Bi-level LED Bollards

The Problem

Bollards provide pedestrians localized lighting in walkway and grounds applications and serve as visual anchors to the surrounding area. While bollards often are necessary for security and wayfinding, the areas they serve often are vacant for much of the night. During unoccupied hours, energy is wasted on a fully illuminated space that actually requires significantly reduced lighting.

The Solution

The PIER Program sponsored development of the bi-level LED bollard, an innovative technology designed to combat the energy wasted on overlighting unoccupied urban spaces. To successfully reduce energy consumption and provide dynamic light levels to the surrounding environment, project partners selected long-life light emitting diodes (LED) and fixture-integrated occupancy sensors to create a unique bi-level bollard. This combination delivers long life, low-energy consumption, and dynamic light output based on occupancy. It operates at 50% of full output during vacant night hours and 100% only when pedestrians are present in the area. When spaces are vacant, the bollard intelligently reduces light levels. The product highlighted in this case study is the Gardco 830 series LED Bollard with Demand Response.

Features and Benefits

- Bi-level light output based on occupancy
- Instant increase to full light output, decrease to low light level
- Long-life light source reduces operating and maintenance costs
- Rugged design and vandal resistant
- Aluminum base, concrete base, or head-only assembly

Technology Costs and Incentives

Savings are achieved by combining broad-spectrum sources such as LEDs with fixture-integrated microwave occupancy sensors to increase light levels only when needed. The use of a broad-spectrum, white-light source may allow for reductions to the overall demand size (watts) of the luminaire, in addition to savings from fixture-integrated controls.

FIGURE 1: BI-LEVEL LED BOLLARD
Gardco 830 series LED Bollard with Demand Response

In retrofit applications, bi-level LED bollards generally achieve 50–85% savings over most incumbent HID or fluorescent sources.

Installation is identical to other typical bollard-style luminaires, and replacement scenarios are generally one-to-one in retrofit applications. Equipment costs may be up to 50% higher than common lighted bollards, but this cost may be offset by maintenance savings and utility rebates. Many California utilities offer one-time incentives ranging from 5–24 cents per kWh saved, plus up to $100 per kW reduced, as compared to incumbent technologies or state energy regulations. More information on incentives and rebates may be found at www.fypower.org.

Demonstration Results

Arcade Creek Recreation and Park District

The Arcade Creek Recreation and Park District, in partnership with the Sacramento Municipal Utility District (SMUD) and the PIER Program, installed 15 new 834 series LED Bollards with Demand Response technology at the Arcade Creek Park, a neighborhood park in Sacramento, CA.

FIGURE 2: PRE-RETROFIT
Arcade Creek Park, Sacramento, CA

FIGURE 3: POST-RETROFIT LIGHTING
Arcade Creek Park, Sacramento, CA

The bollards highlight two pathways: one leading to the park's basketball courts, the other winding through the park's multiuse fields. The bollards provide localized pathway lighting and supplement general area lighting in these areas.

The new luminaires operate from dusk until 10 p.m. The facility chose to keep the factory default occupancy sensor setting of zero, which means the luminaires dim immediately after motion is no longer detected. In low mode, each bollard consumes just 8 W of power, and at high mode only 40 W. Compared to traditional sources for this type of application, the bi-level LED bollard can deliver up to 83% energy savings.

Table 1 shows a typical daily load profile for the bollards at Arcade Creek Park. Occupancy was infrequent and bollards operated in low mode about 85% of the time.

TABLE 1: DAILY LOAD PROFILE
Arcade Creek Park, Sacramento, CA

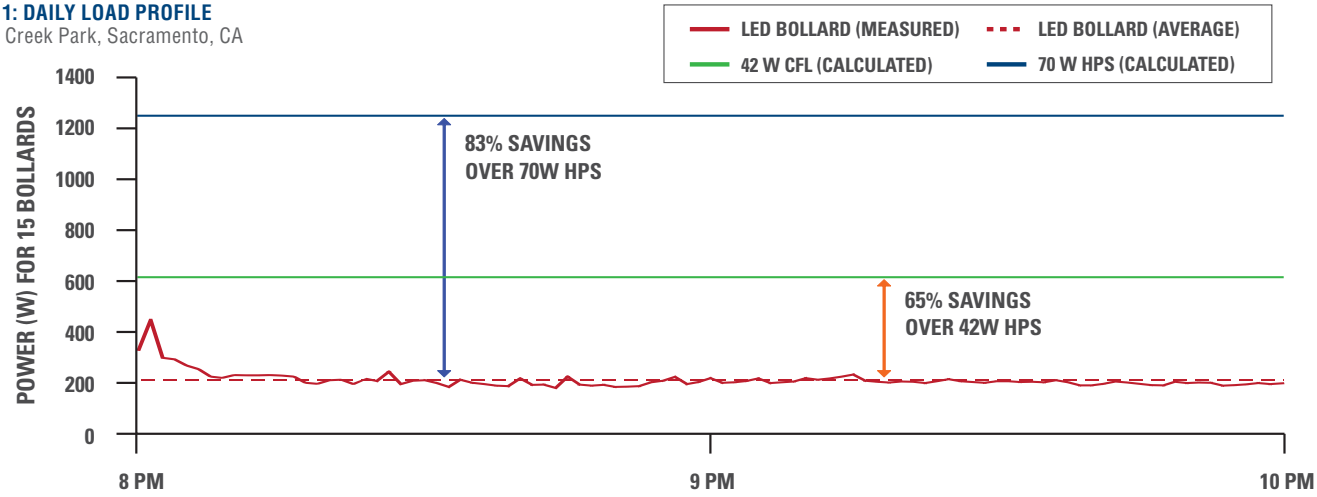
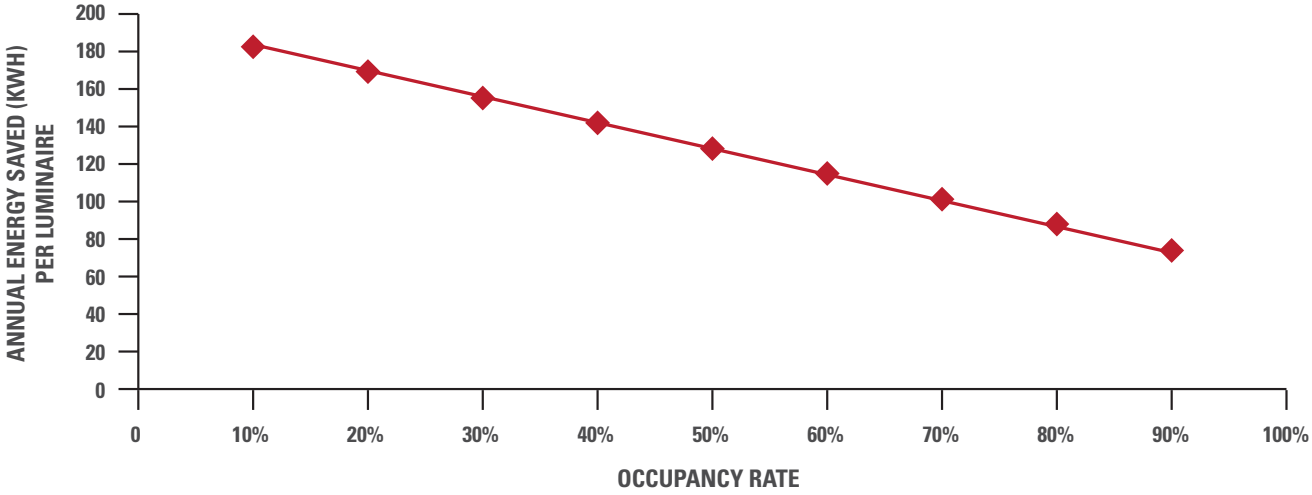


TABLE 2: ENERGY SAVINGS BASED ON WALKWAY OCCUPANCY RATE



California Department of Public Health

The PIER Program partnered with the California Department of Public Health (CDPH) to replace 18 CFL bollards with nine bi-level LED bollards along CDPH auditorium walkways in Richmond. Lighting renovations consisted of a two-to-one replacement of existing luminaires with new LED luminaires.

Post-retrofit monitoring conducted over a five-week period yielded a 10% pathway occupancy rate. At this rate, the LED bollards consumed 78% less energy than the original luminaires, while providing the same average light levels. In addition, lamp lifetime increased from 10,000 hours to 70,000 hours, resulting in reduced maintenance costs.

The simple payback period was long because of the small volume of this retrofit. However, if the bollards were ordered in larger volume and as the technology grows cheaper, simple paybacks will fall in line with conventional technologies.

Product Availability

Gardco Lighting offers the 830 Series LED bollard featuring Demand Response in a variety of styles. More information may be found at www.sitelighting.com.

Additional manufacturers offer options for bi-level LED bollards. More information about BetaLED bollards may be found at www.betaled.com; more information about Hydrel bollards may be found at www.hydrel.com.

What's next

CLTC continues demonstrations of smart exterior luminaires as part of the State Partnership in Energy Efficiency Demonstrations (SPEED) Program. In addition to bi-level bollards, the program includes bi-level wall packs and parking lot and area luminaires.

Collaborators

The Arcade Creek Park demonstration was a collaboration between CLTC, the Arcade Creek Park District, and Gardco Lighting.

The CDPH bollard demonstration was a collaboration between CLTC, DGS, and Gardco Lighting.

For More Information

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- More information on bi-level LED bollards is available at cltc.ucdavis.edu/content/view/667/353
- More information on PIER demonstrations is available at www.pierpartnershipdemonstrations.com.

FIGURE 4: POST-RETROFIT LIGHTING
California Department of Public Health, Richmond, CA

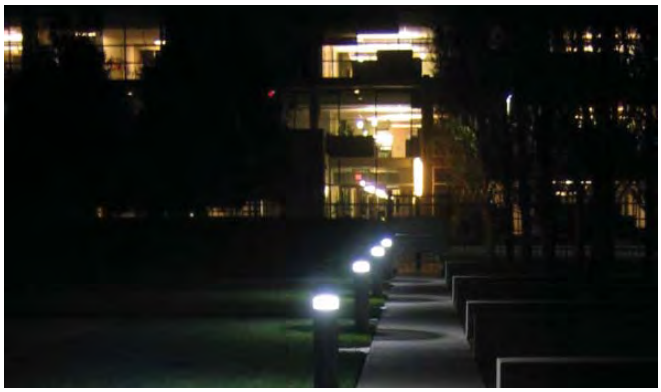

TABLE 3: ENERGY AND MAINTENANCE COST AND SAVINGS

TECHNOLOGY	ANNUAL ENERGY CONSUMPTION (kWh)	ANNUAL ENERGY COST	ANNUAL MAINTENANCE COST	TOTAL ANNUAL COST	LIFECYCLE ENERGY COST	LIFECYCLE MAINTENANCE COST	TOTAL LIFECYCLE COST
CFL	113.88	$14.58	$5.47	$20.05	$166.40	$62.50	$228.90
LED	49.49	$6.34	$0.00	$6.34	$72.32	$0.00	$72.32
SAVINGS	64.39	$8.24	$5.47	$13.71	$94.08	$62.50	$156.58

Years of use: 11 Annual hours of use: 4380 Cost of Labor: $50/hour Time to replace lamp: 0.25 hrs Energy Cost: $0.128/kWh Occupancy: 10%

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.

Arnold Schwarzenegger, *Governor*

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

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