Green Building:

What Is It and Why Should Planners Care?

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Green building is on the rise and many planners are paying attention to the potential environmental, financial and economic benefits, including reduced energy and water costs, enhanced worker productivity, better health conditions, and reduced liability. This article provides an introduction to green building by defining green building and explaining the U.S. Green Building Council's LEED guidelines, addressing the specific benefits and costs of green building, discussing the various criticisms and weaknesses of LEED, and proposing how LEED and green building may be of interest to those involved in transportation planning, community development, economic development, and environmental planning.

Senior scientist for the Natural Resources Defense Council Rob Watson claims that "buildings are the worst thing that we do to the environment" (Watson 2003). The EPA reports that the construction and building industries account for 1/3 of all environmental impacts in the United States (EPA 2001). According to the U.S. Green Building Council (USGBC), buildings in the U.S. account for 65.2 percent of all electricity consumption, 30 percent of greenhouse gas emissions, 12 percent of potable water use, and 136 million tons of construction and demolition waste annually (2.8 pounds/person/day). Globally, buildings account for 40 percent of raw material use (USGBC 2004a). By combining the residential and commercial sectors and including the portion of the industry sector used to operate industrial buildings as well as the "embodied energy" of industrial buildings, Ed Mazria, architect and author of the Passive Solar Energy Book, calculates that buildings actually account for 48 percent of total energy use and 46 percent of total carbon dioxide production in the U.S (Hawthorne 2003). With such dramatic environmental impacts, it seems prudent to consider building designs in a discussion of environmental planning and sustainable development.

Defining and Rating Green Buildings

Green building, a relatively new trend in the building industry, is defined in many ways: high performance building, healthy building, biomimetic building, natural building, and bioclimatic architecture. High performance building design may focus on improved worker productivity or more efficient energy and water use. Healthy building may focus on the use of products that don't release harmful compounds, such as volatile organic compounds (VOCs), into the indoor environment.

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Natural building, on the other hand, refers to designs such as straw-bale construction (see Figure 1), underground homes, or cob building.

Figure 1. Example of straw-bale construction used in the Berea College Eco-village in Berea, Kentucky. *Photo courtesy of Ann Hartell.*

Environmental Building News, a leading source of information for architects and builders in this market, partially defines green buildings as those that:

- renovate old buildings;
- re-develop brownfields instead of developing new green space;
- manage storm water with detention ponds and porous pavement;
- orient the building to maximize southern exposure to utilize passive solar heating;
- cluster buildings to minimize paved areas;
- use native plantings;
- increase efficiency and insulation in order to minimize or eliminate HVAC systems;
- model the energy performance of a building to optimize HVAC systems;
- use salvaged materials;
- use solar water heating;
- install task light and day lighting;
- save water with efficient plumbing designs and fixtures;
- install Energy Star appliances; and
- integrate planning and design so that all professionals involved in the building can maximize green construction (*Environmental Building News* 2003).

The Energy Star Program, a partnership between the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE), and the U.S. Green Building Council's Leadership in Energy and Environmental Design standards (often referred to as the LEED guidelines) are two ways in which these definitions are becoming standardized. Energy Star essentially certifies buildings with superior energy performance—typically a 40 percent savings in energy compared to conventional buildings. As of January 2004, Energy Star ratings accounted for almost 1400 buildings in the U.S., totaling nearly 325 million square feet. This total includes 791 offices, 375 public schools, as well as supermarkets, hospitals, and hotels. To earn the label, buildings must achieve a score of greater than 75 out of 100 on the EPA's 100-point national energy rating scale as well as conform to industry standards including indoor air quality. Through partnerships with 8000 private and public organizations, Energy Star helps save businesses, consumers, and organizations $8 billion in energy costs per year (EPA 2004).

The LEED guidelines are the most widely accepted definition of green buildings. LEED was developed by the USGBC, which is a consortium of 4,600 member organizations and companies with a stake in green building. These organizations include building product manufacturers, building owners and managers, insurance and financial firms, design firms, contractors, environmental groups, utilities, universities, and governments. The LEED guidelines, specifically LEED-NC (new construction), were developed for the DOE,

Energy Efficiency, and Renewable Energy's Office of Building Technology, State, and Community programs. The intent was that LEED be applied to commercial, institutional, and multi-story (greater than four stories) housing complexes to improve the environmental and economic performance of buildings using "established and/or advanced industry principles, practices, materials, and standards." LEED committees serve as the third party certifying party (USGBC 2001).

This rating system consists of a much broader scope than simply energy use and indoor air quality like Energy Star. The LEED-NC guidelines are focused on a whole-building, life-cycle perspective. These guidelines serve as an indicator system for rating how well a building creates a healthy indoor environment and reduces its impact on the environment among other benefits. LEED-NC is broken down into 6 sections, each with corresponding points. The following sections are listed in order of total points per category, i.e., the list indicates priority:

1) Energy and Atmosphere – 17 points,
2) Indoor Environmental Quality – 15 points,
3) Sustainable Sites – 14 points,
4) Materials and Resources – 13 points,
5) Water Efficiency – 5 points, and
6) Innovation and Design Process – 5 points. The maximum score is 69, and various levels of certification are possible: 26 points earns a building the status of Certified, 33 qualifies for Silver, 39 obtains Gold, and 52 or more receives Platinum certification.

For more details on the LEED point system, go to the web site: www.usgbc.org and look for the links to LEED Green Building Rating System documents.

Various Versions of LEED

In addition to LEED-NC, other versions of LEED are being developed, or have been recently completed, to include other sectors of the construction industry. When completed and marketed, these new versions will cover a much larger percentage of the construction and building industry. These include existing buildings (LEED-EB), commercial interiors projects (LEED-CI), core and shell projects (LEED-CS), homes (LEED-H), and neighborhood development (LEED-ND). While the first of these new systems addresses primarily building methods, the latter are concerned more with site selection and the principles of New Urbanism. Currently, the USGBC, the Congress for New Urbanism, and the Natural Resources Defense Council are working to create a consensus-based rating system in consultation with professionals around the country. LEED-ND will focus on the Smart Growth Network's ten principles of Smart Growth; the guidelines will promote mixed-used developments and mixed housing types, in addition to other related foci already present in the existing LEED-NC, such as proximity to mass transit, proper site selection, and support for bicycle and carpool travel. The goals of LEED-ND include the following:

- revitalization of urban land;
- decrease in land consumption;
- decrease in vehicle-miles traveled;
- improved air quality;
- decrease in polluted stormwater run-off;
- design of communities with mixed-incomes; and
- walkable communities (USGBC 2004c).

Who's Practicing Green Building?

There is little doubt that the construction of (and renovation to create) green buildings is on the rise. From 2000 to 2004, over 168 million square feet of commercial building space has either been registered or certified with the USGBC's LEED certification program (Banham 2004). In total, LEED boasts 137 total certified projects and 1,640 total registered projects in 50 states and 13 countries for a total of nearly 200 million gross square feet. California leads the way with 260 registered projects, followed by Pennsylvania with 101, Washington with 90, Oregon with 85, and New York with 80. North

Carolina has 38 projects in the pipeline. The University of North Carolina at Chapel Hill accounts for two of those projects—the Carrington Nursing School addition, which will include a green roof, and the Botanical Garden Visitor Education Center, shown in Figure 2, which is shooting for the LEED Platinum level of certification (USGBC 2004b).

Figure 2. North Carolina Botanical Gardens Visitor Education Center, a proposed LEED-NC Platinum Building. *Image courtesy of Chris Wedding.*

There are other signs that green building is gaining momentum. While it is to be expected that progressive cities like Portland, Oregon implement green building policies, the fact that conservative departments, cities, and states are also adopting LEED guidelines shows broad-based approval for this new trend. The following is an abbreviated list of agencies, states, municipalities, and private sector businesses that are using LEED as a guide or mandate on their building projects:

- U.S. General Services Administration;
- U.S. Department of Interior;
- U.S. Environmental Protection Agency;
- U.S. State Department;
- U.S. Air Force, Army and Navy;
- the states of California, Connecticut, Maryland, Illinois, Maine, New Jersey, New York, Oregon, Pennsylvania, and Washington; and
- the cities of Los Angeles, Seattle, Portland, Atlanta, Berkeley, San Francisco, Chicago, Dallas, Arlington, and many more (Templeton 2004).

What are its Costs and Benefits?

The benefits of green building generally include the following:

1) reduction in negative impacts on ecosystems and natural resource bases;
2) reduction in operating and maintenance costs;
3) enhancement of building marketability;
4) increase in worker productivity; and
5) reduction in possible liability for indoor air quality problems (USGBC 2001).

William Browning, Founder of Green Development Services at the Rocky Mountain Institute, states that green building strategies can increase occupant performance by 6 percent to 16 percent (USGBC 2003). Because office workers' salaries are by far the largest business expenditure (compared with rent, utilities, repair, etc.), improvements in this domain have far-reaching impacts on profits (Hawken, Lovins, and Lovins 1998). Portions of the *Sustainable Building Technical Manual* illustrate this relationship well (see Figure 3). A study by the California Energy Commission confirmed these benefits. Call-center workers located in rooms with views to the outside and daylight processed calls 6 percent to 12 percent faster and performed 10 percent to 25 percent better on tests of mental function and memory compared to their secluded counterparts. In addition to worker productivity, daylighting has been shown to in-

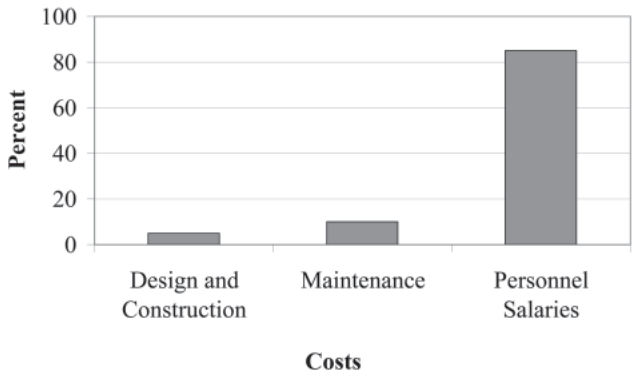

Figure 3. Thirty-year cost of a building. *Image courtesy of Chris Wedding.*

crease sales by up to 40 percent compared to traditionally lit retail locations (Heschong Mahone Group, Inc 2004).

Water efficiency is another benefit of green building methods. Conservation measures can easily reduce water usage by 30 percent compared to the standards set by the 1992 U.S. Energy Policy Act; even greater savings can be achieved when compared to buildings that pre-date this act. According to the USGBC, for a 100,000 square foot office building, low-flow fixtures with automatic controls could save 1,000,000 gallons of water per year, assuming 650 occupants using an average of 20 gallons per day (USGBC 2001).

Additionally, some architects have suggested that a synergy exists between green building and historic preservation. That is, both are concerned with conservation (Solomon 2003). One example includes the reuse of the shell and structure of a building, which reduces construction and demolition waste while preventing the extraction, processing, and transportation of new building materials. However, contention exists in certain areas; for example, the use of historical decorative versus energy efficient options. These issues are often relevant to abandoned, contaminated properties with standing buildings, as is often the case with brownfield properties.

Overall, green buildings are financially attractive. Table 1 shows the total financial benefits (per square foot) less the initial premium over a 20-year period. An upfront investment for green techniques of 2 percent of construction costs can generate benefits in energy, operation and maintenance, and water savings, as well as gains in productivity, equal to a total ten times the initial investment over a 20-year period. This is a conservative estimate because most buildings last much longer than 20 years, although some components, such as mechanical systems, may need upgrading or replacement (Kats 2003).

Table 1. Total financial benefits of green building.

Costs and Benefits of Green Building 20-Year Net Present Value (NPV) (Per Square Foot)	
Energy Value	$5.79
Emissions Value	$1.18
Water Value	$0.51
Commissioning Value	$8.47
Operations and Maintenance	
Productivity and Health Value	$36.89
Certified and Silver	
Productivity and Health Value	$55.33
Gold and Platinum	
Minus Green Cost Premium	$(4)
Total 20-year NPV	
Certified and Silver	**$48.47**
Gold and Platinum	**$67.31**

Source: Kats, G. 2003. *The Costs and Benefits of Green Building*.

The most recent study on the costs of green building indicates that green buildings don't have to cost more than conventional structures. A study conducted by the Davis Langdon Adamson cost consulting company shows that based on initial budget estimates and final construction costs, the majority of the 61 buildings studied achieved LEED certification without any additional funding. Those that did require additional funds for more expensive items like photovoltaic panels typically only need up to 3 percent of the initial budget. The analysis also indicated that costs per square foot for LEED buildings fell into the existing range of costs for buildings of similar program type (Davis Langdon 2004). A study by the Brendle Group concluded that the premium for LEED-certified buildings was less than 1 percent, for Silver and Gold certification less than 2.1 percent, and for Platinum the premium approached 6.5 percent (The Brendle Group 2004).

This small premium for a green building is not necessarily universal. The Chicago Center for Green Technology, for example, which is more of a demonstration project, exceeded costs for a comparable building by 30 to 40 percent (Trumbull 2004).

The Davis Langdon Adamson study also discusses some of the factors that add to the extra potential costs for a green building. These include:

1) the demographic location—rural versus urban;
2) the bidding climate and culture;
3) the local and regional design standards, codes, and initiatives;
4) the intent and values of the project—the owner's dedication from the beginning;
5) the climate—heat and humidity, for example, limit passive cooling potentials;
6) the timing of implementation—integrating systems early in programming is cheaper than adding on later;
7) the size of building; and
8) the point of synergies (i.e., can more than one green building goal be achieved with the same building material or method?).

The authors state that the most significant variable is the bidding climate and culture. The bidding pool of knowledgeable contractors may be small and, therefore, limit competition and drive up prices. Additional costs may result from the documentation of steps taken to achieve LEED requirements, the application of indoor air quality construction protocols, scheduling delays to implement post-construction building flush-outs, the risk and learning curve of unfamiliar green practices, and responsibility of ensuring that a project earns LEED certification (Davis Langdon 2004).

A final benefit derives from public image. According to Nigel Howard, USGBC's vice president and head of the LEED program, companies building green can distinguish themselves as ethical organizations. With so much scrutiny over a company's environmental activities, this association may increase the demand for a firm's products or services. Thomas Leppert, chairman and chief executive office of The Turner Corporation, a national general builder that in 2003 completed more than $6 billion worth of construction, claims that "green is the new corporate color" (Banham 2004). With the rising popularity of green building, many are realizing that the real question is not "What does it cost to build green?" but rather "What does it cost to not build green?"

Criticisms of LEED

The LEED rating system still faces several challenges. Some of the common criticisms are highlighted below:

- All credits essentially receive the same weighting. That is, a building project can earn a point towards certification by redeveloping on a former brownfield or by using only low-VOC paint throughout the interior of the building. The reader will quickly understand that these two credits require vastly different amounts of time, planning, and money to obtain.

- Earning a credit does not always transfer into direct benefits to or reduced impact on the environment. For example, a building may achieve Sustainable Site credit 4.3 by installing special refueling stations for alternative fuel vehicles to meet 3 percent of the total parking capacity at a site. This does not necessarily mean that users of that building will own or use alternative fuel vehicles, and, therefore, achieving this credit does not translate into real reductions in air pollution related to the use of gasoline-powered vehicles.

- LEED is not the end all in defining green buildings. At the 2004 Annual USGBC conference in Portland, Oregon, some speakers presented a slogan that made others a bit uncomfortable: "If it's not LEED, it's not green." Clearly the argument here is that while LEED has done an excellent job of defining green building and increasing its share in the market, there have been and will be buildings that meet many of the goals of green building without receiving actual certification.

- LEED does not give enough attention to the context of a building. Sustainable Sites credit 2 may be a case in point. The goal of this credit is to reward projects that encourage bicycle commuting. However, if a site is located on a highway or bypass where bicycles are not allowed by law, achieving this point has nothing to do with the owner or designer, but perhaps with the state department of transportation.

- LEED is full of trade-offs which can counteract the efforts and goals of a variety of credits. Two examples illustrate this effect. First, a project may aim for incorporating rapidly renewable materials into the design and specify bamboo flooring with enthusiasm. However, doing so contradicts the credit for locally produced materials—since bamboo is produced in China—and adds to negative transportation-related externalities. Another example deals with the credit for giving occupants control over their thermal environment. While this may make them more comfortable and enhance their productivity, certain users will surely use excessive heating or cooling and accordingly negate attempts to achieve the credit for energy efficiency.

- LEED documentation adds another level of paperwork and bureaucracy to the already complex process of developing a site and building a new structure. The time, and, therefore, the money spent on documenting that proper actions were taken to achieve the said credits are unappealing to owners and developers.

- LEED offers no credit based on the relative size of a building. While the decision for how much space a building program requires is totally in the hands of the owner/developer, it can be argued that unnecessarily large buildings (i.e., relative to actual need) consume a great deal more resources in both materials and energy. Consequently, these projects should somehow be characterized as more wasteful and environmentally unfriendly.

Why Should Planners Care About Green Building?

While the upcoming LEED-ND will address a multitude of planning goals, the version of LEED most used today (LEED-NC) addresses many objectives often discussed in the planning community. Table 2 on the following page illustrates a variety of credits relevant to four subsections of city and regional planning: 1) transportation planning, 2) community development, 3) economic development, and 4) environmental planning. The lists are by no means comprehensive and the ability of each credit to reach the goals of each of these subsections listed above is subject to interpretation for each site.

As the table indicates, there are many reasons why planners should be aware of and in support of green building efforts in their communities. Reaching for LEED certification has its limitations, but it serves as one way to create public and market awareness for the environmental, financial, and social benefits inherent in many green building methodologies. As the USGBC's motto goes: "Build green. Everybody profits." Green building may only account for 5 percent of the building market now, but LEED has only been around since 2000. Most agree that not only is it is here to stay, but one day, we won't need LEED—green building will be the norm. Then we'll be shooting for some higher standard—buildings that are net exporters of energy, buildings that change color with the seasons to gain or shed heat, building sites with greater biodiversity than their natural surroundings. LEED is a useful guide, but it's only a stepping stone.

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Table 2. LEED credits and their relationship to various planning interests.

Potentially Relevant LEED Points	Discussion of Relevance
Transportation Planning Focus	
SS Credit 4.1: Public Transportation Access	Promotes mass transit.
SS Credit 4.2: Bicycle Storage and Changing Rooms	Supports healthy, non-polluting modes of transport.
SS Credit 4.3: Alternative Fuel Vehicles	Encourages transportation options with reduced health impacts.
SS Credit 4.4: Parking Capacity	Promotes carpooling, vanpooling, and reduced parking capacity.
MR Credit 5.1: Locally Manufactured Materials	Serves to reduce transportation-related negative externalities.
MR Credit 5.2: Locally Harvested Materials	Serves to reduce transportation-related negative externalities.
Community Development Focus	
SS Credit 2: Urban Redevelopment	Rewards infill development.
SS Credit 3: Brownfield Redevelopment	Encourages environmental remediation, removes of urban blight, provides jobs, and reduces health risks.
EA Credits 1, 2, 3: Optimize Energy Performance, Renewable Energy, Additional Commissioning	Facilitates economic efficiency with smaller percentage of monthly expenses going towards utility bills. Promotes energy independence. This leaves more funds available to support other municipal programs.
EA Prerequisite 1: Fundamental Building Systems Commissioning	Facilitates economic efficiency with smaller percentage of monthly expenses going towards utility bills. This leaves more funds available to support other municipal programs.
MR Credit 1: Building Reuse	Supports the preservation of cultural and historical heritage.
MR Credit 3: Resource Reuse	Supports the preservation of cultural and historical heritage.
MR Credit 5: Locally Harvested and Manufactured Materials	Sustains the local economy.
Economic Development Focus	
SS Credit 2: Urban Redevelopment	Rewards downtown redevelopment. Discourages inefficient greenfield development. Spurs ancillary development.
SS Credit 3: Brownfield Redevelopment	Replenishes tax base (e.g., property, sales, income). Creates jobs. Spurs ancillary development.
SS Credit 4: Alternative Transportation	Reduces need for street/road expansion and maintenance. Ultimately frees up funds for other municipal projects.
EA Credits 1, 2, 3 and Prerequisites 1: Optimize Energy Performance, Renewable Energy, Additional Commissioning, Fundamental Building Systems Commissioning	Reduces operating expenses and frees up money for other investments.
MR Credit 5: Locally Harvested and Manufactured Materials	Promotes jobs and businesses in local area.
IEQ Credits 1-7: Carbon Dioxide Monitoring, Ventilation Effectiveness, Construction IAQ Plan, Low-Emitting Materials, Indoor Chemical and Pollutant Source Control, Controllability of Systems, Thermal Comfort	Attracts high-level tenants and building owners who value optimal spaces for workforce. Reduces social health costs through building-related illness and lost productivity through morbidity.
IEQ Credit 8: Daylight and Views	Attracts high-level tenants and building owners who value optimal spaces for workforce.
Environmental Planning Focus	
SS Credit 5: Reduced Site Disturbance	Rewards developments with minimal impact on the area surrounding the building footprint.
SS Credit 6: Stormwater Management	Encourages stormwater retention and on-site treatment.
WE Credits 1, 2, and 3: Water Efficient Landscaping, Innovative Wastewater Technologies, Water Use Reduction	Promotes reduction in water demand and decrease in waste water generation. Lessens load on water infrastructure.
MR Credit 1, 2: Building Reuse, Construction and Demolition Waste	Reduces waste going to landfill, thereby extending its useful life.
MR Credit 3, 4: Resource Reuse, Recycled Content	Leads to reduced consumption of natural resources and decrease in pressure on landfills.
MR Credit 6: Rapidly Renewable Materials	Facilitates the preservation of non-renewable materials as well as those that require greater time to harvest.
MR Credit 7: Certified Wood	Supports sustainable forest practices, i.e., only those certified by the Forest Stewardship Council (FSC). Contributes to more protected water supplies.
Notes: SS = Sustainable Sites; EA = Energy and Atmosphere; MR = Materials and Resources; IEQ = Indoor Environmental Quality;WE = Water Efficiency	

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