Thermal Comfort and Cooling in Low-Income Communities

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Low thermal satisfaction of the occupants in hot climates can be associated with ventilation performance. To improve user comfort and energy efficiency, various smart cooling technologies are currently in use. These advanced systems include smart thermostats, automated vents, zoning systems, IoT-enabled heating, ventilation, and air conditioning (HVAC) systems, demand response systems, geothermal cooling, and advanced sensors for occupancy, temperature, and humidity. These technologies collectively contribute to more efficient and comfortable cooling solutions. But what if your only solution to regulate indoor temperature was to control operable windows, such as in social housing?

Since there is a need to provide housing with acceptable thermal comfort for low-income communities, financing mechanisms need to support the adoption of sustainable cooling technologies. However, the exploration of climate-responsive design techniques can accelerate the process as alternative solutions for cooling-dominated regions. Before the implementation of any active systems, passive strategies should be considered, such as building characteristics including form, envelope, opening size, perforated screens, and shading devices. With the help of computational fluid dynamics and energy simulations, the performance of the buildings, natural ventilation, and airflow can be easily investigated when evaluating several ventilation approaches and thermal comfort. These measures provide valuable insights for architects and engineers to improve the occupants' thermal comfort while optimizing energy efficiency for affordable and sustainable cooling.