

# The Road Ahead

An in-depth survey of more than 200 California cities reveals the direction that streetlight upgrades will likely take in that state

BY KELLY CUNNINGHAM AND MICHAEL SIMINOVITCH

**U**pgrade now or upgrade later? When it comes to street lighting, that is the question facing cities and utilities today. For decades, high-pressure sodium (HPS) lamps were the simple, most cost-effective choice. Now cities and utilities have the power—and the responsibility—of choosing among new light sources and advanced controls that drastically reduce energy use and electricity costs. The issue is a particularly pressing one in California, where legislation, including Assembly Bill 1109, is an impetus to reduce energy consumption and recession shortfalls have cities digging deep for ways to cut costs. Surprisingly little information on the state's street lighting is publicly available, so the California Lighting

Technology Center, part of the University of California, Davis, partnered with Chevron Energy Solutions to map out a clearer picture of the state's street lighting infrastructure. After gathering survey data from 212 cities on 1.1 million streetlights, researchers at the California Lighting Technology Center (CLTC) discovered a state ready to embark on upgrades but just beginning the journey. What follows are the key topics and findings from the survey.

**Technology.** The survey posed nine targeted questions to municipal staff regarding cities' goals for energy efficiency, as well as the number and type of streetlights within each city. Although 74 percent of the cities that responded to the survey rated energy efficiency as a

"high" or "very high" priority, more than 76 percent of those cities' streetlights still use HPS lamps. LED and induction sources are twice as energy-efficient as HPS, but only 2 percent of streetlights use LED sources and just 3 percent use induction lights, according to the survey. Solid-state light sources also pair well with advanced lighting controls, which trim energy use by another 40 percent. The prevalence of old technology reveals the potential of retrofits to increase energy savings across the state.

**Ownership.** The CLTC survey found that most cities own some, but not all, of the streetlights within their city limits. Cities reported that 32 percent of their streetlights are utility-owned and utility-maintained;



Photos: Rudol Lighting—a Cree company

Despite these LED applications in Pittsburg (left) and Watsonville, LEDs still account for only 2 percent of California's streetlight sources.

approximately 5 percent were described as city-owned and third-party maintained; and close to 5 percent are reportedly city-owned and maintained by a utility. The majority of the streetlights, 54 percent, are city-owned and city-maintained. (Ownership and maintenance were not reported for roughly 5 percent.)

The survey revealed an interesting correlation: Cities with a higher proportion of city-owned, city-maintained streetlights are significantly more likely to invest in advanced street lighting technologies, indicating most street lighting is poised for change. During the Q&A portion of a post-survey webinar on the findings, participating cities urged utilities to accelerate the transformation of utility-owned lighting as well.

**Environmental impact.** CLTC researchers also found that having a climate action plan or similar sustainability initiative in place also made cities more likely to em-

brace retrofits. According to the California Energy Commission's 2009 *Integrated Energy Policy Report*, street lighting accounts for just 1 percent of California's total electricity consumption, but over time, efficiency improvements in street lighting can reduce carbon dioxide emissions by thousands of metric tons.

In addition to reducing energy use, and thus eliminating CO<sub>2</sub> emissions, directional light sources reduce sky glow to help preserve the dark sky aspect of natural habitats. This is particularly true with adaptive lighting solutions that use sensors and controls to automatically dim lights when streets are empty.

Some researchers and lighting designers, including James R. Benya, caution that the blue-rich light of many white LED designs can disrupt the circadian systems of humans and animals. Other experts say more research is needed on this topic, but tunable

light sources and those with reduced blue spectrum, full-cutoff optics and adaptive controls are technological solutions.

**Savings, controls and safety.** Street lighting can account for as much as 60 percent (or more) of a city government's electricity costs, and since advanced street lamps use half the energy of traditional HPS lamps, retrofits can have a significant effect on a city's bottom line. LED and induction lights are also longer-lasting and more durable, reducing maintenance costs (including materials and labor).

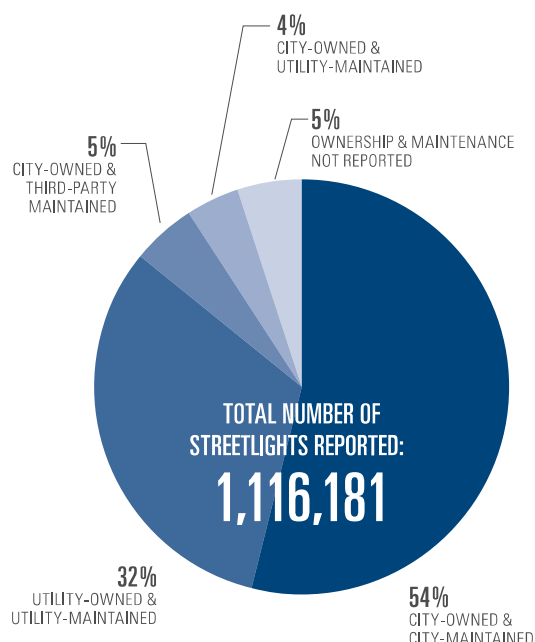
In 2009, Los Angeles undertook the world's largest LED street lighting retrofit project to date, with help from the Clinton Climate Initiative (CCI) Cities Program and rebates from the city's Department of Water & Power. Two years into the five-year project, a case study issued by the CCI found the project was ahead of schedule and actual results exceeded projected

## The California Story



# 76% HPS

A total of 852,000 of the streetlights surveyed still use high-pressure sodium lamps.





## Cities in Transition

Comments from some of the individual cities surveyed underscore California's focus on improving street light.

**Haywood, CA:** In addition to 70 new LED lights being installed by the end of August 2011, the city will be replacing 157 existing HPS lights with 510 new LED lights by the end of the 2012 calendar year.

**Ventura, CA:** The city is in the process of retrofitting all 500 city-owned lights from HPS to LED through a CEC grant. Replacements will be done during the course of the 2011-12 fiscal year.

**Redlands, CA:** Redlands is interested in funding for the conversion of the city streetlights from HPS to LED.

**Hermosa Beach, CA:** A representative of the city reported being interested in lighting controls and dimmable fixtures and would like to know about local cities using them for street lighting.

outcomes. With 51,035 of the 140,000 total streetlights replaced as of July 2011, Los Angeles had cut its annual energy use by 21,241 MWh, saving \$1.9 million annually and reducing emissions by 12,560 metric tons of CO<sub>2</sub>e annually, the equivalent of taking 9,000 cars off L.A.'s highways.

Incorporating lighting controls in a retrofit project further increases energy savings by 40 percent, by switching lights to low-power mode when streets are empty. Controls can also have a big impact on maintenance and other city resources by automatically reporting outages and malfunctions as soon as they happen, increasing service and repair efficiency, which, in turn, boosts public safety, too.

A recent case study in Glendale, AZ, found that Acuity Brands' Remote Operations Asset Management (ROAM) system

helped the city reduce system-wide outages and malfunctions from 20 to 3 percent. Citizen call volume also dropped from about 20 to three calls per day. ROAM pairs a smart photocontrol, capable of diagnosing lighting problems, with wireless technology to allow remote monitoring and management of outdoor street lighting systems.

Though not without some substantial up-front investment costs, street lighting retrofits start saving cities money immediately, and the long-term benefits clearly outweigh the initial costs. The American Recovery and Reinvestment Act of 2009 (ARRA) gave California city governments another compelling reason to move forward on streetlight pilot projects if not full-scale retrofits. ARRA funds fueled the California Energy Commission's Energy Efficient Conservation Block Grants program, which has

provided more than \$35 million in funding for energy upgrades to small city and county governments. Cities that participated in the CLTC survey also commented that utility rebates, usually based on kWh saved, were another help in financing upgrades.

Finally, two UK studies, conducted through the University of Cambridge's Institute of Criminology, estimated that the first-year financial savings from crime deterrence alone exceeded the costs of the lighting retrofits in those test areas. Advanced lighting technologies certainly offer improved light distribution and better color rendering than HPS sources, resulting in better visibility with fewer shadows. Facial recognition is also dramatically improved under white light, even from a distance, contributing to a heightened feeling of safety for end-users surveyed in numerous pilot demonstrations.

**Down the road.** CLTC researchers found that in addition to ownership and a commitment to environmental stewardship, cities that were able to take advantage of programs and incentives aimed at making the retrofit process easier or more affordable were also more likely to upgrade their street lighting. Cities are also looking to demonstrations as a way to test new systems before committing. Davis and Roseville are two such cities. Both opted for mock-ups and gathered feedback from residents before shifting to a new light source that would have such a visible difference in CCT and fixture style. As with the overwhelming

majority of such surveys, resident feedback was positive for the more advanced, whiter light sources (LEDs, in these cases).

City planners are now mainly left weighing the expected continued drop in LED prices and improvements in technology against the energy costs of putting off retrofits—a difficult trade-off to measure. Municipalities must also consider which products are right for their cities' needs. The task may not be simple, but with strategic planning and careful implementation, street lighting retrofit projects offer an attractive return on investment, for both current and future taxpayers. They

achieve other goals, too—energy savings, environmental benefits and city improvements—that constitute a lasting legacy. ■

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