International Journal of Sustainable Built Environment

Volume 1, Issue 1, June 2012, Pages 125-139

open access

Electrochromic dynamic windows for office buildings

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https://doi.org/10.1016/j.ijsbe.2012.09.001

Abstract

The next generation of advanced fenestration products includes dynamic electrochromic (EC) windows which can modulate the solar energy entering a building by application of an applied voltage. The windows can be switched from 62% visible transmittance (Tvis), 0.47 solar heat gain coefficient (SHGC) to a fully tinted state with â©½2% Tvis, 0.09 SHGC. EC windows save energy in buildings â€“ the total energy use for an eight story ASHRAE 90.1 2007 commercial office building with EC windows was modeled using the eQuest building simulation program and compared with the energy use of the same building with a variety of static glazings. The simulations were carried out in three US climate zones, encompassing a broad range of environmental exposure conditions from hot and dry (Arizona) to very cold (Minnesota). For all climate zones, building energy savings with EC glass were â©¾45% when compared to single pane static glazings

common in existing building stock. When EC glass was compared to ASHRAE 90.1 2007 code compliant glazings, energy savings greater than 20% were calculated for the same building configuration. Optimum EC window control and performance strategies were derived from the modeling results. The EC glass and dimmable electric lights were synergistically controlled to maximize the use of natural daylighting and minimize electricity for lighting. Since EC glass can tint to â©½2%, shades and/or blinds are not required for glare reduction, and building occupants always have a comfortable working environment and an unobstructed view and connection to the outdoors. All static glazing systems were assumed to have manual shading devices that are pulled by building occupants when glare becomes uncomfortable. For integrated building control systems, the peak load is significantly reduced when dynamic glazings are part of the building envelope. Consequently, chiller costs are lower, and the upfront capital costs for new building construction are reduced. Another key benefit of EC glass, elucidated by the simulations is reduction of CO_2 emissions. EC glass reduces peak load carbon emissions by as much as 35% in new construction and 50% in renovation projects.

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Keywords

Electrochromic windows; Energy-saving windows; Dynamic window glazings; Commercial building energy savings

Peer review under responsibility of The Gulf Organisation for Research and Development.

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