

CO₂ Control Reduces Costs for Outside Air Ventilation In Buildings



Overview

Carbon dioxide (CO₂) ventilation control can typically reduce HVAC cost in most buildings by 5% to 20%. When an economizer strategy is combined with the CO₂ control, combined heating and cooling potential energy savings is estimated from 30% to more than 80% percent, depending on climate and building type.

Most buildings' air handling systems deliver a fixed amount of outside air ventilation, based on the building design (maximum expected) occupancy, which is needlessly expensive and the costliest of any air ventilation strategy. Average occupancy in most buildings never approaches design occupancy.

To the degree the building's actual occupancy is less than the design maximum, heating or cooling that extra air will directly increase energy costs. Further, most buildings actual level of outside air ventilation is in excess of the design level, resulting in even greater over-ventilation and additional energy expense.

CO₂ control is the first viable technology to actually measure and control outside air delivered to a space inside a building, based on actual required ventilation. It is increasingly being used to measure and control fresh air delivery to all space based on their real time occupancy to ensure code required levels of ventilation are maintained at all times.

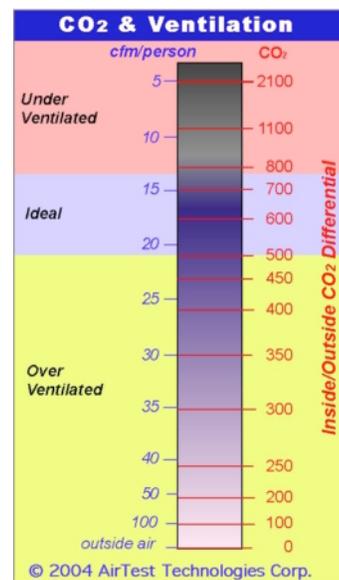
How CO₂ Works

Indoor CO₂ levels indicate the amount of outside air being introduced to the space to dilute CO₂ exhaled by people in a space. This relationship between CO₂ levels and ventilation rates is recognized by ASHRAE, the International Mechanical Code and California Title 24. The chart on this page shows the relationship between the inside/outside differential of CO₂ levels and ventilation rates/cfm per person within a space.

The lower the differential, the more over-ventilation is taking place and the greater the energy waste. When a building exceeds 20 cfm/person, it is over-ventilated. A CO₂ sensing system measures CO₂ levels on a real time basis, and adjusts air delivery to ensure ventilation meets actual occupancy needs to reduce over-ventilation. In humid climates, this can also mean better humidity control in spaces.

CO₂ Control as an Air Balancing System

CO₂ ventilation control is a real time air balancing system that ensures the right amount of ventilation is provided at all times to all parts of your building to ensure acceptable indoor air quality. This approach provides automatic ventilation control. You don't have to rely on an air-balance report that may be years old.



Ventilation Rates & CO₂

Ideal Candidates for CO₂ Control

Actual savings will depend on such critical factors as building construction, usage, actual occupancy, location, nature of the HVAC equipment, parameter settings, and control systems. The most extraordinary savings are in facilities with variable occupancy, such as theaters, gymnasiums, malls, classrooms, retail stores, meeting rooms, and hotels. While office buildings do not have highly variable occupancies, they are often significantly over

ventilated due to over design and/or improperly adjusted air intakes. CO₂ control ensures proper ventilation for the use and occupancy of each suite.

The integrated solution of CO₂ sensor-based demand control ventilation with economizer control can be easily implemented and produces the highest level of savings, generally with compelling paybacks.

Implementation

Installation is quite simple with the availability of wireless systems that work equally well with pneumatic or digital building control systems. A typical installation would involve installing CO₂ sensors in each major distinct occupied zone (i.e. a suite or meeting room). Generally one sensor should serve about 5000 square feet of floor area.

Based on the CO₂ reading in the space, ventilation can be regulated in the zone, for the floor or entire building. If a number of areas are served by one ventilation control device, ventilation levels are usually based on the highest level measured in all served zones. Return air sensing is not advised as it may not represent ventilation levels in a particular space.

The combined use of economizers and CO₂ control are the one-two punch for getting control of ventilation related energy costs. When outside conditions are right, the outside air will be used for free cooling. During the bulk of time when outside air is too warm, too humid or too cold, CO₂ control will regulate outside air to minimize energy cost and optimize indoor air quality. Unusual levels of CO₂ can also give an indication of a malfunction somewhere in the air delivery system.

When using CO₂ control, a minimum ventilation rate is maintained at all times to control non-occupant contaminants like off-gassing from furniture, equipment and building components. A newly approved version of ASHRAE Standard 62 suggests this ventilation rate to be 0.06 cfm/sq ft for offices and 0.12 cfm/sq ft in classrooms and for retail.

How Much Can Your Building Save?

The first step to determine if CO₂ ventilation control can reduce energy costs in your facility is to measure current ventilation rates in representative spaces.

A hand held sensor measures CO₂ concentrations and displays cfm/person ventilation rates based on the difference between inside and outside CO₂ concentrations. This type of measurement should be performed 2 to 3 hours after initial occupancy and when economizers are non operational. This quick measurement can indicate the magnitude of savings available from CO₂ based ventilation control. There is software to calculate the cost to heat and cool outside air based on your ventilation measurements and to determine payback of installing a system.



The PT9250 CO₂ & Ventilation Rate Monitor

Reliability and Accuracy

Sensors are self-calibrating and do not require an adjustment for the life of the sensor, rated at 15 to 20 years. Versions are also available that measure temperature and humidity.

Sensors are ISO-9001 manufactured to ensure quality. Reliability and accuracy of the measurement is assured with a gold plated infrared sensor that incorporates a patented 4.7-inch optical path length.

The Opportunity for Savings

Area (1) below with diagonal lines illustrates outside air brought into the building in excess of current standards. CO₂ based ventilation control eliminates this over-ventilation.

Area (2) with horizontal lines illustrates the outside air in excess of needs for actual occupancy.

Ventilation to meet actual occupancy requirements is Area (3), the dark shaded area.

