

Why glass is the red-hot green building material

Designers have found that glass fits nicely into today's green building environment

Glass may be the greenest building material available today. Why? It controls light, letting in the good rays and keeping out the bad ones; it saves on energy costs, providing natural daylighting; and it harmonizes a structure with its environment.

For these reasons, and probably others as well, designers have found that glass fits quite nicely into today's green building environment.

Thomas O'Connor, an architect at Smith Group, Inc., based in Detroit, MI, puts it bluntly. "I like a lot of glass in buildings, and that is the trend in design today. Glass is back, and it's a 21st century material."

A look at the content of today's architectural magazines shows that architects "have a fondness for big expanses of glass," he points out, "and I don't see that going away."

Of course, it wasn't always so, remembers Russell J. Ebeid, president, Glass Group, Guardian Industries Corp., Auburn Hills, MI. In fact, in his opinion, the glass industry still suffers from the 1973 oil embargo. "Glass was going to be limited in its usage, and that image still hurts to some extent," he states. "Say big walls and think heat loss. That's the image we've got." Ebeid points out that other building trades, such as cement, seem to "speak with a clearer voice and get their message out in terms of energy efficiency better than we [the glass industry] have."

The advantages of glass seem clear to O'Connor, however. What the industry has to do, in his opinion, "is keep bringing out more energy-efficient and green products. We need more products with higher thermal properties," he states. "I've been amazed at the glass products that have become available, and their thermal properties.

I've also heard of higher performing products that will become available."

In terms of products, the glass industry has come a long way since 1973, with primary glass manufacturers and fabricators bringing an increasing array of energy-efficient glass products to market.

In the future, Ebeid advises looking for products that are more user- and environmentally-friendly.

C. Greg Carney, technical director of the Glass Association of North America (GANA), Topeka, KS, also sees product improvements in the years to come. "The future will likely bring continued enhancements in glass coating and insulating technology, as well as the increased use of glass and mirror in interiors to move natural daylight throughout buildings," he projects.

Expanding the Envelope

Robert (Bob) Foster, senior marketing manager for Kawneer Co., Inc., Norcross, GA, points out that the need for solar control "provides opportunities for the development of new glass technologies and shading devices, particularly in regards to the development and application of electrical generation through glass-based photovoltaics. "There are many opportunities to develop smart window technology and framing systems designed to provide climate control within building spaces," he explains.

Touching on another aspect of the energy equation, Ebeid points out that there has been a tendency in government circles to clamp down on manufacturer emissions. "The use of low-E glass would save more energy than clamping down on the manufacturers," he points out. "Currently, 40 percent of windows are low-E. We could save the

Cofrin Hall Academic Center at the University of Wisconsin, Green Bay, is a LEED project and one of the most energy-efficient buildings ever constructed. It exemplifies the capabilities of new energy-efficient products available from the architectural glass and metal industry. Kawneer's 1600 PowerWall was installed on the top third of the vertical elevation and its

PowerSlope slope glazes the roof area. The photovoltaic modules incorporating thin-film technology were engineered by Solar Design Associates of Harvard, MA, and produced by BP Solar, Toano, VA. Fully tested, the 1600 PowerWall and 1600 PowerSlope convert light energy from the sun directly into electricity. The architect for the project was Helmuth, Obata + Kassabaum, Inc. (HOK) of St. Louis, MO, and the glazing contractor was H. J. Martin & Son, Inc., Green Bay.

need to build 20 300-megawatt power plants if all windows used low-E glass," he reports. "If the United States were like Western Europe, that's what we'd save. It is a do-able thing."

Robert Spindler, director, product development group, Cardinal IG, Minneapolis, MN, makes the same point. "With the use of low-E coated glasses, we save heating and cooling energy (natural gas, oil, electricity for heating, and electrical energy for cooling). This results in significantly less energy usage by consumers, which not only helps the environment but also the need for more power plants," he states.

Offering an outsider's perspective, O'Connor questions whether it's possible to invent a more



The impact of energy issues on glass

"Energy and green building issues have impacted the glass industry as a whole and will continue to do so as the green building trend continues to gain momentum," explains Kawneer's Foster.

As he sees it, "The most significant impact has been the demand for higher performing glass products, including higher performing architectural windows, framing, and curtainwall systems in support of the glass infills."

Among other requirements, the LEED (Leadership in Energy and Environmental Design, a standardized rating system developed by the U.S. Green Building Council) specification has pushed the glass and metal industry to higher levels of performance, including the use of recycled materials in glass production and the recycled aluminum content of aluminum billets, Foster points out.

Energy issues also have prompted the development of new

thermal break technologies and architectural systems that can be delivered to the job site and installed with less energy consumption, he adds.

As GANA's Carney points out, "From the perspective of the glass industry, the biggest impact of green building design has probably been the increased awareness of the energy performance capabilities of today's insulating glass units with low-emissivity (low-E) coatings, spectrally selective substrates, and low-conductance spacers."

He adds that programs such as Energy Star have helped educate designers and consumers about the virtues of glass, and the greater awareness has led to continual product development. "For example," he points out, "Energy Star frequently notes that the labeled windows of today are twice as efficient as the typical window produced just 10 years ago."

energy-efficient way of manufacturing glass. “The glass industry needs to get behind green building issues,” he explains. “In addition to more thermally-efficient products and more design with glass, it would be good if there could be more energy efficiency in manufacturing the product,” he states.

Designed for Success

Carney is not surprised by the success of glass in today’s design environment. “Green building design criteria emphasizes the energy-efficient performance of fenestration materials and maximum use of natural daylight,” he explains.

“This encourages architects to truly design for performance with windows, doors, and skylights. As architects become aware of today’s window performance, they see opportunities to provide more natural daylight without sacrificing performance. Increased emphasis on natural daylight should lead to greater use of high performance fenestration materials,” he reports.

Ebeid agrees. “Where we go from here is under our control. The message is that glass now has better characteristics and shouldn’t suffer from that old negative image.” He would like to see the industry promoted more monolithically. “The industry is going to come out with a lot of good products, but it also has to better its marketing effort for dispersing information about these products,” he explains.

Carney offers a solution, echoing a point made by Ebeid. “Educating the design professionals about product performance and the proper selection, specification, and application of future glass products will be a challenge. As our products become more sophisticated, architects and engineers will need increased educational assistance. In comparison to many other building product industries, this is a weakness for the glass industry. We need the industry to work together to develop generic glass educational resources.”

Challenges Ahead

Foster points to other challenges as well. “Manufacturers will need to see the benefits of developing new technologies required by the energy and green building issues,” he states. “Many industry manufacturers do not have the resources to conduct the necessary state-of-the-art research and development. The economy also will influence product development,” he points out.

Some industry experts believe higher performing products mean higher material costs in a highly competitive market, Foster adds. If development continues to be voluntary, in his opinion, “it will be slow to respond. It may be necessary to issue mandates, government grants, and subsidies to stimulate research and new product development.” Another challenge Foster sees involves the industry’s means of distribution, which may require changes.

Looking into the future, Foster predicts ongoing development of higher performing exterior glass and metal systems. “This is a given,” he states. “We also see framing and curtainwall systems taking on the role of conduits for climate control. We believe phase change materials will be more widely used, and systems will be developed intentionally from recycled materials with the integration of disassembly features for multi-use.

“In addition, we predict that building material leasing programs will become more common, whereby glass and metal manufacturers lease the high performing products with an obligation to switch out the materials as new technologies are developed. Driving the development of new technologies will be not only energy-related mandates, but also the higher demands of specifications such as LEED (Leadership in Energy and Environmental Design, a standardized rating system developed by the U.S. Green Building Council), as well as a higher market potential for such products,” Foster states.

In O’Connor’s opinion, the challenges for the glass industry are greater than ever. “With today’s new products, energy efficiency, and green building issues, the challenges are even greater than when the first big curtainwall buildings were constructed in the 1950s,” he states. **8**

On the cover

A blue insulating glass unit was used at the Schafer Gear Works facility in South Bend, IN, due to its energy-efficient qualities. The 1 inch (25 mm) IG unit features Pilkington glass with its ¼-inch Arctic Blue high-performance tinted float glass as the outboard lite and ¼-inch Optifloat clear glass as the inboard lite. Panzica Construction Group, South Bend, was the architect, and US Aluminum Wall Framing was the glazing contractor for the project. Tempglass fabricated the IG units.

Green glazing checklist

Design considerations for energy-efficient glass constructions and the optimum use and control of natural light

There are many considerations that must be taken into account when designing a facility, and energy efficiency increasingly is becoming more important on this list of priorities. To assist with the glass and fenestration aspects of design, the following checklist highlights areas that are critical for creating an energy-efficient structure. You will probably want to add your own personal items to this list, as it is meant as a starting point.

Energy Efficiency

1. Is the building orientation optimized for the site in terms of being an energy-efficient structure? Yes No
2. Are the fenestration areas and the glass designed to best meet the site's heating and/or cooling needs? Yes No
3. Do the insulating properties of the glass products reflect the structure's usage (i.e., residential, commercial)? Yes No
4. Would operable windows be an energy-saving alternative to air conditioning? Yes No
5. Has the comfort of the personnel in the structure been considered in terms of placement near windows? Yes No

Natural Light

1. Is glass used to maximize/control the amount of light available throughout the day? Yes No
2. Does the design allow light into the interior of the structure (through skylights or light-wells)? Yes No
3. Are windows used in enclosed areas (closets, storage rooms, stairwells, etc.)? Yes No
4. Have shading properties been taken into account? Yes No
5. Is there the possibility of using photovoltaic glass to generate power for use in the building? Yes No

Glass Products and Construction

1. Is insulating glass construction (two or three lites of glass separated by spaces) used? Yes No
2. Are low-emissivity coatings used on the glass, and what glass surface have they been placed on? Yes No
3. Do the insulating glass units have low conductance spacer materials? Yes No
4. Would spectrally-selective tinted glasses be useful for controlling solar heat gain? Yes No
5. Are there any other solar control options that should be considered for use with the fenestration areas? Yes No

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