

Integrated Office Lighting System

University of California Office of the President
Oakland, CA



PIER Buildings Program

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The Problem

California's 2005 Building Energy Efficiency Standards (Title 24) stipulates a maximum lighting power density of 1.2 W/ft² for office lighting. California's 2008 Building Energy Efficiency Standards reduces the allowed lighting power density by 25% to 0.9 W/ft². Office lighting traditionally is provided by recessed fluorescent troffers or suspended pendants, with additional task lighting provided by energy-intensive fluorescent undercabinet fixtures and desk lamps. Achieving significant energy savings to meet code requirements requires both general lighting and task lighting loads be reduced without sacrificing occupant satisfaction and visual comfort.

The Solution

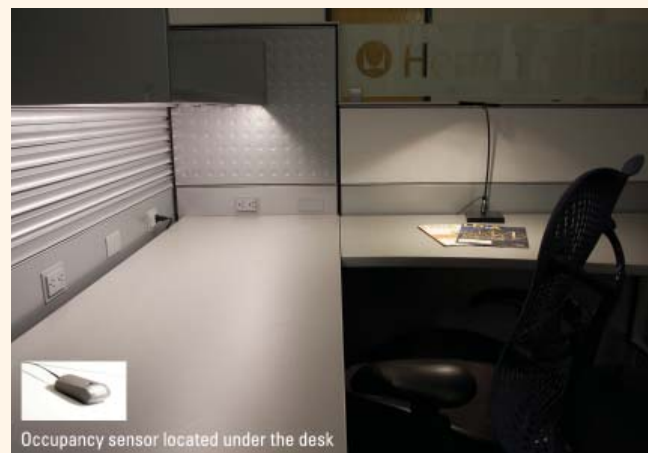
California Lighting Technology Center (CLTC) partnered with Finelite, Inc. to develop a task lighting system powered by energy-efficient light emitting diodes (LEDs). The resulting commercial product, called the Personal Lighting System (PLS), consists of a suite of luminaires in 3, 6, and 9 W undercabinet and desk lamp styles that can be combined to create custom task light systems (Figure 1). The luminaires typically are connected to a single power supply that operates up to 21 W of task lighting and may be controlled by an optional personal occupancy sensor.

CLTC has demonstrated that the PLS, in combination with reduced general (overhead) lighting, can achieve unprecedented energy savings and a total integrated office lighting power density as low as 0.6 W/ft². This combination is called the Integrated Office Lighting System (IOLS). Average savings at early demonstration sites was 45%.

Features and Benefits

- High-quality ambient and task lighting for an aesthetically pleasing office environment
- Energy-efficient LED task light components that can be customized to the individual workspace
- Optional personal occupancy sensor to control task lights
- High user satisfaction for the IOLS retrofit compared to baseline scenarios
- Significant energy savings ranging from 25–60% with lighting power densities as low as 0.6 W/ft²

FIGURE 1: PERSONAL LIGHTING SYSTEM



Occupancy sensor located under the desk

Technology Costs and Incentives

Task-ambient lighting provides an estimated 40–50% energy savings over current energy codes. It has the potential for 600–700 MW demand reduction statewide, and 2,000–3,000 GWh annually. It should provide an annual energy savings of about 15 to 25 cents per square foot of building space, meaning \$300 million to \$400 million annual energy savings for California. The simple payback is immediate to one year when used in new construction projects. It has a four- to seven-year simple payback in retrofit projects.

Demonstration Results

University of California Office of the President

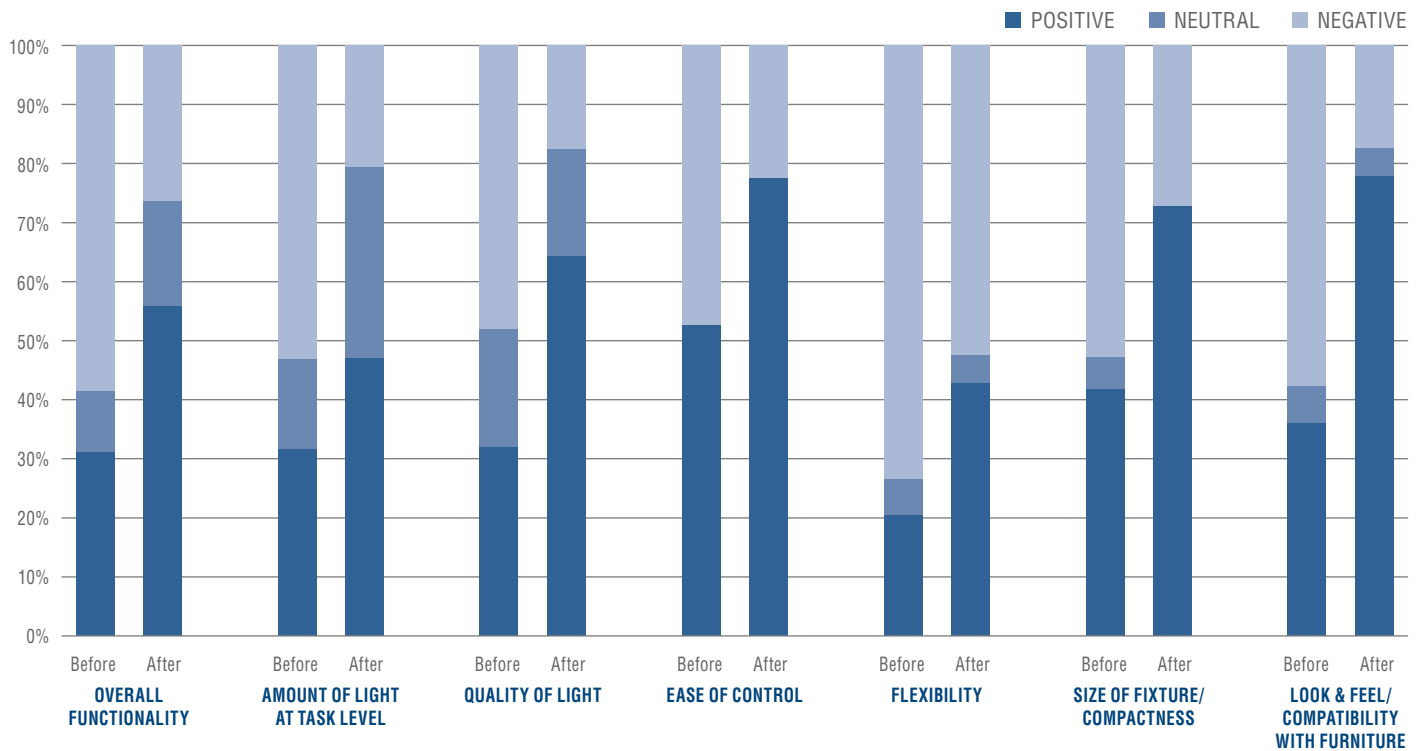
Six private offices and 44 open cubicle spaces on the ninth floor of the University of California Office of the President Franklin Building in Oakland, CA, received an IOLS retrofit in 2009. This site was selected because it provided a large, open office space, a high-occupant density, and expected long-term employee occupancy in the space. Before this retrofit, the office power density exceeded current Title 24 regulations.

The goals of the project were to successfully demonstrate that task-ambient lighting can save energy; maintain or improve occupant comfort; and be a cost-effective alternative to simple retrofit projects such as lamp and ballast retrofits.

In the 9,000-square-foot open office area, general delamping was combined with replacement of standard 32 W linear fluorescent lamps with energy-saving, high correlated color

TABLE 1: HOW WOULD YOU ASSESS THE PERFORMANCE OF THE NEW TASK LIGHTING AT YOUR WORKSTATION?

Survey of users at UCOP, Oakland, CA



temperature (CCT) lamps, plus custom, energy-efficient LED task lighting with personal occupancy sensors for each work station. These retrofits reduced the average power density by 62%. In the 140-square-foot private offices, delamping of overhead troffers was combined with an LED task light or the Berkeley Lamp II. Changes in these areas reduced the average power density by 30%.

This IOLS retrofit produced lifecycle cost savings of 47% assuming a 15-year useful life on the capital improvements, a 3.8-year simple payback, and 44% reduction in annual energy consumption. UCOP plans to use these results to prepare for a buildingwide IOLS renovation in 2010.

Product Availability

The products used in this demonstration include high CCT, super saver T8 lamps provided by Philips Lighting, and LED task lighting provided by Finelite, Inc. Reduced wattage, high CCT fluorescent lamps also are available from other manufacturers, including GE lighting and Osram Sylvania.

What's Next

CLTC continues demonstrations of task-ambient lighting as part of the PIER State Partnership in Energy Efficiency Demonstrations (SPEED) Program.

Upcoming demonstration projects are slated for the University of California, Santa Barbara, and the California National Guard in Sacramento. Energy savings from im-

TABLE 2: DEMONSTRATION EQUIPMENT

UCOP, Oakland, CA

- LED Task Light Systems by Finelite
- Philips F32T8 28 W ADV850 EW ALTO lamp
- Berkeley Lamp II by Full Spectrum Solutions
- **Annual energy savings: 44%**

plementation of task-ambient lighting solutions at these locations is estimated at 50–70%.

Collaborators

This IOLS demonstration project was a partnership with CLTC, Finelite, University of California Office of the President, and the California Energy Commission through the PIER Program.

For More Information

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- Reports on the Integrated Office Lighting System are available at www.energy.ca.gov/research/reports_pubs.html
- More information on demonstrations in California is available at www.pierpartnershipdemonstrations.com

FIGURE 2: POST-RETROFIT
Fluorescent pendants



FIGURE 3: POST-RETROFIT
Berkeley Lamp II



TABLE 3: COMPARISON OF PRE-RETROFIT TO POST-RETROFIT LIGHTING
UCOP, Oakland, CA

	EXISTING BASELINE	IOLS RETROFIT	IOLS SAVINGS OVER BASELINE
Ambient Lighting	Fluorescent Pendants	Fluorescent Pendants	
Task Lighting	Fluorescent and Incandescent Desk Lamps and Fluorescent Undercabinet lights	LED Desk Lamps and LED Undercabinet Lights	
Ambient LPD	1.90 W/ft ²	0.84 W/ft ²	56%
Task LPD	0.48 W/ft ²	0.13 W/ft ²	73%
kWh Per Year¹	76,567 kWh	33,064 kWh	57%
Yearly Cost (\$0.128/kWh)	\$9,801	\$4,232	\$5,569
Lighting Retrofit Cost²		\$20,506	
Life Cycle Cost Savings	47%	Simple Payback on Cost	3.7 Years

¹ Assumes 4,382 hours of operation per year for ambient lighting, 2,043 hours of operation per year for task lighting. Calculation for 9th floor only.

² Estimated cost for general lighting component, actual cost for task lighting.

About PIER

This project was cosponsored by the California Energy Commission's Public Interest Energy Research (PIER) Program. PIER supports public-interest energy research and development that helps improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

Arnold Schwarzenegger, Governor

For more information, see www.energy.ca.gov/research

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