Can Building Green Save You Money (Or Just Make You Look Good)?

Thousands of commercial and institutional organizations across the United States and Canada are renovating and constructing new buildings according to high-performance, or "green," standards. Also known as "sustainable" building design, this approach aims to improve upon standard construction and design principles in terms of resource efficiency, waste reduction, and indoor and outdoor environmental quality. Done well, high-performance building design can save the owner money on operations and maintenance, often at little or no additional cost. But if you simply check off items on a standardized green building checklist, you could overlook some big savings opportunities.

Many major corporations, including Wal-Mart and Toyota, are building according to sustainable design principles. So are schools such as the University of California and cities including San Diego and Atlanta. These and other organizations are building green to save on energy and water costs, and to project an image as good corporate citizens. Green buildings may incorporate elements such as low-emitting materials (those that don't emit toxins, like volatile organic compounds), storm-water capture and recycling, natural ventilation, and daylighting. Because the design process can take longer and some materials are more expensive and more difficult to procure or use than conventional materials, building green can cost more than standard construction. But it is possible to keep costs down: The Toyota Motor Sales buildings in Torrance, California, cost just $63 per square foot (within the typical range of $54 to $76 for California office buildings), plus $26 per square foot for interiors (typical range: $22 to $40). Whether it costs more or less to build, it is possible to design a green building that costs far less over its lifetime by focusing on energy and water efficiency.

Unfortunately, simply following a checklist of green building elements cannot guarantee that your building will operate efficiently and cost-effectively. The leading green building standard in North America is currently the U.S. Green Building Council's (USGBC's) Leadership in Energy and Environmental Design (LEED®) rating system (see sidebar, next page). LEED's checklist approach and point-scoring system offer flexibility and steer designers to many of the sustainable options available. They do not, however, provide guidance on what measures work best in particular climates or which strategies have the biggest resource-saving potential. For example, it is theoretically possible to design a building that can earn enough points to satisfy LEED's basic certification requirements, but that is no more energy efficient than a conventional building. And LEED points are not necessarily equivalent in terms of cost to implement or environmental benefits. It is up to the building's designer, contractor, and owner to ensure that it meets resource efficiency and other sustainability targets. The best way to do that is to use integrated design principles, conduct energy modeling and full-building commissioning, and systematize building operations management and tracking.

The Heart of the Matter

Integrated building design is performed by a multidisciplinary team of architects, engineers, and contractors working together to meet clearly defined goals for energy efficiency, good indoor air quality, and environmental sustainability. This process is at the heart of building green. Integrated design can help you harness large energy savings without spending any more than for a conventional building.

Under the typical construction approach, an architect creates the design, then an engineer specifies the mechanical systems, then a contractor is brought in to manage construction. The

Certified Green

Two benchmarking systems are available for commercial construction that complement each other and partially overlap: LEED and E-Benchmark. LEED covers a wider range of green elements but does not provide the detailed guidance for energy savings that E-Benchmark does.

LEED. The LEED rating system provides a common standard to measure how green a building is in terms of its design, materials, equipment, and resource use. The nonprofit USGBC developed LEED to serve as a brand for green building design (see www.usgbc.org). Commercial construction and renovation projects can earn points under LEED for New Construction (LEED-NC) in six categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation and Design Process. To earn LEED points, project developers register a project and later submit documentation demonstrating the fulfillment of requirements. There are four levels of certification: basic, Silver, Gold, and Platinum. Projects that satisfy requirements for at least 26 points (out of a possible 69) earn basic LEED certification; Platinum-rated buildings require a minimum of 52 points.

The USGBC is developing more versions of LEED, including ones for existing buildings and for commercial interiors, the latter intended for leased space. LEED appears to be rapidly gaining momentum as the leading green building brand for the national—and perhaps international—construction market. As of early 2004, construction projects totaling almost 150 million square feet had registered as intending to follow LEED standards—that's 5 percent of the commercial construction market in the U.S.

E-Benchmark. In October 2003, the New Buildings Institute (NBI) released its E-Benchmark checklist of criteria for energy-efficient buildings as part of its Advanced Buildings program. The checklist can be used on its own or as a resource guide for LEED projects. Over 30 of the E-Benchmark criteria were designed to overlap with many points in LEED's Sustainable Sites, Energy and Atmosphere, and Indoor Environmental Quality categories. E-Benchmark offers two tracks: a "prescriptive" approach in which designers and builders select from a set of specific measures and a "simulation" approach that relies on whole-building modeling. The prescriptive approach specifies criteria that are tailored to 15 different climate zones and is designed for commercial buildings up to 80,000 square feet. The simulation approach includes guidelines for technologies and equipment that are not, or only partially, addressed in LEED-NC but that can provide important energy-efficiency benefits, including criteria for air-barrier, window, and transformer performance.

In coordination with the Energy Center of Wisconsin and the USGBC, the NBI is also preparing an Advanced Buildings design manual, an owner's guide to high-performance buildings, a guide to achieving LEED points using the E-Benchmark system, and a multi-level training curriculum.

result is that mechanical systems are frequently oversized and design options that could reduce cooling loads—such as building orientation and window glazing—are often overlooked. When using an integrated approach from the start, not only can operational savings be achieved, but building occupants may be more comfortable.

This approach can carry extra costs in the design stage, both for computer modeling and because the full construction team is brought together early on for additional design meetings. A survey of 18 project participants in Natural Resources Canada's C-2000 system and Commercial Buildings Incentive Program found that design fees rose about 1.5 percent. Then again, the construction services company CH2M HILL was able to build its Denver facilities on a fast-track schedule despite using integrated design (**Table 1**, next page). Until it becomes standard practice, integrated design will continue to be considered one reason that adhering to sustainability principles can cost more than conventional construction.

Sometimes the integrated design process identifies opportunities to reduce capital costs. For example, proper use of daylighting can minimize electric lighting needs and, in turn, reduce the need for mechanical cooling and ductwork. Using multiple smaller boilers can cost less than one or two larger boilers, and can also improve load matching and redundancy. Shooting for

Table 1: CH2M HILL Denver facilities—LEED certified

CH2M HILL built a 390,000-square-foot, three-building campus in the Denver area, working along LEED guidelines and on a tight deadline. The total project cost came in at $66 million, not including land, and most of the project's return on investment is coming from energy savings, which are primarily the result of efficient lighting, advanced building controls, and direct-expansion rooftop air-conditioning units with evaporative condensers.

Item	Value[a]	% of total project cost	Comments
LEED design premium	$240,000	0.36	Included research travel, workshops, and LEED-related specifications, documentation, registration, and certification fees.
LEED construction premium	$580,000	0.88	Included $300,000 for a direct-expansion rooftop air-conditioning unit with evaporative condenser.
Commissioning cost	$74,000	0.11	
Total LEED cost	**$894,000**	**1.35**	
Annual energy savings	$146,700		
Total annual operational savings	$148,000		
Simple payback period	6 years		

Note: a. Value numbers are rounded to the nearest thousand.

Source: E SOURCE; data from CH2M HILL

overall energy savings of 50 percent or more over conventional design offers the best opportunity to cut capital costs, because the mechanical systems can be very small.

When integrated design does cost more than standard design, reported payback from operational savings has ranged from immediate to five years or more. Of course, as with any cost estimates comparing green building design to conventional construction approaches, the evidence is inconclusive because the data is anecdotal. Buildings are complex systems, and each one is unique.

Words of Wisdom

If you talk to folks who have been involved in a green building project, you might get tips like these:

- *Start green.* Projects that target sustainability and resource efficiency goals from the beginning have a better chance at cost-effectively reaching their goals. If you want to follow a certification program, plan that early, too.
- *Get everyone together.* Who should participate in early design planning? As many project participants as possible, including the owner, architect, engineer, contractor, and even subcontractors, occupants, and the facility management team.
- *Anticipate delays.* Some green building elements can introduce delays into your schedule. For example, product specifications can be more complicated, certified wood can take longer to procure, and permits can take longer to secure for natural ventilation, waterless urinals, and some uses of graywater.
- *Use performance-based contracts.* For example, you can structure contracts with the mechanical engineer to pay incentives for meeting energy targets rather than the more conventional percentage of capital equipment costs, which can tempt them to specify larger, more expensive systems.
- *Daylighting is a winner.* Often, daylighting is a key component of an energy-saving design strategy. But it isn't simply adding more windows. Proper building orientation, light shelves that draw light deep into a space, glazing, and lighting controls are some elements of a successful daylighting strategy.
- *Try software tools.* A number of software tools may be useful. Some free tools for evaluating energy-efficiency measures are available from Energy Design Resources (www.energydesignresources.com). Lawrence Berkeley National Laboratory's Desktop Radiance software helps you test energy-efficient

lighting and daylighting options (http://radsite.lbl.gov/deskrad/dradHOME.html). Several vendors, including the USGBC, are also developing documentation software to assist with the LEED certification process (www.k1concepts.com and www.enverity.com).

- *Reuse commissioning documents.* Commissioning records and much of the documentation the team prepares for green building certification can serve valuable functions after construction. Prepare them so they can be used in training manuals, maintenance guides, and to plan building performance tracking.

Should You Go for Platinum?

If design and construction might cost more, why build green? First of all, it might *not* cost more—you've already seen that operations and maintenance may cost less, and there may be opportunities for first-cost savings. Also, building green may mean workspaces are so comfortable and well-lit as to increase worker productivity. (This is a controversial point because it's hard to measure. You can find studies on productivity benefits on the Rocky Mountain Institute's Web site: www.rmi.org.)

Once you have decided to incorporate sustainable principles into your building design, you might choose to follow one of many green building guidelines and get certified by a third party such as the USGBC or build to your own specific needs. Certification carries additional costs such as document preparation, registration and documentation fees, and implementation of measures you might not otherwise have chosen. Getting certified may have promotional value, but the potential marketing and public relations benefits are tricky to measure. Sustainable building design can be used to reflect or enhance corporate culture in the eyes of staff and customers; it may boost a company's image and support its environmental or "good citizen" policies. This message appears to resonate more with owner-occupied building owners than with speculative developers. But even for speculative builders, the potential to cut operating costs and improve indoor environments may make green buildings easier to sell or lease.

In the end, you may opt to build according to sustainable principles for the savings, health, and comfort benefits, and forego certification. Green building design isn't just about certification, it's about challenging companies to construct and manage their brick-and-mortar assets well.