November 2003

BUILDING DESIGN & CONSTRUCTION®

White Paper on Sustainability

A Report on the Green Building Movement

Sustainable development is the most vibrant and powerful force to impact the building design and construction field in more than a decade.

In this White Paper, the editors of *Building Design & Construction* offer a brief history of green building; present the results of a specially commissioned survey of our readers; and analyze the chief trends, issues, and published research, based on interviews with dozens of experts and participants in green building.

The White Paper concludes with an "Action Plan," a set of recommendations designed to encourage further dialogue about sustainable development.

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WHY A WHITE PAPER ON SUSTAINABILITY?

The November 2002 convention of the U.S. Green Building Council signaled a momentous upturn of activity and interest in sustainable design and construction.

Attendance at Greenbuild 2002, as the Austin, Texas, conclave was known, was double what event planners anticipated. Seminar rooms were packed to overflowing with enthusiastic audiences eager to gather the latest information about the most exciting construction industry phenomenon of the last decade.

But even as this enormous demonstration of interest in green building was taking place, the sustainability movement was beginning to show signs of growth pains. The proliferation of green products on display at Greenbuild 2002 prompted some attendees to wonder what "green" really meant. Others questioned the practicality of certain aspects of the USGBC's Leadership in Energy and Environmental Design rating system —the increasingly popular "LEED" program. Still others wondered how they fit into the sustainability picture, and whether they and their firms were moving fast enough to catch the wave.

In the jubilant aftermath of Greenbuild 2002, the editors of *Building Design & Construction* decided to undertake this White Paper, in the belief that a publication with more than 50 years of credibility with the professional design and construction community might be uniquely positioned to provide an objective, third-party review of the public policy aspects of sustainable design.

This White Paper on Sustainability has four main elements:

The first is a brief historical overview of green building.

The second presents the results of a specially commissioned survey of readers of this publication. This was done to ascertain their level of interest and involvement in sustainability, as representative of activity and interest among the professional community in the U.S. and Canada at large.

The third is an analysis of trends, issues, and published research, based on interviews with dozens of technical experts, academicians, researchers, and prominent authorities in the field.

The fourth and final element is a set of recommendations, in the form of an "Action Plan." Each recommendation describes a specific action to be taken; a suggestion of the party or parties best qualified to carry out the recommendation; some estimate of the required budget or resources; a suggested time frame for accomplishing the task; and a metric by which success or failure could be determined.

The editors believe that only by offering concrete recommendations, some of which may not be greeted enthusiastically by all constituents in the green building movement, can we provide a document that will spark further constructive activity and perhaps nudge the sustainability movement up one more notch.

I believe it equally important to state what this White Paper does not attempt to do. It is not a "how-to" of green building, nor a compendium of information about green products, nor a set of case studies. Nor is it an "investigative" report. While there may be disagreement over strategies and tactics, we believe that those involved in the sustainable-design movement are well-intentioned individuals and organizations whose common goal is to produce more environmentally viable and humane buildings and communities.

A final word, regarding our editorial policy: Each of the sponsors and underwriters has signed an agreement stating clearly that, while their input and suggestions in the production of this White Paper would be welcome (as was the case for many other individuals and organizations), responsibility for all editorial and policy matters related to the White Paper rests with me, the Editor-in-Chief of *Building Design & Construction*.

The editors welcome your comments. Please send them to me at: rcassidy@reedbusiness.com. Thank you.

Respectfully submitted,
Robert Cassidy
Editor-in-Chief

P.S. Join us at 1 p.m. Thursday, November 13, at Greenbuild 2003 in Room 330 of the David L. Lawrence Convention Center, Pittsburgh, for a one-hour discussion of the White Paper on Sustainability.

EXECUTIVE SUMMARY

This report traces the history of the green building movement in the U.S. and internationally, from the earliest days of the environmental movement to the present. It examines developments at the international, Federal, state, and local level, and analyzes the costs and benefits, both financial and human, of sustainable development. Certification and labeling systems for "green" products are also reviewed.

The White Paper also presents the results of an exclusive survey of the readers of *Building Design & Construction* as to their attitudes toward sustainable development and their actual involvement in green building projects.

The White Paper culminates in an Action Plan, with nine specific recommendations:

1) Conduct peer-reviewed studies of the benefits of green buildings related to human performance, health, and well-being. The National Academies should sponsor a study or series of studies to determine the contribution of green buildings to human health, employee satisfaction, worker productivity, recruitment and retention of employees, and related human and social values.

2) Enlist the real estate brokerage, financial, and appraisal community to champion a rigorous, peer-reviewed study of the economic and "business-case" aspects of sustainable design. The business community should be brought more fully into the sustainable development fold, via participation in a study of the impact of green building on first costs, financing, budgets, life cycle costs, insurance rates, valuation, lease or sales premiums, marketability, and profitability.

3) Establish a Senior Interagency Green Building Council at the Federal level. As suggested by the Federal Environmental Executive, the Federal establishment needs a high-level board to coordinate government activities related to sustainable design.

4) Establish an Institute for Sustainable Development Research, pooling the resources of major universities, the Federal government, and the private sector to create a unified center for R&D and data collection on sustainable design and development. Research activity on green building is scattered. There is a need to consolidate R&D on sustainable design and development in a unified physical location, pooling the resources of Federal research agencies, a consortium of universities, professional firms, and product manufacturers.

5) Create guidelines for states, counties, and municipalities to implement sustainable design policies, legislation, executive actions, regulations, and incentives. Numerous states and local governments have approved laws, regulations, and incentives regarding sustainable development. Sufficient experience now exists to see which of these programs is proving most effective and how that knowledge can be passed on to other states and localities looking to implement green building legislation.

6) Launch a pilot program in up to 10 large public school districts to measure the impact of green schools on student achievement and health. A controlled study of the effect of daylighting, temperature control, improved indoor environmental quality, and related factors on student performance and health would give educators and school designers valuable data to encourage further development of sustainably designed schools.

7) Building product manufacturers should cooperate with efforts to create green product tools and databases using life cycle assessment. Manufacturers must provide the data needed to make life cycle assessment and inventory tools uniform and fair. Developers of these tools must create security mechanisms that ensure the safety and confidentiality of manufacturers' proprietary information.

8) The USGBC should reconsider the admission of trade associations. The USGBC would benefit from greater participation by industry. In turn, trade associations, if granted membership, must make a full-faith effort to embrace the mission of the U.S. Green Building Council.

9) Continue to upgrade LEED. The USGBC should move LEED toward performance-based criteria using life cycle assessment, with consideration of regional factors. Specific credits, such as those for regional materials and renewability of materials, should be reevaluated. The ongoing advisory committee evaluation of vinyl products should continue its mission. Certification standards of wood products should be reviewed. A LEED "master" or "fellow" designation should be developed.

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A BRIEF HISTORY OF GREEN BUILDING

Milestones in Sustainability

- 1851
  Crystal Palace (Joseph Paxton), London
- 1877
  Galleria Vittorio Emanuele II (Giuseppe Mengoni), Milan
- 1903
  Flatiron Building (D.H. Burnham & Co.), New York
- 1905
  New York Times Building (Eidlitz & McKenzie), New York
- 1932
  Rockefeller Center (Hood and Corbett), New York
- 1962
  Silent Spring (Rachel Carson)
- 1963
  Design with Climate (Victor Olgyay, with Aladar Olgyay)
- 1967
  Sun; Wind; Water (Ralph Knowles)
- 1968
  Form and Stability (Ralph Knowles)

What is green building? The Office of the Federal Environmental Executive defines green building as "the practice of 1) increasing the efficiency with which buildings and their sites use energy, water, and materials, and 2) reducing building impacts on human health and the environment, through better siting, design, construction, operation, maintenance, and removal –the complete building life cycle."[1] Although green building, or sustainable design and development, has gained currency in the last decade, it harkens back more than a century, according to David Gissen, curator of architecture and design at the National Building Museum, Washington, D.C.[2]

As far back as the nineteenth century, Gissen notes, structures like London's Crystal Palace and Milan's Galleria Vittorio Emanuele II used passive systems, such as roof ventilators and underground air-cooling chambers, to moderate indoor air temperature. In the early twentieth century, skyscrapers like New York's Flatiron Building and the New York Times Building employed deep-set windows to shade the sun. Still later, Rockefeller Center (1932) utilized both operable windows and sky gardens. New York's Wainwright Building and Chicago's Carson Pirie Scott department store had retractable awnings to block the sun, and other commercial buildings of the period were outfitted with window shades.

Starting in the 1930s, new building technologies began to transform the urban landscape. The advent of air conditioning, low-wattage fluorescent lighting, structural steel, and reflective glass made possible enclosed glass-and-steel structures that could be heated and cooled with massive HVAC systems, thanks to the availability in the U.S. of cheap fossil fuels. The post-war economic boom accelerated the pace of this phenomenon, to the point where the International Style "glass box" became the design icon of America's cities and rapidly growing suburbs.

In the 1970s, a small group of forward-thinking architects, environmentalists, and ecologists, inspired by the work of Victor Olgyay (*Design with Climate*), Ralph Knowles (*Form and Stability*), and Rachel Carson (*Silent Spring),* began to question the advisability of building in this manner. Their efforts were given impetus by the celebration of the first Earth Day in April 1970, but it was not until the OPEC oil embargo of 1973 that the nascent "environmental movement" captured the attention of the public at large. As gasoline prices spiked upward and lines at gas stations stretched for blocks, many Americans started to wonder about the wisdom of relying so heavily on fossil fuels for transportation and buildings.

In response to the energy crisis, the American Institute of Architects formed an energy task force and, later, the AIA Committee on Energy. According to committee member Dan Williams, the group formed into two camps. One group looked toward passive systems, such as reflective roofing materials and environmentally beneficial siting of buildings, to achieve energy savings, while the other concentrated more on technological solutions, such as the use of triple-glazed windows.

Even as the immediate energy crisis began to recede, pioneering efforts in energy conservation for buildings were beginning to take hold. In England, Norman Foster used a grass roof, a daylighted atrium, and mirrored windows in the Willis Faber and Dumas Headquarters (1977). California commissioned eight energy-sensitive state office buildings, notably the Gregory Bateson Building (1978), which employed photovoltaics, underfloor rock-store cooling systems, and area climate-control mechanisms.

In 1977, a separate Cabinet department, the Department of Energy, was created to address energy usage and conservation, the same year the Solar Energy Research Institute (later renamed the National Renewable Energy Laboratory) was established in Golden, Colo., to investigate energy technologies, such as photovoltaics.

The 1980s and early 90s saw further efforts by such proponents as Robert Berkebile, Randy Croxton, Bruce Fowle, Robert Fox, Vivian Loftness, William McDonough, and Sandra Mendler. At the international level, Germany's Thomas Herzog, Malaysia's Kenneth Yeang, and England's Norman Foster and Richard Rogers were experimenting with prefabricated energy-efficient wall systems, water-reclamation systems, and modular construction units that reduced construction waste. Scandinavian governments set minimums for access to daylight and operable windows in workspaces.

[1] Office of the Federal Environmental Executive, "The Federal Commitment to Green Building: Experiences and Expectations," 18 September 2003.

[2] For more on the history of green building, see *Big & Green: Toward Sustainable Architecture in the 21st* Century (2002).

Meanwhile, the 1987 UN World Commission on Environment and Development, under Norwegian prime minister Gro Harlem Bruntland, provided the first definition of the term "sustainable development," as that which "meets the needs of the present without compromising the ability of future generations to meet their own needs."

In 1989, Berkebile led the transformation of the AIA Energy Committee into the more broadly scaled AIA Committee on the Environment (COTE). The next year, the AIA, through COTE and the AIA Scientific Advisory Committee on the Environment, obtained funding from the Environmental Protection Agency to undertake the development of a guide to building products based on life cycle analysis, the first such assessment to be conducted in the U.S. The individual product evaluations were eventually compiled in the AIA *Environmental Resource Guide*, first published in 1992. One of the keystone documents in sustainability, the *"ERG"* is credited with encouraging numerous building product manufacturers to make their products more ecologically sensitive.

In June 1992, the newly elected president of the AIA, Susan Maxman, participated in the UN Conference on Environment and Development, in Rio de Janeiro. The so-called Earth Summit drew delegations from 172 governments and 2,400 representatives of nongovernmental organizations. The momentous event saw the passage of Agenda 21, a blueprint for achieving global sustainability, the Rio Declaration on Environment and Development, and statements on forest principles, climate change, and biodiversity.

Inspired by the Earth Summit, the AIA president-elect chose sustainability as her theme for the June 1993 UIA/AIA World Congress of Architects. Six thousand architects from around the world descended upon Chicago for this event, held in conjunction with the International Union of Architects (UIA). They referred to the U.N.'s 1985 Bruntland Commission definition of sustainability and brought the issue center stage with the signing of the Declaration of Interdependence for a Sustainable Future by AIA president Maxman and UIA president Olufemi Majekodunmi. Today, the "Architecture at the Crossroads" convention is recognized as a turning point in the history of the green building movement.

With the election of Bill Clinton in November of that year, the idea began to percolate among proponents of sustainability to use the White House itself as a laboratory. On Earth Day, April 21, 1993, President Clinton announced plans to make the Presidential mansion "a model for efficiency and waste reduction."

The "Greening of the White House" (which also took in the 600,000 sq. ft. Old Executive Office Building across from the White House) got underway with an energy audit by the Department of Energy, an environmental audit led by the Environmental Protection Agency, and a series of design charettes in which nearly a hundred environmentalists, design professionals, engineers, and government officials were asked to devise energy-conservation solutions using off-the-shelf technologies.

Within three years, the numerous improvements to the nearly 200-year-old residence led to $300,000 in annual energy and water savings, landscaping expenses, and solid-waste costs, while reducing atmospheric emissions from the White House by 845 tons of carbon a year.

The spectacular success of the Greening of the White House encouraged the participants to green other properties in the vast Federal portfolio. In short order, the Pentagon, the Presidio, and the U.S. Department of Energy Headquarters were given green treatment, as were three national parks: Grand Canyon, Yellowstone, and Alaska's Denali. More than a thousand people participated in the design charettes for these and other Federal buildings, according to the AIA Committee on the Environment. This work was consolidated in *Greening Federal Facilities*, an extensive guide for Federal facility managers, designers, planners, and contractors, produced by the Department of Energy's Federal Energy Management Program.

The flurry of Federal greening projects was not the only force propelling the sustainability movement in the 1990s. Shortly after the call to green the White House was issued, Executive Order 12852 established the President's Council on Sustainable Development, whose work culminated in 1999 with a final report (under chairman Ray C. Anderson) recommending 140 actions to improve the nation's environment, many related to building sustainability. In 1996 the U.S. Department of Energy signed a memorandum of understanding with AIA/COTE to conduct joint R&D and began a program to develop a series of roadmaps for buildings of the 21st century. (Subsequently, the DOE's Office of Building Tech-

Milestones in Sustainability

- 1 April 1970
  First Earth Day
- 1972
  The Limits to Growth (Club of Rome Report)
- 1972
  UN Conference on the Human Environment, Stockholm
- 17 October 1973
  OPEC oil embargo
- 1973
  AIA Energy Conservation Task Force established
- 13 November 1973
  Trans Alaska Pipeline approved
- 4 December 1973
  Federal Energy Office established (E.O. 11748)
- 1973
  Federal Energy Management Program chartered
- 7 May 1974
  Federal Energy Administration Act signed
- 1975
  AIA Committee on Energy established
- 1 October 1977
  Department of Energy commissioned
- 1977
  USDOE Solar Energy Research Institute (SERI) established (later renamed National Renewable Energy Lab)
- 1977
  Willis Faber and Dumas Headquarters (Foster and Partners), Ipswich, England
- 1978
  Gregory Bateson Building (Sim van der Ryn), Sacramento, Calif.

Milestones in Sustainability

- 1985
  Environmental Defense Fund offices (William McDonough + Partners), New York
- 1987
  Bruntland Report, UN World Commission on Environment and Development
- 1989
  AIA Committee on the Environment (COTE)
- 24 March 1989
  Exxon Valdez runs aground
- 1989
  NRDC Headquarters (Croxton Collaborative), New York

Who belongs to the USGBC?

Professional firms	2256
Contractors, builders	410
Product manufacturers	244
Nonprofit organizations	134
State and local governments	118
Universities, research institutes	96
Building owners, real estate firms	35
Federal agencies	25
Utilities	19
Corporate and retail	11
Retail	11
Financial, insurance firms	3
Total	**3376**

Source: U.S. Green Building Council, October 2003

Architectural, engineering, and other professional firms make up more than two-thirds (66.8%) of the membership of the USGBC.

nology and the Office of Energy Efficiency and Renewable Energy facilitated publication, with support from industry, of 20-year "Building Technology Roadmaps" for high-performance commercial buildings, lighting, HVAC and refrigeration, the building envelope, and residential buildings.) And on Earth Day 1998, the then-chair of AIA/COTE, Gail Lindsey, announced the first "Top 10 Green Projects," to call attention to successful sustainable design, a program that has continued to the present.

On September 14, 1998, President Clinton issued the first of three "greening" executive orders. E.O. 13101 called upon the Federal government to improve its use of recycled and "environmentally preferred" products (including building products). E.O. 12123 (June 3, 1999) encouraged government agencies to improve energy management and reduce emissions in Federal buildings through better design, construction, and operation. E.O. 13148 (April 21, 2000) charged Federal agencies to integrate environmental accountability into day-to-day decision making and long-term planning.

Individual Federal departments were making headway, too. In mid-decade, the Navy undertook eight pilot projects, notably the Naval Facilities Engineering Command (NAVFAC) headquarters at the Washington Navy Yard. The 156,000 sq. ft. structure, built 150 years before as a gunnery assembly plant, underwent a transformation that reduced energy consumption 35%, saving $58,000 a year. Similar pilot projects were undertaken by the General Services Administration (with the 1995 Federal Courthouse in Denver), the Environmental Protection Agency (with the revamping of its facilities in Research Triangle Park, N.C.), and the National Park Service.

In 1997, the Navy initiated development of the *Whole Building Design Guide*, an online resource that incorporates sustainability requirements into mainstream specifications and guidelines. Seven other Federal agencies now participate in this project, which is now managed by the National Institute of Building Sciences.

Outside the U.S., the Building Research Establishment was perfecting its building assessment method, known as BREEAM (see p. 18), even as new software and databases for building products were coming online throughout Europe.

The most ambitious international effort of the period was the Green Building Challenge (October 1998), with representatives from 14 nations —Austria, Canada, Denmark, Finland, France, Germany, Japan, the Netherlands, Norway, Poland, Sweden, Switzerland, the U.K., and the U.S. Hundreds of individuals flocked to Vancouver, B.C., in October 1998 for this event, so many that late arrivals had to be turned away. Subsequent conferences in Maastricht, the Netherlands (2000), and Oslo, Norway (2002), drew additional delegations from Australia, Brazil, Chile, Greece, Hong Kong, Israel, Italy, South Africa, Spain, and Wales. The goal of the challenge, which meets again in 2005, is to create an international assessment tool that takes into account regional and national environmental, economic, and social equity conditions — the so-called Triple Bottom Line.

Meanwhile, as all this was going on, a parallel effort was taking shape —the creation of the U.S. Green Building Council.

The USGBC and 'market transformation'

In less than a decade, the U.S. Green Building Council has emerged as one of the most successful examples of nonprofit membership organization development in recent history. Its story could easily be a case study at Harvard Business School.

It may be impossible to set an exact date when the idea of a national green building coalition came together, but it is safe to say that the roots of the USGBC go back to the mid-1980s, when David Gottfried, a construction manager and real estate developer, met Michael Italiano, an environmental lawyer. Both were working on architect William McDonough's Environmental Defense Fund project in New York City, one of the earliest examples of high-performance green building.

Over the next few years, Gottfried and Italiano held numerous informal meetings with a core group of like-minded professionals —people like Robert Berkebile, chair of the AIA Committee on the Environment, William Browning and Amory Lovins of the Rocky Mountain Institute, Carl Costello of Greening America, Alan Traugott of engineering consultants Flack + Kurtz, as well as individuals from industry (notably firms like Arm-

strong World Industries, Carrier Corporation, Herman Miller Inc., and Interface Inc.) and Federal agencies such as the Department of Energy, the National Institute of Standards & Technology, and the Naval Facilities Engineering Command. In 1993, the group, which numbered no more than a couple of dozen, incorporated as the U.S. Green Building Council, with S. Richard (Rick) Fedrizzi (then of Carrier, now of Green-Think) as founding chair. Its first conference, held in conjunction with the UIA/AIA convention in Chicago, drew 600 participants. The new organization set as its first goal the creation of a sustainability rating system, through the American Society of Testing and Materials.

The next two years proved frustrating to the USGBC members who worked on the ASTM subcommittee. ASTM's rigorous consensus-based process moved much too slowly for the USGBC representatives. By 1995, the ASTM effort was dropped in favor of creating an independent rating system under the USGBC banner. Rob Watson, a senior scientist with the Natural Resources Defense Council, became chairman of the committee formulating LEED —the Leadership in Energy and Environmental Design green rating system.

For the next three years or so, Watson's committee considered, then rejected, various building ratings models, including Austin, Texas's, Green Builder program, a Canadian model (BEPAC), and the Green Building Challenge.

The obvious candidate was the U.K.'s BREEAM system, but it, too, was rejected, according to Watson: first, because it relied on the development of an elaborate assessor infrastructure, essentially a national corps of code officials; and, second, because it was seen as focusing primarily on reducing carbon dioxide emissions, whereas the LEED committee wanted to address a much broader set of energy impacts.

After a succession of starts and stops, the USGBC membership approved LEED Version 1.0 in late 1998. Within months, a pilot program was launched, with support from the Federal Energy Management Program. A reference guide was drafted to steer practitioners through LEED, and buildings totaling more than a million square feet in size were registered in the first year alone. LEED was on its way.

The pilot program quickly exposed the shortcomings of LEED 1.0. According to Watson, some of the 40 credits that could be earned were either too prescriptive or were already standard practice. Energy-related credits were not sufficiently related to performance. The reference guide needed beefing up.

The result was LEED 2.0, which was approved in March 2000. LEED 2.0 expanded the credits to a maximum 69. The range limits of the various categories —Bronze (now "Certified"), Silver, Gold, and Platinum —were expanded. The resource guide was thoroughly revised and upgraded.

With further refinements in early 2003 under LEED 2.1, the Leadership in Energy and Environmental Design rating system has, in just a few years, truly begun to transform the $315 billion U.S. design and construction industry, much as the founders of the USGBC dreamed it would. The General Services Administration requires all new GSA construction to seek LEED Silver status, and NAVFAC has incorporated LEED into its instructions for new Navy buildings; other Federal entities, such as the Army and the Air Force, are reworking LEED to meet their own specific requirements. Major corporations —Ford, Sprint, Steelcase, PNC Financial Services, Toyota —have embraced LEED and sustainable design. Foundations are jumping on board. Cities, counties, and whole states are either adopting LEED or refashioning it to meet local or regional needs. Colleges and universities are making LEED their standard for new construction. Even speculative real estate developers have taken the LEED challenge, as with Four Times Square, in Manhattan, and EcoWorks at Southlake, outside Kansas City.

As of September 2003, 948 projects, representing nearly 140 million square feet of space, were registered in the program. LEED has spread internationally with the approval of LEED Canada, and other countries are looking to LEED as a possible model of sustainability. Plans are already in motion to expand LEED to take in existing buildings, commercial interiors, core and shell, residential construction, and ultimately whole communities. A comprehensive revision of LEED for new construction, Version 3.0, is in the works.

Although LEED is not without its imperfections, its simple structure, based on achieving points, has given it enormous appeal and made it the most widely accepted program of its kind in the U.S.

Milestones in Sustainability

- 1990
  Building Research Establishment Environmental Assessment Method (UK)
- 1991
  Residential Green Building Program initiated, Austin, Texas
- 1992
  Audubon House (Croxton Collaborative, Architects), New York
- 3-14 June 1992
  'Earth Summit,' UN Conference on Environment and Development, Rio de Janeiro
- 1992
  Energy Policy Act of 1992
- 1992
  Menara Mesiniaga (T.R. Hamzah and Yeang), Selangor, Malaysia
- 1992
  Executive Order 13123
- June 1992
  EPA introduces ENERGY STAR labeling program
- 1993
  Navy launches green pilot project with eight buildings

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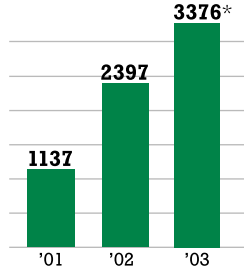
USGBC membership
(cumulative total)



*As of 10/03
Source: USGBC

THE BASICS OF LEED

The Leadership in Energy and Environmental Design Green Building Rating Program is, in the words of the U.S. Green Building Council, "a national consensus-based, market-driven building rating system designed to accelerate the development and implementation of green building practices. In short, it is a leading-edge system for designing, constructing, and certifying the world's greenest and best buildings." This statement at once reveals both the brilliance and the shortcomings of LEED for new construction in its current form –and points the way toward improvements that need to be addressed in its next iteration.

LEED works so well, first of all, because it is simple to understand. LEED is divided into five categories related to siting, water conservation, energy, materials, and indoor environmental quality, plus an innovation and design category. Each category contains a specific number of credits; each credit carries one or more possible points (see chart). A project that earns enough points (26) can become "LEED Certified," on up the ladder to Silver (33), Gold (39), and Platinum (52 or more). Some categories have prerequisites that must be met or points cannot be earned in that category.

LEED certification levels

Rating	Earned points
Certified	26-32
Silver	33-38
Gold	39-51
Platinum	52-69

Source: USGBC

LEED building vs. conventional building

LEED rating	Anticipated energy/environmental impact (energy, water, land improvements, etc.)
Certified	30%
Silver	40%
Gold	50%
Platinum	70%+

Source: USGBC

LEED's point-based system is easy to understand and use (top). Achieving increasingly rigorous levels in LEED rating should yield commensurately greater gains in energy savings and environmental benefits (above).

Another reason for LEED's remarkable success is its appeal to Americans' competitive nature. It takes a complex, multifaceted problem –sustainable design and development –and turns it into a game, with clearly established rules and intricate strategies, where Building Teams can decide how far they want to go, right up to Platinum, and devise a strategy to reach that mark.

LEED has yet another secret ingredient: a branded metric that establishes a means of comparison in the real estate marketplace. The LEED rating imbues projects with the equivalent of the *Good Housekeeping* seal of approval or a favorable review in *Consumer Reports*. Since LEED is designed to reflect the best practices of the top 25% of new buildings, owners of LEED-rated buildings can state that their properties are, at least in theory, environmentally superior to at least 75% of the contemporary buildings in the market. Of course, LEED Silver, Gold, or Platinum status conveys even more prestige. The LEED brand has already become a marketing distinction for a number of certified projects, especially those with Silver or Gold ratings.

That's the brilliance of LEED: its simplicity, its competitive structure, its ability to provide a branded metric. The developers of LEED have invented an extremely clever device that has succeeded beyond all expectation. Like the catalytic agent that speeds up a chemical reaction without itself being consumed, LEED has precipitated enormous activity in the real estate community without losing any of its potency. LEED has certainly lived up to its goal to "accelerate the development and implementation of green building practices."

At the same time, even the staunchest proponents of LEED would acknowledge that it is an imperfect instrument (which is why it is undergoing an extensive third-generation revision); and the process by which it was developed also has flaws. For example, while it describes LEED as "consensus-based," the USGBC in its infancy purposely excluded trade associations (which themselves function on a consensus basis within their respective industries) from joining the organization, out of fear that trade groups would use their financial resources and lobbying capacity to take over the organization –an understandable concern at the time, but one that no longer applies, given the USGBC's current stature. A USGBC task force recently held meetings with trade associations seeking admission and environmental groups opposed to trade association membership, and a report is expected to be issued in Q1/04.

Furthermore, while the USGBC describes LEED as "market-driven," most of the early adopters have been government agencies (Federal, state, and local government buildings make up half the LEED registry), universities, schools, foundations, and environmental organizations, which do not operate under the same financial parameters as the speculative commercial real estate market. A

The LEED-NC 2.1 checklist

Category/possible points	Summary
Sustainable sites **14**	Requires the design of a sediment and erosion plan. Site must not be: on prime farmland; on land lower than 5 ft. above a 100-year flood plain; on a protected habitat; within 100 feet of wetlands; on public parkland. Offers points for: channeling development to urban areas (equivalent to two-story downtown development); brownfield redevelopment; locating near rail or bus lines; providing bicycle storage and showers for 5% of occupants; providing preferred parking and alternative-fuel vehicles for 3% of occupants, or installing refueling stations for alternative-fuel vehicles for 3% of occupants; setting aside preferred parking for vanpool and carpool vehicles for 5% of occupants; limiting site disturbance; reducing the development footprint by 25%; implementing a stormwater management plan and system; reducing light pollution; providing shaded, light-colored, or open-grid paving, underground or structured parking (50% of spaces), and 'tool''or vegetated roofs.
Water efficiency **5**	Reduce water consumption for irrigation by 50%; use only captured rain or gray water for irrigation, or do not install landscape irrigation systems; reduce use of city water for sewage by 50% or treat 100% of wastewater on site to tertiary standards; use 20% or 30% less water (not including irrigation) compared to Energy Policy Act fixture performance requirements.
Energy and atmosphere **17**	Must use best practice commissioning procedures. Must design to comply with ASHRAE/IESNA 90.1-1999 or more stringent local code. Zero use of CFC-based refrigerants in HVACR systems. Points for: reducing design energy costs vs. ASHRAE/IESNA 90.1-1999 by 10%, 20%, 30%, 40%, 50%, or 60%; supplying 5%, 10%, or 20% of total energy use via on-site renewable systems; using an independent commissioning authority; providing the owner with a manual for recommissioning building systems; contracting to review building operation with O&M staff; installing HVACR and fire-suppression systems that contain no HCFCs or halons; providing 50% of electricity from renewable sources over a two-year contract.
Materials and resources **13**	Points for: providing an area for recycling waste materials; diverting 50% or 75% of construction, demolition, and land-clearing waste from landfill; using 5% or 10% of salvaged or reused materials; using 5% or 10% of total value of materials from reused materials and products; using 5% or 10% of total value of materials from post-consumer recycled content; using 20% or 50% of building materials that are manufactured within 500 miles; using products made from plants that are harvested within a 10-year cycle for 5% of the value of all building materials; using 50% of wood-based materials from Forest Stewardship Council-certified forests. For reused buildings, maintain 75% or 100% of existing building structure and shell or 100% of shell/structure and 50% of non-shell areas (interior walls, doors, etc.).
Indoor environmental quality **15**	Must meet minimum requirements of ASHRAE 62-1999. Must prohibit smoking in the building or provide ventilated smoking rooms verified by tracer gas testing (ASHRAE 129-1997). Points for: installing a permanent CO_2 monitoring system; designing ventilation systems that result in air-change effectiveness of at least 0.9 (ASHRAE 129-1997); developing an IAQ management plan for construction and pre-occupancy phases; using adhesives and sealants with VOC content less than that required by SCAQMD Rule #1168 and sealants used as fillers that meet or exceed Bay Area Quality Management District Reg. 8, Rule 51; using paints and coatings whose VOC/chemical component limits do not exceed Green Seal Standard GS-11; using carpet systems that meet or exceed Carpet & Rug Institute Green Label IAQ Test Program; using wood and agrifiber products containing no added urea-formaldehyde resins; designing to minimize pollutant cross-contamination of occupied areas; providing an average one operable window and one lighting control zone per 200 sq. ft. for occupied areas within 15 ft. of the perimeter wall; providing individual controls for airflow, temperature, and lighting for 50% of occupants; complying with ASHRAE 55-1992, Addenda 1995, for thermal comfort standards; installing a permanent temperature/humidity monitoring system; achieving a Daylight Factor of 2% (excluding direct sunlight penetration) in 75% or 90% of all space occupied for critical tasks.
Innovation and design process **5**	Points for: exceptional performance above the requirements set by LEED or for innovative performance in green building categories not addressed by LEED; having a LEED-accredited professional as a principal participant.

number of environmentally conscious corporations have also embraced the program, but they, too, see their investment in more long-range terms than is the case for the speculative market.

Finally, while LEED is supposed to produce "the world's greenest and best buildings," the process does not in and of itself guarantee optimal results. A study by the University of Michigan's Center for Sustainable Systems, produced under the auspices of the National Institute of Standards & Technology, found LEED wanting: "While LEED appears to be accomplishing the goals of an eco-labeling program that is [successful] as a marketing and policy tool," the authors wrote, "it is not as successful at being a comprehensive methodology for assessment of

Version 2.1 of LEED-NC (for new construction and major renovations) provides significant administrative updates to the LEED system, notably the addition of letter templates that cut red tape in submitting projects for LEED certification.

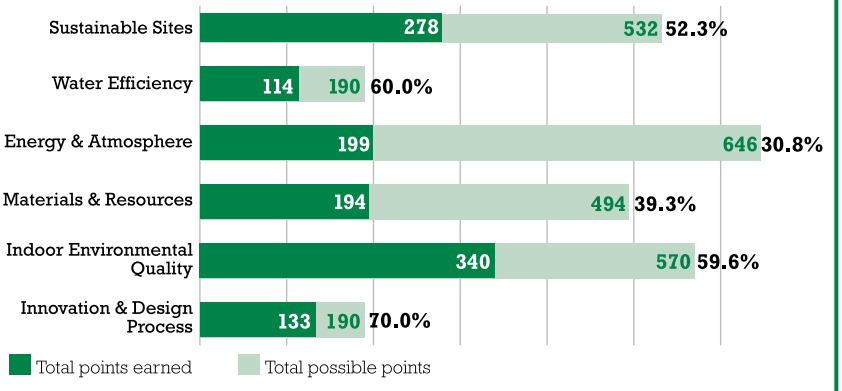
Where the points are in LEED

Category	Possible points	(% of total)
Sustainable sites	14	(20%)
Water efficiency	5	(7%)
Energy/atmosphere	17	(25%)
Materials/resources	13	(19%)
IEQ	15	(22%)
Innovation	4	(6%)
Accredited professional	1	(1%)
Total	**69**	(100%)

Source: USGBC

Total points earned out of total possible points

(of 38 LEED-NC projects)



Source: Rob Bolin, P.E., LAP, Syska Hennessy Group, 2003

Energy/atmosphere and IEQ account for nearly half (46.3%) of the 69 possible points in the LEED rating system (above). Early experience shows that only 30.8% of possible energy and atmosphere credits were earned in the first 38 LEED projects (right).

[3] "Evaluation of LEED Using Life Cycle Assessment Methods," Chris W. Scheuer and Gregory A. Keoleian, University of Michigan Center for Sustainable Systems, September 2002, p. 93.

environmental impacts."[3] (It should be noted, however, that this report analyzed LEED from the perspective of life cycle assessment, a standard to which the early program did not aspire.) Clearly, it takes more than following a checklist to create a well-designed, fully integrated sustainable building.

Top LEED point-getters

(of 38 LEED-NC projects)

# of projects earning this point (of 38)	LEED credit	Description
38	ID 2	Employ a LEED accredited professional
38	MR 5.1	Use 20% of building materials manufactured within 500 miles
35	EQ 4.3	Use low-emitting carpets
34	WE 1.1	Install high-efficiency irrigation or reduce potable water use for waste by 50%
33	SS 4.2	Provide bicycle storage and changing facilities for x% of occupants
33	MR 4.1	Recycled content
33	EQ 4.1	Use low-emitting adhesives
33	ID 1.1	Various innovations to enhance sustainability
30	SS 1	Site selection
30	EA 1.1	Reduce design energy cost by 15%
30	MR 2.1	Recycle or salvage 50% of construction and land debris waste
30	EQ 4.2	Use low-emitting paints and coatings
30	EQ 8.2	Provide a direct line of sight to windows from occupied spaces
28	SS 5.2	Exceed local zoning open-space requirements by 25%
28	WE 1.2	Utilize water-efficient landscaping
28	EA 1.1	Reduce design energy cost by 30%

Source: Rob Bolin, P.E., LAP, Syska Hennessy Group, August 2003

All 38 of the first group of LEED projects grabbed the "low-hanging fruit" –hiring a LEED-accredited professional and using locally manufactured products and materials.

There is also evidence that many first-generation LEED projects went after easy points, the so-called "low-hanging fruit." An analysis of 38 early LEED projects (see "Top LEED point-getters") shows that all 38 got points for hiring a LEED-accredited professional and using locally manufactured materials, but only a few took on more demanding challenges, such as brownfield redevelopment or significant (more than 50%) energy reduction (see chart, p.11).

On the other hand, even just a few years' experience shows that participation in LEED does encourage design teams to consider a wide range of environmental issues; in the hands of skilled and experienced practitioners, LEED-rated buildings should invariably turn out to be more environmentally beneficial than conventionally designed equivalents. Building Teams that take a holistic approach from the start of development, rather than adding LEED elements as an afterthought, can and do produce more fully integrated buildings, often without significant added cost.

A number of more substantive and complex issues that are being addressed by the LEED committee and USGBC staff include the following:

- How to account for regional differences (climate, water, sun, energy resources) in the context of a national program.
- Whether –and if so, how –to establish a more rationale "weighting" of points. Under LEED 2.1, "low-hanging fruit" efforts that produce minimal energy or environmental benefits, such as providing bicycle racks for building occupants, earn the same points as much more intensive and beneficial efforts, such as installing a "green roof." A report from the Federal Environmental Executive states that, while LEED has

certain prerequisites, "these are often de minimus. As a result, it is possible under the LEED rating system to perform relatively poorly (or relatively average) in some areas and still become certified."[4]

• Perhaps most difficult of all, introducing life cycle assessment into the structure of LEED, so that the long-term performance of building components and the structure itself is given greater consideration than under the current methodology. Research for this effort is already underway with the Life Cycle Inventory study being conducted by the Athena Institute for the National Renewable Energy Laboratory.

Other LEED-related developments to be anticipated include the following:

Least-employed LEED points

(of 38 LEED-NC projects)

# of projects earning this point (of 38)	LEED credit	Description
1	EA 1	Reduce design energy cost by 60%
1	MR 3.2	Use salvaged or reused materials for 10% of materials usage
2	MR 6	Use rapidly renewable materials
2	EA 1	Reduce design energy cost by 55%
2	EA 1	Reduce design energy cost by 50%
3	SS 3	Brownfield redevelopment
3	EA 2.1	Supply 5% renewable energy
3	EA 2.2	Supply 10% renewable energy
3	EA 2.3	Supply 20% renewable energy
7	SS 2	Meet local urban development density goals
7	EQ 6.2	Provide individual IEQ controls for 50% of occupants
8	WE 2	Innovative wastewater technology

Source: Rob Bolin, P.E., LAP, Syska Hennessy Group, August 2003

The early crop of LEED projects shied away from the more difficult credits. Only one project reduced design energy cost by 60%.

• More and more professional firms will become actively involved in LEED –and sustainable design in general –as a matter of survival. Although our exclusive White Paper Survey indicates that many firms are assuming a wait-and-see attitude, it is likely that more of them will seek to gain experience in this arena for fear of being left behind. Aggressive firms may be able to stake out a niche position in this field and gain market share. As firms grow in experience, they will form alliances with like-minded partners in other disciplines –design firms with certain contractors, those contractors with certain engineering firms, and so on –to the point where, for many professionals, the practice of sustainable design will become routine and ingrained in their corporate culture.

• Technologies and products will continue to improve, although in the short term confusion or doubt about what constitutes "greenness" may linger. Product and systems choices should continue to grow richer as the market responds to ever-growing demand from designers, contractors, and owners.

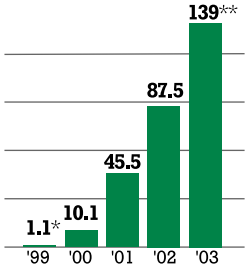
• LEED accreditation and training will, of necessity, become more demanding, as greater emphasis is placed on commissioning to document that the design did indeed produce the intended energy and environmental benefits. Analysis of costs versus benefits will become even more rigorous and extend deeper into long-term building operations, at an increasingly large physical and geographical scale.

• The demand for "proof of the pudding" will accelerate as LEED and sustainable design become more complex. "We're selling the promise of a better building, but there has to be a specific causal link, where 'green building' equals 'specific benefit,'" says Alan Traugott, of Flack + Kurtz Consulting Engineers and a member of the *Building Design & Construction* editorial board.

As of October 2003, 948 projects were registered with LEED, and it is estimated that for every LEED-registered project in the works, architectural firms are designing two or three times as many unregistered projects that meet or exceed LEED guidelines. Even real estate investment trusts are starting to undertake LEED-registered commercial office projects. "When the REITs start doing it, that should get everyone's attention," says William Browning, of the Rocky Mountain

Growth of LEED program

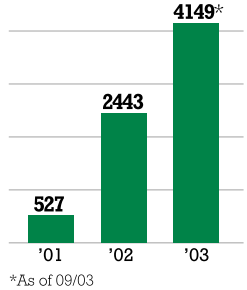
Square footage under LEED registration (in millions)



*Version 1.0 pilot program
**Includes pilot programs for LEED-CI and LEED-EB (as of 09/03)
Source: USGBC

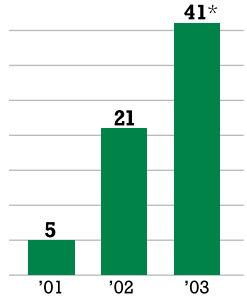
LEED-accredited professionals

(cumulative total)



*As of 09/03
Source: USGBC

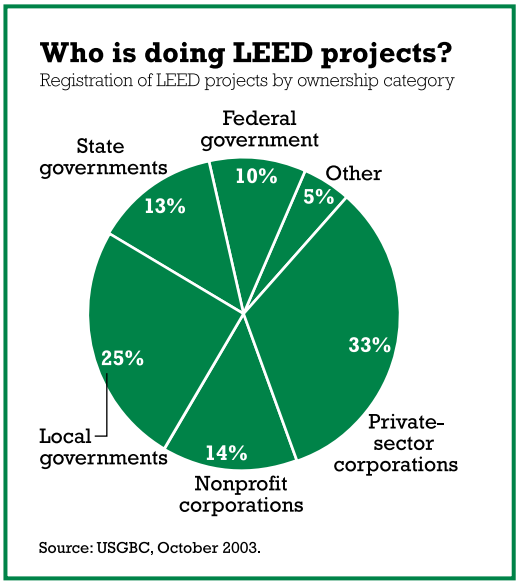
LEED-certified projects



*As of 10/03
Source: USGBC

[4] In "The Federal Commitment to Green Building: Experiences and Expectations," OFEE, September 18, 2003.

Institute. As Malcolm Lewis, chair of the LEED Technical & Scientific Advisory Committee, and Nigel Howard, VP for LEED and International Programs, have noted, LEED has moved beyond the early adopter and innovation stages and is rapidly transitioning toward the mainstream.[5]



Clearly, LEED is a work in progress. Nearly a decade ago, the U.S. Green Building Council took up the sustainability flag when more established standard bearers relinquished the field. Today, as the USGBC opens the doors on its second annual "Greenbuild" exposition and conference, the organization is in the midst of an almost herculean effort to raise the performance standards of LEED. It is anticipated that LEED 3.0, scheduled to come before the membership in 2005, will significantly raise the bar on performance standards required of new buildings seeking certification, with greater emphasis on life cycle assessment and keyed to an international standard such as ISO 14001. Looking ahead, LEED will be breaking new ground in commercial interiors, existing buildings, core and shell, and low-rise residential, as well as in specific applications for schools, hospitals, laboratories, retail stores, and multi-building campuses. Such a vast and ambitious agenda has inspired thousands of individuals to participate nationally and in more than 20 chapters around the country.

[5] "The Future of LEED," Malcolm Lewis and Nigel Howard, *Environmental Design+Construction*, July/August 2003.

Steps on the road to LEED 3.0

The following issues merit consideration by the LEED committee and the USGBC membership in their review of the next generation of LEED:

- LEED grants one point (MR 5.1) if 20% of building materials and products used are manufactured within a 500-mile radius of the site, and another point (MR 5.2) if 50% of materials and products used fall within that circle. This credit is described as supporting regional economies and reducing environmental impacts from transporting products over long distances, but the original intent was to encourage the use of materials that fit regional contexts —adobe or stucco in the Southwest, say, or brick in the Midwest. In its current form, the credit works against products and materials that may be more environmentally benign and contain less embodied energy than locally derived products or materials.
- The credit for hiring a LEED-accredited professional may have served a purpose in the early days of the program, when there were no 'LAPs,' but with more than four thousand now accredited, this point seems superfluous.
- A point can be earned for providing 'alternative-fuel vehicles" and preferred parking for 3% of occupants or installing 'alternative-fuel refueling stations" for 3% of total parking (SS Credit 4.3). Most building owners who want the LEED point do so by installing plugs for electric vehicles —even though there are only 1744 on-road EVs in North America, according to the On-Road Electric Vehicle Inventory. This credit should instead provide incentives for the use of hybrid vehicles by tenants. SS Credit 4.2 for providing bicycle racks and showers is also viewed as an example of a credit that produces relatively little benefit.
- The Office of the Federal Environmental Executive calls the current benchmark for Minimum Energy Performance (EA Prerequisite 1, EA Credit 1), ASHRAE 90.1-1999, 'a standard that some energy experts consider inadequate and unworkable."[4] A more rigorous standard should be established. The OFEE also recommends adding prerequisites for ensuring water conservation and reuse.
- The OFEE report also questions LEED's indoor environmental quality prerequisites keyed to ASHRAE's outdoor ventilation rate (EQ Prerequisite 1), which is 'principally the code minimum," and LEED's prerequisite against second-hand smoke (EQ Prerequisite 2), since 'most buildings now have a 'no smoking' policy."[4] Clearly, the IEQ requirements of LEED 2.1 need shoring up.

WHERE OUR READERS STAND ON SUSTAINABILITY

As part of our research for this White Paper, the editors asked the Reed Research Group, Newton, Mass. (a division of our parent company, Reed Business Information), to conduct a survey of *Building Design & Construction*'s readers. The 76,001 architects, contractors, engineers, and owners who receive *BD&C* comprise a representative cross-section of the U.S./Canadian design, construction, and ownership community specializing in commercial, industrial, and institutional buildings.

The editors wanted to know: What do our readers think of green? And how invested are they and their firms in sustainable design and construction?

Although the study required answers to as many as 92 questions, 498 professionals devoted about 20-30 minutes online to complete the survey (itself something of an indication of interest in the topic).

In general, the study revealed that a core group of professional firms and organizations have either embraced sustainability wholeheartedly (9% of 498) or are starting to do so (33%), with another two-fifths (39%) stating they were inexperienced but interested.

Of the 332 respondents who had some experience with sustainability, nearly half (49%) were at firms that had actu-

Survey objectives

The objectives of the study were:

- To determine how respondents view key issues related to sustainable design
- To measure how active they and their firms were in green building
- To discover any barriers that may exist toward implementing sustainable design
- To gauge how they get information about "green" products (see p. 26)

Methodology

In August and September 2003, Reed Research Group conducted an exclusive study to determine perceptions and actual activity related to sustainability by recipients of *Building Design & Construction*.

A scientifically drawn sample of 10,000 recipients of *BD&C* was invited to take the survey on the Internet. Eligibility to enter a drawing for a $200 Sharper Image certificate was offered as an incentive. In total, 498 respondents completed the survey.

For complete survey results, go to *www.bdcmag.com*.

Professional service/ business category

Architectural firm	23%
Architectural/engineering firm	12%
Engineering firm	11%
Government agency	9%
Design/build firm	7%
General contractor	6%
Engineering/architectural firm	5%
Manufacturer/product vendor	5%
Owner/developer	5%
Facility manager	4%
Consultant	3%
Construction management firm	3%
University/academia	2%
Project management	1%
Other	4%

BD&C White Paper Survey, 09/03 Base: 495
Source: Reed Research Group

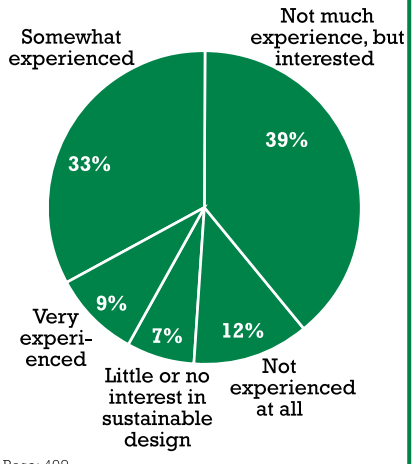
Firm project activity

Commercial	74%
Institutional	69%
Industrial	54%
Multifamily housing	39%
Single-family housing	33%
Other	11%

BD&C White Paper Survey, 09/03 Base: 494
Source: Reed Research Group

Respondents to the *BD&C White Paper Survey* came from a wide variety of firms in the commercial, industrial, institutional, and residential construction field. More than a fourth (27%) were with organizations of 500 or more employees, with 45% having 10 or more years' tenure with their firms.

Firm's experience in sustainable design



Base: 498

BD&C White Paper Survey, 09/03
Source: Reed Research Group

A sizable percentage of respondents (42%) were at firms that had at least some experience in sustainable design, with many more (39%) expressing interest in it.

Measurable experience in sustainable design

Firm has attempted at least one project based on green-building principles	49%
Firm has completed at least one project based on green-building principles	34%
Others in firm are LEED-accredited	25%
Firm has sought LEED certification for at least one project	14%
Firm has achieved LEED certification for at least one project	11%
Respondent is LEED-accredited	4%

BD&C White Paper Survey, 09/03 Base: 332
Source: Reed Research Group

Firm's response to sustainable design market

Encouraged staff members to obtain expertise in sustainable design	57%
Made an effort to green-build at least one project	46%
Hired outside green-building experts as consultants	19%
Created new marketing materials	16%
Recruited professionals with green-building experience	9%
Created a new division or profit center	5%
Other/no activity	10%

BD&C White Paper Survey, 09/03 Base: 383
Source: Reed Research Group

Respondents reported that their firms were taking a wide variety of actions in sustainable building. Nearly half of those responding (49%) had tried at least one green project, and a clear majority (57%) had encouraged staff to learn more about sustainable design.

ally tried to develop at least one green project, and 34% of the total had actually completed such a project. One-fourth of this group (25%) worked at firms that had LEED-accredited professionals, although only 4% of the respondents themselves were accredited.

A substantial minority (18%) work at organizations that belong to the U.S. Green Building Council. Virtually all respondents (97%) saw the green building phenomenon growing, although to varying degrees. Three-fifths saw themselves as being either significantly more active (16% of 489) or somewhat more active (44% of 489) in green building in the next few years, while about one-fourth (26% of 489) said their future level of activity would be "about the same as today."

The generally positive data about the respondents' attitudes toward sustainability were balanced by a certain degree of skepticism as to the market's acceptance of green building. A substantial minority said sustainable design was viewed as adding significantly to first costs (44% of 490), while 42% (of 490) said they felt the market was not interested in sustainability or not willing to pay a premium to achieve it.

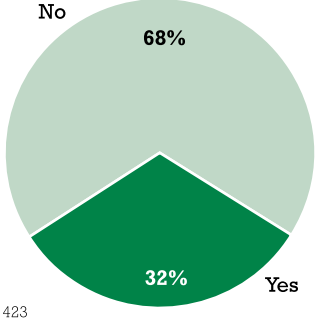
A clear majority (58% of 486) had been rebuffed in efforts to persuade clients or colleagues to try a green project. Of those who had been thwarted, 41% (of 260) said it was primarily due to a perceived lack of interest in sustain-

able design or because sustainability was not required (41% of 260).

And while about one-third of respondents (32% of 423) said sustainable design experience had helped attract new clients, the majority of this group (52% of 126) said green building experience had brought in only a minor amount of new business.

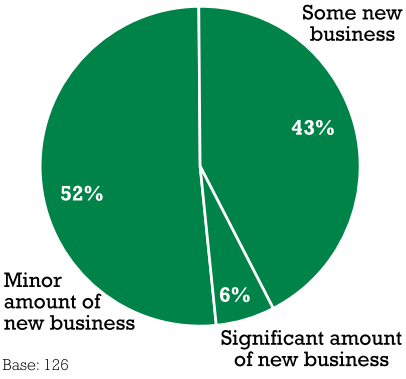
Despite these setbacks, most respondents seemed almost to be crying out for unbiased, documented proof to justify supporting sustainable design. A clear majority (59% of 485) said that independent validation of the costs and benefits of green buildings would go far toward promoting sustainable design; an equal number (59% of 485) asked for

Has sustainable design experience helped attract new clients or projects?



Base: 423

If yes, how much?



Base: 126

BD&C White Paper Survey, 09/03
Source: Reed Research Group

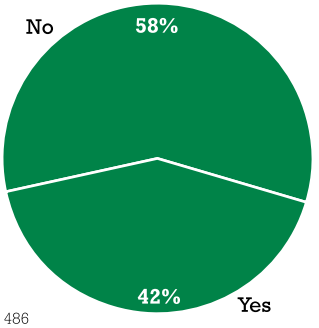
About a third (32%) of respondents said "being green" had helped find new clients, although the amount of work was limited for those who had obtained commissions.

Perceived barriers to sustainable design

'Adds significantly to first costs"	44%
'Market not interested or not willing to pay a premium"	42%
'Hard to justify, even on the basis of long-term savings"	35%
'Not comfortable with new ideas or technologies"	19%
'Too complicated/Too much paperwork"	16%
'Not applicable/Don't know"	24%
'Sustainable design not seen as a barrier"	5%

BD&C White Paper Survey, 09/03 Base: 490
Source: Reed Research Group

Have you tried to persuade clients or others in your firm to attempt a green project?



Base: 486

BD&C White Paper Survey, 09/03
Source: Reed Research Group

If yes, what happened?

Looked at sustainable design principles but withdrew due to costs or uncertainty	40%
Incorporated LEED elements in a project but did not register it	37%
Working on a sustainable design project	35%
Completed a sustainable design project	20%

BD&C White Paper Survey, 09/03 Base: 205
Source: Reed Research Group

If no, why not?

'Perceived lack of interest by client or firm's management"	41%
'Not required"	41%
'Not sure of payoff"	30%
'Insufficient budget"	29%
'Insufficient staff"	16%

BD&C White Paper Survey, 09/03 Base: 260
Source: Reed Research Group

more case studies of successful green projects. Most respondents (57% of 485) thought that additional training and education was called for; in fact, a substantial group (57% of 383) said their firms had encouraged staff members to gain expertise in sustainable design.

One respondent summed up the feelings of many who completed the survey: "Green building is the right direction for construction but also should be used with common sense. Spending millions extra with insufficient payback will only hurt the green building movement."

When asked a wide-ranging set of attitudinal questions about green building (see below), respondents expressed their firmest support for the use of life cycle analysis in evaluating products for greenness (4.22 on a 5-point scale).

What could be done to more effectively promote sustainable design?

Independent validation of the costs and benefits of green buildings	59%
More case-study descriptions of successful projects	59%
More training/education programs	57%
Greater reliance on life cycle analysis in evaluating products	48%
Directory of independently rated green products	45%
Better marketing materials	44%
Greater inclusion of building industry trade groups in setting standards	35%
No reforms or changes needed	2%

BD&C White Paper Survey, 09/03 Base: 485
Source: Reed Research Group

Attitudes and opinions related to sustainability issues

Green products/building materials should be evaluated on the basis of life cycle analysis, long-term disability, and maintenance, not just environmental impact and energy savings.	4.22
Owners should receive tax and/or other financial incentives for building sustainable buildings.	3.86
Green buildings significantly reduce energy costs.	3.76
Green buildings are healthier for occupants than conventional buildings.	3.68
State and local building code authorities should adopt sustainability standards for new construction.	3.57
LEED certification places too much emphasis on gaining points and not enough on overall design considerations.	3.54
The green building movement in the U.S. and Canada lags behind that of other countries.	3.49
The Federal government should devote more funding and support to green building technology.	3.41
Green buildings save money by reusing and recycling materials.	3.34
Building a structure using sustainable design improves the overall quality and design of the building.	3.32
The current LEED certification system is too restrictive.	3.31
Green buildings enhance worker productivity and job satisfaction.	3.22
Green buildings have a higher market value than conventional buildings of the same type and command lease or sales premiums.	3.04
My firm or organization will be left behind if it does not become active in green building and sustainable design.	3.03
Green buildings enhance occupying firms' recruitment and retention of employees.	2.99
Green buildings can reduce lawsuits and liability claims against building owners.	2.95
Green buildings cost no more to build than conventional buildings.	2.74
'Natural'building materials are superior to man-made or synthetic products and building materials.	2.69

BD&C White Paper Survey, 09/03 Source: Reed Research Group

INTERNATIONAL GREEN BUILDING DEVELOPMENTS

'When it comes to global issues, the important factor is the reduction of greenhouse gases."

—Nils Larsson, International Initiative for a Sustainable Built Environment

The United States is by no means the only participant in the green building arena. Europeans have been thinking green for a long time.

Environmental building assessment got its start in the United Kingdom. It was there, more than 80 years ago, that the government established the Building Research Establishment to promote building-related research. BRE was later transformed into a for-profit organization that is wholly owned by the Foundation for the Built Environment.

BRE's Building Research Environmental Assessment Method (BREEAM), introduced in 1990, was the first environmental assessment tool to be used internationally. It is designed to analyze the environmental performance of both new and existing buildings. BRE characterizes BREEAM as the world's most widely used means of reviewing and improving the environmental performance of office buildings. BREEAM is regarded by the UK's construction and property sectors as the measure of best practice in environmental design and management, according to BRE. BREEAM has also been used as a basis for similar programs in New Zealand, Australia, and Canada.

In the past year, about 70 office buildings have been evaluated under BREEAM, a number that is consistent with previous years. BRE estimates that these buildings represent approximately 25% of the total floor area of office buildings constructed in the U.K. during that period. Major U.K. office building developers use the voluntary BREEAM methodology in their project planning.

BREEAM's proponents consider it to be a rigorous, holistic methodology, clearly defined in terms of criteria; its detractors say it is overly cumbersome and complex. BREEAM provides a significant amount of detail about materials and their embodied impacts and prioritizes the relative importance of individual issues in the form of a final score; credits are awarded in nine categories (see chart). Individuals trained and licensed by BRE conduct the building assessments.

But BREEAM is hardly the only assessment method or evaluation resource in Europe. Eco-Quantum, a software program that expresses environmental performance on the basis of life cycle analysis, has been developed by IVAM, a research agency affiliated with the University of Amsterdam, under the direction of Jaap Kortman.

Eco-Quantum, which is currently available only in Dutch, first became available in 1999. The program enables architects to assess overall environmental performance by combining such factors as the effect on energy consumption of installed equipment, the use of materials, water consumption, indoor climate, and building location. Eco-Quantum permits large, diverse quantities of information on building environmental performance to be converted for the use of all parties in the construction process.

Five European countries, including France, Germany, and the Netherlands, have joined efforts in Project Regener to define a common methodology for applying life cycle analysis to buildings. A database of building materials and elements has been collected; inventories for more than 150 building materials have been established, with the cooperation of their manufacturers.

Another life cycle analysis methodology is the Eco-invent 2000 database from the Swiss Centre

How the UK's BREEAM system works

Category	Number of credits	Value/credit	Maximum score
Management	9	1.67	15
Health and well-being	15	1.00	15
Energy	17	0.83	14
Transport	13	0.83	11
Water consumption	6	0.83	5
Materials	11	0.91	10
Land use	2	1.50	3
Ecology	8	1.50	12
Pollution	11	1.36	15
Total			100

Scoring system: Pass **25-40** Good **40-55** Very Good **55-70** Excellent **70-100**

BREEAM ratings are based on the total score earned by a building. For example, a building with 6 Management Credits would earn a score of 10 for that category (6 x 1.67 = 10). Scores in Column 3 are totaled, and a rating from "pass" to "excellent" is assigned. Thus, a building with a score of 41 would be rated "good." Buildings that score less than 25 fail. BREEAM has been in place in the United Kingdom since 1990.

for Life Cycle Inventories. It covers a broad range of building materials, as well as energy and transport processes. The ecoinvent 1.0 database, introduced this past September, is a dataset of over 2,500 processes. It is being licensed by the center in partnership with the Swiss Federal Institutes of Technology (ETH) at Zurich and Lausanne, the Paul Scherrer Institute, the Swiss Federal Laboratories for Materials Testing and Research, the Swiss Federal Institute for Environmental Science and Technology, and the Research Station for Agroecology and Agriculture.

Product labeling programs have also been established in a number of European countries to promote sustainability. Germany's Blue Angel program, introduced in 1977, was the first such national ecolabeling program in Europe. It covers all types of products, not only those used in building construction. Blue Angel evaluates multiple environmental factors, including hazardous substances, emissions, pollution prevention, and safety. The Northern European countries of Norway, Sweden, Finland, Iceland, and Denmark participate in a voluntary ecolabeling program, Nordic Swan, which was introduced in 1989.

An emerging nongovernmental organization at the international level is the World Green Building Council, founded in 1999. Members include green building councils from Australia, Canada, India, Japan, Korea, Spain, and the U.S. At its most recent meeting, which was scheduled to be held in October 2003 in Sydney, attendees were to work on guidelines for creating Green Building Councils in other countries.

WGBC founder David Gottfried (also a cofounder of the USGBC) believes that sustainability efforts at the international scale have to be sensitive to local conditions –climate, culture, codes, standards, and social factors relating to the particular region and nation. A building evaluation system that does not put major emphasis on water conservation, for example, obviously would not work in regions where water is scarce.

The need for a global method of rating buildings, particularly one that focuses on greenhouse gas emissions related to buildings, is being addressed by the International Initiative for a Sustainable Built Environment.

The iiSBE, headquartered in Ottawa under the direction of Nils Larsson, is managing the Green Building Challenge. This is a consortium of about 20 countries that is developing an environmental performance assessment system intended to produce a global standard that facilitates the exchange of information between countries. The Green Building Challenge assessment method defines, structures, and scores a range of collectively agreed performance criteria –the Green Building Challenge assessment framework — using a software program called the GB Tool.

The method –which iiSBE says has already influenced domestic rating systems in several countries, including Austria and the U.K., and is being adopted in northern Italy –is designed to reflect the widely different priorities, building traditions, and cultural values of individual countries and regions, by enabling national teams to adjust values and weightings. The project, which was launched in 1998, has completed two development cycles of two years each. It will next be reviewed at a meeting to be held in Tokyo in 2005.

According to Larsson, "You can talk about lower utility costs and improved indoor air quality, but when it comes to global issues, the important factor is the reduction of greenhouse gases." For countries such as China and India, where sustainability is just starting to gain a foothold, this issue is paramount.

Canada joins LEED program

In August, Canada became the first country outside the U.S. to become a LEED licensee. At that time, the Canadian Green Building Council signed an agreement with the USGBC, resulting in the development of LEED-Canada. A LEED-British Columbia document has already been approved by the USGBC. Documents for the remaining Canadian provinces, reflecting their respective climate zones, are expected to follow. Many Canadian building projects are already being developed to LEED standards. The application of LEED is expected to overtake BREEAM Canada, which has been used primarily by public agencies, and BREEAM Green Leaf, a simpler program that is more suited to smaller buildings.

Milestones in Sustainability

- 6 April 1993
  USGBC founded
- 21 April 1993
  Greening of the White House
- 18-21 June 1993
  UIA/AIA World Congress of Architects, Chicago
- 29 June 1993
  President's Council on Sustainable Development established by Executive Order 12852
- 1994
  Greening of Grand Canyon National Park
- 1994
  Building Environmental Performance Assessment Criteria (BEPAC), Canada
- 1995
  Greening of the Presidio
- 1995
  Commercial Green Building Program, Austin, Texas
- 3-14 June 1996
  Habitat II, UN Conference on Human Settlements, Istanbul
- 1996
  Greening of the USDOE Headquarters
- 1996
  Greening of Yellowstone National Park
- 1996
  The Sustainable Building Technical Manual (Public Technology, Inc.)
- 1997
  Whole Building Design Guide (WBDG) created

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THE FEDERAL ROLE IN GREEN BUILDING

Federal agencies, both civilian and military, were among the earliest advocates of green building nationally. Today, U.S. government buildings comprise about 10% of the projects registered in the USGBC's LEED program.

Federal agencies and departments have also funded research studies, conferences, and program initiatives to support sustainable development. Following is a condensation of Federal "green" activities:

Sustainable design across the federal landscape –Civilian Programs

Agency	Statistics	Policies and Practices
General Services Administration	▪ Manages more than 8,300 buildings, comprising 330 million square feet. ▪ This includes 1,700 government-owned buildings and 6,500 buildings leased from private sector. ▪ About 90% of building space is for offices.	▪ All GSA buildings must be LEED certified; a Silver rating is encouraged. ▪ At least 70 GSA-owned facilities and one leased building have earned the Energy Star Buildings label. ▪ Partnered with Carnegie Mellon University to create the Adaptable Workplace Lab, a 10,000-sq.-ft. space at GSA's D.C. headquarters where the impact of green technologies on employee productivity and energy and environmental performance are measured. ▪ Several GSA facilities have achieved LEED certification, including the $16 million, 49,000-sq.-ft. U.S. Courthouse and Federal Building, Youngstown, Ohio; the $50 million, 447,000-sq.-ft. Social Security Administration Annex, Baltimore, Md.; and the Alfred A. Arraj U.S. Courthouse, Denver. ▪ Sponsoring research to determine any incremental costs for LEED-rated GSA buildings. ▪ Other key projects: 179,000-sq.-ft. border station, Sault Saint Marie, Mich.; $144 million, 575,000-sq.-ft. Federal building, San Francisco; 179,000-sq.-ft. Federal building, Oklahoma City. ▪ Sponsoring Workplace 20•20 initiative.
National Aeronautics and Space Administration	▪Operates 2,824 buildings, comprising more than 44.5 million square feet. ▪Nearly all NASA buildings are owned; only 33,000 square feet is leased space.	▪Recently established goals for facility projects to meet LEED Silver rating. ▪ Encourages Building Teams to strive for LEED Gold, if cost effective. ▪ Provides guidance for cost- and energy-efficient, renewable energy, and water conservation measures in NASA facilities. ▪ Two Energy Star Buildings: a child development center at Kennedy Space Center, Fla.; office building at Stennis Space Center, Miss. ▪ Projects registered with LEED include: the 139,000-sq.-ft., $23 million Marshall Space Flight Center, Huntsville, Ala. (completion: Fall 2004); the 350,000-sq.-ft., $65 million Goddard Space Flight Center in Md. (2007); and the 189,000-sq.-ft., $26.8 million Operations Support Building II at Kennedy Space Center (Fall 2004).
National Park Service, U.S. Department of the Interior	▪ Includes 385 parks located on more than 80 billion acres.	▪ All construction projects valued at more than $500,000 must submit a LEED checklist to the NPS Design Board; LEED certification not required. ▪ NPS first implemented sustainable design concepts in 1993. ▪ First major program, Green Energy Parks, established in 1999. ▪ Key projects: the 7,600-sq.-ft. Zion National Park Visitor Center in Springdale, Utah; Thoreau Center for Sustainability, San Francisco.
U.S. Department of Energy	▪Owns or leases more than 12,000 buildings with 96 million square feet. ▪ Space is divided into laboratory (23%), production (34%), office (14%), and other (29%), such as storage and service space. ▪ About 20% of building inventory has been declared surplus because of changing missions.	▪DOE Order 430.2A of 2000 directs the application of sustainable design principles to new construction and renovation projects. ▪ Offers seed funding to DOE sites that include such practices in their construction programs. Participating sites include Lawrence Livermore National Laboratory, Idaho National Engineering and Environmental Laboratory, Sandia National Laboratory, National Renewable Energy Laboratory, and Oak Ridge National Laboratory. ▪ Several sites, including LBNL, have become pilot partners in the EPA/DOE Laboratories for the 21st Century program. ▪ The Central Supply Building at Argonne National Laboratory-East is the first DOE building certified under the LEED system. ▪ Lab buildings at LBNL and NREL are undergoing LEED certification. ▪ Operates Building Technology Center research facility at ORNL and Indoor Environment Dept. at LBNL. ▪ Established Interagency Sustainability Working Group (2001), led by Federal Energy Management Program.

Source: *"The Federal Commitment to Green Building,"* Office of the Federal Environmental Executive, September 18, 2003

Sustainable design across the federal landscape—Civilian Programs

Agency	Statistics	Policies and Practices
U.S. Department of Health and Human Services	▪Manages 25.4 million square feet of space. ▪About 90% of space is classified as energy-intensive facilities, including laboratories, hospitals, health clinics, and animal housing. ▪Of HHS's 11 divisions, six manage property: Centers for Disease Control and Prevention, Food and Drug Administration, Indian Health Service, National Institutes of Health, Office of the Secretary, and Program Support Center.	▪In 2000, HHS incorporated new directives into existing energy and environmental management programs. ▪CDC, FDA, and NIH mandate the use of life cycle costing, energy-efficient products, analysis of renewable energy systems, and sustainable design principles included in LEED and the Whole Building Design Guide. ▪ New construction projects aiming for LEED certification include CDC's Clifton Road Campus Building 21 laboratory, Atlanta. ▪ Other key projects: NIH's Louis Stokes Laboratory, Bethesda, Md.; PSC's Parklawn Building, Rockville, Md., which saves $211,000 in energy costs and 6.3 million gallons of water annually.
U.S. Department of State	▪Controls more than 15,000 buildings with a total of 59.2 million square feet. ▪Building types include residential, offices, and embassies. ▪Owns just 30% of space; the rest is leased.	▪The State Dept.'s Architectural Design Branch encourages all new office buildings to achieve LEED certification. ▪ Includes green building language in its requests for proposals and in its Standard Embassy Design contract requirements. ▪ Three new office buildings are being developed to the LEED Certified standard. ▪ Embassies under construction in Sofia, Bulgaria; Abidjan, Ivory Coast; Yerevan, Armenia, incorporate green design principles.
U.S. Environmental Protection Agency	▪ Occupies more than 140 buildings comprising 8.9 million square feet. ▪ Owns only 17% of its facilities; the rest are owned or leased by GSA.	▪ Requires LEED Silver rating for significant building projects, but strives for Gold or Platinum. ▪When leasing space, EPA employs green lease riders (amendments to traditional lease language) that emphasize energy, water, and resource efficiency. ▪ Supports the EPA/DOE Laboratories for the 21st Century program, which assists Federal government and private entities in the design and operation of green lab facilities. ▪ New England Regional Lab in North Chelmsford, Mass., achieved LEED Gold.

Sustainable design across the federal landscape—Military Programs

Agency	Statistics	Policies and Practices
Department of Defense	▪ Operates 621,850 buildings with 2.2 billion square feet. ▪ Accounts for two-thirds of all Federal buildings. ▪ Building types range from military bases to shipyards to air hangars.	▪ Initiated the Unified Facilities Criteria Program based on the Whole Building Design Guide, which incorporates sustainable design practices. ▪ Created the Defense Environmental Network and Information Exchange (DENIX 2002) to serve as a central platform for information on environmental, safety, and occupational health issues. ▪ The Pentagon Renovation Program is one DoD's largest undertakings incorporating sustainable design practices.
Department of The Navy	▪ Total facility space is 612 million square feet, which includes facilities for the Navy and Marine Corps. ▪ Leases 57.5 million square feet of space. ▪ Accounts for 7% of all DoD locations. ▪ In 2001, Navy had 91 new building construction projects. ▪ Second only to the Army in terms of size and extent of property portfolio.	▪ Adopted the Whole Building Design Guide in 1997. ▪ Adopted LEED as a required tool and metric, but LEED certification is not required. ▪ DoN applies sustainable design practices to all projects, as long as there's no increase in first cost or design cost. ▪ Before securing a DoN contract, design firms must demonstrate 'knowledge and demonstrated experience in applying sustainability concepts ... through an integrated design approach." ▪ Key projects: LEED-certified, $55 million Bachelor Enlisted Quarters at Great Lakes Naval Training Center, Ill.; Building 33 renovation at Washington (D.C.) Navy Yard; $165 million, 1 million-sq.-ft. Naval Sea Systems Command HQ, Port Hueneme, Calif.; $54 million, 95,000-sq.-ft. Sail Ashore Program, Norfolk, Va. (seeking LEED Silver).
U.S. Air Force	▪Has nearly 1,300 installations on U.S. territory, 300 overseas. ▪ Facilities comprise 563 million square feet of space.	▪2001 policy mandates the use of sustainable development concepts that are 'consistent with budget and mission requirements"throughout the full life cycle of buildings; selection of contractors partly based on their knowledge of environmental issues; LEED is the preferred self-assessment metric. ▪ At least 20% of each major command's projects to be LEED pilot projects in 2004. ▪Goal: all construction projects capable of achieving LEED certification by 2009. ▪Key projects: a military housing complex in Vandenberg, Calif.; Air Combat Command Squadron Operations Facility in Seymour Johnson, N.C.
U.S. Army	▪ The largest Federal building owner. ▪ Real estate portfolio includes more than 4,100 installations with 165,289 buildings and 1.1 billion square feet. ▪ Accounts for about two-thirds of all DoD installations. ▪ More than three-quarters of Army installations are National Guard Centers; 900 are Army Reserve Centers. ▪ Annual maintenance costs for facilities exceeds $2 billion. ▪ 50 million square feet of excess buildings on bases slated for either closure or renovation.	▪ Developed its own green building rating tool in 2001 based on LEED—the Sustainable Project Rating Tool (SPiRiT). Unlike LEED, SPiRiT includes O&M issues and flexibility in design to allow for building modifications as needs change. The Army is working with USGBC to incorporate such issues into LEED 3.0. ▪All construction projects required to strive for at least a Bronze SPiRiT rating; as of FY 2006, a Silver rating will be required. ▪ Goal is to have 10 Gold- or Platinum-rated SPiRiT projects completed in 2003, and to increase that by two every year after. ▪ Focus: greening family housing. ▪Developed a policy in 2001 for the deconstruction and re-use of excess buildings. ▪ Projects: a 2,800-sq.-ft. training facility at Fort Carson, Colo.; National Guard office building in Arizona.

Source: *"The Federal Commitment to Green Building,"* Office of the Federal Environmental Executive, September 18, 2003

STATE AND LOCAL GREEN INITIATIVES

As state and local governments scramble to pass green building legislation, it must be asked if these efforts do, in fact, promote the growth of sustainable building practices in the design and construction of public and private buildings. Do the benefits sufficiently outweigh the costs? Which type of program is more effective, a regulatory program or one based on incentives?

While the available data does not necessarily confirm or disprove the success of state and local

Chart I: Incentives

City/State	Development credits, funding incentives, and technical assistance
Austin, Texas	▪ Owner participants in Commercial Green Building Program (approved by city council in 1995) gain financial incentives from city's Smart Growth Matrix credit. Offsets cost of developing in urban areas. Incentives: waiver of development fees and public investment in new or improved infrastructure (water/sewer lines, streets/streetscape improvements, etc.) Administered by Austin Energy, the program offers up to $6,000 to design teams whose buildings attain a four-star rating in the city's sustainable rating system.
Seattle	▪ LEED Incentive Program (2003) funded by Seattle City Light and Seattle Public Utilities offers financial assistance to building owners and developers whose projects attain LEED certification. Incentives individually negotiated, with a minimum of $15,000 for LEED Certified, $20,000 for LEED Silver. $10,000 incentive funding paid when an agreement is signed and balance paid upon successful certification. Incentives can be used for soft costs only. Technical assistance and assistance with charettes also offered.
Portland, Ore.	▪ LEED Incentive Program offers $15,000 to private-sector developers for green design services at the Portland LEED-certified level, $20,000 for green design services at or above Portland LEED Silver. 75% of funds available at signing of agreement. Fourteen commercial pre-applications have been received for the program, most in the Silver level or better. From a pool totaling $90,000, city offers up to $5,000 in innovation grants available to small businesses incorporating green features.
Oregon	▪ Office of Energy's Small Scale Energy Loan Program offers low-interest loans to developers to fund energy-reduction measure in new or existing buildings.
California	▪ Pacific Gas and Electric's statewide Savings By Design program for commercial, industrial, and agricultural customers encourages energy-efficient building design and construction. Administered by four investor-owned utilities under the auspices of California Public Utilities Commission. Offers building owners incentives of up to $150,000 per project to compensate for investing in energy-efficient design. Design teams can earn up to $50,000 per project for meeting energy-efficiency goals. Design assistance, analysis, and resources to aid building owners and design teams with energy-efficient facility design also offered.
Berkeley, Calif.	▪ Berkeley's Best Builders program provides building owners and architects with free consultations on resource-conserving design strategies, technologies, materials. Selected projects receive a free design assistance meeting with specialized consultants covering a range of environmental systems relevant to the project. New and renovated commercial, industrial, multifamily buildings of 5,000 or more sq. ft. qualify.
Los Angeles	▪ City's Environmental Affairs Department's Residential Rehabilitation Guidebook (part of L.A.'s Sustainable Building Program) focuses on rehabilitation of affordable single- and multifamily housing. California Integrated Waste Management Board's Deconstruction Program promotes careful disassembly of buildings (including five library sites) to maximize reuse/recycling of materials. Brownfields Program develops strategies to redevelop brownfields throughout the city, particularly in disadvantaged communities, including the model Crown Coach Site, where the city is leveraging brownfield redevelopment to encourage green building practices. ▪ Sustainability Partnership a joint project of Bureau of Sanitation and Solid Resources Citywide Recycling Division. Partner with city departments, agencies, organizations, and businesses. Encourage integration of environmental, humanistic, economic concerns. Partnership staff provides information on developing green building practices, construction, demolition recycling, recycled construction products, producer responsibility initiatives, sustainability indicators/measures, sustainable development issues, funding sources, workshops.
San Jose, Calif.	▪ In 2000, the city council adopted a policy to provide leadership and guidance to the private sector.
Pleasanton, Calif.	▪ Energy-Efficiency Rebate & Incentives program offers rebates to owners of residential and nonresidential buildings for energy efficiency, peak load management, and distributed generation. Targets: lighting, HVAC, refrigeration, food service, new construction and shell, motors, self-generation and curtailment.
Santa Barbara, Calif.	▪ County Planning & Development Department Innovative Building Review Committee advises the public on energy-efficient building design. Goal: Improve energy performance of buildings beyond state standards. Services are free. Applicants exceeding California Energy Standards (Title 24) by 25% or more for commercial and industrial developments have projects expedited and plan check by Building Division within 10 working days; Energy Fee reduced by 50%; information on financing energy-efficient improvements through energy savings; free consultation and design assistance on energy-efficient improvements; professional advice on energy-efficient designs and equipment; information on rebates for energy-efficient equipment.

Chart I: Incentives (continued)

City/State	Tax Credits
New York State	▪ Green Building Tax Credit (approved in 2000) provides up to $25 million in tax credits to owners and tenants of commercial and multifamily residential buildings and tenant spaces which meet green standards –increasing energy efficiency, improving indoor air quality, reducing environmental impacts of large commercial and residential buildings. Eligible buildings: hotels and office buildings with at least 20,000 sq. ft. interior space; residential multifamily buildings of at least 12 units (20,000 sq. ft. interior space); residential multifamily buildings with at least two units part of single or phased construction (20,000 sq. ft. of interior space), provided at least 10,000 sq. ft. is under construction or rehabilitation.
Maryland	▪ Maryland's Income Tax Credit for Green Buildings (signed May 2001) applies a tax credit to commercial and multifamily residential buildings, for new construction or renovation. Tenants may qualify for tax credits for investments of their own in tenant-controlled space. The differential cost of improvements attributable to green building may be eligible for a credit of 8% against personal state income tax when the whole building qualifies as green (6% when only the tenant interior space qualifies). Supplemental credits for on-site power systems serving green buildings also available, including photovoltaic systems, wind turbines, and fuel cells.
Oregon	▪ The Business Energy Tax Credit (enacted 1980) rewards investments in energy conservation, recycling, renewable energy resources, or less-polluting transportation fuels. In 2001, sustainable buildings were made eligible for the tax credit. The building must meet an established standard set by LEED. Any Oregon business may qualify for the 35% tax credit, which is taken over five years; unused credits can be carried forward up to eight years. Pass-through option allows nonprofit organizations, schools, governmental agencies, tribes, other public entities and businesses to transfer their tax credits for eligible projects to business partners with tax liabilities. Projects that use solar, wind, hydro, geothermal, cogeneration, or biomass also may qualify for a tax credit. Renewable resource projects must replace at least 10% of the electricity, gas, or oil used. Retrofit lighting and weatherization projects for rental property may be eligible, as well as new construction and projects that reduce worker commuting. More than 6,500 energy tax credits have been awarded, resulting in an estimated $100 million a year in energy savings or alternate generation.
	Floor Area Ratio Increase
Arlington County, Va.	▪ Under the Pilot Green Building Incentive Program (April 2000), developers may earn additional density up to .25 floor-area ratio or additional height up to three stories (or both) if the project meets LEED Silver or higher. Bonus density will be considered from .15 FAR for the lower end of Silver rating to .25 FAR for highest end. A bonus density greater than .25 FAR may be awarded for projects for which LEED Gold or Platinum levels are being sought. Initial focus: office buildings. To date, one developer has taken advantage of the incentive program. Program up for review in 2003.

Chart II: LEED-based regulations

City/State	LEED Certification
Seattle	▪ Sustainable Building Policy (February 2000): New building projects and renovations of more than 5,000-sq.-ft. receiving city funds are required to achieve at least LEED Silver. Projects achieving a higher rating earn Mayor's Award. Since its inception, 15 city-owned projects have participated in the LEED program, totaling 2.75 million sq. ft. and $650 million in capital development. On the private side, the LEED Incentive Program (2003) offers financial assistance for buildings that attain minimum LEED-certified status (see Incentives Chart for details).
Austin, Texas	▪ City council resolution (June 2000) requires municipal projects built under future bond issues to meet LEED Silver. Most current municipal projects are doing so, even though no new bond issues have been passed.
New York State	▪ Executive Order 111 (June 10, 2001) requires state agencies to follow the LEED rating system. In design, construction, operation, and maintenance of new buildings, state agencies are required to follow green-building guidelines set forth in the Green Buildings Tax Credit and LEED rating system.
New Jersey	▪ Executive Order 24 encourages design teams for the state's School Construction Program to utilize LEED principles but does not require certification.
Pennsylvania	▪ Executive Order 1998-1 (March 1998) established the Governor's Green Government Council. The GGGC calls for state agencies to incorporate environmentally sustainable practices. All state project design, development and construction must be accomplished utilizing the GGGC's Building Green in Pennsylvania Program. Includes guidelines for creating high-performance buildings, model green office leasing specifications, and LEED 2.0. State Department of Environmental Protection now requires all leased buildings to achieve LEED Silver and meet performance standards in state's model green office leasing specification. The lessor is responsible for obtaining and maintaining LEED certification.
Maryland	▪ Executive Order 01.01.2001.02 (March 2001) ordered the state's Green Buildings Council to develop High-Efficiency Green Buildings Program to guide design, construction, operations, and maintenance of all new and renovated state-built facilities, modeled after the LEED rating system.
Arlington, Va.	▪ Under the Pilot Green Building Incentive Program, projects that achieve LEED Silver or higher may earn a higher floor-area ratio (see Incentives Chart).

LEED-registered projects by state

California	110
Pennsylvania	56
Oregon	51
Washington	50
Texas	32
Massachusetts	31
Michigan	30
New York	30
Georgia	22
Illinois	22

Source: USGBC, cited in G. Kats et al., "The Costs and Financial Benefits of Green Building"

programs, particularly in light of their novelty and the relative paucity of experience with private-sector projects, most officials interviewed for this White Paper are convinced that their programs have exposed owners to the potential benefits of green design and acquainted them with the process.

The consensus thus far is that incentive programs are the preferred means to promote green design in the private sector. Yet, with more and more mandates being handed down on the public side, further demands on the private sector may not be far behind.

In the absence of a comprehensive evaluation of current state and local green building programs, however, public officials will be playing a guessing game as to whether their efforts will pay off in encouraging sustainable development.

Chart II: LEED-based regulations (continued)

City/State	LEED Certification
Portland, Ore.	▪Adopted LEED rating system in January 2001 and completed local application of Portland LEED in summer of 2002. New construction and major renovations receiving city funding are required to obtain LEED certification. Portland Development Commission is required to adopt Portland LEED Green Building Rating System. Private-sector funding incentives require buildings to attain at least LEED-certified status.
Eugene, Ore.	▪February 2000 resolution requires LEED certification to be used as design guideline for constructing new city projects. The 127,000-sq.-ft. public library now under construction is the city's first project utilizing system.
California	▪California Integrated Waste Management's Green Building Program is designed to be used in conjunction with LEED 2.0. Provides information on state codes, policies, and practices, raises minimum performance standards for sustainable building elements to levels higher than those in LEED 2.0. Supplement applies to state government construction projects over 5,000 sq. ft., including new construction, renovations, appropriate leased space, new and renovated significant building construction projects over 50,000 sq. ft., or prototype buildings that can be replicated and impact over 50,000 sq. ft., or highly visible buildings that serve an educational purpose. To be recognized as State of California LEED Building, the project must complete the LEED certification process and self-certify for additional prerequisites and other supplemental elements contained in the LEED Supplement for California State Facilities.
Alameda County, Calif.	▪In April 2003, Alameda County Waste Management Authority required LEED Silver status for state GSA buildings of more than $5 million. State GSA projects under $5 million must meet LEED Silver standards, but may be certified under county certification process. Remodels and retrofits are required to use LEED as a guideline.
San Mateo County, Calif.	▪Sustainable Building Policy (December 2001) required future county buildings of 5,000 sq. ft. of new construction to apply for LEED certification. Buildings of less than 5,000 sq. ft. and all renovations or retrofits are encouraged to apply sustainable building practices, build to LEED standards, and apply for LEED certification if practicable.
Los Angeles	▪City council mandates LEED-certified for city-funded projects 7,500 sq. ft. or larger (April 30, 2002).
San Jose, Calif.	▪City requires its facilities to meet LEED-certified rating (July 1, 2002).
Pleasanton, Calif.	▪Commercial and Civic Green Building Ordinance requires city projects to meet LEED-certified status.
Cook County, Ill.	▪County ordinance requires LEED Silver for all new county building projects and encourages application of LEED to existing building retrofit and renovation projects.
	Additional state/local rating systems
Hennepin County, Minn.	▪Minnesota Sustainable Design Guide (1997) educates professionals and the public on sustainable design. The guide is a design tool that can be used to overlay environmental issues on design, construction, and operation of new and renovated facilities.
Oakland, Calif.	▪Modeled after Minnesota's program, the Sustainable Development Initiative (1998) called for sustainable building in the city's development.

Chart III: State and local sustainable design regulations

City/State	Green government-owned buildings
New York State	▪ Executive Order 111 requires state agencies by 2010 to seek to achieve a 35% reduction (relative to 1990 levels) in the energy consumption of all buildings they own, lease, or operate. All state agencies and other affected entities required to establish agency-wide reduction targets to reach this goal. Agencies responsible for establishing peak electric demand reduction targets for each state facility by 2005 and 2010. State agencies engaged in construction of new buildings shall achieve at least a 20% improvement in energy efficiency relative to levels required by state's Energy Conservation Construction Code.
Maryland	▪ Section A of Executive Order 01.01.2001.02, issued in March 2001, sets new goal for procurement of electricity, calling for at least 6% of consumption in state-owned facilities be produced from green energy, including wind power, solar biomass, landfill gas gas-generated sources.

Chart III: State and local sustainable design regulations (continued)

City/State	Green government-owned buildings
Oregon	▪ State Energy Efficiency Design program (1991) directs state agencies to work with the Oregon Office of Energy to ensure cost-effective energy conservation measures are included in new and renovated public buildings. Requires state facilities constructed after June 30, 2001, to exceed the energy conservation provisions of the state building code by at least 20%.
San Francisco	▪Resource-Efficient City Buildings amendment to building code (June 1999) required issuance of guidelines to city departments to assist in compliance with ordinance focused on water conservation for toilets and shower heads, energy conservation, indoor air quality, pollutant source control, storage of recyclables, construction and demolition debris. Ten projects now in design and construction phase.
Los Angeles	▪ Sustainable Building Initiative (April 2002). See Incentive Chart for details.
San Jose, Calif.	▪ In 2000, the city council called for green building principles and practices to be included in all phases of city building construction and adopted a green building rating system.
Pleasanton, Calif.	▪ 2003 Energy Plan guides city toward sustainable future without increasing adverse impacts on community. Includes installation of benign, renewable energy facilities, such as PV panels, programmable thermostats, and cool roofs.
Oakland, Calif.	▪Policy requires all new and remodeled city buildings to capture eligible electric utility rebates and be 10% better than energy code. Agreement in June 2000 to purchase green power.
Florida	▪An executive order (1991) called for 30% reduction in energy use by state agencies.
Illinois	▪An April 2000 executive order led to development of the Green Government program, which calls for state agencies to find ways to incorporate environmentally sustainable practices into their day-to-day management and operations.
	Incorporation of environmentally sustainable practices
Pennsylvania	▪Executive Order 1998-1 (March 1998) established the Governor's Green Government Council, calling for state agencies to incorporate environmentally sustainable practices. All state project design, development, and construction must be accomplished utilizing GGGC's Building Green in Pennsylvania Program. Includes guidelines for creating high-performance buildings, model green office leasing specifications.
Maryland	▪In March 2001, Executive Order 01.01.2001.02, Sustaining Maryland's Future with Clean Power, Green Buildings, and Energy Efficiency issued. Order requires creation of commission to make recommendations and set criteria for constructing and maintaining energy-efficient and environmentally responsible state facilities, setting goals for purchase of green power and outlining comprehensive energy conservation strategy.
Arlington County, Va.	▪As part of its Pilot Green Building Incentive Program, county, in April 2000, began requiring all site plan applications to include completed LEED scorecard. Scorecard allows developer to assess options for including green components in project. Also allows county to measure a project's overall performance and to collect data on environmental status of all site plan buildings in county. Program up for review in 2003.
California	▪An executive order (Aug. 2, 2000) established state's sustainable building objectives: to implement sustainable building goals in a cost-effective manner, considering externalities; identify economic and environmental performance measures; determine cost savings; use extended life-cycle costing; and adopt an integrated systems approach. California has a variety of codes, regulations, and ordinances relating to energy efficiency, indoor air quality, materials, and water efficiency.
Los Angeles	▪Sustainable Building Initiative (April 2002) lists policy and program development goals for city-owned buildings and sites.
San Jose, Calif.	▪San Jose 2020 (adopted 1994) includes Sustainable City Strategy to encourage efficient use of natural resources in construction activities and minimize waste.
Santa Monica, Calif.	▪Santa Monica Sustainable City Program's Green Buildings Design and Construction Guidelines include required and recommended practices for commercial, multifamily, municipal, remodel projects. The guidelines encompass building site and form, landscaping, transportation, building envelope, space planning, materials, water systems, electrical systems, HVAC, control systems, construction management, and commissioning.
New York City	▪City's Department of Design and Construction issued High-Performance Building Guidelines (April 1999). ▪Hugh L. Carey Battery Park City Authority Residential Environmental Guidelines required for use in residential and commercial buildings. Guidelines establish levels appreciably ahead of current standards and practices.
Kitsap County, Wash.	▪Build a Better Kitsap Program promotes environmentally friendly construction, energy saving, and use of natural resources. Establishes Code Plus standards to improve building performance and provide economic and environmental benefits.
Florida	▪The Florida Design Initiative promotes best practices in community and facility design and usage, by developing networks and forums for professional design associations, state agencies, local governments, utilities, nongovernmental organizations, and academic institutions to build high-performance buildings and communities.
Santa Barbara, Calif.	▪County Planning & Development Department Innovative Building Review Committee offers free advice to the public on energy-efficient building design to improve energy performance of buildings beyond state standards.
Scottsdale, Ariz.	▪Green Building Program encourages whole-systems approach to minimize environmental impact and energy consumption of buildings.

SORTING THROUGH THE GREEN PRODUCT MAZE

'We're going from 'bleeding edge' to 'leading edge' [in green products]. There's a proliferation of manufacturers who are producing environmentally friendly materials."

—Elizabeth Heider,
Vice President, Skanska USA Building Inc.

The green products market has exploded in the past decade, from low-VOC adhesives to energy-efficient lighting, to recyclable carpet.

A number of independent product certification and standards organizations have sprung up, offering online directories and other information pertaining to green products (see table).

Without these programs, specifiers would be left to sift through piles of product information filled with unvalidated claims from manufacturers to determine which products are right for the job.

Despite this progress, the green products market is years away from what can be considered a marketplace for truly sustainable products.

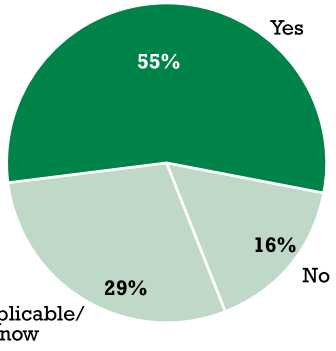
The chief obstacle is the lack of a consensus baseline for measuring the greenness of products. The established certification and standard organizations have often widely different criteria for classifying products as green. Greenguard, for example, focuses solely on VOC emissions, while Energy Star looks primarily at energy consumption.

In *BD&C*'s *White Paper Survey*, more than half of respondents (55%) said they have trouble sourcing green products, largely because they could not get a clear definition of "green."

What makes a product sustainable?

Ten years ago, a product manufactured with 30% recycled material was considered green. As specifiers became more knowledgeable, they started asking questions: How durable is the product? What is its embedded energy? How far

Do you have trouble sourcing green products?



Base: 482

If yes, why?

"Green" not always clearly defined	81%
Don't know what's really green	47%
Don't know where to look	39%
Can't get certain green products	22%
Don't trust green labels	13%

Base: 262

If no, why not?

Green products are readily available	60%
Certification labels provide sufficient guidance	50%
Green-labeled products are well known	34%

Base: 70

BD&C White Paper Survey, 09/03
Source: Reed Research Group

Green product certification and standards programs

Program	What does it evaluate?	Synopsis
EnergyStar US EPA *www.energystar.gov*	Energy-related value for products in more than 35 categories, including HVAC systems, lighting fixtures, office equipment, roofing products, windows, doors, and skylights	▪ EnergyStar roofing products can earn credit toward LEED certification. ▪ Federally supported program ▪ Relies on manufacturer-supplied data to rate products ▪ Ratings based on energy consumption only: Does not take into account life cycle analysis, recycled content, or environmental impact of the manufacturing process ▪ Focused primarily on residential market
Environmentally Preferable Purchasing US EPA *www.epa.gov/opptintr/epp*	Rates building materials and products based on pollution prevention, life cycle analysis, comparison of environmental impacts, environmental performance, and environment/price performance ratio. Product categories include: paints, plumbing, HVAC, lighting, gypsum board, carpets, concrete, coatings, sealants, flooring, doors, and windows.	▪ Rates 650 products using 523 standards and guidelines, including US EPA, US DOE, Green Seal, Scientific Certification Systems, Blue Angel (Germany), Environmental Choice Program (Canada), and Eco Mark (Japan). ▪ Considers such factors as life cycle impact, pollutant emissions, environmental impact of the manufacturing process, recycled content, cost, and energy efficiency. ▪ Not all standards under EPP, such as Energy Star, require independent testing ▪ Geared toward IAQ ▪ Follows Executive Order 13101, which encourages government agencies to purchase products or services that have 'a lesser or reduced effect on human health and the environment"

Green product certification and standards programs (continued)

Program	What does it evaluate?	Synopsis
Greenguard Greenguard Environmental Institute *www.greenguard.org*	Emission of VOCs, formaldehyde, and other pollutants for interior products and building materials. Certifies over 10,000 products, including flooring, ceiling systems, paints, coatings, adhesives, wall coverings, insulation, and office furniture.	▪ Requires independent testing for all products ▪ Certified products can earn credit toward LEED-Commercial Interiors rating ▪ Independent scientific board establishes and maintains testing standards ▪ Tests products for pollutant emissions only. Does not take into account life cycle analysis, recycled content, or the environmental impact of the manufacturing process ▪ Geared toward IAQ ▪ Nonprofit entity
Environmentally Preferable Products and Services (EPP) Scientific Certification Systems *www.scs1.com*	Life cycle impact, risk assessment, and environmental impact of indoor materials and products. Products include adhesives, sealants, carpeting, composite panels, doors, flooring, furniture, paints, and wall coverings.	▪ Uses independent testing for all products ▪ Considers most factors of green design, including life cycle impact, pollutant emissions, environmental impact of the manufacturing process, recycled content, cost, and energy efficiency ▪ Certification process includes on-site inspections by an SCS engineer of manufacturing facilities and upstream suppliers ▪ Manufacturers must also submit updated data on an annual basis ▪ Geared toward IAQ ▪ Private, for-profit company ▪ Operates consistently with E.O. 13101
Environmental Claims Certification Program Scientific Certification Systems *www.scs1.com*	Tests products for specific factors, such as recycled content, biodegradability, pollutant emissions. Products include adhesives, sealants, carpeting, composite panels, doors, flooring, furniture, paints, and wall coverings.	▪ Uses independent testing for all products ▪ Certification process includes on-site inspections of manufacturing facilities and upstream suppliers by an SCS engineer ▪ Manufacturers must submit updated data annually ▪ Testing limited to verification of single claims made by manufacturers. Certification may not include multiple green design considerations ▪ Private, for-profit corporation
Green Seal *www.greenseal.org*	Performance and life cycle evaluation of products, including paint, adhesives, compact fluorescent lamps, chillers, photovoltaic modules, windows, and window films.	▪ Analyzes environmental impact at each life cycle stage: resource extraction, production, distribution, use, disposal or recycling ▪ Product evaluations performed by in-house staff following ISO 14024 standards ▪ 45 construction-related products from five manufacturers are certified ▪ Focused more on a product's impact on outdoor environment ▪Evaluates energy and resource use and emissions to air, water, and land ▪ Nonprofit entity
Green Label Testing Program Carpet and Rug Institute *www.carpet-rug.com*	VOC emissions and other pollutants for carpet products, including carpets, cushions, and adhesives.	▪ All testing performed by an independent laboratory ▪ Most major suppliers in the carpet industry have Green Label products ▪ Limited to carpet products ▪ Tests for VOC emissions only. Does not take into account life cycle analysis, recycled content, or the environmental impact of the manufacturing process ▪ Nonprofit organization
Building for Environmental and Economic Sustainability (BEES) National Institute of Standards & Technology *www.bfrl.nist.gov*	Software from NIST analyzes life cycle impact, environmental performance, and economic issues to determine environmentally preferable products.	▪ BEES 3.0 includes actual environmental and economic performance data for nearly 200 building products ▪ Analyzes all stages of the product life cycle: raw material acquisition, manufacture, transportation, installation, use, recycling, waste management ▪ Twelve environmental impacts assessed: global warming, acidification, eutrophication, fossil fuel depletion, indoor air quality, habitat alteration, ozone depletion, water intake, criteria air pollutants, smog, ecological toxicity, and human health ▪ Includes 80 brand-specific products ▪ Software is free ▪ NIST is a Federal agency under Dept. of Commerce
Cool Roof Rating Council *www.coolroofs.org*	Roofing products for solar reflectivity and thermal emittance. Latest directory includes 107 products from 30 manufacturers.	▪ All products require independent testing ▪ Provides ratings at installation and after three years ▪ Rates both solar reflectivity and thermal emittance (EnergyStar only rates solar reflectivity) ▪ Tests roofing-related products only ▪ Testing is limited to heat-gain characteristics only. Does not take into account life-cycle analysis, recycled content, or environmental impact of manufacturing process ▪ Relatively new program, certifies about 100 roofing products (vs. more than 500 for Energy Star) ▪ Nonprofit organization
GreenSpec Building Green Inc. *www.buildinggreen.com*	Directory of environmentally preferred products. Products are evaluated by Building Green staff members based on 27 criteria, including recycled content, reduced demolition impacts, durability, and energy efficiency.	▪ Directory covers more than 1,600 materials and products ▪ Does not require performance testing or independent verification of product content, except possibly a call to the manufacturer ▪ Actively searches for products, rather than waiting for manufacturers to submit ▪ Strong word-of-mouth reputation among green builders ▪ Directory is free for manufacturers, but architects and specifiers must pay to use the listing ▪ Not a certification or labeling program

Green-product attributes

(rated by importance to user)

Ability to last the life of the building	4.38
Cost vs. equivalent conventional product	4.27
Availability of product to job site	4.16
Use of renewable resources	4.01
Energy used in manufacturing the product	3.75
Ability of product to be recycled	3.74
Recycled content	3.74
Minimal or no added chemicals	3.66
Recyclable or minimal packaging	3.58

Durability and cost were seen as the key factors in choosing green products by respondents to the *BD&C White Paper Survey*.

Sources used to obtain information on green building products

Professional magazines or newsletters	52%
Government certification programs	50%
Product manufacturers' Web sites	45%
U.S. Green Building Council	34%
Product information services	33%
Industry trade associations	31%
Independent product websites	30%
Health/safety associations	30%
Independent product directories	29%
Master specifications	26%
Professional membership associations	26%
Environmental organizations	17%
Independent research studies	15%
Other	6%

Base: 443

BD&C White Paper Survey, 09/03
Source: Reed Research Group

Survey respondents said they relied on a wide variety of information sources to find green building products, particularly trade publications, government certification programs like ENERGY STAR and BEES, and manufacturers' websites.

does that product have to be shipped to the job site? How does the manufacturing process to make that product impact the environment?

For instance, GreenSpec, published by Building Green Inc., Brattleboro, Vt., rates products based on 27 criteria, including recycled content, reduced demolition impacts, durability, and energy efficiency. Anecdotal research conducted by *BD&C* shows that GreenSpec is rated among the most popular sources for green product information. Subscribers like its thorough evaluation process and comprehensive database, which includes more than 1,600 materials and products. But GreenSpec has received criticism from some experts for not setting the bar high enough when ranking the greenness of products and for relying on manufacturer-supplied information.

A truly sustainable product balances dozens of environmental factors related to its manufacture, installation, use, and eventual disposal. Many experts see this type of life cycle assessment (LCA) as the Holy Grail of green product evaluation.

The challenges of LCA are abundant. First, participation by manufacturers is crucial, because evaluation goes well beyond the product itself, into the manufacturing process.

To date, few companies have embraced LCA-based programs like BEES, which charges an $8,000 processing fee and requires a commitment of up to 80 hours. In fact, BEES has evaluated only 118 brand-specific products.

Also, collecting valid data can be difficult, since many manufacturers do not keep detailed environmental statistics. The data must also be updated and verified periodically to ensure that changes to the manufacturing process do not affect the product's environmental impact rating.

Two bright spots in LCA are the Life Cycle Inventory Database Project and the eLCie assessment tool.

The LCI project is a research partnership launched by the National Renewable Energy Lab's High Performance Buildings Initiative in May 2001 and includes 37 participants from industry, government, and NGOs.

LCI involves "detailed tracking of all the flows in and out of the system of interest" —raw materials, energy, water, and emissions to air, water, and land, according to project director Wayne Trusty of the Athena Sustainable Materials Institute, which is conducting the study along with Franklin Associates and Sylvatica.

With funding from the USDOE, the GSA, and NAVFAC, the LCI project will create a national database of materials, products, and processes that is consistent with ISO standards and U.S. guidelines for LCA. All materials and products will be treated uniformly, criteria for evaluating them will be transparent, and regional differentiation will be taken into consideration.

Manufacturers will be able to call up the database to develop life cycle assessments for specific processes, such as cement making, by linking modules —something like "an LCI Lego set," in Trusty's words —that quantify the environmental impact of a process during product manufacture, use, and disposal. A beta version of the free LCI database is expected to be up and running in Q1/04.

Another promising tool is eLCie, a "streamlined" LCA system that is based on full LCA results, but focuses on the 20% of environmental impacts that create 80% of the degradation inherent in a specific product. ELCie is designed to interface with LEED, ISO 14000, BEES, GaBI 3, Sima Pro, Athena, and CSI divisions.

Under development by the International Design Center for the Environment, Raleigh, N.C., eLCie is aimed at volume purchasers — architects, construction specifiers, and facility managers —who want a reliable, science-based database of products but don't want to spend a lot of time verifying product attributes.

ELCie will be launched in beta form in early 2004, under a grant from NIST, with 80-100 products. The key to its success will be getting a sufficient number of volume purchasers to try it.

No certification program is worth the effort unless the product data is accurate and properly validated. Independent, third-party testing ensures that a company's claims can be backed up with unbiased data. Some certification programs also periodically monitor manufacturers' operations and products to ensure that the companies stick to their promises.

DO GREEN BUILDINGS COST MORE TO BUILD?

Do green buildings cost more to build than conventional buildings? And do they produce benefits beyond the norm —improved productivity of occupant workers, better health, higher job satisfaction, or other factors that create value for their owners?

These two questions frame the discussion surrounding the "business case" for sustainable development. For simplicity's sake, they will be reviewed separately here, but it should be recognized that these two questions, taken together, define the value proposition for sustainability.

One of the earliest cost studies was published by the Rocky Mountain Institute, Snowmass, Colo. RMI examined several buildings that had made various energy retrofits. A post office in Reno, Nev., in 1986 did a lighting retrofit that paid for itself in six years; a Pennsylvania power company's lighting upgrade reduced energy consumption from lighting by 69%. Newly constructed buildings showed promising results, too: Lockheed Building 157, completed in 1983, produced energy savings of $500,000 a year with a four-year payback; the design of the West Bend Mutual Insurance Company's headquarters (1992) produced a 40% savings per square foot in electricity costs; the ING Bank headquarters in Amsterdam (1987) achieved annual energy savings of $2.6 million at a cost of $700,000, an amazing three-month payback.[6] The RMI study demonstrated that basic retrofitting of existing buildings could produce remarkably quick paybacks for owners and that sustainable design could have significant payoffs in energy savings for new construction as well.

The cost issue came to the fore in the late 1990s with the implementation of the Leadership in Energy and Environmental Design pilot program and the approval of LEED 2.0 in 2000. Suddenly, the real estate market wanted to know about fees for LEED-accredited professionals, LEED certification costs, perceived added costs for LEED improvements, payback rates, and indirect costs for additional design fees.

The first to pounce on the cost of LEED was the General Services Administration, the government's landlord. In 1998, the GSA pulled together a panel of industry experts to identify potential cost premiums associated with the upcoming pilot phase of LEED 1.0. Subsequently, the agency commissioned the HDR/Hanscomb study, which found that a 2.5-7.0% construction cost premium would be necessary for Federal buildings to achieve various levels of "green" performance.

LEED registration costs

	Less than 75,000 sq. ft.	75,000-300,000 sq. ft.	More than 300,000 sq. ft.
Charges	Fixed rate	Based on sq. ft.	Fixed rate
Registration			
Members	$750	$0.01/sq. ft.	$3,000
Non-Members	$950	$0.0125/sq. ft.	$3,750
Certification			
Members	$1,500	$0.02/sq. ft.	$6,000
Non-Members	$1,875	$0.025/sq. ft.	$7,500

Source: USGBC

The HDR/Hanscomb study concluded further that: 1) LEED 1.0 certification would add "little or no increase in project costs" if GSA's design criteria guideline were rigorously followed; 2) a LEED 1.0 Gold rating for the Denver Federal Courthouse would have added 7% to costs; 3) the Oklahoma City Federal Building would require a 2% premium to reach LEED 1.0 Silver; and 4) other typical Federal projects could reach LEED 1.0 Silver with about a 2.5% premium.[7]

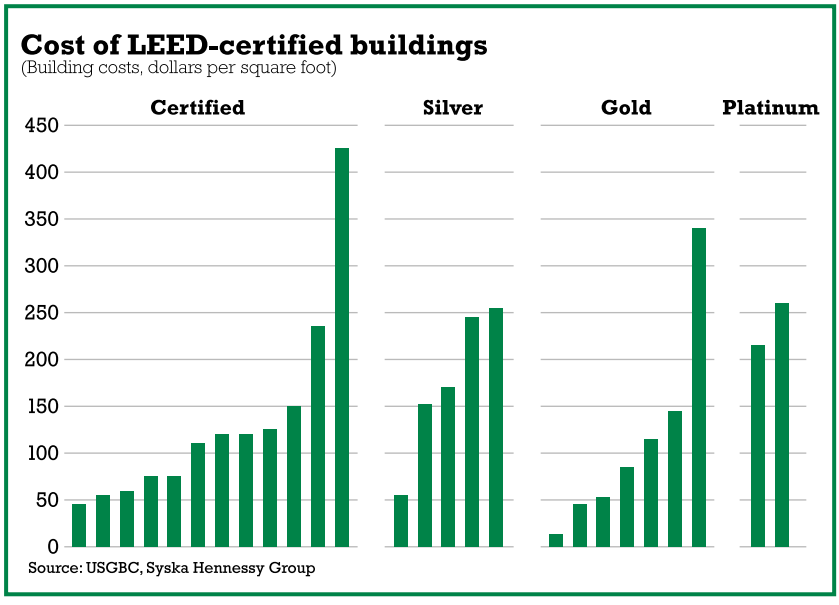
The launch of the more demanding LEED 2.0 in 2000 created a need for more data. Having mandated that all future projects under its control would have to be LEED Certified (and preferably Silver), the GSA wanted to know what that would mean in terms of additional construction costs and professional and registration fees.

The GSA contracted Steven Winter Associates (SWA), Norwalk, Conn., to determine the construction cost differentials for each of the 69 possible LEED points and to then "assemble" the differentials so as to calculate how much extra it would cost to build a new Federal courthouse and to rehabilitate a 1960s-era Federal office building to three LEED standards: Certified, Silver, and Gold. In each case, the building types were to be evaluated at "low intensity" and "high intensity," resulting in 12 different modeling estimates that bracket the potential LEED costs.

The study is not due to be released until later this year, but some of the key findings have been made available for this White Paper. According to study director John Amatruda of SWA, some LEED points (or similar performance requirements) can be met quite simply, while with others "it's a lot more complex and you have to be

[6] "Greening the Building and the Bottom Line: Increasing Productivity Through Energy-Efficient Design," Joseph J. Romm, U.S. Department of Energy, and William Browning, Rocky Mountain Institute, 1994 (updated 1998).

[7] "Scope of Work: Supplement Contract for Performance of Professional Services," Steven Winter Associates, GS-11P99MAD0565, July 15, 2002.



First costs for 26 LEED 1.0 and 2.0 projects ranged from a low of $13 per square foot for a Gold building to a high of $425 per square foot for a Certified project. A higher rating did not necessarily result in greater cost: Two Certified, two Silver, and one Gold project were more expensive than one of the Platinum buildings. Building type was probably a factor in total costs.

* The roundtable heard commentary from: Jim Hackett, CEO of Steelcase; Mike Volkema, chairman, president, and CEO of Herman Miller; Richard S. Ziman, chairman and CEO, Arden Realty; James E. Rohr, chairman and CEO, The PNC Financial Services Group; Thomas Gulen, VP of Goldman Sachs; GSA Commissioner of Public Buildings F. Joseph Moravec; Thomas Leppert, chairman and CEO of Turner Construction Corporation, the nation's largest contractor; and M. Arthur Gensler, Jr., FAIA, chairman of Gensler.

[8]"A Blueprint for Green Building Economics," *Environmental Design+Construction*, July 2003.

thinking in a lot more integrative fashion."

He cites the LEED credit for reducing water consumption 20% (WE 3.1) as a point that can sometimes be earned simply by using low-flow faucets. (Waterless urinals also provide "big bang for the buck," according to Elizabeth Heider of Skanska USA Building Inc., who is doing the cost estimates of LEED points using space-cost models developed by SWA and Hanscomb.) In contrast, earning a point for reducing the use of potable water for irrigation by 50% (WE 1.1) cannot be met simply by installing sophisticated controls, according to Amatruda. Similarly, the threshold for achieving 5% renewable energy (EA 2.1) is "quite high," according to Amatruda, and may be economically unfeasible for larger buildings. He cites Battery Park City in New York, whose building-integrated PV system generates only about 1% of the project's annual energy use.

The final numbers should be released at year-end, but Amatruda is confident that achieving LEED Certified status at the "low-impact" level should cost "almost nothing beyond GSA's current design standards." Reaching Silver or Gold status will entail added construction costs, but these may be mitigated to some degree through well-integrated design strategies.

Meanwhile, the U.S. Green Building Council responded to concerns about costs by arranging for the U.S. Senate Environment and Public Works Committee to convene a roundtable of public officials, real estate practitioners, academicians, and USGBC members in April 2000.*

The summary document "Making the Business Case for High-Performance Buildings" (USGBC, 2002) cited a number of case studies related to costs and concluded that:

- "Many green buildings cost no more to build –or even less than the alternatives –because resource-efficient strategies often allow downsizing of more costly mechanical, electrical, and structural systems. The key is integrated design."
- "Savings in energy costs of 20-50% are common through integrated planning, site orientation, energy-saving technologies, on-site renewable energy-producing technologies, light-reflective materials, natural daylight and ventilation, and downsized HVAC and other equipment."

The report stated further that high-performance buildings produce reduced liability, higher property value, access to tax credits, greater value for tenants, and reduced project uncertainty and risk. The documentation to support these assertions was, however, minimal.

Moreover, in terms of building costs themselves, early experience with LEED paints a somewhat muddy picture. For 26 LEED 1.0 and 2.0 projects, first costs ranged from a low of $13 to a high of $425 per square foot (see chart). Nor was there any apparent correlation between higher rating and higher cost per square foot. Two LEED Platinum buildings came in at $215 and $260, but lesser categories had buildings with first costs nearly as great or greater: a Gold at $340/sq. ft., two Silvers at $245 and $255, and two Certifieds, one at $235, the other at $425, the most expensive building of all on a square foot basis. The most likely explanation for these differentials is that different building types cost more per square foot to construct than others.

More recently, David Gottfried, co-founder of the USGBC and the World Green Building Council, took up the business case.[8] The former real estate developer, now president of World-Build Technologies, cited a municipal building in San Diego whose added cost was 4% and whose internal rate of return on the net investment was 57% (due to significant energy savings); and a building in Sacramento, Calif., that was designed to achieve a LEED Silver rating, built at an added cost of 1%, with an estimated payback period of two years. Gottfried did note that "the cost of funds for government is low, and the time horizon for the average life of a

public building is long," advantages not generally shared by developments in the speculative market.

As more high-performance buildings come on line, Gottfried stated, they will be able to take advantage of a host of additional financial benefits: lower insurance premiums (due to improved indoor air quality, which theoretically would reduce owner liability), lower vacancy rates, potentially higher rents, higher building valuation, and more favorable financing terms. In the absence of documentation of these benefits, however, the financial community has been reluctant to grant green buildings the favorable treatment Gottfried envisions them deserving.

Recently, a number of research studies have been aimed at resolving these financial conundrums.

In California, a hotbed of public sustainable development thanks to a state-mandated sustainable building goal, the Sustainable Building Task Force, with representatives from more than 40 agencies, has examined the costs of green building. According to Geof Syphers, director of green building services with KEMA Xenergy, in Oakland, recent analysis shows that the "green premium" for public buildings is falling quickly. Early estimates for LEED-rated buildings came in at premiums of 2-5% for certified projects and 5-10% for Silver, Gold, or Platinum, but recent estimates are much lower. For example, Block 225 of the Capitol Area East End project in Sacramento earned a Gold rating with no additional cost over base budget. Data from Seattle shows an average 1.7% green premium for municipal projects. That increment has come down over time. KEMA Xenergy's review of 50 green building projects for local governments found a "significant difference" in added costs between an entity's first project and subsequent projects, due to start-up costs, training, and research.

Syphers has identified five factors that contribute to cost inflation for green public (and possibly private-sector) buildings:

1) Lack of a clear green design goal. The design goal should be set as early as possible in the project, ideally before releasing the initial design RFQ/RFP.

2) Incorporating green design in mid-project. This results in added costs due to redesign and additional change orders. However, even starting late may pay off in reduced operating costs long-term.

3) Lack of a single point of responsibility for the LEED process. Experience in green building demonstrates clearly that a single "champion" for LEED research, implementation, and documentation is crucial.

4) Lack of experience with or knowledge of LEED. This can be on the part of the Building Team, who may waste time researching inappropriate technologies, or an inexperienced owner, who may accept a bid for commissioning or some other service that is overpriced.

5) Lack of time to research materials and technologies options. New green products, components, and technologies are coming on the market every week, so Building Teams must use research time wisely to shop cost-effectively for products. This, too, will improve with experience, says Syphers.[9]

Further confirmation of positive cost trends comes from work led by Gregory Kats, a founding principal of Capital E, Washington, D.C., for the California task force. Based on an analysis of 33 buildings nationally that were either certified or pre-certified for LEED, Kats, a former finance director for the DOE's Office of Energy Efficiency & Renewable Energy, found that it was possible to achieve a Certified rating at little or no added cost, while a Silver or Gold rating would require about 1.5-2.0% over the cost of the same building under conventional design[10] (see chart at right).

Over time, the cost of green buildings is coming down, as project teams become more experienced in sustainable development and the cost of green products, components, and materials comes down, says Kats. Green buildings produce a 20-year net present value** of $5.79 per square foot in energy savings, an emissions-reduction NPV of $1.18 per square foot, and a water usage NPV of $.51 per square foot (although water savings can vary considerably by locale). "The findings are that, for public buildings, assuming 5% real inflation and a 20-year term on net present value compared to the marginal cost, you get a ratio of 10:1 over a 20-year term," says Kats.

In August, the USDOE's Federal Energy Management Program weighed in on the green building costs issue with "The Business Case for Sustainable Design in Federal Facilities." This comprehensive report, prepared by Anne Sprunt Crawley and Beverly Dyer, documented numer-

Average green cost premium for LEED buildings

LEED rating (# of projects)	Green cost premium
Certified (8)	**0.66%**
Silver (16)	**2.11%**
Gold (6)	**1.82%**
Platinum (1)	**6.50%**
Average (33)	**1.84%**

Source: USGBC, Capital E analysis, in "The Costs and Financial Benefits of Green Building," Greg Kats et al., October 2003.

Analysis of 33 LEED-registered projects (25 office buildings and 8 schools) shows an average first-cost "green premium" of less than 2%. The projects were chosen because cost data for both actual green design and convention design was available.

[9]"Managing the Cost of Green Buildings," Geof Syphers, P.E.; Arnold M. Sowell, Jr.; Ann Ludwig; and Amanda Eichel, August 2003 (to be presented at Greenbuild 2003).

[10]"The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force," Gregory Kats et al., October 2003.

**Net present value reflects a stream of current and future benefits and costs, resulting in a value in today's dollars that represents the present value of an investment's future financial benefits minus any initial investment.

ous cases of successful Federal green buildings and described their contribution to the "triple bottom line": environmental stewardship (protecting and conserving resources), social responsibility (improving quality of life), and economic prosperity (reducing costs, adding value, creating economic opportunity).[11] The DOE report simulated the savings associated with sustainable building features in a hypothetical two-story 20,000-sq. ft. building in Baltimore. (The average GSA office building is 20,979 sq. ft.) The cost of the "base case" building, which was modeled on meeting ASHRAE 90.1 energy requirements, was estimated to be $2.4 million.

Using the DOE's Energy-10 and DOE-2 modeling software (plus vendor quotes and other estimating techniques), researchers at DOE's Pacific Northwest National Laboratory and National Renewable Energy Laboratory determined that adding sustainable features to such a building would add $47,210 to the base case construction costs –a "green premium" of less than 2%:

Feature	Added cost
Energy-efficiency measures	$38,000
Commissioning	4,200
Natural landscaping, stormwater management	5,600
Raised-floor system, movable walls	0
Subtotal	$47,800
Water-saving measures (no-water urinals)	(590)
Total added costs	**$47,210**

It was determined that using movable walls and raised floors would not add to first costs, while no-water urinals were estimated to actually save $590 to install, because they require less piping than conventional toilets.

According to the DOE models, the annual cost savings for the "sustainable" prototype would nearly match the first-cost premium:

Feature	Annual cost savings
Energy-efficiency measures	$4,300
Commissioning	1,300
Water-saving measures (no-water urinals)	330
Natural landscaping, stormwater management	3,600
Raised-floor system, movable walls	35,000
Total	**$44,530**

[11] "The Business Case for Sustainable Design in Federal Facilities," U.S. Department of Energy, Federal Energy Management Program, August 2003 (draft).

Managing first costs for green buildings

First-cost premiums can be held in check with effective cost-management strategies. In 'Managing the Cost of Green Buildings,"the authors offer a 10-point plan to manage first costs:

1) Determine if the project is right. Not all projects are candidates for sustainable design. Make sure senior decision makers support the concept.

2) Set a clear goal early in the game. Ideally, 'the decision to go green should be made before soliciting design proposals so that contract language may reflect the green goal,"thus permitting more flexibility in decision making. Certain green measures that can save money (such as site planning) have to be done early.

3) Write contracts and RFPs that clearly describe your sustainability requirements. For example, are you going for LEED Silver or the equivalent? Spell it out.

4) Select a team that has experience in sustainable development. The authors state that hiring an MEP firm with 'green" experience alone can save 10% of the MEP construction costs. Look for team members with a history of creative problem solving.

5) Encourage team members to get further training and to develop sources of information on green materials, products, and components and technical/pricing information on advanced systems (underfloor air, energy management, etc.)

6) Use an integrated design process. Do not make the green components 'add-ons'to the rest of the project. Integrate all the candidate green measures into the base budget. Establishing an integrated design can lead to capital savings: Investing 3% of total projects costs during design can yield at least 10% savings in construction through design simplifications and fewer change orders, the report states.

7) Understand commissioning and energy modeling. To minimize upfront costs, use a sampling approach for building commissioning.

8) Look for rebates and incentives from states, counties, cities, and utilities (see p. 22).

9) Educate the decision makers without inundating them with technical information. Stay focused on their objectives. Respect their sense of risk aversion. Don't go overboard with unproven technologies.

10) Manage your time carefully. Select one or two team members to oversee research on green products and systems. Set a specific deadline for research results, and give the 'discovery manager'the power to cut off research. Otherwise it could go on forever.

Adapted from 'Managing the Cost of Green Buildings,"Geof Syphers, P.E.; Arnold M. Sowell, Jr.; Ann Ludwig; and Amanda Eichel, August 2003. The complete document will be discussed at Greenbuild 2003.

The $35,000 savings from the underfloor system and movable walls was estimated to come from reduced "churn" (the cost of moving employees within a building). The $2,680 difference between the green premium and annual cost savings could, according to the authors, be made up by using sustainable materials, such as concrete with slag content, recycled carpet, and low-emitting paint. They also posited a savings of $2,000 a year in "social cost reductions" related to improved air quality (more on this in the next section).

What, then, can be concluded about green building first costs from all these studies?

First, there may, in some cases, be a slight premium for taking a conventional design to the equivalent of LEED Certified, but not always. A well-executed design that reduces infrastructure and building volume can produce a sustainable building at a premium of 1-2% at most. Going up in class to the equivalent of Silver or Gold may push up the premium, but at considerable additional savings over the life of the building.

Whether the rental market will pay a premium for sustainable design is another issue. Jeff Barber, AIA, a vice president in the Washington, D.C., office of the Gensler architectural firm, is skeptical, except in cases where tenants pay their own utilities. Then, he says, it may be possible to charge a rental premium on the basis of lower utility bills, but this is rare.

Hugh Zimmer, the chairman and CEO of Zimmer Real Estate Services, Kansas City, Mo., has personal experience with this issue. He has been trying to charge Class A rates at his EcoWorks at Southlake project –only the second speculative office project to receive LEED certification –but so far has only one tenant. "I don't think you're going to sell [sustainable design] on energy savings alone," says Zimmer. "The savings are probably there, but you can't sell it." Still, Zimmer is holding firm in his beliefs: His next project will be a LEED Platinum office building.

Finally, some first-cost issues need further study, according to Greg Kats. The insurance-related benefits of green buildings in reducing mold liability through better construction methods and moisture-resistant systems need to be analyzed. Owner benefits such as higher rents, lower vacancy rates, faster tenant lease-up, and greater internal rate of return on investment all need to be documented more fully. Appraisal firms need to be brought up to speed on the financial benefits of green buildings so that they can be appraised more fairly for their added value. Still, experienced designers say these issues may evaporate in a few years. "If you have a team that knows what they're doing and has been through this before, you can get to high LEED Silver without any additional cost and, depending on the building type, it could even be cheaper" than conventional construction, says William Odell, AIA, of Hellmuth, Obata + Kassabaum, St. Louis, co-author of *The HOK Guidebook to Sustainable Design*. "Five years down the road, people won't even ask the question."

HUMAN AND SOCIAL BENEFITS OF GREEN BUILDING

Are green buildings healthier for occupants than conventional buildings? If so, does this benefit translate into improved worker productivity, greater creativity in problem solving, more efficient task-handling, perhaps even lower health insurance costs for employers?

Are green buildings more "attractive" to workers, thus improving morale and enabling the recruitment and retention of high-caliber employees? Do green schools produce better student performance? Do patients in green hospitals recover more quickly? Do green retail stores ring up higher sales than their traditional counterparts?

These and related questions were first asked in the 1960s and 70s, when "sick building syndrome" in offices and workplaces was brought to the public's attention. VOCs from carpeting and furniture, inadequate air circulation, poor lighting, disgusting mold buildup and disruptive temperature variances –all were contributing to nausea, respiratory problems, skin rashes, lethargy, headaches, and numerous other health concerns.

Public outcry over sick building syndrome led to improvement in building design and maintenance, although "SBS," as it came to be known, has hardly been conquered (which is why the U.S. Green Building Council has launched its LEED pilot program for existing

buildings). For the purposes of this White Paper, however, the discussion necessarily must focus not on worst-case "sick" buildings but on conventional buildings in comparison to high-performance buildings.

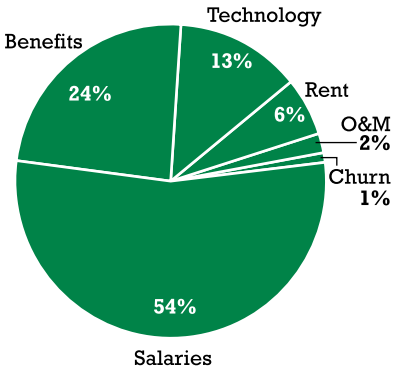
The last couple of decades have produced dozens upon dozens of scholarly papers and research studies on all aspects of indoor environmental quality and its relationship to worker productivity and well-being. In the United Kingdom, William Bordass and Adrian Leaman conducted the groundbreaking "PROBE" building use studies in the 1980s. PROBE —for "Post-occupancy Review of Buildings and their Engineering" — was among the first to use "POE" (post-occupancy evaluation) studies to evaluate occupant comfort, satisfaction, and productivity as well as fulfillment of design intentions.[12]

In the United States, the oft-cited "West Bend" study by Walter Kroner and colleagues at Rensselaer Polytechnic Institute documented productivity gains from daylighting, access to windows, and a view of a pleasant outdoor landscape at the West Bend (Wis.) Mutual Insurance Company. The performance of clerical workers in a new building, opened in 1991, was compared to that of workers in an old building to see which group could produce more reports in an allotted time. (According to Kroner, the insurance business, which relies on the production of standard reports, is one of the few where measurable data of this kind can be obtained.) Employees in the new building were also supplied with individual controls that allowed them to adjust temperature and other conditions in their work environments. According to the study, productivity gains in the new building increased by 16%, with the personal controls alone accounting for a 3% gain.[13]

Another frequently cited report is the Heschong Mahone Group study "Daylighting in schools," which was conducted on behalf of the California Board for Energy Efficiency. The researchers analyzed test scores for 21,000 students in 2,000 classrooms in Seattle; Orange County, Calif.; and Fort Collins, Colo. In Orange County, students with the most daylighting in their classrooms progressed 20% faster on math tests and 26% faster on reading tests in one year than those with the least daylighting. For Seattle and Fort Collins, daylighting was found to improve test scores by 7-18%.[14]

Heschong Mahone conducted a similar study across 108 stores operated by a chain retailer, two-thirds of which had skylights and one-third with electric lighting, mostly fluorescent. Monthly gross sales were converted into a "sales index" to hide actual dollar performance. The researchers concluded: "All other things being equal, an average non-skylit store in the chain would likely have 40% higher sales with the addition of skylights." This was found with 99% statistical certainty.[15] Both daylighting studies were sponsored by VELUX America Inc., a maker of roof windows and skylights.

Building costs as a portion of business expenses



Source: Carnegie Mellon University, 1999

Human costs account for nearly four-fifths (78%) of the lifetime costs of a building, according to data from Carnegie Mellon's Center for Building Performance and Diagnostics.

[12] See "The PROBE occupant surveys and their implications," CISBE National Conference (October 1999) and related papers. PROBE is described at: *www.esd.co.uk/portfolio/PROBE.htm*.

[13] "Using advanced office technology to increase productivity," Rensselaer Center for Architectural Research, 1992.

[14] "Daylighting in schools," Heschong Mahone Group, August 20, 1999. Effects were observed with 99% statistical certainty.

[15] "Skylighting and retail sales," Heschong Mahone Group, August 20, 1999.

Can green buildings reduce stress?

The AIA and the National Institutes of Health have teamed up with the General Services Administration to see if greener workspaces can reduce stress and thereby improve productivity among government office workers. The GSA will recruit about 200 Federal employees who are now working in conventional office space with poor lighting, ventilation, and temperature control. Various physiological stress factors —heart rate, hormone concentrations, even sweat —will be measured in those settings. Then the study participants will be moved to temporary quarters (where they will continue to be monitored) while their offices are 'greened.' Finally, they'll be moved back into their newly renovated offices and monitored for stress. The whole process should take about two years. John Eberhard, AIA director for research planning, is the key contact on the project.

In healthcare, dramatic improvements in patient outcomes have been reported for hospitals participating in the "Pebbles" sustainable design project (see *Building Design & Construction,* February 2003).

One of the most distinguished scholars of IEQ research, William J. Fisk, PhD, of the Indoor Environment Department at Lawrence Berkeley National Laboratory, has projected the estimated potential annual savings and productivity gains from improved indoor air quality at $6-14 billion from reduced respiratory disease, $1-4 billion from reduced allergies and asthma, $10-30 billion from reduced SBS-related illness, and $20-160 billion from direct improvements in worker performance that are unrelated to health. Fisk and his colleague A.H. Rosenfeld have put a value of $12-125 billion annually in worker performance gains from thermal and lighting improvements.[16]

It is beyond the scope of this White Paper to gainsay the validity of these studies, except to say that virtually all of them were conducted before 2000 and thus do not reflect the experience of the most recent group of sustainable buildings. "We haven't had a good sample [to study]," says Judith Heerwagen, PhD, an environmental psychologist and former research scientist at Pacific Northwest National Laboratory, who has written extensively on this subject.

Beyond the academic nuances, the larger concern is that the real estate community simply is not convinced by these studies. While a growing number of developers and owners may be getting more comfortable with the energy and water savings of green buildings, they still have trouble pinning down the dollar value of the human and social benefits of sustainable development.

In this context, one of the more exciting developments on the horizon is Workplace 20•20, an effort by the General Services Administration to create a new generation of quality work environments for Federal workers. The groundwork can be attributed at least in part to what Craig Zimring, professor of architecture and psychology at the Georgia Institute of Technology, calls the "the drumbeat of rhetoric of 'listening to the customer'" in business circles. Here, the customer is what John Zeisel called (in his 1975 book *Sociology and Architectural Design*) the "nonpaying client" –employees and staff, not just the building committee or the owner. Workplace 20•20 will give greater voice to this group in the design of their places of work.

About three years ago, GSA research director Kevin Kampschroer asked a number of university researchers to focus on post-occupancy evaluations (now known as "facility performance evaluation," or FPE). He wanted to know how best to do before-and-after studies that would aid in the design of new and rehabilitated GSA buildings, something he felt the design community needed. "Generally speaking, architects have good intuitive beliefs and some anecdotal evidence, but little beyond that," Kampschroer was quoted as saying (in the August 14, 2003, issue of the journal *Nature)*.

The GSA has good reason to engage in such research. In recent years, its Public Buildings Service, which houses 1.1 million Federal employees in 334 million square feet of space, has had to compete with the private sector to build or renovate buildings for occupancy by Federal workers. With nearly two-thirds ($986 million) of the GSA's FY2003 budget of $1.54 billion devoted to repair and alteration, the PBS decided that, since it was spending so much money moving Federal employees around and into new spaces, it might be wise to learn how to make these places better environments in which to work — more like "a successful business," according to Heerwagen.

Workplace 20•20 was launched in 2002 with pilot studies in Kansas City, Denver, Chicago, New York, and Washington, D.C.; eventually, it will expand to 22 sites. Vivian Loftness, FAIA, dean of the School of Architecture at Carnegie Mellon University, says the study teams are working to capture goals and "metrics of success," with an eye toward determining how to design those factors into sustainable buildings. "The goal is to put some benchmarks down on the table –health, attraction/retention, churn rate, etc. –then to be actively involved with the design team on the new environment, where the goals are clearly stated," says Loftness. Field teams are documenting baseline before-and-after evaluations of Federal buildings that are scheduled to be greened. These studies will lead to the creation of "proof sets" that Building Teams will be able to take to clients to make the case that investing in green buildings can pay off in greater employee productivity. "Controlled research studies have shown that productivity

The Workplace 20•20 approach

- Derives the design from the business strategy and an understanding of the nature of work
- Uses a 'balanced scorecard"approach for planning, design, and research
- Emphasizes both business value and human assets
- Integrates state-of-the-art research findings into the planning and design process
- Measures results
- Synthesizes lessons learned
- Assumes a life cycle perspective

Source: GSA, Public Buildings Service *www.gsa.org*

[16] "Health and productivity gains from better indoor environments and their relationship with building energy efficiency," William J. Fisk, *Annual Review of Energy and the Environment*, Vol. 25, pp. 537-566, November 2000.

Workplace 20•20 participants

Federal agencies
- GSA Public Buildings Service
- Energy Efficiency and Renewable Energy (DOE)
- Federal Energy Management Program
- National Renewable Energy Laboratory
- Interagency Sustainability Working Group
- National Institutes of Health
- Naval Facilities Engineering Command

International
- Public Works & General Services of Canada

State agencies
- California Department of General Services
- Massachusetts Division of Capital Asset Management
- Minnesota Bureau of Facility Management

Universities
- Carnegie Mellon Univ.
- Georgia Institute of Technology
- UC Berkeley
- MIT

Construction industry
- Hines Construction Co.

does improve, but field tests are not as strong," says Loftness.

Heerwagen, who is directing the research for Workplace 20•20, says the program will attempt to address key issues: Do green buildings enhance worker productivity? Are they more comfortable, more healthful? If you get rid of some basic problems, like sick building syndrome, is there a measurable difference between green buildings and conventional ones? Do green buildings help businesses meet their strategic goals? In sum, can sustainable design be a strategic business asset?

Heerwagen says that there has not been sufficient research on good examples of sustainably designed buildings because there hasn't been a large enough sample of such buildings. "You need studies not over single buildings but over numerous buildings of the same type," she says. Hence, Workplace 20•20.

Workplace 20•20 begins with a "discovery process," during which a consultant works with the owner (in this case, a Federal agency) to identify internal and external drivers of change and to define existing and desired ways of working. After these results are analyzed, "scenario development" takes place, which includes workplace programming and the development of alternative concepts and solutions. "Design translation" establishes checks and balances between the GSA and the owner agency as the project moves into consulting, design, and construction. Finally, the workspace is evaluated in a "measurement phase" to make sure the owner's performance criteria have been achieved.

The intellectual underpinning for Workplace 20•20 is formed by two publications, according to Heerwagen. The first is an article by Robert G. Eccles, "The Performance Measurement Manifesto" (*Harvard Business Review,* January 1991), in which Eccles called for a "broader set of measures" for business, beyond financial figures. Among them: product quality, customer satisfaction, capacity for innovation, quality of work life (including employee work attitudes and job satisfaction), employee retention, perceived value of goods and services, operational efficiency, and social responsibility.[17] Heerwagen points out that most of these measures "add value" to the business enterprise or to employees rather than simply reducing costs. Ironically, she says, "when it comes to facility decisions, costs are almost always the predominant consideration. In part this is because there is little evidence, or even theoretical work, linking features and attributes of the building environment to these key dimensions of organizational success."

The other structural foundation for Workplace 20•20 is "The Balanced Scorecard," from a 1996 book of the same name by Robert S. Kaplan and David P. Norton. The Balanced Scorecard approach assesses financial outcomes (e.g., reduced O&M costs), business outcomes (e.g., process innovation), stakeholder relations (e.g., improved public image), and "human resource development," including improved quality of work life, productivity, well-being, and recruitment and retention.[18]

"Everyone wants to believe that happy workers are more productive, but there's nothing in the literature to prove that," say Heerwagen. "We make the assumption that if we make employees happier, more comfortable, they'll work harder, but that's not necessarily true." But, she continues, "there may be psychological benefits [from sustainability] that *are* important: commitment to the organization, looking forward to going to work, feeling more motivated." These can benefit the business enterprise.

Because most offices house employees who do "idea work" or "information work," Workplace 20•20 will seek to assess whether the physical environment can contribute to the owner's business proposition. For example, one question is whether sustainably designed buildings enable social interactions that stimulate collaboration among workers. "We're looking for relationships between the physical space and changes in communications patterns," says Heerwagen. "I think that some of these effects may be very small, very subtle, but the cumulative effect could be very important." In this respect, Workplace 20•20 is designed to view the office workplace as an "enabler" of work, rather than as a mere physical container.

In conclusion, the bottom-line benefits of energy and water savings, waste reduction, and environmental improvement are already becoming well documented and accepted by the real estate marketplace. Proving the business case for the human and social benefits of green building may be more challenging, but could prove to be vastly more rewarding in the long run.

[17] Cited in "Design, productivity, and well being: What are the links?" Judith H. Heerwagen, AIA Conference on Highly Effective Facilities, March 1998.

[18] "Green buildings, organizational success, and occupant productivity," *Building Research and Information*, Vol. 28 (5), pp. 353-367, 2000.

THE FUTURE OF SUSTAINABLE DEVELOPMENT

An estimated $15 billion worth of green buildings are currently in design or under construction in the U.S., representing 12-15% of total public construction and about 2% of private-sector construction, according to Capital E's Gregory Kats. Although that $15 billion represents less than 5% of the total $315 billion U.S. annual construction for commercial, industrial, and institutional buildings, the category is growing at the rate of about 75% a year, according to Kats.

Moreover, while the bulk of respondents to the *White Paper Survey* (65%) said that, in their estimation, green building was growing at less than 25% a year (and only 3% felt it was growing at more than 50% a year), nearly half the respondents (49%) were at firms that had at least attempted a sustainable design project. Forty-two percent said they had some level of experience in sustainable development, and another 39% said they wanted to know more about it –a fairly strong indication of activity and interest.

Looking down the road, one potential roadblock to the growth of the sustainability movement could be the relative lack of hard-core laboratory research devoted to building systems, materials, and technologies. The share of annual sales devoted to R&D by the U.S. construction industry can only be described as abysmal in comparison to other industries, as these figures show:

Research spending by industrial sector

Industry sector	R&D spending as a % of annual sales
Biotechnology	**13-15%**
Semiconductors	**11-14%**
Pharmaceuticals	**8-12%**
Electronics	**4-7%**
Medical devices	**7-10%**
Software	**8-10%**
Aerospace	**6-9%**
Mechanical devices/machines	**2-5%**
Automotive	**2-4%**
Chemicals	**2-3%**
International industry average	**4.1%**
U.S. industry average	**3.0%**
U.S. construction industry	**0.2-0.5%**

Source: *R&D Magazine*, 2003 Annual R&D Funding Forecast.

Current Federal R&D efforts are scattered among numerous agencies, with the Department of Energy conducting the bulk of the laboratory-based research: building-integrated photovoltaics and energy systems at the National Renewable Energy Lab in Golden, Colo. (home of the High Performance Buildings Research Initiative and the Center for Buildings and Thermal Systems); energy-efficient building systems technologies at Oak Ridge (Tenn.) National Laboratory's Building Technology Center; code-related development at Pacific Northwest National Lab, Richland, Wash.; and IEQ studies at Lawrence Berkeley (Calif.) National Lab's Indoor Environment Department.

In academia, a number of universities* are performing research directly or peripherally related to buildings, but they, too, have tight budgets and commensurately limited agendas. Compared to the kind of funding support bestowed on universities for life-science research or military applications, support for building-related research is appallingly low.

It would be comforting to assume that the free-market system alone would be sufficient to encourage the development of new technologies; in fact, many new green products have come online recently in response to perceived market demand. But the history of R&D in the U.S. demonstrates that a healthy dose of targeted funding and directive from the government, coupled with university and private-sector support, can be a marvelous formula for success, the preeminent example being the mission to put a man on the moon in the 1960s. Clearly, there is a need to create a more unified R&D entity whose primary mission would be to conduct research related to sustainable design, green products and components, and new building technologies (see Recommendation 4, p. 41).

An intriguing area of research that merits greater consideration is biomimicry, a phrase coined by the writer Janine M. Benyus.[19] Biomimicry uses nature as a model to solve human problems –for example, studying the silks woven by spiders to create tough and highly elastic fibers for use in building materials.

One manufacturer that is responding to this concept is Interface Research Corporation, a 25-

*Among them:
Carnegie Mellon University
Georgia Institute of Technology
Harvard University School of Public Health
Massachusetts Institute of Technology
Rensselaer Polytechnic Institute
Texas A&M University
University of California, Berkeley
University of Michigan
University of Minnesota
University of Texas, Austin
University of Texas Health Center, Houston

[19]*Biomimicry: Innovation Inspired by Nature*, 1997. Benyus's Website is *www.biomimicry.net.*

member research subsidiary of Interface, Inc. Michael Bertolucci, a PhD chemist and president of Interface Research Corporation, says the group's charter is "to create more nature-mimicking programs and technologies that will allow our company to reduce our environmental footprint to zero, or to create offset programs to reach that level." The company has used biomimicry to develop new flooring products. "We want to find materials that are biomimicking and renewable, and as a result generally recyclable or compostible," to "close the loop" and make such materials "part of nature's cycle," he says.

Biomimicry will be a key element of an interdisciplinary university architecture curriculum being developed by Benyus and Dayna Beaumeister for the Natural Design Consortium, a program of the Boston-based Corporate Design Foundation.

Striving for wider consensus

As for the U.S. Green Building Council, its agenda continues to be vast and ambitious. More than 20 state and local chapters are now in place. The pilot program for existing buildings already has taken in 76 buildings, owned by 58 entities, comprising 20 million square feet of space, in hospitals, corporate offices, government facilities, schools, and universities.

The USGBC message of market transformation is being more fully embraced by the leadership of the design, construction, and real estate industry every day. As recently as August 15, eight national organizations —the AIA, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, the American Society of Interior Designers, the Construction Specifications Institute, the International Facility Management Association, the International Interior Design Association, the Society for College and University Planning, and the USGBC —met under the auspices of the Urban Land Institute to develop a collaborative approach to building sustainable communities; two major real estate groups, the Building Owners and Managers Association and CoreNet Corporate Global Real Estate Network, as well as the American Planning Association and the American Society of Landscape Architects, were scheduled to join the group at its next meeting, at Greenbuild 2003. The goal of this umbrella group is to find common ground on the larger of issues of sustainability.

From a global perspective, issues of social and economic equity must be balanced with the desire to achieve environmental and economic improvement —the Triple Bottom Line —in rapidly industrializing nations like China and India, as well as in Third World. It is one thing to talk about building green in Seattle, quite another to apply the message of sustainability in Shanghai, with the most aggressive construction program of any city in the world. "How do we look at this from a regional, national, and international perspective?" asks Gail Lindsey, the former chair of the AIA's Committee on the Environment, who even questions whether striving for "sustainability" is sufficient. She prefers the idea of "regeneration," or even "abundance" —creating buildings that add to prosperity, rather than depleting it.

The passion and commitment of those in the green building movement carries with it a set of conflicting agendas that have to be respected. This is especially true within the USGBC, whose consensus-based structure can be trying at times for the well-meaning participants. "I can't tell you how long and painful the process of getting approval for Core & Shell has been," says M. Arthur Gensler, Jr., a member of that committee and an editorial adviser to *Building Design & Construction*. Gensler says the infighting among the various Technical Advisory Groups within the USGBC can be frustrating, even when the committee comes up with what seem to be reasonable compromises. "It's mind-boggling," he says.

Conflict is inherent elsewhere in this arena, too. For example, the GSA's Leslie Shepherd, director of the Center for Architecture, Engineering and Urban Development, says the agency has been getting some "pushback" on utilizing underfloor air distribution in GSA buildings —it cuts down the "churn rate" of moving employees and thus saves money —from, of all places, the FBI, which has expressed concern that underfloor systems could literally present an opening for terrorists to access Federal buildings.

All this controversy and debate has to be seen as a healthy sign for the green building movement in the U.S. and abroad. "The building industry is not going to change overnight," says Greg Kiss, of Kiss + Cathcart, Architects, Brooklyn, N.Y. "It takes time to understand the issues, and how to creatively incorporate them into building design. Maybe we're just getting to that point —truly sustainable buildings."

Milestones in Sustainability

- 1997
  Minnesota Sustainable Design Guide established by Hennepin County, Minn.
- Earth Day 1998
  Top 10 Green Projects launched by AIA/COTE (as Earth Day Top 10)
- 14 September 1998
  Executive Order 13101
- 1998
  Green Building Challenge, Vancouver, B.C.
- 1998
  Federal Interagency Committee on IAQ established by EPA
- 1998-9
  LEED Version 1.0 pilot program
- 27 April 1999
  'Green Energy Parks" inaugurated by National Park Service
- 3 June 1999
  Executive Order 13123
- 1999
  Pennsylvania and New York issue guidelines for high-performance buildings
- 12 November 1999
  World Green Building Council founded, San Francisco
- March 2000
  LEED 2.0 adopted
- 15 April 2000
  DOE Order 430.2A, directing application of sustainable design to new DOE buildings

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WHITE PAPER ACTION PLAN

Milestones in Sustainability

- 21 April 2000
  Executive Order 13148
- 2000
  The HOK Guidebook to Sustainable Design (Mendler and Odell)
- 2000
  Seattle Sustainable Building Program approved
- 2000
  National Institute of Building Sciences undertakes management of *WBDG*
- 2000
  Green Building Tax Credit approved for New York State
- 2000
  AIA Sustainable Design Guidelines adopted
- 2001
  Interagency Working Group on Sustainability established by Federal Energy Management Program
- 1 May 2001
  U.S. Army Technical Letter introduces SPiRiT program
- 21 May 2001
  Life Cycle Inventory meeting, Dearborn, Mich.
- 9 June 2001
  UN Declaration on Cities and Other Human Settlements in the New Millennium
- 19 December 2001
  Sustainable Design and Development Policy adopted by USAF

The following recommendations from the editors of *Building Design & Construction* are addressed primarily to the North American commercial, institutional, industrial, and multifamily residential construction market. The editors have strived to present recommendations that would be seen as both practical and economically feasible. Each recommendation is tied to a suggested group of agencies or organizations that could reasonably be expected to accomplish the task; an estimated budget, timeframe, and metric are also included. While we have only the power of suggestion at our disposal, the editors sincerely hope that this Action Plan will lead to further positive activity for sustainable development.

1. Conduct peer-reviewed studies of the benefits of green buildings related to human performance, health, and well-being.

In general terms, the data on the bottom-line benefits of sustainable design, such as dollar savings from reduced energy and water consumption, is much more reliable than that related to many of the less-tangible economic, social, health, and well-being benefits of green buildings. And while there have been numerous studies related to the benefits of daylighting, improved IEQ, and similar factors, almost none of this research has been based on the most recent crop of high-performance buildings. The result is that the real estate market at large remains skeptical about claims that today's green buildings provide greater human and social benefits or whether such benefits, even if proven to exist, would have a practical impact on the bottom line.

To address this issue, it is recommended that the National Academies –the National Academy of Sciences, the National Research Council, the National Academy of Engineering, and the Institute of Medicine, with funding from the National Institutes of Health, the National Science Foundation, nongovernmental foundations, and the private sector –undertake an authoritative, peer-reviewed study (or set of studies) of the less-tangible economic, social, health, and well-being benefits of green building over conventional design. To succeed, this research effort must include participation by both the public and private sectors (especially the speculative commercial real estate community) in providing test cases of recent high-performance green buildings.

Factors to be measured and analyzed could include but not be limited to:

- Health and well-being of building occupants (health, social)
- Employee satisfaction (social, economic)
- Task-related employee productivity (economic, social)
- Retention and recruitment of employees by occupant companies (economic, social)
- Churn rate (economic)
- Retail sales (economic) –retail stores
- Wellness/improved patient outcome (health, social, economic) –hospitals
- Student performance and health (social, health) –schools (see #6, p. 43)

Responsible Parties: The National Academies, with NIH and NSF
Resources/Budget: $100,000 for design of study or studies (additional funding needed later based on study design)
Time Frame: First peer-reviewed study by 2007
Metric: Establish study program in Q1-Q2/04, with review of existing studies and plan of action; funding proposals out by Q3/04; initiate study in Q1/05; draft document by Q2-3/06; final document by Q2-3/07

2. Enlist the real estate, financial, insurance, and appraisal community to champion a rigorous, peer-reviewed study of the economic and 'business-case" aspects of sustainable design.

The brokerage, financial, insurance, and appraisal community has lagged behind other interest groups in becoming active in the sustainable design effort, with the negative effect that green buildings may not be credited with the enhanced market value sustainable design should deliver. To attack this problem, the American Insurance Association, the American Society of Appraisers, the Building Owners and Managers Association, CoreNet Global Corporate Real Estate Network, the National Association of Independent Insurers, the National Association of

Mutual Insurance Companies, the National Association of Real Estate Investment Trusts, the National Association of Realtors, the Public Risk Management Association, the Real Estate Roundtable, and other national real estate and insurance industry professional associations should be encouraged to join –or at least liaison with — the newly formed "Summit of the Professions," which includes the American Institute of Architects, ASHRAE, the American Society of Interior Designers, the Construction Specifications Institute, the International Interior Design Association, the International Facility Management Association, the Society for College and University Planning, the Urban Land Institute, and the USGBC.

The immediate goal of this group should be to sponsor research to firmly establish the business case for sustainable design in the real estate market, particularly in the speculative commercial construction market. Such research would focus on the concerns of the real estate, financial, insurance, and appraisal community with regard to the impact or benefit of sustainable design on: first costs; financing (access and rates); annual fiscal budgets (construction, finance, and development); building life-cycle costs (including Operations & Maintenance); insurance rates; initial building valuation; resale valuation; building safety and security; lease rates and premiums; sales premiums; marketability; and profitability.
Responsible Parties: ULI and USGBC as facilitators, with the participation of the above-named associations.
Resources/Budget: Allocate one executive or board member to participate on this committee or working group for at least one year; ULI and USGBC staff time; T&E for committee work
Time Frame: Establish committee or working group in Q4/2003
Metric: Preliminary committee reports by end Q4/04; Group Plan of Action by Q2/05

3. Establish a Senior Interagency Green Building Council at the Federal level.

This recommendation supports the suggestion of the Federal Environmental Executive (in "The Federal Commitment to Green Building") to work with the Interagency Sustainability Task Force and other entities within the Federal establishment to "create a senior policy group to coordinate Federal efforts on environmental design, including research, education, finance, standards development, measurement, implementation, and policy."

Creation of this senior interagency panel would be an important first step toward two other key objectives at the Federal level: a) issuance of an Executive Order mandating clear guidance and implementation by the Office and Management Budget and individual agency budget offices on the use of life cycle costing-based analysis for Federal capital investments (as opposed to the current practice of exclusive reliance on first-cost analysis); and b) convening of a White House-sponsored conference on Federal green building, to raise the profile of green building within the Federal establishment and to gather input from stakeholders in the public and private sectors on the proposed Executive Order.
Responsible Parties: The Federal Energy Executive, in cooperation with other agencies and the Interagency Sustainability Task Force
Resources/Budget: OFEE and agency/departmental staff time
Time Frame: Establish council by Q3-4/04
Metric: First meeting in Q1/04; proposal to agencies and OMB by Q2-3/04; announce council by Q4/04 latest

4. Establish an Institute for Sustainable Development Research, pooling the resources of major universities, the Federal government, and the private sector to create a unified center for R&D and data collection on sustainable design and development.

Current research efforts in building technology are scattered among a dozen or so universities, a handful of Federal labs, and numerous corporate R&D units. No single facility is devoted exclusively to taking a comprehensive approach to applied research and data collection and analysis related to sustainable design and development. A three-pronged initiative encompassing academia, the Federal R&D establishment, and the private sector in a unified physical setting would be exponentially more effective.

On the academic side, the formation of a multi-university consortium on sustainability would a) strengthen the ability of the university members to generate funding from such sources as the National Science Foundation's Industry/University Cooperative Research Centers program, the NIH, and the Department of Defense (for DoD

Milestones in Sustainability

- 2002
  OMB Circular A-11 Section 55 revision
- 24 April 2002
  Green Building Roundtable, Washington, D.C.
- 4 June 2002
  LEED-EB for existing buildings announced
- 2 July 2002
  Navy adopts LEED as a tool and metric
- 26 August - 4 Sept. 2002
  UN World Summit on Sustainable Development, Johannesburg, South Africa
- November 2002
  Greenbuild 2002, Austin, Texas
- 13 November 2002
  LEED-NC Version 2.1 released
- 18 March 2003
  Facility Performance Evaluation Summit, Washington, D.C.
- 30 April 2003
  LEED-EB pilot program launched
- August 2003
  Canadian Green Building Council licenses LEED
- 15-16 August 2003
  Summit of the Professions, Callaway Gardens, Ga.
- November 2003
  Greenbuild 2003, Pittsburgh

buildings) b) amortize costs over multiple university budgets, c) be more attractive (and less risky) to the private sector, foundations, industry trade associations, and other funding sources for participation and sponsorship.

At the Federal level, the GSA, the EPA, DOE, DoD, NIST, and the National Park Service have taken leadership roles in sustainable design and related R&D. These efforts, while commendable, are limited by the specific goals and missions of the respective departments or agencies.

Currently, less than 1% of total government R&D is devoted to building science, with only a fraction of that sum addressed to sustainable design topics. Consolidating Federal resources within the proposed institute would create synergies with the university consortium members, attract greater participation from private-sector partners, and thereby create a critical mass of activity that would lead to more ambitious results than can be attained under the current R&D model.

As for the private sector, the construction industry historically has devoted less than 0.5% of annual revenues toward R&D. Individual companies, as well as trade associations such as the Association of General Contractors, the National Roofing Contractors Association, the Carpet & Rug Institute, the EIFS Industry Members Association, the Illuminating Engineers Society of North America, and the Acoustical Society of America, would obtain a better value per research dollar by partnering with the proposed institute.

Finally, the Institute for Sustainable Development Research would also provide sufficient mass to support a robust IT backbone, which could be used to gather and assimilate data and analytical systems from such resources as the DOE's High Performance Buildings Research Initiative, the iiSBE's Sustainable Building Information System, and Carnegie Mellon University's Building Investment Decision Support software tool in support of the institute's ongoing research program.

Responsible Parties: Key Federal departments and agencies such as those involved in the Interagency Sustainability Task Force in cooperation with major firms and trade associations in the construction industry and the proposed multi-university consortium

Resources/Budget: Pool a portion of department and agency R&D budgets to establish an Institute for Sustainable Development Research; seek additional funding from private industry and foundations, as well as NIH and NSF (I/UCRC program)

Time Frame: Launch research center by Q4/05

Metric: Prepare work plan by Q2/04; determine location by Q4/04; generate funding for launch by Q3/05; set up pilot operation in Q4/05

5. Create guidelines for states, counties, and municipalities to implement sustainable design policies, legislation, executive actions, regulations, and incentives.

A significant number of states, counties, and cities have developed regulations or incentives for sustainable development (see p. 22). Now it is time to evaluate these efforts to determine how successful they have been and what can be learned from their experience.

An umbrella review committee consisting of state, county, and municipal organizations, in consultation with NGOs, state and local USGBC chapters, and other interested parties should make a detailed review of existing state, county, and city policies, legislation, executive orders, regulations, and incentives, to determine: a) the extent to which such efforts are enhancing sustainable design and construction, b) what improvements and refinements could be made, and c) what guidance their experience might have for state and local governments that are looking to adopt sustainable design legislation, regulations, administrative mandates, or incentive programs. This effort would benefit from consulting the *State and Local Government Tool Kit* (November 2002) and *Sustainable Building Technical Manual* at *www.usgbc.org*.

Such a review would might best be coordinated by a national legislative organization such as the National Conference of State Legislatures, to include such entities as the Council of State Governments (via its affiliated National Association of State Facilities Administrators), the International City/County Management Association, the National Association of Counties, the National Association of State Energy Officials, the National Governors Association, the National League of Cities, the Responsible Energy Code Alliance, and interested NGOs.

Responsible Parties: National Council of State Legislatures as champion, with participation from other organizations on above list

Resources/Budget: One PTE per member; T&E

Time Frame: Present draft report, guidelines, and

legislative models at Greenbuild 2004 (Q4/04)
Metric: Solicit NCSL to act as champion in Q1/04; NCSL to extend invitations, hold first meeting in Q1/04; consultant chosen, plan of work completed in Q2/04; preliminary report sent out for review Q3/04; presentation of final report, suggested legislative guidelines and models at Greenbuild 2004 (Q4/04)

6. Launch a pilot program in up to 10 large public school districts to measure the impact of green schools on student achievement and health.

Educators and school facilities directors would benefit from knowing how, if at all, daylighting, improved IEQ, better temperature control, and related "greening" techniques contribute to the learning environment, as measured by standardized test scores and other reliable indices of student achievement, as well as student health (particularly asthma and other respiratory ailments).

It is recommended that a pilot program be conducted in as many as 10 large school districts, varied as to geography, climate, setting (urban and suburban), economic base, and similar factors. (New Jersey, which has mandated LEED certification for its new schools, and California, with its high-performance schools program, could provide such "laboratories.") In each case, a planned or recently completed "conventional" school in a large district would be compared to a planned "green" school. Research would be conducted to evaluate differences in achievement yardsticks, as well as health indicators, between students at the two schools. School districts would be chosen on the basis of a national competition.

Responsible Parties: The Council of Educational Facilities Planners International as champion, with participation by such organizations as the National School Boards Association, the American Association of School Administrators, the AIA Committee on Architecture for Education, and the U.S. Department of Education, through its National Clearinghouse for Educational Facilities
Resources/Budget: One PTE from each participating organization to develop the guidelines and seek funding for the pilot studies
Time Frame: Hold planning meeting in Q1/04; committee report and guidelines by Q4/04
Metric: Research guidelines ready by Q4/04; seek funding in Q1/05; launch competition in 2005

7. Building product manufacturers should cooperate with efforts to create green product tools and databases using life cycle assessment.

The green product services described on pp. 26-28 have been providing a valuable service to designers and specifiers by evaluating products and cataloguing them in databases and directories.

Nonetheless, as the *BD&C White Paper Survey* results show, many specifiers are still confused by the proliferation of green products, uncertain as to what makes a product "green," and skeptical of the reliability of product claims and certification systems.

The preferred solution would be for green building products to be evaluated using life cycle assessment, but current LCA systems are either too cumbersome or too limited in their coverage of the green product universe.

On the horizon are a number of potentially valuable LCA-based systems, such as the LCI Database being developed by NREL and the eLCie tool from the IDCE (see p. 28). These and other efforts could bring a more sophisticated, science-based life cycle assessment to the green building products field, but product manufacturers must participate in their development. Only then will product-specific LCAs be available to the professional design and construction community.

LCA tool developers must meet the needs of manufacturers to simplify their methodologies so that manufacturers can be comfortable using them. They must also find ways to guarantee the proprietary product data will be kept safe and confidential. At the same time, manufacturers must make this information available to database developers so that products can be evaluated uniformly and fairly through life cycle assessment.
Responsible Parties: LCA/LCI tool and systems developers; green product manufacturers
Resources/Budget: Included in LCA/LCI development costs
Time Frame: Immediate
Metric: Measurable involvement of green manufacturers in LCA/LCI pilot programs for 2004

8. The USGBC should reconsider the admission of trade associations.

As noted elsewhere in this White Paper (p. 11), USGBC's original rationale for denying membership to trade associations had to do with fear that trade groups would overwhelm the

fledgling organization. This concern no longer applies. With more than 3000 voting members, the USGBC is structurally sound enough to withstand pressure from trade groups; in fact, it could be argued that admitting trade associations would diminish their power, since each of them would have only one vote in USGBC ballots (rather than many votes, should the association's members join as individual companies).

The USGBC has formed a task force to review membership policies regarding private-sector trade associations. Interested 501 (c) (6) entities were invited to express their views to the task force in September; nongovernmental organizations opposed to trade association membership were scheduled to have a similar opportunity in October. The task force report is due in early 2004.

It would be inappropriate for the editors of this White Paper to infringe on the USGBC task force's business while it is in progress. However, we do note that, early in its history, the USGBC granted Federal agencies nonvoting "liaison" status; within a brief period, Federal agencies proved themselves to be among the strongest supporters of the organization's goals and were granted full voting membership. We believe that experience will show that greater trade association involvement could, in the end, actually strengthen the USGBC.
Responsible Parties: USGBC, with interested trade associations and NGOs
Resources/Budget: USGBC staff time
Time Frame: Review by Q3/04; report by Q1/04
Metric: Task force recommendations by Q1/04

9. Continue to upgrade LEED.

The USGBC should continue its exemplary practice of continuous review and upgrading of LEED toward the completion of Version 3.0, which is anticipated to "change the content and rigor" of LEED, "so as to address the need for 'raising the bar' in response to improvements in technologies, knowledge, data, and market advancement," in the words of Malcolm Lewis and Nigel Howard ("The Future of LEED," *ED+C*, July/August 2003). The following concerns and issues (many of which are already under review) should be included in that major revision:

a) Move toward the establishment of performance-based criteria, based on life cycle assessment in appropriate categories and credits of LEED 3.0, particularly Materials & Resources.

b) Rethink MR Credits 5.1 and 5.2 for Regional Materials (see discussion, p. 10). Consider a credit based on the use of building materials and products that meet local and regional climatic, geographical, and environmental conditions, regardless of where those products are made, assuming other factors (e.g., environmental impact of transport) are equal.

c) Reconsider the 10-year-or-shorter cycle for renewability (MR Credit 6.0.) While its inclusion may have had the laudable goal of encouraging the development of new building products from short-cycle materials, this credit often has the inadvertent effect of discouraging the use of renewable wood products in LEED-registered projects.

d) Review certification standards other than FSC certification for wood products (notably the Sustainable Forestry Institute, Canadian Specifications Association, and Pan European Certification Program) and either define specific shortcomings of these standards in comparison to FSC or permit them to be used as comparable certification standards under MR Credit 7.0.

e) Carry through with the Technical & Scientific Advisory Committee review of vinyl and other plastic products. Here, too, it would be inappropriate for the editors to infringe on the business of this committee while the review is ongoing. We assume that the committee will make a full and fair assessment of this long-standing controversy between the environmental community and the PVC/vinyl industry.

f) Review the impact of regional differences on LEED prerequisites and credits, with input from USGBC state and local chapters and other state, local, and regional interests.

g) Upgrade the status of LEED accredited professionals through enhanced training and testing, in anticipation of more sophisticated energy and environmental requirements and more rigorous commissioning under LEED 3.0; and create a mechanism for voluntary continuing education in sustainable design and construction, progressing toward the establishment of a "LEED Master" or "LEED Fellow" designation, under the direction of the USGBC curriculum and education committee.
Responsible Parties: USGBC, interested nonmember entities
Resources/Budget: USGBC staff and volunteer time, T&E as needed
Time Frame: Continuous
Metric: Inclusion in LEED 3.0, or report for Greenbuild 2004

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Please share your thoughts with us ...

I ☐ agree ☐ disagree with Action Plan item # _____ or the following:

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What issues regarding green building are of greatest concern to you?

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What other recommendations would you add to the Action Plan?

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In our buildings today, we consume 39% of the energy and more than 70% of the electricity in this country. Thus, improvement of the energy efficiency of the nation's building sector is critical to the long-term security, reliability, and sustainability of the United States. This white paper on green buildings addresses the importance of energy efficiency, and the Building Technologies and Federal Energy Management Programs are pleased to be able to underwrite its development.

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