

Energy Performance Analysis of Coupled-Control Units with Both Thermostat and Humidistat

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The coupled-control unit is a single zone constant air volume system. Due to its relatively low cost, it is still widely used in hotels, dormitory buildings, hospitals, and office buildings. The coupled-control unit uses reheat as the primary measure for room humidity control. When reheat is not provided, it cannot provide good humidity control. A case study showed room relative humidity as high as 70% under normal occupancy conditions for a classroom facility. A strong musty smell and mold was identified in the facility as well. When room comfort is properly maintained, the coupled control unit uses far more thermal and fan energy than a variable air volume system.

Couple-control units have poor energy delivery efficiency (EDE). The typical EDE value varies from 0.28 (Miami) to 0.52 (Chicago). Thermal energy consumption is two to four times higher than optimal energy consumption. Even when the units are properly designed, installed and operated, thermal energy consumption is three times higher than optimal thermal energy consumption under San Antonio weather conditions for typical commercial buildings.

Thermal energy consumption can be reduced by: (a) eliminating excessive airflows, (b) minimizing valve leakages, and (c) modulating airflows with zone sensible load.