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How LEED can maximize potential of const./renovation

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Facilities managers understand that by making buildings more energy efficient and environmentally friendly they can reduce operational costs and increase building occupant productivity and health. That's the good news.

The bad news – it isn't obvious how to produce an all green facility. As stake holders desire to save energy and make facilities more environmentally benign, property managers need not become versed in the often confusing language of sustainability to define realistic green construction and renovation project objectives and management requirements. Fortunately, there is plenty of help available.

Surprisingly, the promise of green design, as exemplified in the Leadership in Energy and Environmental Design (LEED) certification process of the United States Green Building Council, is very straightforward. Despite this simplicity, it is quite powerful and effective at delivering desired energy-saving performance within budgets often comparable to those for traditional construction.

So, what do facilities managers need to know when planning a green construction or renovation project?

- * Embrace an integrated and holistic approach to building design. The LEED certification process is a practical realization of the vision expressed by the celebrated environmentalist John Muir, who believed that "everything in the universe is connected to everything else." In the universe of green building and renovation, this means that a project's ultimate energy efficiency and synergy with the environment is a function of the many building components, design elements, equipment and appliances working together as a fully- integrated system. The many choices among these components that need to be made by the architect, builder and facility manager will invariably impact the outcome of the project's final incarnation as a green facility.

- * Use LEED to guide you through the process. It may seem as if design choices reflect far too many variables for decision makers to understand, let alone measure. Rest assured that the power and practicality of the LEED process simplifies and prioritizes the decision-making for achieving your green building objectives.

- * Understand and accept that there are tradeoffs. The objective of "greenifying" is not just to earn a particular LEED rating (Silver, Gold or Platinum signifying increasing levels of energy efficiency and eco-friendliness). Rather, the key is use the LEED certification process to more easily achieve the level of efficiency that the project budget will allow.

This integrated systems approach to green design inherent in the LEED certification process is best demonstrated by evaluating the role of high performance window glass as a key component in determining the energy efficiency of an entire facility. Why is that so?

The building envelope – foundation, roof, walls and windows – is the interface between the building and its environment and a structure's first line of defense against the elements. Design

choices regarding building envelope components affect a project's ultimate energy efficiency more than the internal systems and components (lighting, heating and cooling, etc.).

In an era of R-19 walls and ceilings (R being a measure of insulating performance), window glass has been the weak link in conservation performance. From 25% to 35% of the energy used in American buildings is wasted due to inefficient windows and glass, which themselves account for 10% of all CO₂ emissions.

Improving the performance of windows represents a significant savings opportunity both for the nation and for individual green building and renovation projects. Glass options alone will have a disproportionate impact on overall building energy efficiency compared to other building components. In that regard let us evaluate those glass options in terms of their impact on energy efficiency and achieving a project's green objectives.

- * Single pane glass does not adequately prevent heat transfer and is no longer acceptable for buildings in most of the US.

- * Standard insulating glass, providing an insulating performance of R-2 as compared to an R-19 wall, is obviously unacceptable although still code-compliant in many locations. Selection of standard insulating glass will necessitate the use of much larger and expensive HVAC systems than would otherwise be the case.

- * Insulating glass with low-e coatings, providing twice the insulating performance of standard insulating glass, simultaneously reflects radiant solar and ambient heat and is the de facto energy efficient standard for buildings in which both summer cooling and winter warming are important. The "e" in low-e, which stands for "emissivity", is the ability of a surface to radiate energy.

Many might think that this is where the story ends, because generic low-e insulating glass, consisting of two pieces of coated glass separated by a sealed, gas-filled air space (or cavity), achieves a maximum R value of 4. However, this level of performance is not nearly enough to achieve what green building promises in terms of energy savings and CO₂ reduction. Fortunately, much of the success of green construction is due to higher performing glass technology that provides powerful energy-conserving alternatives to generic low-e glass and about which facility managers need to become familiar. Understanding these superior glass options in relationship to LEED accreditation (see sidebar below) will help optimize design choices and achieve desired green results.

Alternatives to single-cavity low-e insulating glass are available that can narrow the energy conservation performance gap between windows and walls. One is triple pane glass, consisting of three panes of glass and two low-e coatings. By using a third pane of glass to create a second insulating cavity, triple pane low-e glass doubles the performance of low-e insulating glass from R- 4 to R-9. Unfortunately, triple pane glass is 50% heavier than standard insulating glass, imposing size constraints and requiring stronger window framing at increased cost.

A superior multi-cavity alternative consists of suspending a very thin, low emissivity and solar reflective coated film inside of an insulating glass unit. Without the weight disadvantages of a third pane of glass, suspended film can create two, three or even four insulating cavities that maximize light transmission and provide conservation performance ranging from R-6 to an amazing R-20. Such internally-mounted films do not replace low-e glass. Rather, they leverage the benefits of film-based and glass-based technologies to create a lightweight, multi-cavity insulating glass that offers a level of performance that enables designers to downsize or eliminate other building components (AC systems, perimeter heating, etc) to cost-effectively achieve maximum energy

savings.

Calculating the energy-conserving value of a particular glass option is more meaningful when it is evaluated as part of an integrated approach to a building's energy conservation design as exemplified by the LEED certification process. The selection of suspended film insulating glass at Manheim Township High School in Lancaster County, Pennsylvania, played a key role in the school's ability to qualify for a LEED Silver designation. This high school facility consists of renovated and newly constructed buildings totaling 432,000 square feet. The use of suspended film insulating glass enabled project engineers to specify a smaller HVAC system, which provided considerable up-front cost savings that made the ROI of the high performance insulating glass much more attractive than otherwise would have been the case.

Consider the numbers. Specifying suspended film insulating glass cost Manheim about 3X that of generic low-e glass, saving 40% in annual energy costs. The payback: 11.5 years. However, factoring in a \$90K up-front savings by being able to specify a smaller HVAC system reduced the payback to 6.5 years. This "holistic" approach to green design, in which building components are selected as part of an integrated system to achieve the greatest cost savings and total energy performance, is precisely how LEED architects are designing the "greenest" buildings today.

When facility managers are assessing such issues as energy efficiency, greenhouse gas emissions, occupant comfort and well being, window glass specifically, and the building envelope more generally, must be viewed together with all other building components by as an integrated system to maximize desired conservation results at the most affordable cost. Understanding the potential of film-based, multi-cavity insulating glass to reduce costs while achieving desired efficiencies will make the choices of decision makers that much more effective in the greening of facilities.

Sidebar: LEEDing the Way

With its energy-saving performance capabilities, multi-cavity suspended film insulating glass offers an opportunity for a project to flexibly achieve certification under the LEED program.

The thermal and solar shading performance of suspended film insulating glass as part of an integrated construction or renovation strategy can help project manager's earn up to 21 LEED credits, or 54 percent and 40 percent of the total required credits for Gold and Platinum certification, respectively. Superior glass performance can help achieve LEED credits in the following categories:

- * Sustainable Sites (SS) Credit 1, Site Selection
- * Energy and Atmosphere (EA) Credit 1, Optimize Energy Performance;
- * Materials and Resources (MR) Credit 1, Building Reuse;
- * MR Credit 5, Regional Materials;
- * Indoor Environmental Quality (EQ) Credit 2, Increased Ventilation;
- * EQ Credit 7, Thermal Comfort; and
- * EQ Credit 8, Daylight & Views.

Bruce Lang is vice president of marketing & business development at Southwall Technologies, Inc. in Palo Alto, CA.