FLEXLAB®

ADVANCING OPTIONS FOR BUILDING ENVELOPE DAYLIGHTING

Helping utilities pinpoint which technologies can deliver both energy savings and comfort

THE CHALLENGE

Acquiring reliable data on daylighting products

Innovative daylighting and shading technologies such as sunlight-redirecting films can significantly reduce energy use for cooling and electric lights, yet commercial building operators have been slow to adopt them. Without independent evidence of how products perform in the real world, building managers can be understandably reluctant to install them.

PG&E and other California utilities can help accelerate market adoption of these technologies by offering financial incentives to building owners and design teams. But before PG&E could decide on the types of daylight-redirecting products to include in its rebate programs, it needed to verify which of them could deliver measurable energy savings without sacrificing indoor environmental quality and occupant comfort. Beyond that, the utility needed a detailed understanding of any real-world factors that could undercut product effectiveness.

THE SOLUTION

PG&E commissioned the U.S Department of Energy's FLEXLAB® facility at Lawrence Berkeley National Laboratory to conduct a full-scale monitored study of specific daylighting technologies. Researchers evaluated four daylight-redirecting technologies over a six-month period, assessing energy savings, comfort and indoor environmental quality. FLEXLAB delivered concrete, third-party measured evidence of how the products perform in real-world scenarios. This vital analysis enabled the utility to make more informed decisions when constructing program interventions that would support technology adoption in the market.

THE BOTTOM LINE

PG&E gains key insights on new daylight-redirecting technologies.

Several manufacturers have introduced products designed to bounce sunlight across an indoor space. These daylight-redirecting technologies promise to boost interior natural light while reducing the need for artificial lighting. Some of these are thin-film window coatings with microscopic features that redirect the sun, while others are automated, motorized upper-window blinds combined with automated lower-window roller shades.

Researchers at FLEXLAB® put these systems to the test and were able to verify up to 63% energy savings, giving PG&E the context it needed to design the right incentives for consumers. FLEXLAB's unique facilities enable insights and recommendations for technologies that will be essential to meeting California's zero net energy goals for buildings.

THE EXPERIMENT

- Four daylight-redirecting technologies were evaluated at FLEXLAB over a six-month, solstice-to-solstice period. They were tested in a room adjacent to a reference room with conventional venetian blinds.
- Three types of daylight-redirecting film and one automated motorized system were evaluated.
- Each technology was tested for about five to seven clear and cloudy days within each of the summer solstice, equinox and winter solstice periods.
- The technologies were evaluated in side-by-side, full-scale test rooms designed to emulate a 30-foot-deep commercial office zone with open plan workstations and partitions 42 ⅞ inches high.
- The window wall, lighting and HVAC systems were designed to be reconfigurable so that multiple technologies could be evaluated over a designated test period.
- Data on energy use, comfort and indoor environmental quality was collected.
- The relevant market for these products was new or existing commercial office buildings or buildings with similar patterns of use.

THE RESULTS

- The daylight-redirecting technologies, combined with daylight-responsive LED lighting, saved 48%–63% in annual lighting energy use (kWh/ft2). Under clear sky conditions, average savings were 62%.
- When combined with dimmable fluorescent lighting, the daylight-redirecting technologies saved 3%–5% in annual lighting energy use (kWh/ft2). Under clear sky conditions, average savings were 22%.
- Visual comfort was acceptable when the occupants' views were of the sidewall (parallel to the window), but was unacceptable during the period between the equinox and winter solstice if the views were toward and near the window.
- The daylight-redirecting films are recommended for adoption, as long as the application is designed to mitigate glare through informed use of interior shades and/or space layout.
- The automated daylight-redirecting system did not offer enough of a significant energy savings advantage over the static films to justify its added cost and complexity, but design and control improvements could boost its performance.
- Glare was identified as a critical issue with these technologies. The development of design guidelines was recommended to achieve the best balance between daylight, glare and solar control.
- PG&E now has third-party information vital for planning energy efficiency offerings in its service area.

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