Ceiling Fans Case Study

Photo: Community Preservation Partners

Photo: Dana Miller

OVERVIEW

Location: Stockton, CA
Project Size: 50,565 ft^2
Construction Type: Renovation
Completion Date: 2007
Fully Occupied: 112 units
Building Type: Senior Living Facility
Climate Zone: 3B

Owner: WNC & Associates

Energy retrofits of a senior living facility shows how ceiling fans integrated with air conditioning can deliver thermal comfort improvements and energy savings for community housing.

FRANCO CENTER

The Franco Center Apartments is a five story senior living facility in Stockton, CA. Constructed in 1967 and renovated in 2007, it is built of solid concrete masonry with no additional insulation. The first floor is made up of retail spaces, community rooms for the residents, and office space for staff. The residential spaces occupy the second through fifth floors, with studios and 1-bedroom units on floors two through four, and 2-bedroom units on the fifth floor.

The Franco Center is located in a hot climate, where the ASHRAE 1% summer design conditions are 97.9°F. Thirty-five ceiling fans were installed in the common areas of the building to demonstrate how smart ceiling fans with on-board sensors for occupancy and temperature can reduce energy usage and increase thermal comfort in flexible mixed-use spaces. Elevated air speeds from the fans improved occupant comfort, allowing thermostat cooling setpoints to be increased to save HVAC energy use. This project demonstrates how simple retrofits can deliver impressive results for both energy and comfort.

Energy Performance

The first-floor common room is served by two compressors and nine fan coil units with a total capacity of approx 400 MBtu/hour. Cooling setpoint temperatures were increased by 5-8°F to 76°F after the ceiling fans were installed. Electricity monitoring equipment established baseline energy use before and after the fan installation. Measurements over two summers (Figure 1) show air conditioning energy use increased with outdoor air temperature as expected. The same relationship was seen after installing the ceiling fans, but the total energy use decreased by approx 60% on average. This saved approx $1000 per month in electricity during summer. These savings were achieved by extending the temperature deadband, made possible by coordinating the fans and air conditioning to maintain or improve comfort.

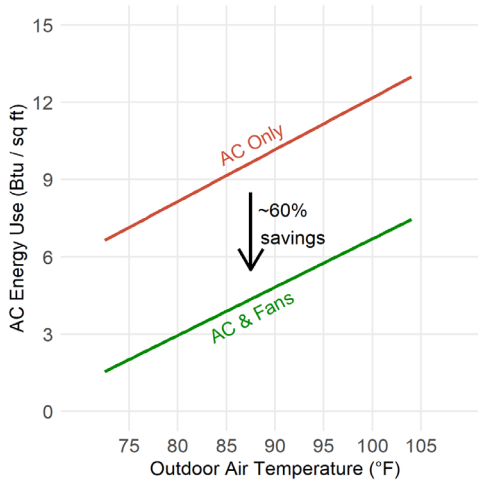

Figure 1. HVAC energy use in the common room was reduced by 60% by raising setpoints and using fans to cool occupants when temperatures were above 74°F. Source: Dana Miller.

Thermal Comfort

Thirty-five ceiling fans were installed in the common room in a grid arrangement to ensure even distribution of air speeds. They were programmed to start at 74°F during occupancy, while the air conditioning was changed to start at approximately 76°F. Thermal comfort surveys were completed by occupants before and after the ceiling fans were installed. Figure 2 shows 92% of surveyed occupants reported being comfortable at 80°F with the ceiling fans running. This is an improvement in thermal comfort over the earlier survey without the fans, even though the temperature in the common room was 8°F warmer. This demonstrates that cooling setpoints can be higher while providing similar or improved occupant comfort by using efficient ceiling fans, substantially reducing energy use and cost.

Photo: Dana Miller

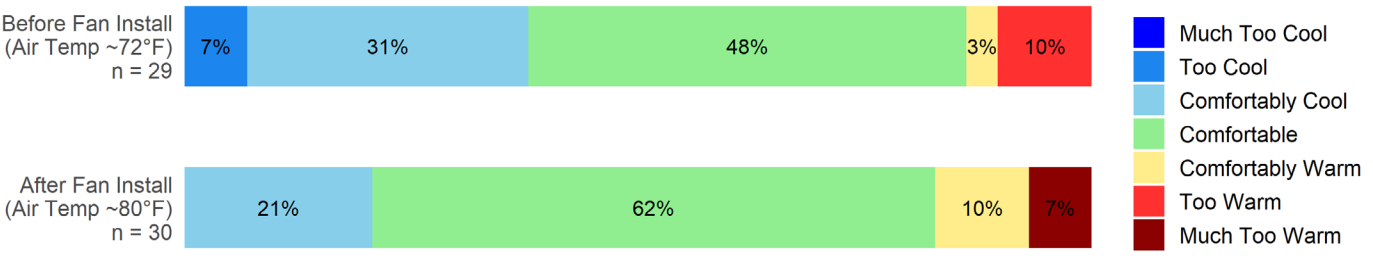

Figure 2. Over 90% of surveyed occupants in the Franco Center Apartments rated their indoor environment as comfortable after the ceiling fans were installed. This is an increase in occupant comfort from the earlier survey even though it was 8°F warmer. Source: Dana Miller.

CBE
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*This case study is part of a project focused on energy and occupant factors within the larger study of Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort. It is being led by Paul Raftery at UC Berkeley Center for the Built Environment (CBE) and funded by **the** California Energy Commission (EPIC Project 16-013).*