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Energy Saving and Performance Evaluation of an Air Handling Unit Integrated with a Membrane Energy Exchanger for Cold Climates

Authors : Peng Liu, Maria Justo Alonso, Hans Martin Mathisen

Abstract : A theoretical model is developed to evaluate the performance and energy saving potential of an air handling unit integrated with a membrane energy exchanger in cold climates. The recovered sensible and latent heat, fan preheating use for frost prevention and heating energy consumed by heating coil after the ventilator is compared for the air handling unit combined heat and energy exchanger respectively. A concept of coefficient of performance of air handling unit is presented and applied to assess the energy use of air handling unit (AHU) in cold climates. The analytic results indicate downsizing of the preheating coil before exchanger and heating coils after exchanger are expected since the required power to preheat and condition the air is reduced compared to heat exchanger when the MEE is integrated with AHU. Simultaneously, a superior ratio of energy recovered (RER) is obtained from AHU build-in a counter-flow MEE. The AHU with sensible-only heat exchanger has noticeably low RER, around 1 at low outdoor air temperature where the maximum energy rate is desired to condition the severe cold and dry air.

Keywords : membrane energy exchanger, cold climate, energy efficient building, HVAC
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