Peter Morris, *Davis Langdon*

What Does **Green** Really **Cost?**

The most common reason cited in studies for not incorporating green elements into building designs is the increase in first cost. People who are green averse are happy to relate anecdotes of premiums in excess of 30% to make their buildings green. These numbers are simply not, however, borne out by the facts, as evidenced by many studies of the cost of green building. Even though there is no one-size-fits-all answer to the cost question, it is clear from the substantial weight of evidence in the marketplace that reasonable levels of sustainable design can be incorporated into most building types at little or no additional cost.


Peter Morris

In addition, sustainable materials and systems are becoming more affordable, sustainable design elements are becoming widely accepted in the mainstream of project design, and building owners and tenants are beginning to demand and value those features. It is important to note, however, that advanced or innovative sustainable features can add significantly to the cost of a project and that these must be valued independently to ensure that they are cost- and/or environmentally effective.

The cost for incorporating sustainable design elements will depend greatly on a wide range of factors, including building type, project location, local climate, site conditions, and the familiarity of the project team with sustainable design. In most cases, these factors have a relatively small but still noticeable impact on the overall cost of sustainability. Cumulatively, however, they can make quite a difference; for example, the cost of greening a laboratory building in Houston will be quite different from the cost of greening an office building in San Francisco.

Clearly there can be no single, across-the-board answer to the question "What does green cost?" On the other hand, it is possible, and quite easy, to answer the question "What will green cost *me* on *my project*?" It is also possible, and quite easy, to manage those costs so that sustainable features can be delivered in a cost-effective and efficient manner.

How Green?

The first step in the process is to set sustainability goals. Defining the level of green can be a challenge. The most widely used measure, at least in the United States, is the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system. This system has four levels—Certified, Silver, Gold, and Platinum—that can be achieved by earning a series of points from five categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, and Indoor Environmental Quality. Points can also be earned for Innovation and Design Process.

Perhaps a measure of the success of the LEED system, which was developed to provide a common basis for measurement, is the recent proliferation of alternative systems, each seeking to address some perceived imbalance or inadequacy of the LEED system, such as the amount of paperwork, the lack of weighting of credits, or the lack of focus on specific issues. Among these alternative measures are broad-based approaches, such as Green Globes, and more narrowly focused measures, such as calculations of a building's carbon footprint or measurements of a building's energy efficiency (the ENERGY STAR rating).

All these systems are valid measures of sustainable design, but each reflects a different mix of environmental values, and each will have a different cost impact. It is therefore necessary for the building owner or investor to

Cost Studies

"The Cost of Green Revisited: Reexamining the Feasibility and Cost Impact of Sustainable Design in the Light of Increased Market Adoption"

Lisa Matthiessen, Peter Morris, Davis Langdon, 2007

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

This update to the previous report ("Costing Green: A Comprehensive Cost Database and Budgeting Methodology") revisits the question of cost of green construction. The report updates original building cost comparisons and examines both a larger sampling of buildings and additional building types. The report concludes that projects continue to achieve LEED standards within their established budgets, despite the recent dramatic rise in overall construction costs.

"The Cost & Benefit of Achieving Green Buildings"

Davis Langdon, 2007

http://www.davislangdon.us/ANZ/Research/Research-Finder/Info-Data-Publications/Info-Data-Green-Buildings

This report assesses the cost of achieving specific levels of green (using the Australian Green Star system) by comparing the budgets of green buildings to similar non-green buildings and concludes that there is a 3% to 5% premium for a 5-Star building, with an additional 5% for a 6-Star building. The report notes that standards in the country have been set so that reaching 4 Stars is usually easily achievable.

"Sustainability Offices"

Simon Rawlinson, Davis Langdon, 2007

http://www.davislangdon.com/EME/Research/ResearchFinder/SustainabilityPublications/SustainabilityOffices_Jan07

This is a cost study of an office building designed to meet a BREEAM Excellent rating. The report concludes that a 6% premium is due to sustainable design features for the building.

"A Business Case for Green Buildings in Canada"

prepared for Industry Canada, 2005

http://www.cagbc.org/uploads/A%20Business%20Case%20for%20Green%20Bldgs%20in%20Canada.pdf

This report focuses on initial and long-term financial implications of building green in Canada. It concludes that green buildings have a higher first cost, due to longer design times and use of "nonstandard" materials or systems, but that long-term cost benefits (money saved on energy, water, and so on) outweigh this first-cost premium.

choose the rating system and the success level that most closely matches his or her own value profile.

Clear goals are critical for managing the cost. It is not enough to simply state "We want our project to be green"; the values should be determined and articulated as early in the design process as possible and incorporated into the project at every stage during the delivery process so that all team members are on board with the specific green elements the project is meant to possess.

How Committed?

Once the sustainability goals have been defined, it is essential to integrate them into the design and to integrate the design team so that the building elements can work together to achieve those goals. Buildings can no longer be broken down and designed as an assemblage of isolated components. The building skin and the interior space planning contribute to energy performance, lighting density, and indoor air quality as much as the mechanical and electrical systems do. Materials and finish selections can affect air quality, lighting, and energy loads. If the components are designed independently, there is likely to be redundancy or conflict between the systems. Integrated design is one of the most effective factors in delivering cost-efficient green buildings.

Integrating the construction team into the project team is also highly desirable. Many sustainable design features can be defeated or diminished by poor construction practices.

"Managing the Cost of Green Buildings"

G. Syphers, et al., Kema, 2003

http://www.ciwmb.ca.gov/greenbuilding/Design/ManagingCost.pdf

This report focuses on managing costs for greening public buildings in California. It concludes that in California, new state construction projects should be able to reach at least LEED Silver within available budgets.

"Costing Green: A Comprehensive Database and Budgeting Methodology"

Lisa Matthiessen, Peter Morris, Davis Langdon, 2004

http://www.davislangdon.us/USA/Research/ResearchFinder/2004-Costing-Green-A-Comprehensive-Cost-Database-and-Budgeting-Methodology

This comprehensive assessment of the cost of green uses several different methodologies, including comparing original budget to final budget and comparing green buildings to non-green buildings of similar type and use. The report also includes a point-by-point assessment of the cost premiums associated with LEED.

"LEED Cost Study"

prepared for the U.S. General Services Administration, 2004

http://www.wbdg.org/newsevents/news_040105.php

This study, commissioned by the GSA to estimate costs for greening new federal building construction, focuses especially on two building types: federal courthouses and office buildings. A baseline cost for each building type was established as well as cost impacts resulting from any modifications to bring the design into LEED compliance above and beyond what is required by the GSA. The study concludes that cost premiums could range from about 1% to 8%, depending on the level of LEED achieved.

"The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force"

Greg Kats, Capital E, 2003

http://www.ciwmb.ca.gov/greenbuilding/Design/CostBenefit/Report.pdf

A number of recently constructed green buildings were assessed to determine financial benefits as well as initial costs. The report compares original budgets to completed budgets to calculate the green premium and concludes that green adds, on average, about 2% to the original cost of a building. LEED was used as the measurement of green.

For example, inattention to sealing or flashing details can dramatically decrease energy performance of the envelope, and poor material handling and site cleanup can create future indoor environmental quality problems. In some cases, the site shortcomings are simply due to a lack of training or understanding by site operatives; at other times, the problems can arise when a design team does not understand the difficulties of site conditions or when developing details or requirements are not practical. Many such problems can be eliminated by engaging the construction team, including subcontractors and site operatives, in the design and procurement process.

The integrated team should also include building users and operators wherever possible. These are the people who will have to live with the design decisions for many years. Sustainable features that require specialized maintenance or sophisticated operation are often bypassed or overridden by building occupants or managers. There are many examples of buildings designed with high levels of "daylighting" where tenants have covered over windows and turned on electric lights because they perceive the space to be too bright. Similarly, building users have taken over shower facilities intended for bicycle commuters to use for office storage, and building maintenance staff members have overridden energy management controls because they find them too complicated to use. Engaging with the users and operators during the design process can lead to better designs and a better understanding by the users of the function of the sustainable features.

How Much?

Having set the goals and incorporated them into the design and construction process, there is still the question of what the sustainable features will cost. Underlying this question, however, is another question: "Compared to what?" In many cases, this question is left unasked or is undefined.

The most common comparison, at least in anecdotal reporting, is comparing the cost of the green project with the original project budget or the original anticipated cost of the project: "The final project cost me this much; I originally thought it would cost that much; the difference must be what I spent on making it green." Clearly, this approach has two substantial problems: It assumes the original budget was adequate in the first place, and it assumes that no other changes or enhancements were made. Nevertheless, this is a widely used methodology and is found in many of the studies of the cost of green projects. It can also be viewed as the ultimate measure of affordability because the budget, if properly set, represents the cost-value breakpoint of the project.

Another concern with this approach is that very rarely will projects report coming in under budget. The range of reported costs, therefore, typically runs from no added cost to some added cost, the result of which is that the reported cost premiums are always positive. In addition, statistically, the distribution is very skewed, with a large number of projects reporting zero or very low premiums, and a small number reporting much larger premiums, up to 10%. This means that the average (mean) cost premium is typically higher than the cost premium for the average project (median). The averages are also very sensitive to changes in the population of buildings studied. Because many of the studies are based on relatively small populations, the averages must be viewed as indicative, not conclusive.

Most of the studies that use this methodology report average green premiums in the range of 1% to 2% to achieve a moderate level of sustainable design, generally equivalent to a LEED Silver rating. Higher levels of sustainability are usually linked to higher green premiums, although the small

population of such buildings available for analysis makes statistical calculations impractical. It should also be noted that though the studies show average premiums of 1% to 2%, closer analysis of the data shows that a significant number of projects—often in excess of 50% of the population—report no increase in cost over the budget to incorporate sustainable features.

An alternative approach, also used in many green cost analyses, is to look at the cost of individual added green features, effectively comparing the building to itself without the green features. Looking at the added cost of green features presumes that the features are, in fact, additive, and that they can be readily priced as separate items and makes assumptions regarding what would have been built. For example, it is easy to look at the cost of a variable-frequency drive on a fan motor. Either you have one or you don't. It may even be possible to establish the cost of efficient zoning of an air-conditioning system by comparing it with a conventional zoning layout. However, assessing the added cost of improved daylighting through good orientation and space planning is virtually impossible. This approach is also not practical with a truly integrated design process.

This individual add-on methodology also tends to return positive values for the green premium because it views most green features as additive to a baseline project. It does not reflect design choices and trade-offs that are typically made during the design and construction process. For example, sustainable finish materials such as linoleum, bamboo, and certified wood are generally more expensive than many typical finish materials and so would show up as added costs for sustainable finishes. Many design teams, however, will offset these costs by reducing the extent of other high-end finish materials, such as stone or wood paneling, making the use of sustainable finish materials budget neutral in practice. Also difficult can be assessing which features would have been incorporated in the base scheme in the absence of specific sustainable goals: For example, would the building have been designed to a minimum energy performance, or would some energy efficiency measures have been incorporated regardless of green?

Most of the studies that use this individual add-on methodology report somewhat higher green premiums, in the range of 2% to 6%, to achieve a moderate level of sustainable design (such as LEED Silver). Higher levels of sustainability, as may be expected, have higher premiums, but how these higher levels are achieved varies widely between studies, and the costs become more hypothetical.

A third approach is to compare the cost of a population of buildings with similar programs but without green elements. This approach eliminates some of the subjectivity of deciding what you would have built, or what it should have cost, but adds in the challenges of finding an adequate population of comparable buildings and deciding whether buildings are truly comparable, given the significant variations between buildings. It also necessitates adjusting costs for time and location in order to bring the comparable buildings to a common base.

Because of the data demands, this approach is not widely used. The one major study undertaken by Davis Langdon that used this approach found that for the selected building types, there was no statistically significant difference between the average cost of green buildings and the average cost of non-green buildings.

How Average?

Each of these approaches provides valid and useful information and can give a broad indication of the likely impact of sustainable goals for a project but should not be used as a predictive tool for an individual project, any more than a table of average costs for construction should be used as a predictive tool for budgeting a project. Furthermore, assigning a set percentage to a building's budget to "cover green" also gives the impression that there will be a cost premium; more importantly, it suggests that green is something that is added on to a building, not something that is part of the building from the very beginning.

How To?

The studies do not and cannot answer the most important question about the cost of green: "What is the cost of green for me/you?" This can be answered only by good cost planning within the context of clear values and a committed project team. The studies do demonstrate that sustainable design is within reach for most projects and that buildings that are better for the environment and for the occupants can be delivered in a cost-effective way. Sustainability goals, strategies, and budgets can readily be established and integrated during the project programming phase in exactly the same way any other project goals, strategies, and budgets can be established: through the use of good planning processes. The real question in planning and budgeting should not be "How much more will this cost?" but "How will we do this?" Sustainability is *not* a below-the-line item. ■