An office in the suburbs of New Delhi, India, maintains an indoor setpoint of 27°C (80.6°F) and uses high-volume, low-speed (HVLS) ceiling fans, which help eliminate the need for the office to run air conditioners during nearly six months of fair weather.

AEON Integrated Building Design Consultants, LLP—a 100-member, multidisciplinary MEP and sustainability firm—determined the higher-than-usual indoor temperature setpoint through adaptive thermal comfort. The indoor temperatures were gradually increased in steps of 0.5°C (0.9°F) over a six-month period, said Ashish Rakheja, Member ASHRAE, and an ASHRAE director-at-large, in an interview with High Performing Buildings.

“In the last two years, the feedback shows satisfaction from over 90% of the employees who have carried the habit back to their home, where they practice similar elevated indoor temperatures. Besides, informal dressing is encouraged in the office during peak summers,” said Rakheja, the firm’s managing partner.

Adaptive thermal comfort is one strategy the company has used to increase its office’s energy efficiency, affordably and comfortably. The office, which was occupied starting in January 2017, has earned industry accolades for its sustainable features.

When the company was looking to relocate a few years ago, the budget was not large, and the move’s capital investment was limited to new lighting, air-conditioning equipment and electrical/IT infrastructure, said Rakheja. This inspired the company to carefully plan, design and execute key considerations such as pursuing sustainability principles and twin platinum ratings under the Green...
Rakheja says the outcome of design was so positive that the project’s architecture and interior design firm ultimately colocated in the same building on another floor with similar features.

Simple Strategies

The company focused on keeping the renovation simple and affordable and prioritized payback on the capital wherever investment is made in technology. The firm used those principles to maximize energy efficiency with the following:

1. Two sides of the office space have structural glazing, and another side has operable windows. The depth of the floor plate is just 10 m (32.8 ft), which ensures maximum daylight penetration.

2. The interior was planned to spread daylight into all areas. As a result, the office is 100% daylit including toilet, store and pantry areas. During the day, the office does not use any artificial lights. This significantly reduces the energy consumption and helps maintain circadian cycle, which contributes to occupant health.

3. The artificial lights the office uses are LED and were planned using simulation tools to ensure they are focused over task areas. The lighting power density of the office is only 0.35 W/ft² (3.8 W/m²) without compromising the illumination levels and its uniformity across the task and non-task-based areas.

4. All air conditioning is inverter-based direct-expansion units with an EER of 3.41, and electronic appliances are Energy Star-rated by the Bureau of Energy Efficiency, India.

5. Underdeck insulation reduces overall thermal conductivity and heat ingress. The overdeck surface of the roof is painted with high albedo paint with an SRI value of 110 to reduce

Interiors and Health and Wellbeing rating programs of the Indian Green Building Council (IGBC). The result is an office that is “affordably green” and helped the company “walk the talk,” said Rakheja.

“Since the inception of the green building movement across the world, the word ‘green’ elicits a vision of an expensive building and associated with rich corporates. There are very few examples where a small office has attempted a green rating,” he said. “We believe that sustainability is a mindset, and green rating can easily be achieved through a climate-responsive design by adhering to simple principles rather than investing in expensive technology to fight the ills of a poorly designed building.”

Building Features

100% of the office space has daylight and views, enabling visual comfort for occupants.

55% circulation areas create a comfortable and spacious work environment.


44% water savings over IGBC baseline.

42% salvaged material reduced the use of virgin materials.

95% construction waste management used during interior work.

Use of low-volatile organic compounds materials for enhanced indoor air quality.

Use of HVLS fans for implementation of adaptive thermal comfort.

Implementation of waste recycling plan where old paper and drawings are cut to A4 and A3 size sheets and reused in a printer/photocopier.
the surface temperature by nearly 9°C (16.2°F).

6. A mini building automation system monitors parameters like energy use, indoor temperatures and scheduling of air-conditioning units in the server and uninterrupted power supply (UPS) room.

7. A dedicated outdoor air system comprising of a heat recovery wheel, a potassium permanganate (KMnO₄) filter to reduce sulfur content (as the building is located close to an open drain, which generates high sulfur content in the air), and a combination of MERV 8 and 13 filters is installed to supply clean, treated outdoor air into the office. Ceiling-suspended MERV 14 efficiency electrostatic precipitators (ESP) help clean the indoor air and maintain indoor air quality.

8. HVLS fans implement the concept of adaptive thermal comfort where the indoor temperature set-point is 27°C (80.6°F).

9. All façade glazing frames have been sealed for potential air leakages from the outside to ensure minimum air loss and maintain positive pressure.

10. Computers and workstations were selected based on optimized power consumption.

11. Networkable electronic meters are installed to log the consumption for total power, emergency diesel generator power and internal lighting separately.

Challenges

The company faced several challenges during the renovation, which started with finding a space that would help the team meet its sustainability goals.

The firm chose the top two floors in a building with a large north-facing glass wall, which is ideal for northern Indian cities because no direct sun enters the space, said Rakheja. The building had a poor envelope made of clay brick walls, single glazing and a non-insulated roof. During the renovation, the team insulated the roof and installed heat reflective film on the glazing.

Rakheja said New Delhi has bad ambient air quality. To offset this and achieve good indoor air quality, they had to invest in MERV 14 efficiency electrostatic air filters that met Indian Society of Heating, Refrigerating and Air Conditioning Engineers’ (ISHRAE) indoor environmental quality (IEQ) guidance.

Rakheja said the team members were involved in the design process. “This helped to generate new ideas to reduce energy consumption and improve quality of indoor experience,” he said.

The Result

Since occupying the space, the company has expanded its operations and the office’s occupancy has grown by 15%, said Rakheja. This increase of occupants is reflected in the building’s reported energy consumption. Energy consumption from March 2018 to March 2019 was 62,374 kWh, while the energy consumption from March 2019 to March 2020 was 66,760 kWh.

Rakheja attributes the project’s success to the following:

1. The adaptive thermal comfort experience of elevated temperature coupled with enhanced air movement has positively affected the mindset of team members and clients.

2. Good indoor air quality.

3. Circadian rhythm through 100% daylit spaces.

4. Metering of utilities, which provides regular feedback and helps the firm optimize the operations.

5. The live display of data, like indoor air quality and building performance, which generates a sense of pride and a feeling of belonging.

6. Pursuing Green Interiors and Health and Wellbeing certifications from IGBC brought a sense of discipline to the design and construction, which ultimately helped reduce the capital and operation cost.

Ratings and Recognition

The office has achieved a Platinum rating from the Indian Green Building Council under the IGBC’s Green Interiors Rating System program. The office also earned a second platinum certification under the IGBC’s Health and Wellbeing Rating program in its second year of operation. The Health and Wellbeing rating is developed along the lines of the USGBC’s WELL program.

“Thus, the AEON office is unique in the country to be awarded two Platinum ratings wherein both resource efficiency and occupant well-being are balanced out,” said Rakheja, who serves as chair of the IGBC’s Technical Committee and also co-chaired the development of the Health and Wellbeing rating program.

The design team changed operation strategies and improved designs in certain areas to meet the Health and Wellbeing rating system’s requirements. Rakheja said some key features that helped earn the rating include improving indoor air quality by installing additional UL-certified ESP filters with negligible ozone generation and continuous monitoring of parameters like PM₂.₅, PM₁₀, VOC and CO₂. The company also implemented a radiation management plan that maps geopathic stress lines and neutralizes radiation from nearby electric lines, mobile towers and on-site IT equipment.

“The proof of pudding was an average 9% reduction in pulse rates recorded before and after implementation of the radiation management plan,” he said.

Beyond the building’s performance, it has inspired many of the firm’s clients, including those who were previously unconvinced, to pursue green projects at no or little additional cost, said Rakheja.