

Using Dynamic Glazing to Eliminate Mechanical Cooling in Multi-family Highrise Buildings

Authors : Ranojoy Dutta, Adam Barker

Abstract : Multifamily residential buildings are increasingly being built with large glazed areas to provide tenants with greater daylight and outdoor views. However, traditional double-glazed window assemblies can lead to significant thermal discomfort from high radiant temperatures as well as increased cooling energy use to address solar gains. Dynamic glazing provides an effective solution by actively controlling solar transmission to maintain indoor thermal comfort, without compromising the visual connection to outdoors. This study uses thermal simulations across three Canadian cities (Toronto, Vancouver and Montreal) to verify if dynamic glazing along with operable windows and ceiling fans can maintain the indoor operative temperature of a prototype southwest facing high-rise apartment unit within the ASHRAE 55 adaptive comfort range for a majority of the year, without any mechanical cooling. Since this study proposes the use of natural ventilation for cooling and the typical building life cycle is 30-40 years, the typical weather files have been modified based on accepted global warming projections for increased air temperatures by 2050. Results for the prototype apartment confirm that thermal discomfort with dynamic glazing occurs only for less than 0.7% of the year. However, in the baseline scenario with low-E glass there are up to 7% annual hours of discomfort despite natural ventilation with operable windows and improved air movement with ceiling fans.

Keywords : electrochromic glazing, multi-family housing, passive cooling, thermal comfort, natural ventilation

Conference Title : ICHPBDS 2020 : International Conference on High Performance Building Design and Sustainability

Conference Location : Vancouver, Canada

Conference Dates : August 06-07, 2020