LED Hybrid Porch Light Cuts Energy, Maintenance Costs

The Problem

Many outdoor areas, such as porches and walkways, are illuminated for unnecessarily long hours. This can enhance security, but significant amounts of energy are wasted to keep a fixture's compact fluorescent lamps (CFLs) or incandescent lamps burning. Also, because the lamps are on for long periods, they will burn out more quickly, which compromises security until the lamps are replaced.

The Solution

A hybrid fixture featuring light-emitting diodes (LEDs) and either an incandescent lamp or a CFL, and integrated with an occupancy sensor (**Figure 1**), addresses both energy and security concerns. The design features a low-wattage, high-brightness LED that runs continuously during the night. The occupancy sensor turns on the main CFL or incandescent lamp only when motion is detected, flooding the area with warm, bright light—enough to light a path or allow a person to unlock a front door. After a few minutes, the occupancy sensor turns off the incandescent lamp, while the LED array continues to run. The concept was developed by the California Lighting Technology Center and its manufacturing partners, with funding from the California Energy Commission's Public Interest Energy Research Program. One of those partners—Watt Stopper/Legrand, a major controls manufacturer—is introducing a product based on the design and also offers an occupancy sensor/LED module that embodies the concept and is available for licensing by fixture manufacturers for incorporation into commercial products.

Features and Benefits

The porch light features a passive infrared motion detector and a photosensor. It uses incandescent lamps of up to 60 watts or CFLs of up to 26 watts, and three LEDs that draw a total of 0.11 watts. In operation, the full light turns on when motion is detected in the vicinity and little or no daylight is present. The main light stays on as long as the sensor continues to detect motion and the preset time delay (adjustable from 15 seconds to 30 minutes) has not expired. The lamp will not turn on if there is ample daylight. At night the LEDs shine continuously to provide safety and security. The LEDs provide sufficient light to identify the surroundings, and the incandescent lamps or CFLs provide the same light level as a conventional outdoor fixture.

Figure 1: Hybrid outdoor fixture

This hybrid lighting fixture features an occupancy sensor/LED module. The main light source can be either a CFL (shown here) or an incandescent bulb. The LED provides low-power, continuous nighttime illumination.

Notes: LED = light-emitting diode; CFL = compact fluorescent lamp.

The benefits provided by the hybrid porch light include the following.

Reduced energy use. The hybrid fixture will use significantly less energy than comparable fixtures without the sensing capabilities. The amount of savings depends on the wattages of the lamps used and on the usage patterns of both the standard and hybrid fixtures. Sacramento Municipal Utility District monitored an early version of a hybrid fixture in a town house and found that the main lamp was on for only about 30 minutes per night. Even if it is activated for a full hour per night, the hybrid device uses about 5 percent of the energy that a conventional incandescent fixture uses (**Table 1**).

Reduced maintenance. An installation of more than 65 units of an earlier version of the product showed decreased maintenance costs due to reduced on-time of the incandescent and CFL sources. The LED source has an expected life of 50,000 hours—that's more than 13 years at 10 hours of on-time per night. An 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 one hour on per night. A CFL with a life of 10,000 hours could last

Table 1: Hybrid system cuts energy costs

A hybrid LED/CFL fixture will use less than 5 percent of the energy of an incandescent fixture that burns all night and about 10 percent of the energy of a CFL fixture. This analysis assumes that the hybrid system is on for one hour per night and that the standard fixture is on for ten hours per night.

	Fixture		
	Standard incandescent	Standard CFL	Hybrid LED/CFL
Full power (watts)	60.00	26.00	26.00
Reduced power (watts)	0	0	0.11
Hours/year at full power	3,650	3,650	365
Hours/year at reduced power	0	0	3,285
Energy use (kWh/year)	219.00	94.90	9.85
Energy cost ($/year)	21.90	9.49	0.99
Energy cost savings ($/year)	NA	12.41	20.91

Notes: kWh = kilowatt-hours; LED = light-emitting diode; NA = not applicable; CFL = compact fluorescent lamp.

more than 25 years at one hour of operation per night, but that number could be considerably shorter if it is installed in an application where on/off switching is frequent.

No more dark spots or dark times. The LEDs, which provide a steady, pleasant ambient background light, ensure 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 main lamp burns out, the LEDs will still provide functional light until the main lamp can be replaced.

Applications

The hybrid porch fixture can be used for entry and walkway lighting at office buildings, hospitals, apartment complexes, residential housing, universities, hotels, and motels.

California Codes and Standards

The hybrid porch light will meet California's Title 24 standards for outdoor lighting, which require either high-efficacy lighting or occupancy sensor-based control.

What's Next

Prototype porch lights will be tested by Sacramento Municipal Utility District. In addition to producing a porch light fixture, Watt Stopper is looking to work with fixture manufacturers in two ways: by licensing the technology to fixture manufacturers and by supplying manufacturers with the control modules.

Collaborators

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

For More Information

For more information on this project, please contact the California Energy Commission researcher listed below.

More PIER Technical Briefs can be found at www.energy.ca.gov/research/techbriefs.html.

For more information on this product and other lighting research activities, please visit the Lighting Portal at http://thelightingportal.ucdavis.edu/index.php.

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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.

Arnold Schwarzenegger, *Governor*

California Energy Commission

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