



Simulation of a hybrid dew-point evaporative cooling system

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Abstract. This article aims to investigate the factors influencing the performances of a hybrid dew-point evaporative cooling system (HDPEC) in a 7-Eleven store in Thailand. Those factors are the channel length, channel gap, air flow rate, and operational strategy of the system. The simulations were conducted using TRNSYS program. The hybrid system consists of a dew-point evaporative cooler and a vapor-compression air-conditioning system (VAC). Three operational strategies were examined. The first one is that both evaporative cooler and VAC operate 24 hours simultaneously. The second is that the cooler and VAC are on when the room temperature higher than 25°C and they are off when the room temperature less than 23°C. The third one is that only the VAC operates and it is on when the room temperature higher than 25°C while it is off when the room temperature less than 23°C. It was revealed that the second strategy consumes the least electricity compared to others. In addition, the performances of HDPEC in the provinces of Bangkok, Nakhon Ratchasima, Sakon Nakhon, and Chiang Mai were compared. It was found that the annual power consumption of a 7-Eleven store with HDPEC in Bangkok is 39.62% less than that of the store with VAC alone. This is the largest reduction of power consumption among the provinces studied. The wet-bulb effectiveness and the payback period of the system in Bangkok are 1.37 and 3.5 months, respectively.

Keywords: Hybrid dew-point evaporative cooling system; Evaporative cooling; TRNSYS; Numerical simulation.