Hybrid Fixture Lights up the Night

The Problem

Many exterior entry and walkway lights in residential and commercial locations use incandescent lamps, because they are small and inexpensive. However, these lights tend to burn all night long, and their inefficiency leads to high energy use. The lights also burn out quickly, which compromises security until the lamps are replaced. Compact fluorescent lamps (CFLs) are more efficient and last longer, but cost more and can be difficult to fit into existing fixtures.

The Solution

A hybrid light-emitting diode (LED)/incandescent fixture with an integrated occupancy sensor (Figure 1) addresses both energy and security concerns. A 5-watt amber LED runs continuously during the night; the occupancy sensor turns on the incandescent lamp only when motion is detected, flooding the area with warm, bright light. After a few minutes, the occupancy sensor turns off the incandescent lamp, while the LED array continues to run. Developed by the California Lighting Technology Center with funding from the California Energy Commission's Public Interest Energy Research (PIER) program, the fixture is now available as a product from Shaper Lighting.

Features and Benefits

The hybrid fixture provides efficient, low-maintenance, high-quality lighting.

Figure 1: Hybrid LED/incandescent outdoor fixture

In this hybrid fixture, a 5-watt light-emitting diode (LED) array burns continuously and a 75-watt incandescent lamp turns on at a signal from an occupancy sensor.

Table 1: Hybrid lighting cuts costs

The hybrid LED/incandescent fixture saves on both energy and maintenance costs. The calculation for the hybrid fixture assumes that although the LED array is on all night, both lights are only operating at the same time for 1 hour per night.

	Standard incandescent fixture	Standard CFL fixture	Hybrid LED/incandescent fixture
Full power (watts)	75	20	80
Reduced power (watts)	0	0	5
Hours per year spent at full power	3,650	3,650	365
Hours per year spent at reduced power	0	0	3,285
Energy use (kWh/y)	274	73	46
Energy cost ($/y)	27.40	7.30	4.56
Main bulb costs ($/y)	0.91	5.11	0.09
Total cost ($/y)	28.31	12.41	4.65
Savings over incandescent fixture ($/y)	NA	15.90	23.66

Note: CFL = compact fluorescent lamp; kWh = kilowatt-hours; LED = light-emitting diode; y = year.

Assumptions: energy costs = $0.10/kWh; operation time = 10 hours per night; incandescent bulb life = 1,000 hours; bulb cost = $0.25; CFL bulb life = 10,000 hours; bulb cost = $14.00; and no LED replacement costs for 13 years.

Energy use. The LED/incandescent lamp combination uses less energy than standard incandescent or CFL fixtures (Table 1). The LED array is rated at 5 watts; the incandescent lamp is rated at 75 watts. Energy savings will depend on usage patterns. For example, in a 10-hour nighttime period, if the incandescent lamp burned for one hour and the LED burned continuously, the total energy use would be 125 watt-hours.

Maintenance. The LED source has an expected life of 50,000 hours—that's more than 13 years at 10 hours on per night. The incandescent lamp has a much shorter life, on the order of 1,000 hours, but reduced on-time means that it can go a long time without burning out—almost three years at 1 hour on per night.

Brightness. The LEDs provide sufficient light to identify the surroundings, and the incandescent lamp provides the same light level as a typical outdoor fixture.

The product offers several other benefits as well. By providing a pleasant, ambient LED background light, the fixture ensures that there is always light in the coverage area. That feature eliminates dark spots—the "all-or-nothing effect" commonly associated with motion-sensor systems. In addition, when the

incandescent lamp burns out, the LEDs will still provide functional light until the incandescent bulb can be replaced. And, with the main light of the fixture directed downwards, there is little or no light pollution.

Applications

This product is aimed at entryway and walkway lighting for office buildings, hospitals, apartment complexes, residential housing, universities, parks, and hotels and motels. It is also targeted at porch lights that use the popular yellow "bug lights" (Figure 2). Those lights are very close in color to amber LEDs, which are among the least expensive, brightest, and most efficient of the LEDs currently on the market.

California Codes and Standards

The use of high-efficiency amber LEDs will enable hybrid fixtures to meet the California Energy Commission's new 2z005 Title 24 outdoor lighting requirements.

What's Next

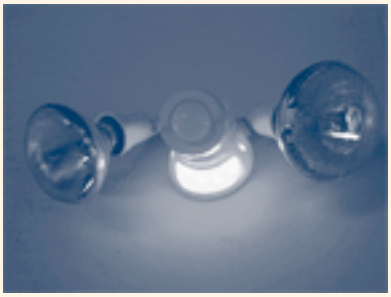
Field demonstrations of the hybrid fixture will be conducted at an apartment complex, in cooperation with the Sacramento Municipal Utility District. Researchers will monitor energy use before and after 50 units are installed.

Figure 2: Hybrid porch light

The amber LED in the hybrid fixture is a good match for popular yellow "bug lights" used on many porches.

Figure 3: Hybrid security light

A new hybrid security light will feature two flood lamps, an occupancy sensor, and an LED.



In addition, the hybrid fixtures will be installed at the Grand Canyon and Yosemite National Parks, where both efficiency and light pollution are concerns.

A second manufacturer, Watt Stopper, plans to apply the hybrid concept to a security light (see Figure 3). The product, expected to be available in 2005, will feature two flood lamps, an occupancy sensor, and an LED that operates all night long.

Collaborators

The organizations involved in this project include Shaper Lighting, Watt Stopper, the California Lighting Technology Center, and the Sacramento Municipal Utility District.

For More Information

Reports documenting this project and providing more details may be downloaded from www.energy.ca.gov/pier/buildings/projects/500-01-041-0-2-2_1.html and www.archenergy.com/lrp/products/ledhybrid.htm.

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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.

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