Meadows Website Information on Green Building

What is Green Building?

Green building is the design, construction, and operation of buildings and landscapes that improve health and air quality while minimizing energy, water, and material use and reducing waste[1]. Building green requires an integrated design approach that looks at all components of the building project. Most green building standards are comprised of the following categories[2]:

- Site
  - Land use
  - Building location and orientation
  - Transportation
  - Connecting to the community
  - Heat island
  - Light pollution
- Water
  - Conserving potable water
  - Managing stormwater
  - On-site wastewater treatment
  - Water-wise landscaping
- Energy
  - Conserving energy through efficient lighting, equipment, and appliances and climatic design
  - On-site renewable energy such as solar electric and solar thermal arrays
  - Off-site renewable energy such as wind power
  - Commissioning
- Materials
  - Recycled content, regional, and bio-based materials
  - Local/regional sourced and manufactured materials
  - Certified wood, such as through the Forest Stewardship Council
  - Diverting construction and demolition waste from the landfill
  - On-site recycling programs
- Indoor Environmental Quality/Indoor Air Quality
  - Low VOC (i.e., low odor) paints, sealants and adhesives
  - Low emission carpeting
  - Natural light or daylight
  - Views to the outdoors

[1] Green Building Alliance, "About Us," 2008, http://gballiance.com.

[2] Barbara Wilson, Michael Gatto, and Gail Vittori, "Meadows Foundation Green Funding Initiative Report," October 31, 2007.

Why Go Green?

Environmental Benefits: According to the United States Green Building Council (USGBC), buildings in the United States account for:

- 72% of electricity consumption,
- 39% of energy use,
- 38% of all carbon dioxide (CO2) emissions,
- 40% of raw materials use,
- 30% of waste output (136 million tons annually),
- 14% of potable water consumption.

For these reasons, concerns regarding buildings in the U.S. and their significant influence on climate change have focused attention on the need to reduce our reliance on fossil fuel derived energy sources and increase the use of energy-efficient measures and renewable energy sources. Additional environmental benefits include reducing water use; and the use of recycled and low-impact materials.

Economic Benefits: Green building leads to lower energy, water, landscaping, and waste costs. Savings of **20%-50%** in energy costs are common through integrated planning, site orientation, energy-saving technologies, natural daylight and ventilation, and downsized HVAC and other equipment. And with improvements in occupant comfort, indoor air quality, and natural light, employee productivity and satisfaction increases (see the following website for a list of research on green building and worker productivity http://www.greenbuildingrutgers.us/faq.asp?Level2ItemID=23).

Community Benefits: Green building reduces smog and the urban heat island effect and lowers the carbon footprint.

Health Benefits: The U.S. Environmental Protection Agency (EPA) reports that, on average, Americans spend approximately 90% of their time indoors. Green building promotes a healthier indoor environment with the use of low VOC paints, primers, adhesives, and sealants. Additional health benefits are derived from the use of natural lighting.

Does Green Building Cost More?

A number of studies have been conducted that analyze the costs associated with green building. An October 2006 study by Greg Kats, "Greening America's Schools: Costs and Benefits[3]," analyzed 30 green schools in 10 states built between 2001 and 2006. Data in the study demonstrate that, on average, green schools cost **1.7%** more than conventional schools, or about $3.00 per square foot, and provide financial benefits up to **20** times as great. These benefits include direct benefits such as reduced utility costs, and indirect benefits such as reduced emissions from energy generation, and savings due to asthma and cold and flu reduction. The study looks at cost savings associated with specific green building features and estimates the average energy cost savings is 33% or $6.00/sf^2 over a 20-year period with a 7% discount of future benefits of lower energy prices. The study estimates the average water and wastewater reduction at 32% or approximately $1.00 per square foot over 20 years.

An October 2003 green building study, also by Greg Kats, for California's Sustainable Building Task Force was based on 33 LEED-certified projects. The report shows that a minimal increase in costs of about **2%** early on in the design process

[3] Gregory Katz, "Greening America's Schools: Costs and Benefits," October 2006.

would result in an average life cycle cost savings of 20% of total construction costs – more than **10** times the initial investment.

A 2005 report on green affordable housing looked at 16 developments from across the country[4]. The study found that the first cost premium for green building was 2.4% of the total development cost.

In summary, the cost premium on green building ranges from a low of .66% to a high of 2.4%.

The Meadows Foundation's Green Building Performance Goals

The Meadows Foundation does not require green building strategies to be eligible for grant support; however, the Foundation believes that green building is a social value and looks with favor on those construction projects that include significant energy savings and other environmentally friendly features. Below are the Foundation's energy- and water-related goals for building projects:

- 30% reduced operational energy use for new buildings
- 15% reduced operational energy use for existing buildings
- 35% of grid-connected energy is provided by Green-e certified renewable energy sources
- 20% reduced indoor potable water use
- Landscape plants comprised of water-wise native and non-invasive adapted plant species

As an energy saving strategy, the Foundation encourages grantees to consider renovating existing buildings rather than new construction whenever appropriate. Grant proposals for new construction and renovations of existing buildings should include a Green Development Plan comprised of the following:

- The strategies that will be used to achieve the performance goals above
- A description of the green building rating system that will be used, if any
- A statement of commitment that these goals will be pursued throughout the course of design and construction.

Measuring Green Building Performance Goals

Grantees are encouraged to use energy modeling, which is a method of calculating the energy use of a building during the design phase, to demonstrate compliance with the performance goals.

Grantees will be asked to provide the Meadows Foundation with energy and water consumption data as part of their grant reporting requirements. This should include a comparison of the actual consumption data and the Green Development Plan targets that resulted from the energy modeling process.

[4] William Bradshaw, et al. "The Costs and Benefits of Green Affordable Housing", 2005.

Possible Strategies to Achieve the Meadows Foundation Performance Goals

- Reduce operational energy use for new and existing buildings
    - Use on-site non-polluting and renewable energy including solar, wind, geothermal, low-impact hydro, biomass and bio-gas strategies.
    - Only light exterior areas as required for safety and comfort.
    - Provide individual lighting controls and light sensors to control for areas not in use.
    - Use operable windows.
    - Provide individual air-conditioning/heater controls to allow adjustments to meet individual or group needs.
    - Design the building to maximize interior daylight.
    - Use Energy Star appliances and Energy Star Advanced Lighting Package.
    - Construct a cool roof which transfers less heat to the building, resulting in less energy use to cool it.
    - High efficiency heating, cooling, and ventilation systems.
- Reduce indoor potable water use
    - Use water-conserving fixtures (toilets, faucets, showers), occupant sensors, composting toilet systems, and non-water using urinals
        - Green Communities criteria specifies the following minimum specifications for new construction and existing buildings: toilets – 1.3 GPF (gallons per flush); showerheads – 2.0 GPM (gallons per minute); kitchen faucets – 2.0 GPM; bathroom faucets – 2.0 GPM
    - Reuse rainwater or greywater for non-potable uses such as toilet and urinal flushing.
    - Locate water heaters in close proximity of fixtures.
    - Install hot water on demand system.
- Landscape plants comprised of water-wise native and non-invasive adapted plant species
    - Reuse collected rainwater for landscape irrigation.
- Integrated Design Process
    - Assemble the design and development team as early in the development process as possible to generate the Green Development Plan.
    - Collaborative participation by all members of the design and development team throughout the design and construction process to execute the Green Development Plan.

National Green Building Rating Tools

A number of green building rating systems have been developed to objectively evaluate the energy and environmental performance of green building projects. A sample of rating systems is provided below.

Leadership in Energy & Environmental Design Green Building Rating System (LEED®): LEED is a third-party certification program and the nationally accepted benchmark for the design, construction and operation of high performance green buildings. Certification through LEED promotes a whole-building approach to sustainability by recognizing performance in six key areas: sustainable site development, water savings, energy efficiency, materials selection, indoor environmental quality, and design and innovation. LEED certification rating levels include certified, silver, gold, and platinum. More information on LEED certification can be found at the following website: (http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222).

Green Communities Criteria: The Green Communities Initiative promotes building healthy, efficient affordable housing for low income residents (http://www.greencommunitiesonline.org/). Many of the Green Communities criteria are aligned with the LEED Green Building Rating System.

Green Globes: The Green Globes rating system (http://www.thegbi.org/green-globes-tools/) is assessed along seven areas: energy, indoor environment, site, water, resources, emissions, and project management. Projects receive a rating of one to four green globes depending on the percentage of total points achieved.

Living Building Challenge: The Living Building Challenge (LBC) defines one of the most advanced measures of sustainability and green building. LBC buildings must generate all of their own energy with renewable resources, capture and treat all of its water, and operate efficiently. More information on the Living Building Challenge can be found at http://www.cascadiagbc.org/lbc.

National Association of Home Builders (NAHB): The NAHB Green Home Building Guidelines (http://www.nahbgreen.org/Guidelines/default.aspx) provide guidance for builders engaged in or interested in green building products and practices for residential design, development and construction.

Select Local Green Building Standards

Grantees should be aware that a number of Texas cities have adopted green building standards and projects may be subject to these standards. For a sample list of local green building standards, you may visit the following websites.

Austin: http://www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/index.htm)

Dallas: http://www.greendallas.net/

Houston: http://www.greenhoustontx.gov//index.html

San Antonio: http://www.buildsagreen.org/BuildSAGreen/index.html)

Additional Funding Opportunities

The Enterprise Community Partners offers charrette grants and green building grants through their Green Communities Initiative (http://www.greencommunitiesonline.org/).

The Kresge Foundation offers grants through their Green Building Initiative if a specific green building threshold is met (http://www.kresge.org/content/displaycontent.aspx?CID=59).

Helpful Websites and Other Resources

The U.S. Green Building Council's (USGBC) website provides a list of green building links collected by USGBC staff and members for research purposes:. http://www.usgbc.org/DisplayPage.aspx?CMSPageID=76.

Research and publications regarding green building and LEED certification are available on the U.S. Green Building Council's website at http://www.usgbc.org/DisplayPage.aspx?CMSPageID=77.

WWW.greenbuild365.org, hosted by the USGBC, provides an online portal to green building education. The site contains information on a broad range of green building topics ranging in formats that include in-person interaction with USGBC's expert faculty, online courses, and do-it-yourself research through the online media library.

LEED rating system information available at: http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222.

The Green Communities website (http://www.greencommunitiesonline.org/) provides additional resources on green building, including information on green building conferences and online training programs.

The American Institute of Architects' website provides a comprehensive guide for sustainable design: http://www.aia.org/susn_rc_default.

Energy Star website: http://www.energystar.gov/index.cfm?c=home.index.

The Oikos website provides links to green building news stories, articles, publications, and green building products: http://oikos.com/.

The Center for Green Building at Rutgers Edward J. Bloustein School of Planning and Public Policy promotes green building through research, education and training, and partnerships with industry, government and not-for-profit agencies: http://www.greenbuildingrutgers.us/.

The U.S. Department of Energy, along with the National Renewable Energy Laboratory, has sponsored the High Performance Buildings Database which contains data on 104 high-performance green building projects across the United States and abroad. The Database includes information on the energy use, environmental performance, design process, finances, and other aspects of each project (http://eere.buildinggreen.com/).

For more information on energy modeling: http://www.buildinggreen.com/features/mr/sim_lit_101.cfm.

The U.S. Department of Energy website provides a list of energy modeling software that includes a summary of the software capabilities, strengths and weaknesses: (http://apps1.eere.energy.gov/buildings/tools_directory/subjects.cfm/pagename=subjects/pagename_menu=whole_building_analysis/pagename_submenu=energy_simulation).

Both the Austin Community Design Center (www.acddc.org) and the Center for Maximum Potential Building Systems (www.cmpbs.org) offer sustainable design services.

Definitions

Commissioning: In essence, building commissioning is similar to the commissioning of a ship[5]. The captain (or, in this case, commissioning consultant) takes the building for a trial run PRIOR to opening the building for occupancy. The performance of the building is compared to specifications (and expectations) and areas requiring correction are identified. This process usually involves the testing of equipment (such as occupancy sensors for lights), systems (such as HVAC system), and inter-system operations (for example, the interaction of electric lighting with daylighting).

[5] New Jersey Sustainable Business Alliance, "Energy and Atmosphere," 2008, http://www.starphire.net/SustainableAlliance/usalliance/LEED/Energy/Energy.htm.

Commissioning has also been extended into the design process for buildings. Extending commissioning into design (rather than just operation) also helps ensure that the building can be commissioned upon completion of construction by providing contractual obligations, outlining coordination expectations, or simply installing necessary test instruments. For new construction, commissioning costs about $1.00/sf[6]. Commissioning costs have a median payback time of 4.8 years from quantified energy savings alone.

Cool Roof: The reflectivity (ability of a material to deflect a fraction of the radiant heat generated by the sun) and emissivity (the tendency to radiate heat – the higher the emissivity, the more quickly a roof can cool itself through radiation) of roofs can have a significant impact on the cooling load of a building. The higher the reflectivity and emissivity, the cooler the roof surface.

Daylighting: The use of controlled natural lighting methods indoors through strategically located skylights, windows and reflected light.

Energy Modeling: Method of simulating the energy use of a building during the design phase through the use of computer-based tools. The computer model simulates the performance of the building using the proposed design parameters and climate data for the proposed building's location. The estimated energy performance of the proposed building is then compared to a certain baseline condition which is often the minimum code requirements. The estimated cost of energy modeling is approximately $0.60 per square foot[7].

Energy Star: The Energy Star program (http://www.energystar.gov/index.cfm?c=home.index) is a joint venture between the U.S. Environmental Protection Agency and the U.S. Department of Energy helping consumers save money through the use of energy efficient products. According to the Energy Star website, "energy efficient choices can save families about a third on their energy bill with similar savings of greenhouse gas emissions."

GPF (Gallons Per Flush): Used to rate the flow of water in toilets. The lower the number, the more efficient the fixture. A low flow toilet uses a maximum of 1.6 GPM. A high efficiency toilet, or HET, uses no more than 1.28 GPM.

GPM (Gallons Per Minute): Used to rate the flow of water in faucets and showerheads. Low flow showerheads and faucets range from 1.0 to 2.0 GPM. The American National Standards Institute (ANSI) current standards require 2.20 GPM or less for faucet flow and 2.5 GPM or less for showerhead flow.

Green-e Certified: Green-e is an independent consumer protection program for the sale of renewable energy. Green-e verifies and certifies renewable energy that meets environmental and consumer protection standards that were developed in conjunction with leading environmental, energy, and policy organizations. Green-e Energy also requires that sellers of certified renewable energy disclose clear and useful information to potential customers, allowing consumers to make informed choices. www.green-e.org

Heat Island Effect: The rise in ambient temperature that occurs over large paved areas. Strategic placement of trees and the use of cool roofing materials can reduce the heat island effect.

[6] Barbara Wilson, Michael Gatto, and Gail Vittori, " Green Building: Costs and Benefits," April 2008.

[7] Wilson, et al., April 2008.

Net-zero energy efficiency: the facility produces as much energy as it consumes each year.

IECC: International Energy Conservation Code is a building code created by the International Code Council. It is a model code adopted by many state and municipal governments in the U. S for establishing minimum design and construction requirements for energy efficiency.

Integrated Design Process: A collaborative process begun as early as possible in a project's planning and design phases involving building owners and managers, design and construction professionals, and other stakeholders who participate and interact in the pre-design, design, and construction of buildings. It is a design approach for creating high performance buildings in which the building's structure, its systems, and the site are treated as an interdependent whole. The integrated design process is fundamental to green building, since a successful green building benefits from a holistic approach to building performance, which, in turn, requires stakeholders and design professionals to collaborate.

LEED (Leadership in Energy & Environmental Design): The U.S. Green Building Council's Green Building Rating System. .

R-Value: Insulation of walls and attic space is measured in R-values - the higher the value the better. The Department of Energy (DOE) recommends minimum ranges of R-values based on local heating and cooling costs and climate conditions in different areas of the nation. Most U.S. homes should have between R-22 and R-49 insulation in the attic and R-11 to R-28 insulation is recommended at a minimum for exterior walls. The DOE recommends houses in the central, western, and northern areas of Texas have R-49 insulation in the attic and R-18 insulation for exterior walls. Homes in the southern region of the state are recommended to have R-38 insulation in the attic and R-13 insulation for exterior walls.

SEER (Seasonal Energy Efficiency Ratio): Used to rate the energy efficiency of a central air conditioning unit. The higher the number, the more efficient the unit. National minimum standards for central air conditioners in the US require a SEER of 13, however the most efficient units reach 21 SEER. Beginning January 1, 2009, A/C equipment with the Energy Star label must meet or exceed a SEER of 14.

Sustainable Design: Sustainable design (also referred to as "green design") seekss to reduce negative impacts on the environment, and the health and comfort of building occupants, thereby improving building performance. The basic objectives of sustainability are to reduce consumption of non-renewable resources, minimize waste, and create healthy, productive environments.

U-Factor: The U-factor measures how well a product prevents heat from escaping. The rate of heat loss is indicated in terms of the U-factor of a window assembly. U-factor ratings generally fall between 0.20 and 1.20. In the United States, the U-factor is usually expressed in Btu/h ft^2 F. The insulating value is indicated by the R-value, which is the inverse of the U-factor. The lower the U-factor, the greater a window's resistance to heat flow and the better its insulating value.

VOC (Volatile Organic Compounds): VOCs, commonly found in carpet, paints, coatings, adhesives, and sealants, are compounds that readily evaporate (off-gas) under ordinary conditions, and can cause short-term and long-term adverse health effects, including headaches, dizziness, and nausea. Off-gassing adversely affects indoor air quality, and may continue for months or even years. A primary goal in the creation of healthy buildings is to generally reduce the overall amount of VOCs.