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The influence of sleeping habits on cooling energy use in residential sector in Hong Kong

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Abstract

Sleep is a dominant part of our daily lives. People often have sleeping habits. Sleeping habit is referred as the preferred bedding system (type of bedding and sleepwear) and thermal environment. Thermal environment and cooling energy use are closely related. Many works have been done on sleep quality, sleeping habits, and the associated cooling energy use. However, it is noted that they are either separately or pairwise investigated. No investigations to date have been done to investigate their interactive effect. This study serves as a pilot study to fill the research gaps in investigating the interactive effect of sleep quality, sleeping habits and cooling energy use. Based on the use of three bedding systems and four temperature settings, 12 sleeping tests, each refers to one sleeping habit, were performed simultaneously in eight subjects. Sleepbot was employed to quantify sleep quality. Upon ascertaining the best sleep quality for different bedding systems, hour-by-hour energy simulations using EnergyPlus were conducted. It was found that for the use of light bedding systems, the associated drop in energy use would be 78.3% and 37.8% for female and male subjects respectively. Two prediction models, one relating energy use with thermal environment, and the other relating sleep quality with sleeping habit, have been established. The models can help quickly determine the tradeoff amongst sleep quality, sleeping habit and energy use.

Keywords: sleeping habits; sleep quality; cooling energy use; comfort analysis; prediction model

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