

Bi-level Fluorescent Parking Garage Luminaires

University of California, Santa Barbara



PIER Buildings Program

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The Problem

Most parking garages use high intensity discharge (HID) light sources that operate continuously regardless of lighting needs. These facilities typically do not employ energy-saving control strategies, and no considerations are made for lighting control based on garage occupancy. Garage lighting that operates at a single, static level wastes energy, contributes to peak demand during the day, and adds to light pollution at night.

The Solution

The California Energy Commission's Public Interest Energy Research (PIER) Program funded the demonstration of bi-level fluorescent parking garage luminaires that combine mature fluorescent sources with occupancy-based dimming controls. The Philips Day-Brite Vaporlume fluorescent strip fixture, equipped with an optional occupancy sensor and step-dimming ballast, automatically reduces power consumption upon vacancy and increases to full power upon occupancy. Bi-level products may be combined with traditional photocontrols to maximize energy savings.

Features and Benefits

- Bi-level light output is based on garage occupancy
- Cost-effective, mature light source is replaceable
- Can be installed in wet and humid locations

Technology Costs and Incentives

Savings are achieved by combining a familiar light source, fluorescent, with a fixture-integrated occupancy sensor to increase light levels to maximum only when necessary. The use of a broad-spectrum, white light source (4100K) may allow for reductions to the overall demand size (watts) of the luminaire, in addition to the savings from the fixture-integrated controls, when compared to some HID sources.

Installation is identical to other deck-mounted canopy luminaires, and replacement scenarios generally are one-to-one in retrofit applications. Equipment costs may be up to 20% higher than the same canopy fixture without bi-level controls, but this cost may be offset by utility rebates. Many California utilities offer one-time incentives ranging from 5 to 15 cents per kWh saved, plus up to \$100 per kW reduced as compared to incumbent technologies or state energy

FIGURE 1: BI-LEVEL FLUORESCENT PARKING GARAGE LUMINAIRE
Parking Garage 22, University of California, Santa Barbara



regulations. Additionally, some utilities offer rebates of up to \$25 per fixture. For more information on incentives and rebates, check with your local utility or www.fypower.org.

Demonstration Results

University of California, Santa Barbara

UC Santa Barbara, in partnership with the California Lighting Technology Center (CLTC), UC Davis, and PIER, retrofitted 30 existing fluorescent parking garage fixtures on the third floor of Parking Garage 22 with Philips Day-Brite Vaporlume bi-level fixtures. The new luminaires include step-dimming ballasts and integrated occupancy sensors that switch between high and low light levels based on garage occupancy. Incumbent fixtures consumed 58 W each. The new fixtures consume 54 W in high mode and 32 W in low mode. Perimeter units are connected to a photocell and operate only from dusk until dawn. Table 1 shows an energy consumption comparison between the two fluorescent fixtures. The pre-retrofit fluorescent luminaire consumed the same amount of energy throughout the night because it stayed on at the same light level. The bi-level retrofit luminaire consumes less energy throughout the night as garage activity slows.

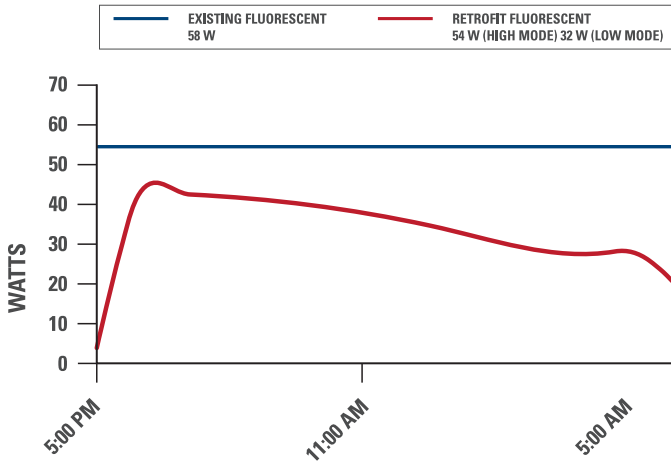
Light level monitoring of the new fluorescent luminaires found they operated in low mode on average 35% of the time, resulting in 20% energy savings.

Product Availability

Philips Day-Brite offers the Vaporlume luminaire at www.daybritelighting.com. Columbia Lighting and Lithonia Lighting also offer bi-level fluorescent luminaires appropriate for garage applications.

TABLE 1: ENERGY CONSUMPTION, STANDARD VS. BI-LEVEL T8 LIGHTING

Average hourly energy consumption per fixture,
Parking Garage 22, UC Santa Barbara



What's Next

CLTC continues demonstrations of energy-efficient bi-level lighting and controls technologies that use a wide range of sources and applications, and is seeking new sites and partners as part of the PIER program. To date, more than 100 installations have been completed. Contact CLTC for more information.

Collaborators

The UCSB bi-level fluorescent parking garage luminaire demonstration is a collaboration between Day-Brite, UCSB, CLTC, and PIER.

**FIGURE 2: PARKING GARAGE 22
UNIVERSITY OF CALIFORNIA, SANTA BARBARA**



For More Information

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- More information on bi-level fluorescent parking garage luminaires is available at cltc.ucdavis.edu/content/view/806/406
- More information on demonstrations is available at www.pierpartnershipdemonstrations.com
- Reports on the bi-level induction parking garage luminaires project are available at www.energy.ca.gov/research/reports_pubs.html

TABLE 2: ENERGY AND MAINTENANCE COST AND SAVINGS

30 demonstration luminaires at UC Santa Barbara

TECHNOLOGY	SYSTEM SIZE (WATTS)	ANNUAL ENERGY CONSUMPTION (KWH)	ANNUAL ENERGY COST	ANNUAL MAINTENANCE COST	TOTAL ANNUAL COST	LIFECYCLE ENERGY COST	LIFECYCLE MAINTENANCE COST	TOTAL LIFECYCLE COST
STANDARD FLUORESCENT	58	12,959	\$1,659	\$316	\$1,975	\$33,174	\$7,898	\$41,071
BI-LEVEL FLUORESCENT	54	10,014	\$1,282	\$316	\$1,598	\$25,636	\$7,898	\$33,533
SAVINGS		2,945	\$377		\$377	\$7,538		\$7,538

Average annual hours of use: 7,230
Energy cost: \$0.128/kWh

Cost of labor: \$100/hour
Occupancy: 65%

Time to replace lamp: 0.5 hrs
Lamp cost: \$2.65

About PIER

This project was conducted 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.

Jerry Brown, Governor
California Energy Commission

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