

# Healthy Zero Energy Buildings

March 2011

## Fact Sheet

### The Issue

Previous studies have associated low ventilation rates with reduced worker and student performance. Low ventilation rates, leading to inadequate removal of indoor-generated air contaminants, have also been associated with negative impacts on human health. Increasing ventilation rates above current guidelines has been associated with reduced absenteeism in schools and offices.

Outside air ventilation is the principal mechanism by which indoor-generated air pollutants are removed from buildings. Ventilation, however, comes with a significant energy cost. Currently, heating, cooling and ventilating commercial buildings represents 29 percent of their total on-site energy use, with roughly one-third of this energy used to heat and cool ventilation air. As buildings strive to become more energy efficient in response to programs such as California's Zero Energy Buildings mandate, energy consumption from building ventilation could be one of the limiting factors in achieving energy reduction goals.

Current ventilation standards do not explicitly consider the health impacts of indoor contaminants since they are not based on established environmental health risk assessment methods. Poorly defined ventilation standards can result in either under-ventilation of spaces, which reduces indoor air quality or, conversely, over-ventilation, which wastes energy. To develop the health-based ventilation standards needed to build energy efficient buildings safely, it is important to first understand how much ventilation is necessary to provide healthy, productive environments.

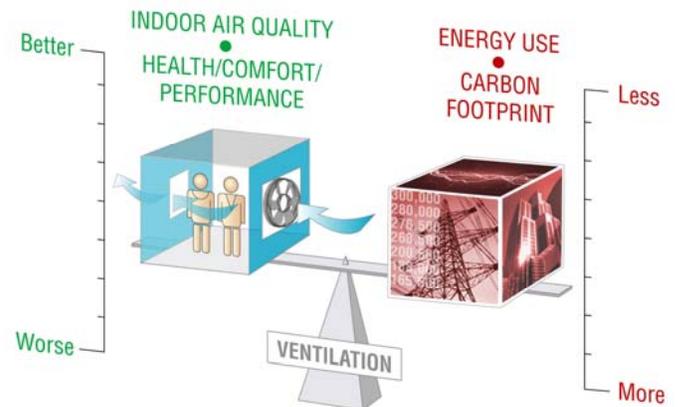


Illustration of the ventilation trade-offs when balancing indoor environmental quality and energy use

Graphic source: Lawrence Berkeley National Laboratory

### Project Description

The Healthy Zero Energy Buildings program is a six-year, two-phase multidisciplinary program that includes field and chamber studies and modeling to investigate indoor air quality, energy use, and human outcomes as a function of ventilation rates. The program will involve stakeholders from different sectors to advise on study design, approach, and analysis through workshops and a review process.

The program includes the following key tasks:

- Develop new state of the art methods to measure ventilation rates, indoor and outdoor contribution to indoor pollutants, ventilation control strategy impacts on indoor air quality, and impacts of ventilation and indoor contaminants on health, comfort, performance, and productivity.

- Use building energy simulation tools to study the energy implications of proposed ventilation scenarios.
- Perform laboratory experiments on ventilation and indoor air quality to validate measurement protocols, develop new instrumentation packages for field studies, improve analytical techniques, quantify key secondary pollutants generated in HVAC filters, simulate occupant exposures, and study occupant perception, performance, and other human outcomes as affected by ventilation.
- Perform field studies in several occupied commercial buildings, such as offices and retail buildings, encompassing indoor pollutant source characterization, baseline ventilation and indoor air quality measurements, low-energy ventilation scenarios and ventilation rate interventions, occupant perception surveys, and human health, comfort and productivity studies.
- Assess the costs of various ventilation strategies and benefits of improved occupant health and productivity.

## PIER Program Objectives and Anticipated Benefits for California

This program will gather and analyze scientific information on commercial building ventilation rates necessary to maintain occupant health, comfort, productivity, and performance. The key benefits of the research are:

- New information on energy costs of ventilation in commercial buildings.
- New techniques to measure ventilation, indoor air quality, building occupant health, comfort, and productivity.
- Development of a much-needed database of commercial building indoor air quality in California.
- Identifying the sources and dynamics of key indoor pollutants that are controlled through ventilation.
- Increased knowledge of the relationship between ventilation and human outcomes.

The findings will help develop science-based ventilation standards that support the health, comfort, and performance of building occupants while limiting unnecessary over-ventilation of buildings. The findings will be used when reviewing or considering new ventilation standards in California's Title 24 building efficiency standards. This information is vital for the design and operation of energy efficient buildings in California, and worldwide, for guiding policy and standards.

## Project Specifics

Contract Number: 500-09-049

Contractor: Lawrence Berkeley National Lab  
City/County: Berkeley, Alameda County

Assembly District: 14

Senate District: 9

Application: Worldwide

Contract Amount: \$3,400,000

Contract Term: 08/13/2010 – 03/15/2015

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