Smart glass and daylight harvesting: Advanced light control that saves energy

April 14, 2009 - Owners Developers & Managers

Windows are integral features of commercial and residential buildings. From a design perspective, they are drivers of a building's aesthetic appeal, give occupants a connection to the environment, and introduce natural light into the building. Functionally, windows support safety needs and can provide ventilation.

The energy efficiency of architectural windows has improved over the years. With buildings in the U.S. representing 40% of the nation's primary energy use according to the U.S. Green Building Council, such improvements are strongly embraced by the architectural community.

Satisfying interior lighting needs while minimizing energy costs is especially important to building owners. The U.S. DOE reports that artificial lighting accounts for 25% and 12% of the energy used in commercial and residential buildings, respectively. Overall, the U.S. Green Building Council reports that buildings in the U.S. account for 72% of the country's total electricity consumption. The energy impact of artificial lighting is not fully captured by these data, however, because lighting generates heat which elevates cooling requirements.

Smart glass allows users to regulate the amount of light passing through windows and other products including skylights, doors and partitions. This is accomplished without the need for conventional window treatments such as blinds, shades or curtains because the light-controlling technology of smart glass is within the glass itself.

Smart glass offers a broad range of functionality within a single system. On sunny days, for example, users can adjust the transparency of their smart glass to more shaded levels that achieve desired in-room lighting levels and reduce glare. When privacy is needed, the tint of the windows can be set to their darkest level. At times when maximum incoming light is needed or when occupants want the clearest view to the outside, the windows can be tuned to their most light-transmissive states. Smart glass is easily cleaned, saves space, and can be operated using controllers ranging from manual switches to automated methods using photosensors or intelligent building systems.

Smart glass can reduce the amount of energy used for artificial interior lighting because it can adapt more effectively to owners' energy efficiency objectives and occupants' changing lighting needs. This is done through the application of daylight harvesting strategies that use smart glass to introduce more natural light into the interior of buildings and thus reduce the energy used for artificial lighting. Daylight harvesting has strong potential as a sustainable and profitable design strategy. Studies have found that daylighting increases occupant well-being and The New Buildings Institute reports that daylight harvesting in buildings can lead to annual savings of 35-60% on lighting energy. For building owners with daylight harvesting interests, windows with smart glass are a more effective solution than static tints. On bright days, these windows can be adjusted to allow the desired

amount of daylight to enter - but not more than is needed. As the day progresses and sunlight begins to ebb, the windows can become more light-transmissive to levels much greater than what a static tint allows. This extends the period over which natural light can be harvested, thus reducing use of artificial lighting while satisfying occupants' lighting requirements.

SPD-SmartGlass uses patented film technology developed and licensed by Research Frontiers Inc. of Woodbury, New York. Within the SPD film are microscopic particles that align or randomize in response to an electrical voltage. SPD-SmartGlass is an excellent solution for advanced daylight harvesting. It is the only architectural smart glass technology that allows users to instantly and precisely adjust the tint of the glass to any point between very dark and clear. It blocks more than 99% of harmful incoming UV light and is available in custom configurations for both new construction and retrofit applications.

Speed matters when optimizing energy efficiency goals through daylight harvesting. Windows with SPD-SmartGlass are exceptionally responsive. Through the use of photosensors or other intelligent control systems, SPD-Smart windows can be adjusted instantly in response to changing environmental conditions such as clouds passing in front of the sun. In addition, SPD-SmartGlass can be controlled to darken when rooms are unoccupied, which is its most energy efficient state due to its blocking of solar energy.

Joseph Harary, CEO of Research Frontiers, sees great potential for SPD-SmartGlass in several areas. "With regard to aesthetics, there are expanded opportunities for building designs that are elegant, sleek and modern. In addition, having the ability to utilize, when desired, very dark window tinting can reduce air conditioning costs for tenants and building operators. This also can decrease the size of mechanical rooms resulting in more rentable space. Additional costs can be saved as part of a daylight harvesting strategy. Building operators and architects recognize that in addition to the aesthetic benefits of smart glass, sustainable buildings offer the opportunity for improved operating efficiencies and enhanced occupant well-being. Because of its ability to instantly and precisely adjust tint levels, SPD-Smart windows can support lighting and cooling goals very effectively. We encourage people to learn more about SPD-SmartGlass and experience how smart glass can actually be."

Research Frontiers' SPD-SmartGlass Design Center is now hosting events. Contact the company to schedule a visit. You're invited!

Gregory Sottile, Ph.D. is the
director of market development for Research Frontiers Inc.,
Woodbury, N.Y.