cooling in summer and heating in winter with solar energy from PV/T to optimize the energy utilization.

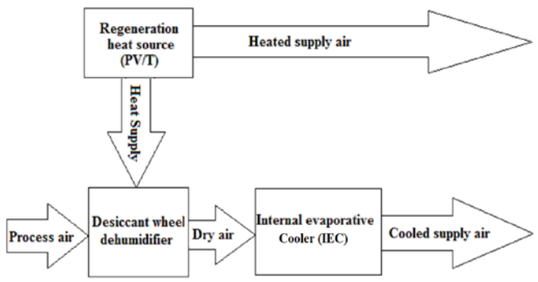

Figure 1: Schematic diagram of the PV/T desiccant wheel cooling system

Methodology

A TRNSYS model including the building (monitoring room 401), PV/T, desiccant wheel and internal evaporative cooler (IEC) will be established for determining each parameter of the system and simulation.

By closely cooperating with CSIRO and BlueScope, a real model of PV/T air desiccant wheel cooling system will be designed, installed and operated on the roof of Tyree Energy Technologies Building (TETB), UNSW in the following year. This system can provide us with the required data to verify that PV/T desiccant wheel system can meet the requirements for supplying cooling and heating for conditioned space.

Results

Current research is focussed on developing simulation models for the whole system. Models of the monitoring room have been established in both TRNSYS and OpenStudio for verification. The width of shading was also optimized by simulation.

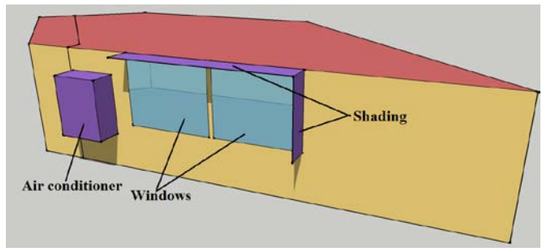

Figure 2: Schematic diagram of the model established.

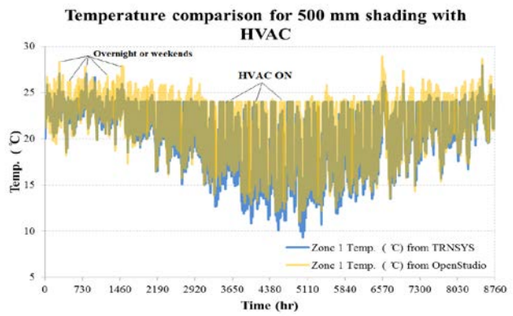

Figure 3: Comparison for the zone 1 temperature in TRNSYS and OpenStudio with HVAC.

	500 mm shading	*1000 mm shading*
Cooling (kWh/year)	1130	960
Heating (kWh/year)	71	101
Sum (kWh/year)	1201	1061

Table 1: Summary of the simulation results in TRNSYS

Then, both real and simulated temperature data of the monitoring room were compared.

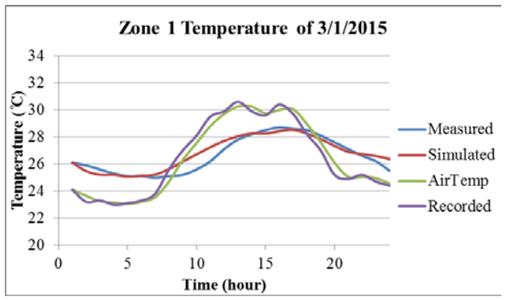

Figure 4: Comparison of the simulated and measured temperature data.

The system is still under a design phase and the draft design of an optimized system is being discussed.

Conclusions

Based on the simulation results, the comparison results of both TRNSYS and OpenStudio are similar. Moreover, the total annual sensible cooling and heating loads could be identified and 1000mm width of shading was chosen to reduce the total energy consumption of the room. The gaps between real and simulated figures are small now, but it is still possible to develop a more accurate model with even less variances.

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.

This project focuses on further providing cooling in summer when maximum solar radiation is available and heating in winter when required with the limited alternative uses for the collected heat.

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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