

Executive Summary

Buildings and construction together account for global energy use of 36%. Thermal properties of building facade have significant impact on the cooling and heating loads as well as the lighting loads. Facade, accounts for almost 50% of the thermal loads in buildings in the tropics. Electrochromic glazing (EC) can dynamically modulate the solar energy entering a building by adjusting its tinting state, which influences the visible transmittance (τ_v) and solar heat gain coefficient (SHGC). Due to this adjustability, EC provides the potential for optimisation of solar heat gain and visual comfort. This research project hence aims to further understand the performance of EC glazing facade against an advance spectrally selective low-emissivity double glazing unit (DGU).

The objective of this controlled laboratory evaluation was to analyse the EC glazing operational characteristics and energy savings potentials in the tropical context. The study focuses on the investigation of facade performance of EC glazing in terms of heat gain and its impact on thermal and visual comfort. The impacts of EC glazing on lighting and air-conditioning energy consumption is also analysed.

EC glazing's ability to modulate the solar heat gain through the window, reduces stress on HVAC and other equipment. EC window require low-voltage power to modulate between it clear and dark state. In the clear state, more solar radiation is transmitted in to the interior. A high transmission is desirable for admitting daylight during the time of the day when sun is not shining directly into the space and during overcast periods. In the tinted state solar radiation is absorbed, to reduce heat transfer to the interior.

Following are the advantages of EC glazing system-

- a. EC glass reduces heat gain by tinting the glass instead of covering the window with opaque shading elements like blinds do. This provides advantage in maintaining the exterior view.
- b. Provides energy saving potential.
- c. Better thermal comfort by enabling zonal control of occupant temperature.
- d. Better visual comfort by tint modulation to control glare at occupant viewing position.

The EC glazing was evaluated against the reference technology, DGU along with blinds, through a controlled laboratory monitoring at BCA SkyLab, Singapore. The SkyLab facility consists of two test compartments designed to replicate a typical office interior environment. The testing was performed for two different window orientations (North and West) to represent the majority of the buildings in Singapore. Monitored data related to energy consumption, heat gain, weather, comfort was collected to conduct an exhaustive study of the EC glazing performance in tropical climate.

Compared to traditional double glazing with indoor solar protection, Halio was able to:

- eliminate 100% of the glare experienced with double glazing and retracted blinds;
- save 17%-25% on lighting energy compared to double glazing with closed blinds;
- deliver good thermal comfort (PMV in category B per ISO 7730) for 95% of the time, compared to 75%-78% for double glazing.