BIOCLIMATIC HOME COOLING DESIGN FOR ACCEPTABLE THERMAL COMFORT IN MALAYSIAN CLIMATE

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Abstract
This study investigates the applicability of hydronic radiant cooling system charged with night cooled water in combination with Earth Tube Heat Exchanger (ETHE) to cool down a residential building in Malaysia. Through the use of building simulation program, it is possible to design an environmentally friendly or bioclimatic building where sustainability has become a crucial element in building development. The hybrid system takes advantage of the readily available heat sink source such as the night sky and cooler ground to passively cool down a residential building. The annual simulation using Energy Plus program shows that 95% of the time the building occupant could expect an indoor operative temperature of not more than 28.5 ºC. The hybrid system can meet the thermal comfort standard set by ASHRAE Standard 55 and ISO 7730. The hybrid system is also able to improve the base case operative temperature of 33.5ºC to 28.5ºC. Simulation on energy spent shows that as much as 95% energy can be saved by using the hybrid system. This level of saving is not impossible as the renewable night cooled chill water is used to charge the indoor radiant cooling system in place of an energy-guzzling air conditioning compressors.

Keywords: *Bioclimatic Building; Energy Plus; earth tube heat exchanger; hydronic radiator; night cooled water*

INTRODUCTION

In the modern world society, sustainability has become a crucial element in building development. Thus, it has become necessary for building designer or developers to design a building according to bioclimatic principles. Balance in the relationship between the home occupants, the housing and climate defines the sustainability that is required for a bioclimatic housing. Some input measures in the bioclimatic housing include the use of passive systems rather than active mechanical systems, renewable energy systems, sustainable materials, water as well as the integration of passive system through integration of microclimate and active system (Hyde, 2008). The given measures normally are aimed to improve the comfort and well-being of occupants, reduce environmental impact as well as reduction of cost over life cycle period. In the past ventilation, dehumidification and shading have been seen as integral to the passive design of building in Malaysia (Zain et al., 1998). Over time the sustainability has demanded more from building design and requires building to embrace and respond to the local environment as oppose to challenging the environment with mechanical systems. The focus is now given in resource conservation and applying new technology to help buildings to be more climate adaptive or responsive to the natural condition. This technique to use new technology to enhance or amplify bioclimatic strategy have become the latest trend in architecture as humans are required to adapt to a rapidly warming world (Gregor, 2014).

Air conditioning is seen as a part of the climate change problem as the energy used to run the systems contributes to greenhouse emissions therefore give rise to adoption of more