

# Harvesting daylight

## Developing new technologies to maximize energy-efficient lighting for large retail buildings.

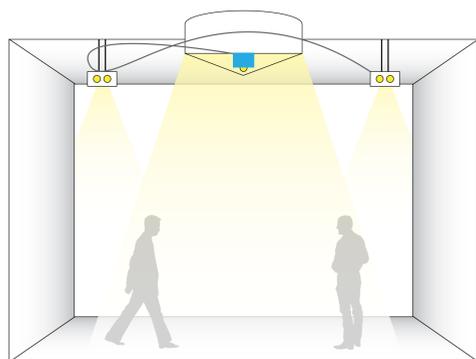
RETAIL BUILDINGS across the nation account for 20% of commercial sector energy consumption, making them a prime target for energy-efficiency measures. Under California's Title 24, all new big-box retail stores in the state larger than 25,000 square feet must have skylights with controls that turn off the lights when adequate daylight is available. Photosensor control systems have not experienced widespread use because of problems with overdimming and underdimming, which often diminish reliability and energy savings.

To address this problem, UC Davis' California Lighting Technology Center (CLTC) developed a photosensor-based lighting control system that maximizes the daylighting benefits of skylights, minimizes electric lighting use, and provides a consistent, comfortable level of light in the store for employees and shoppers. This project represents the CLTC mission of taking ideas from research and demonstration to the marketplace. The result is a system that can detect a true daylight change, automatically commission, provide a consistent light level, and save significant energy.

### FEATURES

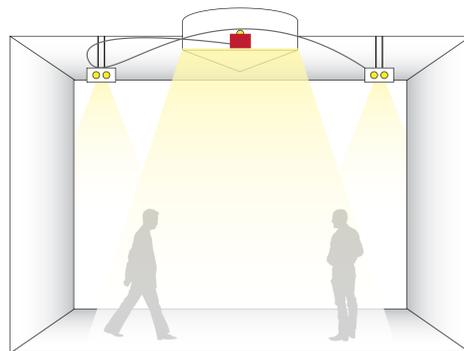
- Reduce or eliminate the need to recommission or recalibrate to account for long-term space changes
- Differentiate between daylight changes and space changes
- Control electric light more accurately and maintain a more consistent light level compared to an open-loop system
- Provide more than 50% energy savings compared to an open-loop system

CLTC developed the dual-loop photosensor control system for skylight applications through the Building Energy Research Grant (BERG) program from the California Energy Commission.



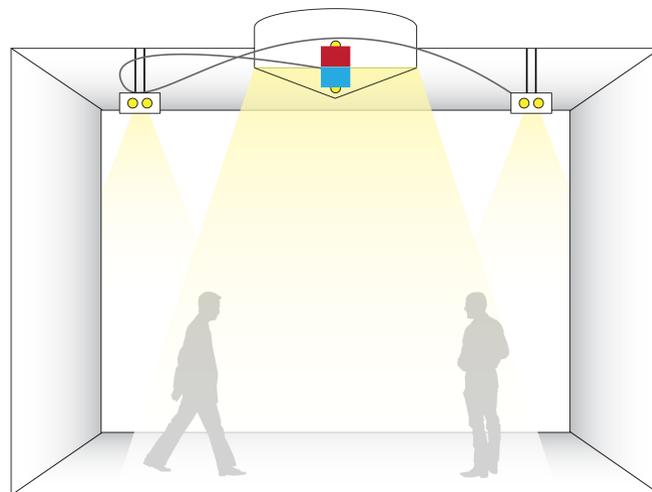
### ▲ CLOSED-LOOP SYSTEM

In a closed-loop system, the photosensor is oriented so that it senses both daylight and electric light and adjusts the electric light accordingly. Closed-loop systems are unable to distinguish between changes in daylight and changes caused by occupant interferences or in the object reflectance within the space. A closed-loop system also requires recommissioning every time the retail display spaces change.



### ◀ OPEN-LOOP SYSTEM

In an open-loop system, the photosensor is oriented so that it senses only daylight and adjusts the electric light accordingly. Open-loop controls respond only to changes in daylight but do not always accurately respond to actual light levels in the interior space.



### DUAL-LOOP SYSTEM ▶

The dual-loop system employs a closed-loop control photosensor and references an open-loop photosensor to determine if changes to the closed-loop photosensor signal are from daylight or space changes (i.e., interior design change or occupant interference).

### DEMONSTRATION SAVINGS:

Average Open-Loop Energy Savings / Ballast / Month: 52.5 kWh  
Average Dual-Loop Energy Savings / Ballast / Month: 43.0 kWh  
Dual-Loop over Open-Loop Energy Savings / Ballast / Month: 9.5 kWh  
Average Cost Savings / Ballast / Month: \$1.21  
Cost Savings / Store / Month: \$14,529  
Cost Savings / Year: \$0.10 / ft<sup>2</sup>  
Energy Savings / Year: \$0.76 kW / ft<sup>2</sup>

\*Based on 150,000 ft<sup>2</sup> retail store using 1,000 dimmable ballasts



Skylights (above and right) help big-box retail stores use daylight to reduce electric light use. A dual-loop photosensor dimming control system contributes to additional energy savings and reduced maintenance costs.

### DEMONSTRATION:

#### Walmart, West Sacramento, CA

CLTC worked with Walmart to develop a laboratory prototype and place it in the skylight well of a 150,000-square-foot Walmart store. This technology is being successfully demonstrated and has been licensed by three manufacturers.

CLTC is working with WattStopper, a commercial lighting control manufacturer and research partner, to develop a derivative product from this demonstration project. The LMLS-600 Dual Loop Switching and Dimming Photosensor should be available by late 2010.



### FOR MORE INFORMATION:

California Lighting Technology Center:  
[cltc.ucdavis.edu](http://cltc.ucdavis.edu)