



CBE Livable Buildings Awards 2008
September 30, 2008

Omaha Department of
Homeland Security
Federal Building



Omaha Department of Homeland Security Federal Building

Omaha, NE, USA
86,000 sf

Completed 2005
LEED® NC Gold

Project Team

Architect: Gensler
Landscape Architect: EDAW
Structural/Civil Engineer: Kirkham Michael Consulting Engineers
Mechanical/Electrical Engineer: ME Group Inc.
General Contractor: Weitz Co.
Owner/Developer: Harwood and Associates
Fundamental Commissioning Agent: ME Group

For GSA, the Omaha Department of Homeland Security (DHS) Federal Building is a first of its kind: a new build-to-suit, leased facility that is shared by multiple agencies. From the outset, the GSA, the developer, and the A/E teams established three key design goals: create a positive public experience, maximize occupant satisfaction, and deliver state-of-the-art green building performance. Simultaneously, the team knew that they would need to meet both the building tenants' strict security needs, and the developer's requirements for a cost-effective facility.

An independent post-occupancy evaluation (POE) by Pacific Northwest National Laboratory confirms that the project met these goals, and serves as an imperative to design and operate livable buildings in a similar way. Specifically, the POE identifies the project's fully integrated approach to sustainable design as the key to its success. For example, the project reduces energy consumption by combining innovative design strategies like geothermal, super-insulated envelope, demand-based ventilation, and lower lighting power densities. Net result: energy consumption was reduced by 66% compared to ASHRAE 90.1. Water conservation was another driver for the project team. Rainwater collection, low flow plumbing fixtures, and sub-metering water usage led to more than 40% potable water savings. Overall, the building delivers 42% lower aggregate operational costs, compared to the industry baseline. The building also makes ample use of local and regional materials—over half of the materials used were manufactured within 500 miles of the project site.

Most importantly, the DHS Federal Building demonstrates that resource efficiency and occupant satisfaction can successfully reinforce each other. For example, the building's innovative thermal design not only results in a low energy use intensity for the building, but also delivers occupant satisfaction with thermal comfort that scores in the 90th percentile of the CBE survey. Similarly, the facility incorporates many of the same daylight harvesting systems that in other LEED rated projects appear to produce acoustical dissatisfaction. The DHS Federal Building's client-driven acoustical design, however, resulted in occupant satisfaction with acoustics that scores in the 90th percentile of the CBE survey. Impressively, CBE survey results indicate that, in general, building occupants are 95% more satisfied with their building than the national average.

As a result of this evaluation of the DHS Federal Building, GSA has concluded that a fully integrated approach to sustainable design is the best path to delivering buildings that use substantially less energy, cost less to operate and maintain, and lead to greater occupant satisfaction.













Energy Performance Data

The annual energy use for the DHS Federal Building is 50 kBtu/GFS. The building is 66% more efficient than ASHRAE 90.1-1999.

“GSA delivered a facility that is a great place to work and visit, while incorporating the latest in security and sustainable design. It sets a new standard for Federal buildings.”

Jerry Heinauer, District Director
U.S. Citizenship and Immigration Services, Omaha

42 Points Earned, LEED Gold Rated



LEED Score Card



LEED for New Construction v2.0/2.1

Department of Homeland Security

Project # 2209

Certification Level: Gold

4/1/2006

42 Points Achieved

Possible Points: 69

Certified 26 to 32 points Silver 33 to 38 points Gold 39 to 51 points Platinum 52 or more points

6 Sustainable Sites

Possible Points: 14

Y			
Y	Prereq 1	Erosion & Sedimentation Control	
	Credit 1	Site Selection	1
	Credit 2	Development Density	1
	Credit 3	Brownfield Redevelopment	1
	Credit 4.1	Alternative Transportation, Public Transportation Access	1
	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
1	Credit 4.3	Alternative Transportation, Alternative Fuel Vehicles	1
1	Credit 4.4	Alternative Transportation, Parking Capacity & Carpooling	1
	Credit 5.1	Reduced Site Disturbance, Protect or Restore Open Space	1
1	Credit 5.2	Reduced Site Disturbance, Development Footprint	1
	Credit 6.1	Stormwater Management, Rate & Quantity	1
	Credit 6.2	Stormwater Management, Treatment	1
1	Credit 7.1	Landscape & Exterior Design to Reduce Heat Islands, Non-Roof	1
1	Credit 7.2	Landscape & Exterior Design to Reduce Heat Islands, Roof	1
	Credit 8	Light Pollution Reduction	1

3 Water Efficiency

Possible Points: 5

Y			
	Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
1	Credit 2	Innovative Wastewater Technologies	1
1	Credit 3.1	Water Use Reduction, 20% Reduction	1
1	Credit 3.2	Water Use Reduction, 30% Reduction	1

13 Energy & Atmosphere

Possible Points: 17

Y			
Y	Prereq 1	Fundamental Building Systems Commissioning	
Y	Prereq 2	Minimum Energy Performance	
Y	Prereq 3	CFC Reduction in HVAC&R Equipment	
2	Credit 1.1	Optimize Energy Performance, 15% New / 5% Existing	1
2	Credit 1.2	Optimize Energy Performance, 20% New / 10% Existing	1
2	Credit 1.3	Optimize Energy Performance, 25% New / 15% Existing	1
2	Credit 1.4	Optimize Energy Performance, 30% New / 20% Existing	1
2	Credit 1.5	Optimize Energy Performance, 35% New / 25% Existing	1
	Credit 1.6	Optimize Energy Performance, 40% New / 30% Existing	1
	Credit 1.7	Optimize Energy Performance, 45% New / 35% Existing	1
	Credit 1.8	Optimize Energy Performance, 50% New / 40% Existing	1
	Credit 1.9	Optimize Energy Performance, 55% New / 45% Existing	1
	Credit 1.10	Optimize Energy Performance, 60% New / 50% Existing	1
	Credit 2.1	Renewable Energy, 5%	1
	Credit 2.2	Renewable Energy, 10%	1
	Credit 2.3	Renewable Energy, 15%	1
	Credit 3	Additional Commissioning	1
1	Credit 4	Ozone Depletion	1
1	Credit 5	Measurement & Verification	1
1	Credit 6	Green Power	1

6 Materials & Resources

Possible Points: 13

Y			
Y	Prereq 1	Storage & Collection of Recyclables	
	Credit 1.1	Building Reuse, Maintain 75% of Existing Shell	1
	Credit 1.2	Building Reuse, Maintain 100% of Shell	1
	Credit 1.3	Building Reuse, Maintain 100% Shell & 50% Non-Shell	1
1	Credit 2.1	Construction Waste Management, Divert 50%	1
1	Credit 2.2	Construction Waste Management, Divert 75%	1
	Credit 3.1	Resource Reuse, Specify 5%	1
	Credit 3.2	Resource Reuse, Specify 10%	1
1	Credit 4.1	Recycled Content, Specify 10%	1
1	Credit 4.2	Recycled Content, Specify 20%	1
1	Credit 5.1	Local/Regional Materials, 20% Manufactured Locally	1
1	Credit 5.2	Local/Regional Materials, of 20% Above, 50% Harvested Locally	1
	Credit 6	Rapidly Renewable Materials	1
	Credit 7	Certified Wood	1

9 Indoor Environmental Quality

Possible Points: 15

Y			
Y	Prereq 1	Minimum IAQ Performance	
Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1	Credit 1	Carbon Dioxide Monitoring	1
	Credit 2	Ventilation Effectiveness	1
1	Credit 3.1	Construction IAQ Management Plan, During Construction	1
1	Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2	Low-Emitting Materials, Paints	1
1	Credit 4.3	Low-Emitting Materials, Carpet	1
	Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber Products	1
1	Credit 5	Indoor Chemical & Pollutant Source Control	1
	Credit 6.1	Controllability of Systems, Perimeter	1
	Credit 6.2	Controllability of Systems, Non-Perimeter	1
1	Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-1992	1
1	Credit 7.2	Thermal Comfort, Permanent Monitoring System	1
	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1




5 Innovation & Design Process

Possible Points: 5

Y			
1	Credit 1.1	Innovation in Design	1
1	Credit 1.2	Innovation in Design	1
1	Credit 1.3	Innovation in Design	1
1	Credit 1.4	Innovation in Design	1
1	Credit 2	LEED® Accredited Professional	1

Omaha DHS Federal Building - Overview

The Omaha Department of Homeland Security (DHS) Federal Building was designed to accommodate the varying needs of multiple DHS agencies and is the central facility for all immigration services. The LEED Gold certified building uses a ground source heat pump system, and in combination with the building envelope and daylight-harvesting system, the building energy model predicted and delivered a 66% energy reduction over ASHRAE 90.1-1999. The use of a rainwater-harvesting system, and low-flow and auto-flow lavatory fixtures resulted in an aggregate water use reduction of 77% as compared to the Energy Policy Act of 1992 requirements. Green Seal janitorial products are used consistently throughout the building.

	Building Location:	1717 Avenue H
		Omaha Nebraska 68110-2752
	Building Function:	Federal Building
	Project Type:	New <i>1 floors</i>
	Design Recognition:	LEED-NC Gold
	Year Occupied	2005
	Gross Square Foot:	86,000
	Rentable Square Foot:	73,459
	Hours of Operation:	112
	Regular Occupants:	65
	Occupant Visitor Equiv.	360
	Electronic Equipment:	80
	Total Project Cost:	n/a
	Construction Cost:	n/a







Whole Building Performance Data Summary

The Omaha DHS Federal Building operating costs are lower than the industry baseline for energy, water, waste, janitorial, and grounds maintenance costs. The general maintenance and recycling costs were not provided for the study. Overall, the building costs less to operate than a baseline building.



Whole Building Performance Data Detail

Pacific Northwest National Laboratory collected, normalized, and compared the whole building performance data for the Omaha DHS Federal Building to industry baselines. The following table summarizes the annual performance data that were collected and normalized.

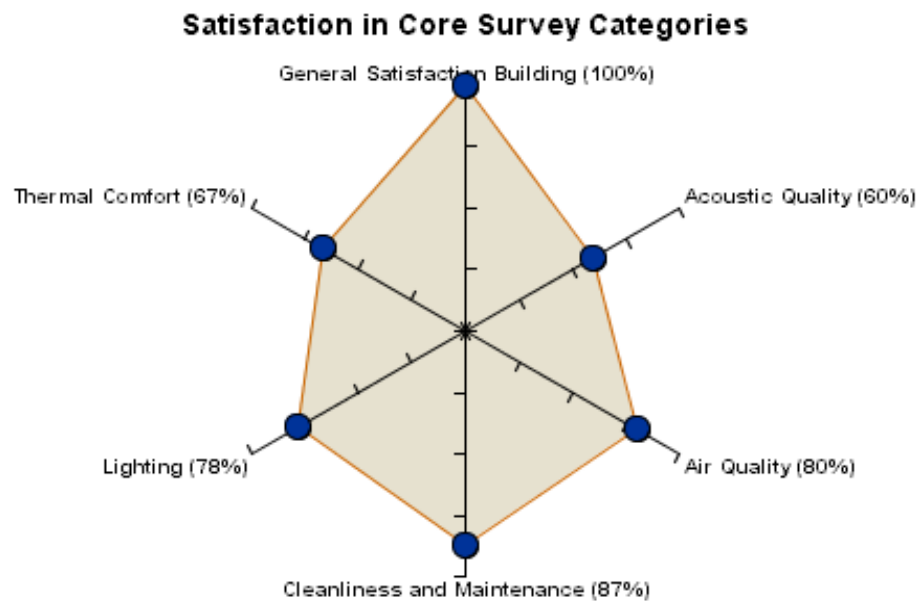
Metrics	Annual Performance Measurements		Annual Reporting Metrics	
	Water Use (gal)	1,392,123	Gallons per occupant	3,276
	Cooling Tower Water Use (gal)	-	Water Cost per occupant	\$8.86
	Outdoor Water Use (gal)	-	Gallons per GSF	16.19
	Water Cost	\$3,765	Water Cost per GSF	\$0.05
	Energy Star Score	85	Energy Use (kBtu) per GSF	50
	Energy Cost	\$4,333	Energy Cost per GSF	\$0.92
			Energy Emissions per building (metric tons CO ₂ equiv)	1,168
	General Maintenance Cost	n/a	General Maint Cost per RSF	n/a
	Janitorial Services Cost	\$70,800	Janitorial Services Cost per RSF	\$0.96
	Grounds Maintenance Cost	\$8,200	Grounds Maint Cost per RSF	\$0.11
	Quantity of Maint Requests	150	Ratio of Maint Requests to Total Maintenance Jobs	0.38
	Quantity of Prev Maint Jobs	240		
	Solid Waste Generated (tons)	113	Solid Waste (lb) per occupant	13.85
	Solid Waste Cost	\$2,400	Solid Waste Cost per RSF	\$0.03
	Quantity Recycled (tons)	24	Solid Waste Cost per occupant	\$6.67
	Recycling Cost	n/a	Ratio of Recycled to Solid Waste	0.21
	Survey # of Invitees	18	Survey Return Rate	89%
	Survey # of Respondents (n)	16		
	Commute Miles per occ (avg)	30	Commute Emissions per occ (metric tons CO ₂ equiv)	2.09
	Commute fuel per occ (avg gal)	225		

NE1430ZZ SPOT 2007 - 1717 Avenue H (DHS)

Building Scorecard

Survey Dates: 6/6/2007 2:09:23 PM through 6/29/2007

Center for the Built Environment
University of California, Berkeley

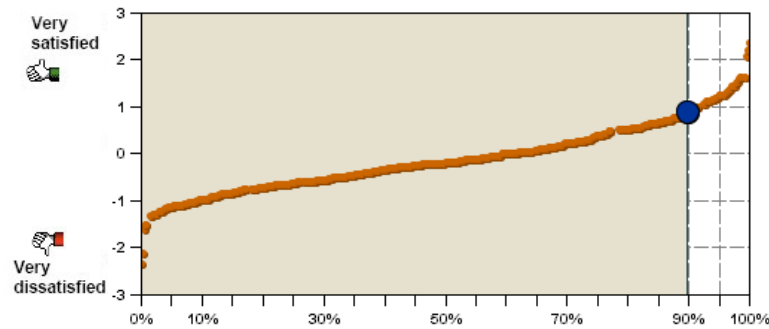


1.2 Category Mean vs. Benchmark

Performance of NE1430ZZ SPOT 2007 - 1717 Avenue H (DHS) in core survey categories

Acoustic Quality

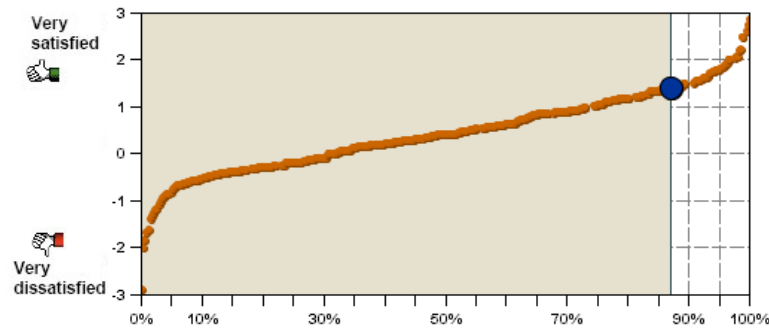
90%
Percentile



0.9
Mean Response
60%
Satisfied

Air Quality

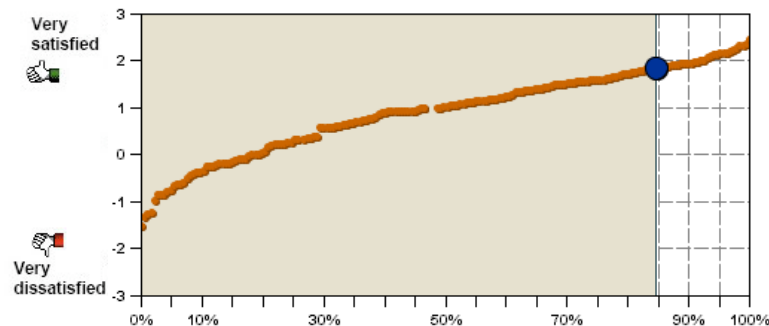
87%
Percentile



1.4
Mean Response
80%
Satisfied

Cleanliness and Maintenance

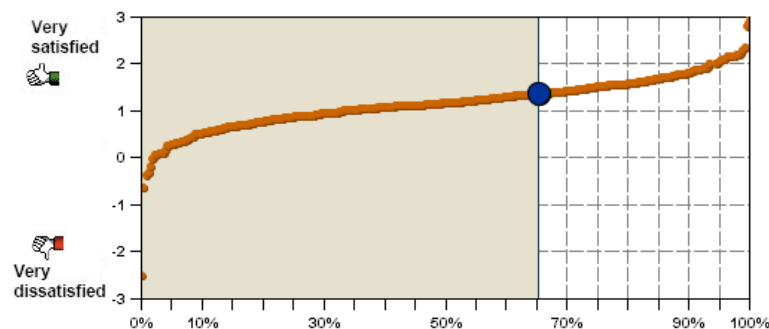
84%
Percentile



1.87
Mean Response
87%
Satisfied

Lighting

65%
Percentile

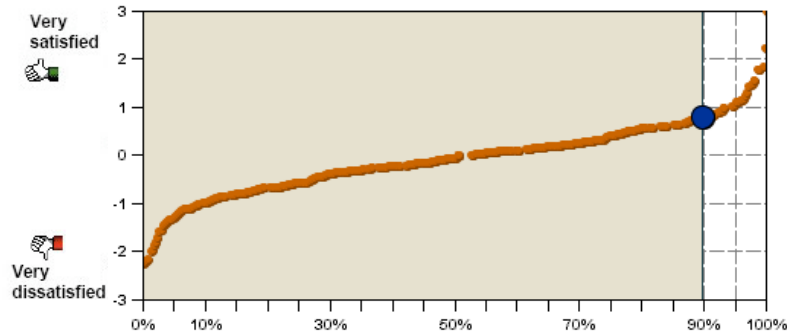


1.38
Mean Response
78%
Satisfied

Performance of NE1430ZZ SPOT 2007 - 1717 Avenue H (DHS) in core survey categories

Thermal Comfort

90%
Percentile



0.8

Mean Response

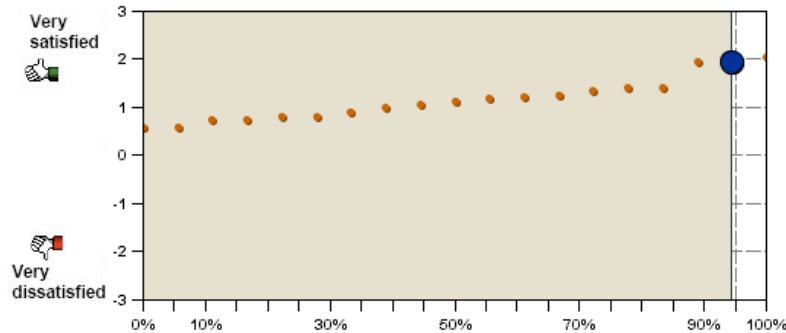
67%

Satisfied

Performance of NE1430ZZ SPOT 2007 - 1717 Avenue H (DHS) in additional survey categories

Communication

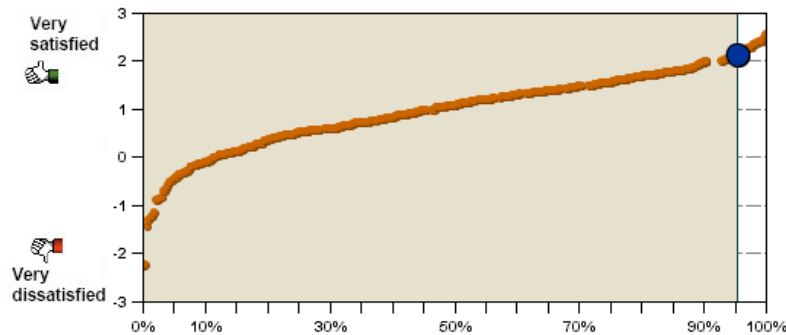
94%
Percentile



1.97
Mean Response
83%
Satisfied

General Satisfaction-Building

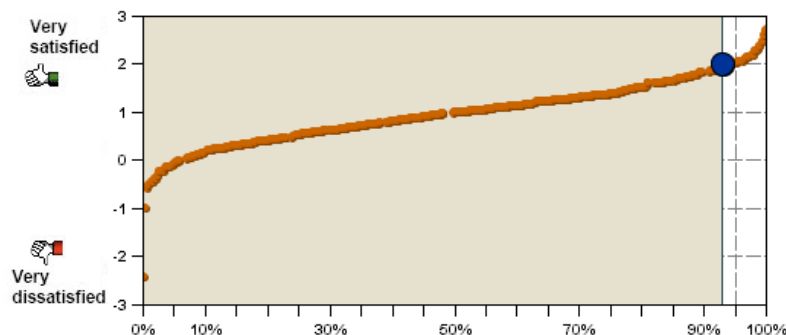
95%
Percentile



2.13
Mean Response
100%
Satisfied

General Satisfaction-Workspace

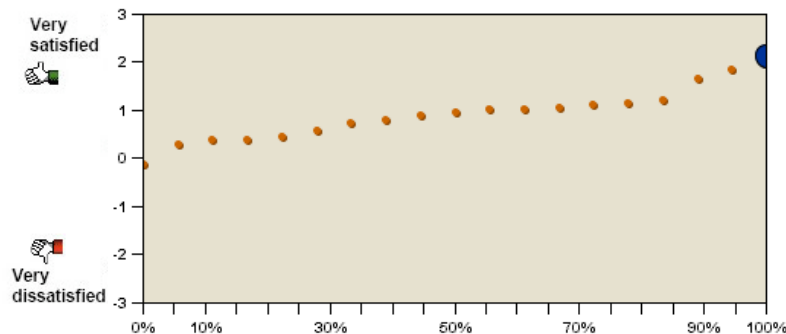
93%
Percentile



2
Mean Response
87%
Satisfied

Meeting Facilities

100%
Percentile

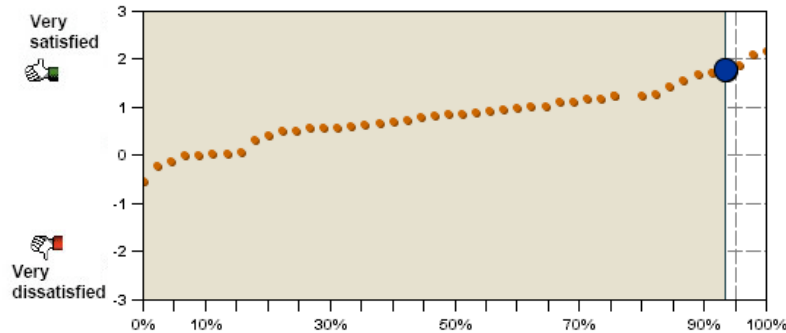


2.13
Mean Response
89%
Satisfied

Performance of NE1430ZZ SPOT 2007 - 1717 Avenue H (DHS) in additional survey categories

Overall Effectiveness -Individual

93%
Percentile

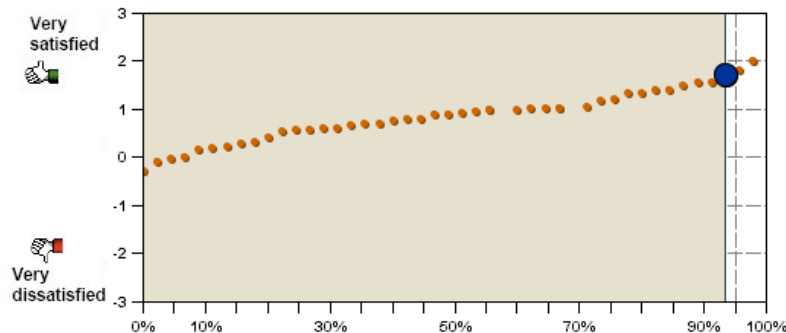


1.8
Mean Response

87%
Satisfied

Overall Effectiveness -With Others

93%
Percentile

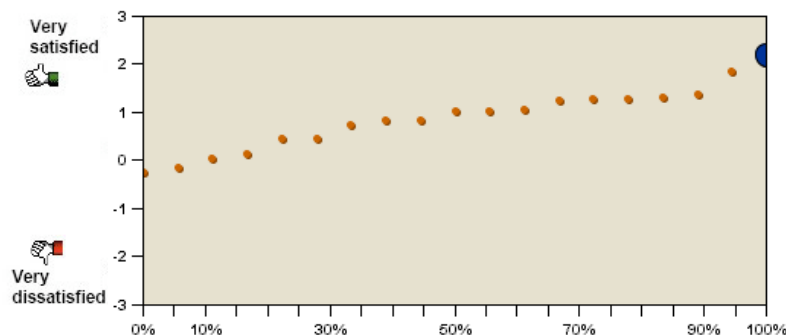


1.73
Mean Response

93%
Satisfied

Windows and Daylight

100%
Percentile

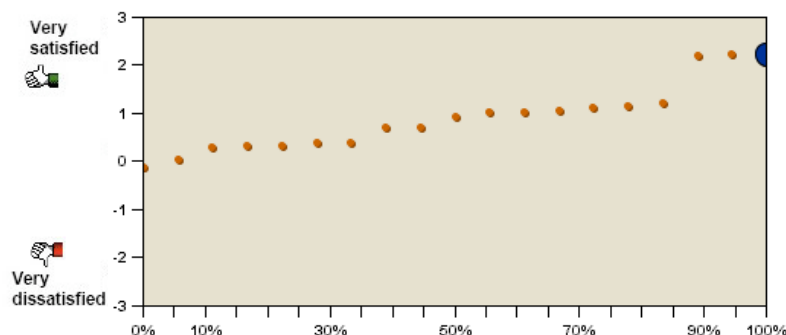


2.2
Mean Response

93%
Satisfied

Work Experiences

100%
Percentile



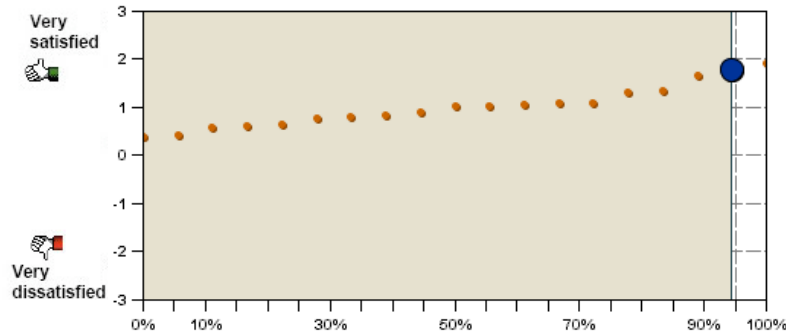
2.25
Mean Response

90%
Satisfied

Performance of NE1430ZZ SPOT 2007 - 1717 Avenue H (DHS) in additional survey categories

Work Experiences Continued...

94%
Percentile

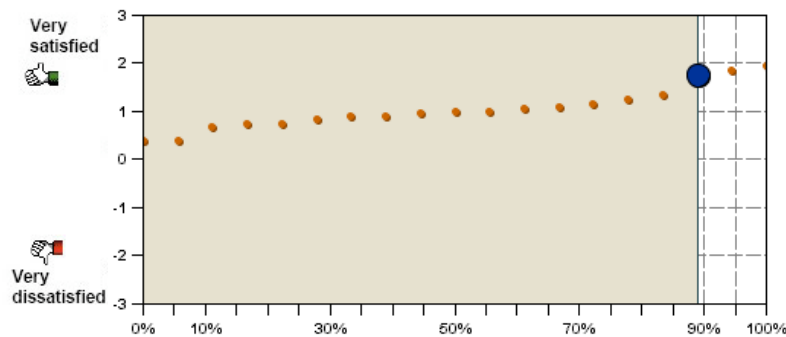


1.79
Mean Response

83%
Satisfied

Your Workstation

89%
Percentile



1.77
Mean Response

84%
Satisfied

Appendix

<i>Federal Times</i> Article	22
<i>Eco-Structure</i> Article	23-29
GSA White Paper	30-47

Green design nets results, study shows

By **TIM KAUFFMAN**

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Federal facilities incorporating sustainable design features cost less to operate, consume less energy and have more satisfied employees on average than all U.S. commercial buildings, according to a landmark study to be issued this week.

The study evaluated performance data from a dozen owned or leased buildings either constructed or renovated this decade by the General Services Administration and compared it to results from surveys of commercial buildings. The results should sway skeptics inside and outside of GSA who continue to doubt the true benefits of building sustainable facilities, said David Bibb, acting GSA administrator.

"I think when people see this study, people on the fence will jump over to the right side of the fence," Bibb told *Federal Times*.

The results overall are impressive. The 12 buildings surveyed produce 33 percent less carbon emissions, consume 26 percent less energy and use 3 percent less water on average than all U.S. commercial buildings. In addition, employees in the 12 federal buildings were 29 percent more satisfied with their working conditions than other employees.

But the findings do suggest areas for improvement. Even though the 12 buildings were designed to meet sustainability requirements or save energy, some performed worse in other respects than buildings designed with no green features. The lowest-performing green buildings used 33 percent more water than the national average, had higher energy and maintenance costs than commercial buildings and had less satisfied employees.

Those results reinforce the need to set specific performance goals at the outset and adhere to those goals throughout the design and construction of buildings, said Donald Horn, director of sustainable design at GSA.

"If you set good project goals to be energy efficient and focus on these higher performing issues, you're more likely to achieve them. The projects where green was maybe not a top priority from the start are buildings that don't perform quite as well," Horn said. "It's kind of obvious, but this helps to reinforce that it's got to be a project priority from the start if you want to achieve a high-perform-



STEVE MORRELL/GENERAL SERVICES ADMINISTRATION

A modern energy management system installed at the John J. Duncan Federal Building in Knoxville, Tenn., will pay for itself in four years, the building's manager says.

ance green building."

The study found that occupant satisfaction is undermined in many of the buildings by poor acoustics, poorly planned lighting and maintenance problems. Some green buildings sound louder than traditional offices because of open layouts, the use of hard surfaces such as steel and concrete and deliberate efforts to minimize background noises. Another common complaint is glare on computer monitors that results from poorly designed natural lighting features.

GSA officials intend to continue studying the buildings and adding others to its study as they come online so building owners and developers can make better choices about sustainability features.

"We hope that the study itself will spur follow-on research. You can come back and look at those buildings and look at a larger set of buildings and see if there are trends we can identify," said Kevin Powell, director of research in GSA's Office of Applied Science.

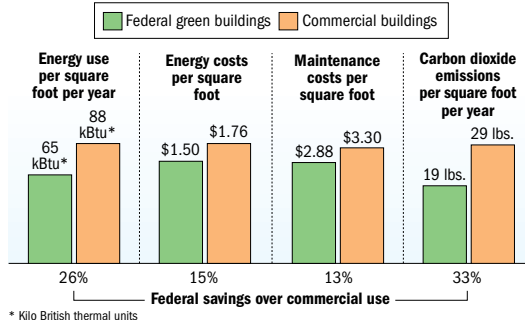
Federal Times obtained an advance copy of a white paper summarizing the findings of the report, which was completed by the Energy Department's Pacific Northwest National Laboratory.

The buildings were selected to represent different regional climates and a mix of uses, including courthouses, multiagency federal centers and agency-specific offices.

The best performing buildings by far were two facilities that earned the second-highest ranking, gold, from the U.S. Green Building Council's Leadership in Environmental Design (LEED) program. The two buildings — the Carl T. Curtis Midwest Regional Headquarters of the National Park Service in Omaha, Neb., and the Omaha regional

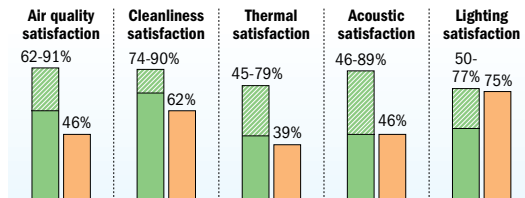
ENERGY — AND DOLLARS — SAVED

Twelve federal buildings designed to save water, conserve energy and ensure satisfactory indoor environmental quality outperformed average commercial buildings.



HAPPIER TENANTS

Federal employees in buildings incorporating sustainable design features generally are more satisfied than employees in commercial buildings.



* Buildings were divided into three groups based on the actual performance of sustainable design features. Percentage ranges indicate variance in satisfaction in those groups.

SOURCE: General Services Administration

GRAPHIC BY LISA ZILKA CHAVEZ

headquarters of the Homeland Security Department — use 54 percent less water than the national average, have the lowest utility and maintenance costs, and have the highest employee satisfaction scores of all other federal and non-federal buildings.

GSA requires a minimum LEED rating of silver, one step below gold, for all new buildings and major renovations. That's unlikely to change anytime soon because of the higher upfront costs involved in achieving top LEED ratings, but the study clearly documents the benefits, officials said.

"I don't know that we will request funding to go to the gold level, but if we do, we have the data to back that up," Bibb said.

Eight of the 12 buildings studied meet or exceed basic LEED certification, while the others were designed to meet requirements of Energy Star or other programs.

One of the buildings analyzed was the John J. Duncan Federal Building in Knoxville, Tenn., which houses local offices of the FBI, IRS, Housing and Urban Development Department and other agencies.

The eight-story building was completed in 1986, but by 2004 the building's energy system was "on its last leg," building manager Johnathan Sitzlar said at the GSA Expo last month in Anaheim, Calif.

A modern energy management system was installed that centralized control over the chillers and boilers, lighting, restroom exhaust fans and practically anything else that uses energy. Sitzlar uses meters to see how much energy the building is consuming at any given time and can adjust systems if needed to reduce the energy load. For example, Sitzlar can turn off the chillers near the end of a day to avoid cooling a building that soon will be empty.

Other renovations included replacing the old wooden cooling tower with a stainless steel model that uses half the horsepower, installing motion sensors so lights turn off automatically when rooms are unoccupied, reducing the height of furniture to bring more natural light into the building and installing waterless urinals that save 40,000 gallons of water per fixture annually.

In its first year, the building surpassed federal energy reduction goals by 33 percent. It saves more than 290,000 kilowatt hours of electricity annually over previous use, enough to power 26 average homes, and saves 400,000 gallons of water annually.

All told, Sitzlar spent \$160,000 for the improvements and will have recouped that investment in less than four years. ■

Industry seeks help with disaster recovery

By **GREGG CARLSTROM**

gcarlstrom@federaltimes.com

A panel of business leaders and security experts told lawmakers last week that the government is falling short in preparing for terrorist attacks or pandemic diseases.

The Homeland Security Department has done a poor job of coordinating and planning for events that disrupt key industry sectors. And federal health officials have done little to ensure that hospitals can accommodate mass injuries in the event of a disaster, experts said.

"The important thing is shifting our thinking from exclusively, 'How do we prevent terror?'" Yossi Shefi, a terrorism expert and professor at the Massachusetts Institute of Technology, told the House Homeland Security Committee last week. "We need to focus on ... 'How do we recover from an attack?'"

Eighty-five percent of the nation's infrastructure — sectors like transportation, chemical production, communications and finance — is privately owned, and experts told the committee that DHS needs to develop a plan for helping those industries recover after an attack.

Rep. Bennie Thompson, the committee chairman, said Congress had done far more than DHS to prepare the private sector for a disaster. Thompson pointed to the Chemical Facility Anti-Terrorism Act, passed earlier this year, which encourages chemical plant operators to install technology that reduces the damage from a terrorist attack.

But Thompson said legislative solutions can't solve the whole problem.

"The business community must have effective resources to bounce back," Thompson said. "The longer our economic sector is down, the more terrorists can brag they were successful."

DHS officials defended their track record. Stewart Baker, the department's assistant secretary for policy, said the Coast Guard and Customs and Border Protection are working on way to be more responsive in the event a port is closed because of terrorism or natural disasters.

But Baker acknowledged the importance of better collaboration with industry, and he said DHS hoped to make it a priority when a new administration takes office next year. He also suggested that state governments, not just DHS, need to take the lead on working with the private sector. ■



SECURITY AND SUSTAINABILITY

SETTING A NEW STANDARD FOR FEDERAL BUILDINGS

BY KATE GAWLIK

YOU NEVER GET A SECOND CHANCE TO MAKE A FIRST IMPRESSION. The first impression a building makes also is lasting and could alter the experience people have in that space. • In 1998, the U.S. General Services Administration, Washington, D.C., created the GSA First Impressions Program with the help of some architects. The program was created to increase employees' efficiency and improve the appearance of government buildings that serve Americans. Many government facilities have been renovated according to program guidelines by updating lighting, paint colors, flooring, seating, etc.



Gensler's Denver office helped create the First Impressions Program. When it was designing a Department of Homeland Security building in Omaha, Neb., occupied by CIS (Citizenship and Immigration Services) and ICE (Immigration and Customs Enforcement), architects decided to use some of the program's principles in the new building.

"We thought it was really important to take this First Impressions initiative and apply it to the project in the sense that the mission of the First Impressions is to be welcomed, secured and professionally served. So we thought why don't we make that the mission of the Homeland Security development by organization of the security desk, how people flow into the building and what the building looks like once you get into it," explains Blake Mourer, the project's lead designer.

The result is a highly secured LEED Gold federal building with public areas that are inviting and private areas that foster working in a positive environment. Described as a square-shaped donut, the building flows around a 12,000-square-foot (1115-m²) courtyard, which actually can only be accessed by ICE and CES

employees once deep inside the building. This courtyard floods space with daylight but also allows employees, who are very isolated, the opportunity to step outside. Because of the nature of their work and security concerns, employee/government space layouts are not available.

GREEN STRATEGIES

Gensler became involved with this project through a design competition. The client, developer Harwood and Associates, Fairfax, Va., specified a LEED Silver building on a 10-acre (4-hectare) site. Gensler was able to achieve LEED Gold by challenging federal standards, performing extensive studies and borrowing sustainable features used in other facilities.

The 86,500-square-foot (8036-m²) building was designed to be 66 percent more energy efficient than ASHRAE 90.1-1999. This efficiency partially is achieved because of the wall system. "We looked at everything from traditional brick veneer over metal studs, CMUs [concrete masonry units] to cast-in place concrete. We ended up with a CMU and brick combo with extra



» GENSLE WAS ABLE TO ACHIEVE LEED GOLD BY CHALLENGING FEDERAL STANDARDS, PERFORMING EXTENSIVE STUDIES AND BORROWING SUSTAINABLE FEATURES USED IN OTHER FACILITIES.



concrete. We ended up with a CMU and brick combo with extra insulation in key locations; Omaha has large swings in temperature. By studying the wall system, we optimized the walls to achieve maximum energy savings."

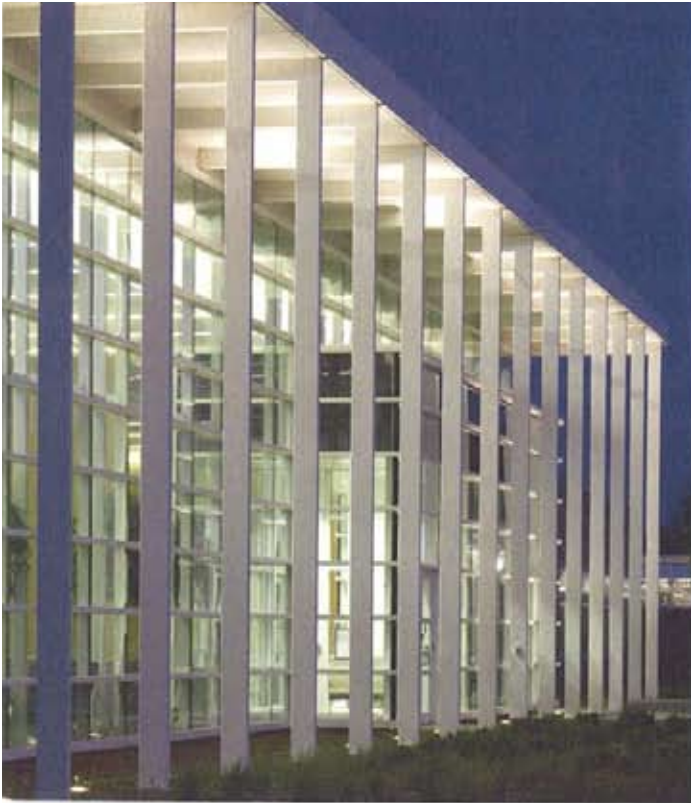
The roof system also plays a role. The white polyvinylchloride roof meets emissivity requirements and Energy Star standards to reduce the heat-island effect.

Taking advice from an engineer, Gensler incorporated a geothermal exchange system into the building, a mechanical system the firm never had specified before. "We knew it was a technology done in a lot of K through 12 schools. The building has a similar 1-story floor plan as schools, so we tried to adapt the technology here," Mourer says.

When it came to parking, architects found themselves challenging a federal standard for parking, calling for parking stalls to be 10- by 20-feet [3- by 6-m]. "We forced them to challenge their own standard by saying you really only need 9 by 18 feet [3 by 5 m] per stall," Mourer remembers. By reducing the size of each stall—but maintaining the number of parking spaces—the parking area footprint was reduced by almost 10 percent.

Mourer notes that one decision about the size of parking stalls fostered other benefits. It reduced the amount of storm-water runoff and increased the amount of landscaping. To take the parking benefit one step further, concrete was used instead of asphalt to lower the heat-island effect.





e c o m m e r c i a l (continued from page 38)

"It sounds mundane," Mourer admits. "But it's 38 square feet [3 m²] per parking stall saved. It's a significant deal when talking about land."

Zoned as a heavy industrial area, the building could have covered 100 percent of that land, allowing for 0 percent green area. By creating an efficient building and parking area, Gensler created a site that is 38 percent more green than zoning allowed.

PLEASING CLIENTS

Owned by a developer but occupied by ICE and CIS, Gensler, in a sense, was working for two clients. One—the developer—who was concerned about an investment, energy savings and the rate of return. And another—federal agencies and employees—who wanted to perform their jobs with the creature comforts afforded at any office.

And the proof that Gensler pleased its clients, as well as building visitors, is in what Jerry Heinauer, district director for CIS in Omaha, says about the work. "Gensler created a facility that is a great place to work and visit while incorporating the latest in security and sustainable design. It sets a new standard for federal buildings." 🌱



Mbad lighting and isolated by Plexiglas dividers. Flooded with daylight, the Department of Homeland Security building in Omaha, Neb., is nothing like other government facilities.

Visitors enter the public space—set off by a separate public drive and ample landscaping—through a large glass atrium. Instead of immediately being shuffled through security devices, visitors are greeted by a welcome desk and have the opportunity to get settled. The layout flows visitors into the proper area. “The process of becoming a U.S. citizen should be a positive one,” says Blake Mourer, the project’s lead designer. “In designing the public areas, we avoided things that can contribute to a negative experience, such as long lines, enclosed waiting rooms and confusing signs. Instead, we aimed for a more humane, direct and streamlined process.”

Although visitors may not realize it, they are surrounded by many sustainable features, in addition to daylighting. Bamboo clads the walls and ceilings, and terrazzo covers some floors. Carpet was used in other areas, and the low-VOC carpet tiles can be returned to the manufacturer when the tiles need to be replaced so they can be recycled. Low-VOC paints, adhesives and sealants were used, and all the furniture is certified by the GREENGUARD Environmental Institute, Atlanta.

To conserve water, low-flow fixtures were installed. The building also recycles greywater and has a rainwater collector.

Sensors are used to ensure mechanical and electrical systems are working properly. For instance, a carbon-dioxide sensor monitors outside ambient levels and increases ventilation when necessary.

Many of these green products and systems can be found on the nonpublic side, too. This area contains offices for enforcement agents, supervisors and other employees; a fitness center with recycled rubber tiles; and break area. Employees also have a bicycle storage area so they can bike to work.

BAMBOO CLADS THE WALLS AND CEILINGS, AND TERRAZZO COVERS SOME FLOORS. CARPET WAS USED IN OTHER AREAS, AND THE LOW-VOC CARPET TILES CAN BE RETURNED TO THE MANUFACTURER WHEN THE TILES NEED TO BE REPLACED SO THEY CAN BE RECYCLED.

PROJECT TEAM

ARCHITECT: Gensler, Denver, www.gensler.com

- Phil McCurdy, project principal
- Brad VanArsdale, project architect
- Kirsty Ferguson
- Jeff Hall
- Sarah Hornfeck
- Barb Christian-Schoeman
- Blake Mourer, lead designer
- Janet Pogue
- William Frank
- Susan Hickey
- Sonny Putro
- William Hartman

LANDSCAPE ARCHITECT: EDAA, San Francisco, www.edaw.com

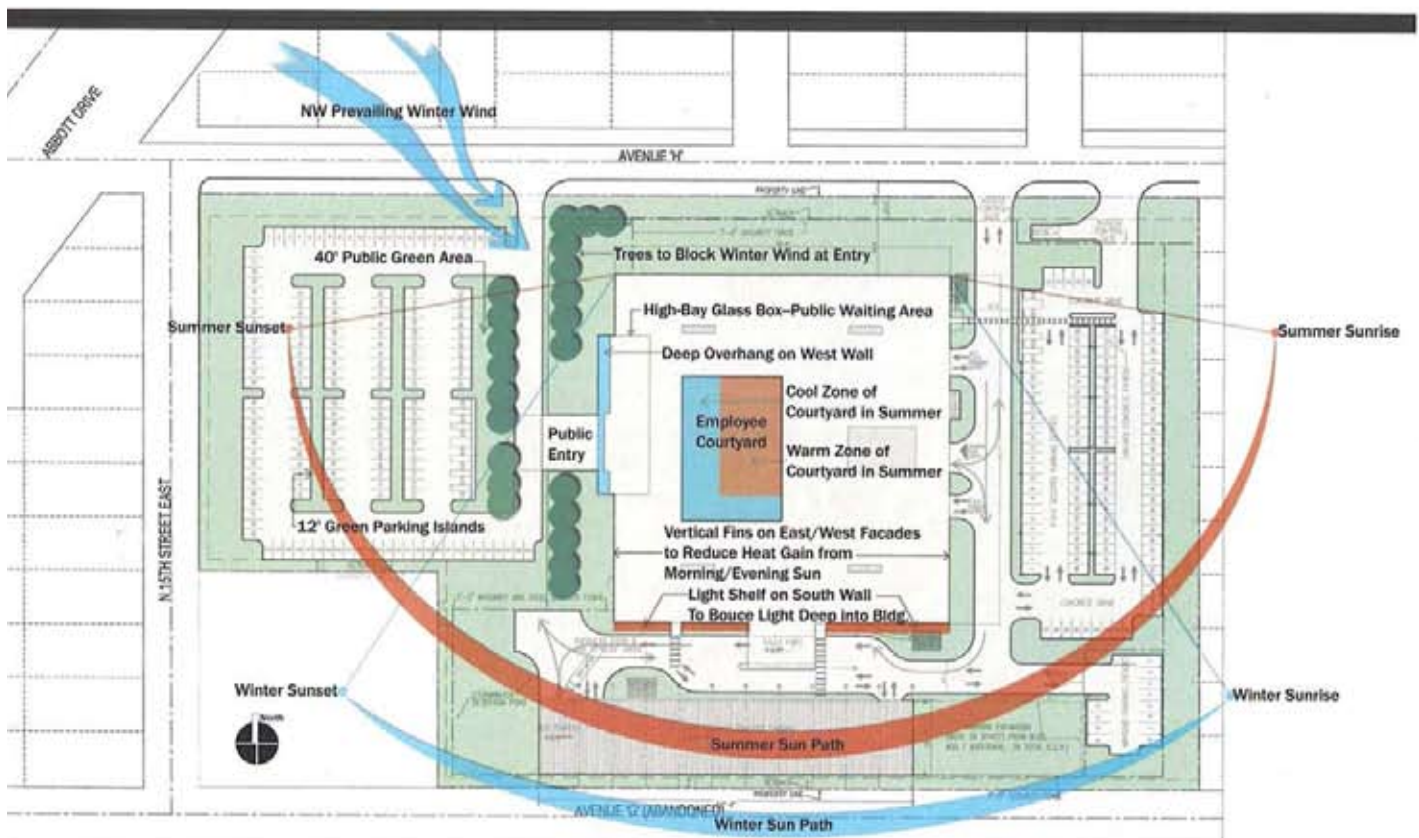
STRUCTURAL/CIVIL ENGINEER: Kirkham Michael Consulting Engineers, Omaha, Neb., www.kirkham.com

MECHANICAL/ELECTRICAL ENGINEER: ME Group Inc., Omaha, www.megroup.com

GENERAL CONTRACTOR: Weitz Co., Omaha, www.weitz.com

OWNER/DEVELOPER: Harwood and Associates, Fairfax, Va.

FUNDAMENTAL COMMISSIONING AGENT: M.E. Group



Bioclimate Diagram

ecommercial (continued from page 42)

MATERIALS AND SOURCES



RUBBER BASE FOR FLOORING:

Enviroflex by **FLEXCO**, Tuscumbia, Ala.,
www.flexcofloors.com

CARPET TILE: Ecoworx Backing and
Ecosolution Q Yarn by **SHAW INDUSTRIES
INC.**, Dalton, Ga., www.shawfloors.com

STATIC DISSIPATIVE VINYL COMPOSITE TILE:
Enviroflex ESD by **FLEXCO**

RECYCLED RUBBER TILES: Atmosphere
by **TO MARKET**, Oklahoma City,
www.tomkt.com

CERAMIC TILE: Terra Traffic by **TERRA
GREEN CERAMICS INC.**, Richmond, Ind.,
www.terragreenceramics.com

CORK TILE: XCR 3 by **EXPANKO INC.**,
Coatesville, Pa., www.expanko.com

CONCRETE MASONRY UNITS: **WATKINS
CONCRETE BLOCK CO.**, Omaha, Neb.,
www.watkinsconcreteblock.com

CEILINGS: Olympia Nicro Clima Plus
by **USG**, Chicago, www.usg.com

BAMBOO WALL PANELING: **JIAN &
LING BAMBOO**, Virginia Beach, Va.,
www.jianlingbamboo.com

REPROCESSED LOW-VOC PAINT:
VISIONS RECYCLING INC., Sacramento,
Calif., (916) 564-9121

PLASTIC TOILET PARTITIONS: Poly Granite
HD by **SANTANA PRODUCTS INC.**, Scranton,
Pa., www.santanaproducts.com

ROOFING: Ultraply PVC by **FIRESTONE
BUILDING PRODUCTS CO.**, Indianapolis,
www.firestonebpco.com

LOW-E INSULATED GLAZING: Solarscreen
2000 by **VIRAcon**, Owatonna, Minn.,
www.viracon.com

BRICK: **YANKEE HILL BRICK & TILE**,
Lincoln, Neb., www.yankeehillbrick.com

U.S. General Services Administration
Public Buildings Service
Office of Applied Science
Applied Research



ASSESSING GREEN BUILDING PERFORMANCE

A POST OCCUPANCY EVALUATION OF 12 GSA BUILDINGS

RESEARCH OVERVIEW: INTEGRATION MEANS HIGH PERFORMANCE.....	PG. 03
RESEARCH CONTEXT: A COMPREHENSIVE EVALUATION.....	PG. 05
FINDING 1: FULLY INTEGRATED DESIGN DELIVERS HIGHER PERFORMANCE.....	PG. 09
FINDING 2: GSA'S GREEN BUILDINGS COST LESS TO OPERATE.....	PG. 11
FINDING 3: GSA'S GREEN BUILDINGS HAVE SATISFIED OCCUPANTS.....	PG. 13
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National Park Service,
Omaha, Nebraska



INTRODUCTION

SUSTAINABLE DESIGN DELIVERS

To answer the question, ‘does sustainable design deliver?’ GSA evaluated 12 sustainably designed buildings in its national portfolio. The evaluation of these buildings was comprehensive—measuring environmental performance, financial metrics, and occupant satisfaction. No previous analysis has taken such a holistic view. The buildings studied all incorporated sustainable design criteria to varying degrees, with seven receiving LEED ratings. The results of GSA’s evaluation show that sustainably designed buildings outperform the national average for buildings of their type by a substantial margin.

INTEGRATED DESIGN YIELDS EVEN BETTER PERFORMANCE

The best performing buildings in the study were those that took a fully integrated approach to sustainable design—addressing site development, water savings, energy efficiency, materials selection, and indoor environmental quality. As America’s largest public real estate organization, GSA has a special responsibility to lead in building sustainably and meet federal mandates, including energy policies and Executive Orders. What the evaluation shows is that a fully integrated approach to sustainable design is helping GSA to meet its mandates by delivering buildings that use substantially less energy, cost less to operate and maintain, and lead to greater occupant satisfaction.

NEEDED NEXT: NATIONAL SUSTAINABLE BUILDING DATA

This study is an important first step in a much-needed national assessment of sustainable building performance in the public, private, and institutional sectors. GSA’s evaluation establishes a new benchmark for comprehensiveness using a protocol that others can follow, both in the federal and private sectors.

RESEARCH OVERVIEW

Integration Means High Performance

"This study breaks new ground by comparing GSA's sustainably designed buildings against US commercial buildings, using the latest performance data. Its findings will be relevant to building owners and developers, public and private, across the country."

-DAVID WINSTEAD
Commissioner, Public Buildings Service

The US General Services Administration (GSA) commissioned a comprehensive post-occupancy evaluation of 12 of its sustainably designed buildings.¹ The measures studied included environmental performance, financial metrics, and occupant satisfaction. No previous US study has taken such a holistic approach to building performance. The LEED buildings evaluated represented one-third of the total LEED buildings in GSA's national portfolio at the time the study was conducted.

The study compared the energy performance, operating cost, and water use of the 12 GSA buildings against the average performance of US commercial buildings, using the following sources of data:

Measurement	Data Source ²
Energy Performance:	CBECs National Survey of Commercial Buildings constructed between 1990 and 2003 ³ ENERGY STAR ⁴
Maintenance Costs:	IFMA ⁵ and BOMA ⁶ 2006/2007 Surveys reporting 2003-2005 data
Water Use:	Federal Water Use Index ⁷
Occupant Satisfaction:	Center for the Built Environment, UC Berkeley ⁸

The study found that GSA's green buildings outperform national averages in all measured performance areas—energy, operating costs, water use, occupant satisfaction, and carbon emissions. The study also found that GSA's LEED Gold buildings, which reflect a fully integrated approach to sustainable design—addressing environmental, financial, and occupant satisfaction issues in aggregate—achieve the best overall performance.

KEY FINDINGS:

Compared to national averages, buildings in this study have:

26%

Less energy use
(65 kBtu/sf/yr vs. 88 kBtu/sf/yr).

13%

Lower maintenance costs
(\$2.88/sf vs. \$3.30/sf)

27%

Higher occupant satisfaction

33%

Fewer CO₂ emissions
(19lbs/sf/yr vs. 29lbs/sf/yr)

RESEARCH CONTEXT

A Comprehensive Evaluation

05

“We believe that ‘green’ building and sustainable design and operation has a very positive impact on the people that work in our buildings, in terms of their morale and productivity. ‘Green’ building is the right thing to do, and it’s also the right business thing to do.”

DAVID BIBB
Acting Administrator, GSA

GSA asked Pacific Northwest National Laboratory (PNNL) to evaluate 12 of GSA’s sustainably designed buildings, and answer this question:

While sustainably designed buildings promise higher performance, do they deliver?

The study evaluated actual, not modeled, building performance, so the results are reliable and objective. Successes and shortcomings were identified, along with areas requiring further research, to provide best practices to emulate and actions to take to improve performance.

The 12 buildings selected reflect different US regional climates, a mix of uses (courthouses and offices), and a mix of build-to-suit leases and federally owned buildings. Land ports of entry were excluded because, as a building type, they are too different to allow meaningful comparisons. Eight of these buildings were designed to meet or exceed basic LEED certification. The other four were designed to meet the requirements of other programs, including ENERGY STAR and the California Title 24 energy standard.

The research team used a consistent evaluation process for every building studied:

- Obtaining and reviewing one year of operating data
- Surveying building occupants
- Interviewing the building manager
- Conducting an expert walkthrough

To make the study useful to a larger audience, the team compared each performance measure with the national average for US commercial buildings. The latest available benchmark data comes from widely accepted industry and government standards.

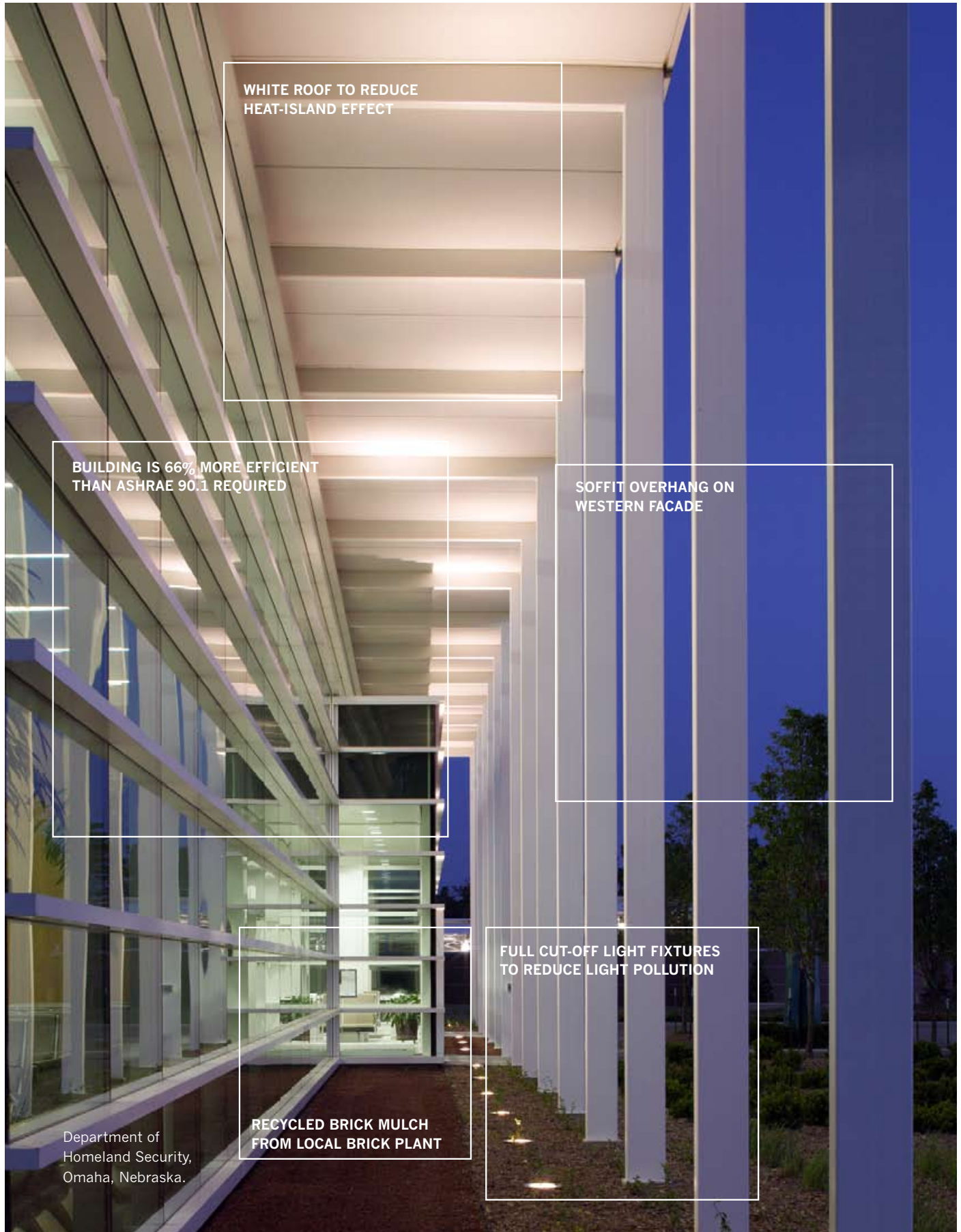
ABOUT THE LEED GREEN BUILDING RATING SYSTEM

The US Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED) Rating System is a nationally accepted third party certification program for green building design, construction, and operation. As the USGBC puts it, “LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.” LEED closely approximates GSA’s holistic approach to sustainable building development and operation.

The LEED Rating System addresses new construction and renovation, operations and maintenance of existing buildings, design of commercial interiors, building core and shell development, as well as neighborhood development and homes.

LEED provides four measures of performance: basic certification, Silver, Gold, and Platinum, based on a set of prerequisites and credits in the five major categories listed above. Each measure represents an incremental step toward integrating the different components of sustainable design, construction, and operation to achieve optimal performance.

Learn more:
For more information on the LEED Rating System: www.usgbc.org



WHITE ROOF TO REDUCE
HEAT-ISLAND EFFECT

BUILDING IS 66% MORE EFFICIENT
THAN ASHRAE 90.1 REQUIRED

SOFFIT OVERHANG ON
WESTERN FACADE

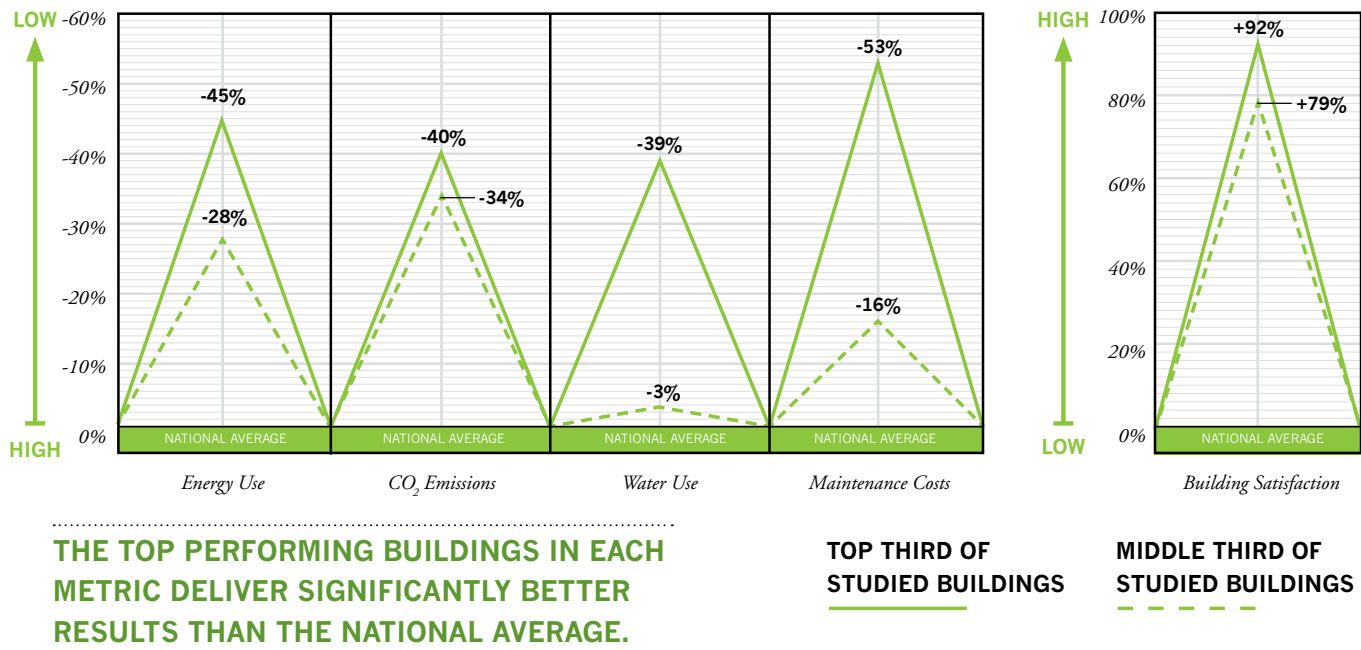
FULL CUT-OFF LIGHT FIXTURES
TO REDUCE LIGHT POLLUTION

RECYCLED BRICK MULCH
FROM LOCAL BRICK PLANT

Department of
Homeland Security,
Omaha, Nebraska.

HOW THE GSA STUDY BUILDINGS PERFORM

Figure 2: Comparison Against National Averages



GSA STUDY BUILDINGS: FAST FACTS



CLEVELAND

The Metzenbaum Courthouse is on the National Register of Historic Places. The renovations preserved 96% of the existing shell and 59% of the interior elements.

The courthouse won GSA's Environmental Award for recycling because of its seven-material collection system and green housekeeping practices.

Year Built: 1910
Year Renov: 2005
Employees: 105
Energy Star: 82
CO₂e: 2,440 mt
LEED-NC Certified



DAVENPORT

The Davenport Courthouse is on the National Register of Historic Places. The renovation maintained the integrity of the historic space, while updating the mechanical systems in the building.

The courtrooms incorporate techniques to bring in daylight and the mechanical systems use variable speed drives. The HVAC system consists of water-cooled chillers, boilers, and air handling units.

Year Built: 1933
Year Renov: 2005
Employees: 45
Energy Star: 78
CO₂e: 945 mt
LEED Registered



DENVER

The Arraj Courthouse was designed as a green courthouse prior to the completion of the LEED rating system. It is currently seeking LEED for Existing Buildings Certification.

Denver employs a hybrid underfloor air distribution system, HVAC and lighting sensors, as well as photovoltaic panels.

Year Built: 2002
Employees: 170
Energy Star: 77
CO₂e: 4,668 mt



FRESNO

The Coyle Courthouse and Federal Building houses 14 courtrooms and is the tallest building in the city (11 floors high).

Designed under California's Title 24 energy standard, the building includes high efficiency lighting, underfloor air distribution systems, water-cooled chillers, and natural gas boilers.

Year Built: 2001
Employees: 85
Energy Star: 92
CO₂e: 2,666 mt
CA Energy Standard Title 24



Year Built: 2001
Employees: 85
Energy Star: 87
CO₂e: 1,397 mt

GREENEVILLE

The Quillen Courthouse replaced a small-er courthouse from which the occupants reclaimed quality historic furniture.

Some of the energy-efficiency features include a well-insulated white roof and an Energy Management Control System of lighting and occupancy sensors. It also scores the highest occupant satisfaction for air quality, acoustics, and lighting.



Year Built: 2001
Employees: 252
Energy Star: 80
CO₂e: 2,150 mt
 LEED-NC Silver

LAKEWOOD

The facility at Lakewood for the Department of Transportation is a LEED Silver-leased building.

Some features include low-emitting material selection, and daylight and views in 91% of regularly occupied spaces. In addition, all building occupants receive a booklet about the design and operations of the building.



Year Built: 2001
Employees: 252
Energy Star: 85
CO₂e: 1,168 mt
 LEED-NC Gold

OMAHA DHS

The Omaha Department of Homeland Security was designed to house multiple DHS agencies, and recently won the 2007 American Council of Engineering Award for its design.

As a LEED Gold building, the facility incorporates daylight and rainwater-harvesting systems, a ground source heat pump, and Green Seal janitorial products.



Year Built: 1975
Year Renov: 2005
Employees: 409
Energy Star: 92
CO₂e: 1,344 mt
 CA Energy Standard Title 24

SANTA ANA

Renovated in 2005, the Santa Ana Federal Building lies in the heart of the civic center district and accommodates a large flow of visitors to the building each day.

This building features high-efficiency lighting and HVAC systems, a new roof, energy-efficient elevators, and lighting sensors.



Year Built: 1986
Year Renov: 2005
Employees: 285
Energy Star: 91
CO₂e: 1,516 mt
 LEED-EB Silver

KNOXVILLE

Located in downtown Knoxville, the Duncan Federal Building currently houses a range of services including the FBI, US Customs, and HUD.

Alterations to the building incorporate high-efficiency lighting, enhanced metering techniques, and low-flow fixtures. The roof reduces the heat island effect, as well as housing photovoltaic panels.



Year Built: 2001
Employees: 252
Energy Star: 79
CO₂e: 1,161 mt
 LEED-NC Silver

OGDEN

Renovations transformed the historic Scowcroft Federal Building into usable office space meeting the IRS's specific needs.

The space incorporate earthquake prevention upgrades, improved roof insulation, radiant baseboard heating, and an underfloor air distribution system coupled with indirect/direct evaporative cooling.



Year built: 2004
Employees: 125
Energy Star: 86
CO₂e: 872 mt
 LEED-NC Gold

OMAHA NPS

The Curtis National Park Service building was built on a brownfield as part of an urban redevelopment effort.

The building showcases passive solar design, daylight harvesting and HVAC sensors, as well as underfloor air distribution. Use of native and adaptive vegetation eliminated the need for irrigation. Operations also include green housekeeping practices.



Year Built: 2002
Employees: 45
Energy Star: 58
CO₂e: 655 mt
 LEED-NC Certified

YOUNGSTOWN

The Jones Federal Building and Courthouse facility was built on a brownfield, and was part of the city's urban revitalization.

Youngstown incorporates building controls and daylighting to over 75% of occupied spaces. Unique features include a storm water management demonstration, a white membrane roof, and light-colored pavement.

FINDING 1:

Fully Integrated Design Delivers Higher Performance

GSA's sustainably designed green buildings have 26% lower energy use compared to the National Average.

(65 kBtu/sf/yr vs. 88 kBtu/sf/yr)
Source of National Average: CBECS

To achieve LEED Gold certification, credits must be obtained in all five rating areas, requiring a completely integrated approach to sustainable building design. The two LEED Gold buildings in this study clearly show that a comprehensive approach yields broad, holistic performance benefits. While neither building led in every category, these two buildings were the only ones studied that achieved consistently high levels of performance on all measures.

The **Curtis National Park Service (NPS) building**, Omaha, Nebraska, performed well in all categories. Its ENERGY STAR rating (86) is in the top third for the group. Its water costs are 91% below the BOMA/IFMA baseline. Its domestic water use is 50% below baseline. Its CO₂ emissions are 34% under baseline, putting it in the top half. Its emissions from occupants' commutes, 1.7 metric tons per person, put it in the top one-third.

The **Omaha Department of Homeland Security (DHS) building**, Omaha, Nebraska, performed well across all categories. Its ENERGY STAR rating (85) is also in the top third for the group. Its water costs are 66% below the BOMA/IFMA baseline, achieved using rainwater harvesting and low-flow and auto-flow lavatory fixtures to offset its greater public use. DHS has 65 regular occupants and 360 occupant visitors while NPS has 125 regular occupants and 134 occupant visitors. DHS's domestic water use is 58% below baseline.

LESSON LEARNED

Across all buildings studied, building performance tracks design intent. Buildings designed with a strong energy focus—compliance with California's demanding Title 24 energy code or ENERGY STAR—had outstanding energy performance, although with a lesser achievement in terms of water use intensity. One LEED certified building did not pursue energy efficiency during design. As a result, it achieved no LEED energy optimization credits, and had the lowest ENERGY STAR rating in the study.

NATIONAL BUILDING FACTS

31%

projected increase in energy consumption by the year 2030 despite dramatic gains in energy efficiency.⁹



20%

of U.S. drinking water supply is consumed by commercial buildings.¹⁰

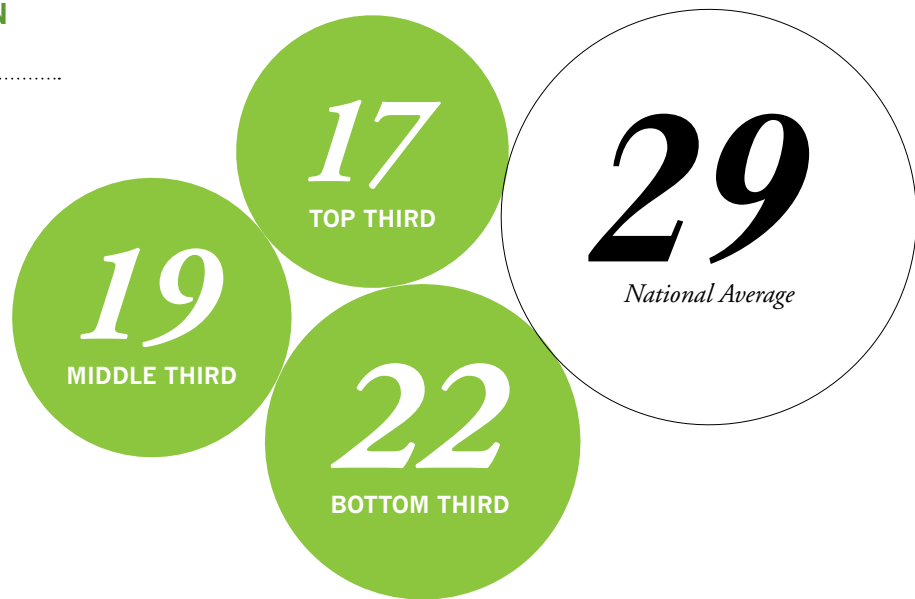
2 trillion

gallons of water a year would be saved if commercial buildings reduced their water consumption by 10%.¹¹

Figure 3: Top Performers by CO₂ Emissions (lbs/sf/yr)

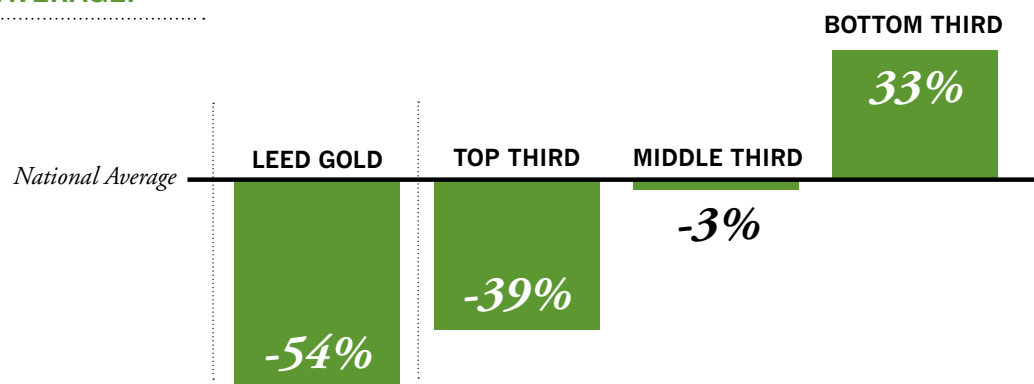
Source of National Average: Energy Star

ALL BUILDINGS IN THIS
STUDY PRODUCE A SMALLER
CARBON FOOTPRINT THAN
THE NATIONAL AVERAGE.

**Figure 4: Top Performers by Water Use (thousand gallons/yr)**

Source of National Average: Federal Water Use Index

LEED GOLD BUILDINGS IN THIS
STUDY HAVE SIGNIFICANTLY
LOWER WATER USE COMPARED
TO THE NATIONAL AVERAGE.



Domestic Water Usage
Index Compared to the
National Average

FINDING 2:

GSA's Green Buildings Cost Less to Operate

The five top-performing buildings studied spent 14% to 45% less on energy than the National Average.

Source of National Average: BOMA/IFMA

Why do operations and maintenance (O&M) costs matter? Considered in aggregate, they approximate the consumption side of overall sustainable performance. As a group, the 12 buildings studied performed only slightly better than the national average for US commercial buildings: 7% below that baseline. However, the top-performing one-third of the group did much better, at 41% below.

The two LEED Gold buildings were among the best performers from an O&M cost perspective. Lower utility and janitorial costs and savings from recycling resulted in top scores for the Curtis National Park Service building and the Omaha Department of Homeland Security building. The use of green cleaning practices enhanced their performance.

On average, the bottom quartile of the buildings studied had considerably higher costs than the industry baseline: 45% above the national average for US commercial buildings. These buildings had unusually high maintenance costs and, in one case, an operating emergency.

LESSON LEARNED

The best practice lesson here is that O&M costs are lowest when sustainability is integral to every aspect of a building, including cleaning and recycling. Building and systems efficiency alone isn't enough. Upfront investments in sustainable measures need to be matched by sustainable O&M practices.

NATIONAL BUILDING FACTS

18%

of total U.S. energy use consumption comes from commercial buildings.¹²



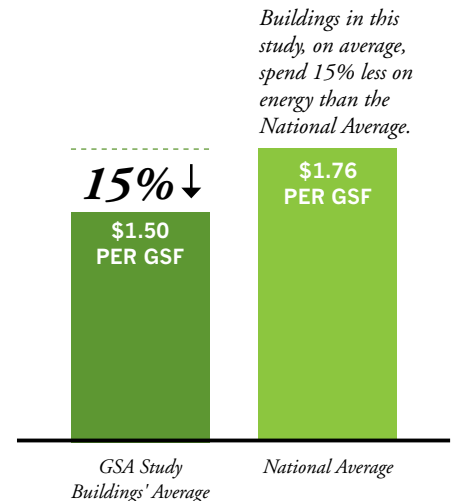
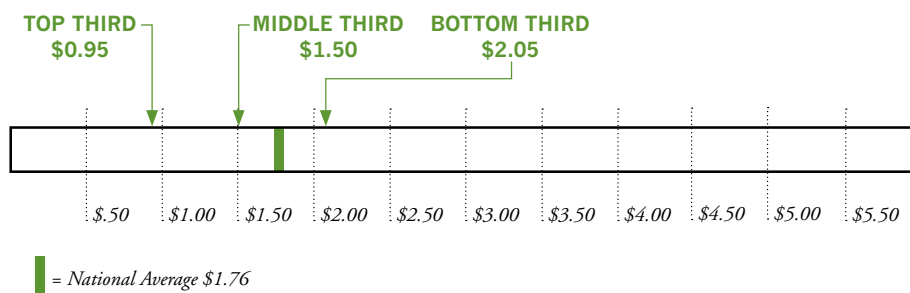
Why water efficiency?

Between 1950 and 2000, the US population nearly doubled. In that same period, however, public demand for water nearly tripled. Americans now use an average of 100 gallons of water per day—enough to fill 1,600 drinking glasses!¹³

Figure 5: Top Performers by Energy Cost (\$/sf/yr)

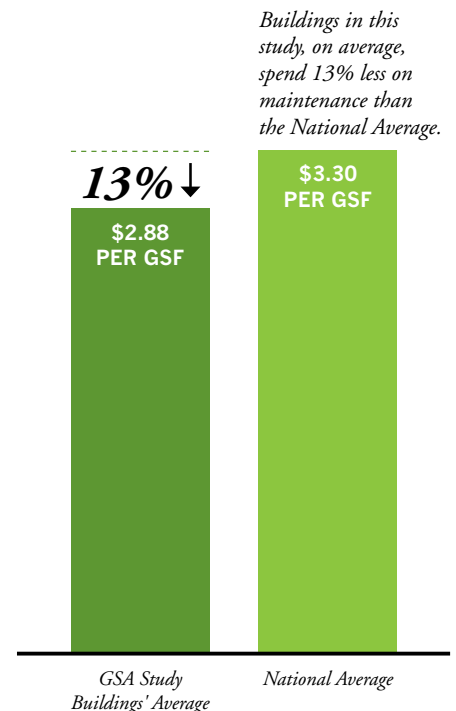
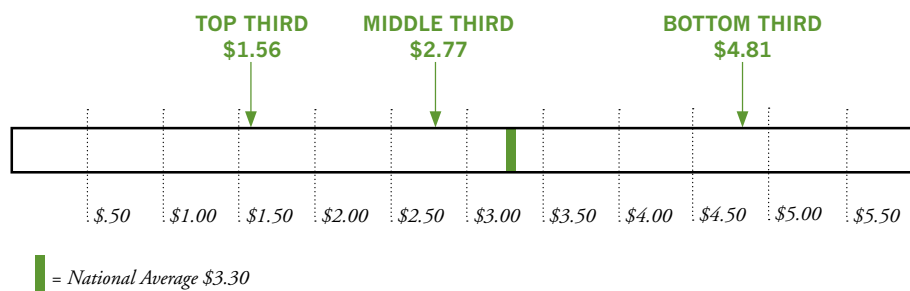
Source of National Average: BOMA/IFMA

THE TOP-PERFORMING SUSTAINABLE BUILDINGS STUDIED SHOWED CONSISTENTLY LOWER ENERGY COSTS THAN NATIONAL AVERAGES.

**Figure 6: Top Performers by Maintenance Cost (\$/sf)**

Source of National Average: BOMA/IFMA

THE TOP-PERFORMING SUSTAINABLE BUILDINGS STUDIED SHOWED CONSISTENTLY LOWER MAINTENANCE COSTS THAN THE NATIONAL AVERAGE.



FINDING 3:

GSA's Green Buildings have Satisfied Occupants

GSA's sustainably designed green buildings demonstrate a 29% higher occupant satisfaction than the National Average.

Source for National Average: CBE, UC Berkeley³

This study provides important new evidence that occupant satisfaction is higher in sustainably designed buildings. Occupant satisfaction is important because it correlates with personal and team performance. That often means higher productivity and creativity for an organization.

As a group, the 12 sustainable buildings studied scored better in occupant satisfaction than the national average for US commercial buildings. Half of the buildings studied scored in the top quartile for occupant satisfaction. Significantly, their average scores in all categories were higher than those of LEED certified buildings in the private sector¹⁴. This suggests that GSA's integrated life cycle approach will be a valuable model for public and private organizations.

For the lower-performing buildings, the study found that occupant satisfaction is undermined by poor acoustics, lighting and maintenance problems. A low level of ambient noise, a lack of sound masking, and a perceived lack of privacy make acoustic quality worse. The poorly calibrated systems that turn lights on and off in response to daylight conditions may cause problems for some occupants. Mechanical failures and poor maintenance can drive down satisfaction scores.

LESSON LEARNED

GSA's sustainably designed buildings are scoring points with their occupants in terms of overall building and workplace quality, indoor air quality, cleanliness, and quality of maintenance. We also gained the following insights from the lower-performing buildings:

First, acoustic performance matters, and should be addressed by appropriate teaming and design criteria at the outset of every project.

Second, both change management and periodic fine-tuning may be needed to make automated systems work well for building occupants, at least until these systems are fully accepted.

Third, good building maintenance is a foundation stone of occupant satisfaction. Don't neglect it.

NATIONAL BUILDING FACTS

79%

of employees surveyed were willing to forgo income to work for a firm with a credible sustainable strategy.¹⁵



80%

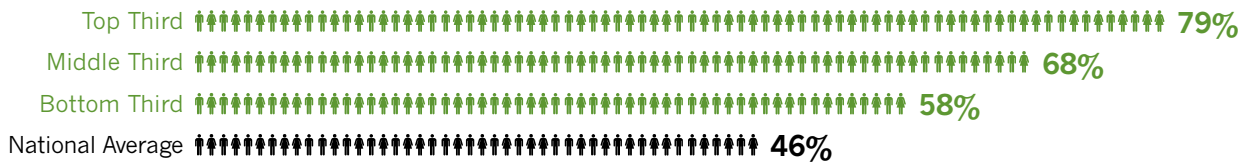
of employees surveyed said they felt greater motivation and loyalty toward their company due to its sustainability initiatives.¹⁶

OCCUPANT SATISFACTION SURVEY

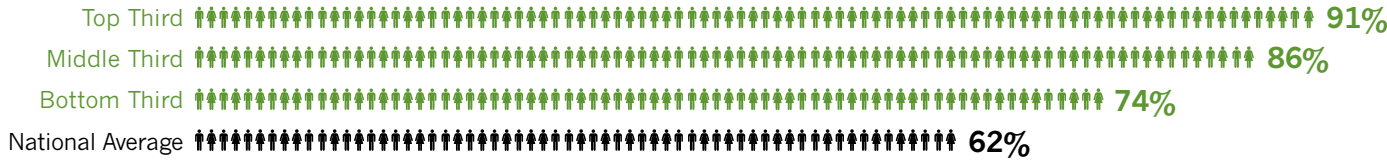
Figure 7: Comparison Against National Averages

Source of National Average: Center for the Built Environment, UC Berkeley

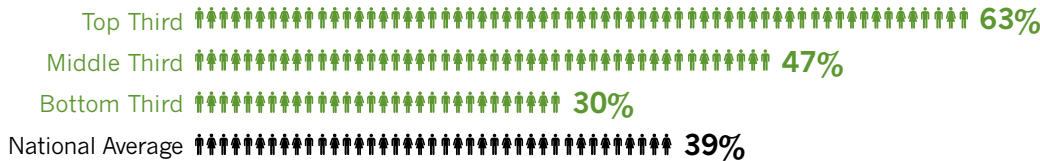
Air Quality Satisfaction



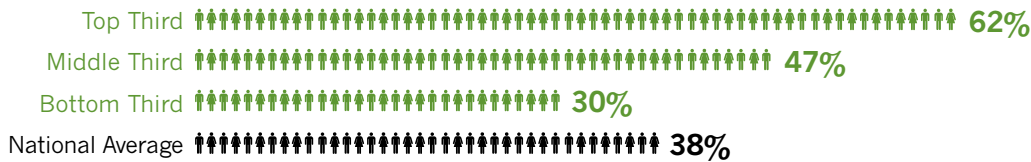
Cleanliness Satisfaction



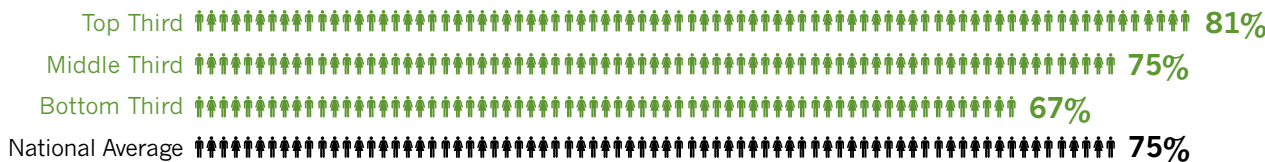
Thermal Satisfaction



Acoustic Satisfaction



Lighting Satisfaction



FINDING 4:

Green Buildings Deliver on GSA's Mandates

New executive and legislative mandates raise the performance requirements for buildings in GSA's national real estate portfolio. (See chart to right)

To meet these new requirements, GSA will need to ensure that its future buildings, including both new construction and major renovation projects, achieve a consistently high standard of performance. The study found a strong positive correlation in that direction. Taken as a group, these 12 sustainably designed buildings use less energy and water, and have a smaller carbon footprint than the national average for US commercial buildings.

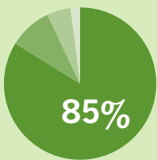
LESSON LEARNED

Although they were not designed to meet GSA's new legislative mandates, the top performing quartile of the buildings studied already meet 2015 requirements for reducing metered energy and water use. GSA can build on this strong foundation of achievable performance. GSA is and will continue to be an important benchmark for other public agencies and for companies and institutions as they plan and implement their building programs.

MANDATE	PERFORMANCE REQUIREMENT
EPAct 2005	• Modeled energy performance must be at least 30% better than ASHRAE 90.1-2004 by 2015
EO 13423	For entire GSA portfolio: <ul style="list-style-type: none">• 3% per year metered energy use reduction• 33% metered energy use reduction by 2015 (an average of 54.6 kBtu per sf per year)• 16% metered water use reduction by 2015
EISA 2007	For new GSA buildings and major renovations, reduce fossil fuel generated energy consumption by: <ul style="list-style-type: none">• 55% by 2010• 100% by 2030

For additional information on EISA, EPAct 2005, and EO 13423: www.wbdg.org/references/federal_mandates

NATIONAL BUILDING FACTS



CO2 EMISSIONS

In the year 2004, the United States emitted over 7 billion metric tons of greenhouse gases. Carbon dioxide accounted for the largest percentage of greenhouse gases (83%), followed by methane (9%), nitrous oxide (5%), and high global warming potential gases (2%).¹⁷

GSA ON THE GROUND

Green Elements of the Omaha Department of Homeland Security

Although designed in 2004, the Omaha Department of Homeland Security already meets the latest federal mandates.



Landscaping captures storm water run-off



Bike racks encourage people to leave their cars behind



The building features access to windows and daylight



Skylights provide daylight where needed



Rainwater is stored and reused for landscape irrigation



A ground source heat pump reduces energy costs

TEST YOUR KNOWLEDGE:

QUESTION 1
How much of US total energy is used by commercial buildings?

QUESTION 2
How much of US energy is generated by coal?

QUESTION 3
How much of US electricity is used by commercial buildings?

QUESTION 4
Over the 30 year life-cycle cost of a building, what percentage is dedicated to occupant salaries?

QUESTION 5
How much time does the average human spend indoors?

QUESTION 6
Compared to average US buildings, what is the aggregate reduction in energy use over the past year for the 12 buildings studied?

QUESTION 7
Compared to average US buildings, what is the aggregate reduction in domestic water use over the past year for the 12 buildings studied?

QUESTION 8
Compared to average US buildings, what is the aggregate reduction in carbon emissions over the past year for the 12 buildings studied?

QUESTION 9
Compared to average US buildings, how much did the 12 buildings studied save in aggregate maintenance costs over the past year?

ANSWERS

1. 18%	equivalent to	8. 172,000 mt.
2. 49%	the annual	emissions for
3. 35%	28,667 cars.	
4. 88%	9. \$892,000	
5. 90%		
6. 16,000 BTUs		
7. 313,000 gallons		

RESOURCES

LESSONS LEARNED FROM CASE STUDIES OF SIX HIGH-PERFORMANCE BUILDINGS
National Renewable Energy Laboratory
2006

Analyzed the design, construction, and energy performance of six commercial buildings. All of the low-energy buildings used more energy than predicted, but those designed with a whole building approach and with the “strongest” energy goals had the best energy performance. Monitoring buildings to provide feedback improves their energy performance.

THE COST OF GREEN REVISITED
Davis Langdon
2007

Found no significant difference in the average costs between green and other buildings. The study also found that the construction industry has embraced sustainable design in most US regions, and no longer views sustainable design measures as an extra cost burden.

THE ENERGY CHALLENGE: A NEW AGENDA FOR CORPORATE REAL ESTATE
Rocky Mountain Institute / CoreNet
2007

Buildings use two-fifths of the world’s materials and energy and one-sixth of its fresh water. In the US, buildings make up 85% of all fixed US capital assets. In short, buildings are part of the problem and part of the solution. The Energy Challenge identifies barriers, documents successes, and recommends actions to achieve greater energy efficiency in US corporate real estate.

ENERGY PERFORMANCE OF LEED NC BUILDINGS
National Buildings Institute
2008

Compares design intent to energy performance in 121 LEED-rated buildings. Office buildings used 33% less energy and all buildings used 24% less energy than the CBECS average for US commercial buildings. Nearly half the buildings had an ENERGY STAR rating of at least 75; the average rating for all buildings was 68, with a quarter rated below 50.

GLOSSARY

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BOMA

Building Owners and Managers Association International. This study used their research to obtain the national average for maintenance costs.

CBE

Center for the Built Environment. This study used their research as a basis for the occupant satisfaction surveys, as well as obtaining the national average for general building satisfaction, cleanliness, lighting, air quality, acoustic, and thermal satisfaction.

CALIFORNIA TITLE 24 ENERGY STANDARD

A California-specific building standard that compiles codes from three sources: standards from national model codes, adapted national model codes to meet California conditions, and new standards to address particular California concerns.

CBECs

Commercial Buildings Energy Consumption Survey. The survey gathers and compiles energy use and cost information for US commercial buildings. This study used their research to obtain the national average for energy use.

CH

Courthouse

ENERGY STAR

Energy Star is a rating to promote energy efficiency in products and buildings. This study used their research to obtain the national average for CO₂ emissions. It is a joint program between the US Environmental Protection Agency and the U.S. Department of Energy.

EUI

Energy Use Intensity.

FB

Federal Building

Federal Water Use Index

This study used the Department of Energy's research to obtain the national average for water use.

GSF

Gross square feet. Refers to a building's overall floor plate size, measuring from the outside of its exterior walls and including all vertical penetrations, such as walls and elevator shafts.

NOTES

¹This white paper summarizes research presented in the following report:

KM Fowler and EM Rauch: *Assessing Green Building Performance: A Post-Occupancy Evaluation of 12 GSA Buildings*, PNNL-17393, Pacific Northwest National Laboratory, Richland, WA, 2008.

www.gsa.gov/appliedresearch

²See glossary for abbreviations

³U.S. Department of Energy. Commercial Buildings Energy Consumption Survey (CBECs). 2003. Energy Information Administration. Washington, DC.

⁴ENERGY STAR Portfolio Manager. www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

⁵IFMA. 2007. Space and Project Management Benchmarks #28. IFMA. Houston, Texas.

⁶Building Owners and Managers Association (BOMA) International Experience Exchange Report. 2006. Special Studies 2005, Agency Managed, Downtown all sizes, U.S. Government Sector. BOMA International, Washington, DC.

⁷Federal Water Use Index, Department of Energy, Federal Energy Management Program.

⁸IFMA. 2007. Space and Project Management Benchmarks #28. IFMA. Houston, Texas.

IFMA

International Facility Management Association. This study used their research to obtain the national average for energy costs.

kBtu

Kilo Btu

mt

Metric ton

⁹Building Owners and Managers Association (BOMA) International Experience Exchange Report. 2006. Special Studies 2005, Agency Managed, Downtown all sizes, U.S. Government Sector. BOMA International, Washington, DC.

¹⁰Center for the Built Environment (CBE) Occupant Satisfaction Survey. UC Berkeley.

¹¹www.yourenergyfuture.org/energy-facts.htm, (accessed 23.04.2008).

¹²www.energystar.gov/index.cfm?c=business.bus_water, (accessed 23.04.2008).

¹³ibid.

¹⁴goliath.ecnext.com/coms2/gi_0199-6408096/Section-2-Energy-consumption-by.html, (accessed 01.05.08)

¹⁵www.epa.gov/watersense/water/why.htm, (accessed 23.04.08)

¹⁶Center for the Built Environment (CBE) Occupant Satisfaction Survey. UC Berkeley.

¹⁷Survey of 800 MBAs from 11 Top International Business Schools; Stanford Graduate School of Business, 2002 GlobeScan International Survey, MORI.

¹⁸ibid.

¹⁹www.pewclimate.org/global-warming-basics/facts-and-figures/us-emissions/usghgemgas.cfm, (accessed 01.05.08)