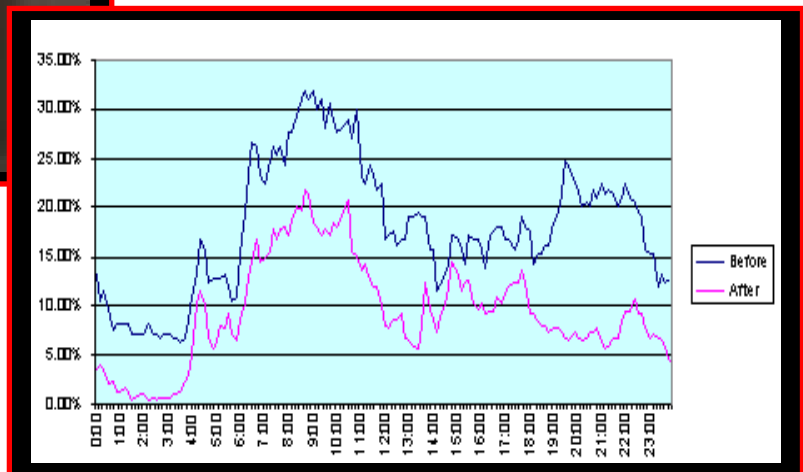
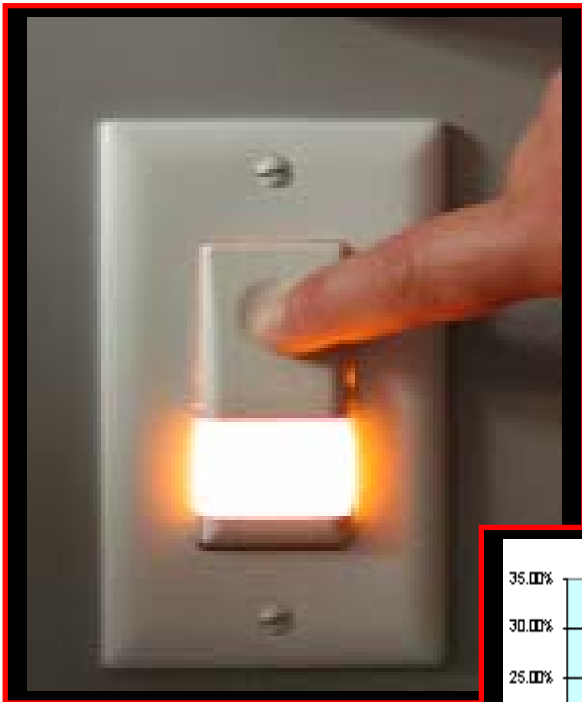


*Customer Advanced Technologies Program*

***Light Emitting Diode (LED)  
Lighting Control Systems***



Prepared by

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Customer Advanced Technologies Program  
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### **About the Customer Advanced Technologies Program**

SMUD's Customer Advanced Technologies (C.A.T.) program works with customers to encourage the use of and evaluate new or underutilized technologies. The program provides funding for customers in exchange for monitoring rights. Completed demonstration projects include lighting technologies, light emitting diodes (LEDs), residential building shell construction, geothermal heat pumps, indirect/direct evaporative cooling, non-chemical water treatment systems and a wide variety of other technologies.

For more program information, please visit: <http://www.smud.org/community/cat/>

**Note: SMUD does not endorse products or manufacturers. Mention of any particular product or manufacturer in this report should not be construed as an implied endorsement.**

## ***Introduction***

Have you ever done this? You're on vacation or a business trip, and have just checked into your hotel room. You turn on every light in the room, change into your bathing suit, and then head off to the pool. Later that night, because you are in unfamiliar surroundings, you leave the bathroom light on to provide a nightlight.

Those of you who said "yes" are not alone. A recent study by Berkeley National Labs shows that many hotel guests do the same thing. Although hotel operators have known this for years, they have been very reluctant to use lighting controls due to concerns about the comfort of their guests. The last thing they want is to leave their guests in the dark. Fortunately, Berkeley researchers and The Watt Stopper® Inc. have developed an innovative solution: a wall-mounted occupancy sensor with a built-in nightlight. The sensor was named the WN-100 Motion Sensor Nightlight.

Last December, the DoubleTree Hotel in Sacramento installed over 400 of these sensors in its guestrooms. The project generated considerable media interest and was featured in local television news coverage and in a national energy trade magazine. What's all the excitement about? Read on.

## ***Technology Description***

Occupancy sensors and LEDs are nothing new; both have been around for over two decades. However, sometimes, fresh ideas come from combining existing technologies into a new package. Simply put: the WN-100 is a wall-mounted occupancy sensor with a built-in LED nightlight.

The nightlight is WN-100's most unique feature. Its sole purpose is to provide a nightlight for guests. When you first see the LED, it does not appear to be bright enough to accomplish this task. However, once your eyes have adjusted, the LED provides enough illumination to successfully navigate in the room.



Source: The Watt Stopper, Inc.

Like most sensors, the WN-100 features a time delay that can be adjusted from 15 minutes to two hours. Conventional wisdom suggests that the time delay for occupancy sensors should be set for 15 minutes to maximize energy savings. However, this setting doesn't work well for hotel guestrooms.

In the hotel industry, reputation and guest comfort are paramount. Needless to say, having the lights turn off while a guest is in the shower is bad for business. For this reason, the time delay settings in the DoubleTree hotel project were set for one hour. The results? A **fifty percent (50%)** reduction in lighting energy consumption!

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## Customer Advanced Technologies Showcase Project

**Project:** DoubleTree Hotel  
2001 Point West Way  
Sacramento, CA 95815

**Background:** Research funded through the California Energy Commission's Public Interest Energy Research (PIER) Program confirmed what many hotel operators already knew: Many guests leave the lights on when they leave the room and use the bathroom lights as a nightlight. Berkeley researchers formed a partnership with The Watt Stopper, Inc to develop an innovative solution: a wall-mounted, occupancy sensor with a built-in LED nightlight. Once the sensor was lab tested and approved by Underwriters Laboratory (UL), the sensors were ready for field-testing.

**Project Description:** The DoubleTree Hotel was chosen as the test site. The demonstration project included the installation of over 400 sensors. The sensors were purchased by SMUD and installed by DoubleTree staff. LBNL researchers conducted pre-and post-monitoring for a period of six months.

**Results:** The new lighting controls reduced energy consumption by over fifty percent! For more details, please refer to the graphs on the following pages of this report.



- Estimated total project cost (including labor): \$20,000
- Customer Advanced Technologies Program grant = \$13,500
- Estimated annual energy savings = 66,500 kWh
- Estimated annual cost savings = \$8,000
- Simple payback = 2.5 years

**Comments:** *"In addition to the energy savings, we are experiencing some additional benefits such as reduced lamp replacement, which is providing us cost savings for material and labor as well as the elimination of guest complaints for burnt out lamps in the bathrooms. Instead this product is being well received by our customers who are providing us positive feedback on our guest comment cards."*

- Bob Hughes, Regional Director of Operations, DoubleTree Hotels

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### Sometimes, Pioneers Take the Arrows...

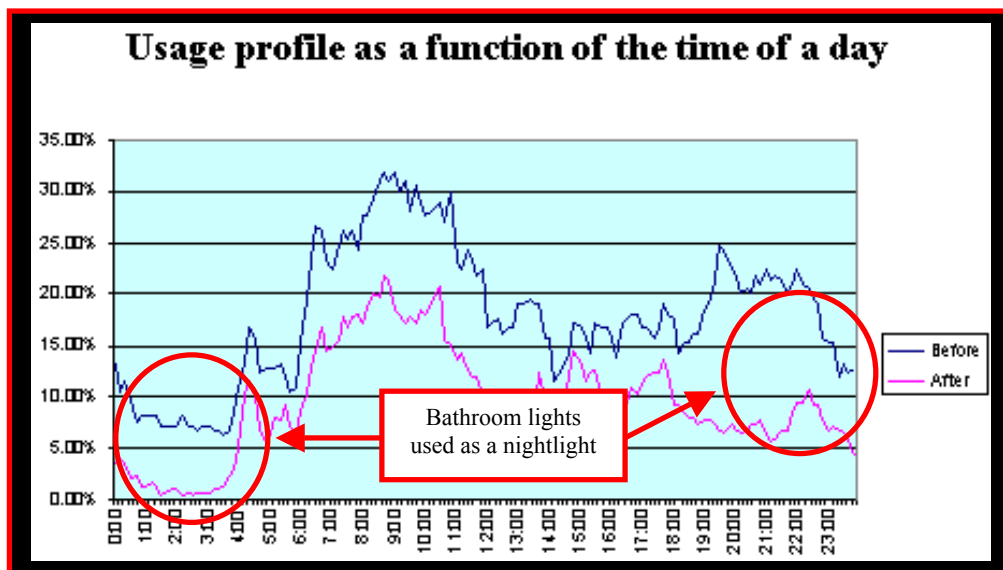
Although the DoubleTree project was an overwhelming success, participants encountered a few bumps in the road.

The 400 sensors used in this demonstration project were part of a 'pre-production' run. Consequently, when DoubleTree staff member Uwe Burkart installed the first couple of sensors, he discovered a minor manufacturing flaw. The screw hole for the cover plate was slightly misaligned (less than 1/32 of an inch). Unfortunately, this caused the switch to bind on the cover.

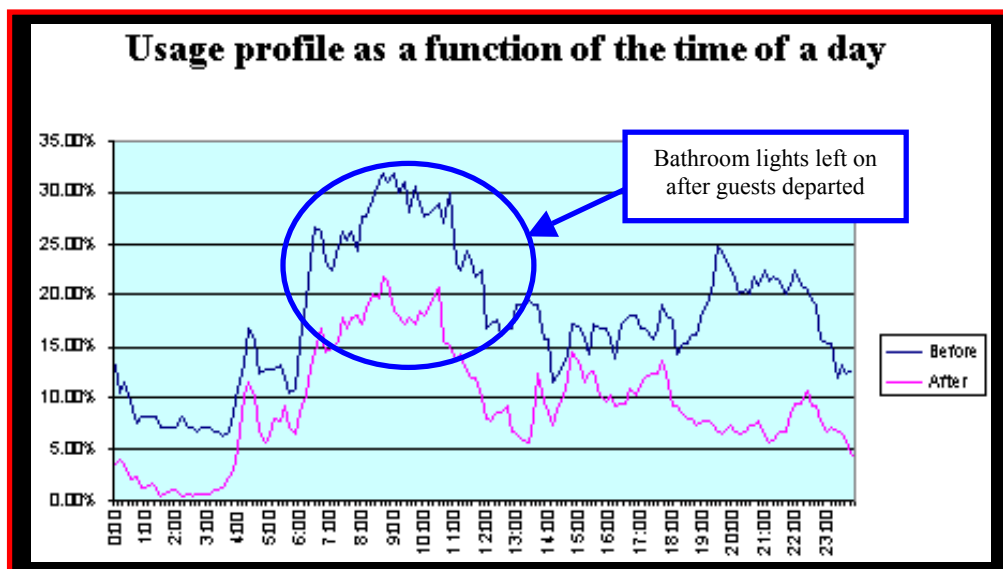
In order for the sensors to work properly, Mr. Burkart had to file *over 400 cover plates by hand*. Fortunately, this problem was discovered and corrected before full production.

## Key Observations

Berkeley Labs monitored 15 rooms before and after the sensors were installed. The graphs below reflect the lighting usage habits of the hotel guests. As expected, some of the occupants were in fact using the bathroom light as a nightlight. However, the real surprise was the amount of savings between the hours of 6:00 a.m. and 2:00 p.m. (14:00). Apparently several guests left the bathroom lights on when they departed.



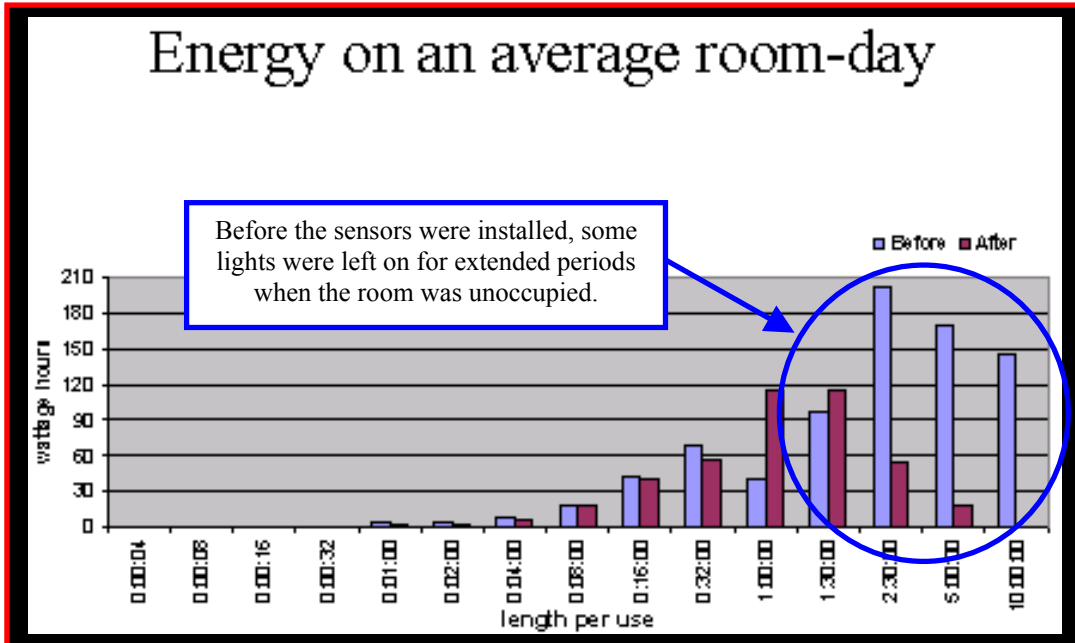
Source: Lawrence Berkeley National Labs



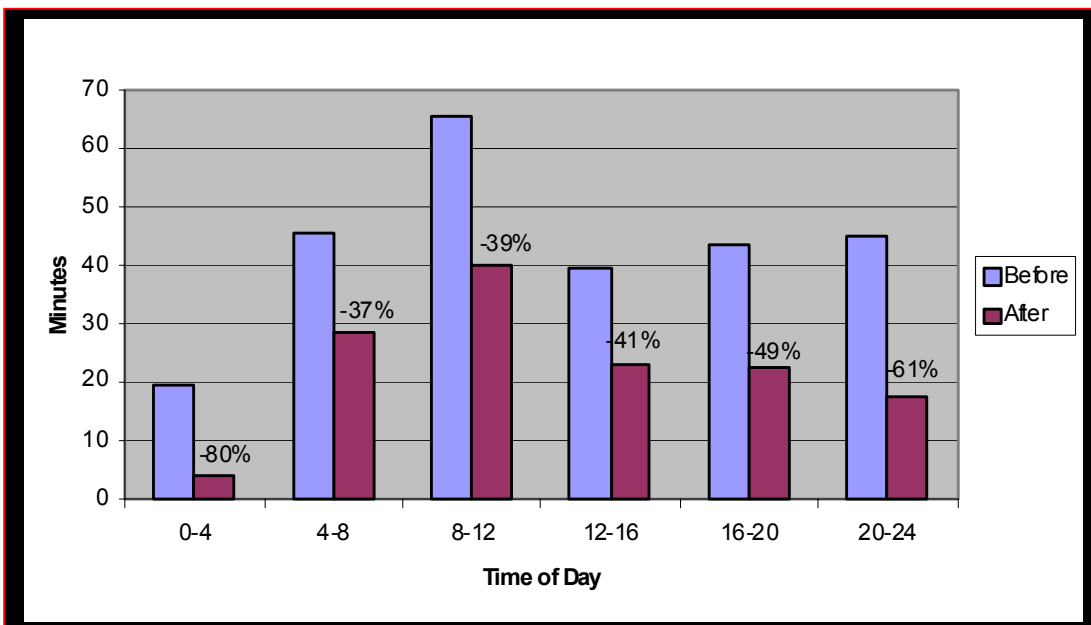
Source: Lawrence Berkeley National Labs

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The graph below shows the duration (hours) the bathroom lights were used and the corresponding energy consumption. Note the differences between the pre-and post monitoring periods. Before the sensors were installed, some lights remained on for up to ten hours when the room was unoccupied!



As shown below, the sensors reduced lighting energy consumption throughout the day. On average, the sensors reduced overall energy consumption by 50%.



Source: Lawrence Berkeley National Labs

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## Conclusions

### Potential Benefits

Using this technology in hotel guestrooms has significant energy savings potential. This has been verified through end-use monitoring. However, there may also be additional benefits that are much more difficult to quantify:

- **Improved guest comfort:** When asked about the sensors, some guests said that the nightlight made them feel safer and more secure.
- **Improved safety:** Research has shown that the human eye requires time to adjust to different illumination levels. Consequently, when people first turn on the lights in a dark room, their vision is impaired. According to guests, the LED sensors provided enough light to safely navigate through the room.
- **Reduced maintenance costs:** In this study, the sensors reduced lighting usage by an average of 50%. Therefore, the lamps in the bathroom fixtures should last up to 50% longer. Also, unlike incandescent nightlights, LEDs will last up to 100,000 hours.

“This project illustrates the importance of introducing a lighting controls technology that reduces or eliminates any potential for customer complaint or problems associated with reduced light levels.

The key to the success of this project was working cooperatively with the industry, utility and end user via a partnership approach. All of the partners brought unique skills and interests to the table and all share value in its success.”

- Michael Siminovitch, PHD  
Lawrence Berkeley National Labs

### Challenges

Presently, major challenges for this technology appear to be:

- **Relatively high first cost:** Since the WN100 is a commercial grade sensor, it carries a relatively high price tag of \$38. Although this may be comparable with other commercial products, residential grade, wall-mounted, passive-infrared sensors typically range from \$15 to \$30. Hopefully, increased production levels and competing products will lower prices for all consumers.
- **Market acceptance:** As mentioned earlier in this report, guest comfort and reputation are paramount in the hotel industry. Because of this, hotel operators have historically been opposed to using any type of sensors in guestrooms.

### Technology Transfer and Recommendations

This technology shows great potential for the hotel industry. There may also be significant potential for residential new construction, military housing, senior housing and convalescent homes. The Customer Advanced Technologies program is currently seeking candidates to implement demonstration projects for these sectors.

In the meantime, since Berkeley Labs monitoring data clearly shows that this technology saves energy throughout the day, electric utilities should include this technology in their mainstream energy efficiency incentive programs.

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