

Accommodating Thermal Features of Commercial Building Systems to Mitigate Energy Consumption in Florida due to Global Climate Change

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The global climate change has significant impact on the energy demands of buildings. Studies have found that global warming would cause a decrease in heating requirements and an increase in cooling requirements. In Florida, cooling demands are major concerns in order to maintain the indoor comfort standards and to respond to the energy efficiency requirements from the government (Jiang et al., 2018; Kwok and Rajkovich, 2010). According to the reports of U.S. Energy Information Administration, commercial buildings in Florida account for about 24% of total energy in 2015. (U.S. Energy Information Administration). Research conducted by Jiang (2018) indicated the cooling demand will increase in the coming decades at various rates ranging between 26% and 80% in Florida depending on the commercial building types and locations in Florida. Although the studies of the impact of climate change on the energy consumption of various building types have been conducted in many countries, few of the studies propose mitigation of the impact on energy demands of the buildings. The mitigation of global climate change impact on buildings challenges architects, engineers, and builders to design and construct sustainable and energy efficient buildings and facilities. The study investigates the current and future cooling demands of four main commercial buildings in eight selected cities of nine climate zones of Florida by accommodating the thermal resistance features of wall and roofing systems.

The study shows that the cooling demands are reduced at various rates in all studied building types and in all climate zones by changing the thermal resistances of roofing systems from R-12/14/16 to R-19/21 and wall systems from R-13 to R-19/21. Among the studied commercial building types, the secondary schools have highest cooling demands per unit area 75-110 kWh/m² while the apartments have lowest cooling demands 30-60 kWh/m². The cooling demands of apartment buildings can be reduced as much as 5% by changing the wall and roofing thermal resistance to R-21. The cooling demands of secondary school is least sensitive to the change of thermal resistance, the reduction rate is as much as 3.5%. Since the buildings have more exterior wall area than roof areas of the buildings, the cooling demands are reduced more by increasing the thermal resistances of wall systems in all studied building types.

Keyword: Thermal Features, Climate Change, Energy Efficiency, Global Warming

Reference

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