Ceiling Fans Case Study

Photo: Nic Lehoux

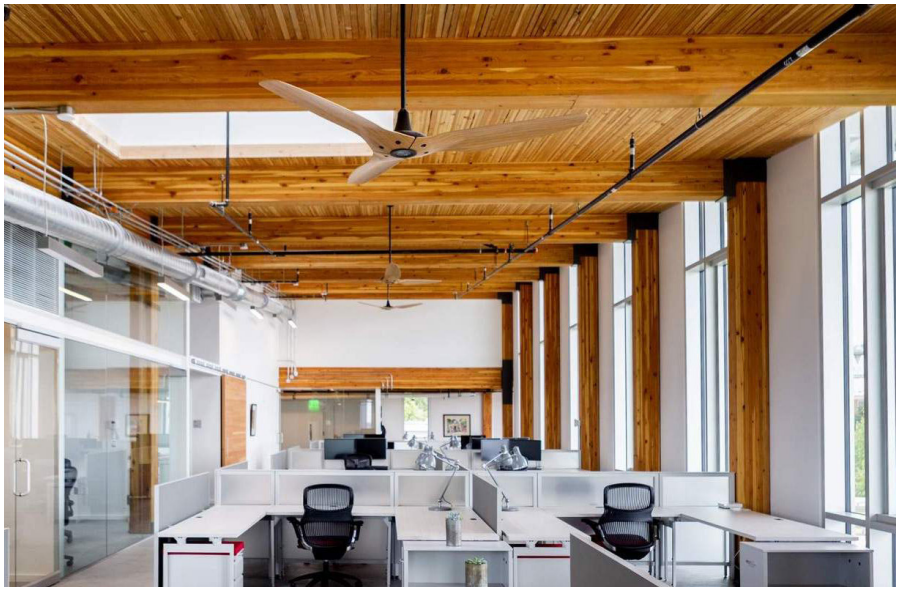

Photo: Big Ass Fans

OVERVIEW

Location: Seattle, WA
Project Size: 52,000 ft^2
Construction Type: New Building
Completion Date: 2013
Fully Occupied: 100%
Building Type: Office
Climate Zone: 4C
Total Building Cost: $32.5 million

Owner: Bullitt Foundation
Architect: Miller Hull Partnership
Development Partner: Point32
General Contractors: Schuchart, Foushee
Structural Engineer: DCI Engineers
MEP Engineering: PAE
Civil Engineer: Stantec
Commissioning: Keithly Barber Associates
Solar Team: Northwest Wind and Solar
Water Systems: 2020 Engineering
Landscape Architect: Berger Partnership

Ceiling fans are a key part of the strategy in achieving world-class commercial building performance and delivering a comfortable indoor environment for office workers.

THE BULLITT CENTER

The Bullitt Foundation, a nonprofit philanthropic organization with a focus on the environment, worked with local real estate firm Point32 to deliver a building at the cutting-edge of sustainable architecture. The building was the vision of CEO Denis Hayes to create “the greenest urban office building in the world” and received the Sustainable Building of the Year award from World Architecture News in 2013.

The building uses a mixed-mode cooling, heating, and ventilation strategy. To help meet the low energy targets, ceiling fans were combined with automated windows for passive cooling and to provide natural ventilation and fresh air. Fans use only 2% of end-use energy but allow higher cooling setpoints to reduce HVAC reliance. This system was estimated to offset about 750 hours of annual cooling. Occupants use the fans to provide thermal comfort and ensure the building operates sustainably. The result is far above- average thermal satisfaction and world-class energy performance.

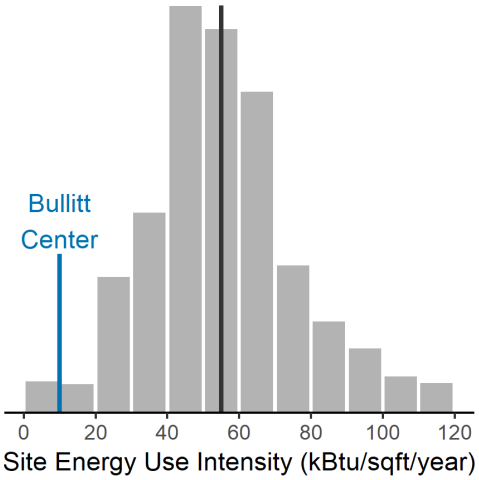

Figure 1. The Bullitt Center is placed in the top 2% of office buildings from the same climate zone in the BPD. The Site EUI of 10 is over 80% less than the mean EUI of 55.

Energy Performance

The Bullitt Center was designed to have exceptionally low energy use to meet zero-net energy targets and Living Building Challenge standards. The whole building site Energy Use Intensity (EUI) of just 10 kBtu/ft² is over 80% less than the average EUI performance of 1,142 offices in the 4C climate zone within the Building Performance Dataset (BPD). This places it in the top 2% of those buildings in terms of energy performance (see Figure 1). While that dataset includes a mix of construction age, the Bullitt building's energy use is also significantly lower than a new-code building in the same year, and best-practice in ASHRAE's Standard 100-2015 Energy Efficiency in Existing Buildings by approximately 70%. The mechanical engineers used efficient ceiling fans to help reduce HVAC energy and meet the ambitious design goals.

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Thermal Comfort

Aiming for low energy use targets required PAE Consulting Engineers to think creatively about ways to reduce HVAC energy consumption. Sensors and controls coordinate the windows to optimize thermal comfort and outside air, thereby reducing reliance on mechanical cooling. The use of ceiling fans helps to lower energy use and enhances occupant comfort by cooling occupants much quicker than a centralized system can. The results of the thermal comfort survey show a 50% increase in occupant satisfaction with the temperature over the average building in the CBE database (see Figure 2). The mean score on the 7-point satisfaction scale was +0.8, well above the thermal comfort benchmark of 0.0 in the 500 offices in the CBE database, placing it in the top 15% of commercial office buildings in that dataset.

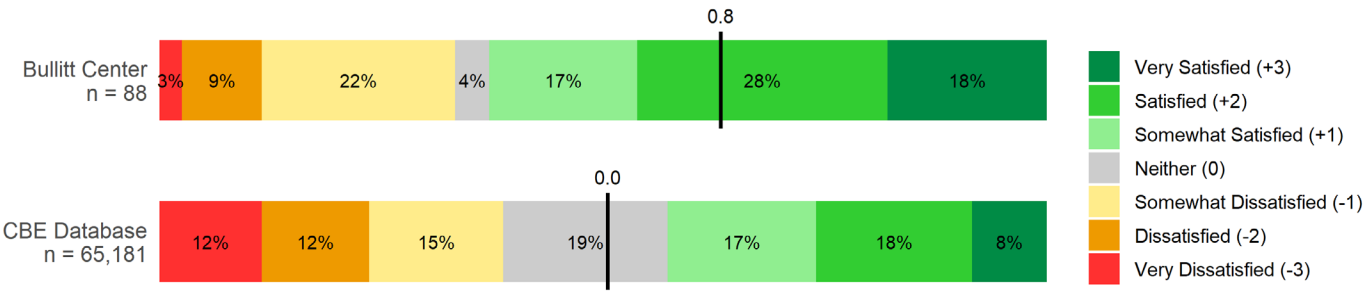

Figure 2. Over 60% of occupants in the Bullitt Center rated their indoor temperature as satisfactory. The mean thermal satisfaction vote of 0.8 places it in the top 15% of commercial office buildings for thermal comfort in the CBE Occupant Survey database.

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).*