Busting the Myth that Green Costs More Green

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ABSTRACT

Buildings are one of the largest consumers of resources and energy in this country, and according to the AIA (American Institute of Architects) are responsible for almost half of all carbon emissions in the United States. Since Americans spend nearly 90 percent of their lives indoors, buildings are clearly important to our way of life. The most common misconception about green building is that these approaches cost more to implement than traditional strategies and techniques of design and construction.

Any decision made in the early stages of programming and design will have economic impacts on the overall building cost. How many floors will our building have? Will we use marble in the lobby? Can we use fancy fixtures in the bathrooms? But according to a Davis Langdon study, there was "…no significant difference in the construction costs for LEED®-seeking versus non-LEED® buildings…" In addition to this widely referenced report, other independent studies by the State of California and the GSA indicate that cost premiums are minimal.

More importantly, first cost is only a small part of the total cost of building ownership. Cost-of-ownership studies agree that first cost only accounts for around 10 percent of all costs a building owner will spend over the life of the building. The other 90 percent comes in the form of operation and maintenance—two areas in which designing for LEED® certification can save enormously. Any additional costs for building green are recouped in one to two years on average, with exponential cost savings thereafter that leave traditional construction far behind.

COSTS

The importance of “costs” in the design and construction world can not be overstated. Entire firms dedicate their business to helping owners, architects, and contractors determine the feasibility of projects based on estimates and projections that detail almost up-to-the-minute market trends. But what considerations are made to establish which projects are built and which features are utilized in any particular building? Our industry disproportionately agonizes over “first cost” concerns while many times ignoring operational or “life cycle” cost analysis. Because every decision we make in the design and construction process affects everything during the potential 40-, 50-, or even 100-year life of a building, it is important to make the right decisions during this phase. In doing so, dramatic reductions in costs to operate and maintain a building will be achieved, and oftentimes can be accomplished for little or no additional up-front cost.

How do we make these “right decisions?” First, we need to understand how design decisions are made today 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 increase costs. Once this “green building increases costs” misconception is removed, there will be virtually no reason for any building to not pursue Leadership in Energy and Environmental Design (LEED)® certification.

Importance and Perceptions

There is 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” published in October 2007, 86 percent of survey respondents indicated that “green building costs more” than traditional design and construction methods (Figure A).

These general cost misconceptions stem from two main sources: lack of project experience and antiqued approaches to building programming and budget analysis. Despite the phenomenal growth of projects seeking LEED® certification (project registrations increase about 50 percent per year), only about 10 percent of all new construction projects in the United States are currently registered to pursue certifi-

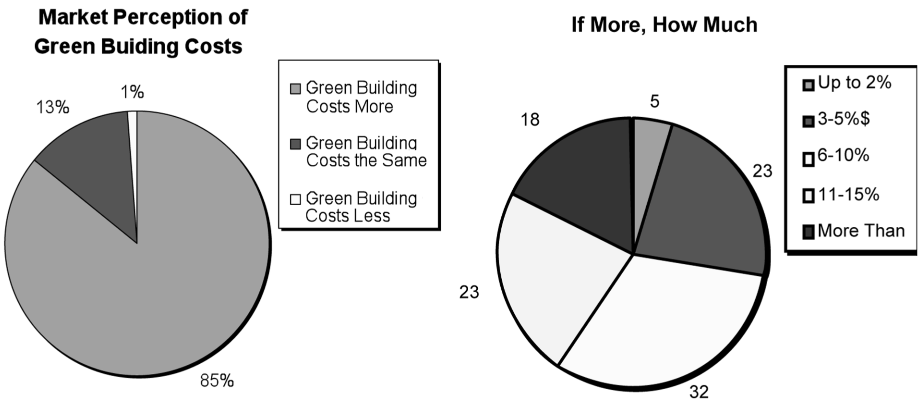

Figure A. Green Building Cost Perceptions

Source: BD+C Green Building Survey 08/07, © Reed Business Information

cation. Additionally, many project teams pursue certification utilizing a now-antiquated approach to building programming and budget analysis. Specifically, if LEED certification is pursued as an added feature of design, then any sustainability feature or strategy's estimated cost is considered in 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.

Goals of the USGBC, the LEED Process, and Implementation

A goal of the United States Green Building Council (USGBC), the administrator of the LEED rating system, is to foster "complete market transformation." This implies the hope that eventually *all* buildings will pursue LEED certification. It also implies the USGBC 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 programs the facility and makes design decisions that will ultimately affect other sub-consultants not yet represented on the team. Any time decisions are made in a vacuum, or without the input of "specialty consultants," the ability to integrate the design elements of a building is severely diminished. This is especially true when sustainability is a priority and LEED certification is a project goal.

To properly design a sustainable building, all stakeholders must be engaged as early as possible. All consultants must be assembled before major decisions occur to maximize potential synergies that exist and grow out of an integrated and holistic approach. The benefits are obvious. Any decision made by the architect, or any other consultant, affects all of the other consultants. Changes in glass, wall massing, building orientation, roofing materials, HVAC systems, water capture and use systems, lighting systems, 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.

HIGH-PERFORMANCE BUILDINGS AND THE BUSINESS CASE

Market sales of Prius (Toyota's hybrid-electric compact sedan) have soared in recent years despite the purchase price of the car being more than that of a traditional sedan. Depending on driving habits and location, this investment may not be recouped over the life of the vehicle. Because sometimes the extra cost can't be recouped, Prius ownership must include some perception of doing good for the environment or another qualitative factor. This is not the case with buildings. Both quantitative and qualitative studies continue to show that high-performance buildings recoup additional first costs when the total cost of ownership is considered.

The Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) defines a high-performance commercial building as "a building with energy, economic, and environmental performance that is substantially better than standard practice. It's energy efficient, so it saves money and natural resources. It's a healthy place to live and work for its occupants and has relatively low impact on the environment. All this is achieved through a process called whole-building design." The EERE further speaks of whole-building design as "design [that] considers all building components during the design phase. It integrates all the subsystems and parts of the building to work together. Because all the pieces must fit together, it is essential that the design team be fully integrated from the beginning of the process.

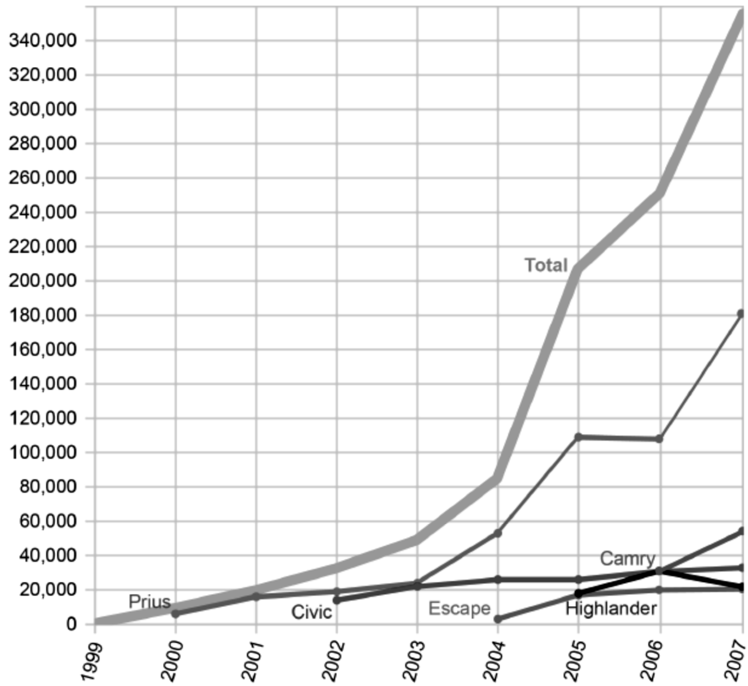

Figure B. U.S. Hybrid Market Sales (1999-2007)
Source: Hybrid Cars, December 2007 Hybrid Market Dashboard

The building design team can include architects, engineers, building occupants and owners, and specialists in areas such as indoor air quality, materials, and energy use." This is more commonly referred to as sustainable design, discussed previously.

Since sustainable design involves many stakeholders early in the design and construction process, the traditional project scope definitions must be re-evaluated. The American Institute of Architects (AIA) has already formalized a guide to contractual arrangements using what they call integrated project delivery (IPD), which by their definition is synonymous with sustainable design. According to the AIA, IPD is a "project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction." The AIA guide further explains that "IPD principles can be applied to a variety of contractual arrangements and IPD teams can include members well beyond the basic triad of owner, architect, and contractor. In all cases, integrated projects are uniquely distinguished by highly effective collaboration among the owner, the prime designer, and the prime constructor, commencing at early design and continuing through to project handover."

These two examples from the EERE and the AIA stem from the foundation previously laid by the USGBC. Regardless of the terminology or promoting organization, sustainable design encompasses a new approach to designing and constructing buildings. Some would argue that high-performance buildings can be achieved either through the traditional design and construction process or through sustainable design. Additional first costs for high performance buildings are common when sustainable design is not properly employed. If a building truly becomes high performing without undergoing the complete sustainable design process—through a commissioning or other metrics—these first-costs can usually be recouped. Sustainable design can eliminate altogether first costs for high performance, resulting in an even better return on investment for owners that understand and employ this new approach.

Benefits

High-performance buildings (HPBs) must exude additional benefits over traditional buildings; otherwise, they cannot be deemed high performance. HPBs inherently contain aspects of financial prosperity for an owner, occupant satisfaction, and environmental conservation. These three components, when evaluated on equal footing, are often referred to as the "triple bottom line."

The two methods of evaluating these triple bottom line benefits of high-performance buildings are quantitative and qualitative, with subcategories within each. Quantitative benefits can be measured directly and reproduced independently across all project types and all locations. Quantitative benefits are objective in nature and studies of these benefits can usually stand on their own merit without comparison. Qualitative benefits can be directly measured or indirectly deduced, and must be qualified on a case-by-case basis. Qualitative benefits are subjective in nature, and studies of these benefits usually must be grouped together before validity can be acknowledged.

Hundreds of case studies exist about the benefits of high-performance buildings. It is not in the scope of this article to present them all, but a few examples of some quantitative and qualitative benefits are referenced below.

Quantitative Examples

The most common example of a quantitative benefit is saving money through energy efficiency. Energy modeling is typically used for simulating building system comparisons, such as glass types, insulation values, mechanical systems, and lighting controls schemes, to determine payback of operating costs versus first costs. In June 2007, the USGBC mandated that all LEED projects would achieve at least 14 percent energy savings over a baseline building design, thus forcing the market to learn to utilize the benefits of energy modeling for design assist.

Other quantitative examples include calculations of water savings; reduced maintenance costs; longer-lasting components or systems; insurance premiums; tax benefits; and diverting construction waste from a landfill to reduce tipping fees.

Qualitative Examples

The most common example of a qualitative benefit is using the commissioning process to help ensure that building systems are designed and installed according to the owner's project intent. Commissioning scope and fee varies widely across building types, and cost savings for benefits such as increased energy efficiency, higher occupant satisfaction, and fewer equipment failures cannot be predicted before the commissioning process is applied. A 2004 study by Evan Mills at Lawrence Berkeley National Laboratory titled "The Cost-Effectiveness of Commercial-Buildings Commissioning" found median commissioning costs for existing buildings of $0.27/ft^2, whole-building energy savings of 15 percent, and payback times of 0.7 years. For new construction, median commissioning costs were $1.00/ft^2 (0.6 percent of total construction costs), yielding a median payback time of 4.8 years (excluding quantified non-energy impacts).

Other qualitative studies include: ability to charge and receive higher rents in some markets for HPBs; fewer vacancies; lower turnover; higher employee productivity; better retail sales; reduced hospital stay; lower susceptibility to building-born illness; and better overall occupant health.

Life Cycle Assessment and the Total Cost of Ownership

Industry experts are also investigating how to determine the total environmental impact of buildings and the components and process necessary for construction. A 2005 report by *Building Design and Construction* magazine titled "Life Cycle Assessment and Sustainability" defines life cycle assessment (LCA) as "a measurement tool, a way to measure the environmental performance of products over their life cycle, from 'cradle' (where the raw materials are extracted) to 'grave' (where the product is finally disposed of). The LCA of a building will indicate how much climate change was caused by the building…" By this definition, determining the total cost of ownership for a commercial building from "cradle to grave" begins before project conception and continues after the useful life of the building. William McDonough lobbies for an even more-encompassing analysis in his book *Cradle to Cradle*. In his book, McDonough provides examples and analysis of ways to "remake the way we make things" so that industrial and technological waste can be used again in a new process or system after the first useful life has ended.

In the Prius example, hybrid-electric vehicle owners may indeed be considering some forms of life-cycle assessment and self-subsidizing environmental conservation. Some building owners may be doing the same. More time and collaboration is needed to fully develop standards for LCA, if indeed the market is interested. In the meantime, there are plenty of hard cost reasons for owners and developers to engage in sustainable design and construction.

COST STUDIES

The following section provides a detailed summary of the most widely referenced studies that support the positions presented in this article. Links to the complete reports are found at the end of each section.

State of California Cost Study, 2003

This study was the first comprehensive green building cost analysis ever conducted.

"It demonstrates conclusively that sustainable building is a cost-effective investment, and its findings should encourage communities across the country

to 'build green'. While the environmental and human health benefits of green building have been widely recognized, this comprehensive report confirms that minimal increases in upfront costs of about 2% to support green design would, on average, result in life cycle savings of 20% of total construction costs—more than ten times the initial investment. For example, an initial upfront investment of up to $100,000 to incorporate green building features into a $5 million project would result in a savings of $1 million in today's dollars over the life of the building. These findings clearly support the work of the Sustainable Building Task Force and reinforce our commitment to build the greenest state facilities possible."

Table 1. First Cost vs. Certification Level Achieved

Certification Level	*Cost Premium*	*Number of Projects Included*
Certified	0.66	8
Silver	2.11	18
Gold	1.82	6
Platinum	6.50	1
Average	1.84	33

Source: Greg Kats, The Cost and Financial Benefits of Green Buildings, 2003
http://www.ciwmb.ca.gov/greenbuilding/design/costbenefit/report.pdf

General Services Administration LEED ® Cost Study, 2004

In many ways, the GSA study supports the conclusions of the 2003 California study that sustainable building is cost-effective. As a result of this study,

"GSA's P100 requires all new construction and major modernization projects to be certified through the LEED program, with an emphasis on obtaining Silver ratings. Individual client agencies may also work with GSA to pursue even higher levels of LEED certification. Using the results of the LEED Cost Study, the GSA intends to refine the amount of 'sustainability' funding provided for future projects (prior to the Cost Study, GSA has Executive Summary GSA LEED COST STUDY 8 allocated a 2.5% budget increase for green building construction costs). The new budget allocation will be enough to ensure that projects can achieve LEED Certified ratings; however, project teams will be encouraged to achieve the highest level of LEED rating that is practical within the overall budget. With the revised budget allotments (which

will likely vary between 2.5% and 4.0%, depending on the project), the study indicates that many Silver rated buildings should be possible, as well as occasional Gold rated projects.

The opportunity to achieve silver ratings or higher is also supported by GSA's general project contingencies and by the accuracy allowances of the cost estimates themselves. As illustrated in Figure ES-1 [Table 2], the range of estimated construction cost impacts for the certified and silver rated scenarios falls below the 5 percent estimating accuracy that would normally be expected of early conceptual estimates. In addition, the construction cost impacts for all of the rated scenarios, including gold, fall below the 10 percent design contingency carried in most GSA project budgets at the concept phase. These numbers imply that in some scenarios (depending on the design solution, market conditions, and other contingency factors), an LEED rating could be achieved within a standard GSA project budget (without a green building budget allowance). By including a dedicated green building allowance, the potential for GSA buildings to achieve higher LEED rating levels—with the attendant benefits—is substantially greater."

Table 2. First Cost vs. Certification Level Achieved

Certification Level	*Cost Premium by Building Type*	
	New Courthouse	*Office Building Modernization*
Certified	-0.4~1.0%	1.4~2.1%
Silver	-0.03~4.4%	3.1~4.2%
Gold	1.4~8.1%	7.8~8.2%

Source: GSA LEED ® Cost Study, 2004, Page 2
http://www.ecy.wa.gov/programs/swfa/greenbuilding/pdf/gsaleed.pdf

Davis Langdon Cost Study, Cost of Green Revisited, 2006

This paper builds on a previous study performed by Davis Langdon released in 2004.

"The 2006 study shows essentially the same results as 2004: there is no significant difference in average costs for green buildings as compared to non-green buildings. Many project teams are building green buildings with little or no added cost, and with budgets well within the cost range of non-green buildings with similar programs. We have also found that, in many areas of the country, the contracting community has embraced sustainable design, and no longer sees sustainable design requirements as additional burdens to be priced in their bids. Data from this study shows that many projects are achieving

certification through pursuit of the same lower cost strategies, and that more advanced, or more expensive strategies are often avoided. Most notably, few projects attempt to reach higher levels of energy reduction beyond what is required by local ordinances, or beyond what can be achieved with a minimum of cost impact.

The cost of documentation remains a concern for some project teams and contractors, although again, as teams become accustomed to the requirements, the concern is abating somewhat.

We continue to see project teams conceiving of sustainable design as a separate feature. This leads to the notion that green design is something that gets added to a project—therefore they must add cost. This tendency is especially true for less experienced teams that are confronting higher levels of LEED certification (Gold and Platinum). Until design teams understand that green design is not additive, it will be difficult to overcome the notion that green costs more, especially in an era of rapid cost escalation. Average construction costs have risen dramatically the past three years—between 25 percent and 30 percent. And yet we still see a large number of projects achieving LEED within budget. This suggests that while most projects are struggling with cost issues, LEED is not being abandoned."

http://www.davislangdon.com/USA/Research/ResearchFinder/2007-The-Cost-of-Green-Revisited/

Greening America's Schools Cost and Benefits Analysis

The Greening America's Schools study applies the same questions and rigor of previous analysis to the K-12 school market segment.

"This report is intended to answer this fundamental question: how much more do green schools cost, and is greening schools cost effective?

Conventional schools are typically designed just to meet building codes—that are often incomplete. Design of schools to meet minimum code performance tends to minimize initial capital costs but delivers schools that are not designed specifically to provide comfortable, productive, and healthy work environments for students and faculty. Few states regulate indoor air quality in schools or provide for minimum ventilation standards. Not surprisingly, a large number of studies have found that schools across the country are unhealthy—increasing illness and absenteeism and bringing down test scores.

This report documents the financial costs and benefits of green schools compared to conventional schools. This national review of 30 green schools demonstrates that green schools cost less than 2 percent more than conventional *schools—or about \$3 per square foot (\$3/ft^2)—but provide financial benefits that are 20 times as large. Greening school design provides an extraordinarily cost-effective way to enhance student learning, reduce health and operational costs and, ultimately, increase school quality and competitiveness.*

The financial savings are about \$70 per ft^2, 20 times as high as the cost of going green. (Table A [Table 3]) Only a portion of these savings accrue directly to the school. Lower energy and water costs, improved teacher retention, and lowered health costs save green schools directly about \$12/ft2, about four times the additional cost of going green. For an average conventional school, building green would save enough money to pay for an additional full-time teacher. Financial savings to the broader community are significantly larger, and include reduced cost of public infrastructure, lower air and water pollution, and a better educated and compensated workforce."

Table 3. Financial Benefits of Green Schools (\$/ft^2)

Energy	**\$9**
Emissions	\$1
Water and Wastewater	\$1
Increased Earnings	\$49
Asthma Reduction	\$3
Cold and Flu Reduction	\$5
Teacher Retention	\$4
Employment Impact	\$2
TOTAL	\$74
COST OF GREENING	(\$3)
NET FINANCIAL BENEFITS	\$71

Source: Greg Kats, Greening America's Schools, 2006
http://www.cap-e.com/ewebeditpro/items/O59F9819.pdf

ABOUT THE AUTHORS

James D. Qualk is vice president and team leader for SSRCx, LLC (Smith Seckman Reid's commissioning subsidiary) and helped form the Sustainable Solutions Group. James is responsible for the management of operations and direction of marketing and sales of sustainable consulting services that include LEED® facilitation, LEED® feasibility analysis, energy modeling, various commissioning services including Continuous Commissioning®, and other sustainability consulting services.

James is a former board member of the Middle Tennessee chapter of the U.S. Green Building Council and served as their communications chair for two years. He also serves on various committees for the Tennessee Environmental Council (TEC) and acts as their liaison to the Tennessee Pollution Prevention Roundtable in the Tennessee Department of Environment and Conservation (TDEC). He lectures in the civil engineering department of Vanderbilt University in a graduate class titled CE 299—Electrical, Mechanical Systems in Building & LEED.

He serves as the citizen member of an advisory committee for the Tennessee Department of Commerce and Insurance regarding the implementation of rules and regulations relating to the purchase, sale and theft of scrap metal in Tennessee. Recently, James spoke at the Global Construction Summit in Beijing, China, on a panel titled "Greening the Desert—The Green Building Movement in the Middle East."

Paul McCown joined Smith Seckman Reid, Inc. in 2001 and serves as manager of the Sustainable Solutions Group of SSRCx, LLC.

Paul is a board member of the Tennessee Environmental Council and an active member and contributor to state and national professional organizations, including the American Society of Heating, Refrigerating and Air Conditioning Engineers, the AABC Commissioning Group, the Association of Energy Engineers, the Building Commissioning Association, and the U.S. Green Building Council Middle Tennessee Chapter. Paul is a registered professional engineer in the state of Tennessee, is an LEED® Accredited Professional, Certified Energy Manager, and Certified Commissioning Authority. He lectures in the civil engineering department of Vanderbilt University in a graduate class titled CE 299—Electrical, Mechanical Systems in Building & LEED.

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