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# STATEMENT OF
# THE U.S. GREEN BUILDING COUNCIL

## BEFORE
## THE SENATE COMMITTEE ON
## COMMERCE, SCIENCE AND TRANSPORTATION

## SUBCOMMITTEE ON SCIENCE,
## TECHNOLOGY AND INNOVATION

## ON
## ENERGY EFFICIENCY TECHNOLOGIES
## AND PROGRAMS

**June 21, 2007**

Thank you for providing the U.S. Green Building Council (USGBC) with the opportunity to testify on the benefits of green buildings. We commend Chairman Kerry for his leadership in this critical area.

My name is Tom Hicks, and I am USGBC's Vice President of LEED, USGBC's green building rating system that has become the leading national rating system for evaluating and certifying green buildings. It is a privilege to talk with you about the role of the Council and the LEED® (Leadership in Energy and Environmental Design) Green Building Rating System™ in addressing the urgent challenge of energy efficiency and climate change, and the many far-reaching benefits of green building.

## The Impact of the Built Environment

Buildings are an essential element of the solution to the energy, resource, and climate issues our country is facing.

Buildings have a lifespan of 50-100 years, throughout which they continually consume energy, water, and natural resources, thereby generating significant $CO_2$ emissions. In fact, buildings are responsible for 39% of U.S. $CO_2$ emissions per year. If the U.S. built half of its new commercial buildings to use 50% less energy, it would save over 6 million metric tons of $CO_2$ annually, for the entire life of the buildings—the equivalent of taking more than 1 million cars off the road every year.

In addition, buildings annually account for 39% of U.S. primary energy use; 70% of U.S electricity consumption; use 12.2% of all potable water, or 15 trillion gallons per year; and consume 40% of raw materials globally (3 billion tons annually). The EPA estimates that 136 million tons of building-related construction and demolition debris are generated in the U.S. in a single year. (By way of comparison, the U.S. creates 209.7 million tons of municipal solid waste per year.)

Green buildings are a significant part of the solution to the problems of energy dependence and climate change. The average LEED certified building uses 32% less electricity, 26% less natural gas and 36% less total energy than a conventional building. LEED certified buildings in the U.S. are, in aggregate, reducing $CO_2$ emissions by 150,000 metric tons each year, which equates to taking 30,000 passenger cars off the road.

Of the various strategies that have been proposed, building green is one of the most effective for meeting the challenges of energy consumption and climate change. The technology to make substantial reductions in energy use and $CO_2$

emissions in buildings already exists; modest investments in energy-saving and other climate-friendly technologies can yield buildings and communities that are significantly more environmentally responsible, more profitable, and healthier places to live and work.

By addressing the whole building, from construction materials to cleaning supplies, LEED generates opportunities to reduce emissions and environmental impact throughout the supply chain and the complete building lifecycle. 65% of the credits in the LEED Rating System reduce the $CO_2$ footprint of the building. The avenues by which LEED mitigates climate change include:

**Energy**
LEED awards credits for reducing energy use in buildings through such means as installing energy efficient heating and cooling systems; using renewable power (e.g., daylight, solar heating, wind energy); requiring building commissioning; and purchasing green power.

**Water**
On average, a LEED certified building uses 30% less water than a conventional building, which translates to more than 1 million gallons of water saved per year. Reducing the amount of water that needs to be conveyed to and treated by municipal wastewater treatment facilities also reduces pumping and process energy required by these systems. LEED also promotes on-site treatment of storm water to minimize the burden on municipal treatment systems.

**Materials**
LEED buildings use fewer materials and generate less waste through measures such as reusing existing building structures whenever possible; developing a construction waste management plan; salvaging materials; using materials with recycled content; using local materials; and implementing an on-site recycling plan. Reduced materials consumption lowers the overall embodied energy of the building, which has a direct impact on the building's carbon footprint.

**Transit- & Density-Oriented Development**
LEED buildings earn credits for being located near public transportation. LEED also rewards car pooling; using hybrid or electric cars; and bicycling or walking instead of driving. In addition to the emissions produced by the cars themselves, the infrastructure required to support vehicle travel increases the consumption of land and non-renewable resources, alters storm water flow and absorbs heat energy, which exacerbates the heat island effect.

# Green Building Trends and Market Transformation

Just a few years ago, green building was the domain of a vanguard of innovative practitioners. Today, green building is being rapidly adopted into the mainstream of building practice in both the residential and commercial sectors. McGraw-Hill Construction forecasts that the combined annual commercial and residential green building markets will total $62 billion by 2010.

USGBC's LEED Green Building Rating System serves as an essential, proven tool for enabling this market transformation. Equally as important as recognizing leading practice through third-party certification, LEED has given the community of building design, construction, and management professionals a concise framework for best-practices in high-performance green building design and operations.

To date, there have been 889 LEED-certified buildings worldwide, with the majority in the United States. In addition, more than 6,700 commercial building projects have enrolled with USGBC, and are pursuing certification. In total, 1.1 billion square feet of construction space is being built to meet LEED, and that figure grows daily.

The growth is manifest in USGBC's green building professional accreditation program as well. Since the program's launch in 2002, more than 36,000 professionals from all disciplines have become LEED Accredited Professionals (LEED APs).

The LEED Rating System was originally developed for new commercial construction projects, and the rapid uptake of the program demonstrated that the market needed additional tools to address different building types and lifecycle phases. USGBC released rating systems for the operations and maintenance and commercial interiors markets in 2006, and is currently pilot-testing rating systems for homes and neighborhood developments. Already, more than 6,000 homes and 200 builders are participating in the LEED for Homes pilot test; nearly 200 homes have been certified to date. LEED for Neighborhood Development, which integrates principles of smart growth, urbanism, and green building at the neighborhood level, is also being pilot-tested. More than 350 projects have enrolled for consideration for the pilot. USGBC recently launched LEED for Schools, and is completing rating systems for health care facilities, retail, labs, and campuses.

In addition, USGBC is currently piloting a new LEED program for portfolio performance that meets the needs of large owners of commercial real estate who are seeking to green their entire real estate portfolios. This innovative approach

provides cost-effective solutions to improve building performance across entire companies and organizations. The goal is to facilitate immediate and measurable achievements that will contribute to long-term sustainability. The portfolio program focuses on the permanent integration of green building and operational measures into standard business practice. USGBC is working with 26 market leaders as a part of the pilot, including American University, Bank of America, California State University – Los Angeles, Cushman & Wakefield, Emory University, HSBC, N.A. , PNC Bank, State of California Department of General Services., Syracuse University, Thomas Properties Group, Transwestern, University of California at Merced, University of California at Santa Barbara, University of Florida, and USAA Real Estate Company.

## Green Building and Innovation

Across the spectrum of green building, new products, new services and new ways of tackling building process are emerging, laying the foundation for what stands to be one of the greatest market evolutions in history. USGBC takes seriously its role in helping these innovations come to market quickly, and uses its role as market educator to provide the support and visibility these kinds of advances deserve. One key venue is UGBC's annual Greenbuild International Expo and Conference, which last year attracted more than 13,000 attendees, featured almost 1,000 exhibitors, and 12 full educational tracks in all aspects of green building, setting up the mechanism for ongoing technology and idea sharing.

USGBC also encourages the introduction of new ideas and scientific advances directly into the LEED rating system through Innovation in Design credits, which can be introduced and tested by individual project teams before being put out for public comment and balloted through the consensus membership process.

Green building technologies touch every element of green building design – from site selection, to water and energy efficiency and management, to indoor environmental quality, to recycling of construction waste.

Many of these innovations are focused on optimizing energy performance, and reduce environmental impacts associated with excessive energy use. The fluorescent lamp, for example, saves three-quarters of a ton of carbon dioxide and 15 lbs of sulfur dioxide. It also saves $30 to $50 over the life of the bulb because it uses 75% less energy and lasts 10 times as long.

Energy Star has been a significant catalyst for the development of energy efficient appliances for office buildings, ranging from computers and copiers to printers and water coolers. All save on the amount of electricity used, reducing the demand for energy.

Green buildings have also been a significant driver for renewable energy resources, by encouraging on-site renewable energy in order to reduce environmental impacts associated with fossil fuel energy use. Some of the innovations in this area include:

- Biomass, where plant material is converted to heat energy in a boiler or gasifier to generate electricity. The heat is converted to mechanical energy in a steam turbine, gas turbine or an internal combustion engine, and the mechanical device drives a generator that produces electricity. Current biomass technology produces heat in a direct-fired configuration. Biomass gasifiers are under development and are being introduced to the marketplace.
- Photovoltaics (PVs) are composite materials that convert sunlight directly into electrical power. In recent years, the efficiency of the cells has increase and the cost has dropped. As a result Building – Integrated Photovoltaics (BIPVs) are increasingly incorporated into building elements such as the roof, cladding or window systems. They generate direct current electricity, which must be converted to alternating current before it can be used in mainstream building systems.
- Wind energy, where wind is converted into electricity via large rotors, has gained a lot of attention in buildings. Advances in the wind energy market include the development of a vertical-axis wind turbine which relies on simplicity of design and advanced blade configuration to create a potentially low-cost, efficient power system.
- Green roofs, where a roof of a building that is partially or completely covered with vegetation and soil, or a growing medium, planted over a waterproofing membrane. It provides amenity space for building users, reduces heating loads on buildings, cleans air, reduces storm water runoff and increases roof life span.

Research has shown that electrical lighting makes up a significant portion of energy use in buildings, especially commercial buildings. Re-designing new buildings to optimize the use of natural light or "daylighting" to replace electrical lighting in areas such as atriums, hallways, cafeterias, and playrooms can have a significant impact on energy reduction.

Electrochromic or "smart" windows save energy by controlling the amount of solar heat that passes through the window glass. For example, in winter, they lighten to allow heat to pass through the glass but not back out, reducing the amount of energy needed for home heating. In summer, they darken without blocking visible light to reduce the amount of heat coming into the home and decrease cooling costs. Electrochromic windows darken or lighten by a chemical

reaction that is set off by a small voltage (you can run an entire house on the voltage required to run one traditional light bulb).

Although they can technically be classified as electrochromic materials, the new reflective hydrides that are being developed for windows behave in a noticeably different way. Instead of absorbing light, they reflect it. Thin-film solar cell material made of nickel-magnesium alloy is able to switch back and forth from a transparent to a reflective state. The switch can be powered by electrochromic or hydrogen and oxygen gases (gas-chromic technology). Furthermore, this material has the potential to be even more energy efficient than other electrochromic materials.

High-performance, whole-building design methods integrate passive solar, energy efficiency and renewable technologies to reduce building energy consumption. Many buildings use passive solar to offset significant electrical loads, such as replacing electrical lighting with natural light or "daylighting" and reducing heating and cooling loads by storing heat and cool air in building materials such as brick. Low-cost solar hot water systems can significantly contribute to reaching the goal of cost-effective energy savings greater than 50% in most climates.

On the horizon, there is great promise for inexpensive highly efficient nanocomposite materials for solar energy conversion and thermoelectric materials that can transform heat directly into electrical energy.

It is clear that new technologies are transforming not just what we do but how we do it, reinventing the building industry and driving market transformation.

## Costs and Benefits of Green Building using LEED

Projects enroll in LEED by registering their intent with USGBC and paying a fee of $450. Project certification fees are approximately $0.03 per square foot, and average about $4,500.

According to third-party studies published and updated by Capital E and by Davis Langdon in the past 24 months, the average total additional cost for using LEED on a project (including professional fees, materials, and systems) is 1.5% or less. That cost is typically repaid in the first 10 months of building operation based on energy savings alone.

For example, according to *U.S. Banker Magazine*, the greening of the Bank of America Tower, being constructed in Manhattan, is adding less than 2% of its projected cost. The project expects to recoup any investments through reduced electricity usage and water-saving techniques.

*Harvard Business Review* cites the DPR building in Sacramento, California, as having invested 1.4% upfront additional costs to implement green measures. The project is expected to more than make up the investment by generating over $400,000 in operations savings.

## About the U.S. Green Building Council

The U.S. Green Building Council (USGBC) is a nonprofit membership organization with a vision of sustainable buildings and communities within a generation. Our 9,500 member organizations and 92,000 active individual volunteers include leading corporations and real estate developers, architects, engineers, builders, schools and universities, nonprofits, trade associations and government agencies at the federal, state and local levels. Green buildings save energy, reduce $CO_2$ emissions, conserve water, improve health, increase productivity, cost less to operate and maintain, and increasingly cost no more to build than conventional structures. Because of these benefits, they are becoming highly prized assets for companies, communities and individuals nationwide.

As the developer and administrator of the LEED® (Leadership in Energy and Environmental Design) Green Building Rating System™, USGBC is a leader in green building and green development. Founded in 1993, USGBC is a 501(c) (3) non-profit organization, an ANSI-accredited standards developer and a newly active participant in ISO technical working groups. The organization is governed by a diverse, 31-member Board of Directors that is elected by the USGBC membership. Volunteer committees representing users, service providers, manufacturers, and other stakeholders steward and develop all USGBC programs, including the LEED rating system, through well-documented consensus processes. Seventy local USGBC Chapters and Affiliates throughout the U.S. provide educational programming to local communities.

A staff of more than 85 professionals administers an extensive roster of educational and informational programs that support the LEED Rating System in addition to broad-based support of green building. USGBC's LEED Professional Accreditation program, workshops, green building publications, and the annual Greenbuild conference provide green building education for professionals and consumers worldwide.

# About the LEED® Green Building Rating System™

LEED is the nationally recognized benchmark for the design, construction, and operations of high-performance green buildings. Since 2001, LEED has provided building owners and operators with design and measurement tools with the reliability and integrity they need to have an immediate, quantifiable impact on their buildings' performance.

LEED is a voluntary standards and certification program, and was developed to promote leadership in the building industry by providing an objective, verifiable definition of "green." LEED is a flexible tool that can be applied to any building type and any building lifecycle phase, including new commercial construction; existing building operations and maintenance; interior renovations; speculative development; commercial interiors; homes; neighborhoods; schools; health care facilities; labs; and retail establishments.

LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas, with an additional category to recognize innovation: sustainable site development, water savings, energy efficiency, materials and resources and indoor environmental quality. Each category includes certain minimum standards ("prerequisites") that all projects must meet, followed by additional credits that are earned by incorporating green design and construction techniques. Four progressive levels of LEED certification – Certified, Silver, Gold and Platinum – are awarded based on the number of credits achieved. USGBC provides independent, third-party verification that a building meets these high performance standards.

USGBC member committees develop the LEED Rating System via a robust consensus process that enables USGBC to incorporate constantly evolving practices and technologies. The key elements of the process, which USGBC has refined over more than a decade of leadership experience, include a balanced and transparent committee structure; Technical Advisory Groups to ensure scientific consistency and rigor; opportunities for stakeholder comment and review; member ballot of new rating systems and substantive improvements to existing rating systems; and a fair and open appeals process. Details about the LEED development process are publicly available on the USGBC Web site, www.usgbc.org.

USGBC is continuing to advance the market with the next evolution of LEED, which will harmonize and align LEED rating systems and versions, as well as incorporate recent advances in science and technology. Congruent with this effort, USGBC is introducing a continuous improvement process into LEED, which will create a more flexible and adaptive program and will allow USGBC to

respond seamlessly to the market's evolving needs. Particular focus areas include technical and scientific innovations that will improve building performance; the applicability of LEED to the marketplace, in order to speed market transformation; and the customer experience, to ensure that LEED is an effective tool for the people and organizations using it.

The inclusion of Life Cycle Analysis (LCA) is an important step in the technical development of LEED. USGBC's Life Cycle Assessment working group has developed initial recommendations for incorporating Life Cycle Assessment (LCA) of building materials as part of the continuous improvement of LEED.

LCA holistically evaluates the environmental impact of a product throughout its life cycle: from the extraction or harvesting of raw materials through processing, manufacture, installation, use, and ultimate disposal or recycling. USGBC's long term objective is to make LCA a credible component of integrated design, thereby ensuring that the environmental performance of the whole building takes into account the complete building life cycle.

In 2006, citing the qualities outlined above, the U.S. General Services Administration submitted a report to Congress concluding that LEED is the "most credible" of five different rating systems evaluated. The GSA currently requires its new buildings to achieve LEED certification.

Building projects are enrolled in the LEED program by registering their intent with USGBC through LEED Online. After the building is constructed, the project teams submit proof-of-performance in the form of online documentation through LEED Online. LEED Online was developed through a partnership with Adobe Systems Inc.

Expert certification teams review and verify project documentation, and award LEED Certified, Silver, Gold, or Platinum certification based on the number of credits the project achieves based on a sliding scale.

## LEED and the Government

Governments at all levels have been highly influential in the growth of green building, both by requiring LEED for their own buildings and by creating incentives for LEED for the private sector. From the Department of Energy's support for the initial development of LEED, to the Federal Energy Policy Act of 2005, to the many cities and states that have adopted LEED, the public sector has demonstrated considerable vision and leadership in the transformation of the built environment. Currently, 12 federal agencies, 22 states and 85 local governments have made policy commitments to use or encourage LEED.

The federal government has been a particularly strong supporter of USGBC and LEED. The U.S. Department of Energy enabled the development of LEED with a $500,000 grant in 1997, and has also provided USGBC with $130,000 in grants to support the Greenbuild Conference and Expo. Staff from the national laboratories, FEMP and other program areas have actively shared their expertise to develop and refine LEED. USGBC has also collaborated with DOE's Office of Energy Efficiency and Renewable Energy with BuildingGreen on the High Performance Buildings Database.

The U.S. General Services Administration—which is the nation's largest landlord—requires its new buildings and major renovation projects to achieve LEED certification. As mentioned previously, GSA also submitted a report to Congress affirming that LEED "continues to be the most appropriate and credible sustainable building rating system available for evaluation of GSA projects." In particular, GSA noted that LEED applies to all GSA project types; that it tracks the quantifiable aspects of building performance; that LEED is verified by trained professionals and has a well-defined system for incorporating updates; and that it is the most widely used rating system in the U.S. market.

Government leadership will continue to be essential to the advancement of green building. USGBC supports targeted, viable government initiatives that facilitate market transformation, including:

- The creation of an Office of High-Performance Green Buildings within the U.S. General Services Administration to coordinate green building research, information dissemination and other activities, as provided by S. 506, the High-Performance Green Buildings Act of 2007.
- The expansion of the Office Director's duties that would facilitate: metering, sub-metering and continuous commissioning of federal buildings in order to measure energy use and to ensure that building systems are delivering the efficiencies for which they are designed; agency reports on their $CO_2$ reductions using the existing energy targets required by federal law; establishment of green building education and training programs for federal agency staff in order to ensure that the capability exists to achieve agency sustainable building goals.

**Research**

In a March 2007 report, USGBC found that research related to high-performance green building practices and technologies amounts to only 0.2% of all federally funded research. At an average of $193 million per year from 2002 to 2005, research spending is equal to just 0.02% of the estimated value of annual U.S. building construction. These funding levels are not commensurate with the level of impact that the built environment has on our nation's economy, environment and quality of life. USGBC recommends that total annual federal funding equate to 0.1% of annual construction value, $1 billion.

Furthermore, USGBC has identified the following eight research program areas toward which such funding should be applied: Life Cycle Assessment of Construction Materials; Building Envelope and HVAC Strategies; Lighting Quality; Transportation-Related Impacts of Buildings; Performance Metrics and Evaluation; Information Technology and Design Process Innovation; Indoor Environmental Quality; and Potable Water Use Reduction in Buildings.

**High Performance Schools**

In the U.S., more than 55 million students and more than 5 million faculty, staff, and administrators spend their days in school buildings. These buildings represent the largest construction sector in the U.S.—$80 billion in 2006-2008 – which means that greening school buildings is a significant opportunity to make a major impact on human, environmental, and economic health.

Most important, children in green schools are healthier and more productive. Design features including attention to acoustical and visual quality, daylighting, and color have a profound impact on children's ability to learn. Green schools also have superior indoor air quality and thermal comfort, and expose children to fewer chemicals and environmental toxins—which has been linked to lower asthma rates, fewer allergies, and reduced sick days.

Green schools cost less to operate and greatly reduce water and energy use, which generates significant financial savings. According to a recent study by Capital E, if all new school construction and school renovations went green starting today, energy savings alone would total $20 billion over the next 10 years. On average, a green school saves $100,000 per year—enough to hire two new teachers, buy 500 new computers, or purchase 5000 new textbooks. The minimal increase in upfront costs—on average less than $3 per square foot–is paid back in the first year of operations based on energy savings alone.

To further this effort, USGBC supports federal authorization and funding of K-12 green school demonstration projects in targeted school districts throughout the country. Such a directive must also include a requirement that the buildings are constructed so that they can serve the students as teaching tools on green building design, construction and operation.

# CONCLUSION

The U.S. Green Building Council is a coalition of leaders from every sector of the building industry working to transform the way buildings and communities are designed, built, and operated through market-based tools. USGBC's LEED® (Leadership in Energy and Environmental Design) Green Building Rating System™ has become a nationally accepted benchmark for high-performance green buildings.

In just seven years, LEED has had a significant, positive impact on the building marketplace. LEED was created to establish a common standard of measurement for what constitutes a "green" building, and provides independent third-party validation of a building's green features. LEED provides building owners and operators with the tools they need to make an immediate and measurable impact on their buildings' health and performance, which is why more than 1.1 billion square feet of construction space is being built to LEED standards. The impact is growing: Every business day $100 million worth of construction registers with LEED; 50 people attend a USGBC training course; 20 people become LEED Accredited Professionals and four organizations join USGBC as members.

Green building is essential to environmental, economic, and human health. Annually, buildings account for 39% of U.S. primary energy use; 70% of U.S. energy consumption; use 12.2% of all potable water, or 15 trillion gallons per year; and consume 40% of raw materials globally (3 billion tons annually). The EPA estimates that 136 million tons of building-related construction and demolition debris is generated in the U.S. in a single year.

Buildings are an essential part of the solution to mitigating climate change and establishing energy independence. The average LEED certified building uses 32% less electricity, 26% less natural gas, and 36% less total energy than a conventional building. LEED certified buildings in the U.S. are in aggregate reducing $CO_2$ emissions by 150,000 metric tons each year, which equates to 30,000 passenger cars not driven. Building green is a highly effective strategy for meeting the challenges ahead of us. The technology to make substantial reductions in energy use and $CO_2$ emissions in buildings already exists, which means that modest investments in energy-saving and other climate-friendly technologies can yield buildings and communities that are significantly more environmentally responsible, more profitable, and healthier places to live and work.

Federal, state, and local governments have been instrumental in the growth of green building, both by adopting green building themselves and by encouraging it in the private sector. The government's continued leadership will be essential to ongoing advancements in this area. Significant opportunities exist in increasing federal funding for green building research and in federal support for the design and construction of green schools.

Thank you again for the opportunity to present the views of the U.S. Green Building Council. We look forward to working with you to facilitate the transformation of the built environment to sustainability.