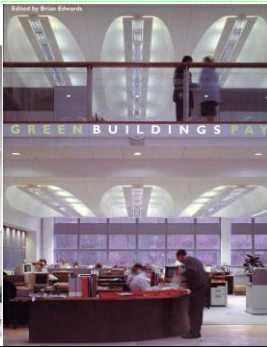


Green Buildings Pay

Do Green Buildings Pay Off?



The PNC Financial Center in Pittsburgh was one of the green buildings analyzed.



Edited by Brian Edwards

GREEN BUILDINGS PAY

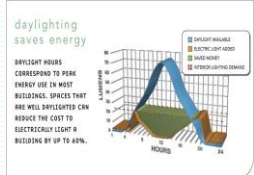
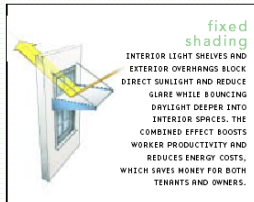
1

Direct Benefits of Green Building

- Lower fuel bills
- Market advantage
- Fewer health risks
- Greater productivity

—Brian Edwards

Any proof?



2

Typical Urban Utility Rate Structure

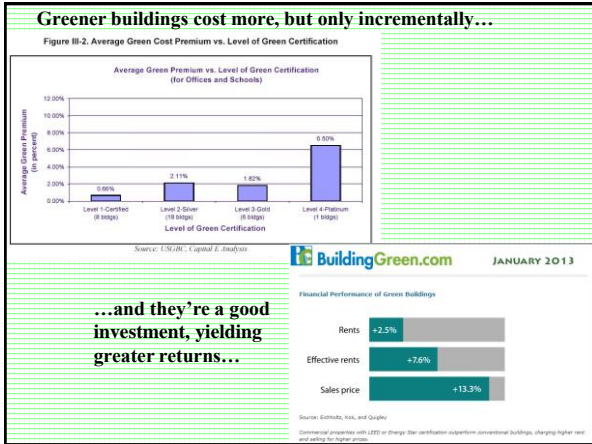
Figure IV-1. PG&E A-6 Time of Use Rate Schedule (simplified)

Customer Charge	Season	Time-of-Use Period	Energy Charge (per kWh)	1/4/01 Energy Surcharge (per kWh)	8/1/01 Energy Surcharge (per kWh)	Total Energy Charge (per kWh)	"Average" Total Rate (per kWh)
Single phase service per meter/day +\$0.26612 Polyphase service per meter/day +\$0.34426. Plus Meter charge +\$0.22341 per day for AB or AEX, +\$0.06571 per day for A6WV	Summer	On Peak	\$0.23258	\$0.01000	\$0.10064	\$0.34322	\$0.14487
		Part Peak	\$0.10288	\$0.01000	\$0.04551	\$0.15839	
		Off Peak	\$0.05618	\$0.01000	\$0.03551	\$0.10169	
	Winter	Part Peak	\$0.11562	\$0.01000	\$0.04551	\$0.17113	
		Off Peak	\$0.07169	\$0.01000	\$0.03551	\$0.11720	

Source: <http://www.pge.com/tariffs/Commercial/Current.xls>

Green Buildings have reduced loads at peak times.

3



4

From: eco-structure 2013 Posted on: March 7, 2013 10:43:48 AM

New Study Highlights the Financial Value of Green Buildings

More productive workplaces are achievable at a price comparable to conventional buildings.

“The Business Case for Green Building: A Review of the Costs and Benefits for Developers, Investors and Occupants,” examines the possibility of attaching a financial value to the cost and benefits of green buildings. It concludes that investments can be recouped through operational cost savings.

WORLD GREEN BUILDING COUNCIL

5

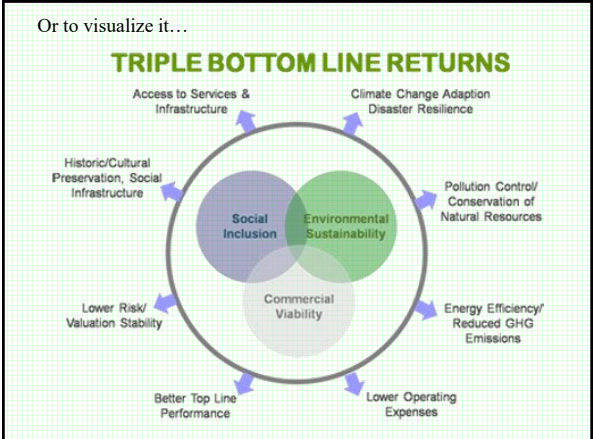
Key findings include:

- **Design and Construction Costs:** Research shows that building green does not necessarily need to cost more, particularly when cost strategies, program management and environmental strategies are **integrated into the development process right from the start.**
- **Asset Value:** As investors and occupiers become more knowledgeable about and concerned with the environmental and social impacts of the built environment, buildings with better sustainability credentials will have increased marketability. In fact, studies from around the world **demonstrate a pattern of greener buildings being able to more easily attract tenants and to command higher rents and sale prices.**

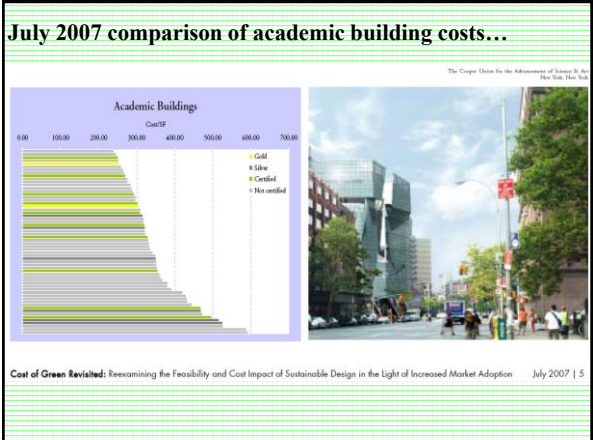
6

- **Operating Costs:** Green buildings have been shown to save money through **reduced energy and water use and lower long-term operations and maintenance costs**. The energy savings alone typically exceed any cost premiums associated with their design and construction within a reasonable payback period.
- **Workplace Productivity and Health:** Research shows that the green design attributes of buildings and indoor environments can **improve worker productivity and occupant health and well-being, resulting in bottom line benefits for businesses**.
- **Risk Mitigation:** Sustainability risk factors can significantly affect the rental income and the future value of real estate assets, in turn affecting their return on investment. Regulatory risks have become increasingly apparent in countries and cities around the world, including mandatory disclosure, building codes and laws banning inefficient buildings.

7



8



9

According to this 2013 study, for green schools:



- 91% of K-12 schools and 89% of universities reported improved student health and well-being.
- 70% of K-12 schools and 63% of universities reported a rise in test scores.
- 83% of K-12 and 85% of universities report increased faculty satisfaction when teaching in a green school.
- 32% of K-12 schools report reduced student absenteeism.
- 48% of K-12 and 56% of universities with increased access to natural light and views into their classrooms reported increased student engagement.
- 44% of K-12 and 51% of universities with improved acoustics noted improvement in student attentiveness.

An earlier McGraw-Hill report found 54% of education construction was green in 2012—up from 30% in 2008.

10

A Study of 33 LEED-Certified California Buildings

GREEN BUILDING "COSTS" GENERATE SAVINGS TO THE 10TH POWER ← Really 10x

Investments in green buildings pay for themselves 10 times over, according to a new study for 40 California agencies. This study, drawing on national data for a hundred green buildings and an in-depth review of several hundred existing studies, found that sustainable buildings are a very cost-effective investment. Conducted by the Capital E group, Lawrence Berkeley Laboratory and participating California state agencies, the study is the most definitive cost-benefit analysis of green building ever conducted, according to its authors.

The report concluded that financial benefits of green design are between \$50 and \$70 per square foot in a LEED building, over 10 times the additional cost associated with building green. The financial benefits were found to be in lower energy, waste and water costs, lower environmental and emissions costs, and lower operational and maintenance costs and increased productivity and health.

With this study, the California Department of Finance, for the first time, has signed off on the existence of financial benefits associated with improved health productivity and lowered operations and maintenance costs in green buildings. The California Board of Regents also drew on the early findings of this study and is moving forward in pushing for all state higher education new construction to be "green."

USGBC President & CEO, Christine Ewin who served as a member of an advisory committee that guided the study, says, "The study's conclusive findings demonstrate that green building is cost-effective and makes good business sense."

Greg Kats, a Principal at Capital E, and the lead author of the report stated that "The report should permanently lay to rest the myth that green buildings are not cost effective and not ready for prime time."

At the US Green Building Conference meeting in Pittsburgh, Kats stressed there was still much more research to be conducted to cement the findings. [See Report...](#)

←Key

11

BuildingGreen.com

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- Publications
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- Testimonials
- FAQ

The Cost of LEED
A Report on Cost Expectations to Meet LEED-NC 2009

The Cost of LEED: A Report on Cost Expectations to Meet LEED-NC 2009 is a 47-page report from BuildingGreen, LEEDuser, and a group of seasoned practitioners which explores cost premiums (if any) for each credit, with alternate approaches.

Going credit-by-credit through LEED for New Construction v2009 (LEED-NC), The Cost of LEED removes the common approaches to achieving the performance that the credit requires and offers the view of an experienced cost estimator on the cost implications of adopting those technologies or design solutions.

The Cost of LEED can't tell you what it might cost to locate your project near mass-transit for 350k+/- alternative Transportation—that's too location and project specific for even a rough guess. But it can suggest a figure to put into your budget for any one of hundreds of specific technologies, and it identifies the other credits that might also benefit from that measure (so you can consider the appropriate synergistic benefits).

The Cost of LEED \$49.00 BUY

...and analysis is on-going...

12

LEED study results (using LCC):

Financial Benefits of Green Buildings
Summary of Findings (per ft²) ← pro rated

Category	20-year Net Present Value
Energy Savings	\$ 5.80
Emissions Savings	\$1.20
Water Savings	\$0.50
Operations and Maintenance Savings	\$8.50
Productivity and Health Value	\$36.90 to \$55.30
Subtotal	\$52.90 to \$71.30
Average Extra Cost of Building Green	(-\$3.00 to -\$5.00)
Total 20-year Net Benefit	\$47.90 to \$68.30

Source: Capital E Analysis

<http://www.usgbc.org/Docs/News/News477.pdf>

13

Costs vs. Savings

Employee Cost as a Percentage of Total Operating Costs

Category	20-year NPV
Energy Value	\$5.79
Emissions Value	\$1.18
Water Value	\$0.51
Waste Value (construction only) - 1 year	\$0.03
Commissioning O&M Value	\$8.47
Productivity and Health Value (Certified and Silver)	\$36.89
Productivity and Health Value (Gold and Platinum)	\$55.33
Less Green Cost Premium	(\$4.00)
Total 20-year NPV (Certified and Silver)	\$48.87
Total 20-year NPV (Gold and Platinum)	\$67.31

Percentage Breakdown of Green Building Financial Benefits (LEED Certified and Silver Buildings)

Category	Percentage
Productivity & Health	70%
Reduced O&M	16%
Energy	11%
Emissions	2%
Water	1%
Waste	0%

Adapted from figures by Capital E Analysis in "The Costs and Financial Benefits of Green Building," October 2002

Environmental Building News - November 2003

14

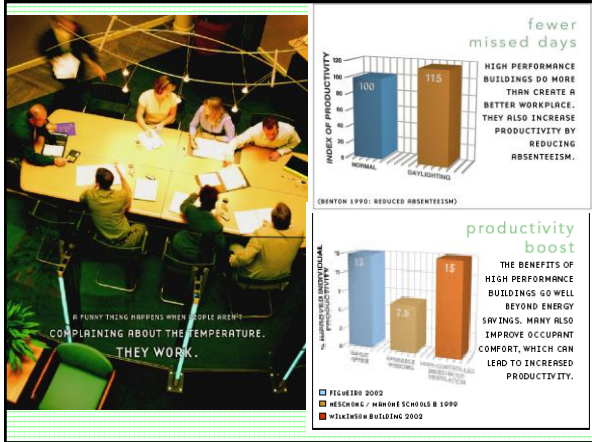
Where are productivity gains realized?

Figure VIII-2. Potential Productivity Gains from Improvements in Indoor Environments

Source of Productivity Gain	Potential Annual Health Benefits	Potential U.S. Annual Savings or Productivity Gain (2002 dollars)
1) Reduced respiratory illness	16 to 37 million avoided cases of common cold or influenza	\$7 - \$16 billion
2) Reduced allergies and asthma	8% to 25% decrease in symptoms within 53 million allergy sufferers and 16 million asthmatics	\$1 - \$5 billion
3) Reduced sick building syndrome symptoms	20% to 50% reduction in SBS health symptoms experienced frequently at work by ~15 million workers	\$10 - \$35 billion
4) Sub-total		\$16 - \$56 billion
5) Improved worker performance from changes in thermal environment and lighting	Not applicable	\$25 - \$180 billion
6) Total		\$43 - \$235 billion

Adapted from: William Fisk, "Health and Productivity Gains from Better Indoor Environments," 2004

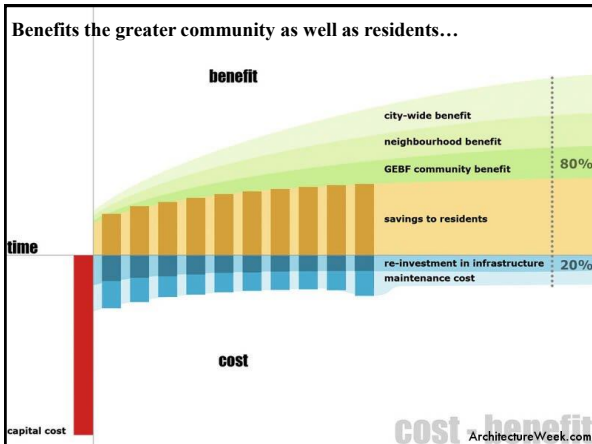
15



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17



18

Virgin trains

It's win, win
Are we acting responsibly?
Share your views and you could win a pair of First Class tickets.

Tell us now

Corporate Social Responsibility... what's it all about?
Corporate social responsibility is the belief that a company needs to be responsible for its actions – socially, ethically, and environmentally.

22

Government agencies are seeing the need to set examples...

AIArchitect best prac

06/2004 **GSA Recommends Healthy, Flexible, Connected Workplaces**
reprinted from Innovative Workplace Strategies

key findings

Compared to legacy stock buildings, GSA's high-performance buildings show:	Compared to industry benchmarks, GSA's high-performance buildings show:
23% energy use	43%
28% water use	35%
23% building operating expenses	10%
9% waste landfilled	not tracked
2% overall tenant satisfaction	1%

23

30 Year Costs of a Building

Construction 2%
O & M 8%
Personnel 92%

Strategy:
Integrated green design reduces construction costs

design versus construction

BUDGETING FOR EARLY COLLABORATION CAN BE ACCOMPLISHED BY SHIFTING FUNDS FROM CONSTRUCTION TO DESIGN. THIS ALLOWS FOR TOTAL COSTS TO REMAIN CONSTANT, BECAUSE INCREASED DESIGN INTEGRATION CAN LOWER CONSTRUCTION MATERIAL COSTS EQUIVALENTLY.

24

HOW TO REAP THE FINANCIAL REWARDS OF BETTER BUILDINGS.

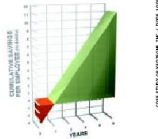
No.2
IN A SERIES

PENNY-WISE BUT POUND-FOOLISH NEVER MADE ANYONE RICH.

The financial benefits of a high performance building shouldn't be judged based on initial costs alone. It's even more important to consider the potential savings, financial returns, and higher market value these buildings provide. Lower energy costs (up to 30% compared to standard buildings) reduce the building's operating expense, raising the net operating income and the asset valuation. Plus, tenants are interested in high performance buildings, which makes it easier to attract new tenants and retain current ones. Higher occupancy and less churn further boosts N.O.I. That's why high performance construction should be looked at as an investment – one that can pay for itself many times over.

Strategy:
Examine cash flow advantages

cumulative savings
INCREMENTAL COSTS FOR A HIGH PERFORMANCE BUILDING CAN BE RECOUPED THROUGH SAVINGS ON ENERGY COSTS, INCREASES IN WORKER PRODUCTIVITY, AND FEWER DAYS OF ABSENTEEISM. PLUS, THE SAVINGS ACCUMULATE FOR THE LIFE OF THE BUILDING.



25

Strategy:
Identify design strategies that are green and improve productivity and user satisfaction.

user-controlled ventilation

YOU CAN INCREASE WORKER COMFORT BY INTRODUCING VENTILATION WITH CONTROLS THAT ALLOW OCCUPANTS TO ADJUST AIR-FLOW IN THEIR AREA. WHEN PEOPLE FEEL MORE COMFORTABLE, THEY CAN CONCENTRATE ON WORK, WHICH BOOSTS PRODUCTIVITY.



Shading



Daylighting

26

Hallmarks of the productive workspace

Spatial equity. The workplace is designed to meet the functional needs of the users by accommodating the tasks to be undertaken without compromising individual access to privacy, daylight, outside views, and aesthetics.

Healthfulness. The workplace is housed in a healthy environment with access to air, light, and water and is free of harmful contaminants and excessive noise.

Flexibility. The workplace configuration adapts to typical organizational and work-process changes but can also be readily restructured to accommodate major functional changes.

Comfort. The workplace allows workers to adjust thermal, lighting, acoustic, and furniture systems to meet personal and team comfort levels.

Technological connectivity. Workplaces on-site (e.g., team, conference/multimedia, and meeting space) and off-site (e.g., satellite or home offices) allow easy communication among distributed coworkers while allowing simultaneous access to data.

Reliability. The workplace is supported by state-of-the-art heating, ventilation, and air conditioning; lighting; power; security; and telecommunication systems/equipment that require minimal maintenance down time and are designed with back-up capabilities to insure minimal loss of service.

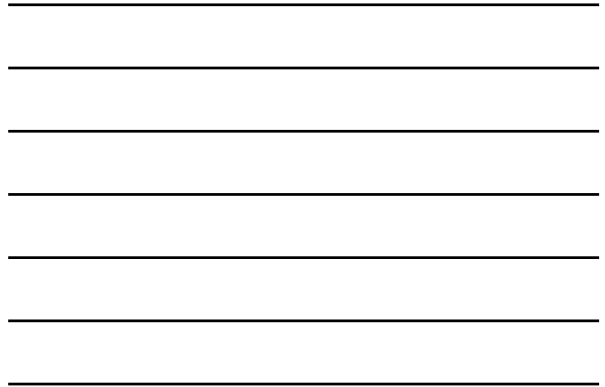
Sense of place. The workplace has a unique character, with an appropriate image and identity, enabling a sense of pride, purpose, and dedication for both the individual and the workplace community.



27



28



**Strategy:
Conduct
Building
Commissioning
and
Regular Post-
Occupancy
Evaluation
(POE)**

finding problems

TRACKING BUILDING SYSTEM PERFORMANCE ALLOWS FOR EARLY PROBLEM DETECTION. A TRAINED BUILDING OPERATOR FOUND A LEAK WHEN THIS GRAPH SHOWED ABNORMAL STEAM USAGE. DETECTING THE PROBLEM EARLY SAVED TIME AND MONEY BY AVOIDING A MORE SERIOUS PROBLEM WHEN DEMAND INCREASED IN THE FALL.

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Kiernan Timberlake developed an in-house POE system ROAST.

ROAST LEARN MORE | CONTACT US | LOGIN

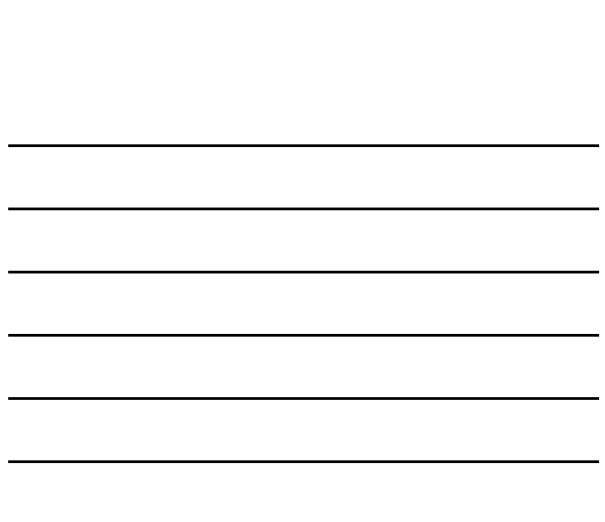
We've broken down the question "How are you feeling today?" into a science. Roast lets you build surveys quickly and easily with pre-populated questions based on building industry standards.

Sent to your smart phone or computer

Asks questions

Gives results

30



Occupant opinions

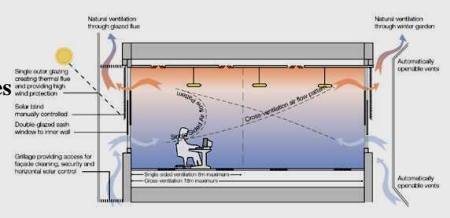
BT recently released the findings of a construction industry standard occupancy survey called PROBE, undertaken for the Brentwood building. Arup Research & Development have prepared the report, under licence from Building Use Studies (BUS). The results are outstanding for the indices on comfort, satisfaction, and summary the building was in the top 2-5% of buildings within the BUS dataset. The occupants perceived an increase of 8% in productivity due to the building - very good, compared to the national benchmarks.



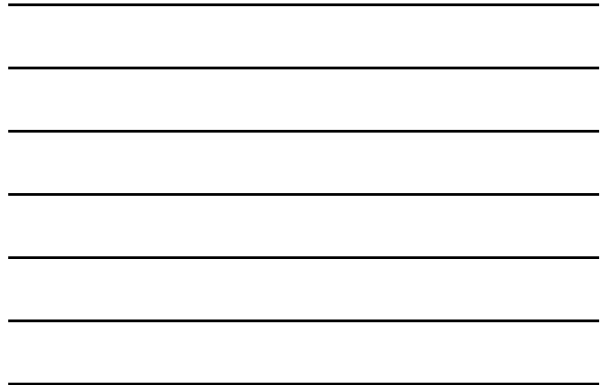
BT Brentwood
Arup Associates

The findings quoted many positive comments from occupants similar to the opinions expressed below and elsewhere in this article:

**Strategy:
Use surveys
and
questionnaires
to gauge
success**



31



BENEFITS OF ECOLOGICAL DESIGN, SELECTED EXAMPLES

BUILDING, YEAR COMPLETED	MEASURES UNDERTAKEN, COST	OUTCOME (ANNUAL GAINS)
Reno Post Office, 1986	Lighting upgrade and lowered ceiling height to improve lighting quality and efficiency at cost of \$300,000	\$50,000 in energy and maintenance; \$500,000 in productivity
Pennsylvania Power and Light, Allentown, early 1980s	Lighting upgrade and reorientation of fixtures in drafting engineers office at cost of \$8,362	73 percent drop in energy and maintenance; \$42,240 (13 percent) gain in productivity
Internationale Nederlanden Bank, Amsterdam, 1987	New building used energy-efficient design for lighting, heating, and elimination of airconditioning; operable windows; thermal storage; cogeneration system; and avoidance of toxic materials at added cost of \$700,000	\$2.4 million in energy; \$1 million (15 percent) drop in absenteeism
Village Homes, Davis, Calif., 1975-81	220-home subdivision designed to capture 50-75 percent heat from sun, incentives for nonmotorized transportation, natural drainage, and edible landscape	12 percent premium in average home value
Lockheed Building 157, Sunnyvale, Calif., 1983	New building used daylighting, efficient lights, and an open layout to encourage worker interaction at added cost of \$2 million	\$500,000 in energy; \$2 million (15 percent) drop in absenteeism; 15 percent gain in productivity
Esperanza del Sol, Dallas, 1994	New residential construction of low-income, energy-efficient, and solar-oriented houses at cost of \$13 added annually to mortgage payments	\$450 in energy

Source: THE GREEN BUILDING SOURCEBOOK, 2006

Strategy: Learn from experience, cite precedent

32



AIArchitect

VOLUME 14 THE NEWS OF AMERICA'S COMMUNITY OF ARCHITECTS

INDUSTRYNEWS

AUGUST 24, 2007

NEWS HEADLINES

Fitter, Happier, Better, Greener.
Science shows sustainable design does more than help the Earth; it makes you feel better, too.

by Zach Morrice
Assistant Editor

Summary: A growing but not yet conclusive body of research indicates that features associated with green and sustainable design can reduce worker absenteeism, improve employee productivity, and boost student test scores. This connection between the built environment and the mind can be explained through biophilic design, the theory that humanity evolved to have an organically connected relationship with the natural world and that the disruptions to this relationship caused by the modern built environment can be mitigated through the use of real or simulated natural elements.

THIS WEEK AT A GLANCE

HOME NEWS HEADLINES
PRACTICE BUSINESS DESIGN

INTERESTING

- Biophilic Design Connects Humans with Nature
- Architecture and the Brain: A New Knowledge Base from Neuroscience by John P. Eberhard, FAIA (review)

MEMBERS SPEAK OUT

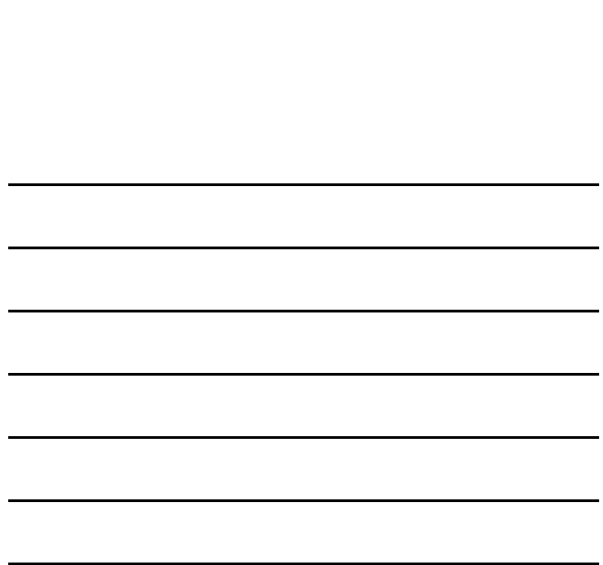
SHARE A COMMENT

REFERENCE

Images

- The Global Ecology Research Center, Stanford, Calif. by EHDD Architects, a 2007 COTE Top Ten Green Building Award recipient, employs a high sky radiant cooling system, which demonstrates the same principles of radiant heat loss to deep space that the researchers are investigating.
- Carnegie-Mellon's Robert L. Proger Intelligent Workplace is a beta.

33



individual workstation control at West Bend Mutual Insurance Headquarters

West Bend, Wisconsin, Zimmerman Design Group

A new 150,000 square foot building for 500 employees, completed in 1991 was constructed for \$90/s.f. where market averages were \$125/s.f. The building has energy efficient lighting, better windows and shell insulation, and efficient HVAC system. 92% of workstations are on the perimeter. 370 workstations are equipped with ERWs (Environmentally Responsive Workstations) which provide individual control over temperature, air flow, lighting, and white noise. Air supply is provided through a raised floor system, allowing displacement ventilation to reduce HVAC requirements.



Compared to their old building, West Bend found these results:

- 40% reduction in energy costs with an annual savings of \$126,000
- early estimate of 16% productivity increase with 4-6% increase attributed to ERWs for an annual savings of approximately \$500,000
- thermal condition complaints dropped from 40 per day (at a documented cost of \$25 per call plus \$300 in maintenance) to two per week

34

Absenteeism drops, productivity increases at Verifone

Costa Mesa, California, Croxton Collaborative -- Architects

In 1992, employees formed a Performance Improvement Team that convinced management to pay added up-front costs for a healthier building by demonstrating an energy savings payback of 4.5 years.

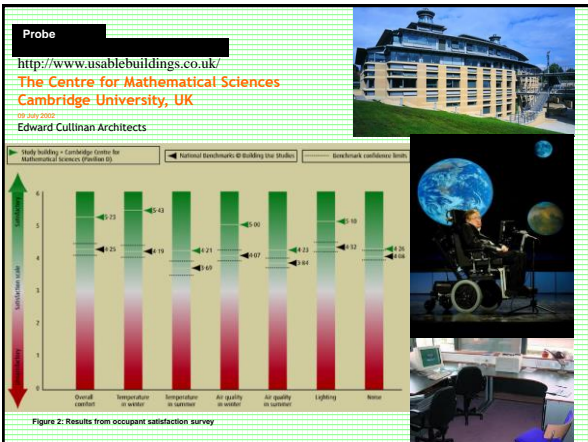


The project was an upgrade of a 76,000 square foot building that included a series of roof skylights, energy efficient air handlers, natural gas fired cooling system, high performance windows, 60% more insulation than code, and occupancy sensors. On sunny days, workers use only natural daylight and small task lights.

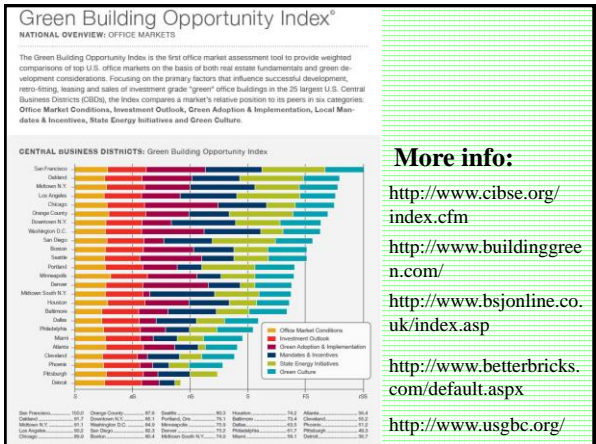
Cost was \$39 per square foot. These are the results Verifone found:

- absenteeism dropped 40% due to improved comfort
- productivity increased 5%, reducing payback time to under one year—a 100% ROI
- 50% energy savings

35



36



37



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