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Building Green Today For a More Cost-Effective Tomorrow



BY JAMES D. QUALK

For the past several years, the U. S. economy has seen a tremendous amount of growth in the adoption of sustainable practices. Organic and natural products now grace the shelves of almost every grocery and department store. Consumer awareness has grown as more people try to purchase organic and locally grown produce. Recycling programs are more prevalent now in the United States, and many of the products we buy include either post-industrial or post-consumer material. This same growth in awareness and sustainable practices also is happening in the design, construction and building operations markets.

How can we explain the growth in sustainable practices over the last decade? The benefits of green building might serve as a start. According to the U.S. Green Building Council (USGBC), green buildings have the potential to reduce energy use by 30 to 50 percent, carbon emissions by as much as 35 percent, water use by 40 percent and solid waste by 70 percent.

The significance of buildings and our lives

According to the U.S. Environmental Protection Agency's Green Building Workgroup, the average American spends nearly 90 percent of his or her life indoors, illustrating how critically important a building is to everyday life. It is important to recognize that buildings directly affect quality of life factors, including productivity and general health.

(Above)

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In addition to the effects that buildings can have on a person's well being, they also significantly impact the environment. For example, the USGBC reports that buildings consume 65 percent of all electricity and 36 percent of all grid energy in the United States. It is this utility consumption that causes buildings to contribute nearly 40 percent of U.S. carbon (CO₂) emissions. Additionally, buildings consume 30 percent of all raw materials. These numbers are staggering to most, because many are still unaware of the personal and environmental impact of our built environment.

The USGBC's Leadership in Energy and Environmental Design (LEED) rating system has set the bar in terms of what constitutes a high-performance building. LEED also provides a market-based definition of what a green building is, and as a result, LEED and "green building" have become synonymous over the past several years. Until recently, some market sectors have been slow to adapt to this change. However, we are now seeing members of almost every industry from healthcare to sports and entertainment pursue LEED certification.

Cost misconceptions

The importance of the "first cost" of a building in relation to the "cost of ownership" over the course of its useful life might also play a major role in the recent surge in sustainable building practices. Of course, the importance of "costs" in the design and construction industry cannot be avoided. A great deal of time is spent during the design and construction process by owners, architects and contractors to determine the feasibility of projects or strategies based on estimates and projections that detail

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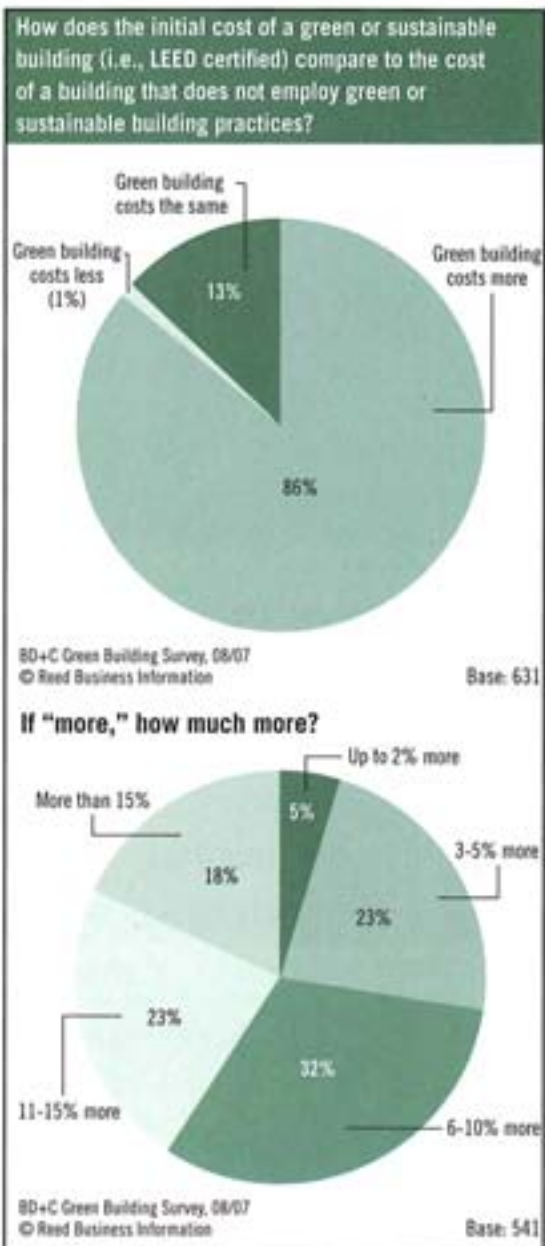
almost up-to-the-minute market trends. But how does this process usually work, and what initial decisions determine the strategy for design and construction of any particular building?

The truth is that the industry spends most of its time focusing on "first cost" concerns while often ignoring operational or "lifecycle" cost analysis related to maintenance or energy efficiency measures. Because every decision made in the design and construction process affects operations during the potential 40-, 50-, or even 100-year life of a building, it is important to make the right decisions on the front end. In doing so, dramatic reductions in a building's operation and maintenance will be achieved and oftentimes can be accomplished for little or no additional up-front cost.

How do we make these right decisions? First, it is important to understand how design decisions are made and what barriers to change exist in the marketplace. Overwhelmingly, the biggest hurdle to overcome when considering sustainability is convincing owners, design teams and construction firms that achieving green building certification doesn't have to increase the cost.

There is still a strong misconception in the marketplace that pursuing LEED certification, or green building in general, adds significant costs to construction budgets. According to *Building Design + Construction's* "Green Buildings Research White Paper," 86 percent of survey respondents indicated that "green building costs more" than traditional design and construction methods (See Figure A).

Figure A: Green Building Cost Perceptions



These general cost misconceptions stem from two main sources:

- Lack of project experience – Despite the phenomenal growth of projects seeking LEED certification, only about 15 percent of all new construction projects in the United States are currently registered to pursue certification.
- Antiquated approaches to building programming and budget analysis – If LEED certification is pursued as an added feature of design, then the estimated cost of any sustainability feature is considered an addition to the established budget analysis. Sustainability is a programming issue and must be addressed before any budgets are established. This approach enables the project team to apply a more holistic and integrated design methodology.

The importance of collaboration

A goal of the USGBC is to foster "complete market transformation." This implies the hope that eventually all buildings will pursue LEED certification. It also implies the USGBC's hopes to transform the process by which buildings are designed and constructed.

Traditionally, when an owner decides to launch a project, he hires an architect and perhaps a construction management firm. This abbreviated team then programs the facility and makes design decisions that will ultimately affect other sub-consultants not yet represented on the team. Anytime decisions are made in a vacuum, or without the input of specialty consultants, the ability to integrate design elements of a building is severely diminished. This is especially true when sustainability is a priority and LEED certification is a project goal.

In order to properly design a sustainable building, all stakeholders must be engaged as early as possible. Every consultant must be assembled before major decisions occur to maximize potential synergies and to grow out of an integrated and holistic approach. The benefits are obvious, because any decision made by the architect or any other consultant affects all other consultants. Changes in glass, wall massing, building orientation, roofing materials, HVAC, water use, lighting and renewable energy systems usually affect multiple consultants who have a stake in the design of a project. Open lines of communication and collaboration must be established among team members before questions are addressed and decisions can be made.

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How do you know if a building is truly green?

Year-to-date, the USGBC has produced what is by far the best third-party independent verification tool for determining if a building is in fact "green" and if so, to what degree. The USGBC officially introduced its LEED rating system in 2000, and growth in registrations and certifications continues to accelerate at a phenomenal pace. Rarely has any trend been embraced within the design and construction industry as quickly as LEED. Today, there are more than 15,000 projects registered with the USGBC and 2,000 certified buildings. In addition, registrations continue to increase by approximately 50 percent year over year. Also worth noting is that 12 federal agencies or departments and more than 30 states, 140 cities and towns, and 30 countries now require some level of LEED certification.

The LEED rating system has proven itself a formidable tool for creating facilities that reduce energy, water and resource use while creating healthier places for all of us to live and work. Until now, the following rating systems have been available for use:

- LEED for New Construction and Major Renovations (LEED-NC) – the original commercial rating system
- LEED for Existing Buildings: Operations and Maintenance (LEED-EB O&M) – the recently revised and improved rating system that address the large number of existing buildings already in operation
- LEED for Commercial Interiors (LEED-CI) – serves the tenant improvement market
- LEED for Core and Shell (LEED-CS) – for core and shell developments
- LEED for Schools – LEED-NC adapted for the K-12 school market
- LEED for Retail – currently in the pilot phase and intended to address the unique market of retail; there will be two versions, including a New Construction version for larger development and a Commercial Interiors version for "build-out" projects
- LEED for Healthcare – currently in review following the first public comment period on the structure and content of this new rating system; it combines design, construction and operational elements tailored specifically for the demanding requirements of healthcare facilities



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- LEED for Homes – a residential version
- LEED for Neighborhood Development – emphasizes proper neighborhood development.

LEED provides a measurable, verifiable and repeatable method for achieving the green movement's goal of "market transformation," revolutionizing the process by which we design, construct and operate buildings. However, it isn't perfect. Although it is the best tool we have to advance sustainability goals, LEED still has much room for improvement.

The LEED rating system is largely successful because of its ability to adapt to changes in the marketplace, as well as improvements in technology over time. If LEED and the green building movement are going to thrive in a volatile and continually changing market, there must be continued evolution and adoption. In the past, there wasn't a schedule for this ongoing improvement, but now there is.

The next generation of LEED

LEED 2009, the newest release of LEED rating systems, exemplifies the stated goals of the USGBC to further reduce barriers to entry – perceived or real – relating to complexity and costs. The three main pieces of the current improvement cycle focus on the following areas:

1. LEED rating system updates and revisions
2. Revision and advancement of the LEED certification process
3. An updated LEED online tool – LEED online v3.

Specifically, the USGBC is aligning credits in all rating systems to make them more uniform. The goal is to reduce confusion among those who might not be sure which rating system is the most appropriate for their project. This alignment of each rating system will include technical and market-based fixes to credits that currently need improvement or revision.

Changes in glass, wall massing, building orientation, roofing materials, HVAC, water use, lighting and renewable energy systems usually affect multiple consultants who have a stake in the design of a project

The USGBC has always offered Credit Interpretation Requests (CIRs) for questions related to credits that might not be completely clear. These CIRs will be integrated into the new LEED offerings based on volume or interpretations associated with any particular credit or prerequisite.

Other changes in LEED 2009 include a predictable development cycle, a transparent environmental/human impact credit weighting procedure and regionalization. As the green movement continues to build momentum, it is important that we continue to push the building industry forward, raising the bar on building performance and environmental impact.

Independent of the LEED 2009 improvements, LEED for Existing Buildings (LEED-EB) has undergone a dramatic facelift recently. LEED-EB was developed in 2004 but did not enjoy the same growth that the "New Construction" rating system continues to sustain. To address this disparity, the USGBC released an overhauled version known as LEED-EB for Operation and Maintenance (LEED-EB O&M). This new version includes revisions that address the perceived or real barriers to implementation related to cost or complexity. It is now much easier to use and can help reduce many potential costs related to certification.

For example, the new LEED-EB O&M rating system completely overhauled the previous commissioning requirements for certification. In the older version, LEED-EB v2.0, a full "retro-commissioning" scope was required as a prerequisite for certification. A full retro-commissioning scope includes the following (source: USGBC LEED-EB v2.0 reference guide):

- Develop comprehensive building operation plan that meets the requirements of current building usage, and address the heating system, cooling system, humidity control system, lighting system, safety systems and the building automation controls.
- Prepare a commissioning plan for carrying out the testing of all building systems to verify that they are working according to the specifications of the building operation plan.
- Implement the commissioning plan and document all of the results.
- Repair or upgrade all system components that are found to be not working according to the specifications of the building operation plan.
- Re-test all building components that required repairs or upgrades to verify that they are working according to the specifications of the building operations plan.

In many cases, this requirement might have represented a majority of the costs associated with existing building certification. To remove that barrier, the USGBC now only requires a minimum amount of commissioning to meet a prerequisite and also offers points towards certification for carrying out a full retro-commissioning or Continuous Commissioning[®] scope. The new prerequisite essentially requires an ASHRAE Level 1 Assessment or qualified equal assessment. Beyond that, if you perform a full retro or Continuous Commissioning scope, you could receive up to 6 points towards certification.

It is important to note that a full scope of existing building commissioning, though no longer required by LEED-EB, potentially offers building owners the most benefit of any other initiative or strategy in the rating system. The benefits of retro-commissioning include minimizing excessive equipment repair/replacement, improving indoor air quality and most importantly, reducing energy costs. In the new LEED-EB O&M rating system, a full retro-commissioning scope can contribute up to 24 percent of the total points needed for certification.

Optimizing systems over time through continuous commissioning

Without a doubt, retro-commissioning can be extraordinarily valuable to building owners and facility managers. Because retro-commissioning and new building commissioning are one time events, even in a new LEED certified building that has been commissioned, the performance of energy consuming systems can degrade over

As the green movement continues to build momentum, it is important that we continue to push the building industry forward, raising the bar on building performance and environmental impact.

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time. This happens for a number of reasons, including a lack of training for personnel and focus on proper maintenance of equipment and systems. According to the *ASHRAE Journal*, this degradation of performance can reduce a building's efficiency by more than 30 percent in the first three years of operation. However, since LEED-EB O&M now recognizes ongoing or Continuous Commissioning as a way to achieve points toward certification, more building owners are going to be able to address this one shortcoming on behalf of other commissioning offerings.

Continuous Commissioning, as defined by the Energy Systems Laboratory at Texas A&M University, is an ongoing process used to resolve operating problems, improve comfort and optimize energy use. This distinction between the goal of complying with original design intent and optimizing HVAC operations and controls is important in understanding how Continuous Commissioning differs from retro-commissioning. It does so by consistently pursuing energy savings through the collection of energy data via an existing BAS and/or stand-alone metering equipment.

Adhering to the formal Continuous Commissioning process not only maintains the long-term savings potential, but also improves system reliability and building comfort as building conditions change. When Continuous Commissioning is properly implemented, reasonable expectations for paybacks and savings are between 20 and 30 percent in less than three years. The table below represents documented savings of 10 buildings on the Texas A&M University campus between 1998 and 2000. As a group, the average payback was 2.67 years.

During the last 15 years, the Continuous Commissioning process has been utilized extensively on campus by Texas A&M University and in buildings across the country. A total cost savings of \$60 million dollars has been well documented at Texas A&M, with an investment of approximately \$10 million in Continuous Commissioning costs and \$8 million in capital improvements. The University's Energy Use Index has been in steady decline since 1998. (See Figure B.)

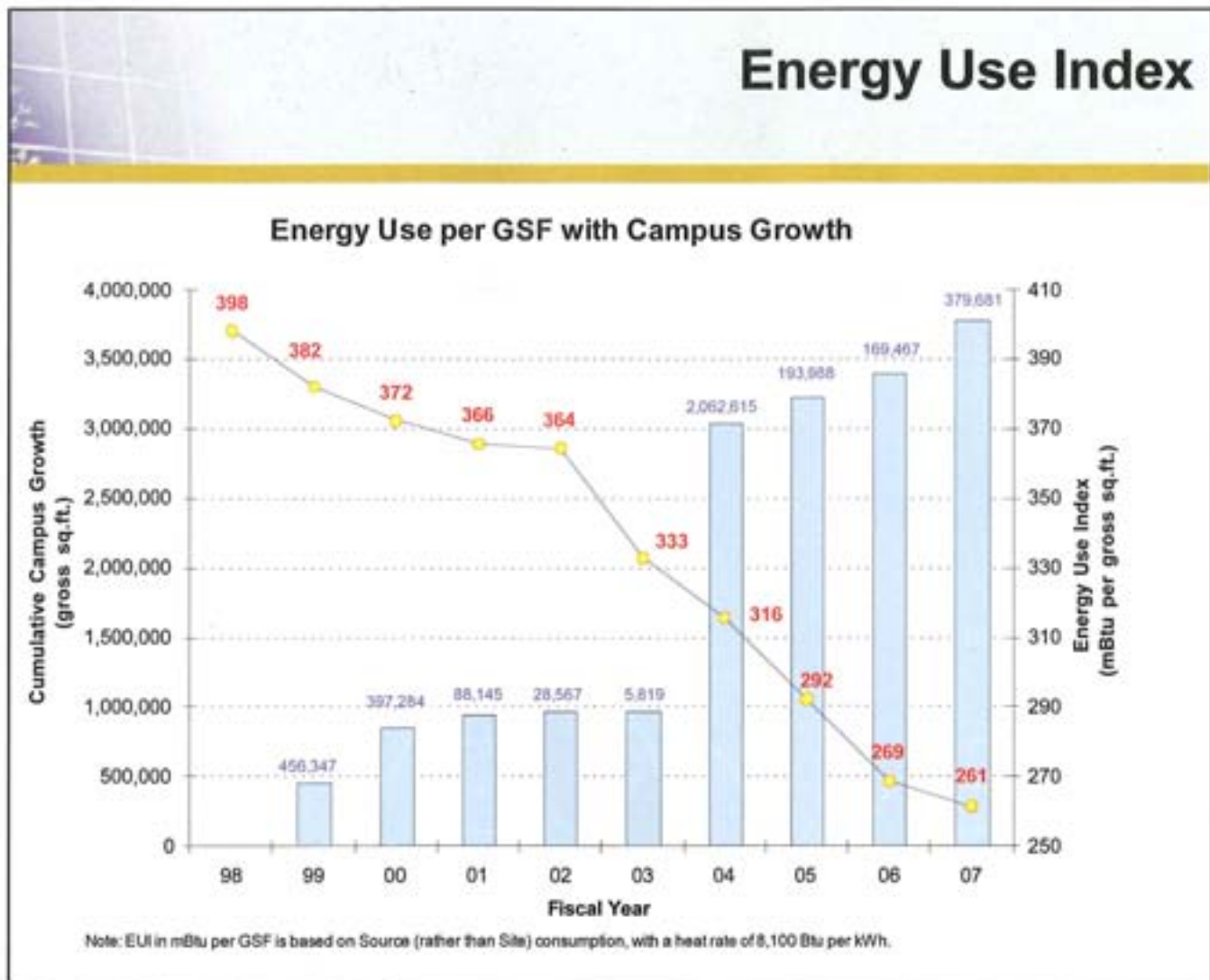
With growing momentum related to green initiatives such as LEED certification and commissioning, it is easy to see that a market transformation is occurring before our eyes.

Table 1

Savings for 10 Buildings – Texas A&M

Building	Baseline Use	2 Year Average Savings 1998, 2000	Simple Payback on 2 Year Avg.
1	\$484,899	\$280,687	1.73
2	\$229,881	\$112,391	2.03
3	\$283,407	\$66,371	4.27
4	\$315,404	\$105,137	3.00
5	\$145,420	\$56,657	2.57
6	\$192,019	\$59,308	3.24
7	\$273,687	\$120,706	2.27
8	\$324,624	\$90,001	3.61
9	\$224,481	\$57,990	3.87
10	\$436,265	\$139,010	3.14
Total	\$2,910,087	\$1,089,255	2.67

Figure 8:



People are beginning to recognize that these strategies will soon become the minimum deliverable related to building a new facility or addressing the operation costs of an existing building. With the current economic crisis and an enhanced awareness on behalf of the public, LEED certification and commissioning will continue to become a permanent part of the design and construction landscape in the United States and around the world.

But this is only the beginning. Where does this paradigm shift take us from here? How long will it be before we see true "net zero" or "carbon neutral buildings"? How long will it be before every building has the ability to generate enough electricity to handle its own needs? While these questions remain unanswered, it is clear that we are moving in the right direction.

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James D. Qualk, LEED AP, is vice president and team leader of the Sustainable Solutions Group (SSG) – a team of LEED Accredited Professionals specializing in the design, construction and operation of high-performance green buildings; according to guidelines set by the U.S. Green Building Council (USGBC). SSG is part of SSRcx, a wholly owned subsidiary of engineering design and facility consulting firm Smith Seckman Reid, Inc.