

APPLICATIONS FOR SSL

Although SSL products overall cannot yet compete on a first-cost basis with their conventional counterparts, they are finding market success in an increasing number of applications, particularly when their directional output, long lifetime, controllability, and other unique features provide comparative benefits and attractive lifecycle returns. Some examples:

PARKING LOTS AND STRUCTURES



Even in CALiPER testing conducted back in late 2009 and early 2010, many LED parking-structure and wallpack fixtures already met or exceeded the light output and efficacy levels of their metal halide, high-pressure sodium, and induction counterparts, while also displaying more uniform light distribution. Evaluated on a lifecycle cost basis, SSL products can be competitive in parking lot applications because of their energy savings, directionality, controllability, aesthetic appeal, and maintenance savings. Nevertheless, selecting LED parking lot lighting products is a complex process. Specifiers must weigh such factors as installation geometry, local ordinances, and acquisition costs to determine the right solution for each location. Lighting levels also must be carefully considered. Many designers find LED systems can achieve satisfactory lighting levels with significantly fewer lumens than incumbent technology. To learn more, see [CALiPER reports](#) and [GATEWAY reports](#) on parking garage and parking lot installations, as well as the Better Buildings Alliance [High-Efficiency Parking Structure Lighting Specification](#).

STREETLIGHTS



Municipalities across the country are evaluating whether to replace their conventional streetlights with new LED streetlights. The main attractions—energy efficiency, durability, and long life—can add up to significant savings, not to mention cut down on greenhouse gas emissions and add to a city's "green" reputation. But

municipalities need to keep several things in mind when considering LED technology. First, there's still a wide range in performance among LED luminaires, and some don't live up to the manufacturers' claims. Second, LED lighting is not a "cut-and-paste" technology that can simply be substituted for existing lighting without taking its own special requirements into account. Due to differences in lumen output and distribution, it's difficult to find an exact match for existing HID luminaires – and often, those existing HID luminaires are not ideal. In response to the heightened interest in LED street lighting, DOE created the [Municipal Solid-State Street Lighting Consortium](#) to share technical information and experiences. See [Outdoor Lighting Resources](#) to learn more about using LED streetlights.

SCREW-BASED LAMPS



Despite a wide range in performance, top-quality LED replacements are emerging for some existing lamp types. The results of a 2010 CALiPER study of LED replacement lamps in retail stores found large disparities between high- and low-performing products, with most of the lamps failing to meet basic performance parameters for use as replacements for incandescent or halogen lamps, and with most retailers carrying at least some very low-quality products. But a follow-up study of LED replacement lamps purchased in November 2011 found that overall performance had improved a great deal, with higher lumen output and efficacy and better color rendering. In addition, there was a significant increase in performance per dollar, although the cost was still higher than incandescent lamps and CFLs. Despite the progress, though, some of these LED products would not make good replacements for conventional lamps. The L Prize 60W replacement competition winner, which hit retail shelves in the spring of 2012, consumes less than 10 watts to produce 910 lumens, is comparable to a 60W incandescent in color quality and light distribution, and has projected lumen maintenance of 99 percent at 25,000 hours. See [General Service LED Lamps](#) for more information.

TROFFERS



The U.S. commercial market is dominated by 2'x2' and 2'x4' troffers with fluorescent lamps. Because of their high performance and efficiency, those lamps are stiff competition for the many LED products on the market that are intended to replace them. Although LED linear replacement lamps have been improving steadily overall in terms of lumen output, their higher cost can prevent an acceptable payback, even when all other things are equal. But SSL manufacturers have started coming out with integral LED troffers, which compare much more favorably with fluorescent troffers and have paybacks as short as a few years for retrofit installations. Instead of merely replacing fluorescent components with LED components, many of these manufacturers have completely redesigned their luminaires to better harness SSL's full potential. See CALiPER reports on [LED Linear Lamps and Troffer Lighting](#) for more information.

RECESSED DOWNLIGHTS



Because of the directional nature of LEDs, recessed downlights were one of the earliest general-illumination applications where SSL could compete with incumbent technology. When CFL or other omnidirectional lamps are used in this type of fixture, more than half of the lamp's emitted lumens can be trapped in the luminaire. By contrast, LED downlights can achieve much higher efficacy by minimizing or even eliminating these losses. LED downlights are now widely available in a range of sizes and lumen packages, offering a viable alternative to incandescent and CFL products. There's substantial variation between LED downlights, though, and performance is often dependent on the specific application. While it's difficult to generalize, many currently available LED alternatives to conventional downlights feature high luminous efficacy and offer striking energy savings, while providing a similar – or even improved – quality of light. See the Technology Fact Sheet [Recessed LED Downlights](#) for more information.

REFRIGERATED DISPLAY CASE LIGHTING



The cold environment in enclosed display cases is optimal for LEDs, which improve in efficacy at lower temperatures – unlike their fluorescent counterparts, which become less efficient. LED refrigerated display case lighting also offers a number of other benefits. For example, the small size of the LED light sources allows for improved beam control and even illumination, and stray light and glare are reduced, allowing shoppers to focus on the merchandise. The inherent directionality of LEDs reduces internal losses, and light isn't wasted in non-uniform "hot spots." What's more, their wide dimming range allows for increased energy savings, and light output can be smoothly controlled by occupancy sensors for minimal customer distraction. Plus they have very low expected maintenance, due to the long life and durability of LEDs. DOE's Better Buildings Alliance has developed a [Refrigerated Display Case LED Lighting Performance Specification](#), which can deliver energy savings of 50 percent or more compared to a typical fluorescent display case lighting system.

ACCENT LIGHTING



Even at this relatively early stage in its development, it would be a mistake to assume that solid-state lighting is fit only for "no frills" applications where energy savings are given priority over lighting quality. In fact, a growing number of LED lighting products on the market are able to compete with conventional lighting for high-end applications where aesthetics are an important consideration, and some of these products may even be preferred because of the unique advantages of SSL. A half-dozen [GATEWAY reports](#), some of them dating back to 2010, chronicle the success SSL has had illuminating artwork in museums, a high-end hotel, and an office building. The most recent of these reports involves the Smithsonian American Art Museum in Washington, DC, where LED PAR 30, PAR 38, and MR 16 lamps displayed the artwork just as effectively as the incumbent products while saving energy and reducing cost. It should be noted that these LED replacement products used at the Smithsonian were not without issues, and the GATEWAY program is still monitoring the lamps as they age in place and investigating whether there is long-term color consistency.

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