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## **Going with Green Design Can Improve Return on Investment**

By Jeffrey R. Crawford, P.E., LEED AP, Ross & Baruzzini

Green design, which is gaining popularity for new construction, also is being successfully used for renovation projects in existing buildings and facilities, including owner-occupied and leased space. In addition to being good for the environment and for the people who work in the buildings, green design also can improve return on investment (ROI) by lowering energy costs for owners and managers.

The latest green design technologies can transform even the most inefficient spaces into models of high performance – from HVAC systems that provide minimal energy consumption and reduce heating and cooling loads to occupancy sensors programmed to automatically turn off lights, set back thermostats and reduce ventilation when spaces are vacant.

Although retrofitting existing space with advanced energy efficient systems can be challenging, the payoff in reduced energy costs in most cases is evident in five years or less. After that, the ROI continues to improve, especially compared to energy costs that only continue to rise.

A recent survey conducted by the American Institute of Architects (AIA) and Autodesk confirms that the “green” building movement is having an impact. An article in *Data Center Journal* states, “The 2007 Autodesk/AIA Green Index survey reports 70 percent of architects say client demand is the leading driver of green building and that the primary reason these owners and developers are demanding greener buildings is reduced operating costs.”

According to the U.S. Green Building Council, which established the Leadership in Energy and Environmental Design (LEED) benchmarks for the design, construction and operation of high performance green buildings, working with an engineering and architectural design firm that has significant LEED experience with existing buildings will help ensure that projects are designed to maximize efficiency, while minimizing environmental impacts.

When choosing a consulting firm, it is worth noting that Individuals who indicate “LEED AP” after their names represent an elite group of building professionals who have completed a series of courses designed to encourage sustainable, environmentally friendly building design. The major focus of courses includes using local material and recycling whenever possible, having a minimum impact on a building’s natural setting and holding down energy costs.

The Leadership in Energy and Environmental Design Accredited Professional designation, awarded by The Green Building Council, is strictly a voluntary program and is not driven by licensing requirements, regulations or government edict.

As stated on the Green Building Council's website, [www.usgbc.org](http://www.usgbc.org), "Using the recognized, performance-based benchmark for building owners and operators established by LEED to measure operations, improvements and maintenance on a consistent scale, it should be possible to deliver economically profitable, environmentally responsible, healthy, productive places to live and work...introducing green design into existing buildings has a positive impact on the triple bottom line of people, planet and profits."

A book published by the Green Building Council outlines and explains nearly 70 steps architects, engineers, builders and project managers can take to accumulate points toward certification of a building as one of the four levels of "green" – basic, silver, gold and platinum. Nationwide, more than 700 buildings have received one of the four levels of LEED certification since the program began in 1999.

### **Energy Improvements Focus on Ventilation and Lighting**

Energy conservation is not a new concept to the engineering consulting world. As far back as the first energy crisis in the early 1970's, when OPEC embargoed oil and sent economic shock waves throughout the industrialized world, experts have been calling for a reduction in the excessive use of power inside office buildings. Before then, energy had been so inexpensive there was no penalty to provide additional capacity other than the first cost of the equipment. But the embargo changed everything.

At that time, The American Society of Heating, Refrigerating and Air-Conditioning (ASHRAE), the national organization that sets design standards for heating and cooling of buildings, began focusing on better understand the impact of the amount of heat generated by people during a work day and how that factored into the amount of cooling needed to adequately control a building. In addition, lighting levels were analyzed for comfort and adequacy so that energy usage could be reduced without sacrificing performance. The key was to use these new parameters to tailor heating and cooling loads to actual energy building demand and reduce costs.

Some of the energy improvements that can make the most significant impact in a renovation project for the least financial investment for the greatest ROI include the following:

- **Ventilation Heat Recovery.** Incorporating a desiccant-based, total enthalpy heat wheel into a building's ventilation system can optimize energy recovery from the exhaust air stream and improve indoor air quality, while providing a very low level of cross contamination between the incoming outdoor air and the exhaust system discharge. During periods of hot weather, the wheel absorbs humidity and heat from the outdoor air, providing cooler, drier air to the building's cooling coils and significantly reducing building cooling capacity requirements. During periods of cold weather, the process is reversed. Results can be significant. Installed chiller and heating plant capacities can be reduced by as much as 50 percent, saving both money and space.

- **Demand Control Ventilation.** HVAC control schemes can offer significant energy savings by utilizing CO<sub>2</sub> sensors and/or programmed time-of-day schedules to control the ventilation supplied to a space based on actual occupancy. Since all spaces are not always at their maximum occupancy, the DCV control scheme saves energy by lowering the ventilation rate to correspond to the actual occupancy of the space, while still ensuring the right amount of ventilation is provided for good indoor air quality.
- **Day Lighting and Occupancy Sensors.** Because lighting consumes a significant amount of energy, finding ways to reduce the use of lighting can result in significant savings. Options include maximizing natural daylight and installing daylighting sensors, digital timers, and occupancy sensors to automatically turn off lights when not needed. Occupancy sensors, which can be mounted on the wall like a light switch or installed in the ceiling, turn on lights when someone enters a room and then turn them off when the room is empty. They are most effective in spaces that are used infrequently or unpredictably, such as conference rooms, private offices, classrooms, storage areas and bathrooms.
- **Energy-efficient Lighting.** T8 and T5 fluorescent light fixtures with electronic ballasts are a good choice for any building retrofit to replace incandescent or T12 fluorescent light fixtures with magnetic ballasts. These types of fixtures are four times as efficient as incandescent light and roughly 20 percent more efficient than T12 fluorescent fixtures. They also last about 10 times longer than incandescent fixtures.

In addition to the above, there are a wide range of additional measures that can be taken to conserve energy. Some of these include converting the air systems from constant volume to variable volume, installing Low-E, insulated, double pane windows coated on one or more surfaces with a shading component to reduce solar heat gain, and incorporating wind or solar-generated electricity. Systems that collect rainwater and reuse it for irrigation or flushing water closets and urinals also deserve consideration.

LEED designation for an existing building is based on maximizing operational efficiency and minimizing environmental impacts.

### **Building Use Determines Sustainability Features**

One of the best sources for up-to-date information on a wide range of building-related guidance, criteria and technology is the Whole Building Design Guide, created by the National Institute of Building Sciences in Washington, D.C., available at [www.wbdg.org](http://www.wbdg.org).

According to the WBDG, “data from the U.S. Energy Administration illustrates that buildings are responsible for almost half (48 percent) of all greenhouse gas emissions annually. Seventy-six percent of all electricity generated by U.S. power plants goes to supply the building sector and buildings often contribute to health problems such as asthma and allergies due to poor indoor environmental quality.”

In addition, the experts agree that creating a more efficient and cost-effective building can result from understanding the interdependencies of various systems. “For example, the choice of a mechanical system might impact the quality of the air in the building, the ease of maintenance, global climate change, operating costs, fuel choice, and whether

the windows of a building are operable. In turn, the size of the mechanical system will depend on factors such as, the type of lighting and controls used, how much natural daylight is brought in, how the space is organized, the facility's operating hours, and the local microclimate."

### **Different building functions influence sustainability considerations**

For example, since the typical laboratory uses far more energy and water per square foot than the typical office building, it is essential for to understand intensive ventilation requirements and other health and safety concerns to create the most sustainable, high performance and low-energy environment. According to WBDG, "Typically, more than 50 percent of the construction cost of a laboratory building is attributed to engineering systems. Hence, the coordination of these (structural, mechanical, electrical and piping systems) ensures a flexible and successfully operating lab facility."

The criteria for a hospital are completely different. The breadth and specificity of regulations, codes and oversight that govern hospitals construction and operations affects everything from mechanical, electrical, telecommunications and security systems to functional requirements for many varied users. In addition, as large public buildings, hospitals have a significant impact on the environment. According to WBDG, "They are heavy users of energy and water and produce large amounts of waste. Because hospitals place such demands on community resources they are natural candidates for sustainable design."

### **Florida is Catching Up in Green Buildings**

The Florida Capital Region Chapter, Inc. of the Green Building Council recently described in a cover story an unusual "green" building renovation for the Solid Waste Administration Building in Tallahassee. The renovation addressed "green" issues such as sustainable site, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality and innovation and design process.

Innovations and improvements included "erosion and sedimentation techniques, designated parking spaces for alternative fuel vehicles and carpoolers, minimal site disturbance, minimal heat island effect, water efficient landscaping, water use reduction, building commissioning, optimal energy performance, fluorocarbon elimination, systems controls for measurement and verification, storage/collection of recyclables, deconstruction, resource reuse, use of regional materials with recycled content, minimum indoor air quality standards, elimination of tobacco smoke, low emitting materials, systems control, and enhanced use of daylight and views."

While the Solid Waste Administration Building is one of the first in Tallahassee to be renovated according to standards established for LEED certification, a series of executive orders signed in July by Florida Gov. Charlie Crist signals strict new environmental requirements on energy and construction for the entire state. In terms of building and construction, the goals are to advance the use of alternative power sources, increase state energy efficiency and conservation levels and promote "green" construction for state projects.

Despite a slow start, Florida is beginning to catch up with the national green building trend. Since December 2004, the number of Florida commercial projects seeking LEED certification increased more than 400 percent. A good example is the University of Florida, where President Bernie Machen has mandated all future buildings be LEED certified. So far, three LEED buildings that have been constructed are reported to be using about half the energy and less than half the water of traditional structures. In addition, the University's first green building, Rinker Hall, part of the College of Design & Construction, which serves nearly 1,000 students, faculty and staff each day is using less potable water than the average home.

The Florida Green Building Coalition's (FGBC) Green Commercial Building Designation Standards, available on the organization's Web site at [www.greenbuilding.org](http://www.greenbuilding.org), is a voluntary, statewide program. FGBC was conceived and founded in the belief that green building programs will be most successful if there are clear and meaningful principles on which "green" qualification and marketing are based.

### **Sustainable Building and Operations Practices For Older Buildings**

The Green Building Council established a separate category for existing buildings is intended to focus on creating a plan for ensuring high performance over time. In addition to the building's physical systems (equipment, design, land use, etc.), key considerations include the way the building is occupied and operated by its managers in terms of waste management, temperature monitoring, commuting programs, etc.

The Council explains the benefits of LEED for existing buildings as an opportunity that "helps building owners and managers solve building problems, improve building performance, and maintain and improve this performance over time. LEED reduces cost streams associated with building operations, reduces environmental impacts, creates healthier and more productive employee workspaces, and provides public recognition for leadership in sustainability."

The bottom line is that "green" building helps owners and managers solve problems and improve a building's life cycle performance. "LEED applies to the spectrum of facilities ranging from those wanting to identify efficiency improvement opportunities and put in place sustainable policies to those facilities in need of significant system and operations improvements," according to the Council.

Nationwide, "green" buildings are estimated to represent only about 2 percent of new construction in 2005. But this percentage is expected to increase to 10 percent by 2010. It also is likely that this number will increase as "green" building appears to be quickly becoming the preferred construction type of state, local and federal governments. The growth of "green" building initiatives also is significant to the construction industry because the building materials and design techniques utilized are often substantially different than those used in traditional buildings.

The AIA/Autodesk survey concluded that over half the respondents said they will be using tools to enable the prediction and evaluation of the environmental impact and lifecycle of the building materials used in their projects. This is a 36 percent increase from today. Furthermore, in terms of HVAC systems, the survey revealed a 25 percent

increase in the number of architects utilizing high-efficiency HVAC systems in projects over the past five years.

No matter what size project is being considered, be sure to hire a consulting team that is committed to sustainability in its design approach and has the practical knowledge gained through extensive experience serving a wide range of applications and geographic sectors. A consulting team that is large enough to have the depth of resources, but small enough to be responsive, will be an effective partner. But, considering today's emphasis on efficiencies, it is essential for any project is to look at energy savings in terms of a long-term solution that considers the entire building lifecycle for delivering the best ROI.

Jeffrey R. Crawford, P.E., LEED AP, Vice President and Director of Education Services for Ross & Baruzzini, can be reached at 314-918-8383. Ross & Baruzzini specializes in providing client solutions and consulting for facilities and infrastructure challenges in the healthcare, education, government, aviation and maritime industries. In addition to being a life member of ASHRAE, Ross & Baruzzini has co-authored energy guidelines since the early 1970s. Clients in Florida have included Jackson Memorial Hospital, South Miami Hospital, Miami Dade Department of Health, Florida International University, Miami Dade Public Schools, University of Miami, Port Everglades, Miami International Airport, Orlando International Airport and others. Ross & Baruzzini has been ranked as one of the top engineering and architectural firms in the United States by *Consulting-Specifying Engineer* magazine. Founded in 1953, the company is headquartered in St. Louis and has regional offices in Miami and Indianapolis. More information is available at [www.rossbar.com](http://www.rossbar.com).