



BUILDING A CASE FOR BUILDING PERFORMANCE

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You have seen the facts before. Americans make up less than 5% of the world's population, yet consume 25% of the earth's resources and create 25% of the world's greenhouse gases. We are also told that the construction and operation of buildings are major contributors to this problem, and that as building industry professionals we have a major responsibility to improve the performance of the buildings and environments that we create.

Although a growing number of states and municipalities have adopted energy efficiency and green building initiatives, the private sector has been very slow to accept this responsibility. Obviously there are several reasons for this. One factor may be the generally conservative, risk-averse nature of the building industry. As service providers we must strive to achieve the goals of our clients, many of them developers and building owners primarily concerned about controlling first costs, and less concerned about a building's future operating cost and performance. For this section of the building industry to adopt a progressive approach to sustainable design, we will need to make a persuasive business case for sustainable design.

THE PRODUCTIVITY ISSUE

The most compelling argument for improving building efficiency and performance may be found in the relationship between occupant comfort and worker productivity. The strength of this argument is seen in the fact that worker salaries comprise the major cost of operating a commercial building, generally estimated at over 90% of the total operating cost, so that even a small increase in employee productivity can substantially increase a company's financial return.

General awareness of the productivity factor was raised by the white paper, "Greening the Building and the Bottom Line," published by the Rocky Mountain Institute in 1994. Drawing from existing research and correspondence with project team members, the authors cite eight projects that show measurable increases in productivity and retail sales through building improvements. The authors reported that the energy savings and the increased productivity saved building owners, in some cases, millions of dollars each year.

Soon after the publication of RMI's report, the correlation between green design and productivity became a rallying cry for green building advocates. Although potentially a compelling argument, there is also a danger with this approach. Some of the evidence to date has been anecdotal, leaving to question whether or not certain strategies will yield similar results when applied to a broad range of projects. Some clients that have become aware of the productivity factor now feel compelled to adopt green design options only when a calculable financial benefit to the project can be predicted. When design teams cannot produce compelling evidence for economic incentives, many innovative sustainable strategies are rejected. For this reason the design community needs evidence based on rigorous research methodologies to explain the environmental factors effecting productivity.

ESTABLISHING THE CORRELATION

One of the first studies to document the correlation between comfort and productivity was produced by researchers at Rensselaer Polytechnic Institute in a study of the West Bend Mutual Insurance Company's headquarters, completed in 1991. In this new office building workstations were equipped with comfort control systems, called Personal Environments Modules, (PEMs) manufactured by Johnson Control Inc. that allowed employees to control temperature, ventilation, lighting, and sound masking to suit their personal preferences at any given time. The company had monitored employee productivity prior to the move, so researchers were able to compare the productivity for occupants in the new building with that measured in the older, more conventional building. The research showed a median productivity improvement of 16% compared to the old building, and that 2.8% of this improvement could be attributed to benefits of the PEM units themselves.

The effects of occupant satisfaction and indoor air quality on productivity is currently being studied in ongoing research at several institutions. At the Center for Indoor Climate and Energy at the Danish Technical University (DTU) researchers have conducted laboratory tests to evaluate the effects of indoor air quality on the performance of simulated office tasks such as typing, proof reading and addition. The studies have shown that decreasing airborne pollutants can improve the performance of these clerical tasks as much as six percent. The airborne pollutants in the experiment were provided by a swatch of 20-year old carpet from a building with a history of sick building syndrome symptoms, replicating conditions that may persist in many office environments.

Here in the Bay Area, at the Center for the Built Environment (CBE) at UC Berkeley, researchers are currently conducting several studies designed to measure building performance and productivity. One study is evaluating the effects of ventilation and other environmental factors on work performance, similar to the DTU study noted above. But while the DTU research simulated a work environment in a laboratory, the Berkeley study is measuring productivity in a real work setting. The study takes advantage of the inherent measurability of the tasks performed at call centers, large open-office environments where employees respond to customers' phone calls. The data that has been collected- productivity measures, ventilation rates, temperature, and other variables- is now being analyzed and a report of the findings will be published later this year.

These three studies use measured performance data, however most office workers do not spend their time completing tasks that allow for this type of measurement. For this reason CBE is using a Web-based survey that asks building occupants for feedback about their workplace and its effect on work performance, something researchers describe as self-reported productivity. CBE is now working with architects and building owners (including CBE partners SOM and the U.S. General Services Administration) to build a database of building performance information based on occupants' feedback. The collected survey data will be used to analyze and compare design features and to improve building efficiency and operations.

Another major focus of ongoing research at CBE concerns the growing number of projects that incorporate underfloor air delivery (UFAD) systems, a technology which facilitates individual comfort control, flexibility for reconfiguration, and that also may be highly energy efficient. Field studies now underway will compare productivity, occupant satisfaction, and energy efficiency of buildings with UFAD systems with that of conventional buildings. The research team has already produced design guidelines and a web site to help design teams understand how to implement this new technology.

THE NEED FOR MORE ANSWERS

The emphasis on indoor environmental quality and productivity is a growing field . The State of New York recently awarded \$15.9 million to a new research consortium led by Syracuse University. The new center will study indoor environmental quality as part of its program to create new building technologies and industries. The full range of projected benefits includes private sector technology transfer, creation of intellectual property, and the fuelling of new business enterprises to create or retain 50,000 jobs in New York State over the next decade.

In terms of a general approach to sustainability, the promise of productivity gains is one factor that may be used to leverage a broader effort. To create truly sustainable development the design industry must make enormous strides forward. Warnings about manmade global climate change and other environmental dangers alone have not been sufficient catalysts for change. By clearly defining the economic benefits of green design from productivity gains, we may find an incentive for a real departure from the status quo.

For additional information on this topic visit the following links:

The Center for the Built Environment at The University of California, Berkeley:

<http://www.cbe.berkeley.edu/>

A research overview for the Center for Indoor Climate and Energy at the Danish Technical University:

<http://www.ie.dtu.dk/resview.asp>

Rocky Mountain Institute's "Greening the Building and the Bottom Line" in *pdf* format:

<http://www.rmi.org/images/other/GDS-GBBL.pdf>

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