

CALiPER

Snapshot Outdoor Area Lighting

Featuring **Area/Roadway Luminaires & Retrofit Kits**
Parking Garage Luminaires & Retrofit Kits
Canopy Luminaires & Retrofit Kits

Outdoor area lighting is a major contributor to nationwide energy use, and the market segment has been an important player in the transition to solid-state lighting. In terms of energy efficiency, LED outdoor area luminaires now easily outclass their conventional counterparts, such as fixtures using high-pressure sodium (HPS) lamps. Some LED products offer the same amount of lumen output for one-third of the power consumed by an HPS-based luminaire. The efficiency difference may be even greater if delivered illuminance is considered. At the same time, these LED outdoor area lighting products can provide superior color rendition, which can improve visibility. As the energy efficiency of LED outdoor area lighting has improved, there has also been a shift toward products with a warmer color temperature, which is perhaps a response to concerns about potential glare, light pollution, and health effects of nighttime lighting.

This report focuses on outdoor area/roadway luminaires (including street lighting and wall packs), parking garage luminaires, and canopy luminaires (e.g., those used for gas station fuel pump areas). The area/roadway luminaires segment makes up a vast majority of the products considered. Although the aforementioned products are grouped together in this report under the term *outdoor area lighting*, the included products may be used in applications that are not strictly outdoors (e.g., parking garages). In this report, retrofit kits and dedicated luminaires in these categories are not considered separately, as only in the area/roadway category did retrofit kits make up a notable percentage (8%) of the total products.

LED outdoor area lighting has been a major component of the LED Lighting Facts® database since its inception, consistently being one of the categories with the most products. As of September 20, 2017, area/roadway products alone comprised 21% of the database, with the other two product categories featured in this report collectively comprising approximately 5%. These percentages have been fairly consistent over the past seven years.

Since the last CALiPER Snapshot Report that focused on outdoor area lighting (September 2016), the average luminous efficacy for products listed in these categories has increased by about 9 lm/W. This has occurred as average correlated color temperature (CCT) has decreased.



September 20, 2017

2,870 Partners

62,770 Total Active Products

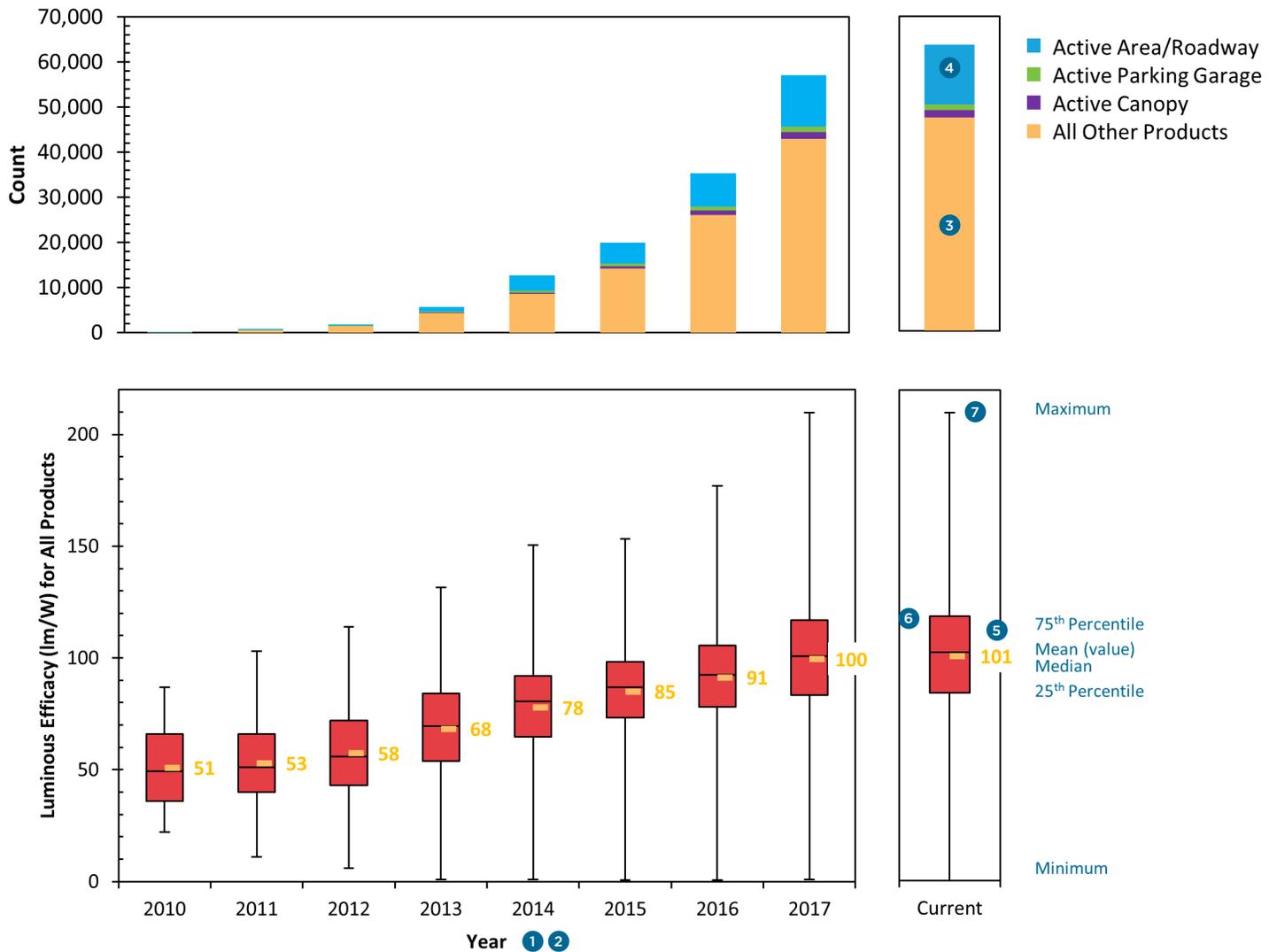
News and Notes

- LED Lighting Facts has been working to streamline the submission process for new products, to increase both speed and accuracy. Data may now be submitted via .ies or .spdx files, or via IES TM-30-15 or IES TM-21-11 Excel files. All documentation, including photos, specification sheets, and performance data, may also be bundled via a .zip file.
- In February 2017, LED Lighting Facts launched a new analysis tool (Product Snapshot Analytics: <http://lightingfacts.com/Analytics>) that allows users to generate, in real time, some of the data and charts shown in this report.
- Lighting manufacturers can now also generate analytics for their own products from the Manage My Products page.

Report Highlights

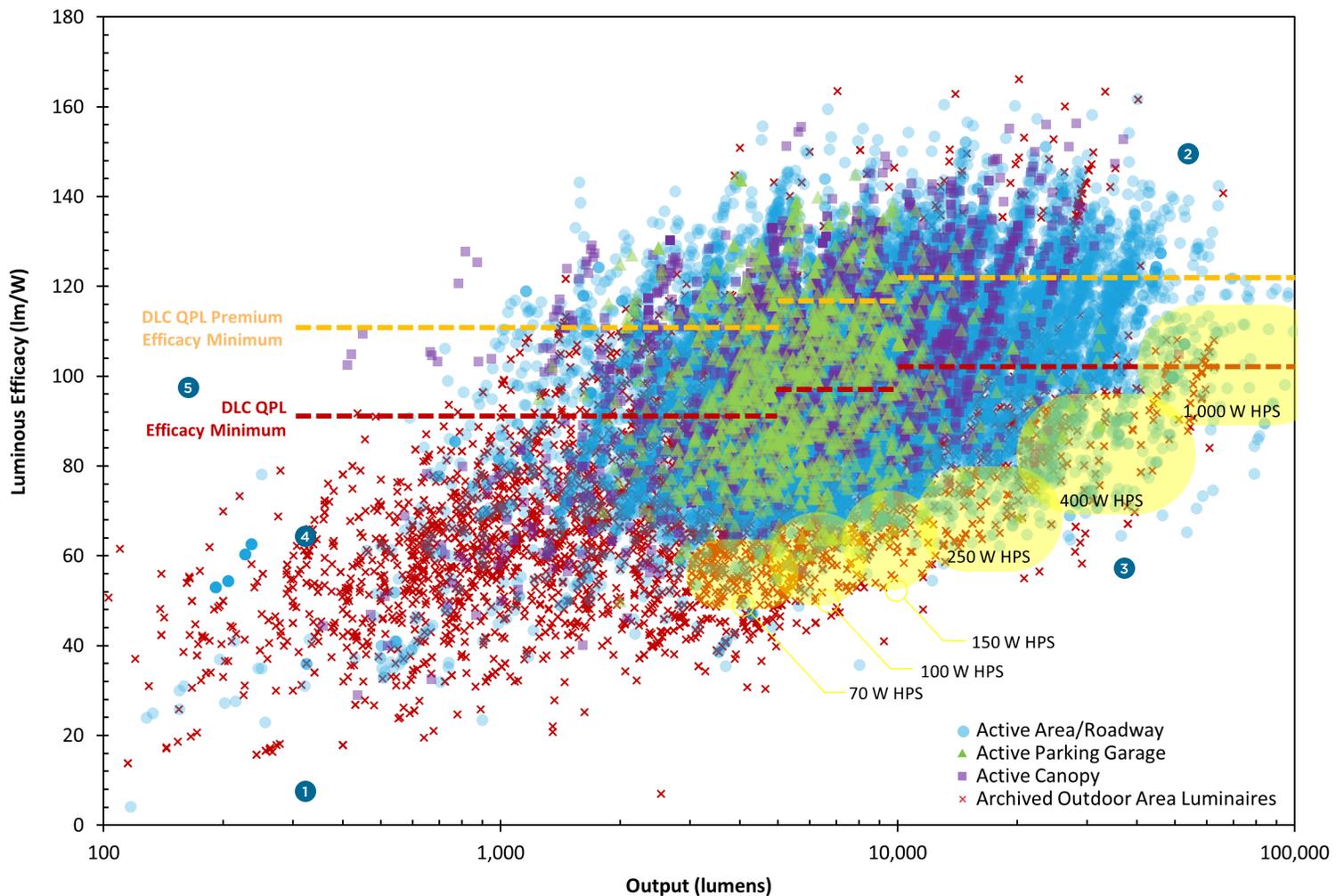
- Outdoor area lighting remains a major component of the LED Lighting Facts database, and of the lighting market in general. Combined, the three types of outdoor area luminaires considered in this report make up about 26% of the LED Lighting Facts database.
- LED outdoor area lighting products are available in a wide range of outputs and color characteristics, allowing the specifier to match the needs of the project.
- At any given output level up to the equivalent of 1,000 W HPS (about 100,000 lm delivered), LED products are available with substantially higher efficacy than that of their conventional counterparts.
- There is a wide range in efficacy for LED outdoor area lighting products.

All Products Listings & Efficacy Over Time



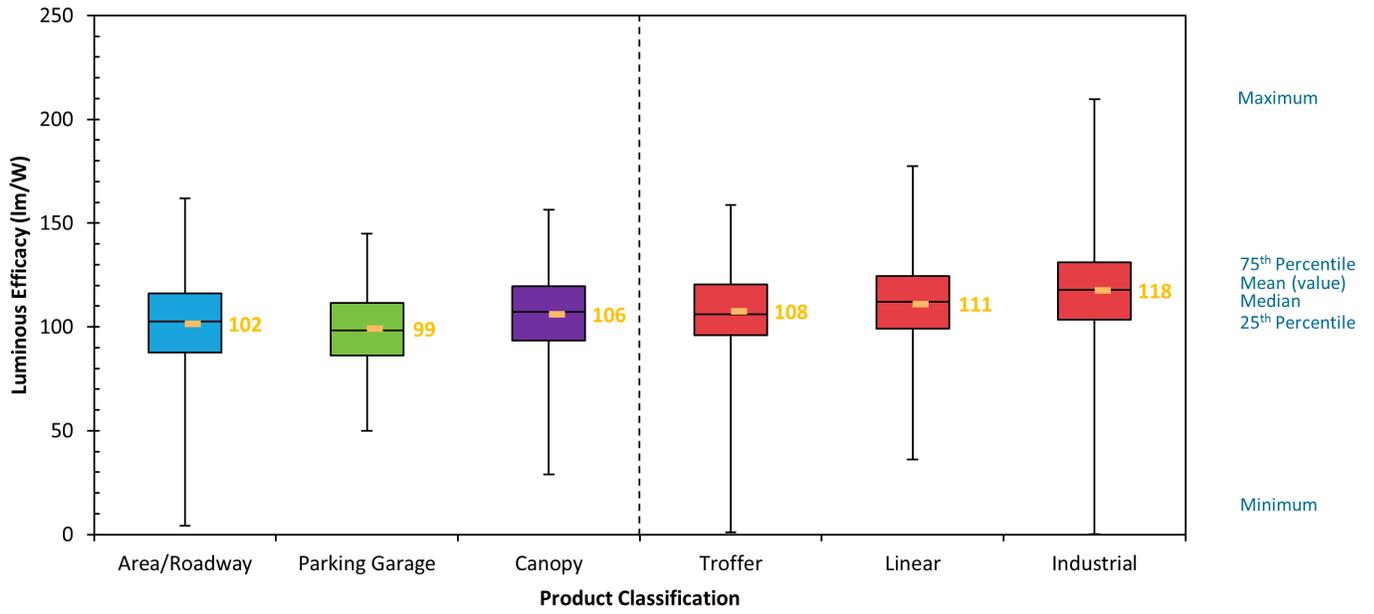
- 1 All yearly data correspond to the status of the LED Lighting Facts database in June of the listed year.
- 2 As of December 2016, lamps are no longer listed by LED Lighting Facts. This includes screw-base lamps (e.g., A lamps, PAR lamps) as well as pin-base lamps (e.g., MR16s, TLEDs). To properly display trends, all lamps have been removed from the historical dataset. This results in small changes in average and maximum efficacy values, compared to those of past CALiPER Snapshot reports.
- 3 As of September 20, 2017, there were more than 63,000 luminaires and retrofit kits listed by LED Lighting Facts. The growth in the number of listed products continues to be strong.
- 4 On the date of capture, there were 12,242 listed products classified as area/roadway luminaires, and an additional 1,016 retrofit kits under the same classification. There were also 1,287 parking garage luminaires and 1,588 canopy luminaires, with just 15 and 19 retrofit kits in, respectively those two categories.
- 5 The mean efficacy of all products currently listed with LED Lighting Facts is 101 lm/W, representing an increase of about 9 lm/W over the past year, which is the greatest yearly gain since the period from June 2013 to June 2014. So far in 2017, newly listed products have a mean efficacy of 113 lm/W.
- 6 As has been the case since the inception of LED Lighting Facts, the efficacy for the middle 50% of listed products covers a relatively small range (84 to 119 lm/W).
- 7 The most efficacious product currently listed by LED Lighting Facts (210 lm/W) is a high-bay luminaire. There are 751 currently listed products that exceed 150 lm/W, which was approximately the highest efficacy two years ago. These 751 products are mostly industrial fixtures but also include streetlights and troffers, as well as linear, canopy, and directional fixtures. A special CALiPER report on these high-efficacy products is being prepared.

Outdoor Area Efficacy & Output



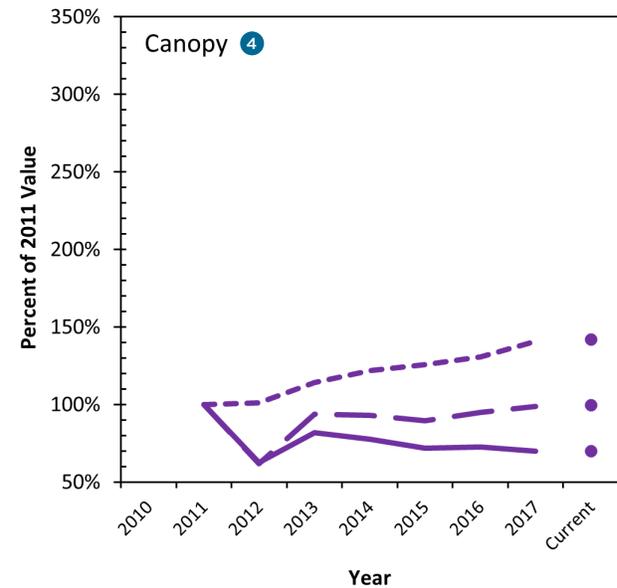
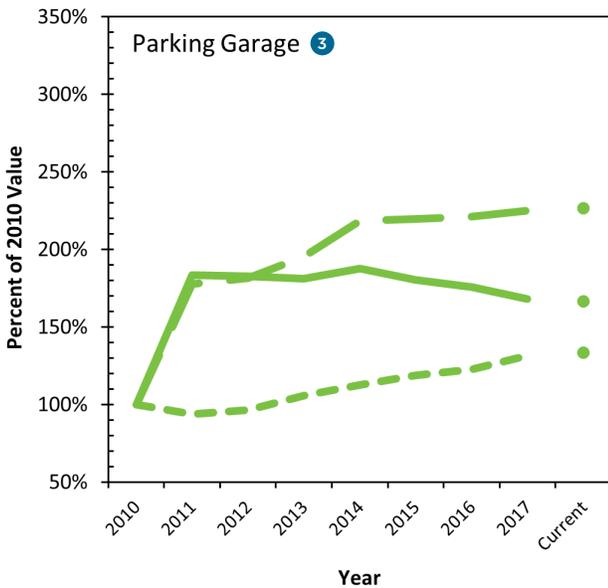
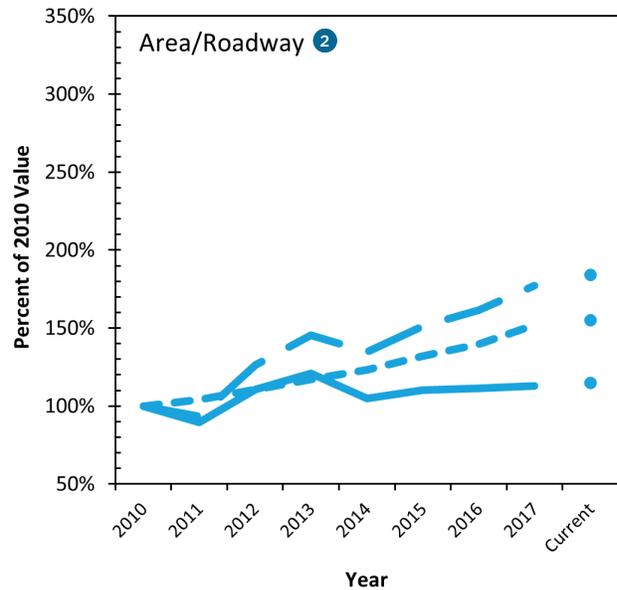
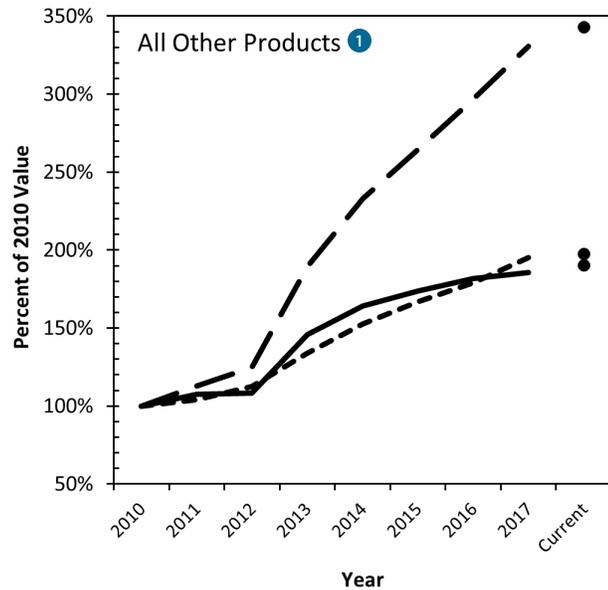
- 1** The range in efficacy and output of outdoor area products is vast, from less than 70 to more than 150 lm/W and from less than 500 to more than 125,000 lumens (not shown). This is indicative of the variety of applications in which the products are used, and is a reflection of the growing market share of LED products.
- 2** In terms of output and efficacy, the performances of all three categories of products considered in this report are fairly similar. Some area/roadway products have higher output, which is appropriate given the needs of the three applications.
- 3** LED products offer energy-saving alternatives to 70 W, 100 W, 150 W, 250 W, 400 W, and 1,000 W HPS products, whose typical performances are indicated in the yellow bubbles. In many cases, improved luminous intensity distributions mean the LED products need less total output to deliver the same illuminance. This provides further energy savings and can help reduce light pollution.
- 4** Many of the archived products have lower output and efficacy than currently listed products, illustrating gains in performance over the last eight years.
- 5** Approximately 63% of the outdoor area products listed by LED Lighting Facts meet the output and efficacy specifications (v4.2) for the DesignLights Consortium™ Qualified Products List (DLC QPL), with 25% achieving the more aggressive output and efficacy levels needed to reach Premium status, although the products at either level may not meet other criteria. These percentages are substantially higher than they were one year ago, when they were 49% and 10%, respectively.

Outdoor Area Current Efficacy Versus Other Product Types



All three types of outdoor area luminaires have a lower mean efficacy than three common types of interior luminaires: troffers, linear fixtures, and industrial fixtures. The differences are relatively small. One factor contributing to the differences may be the need for outdoor area products to have more-carefully engineered luminous intensity distributions. Other factors may include form factor and robustness requirements.

Outdoor Area Trends Versus All Other Products



— Input Power (W) - - - Luminous Efficacy (lm/W) ···· Output (lm)

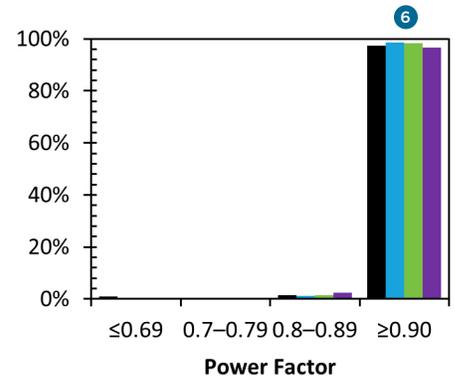
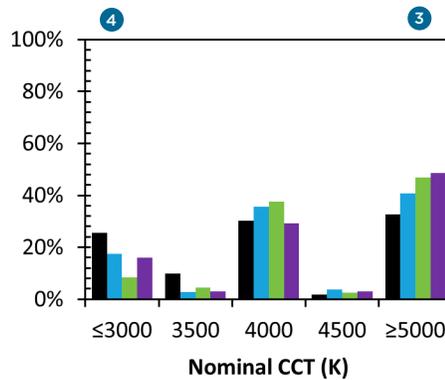
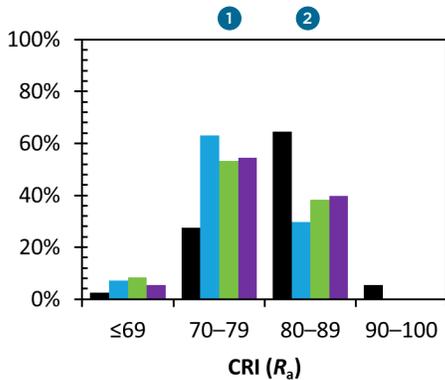
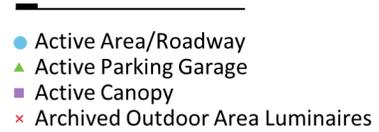
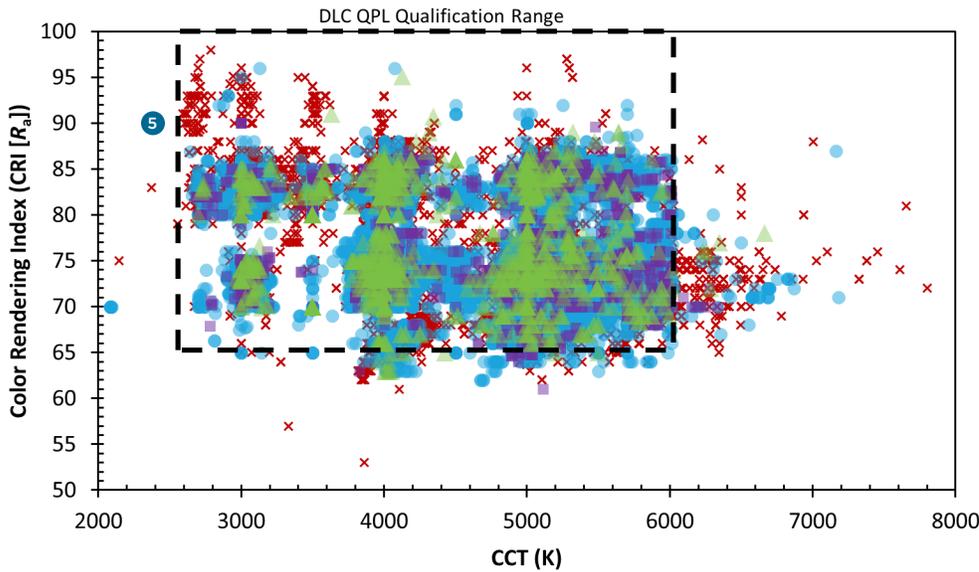
1 When all non-outdoor-area products listed by LED Lighting Facts are considered, average trends indicate that both input power and efficacy are increasing, leading to substantial gains in lumen output. This trend reflects the improvement of LEDs and their ability to meet the needs of more applications, but at some point the average input power should begin to decrease, assuming average efficacy continues to increase.

2 LED area/roadway luminaires follow a similar pattern, but with smaller increases in all three attributes. Notably, average input power has remained relatively steady for the past three years.

3 For parking garage luminaires, higher output has been achieved by increasing input power compared to the first such products to be listed by LED Lighting Facts in 2010. This enabled LED products to compete with a wider range of incumbent products. Slow increases in efficacy have helped to slightly reverse increases in input power in recent years.

4 For canopy luminaires, output has remained mostly constant over the past five years, with gains in efficacy helping to reduce input power. This is similar to the recent trend for parking garage luminaires.

Outdoor Area Color Quality & Power Quality



1 In all three categories, the greatest percentage of products (53% to 63%) have a CRI (R_a) value in the 70s. Note that not enough IES TM-30-15 data are available to make statements about those new measures.

2 Many outdoor area luminaires are available with a CRI (R_a) value in the 80s, especially parking garage and canopy luminaires. While the percentages are lower than the percentage of all products with a CRI in the 80s listed by LED Lighting Facts, many outdoor area lighting applications have lower requirements for color quality, making the performance profile appropriate.

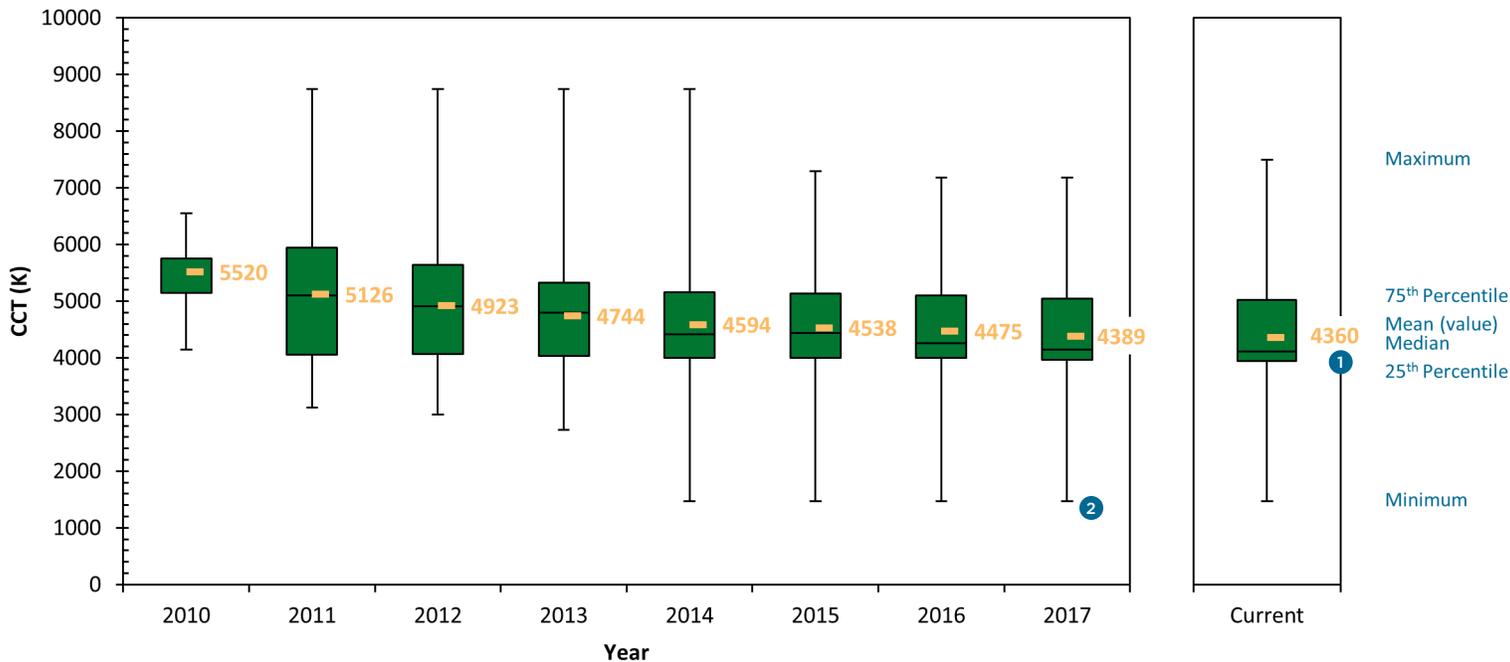
3 Depending on the specific category, between 41% and 49% of the listed outdoor area products have a nominal CCT of 5000 K or greater. Between 29% and 38% have a nominal CCT of 4000 K.

4 About 17% of area/roadway products, 8% of parking garage luminaires, and 16% of canopy luminaires listed by LED Lighting Facts have a nominal CCT of 3000 K or lower. These percentages are all higher than in the last Snapshot Report on outdoor area luminaires (September 2016), indicating a continued shift in color characteristics for outdoor area lighting.

5 Almost all (99%) of the listed outdoor area products meet the CRI and CCT requirements of the DLC QPL. Given the application, stringent color quality requirements are not necessary. The criteria, however, do appear to influence product development, as there is a clear drop in products outside the criteria boundaries.

6 A vast majority (98%) of outdoor area products that are currently listed by LED Lighting Facts (and that report this optional metric) have a power factor of 0.90 or greater. About 39% of the listed outdoor area lighting products provided data on power factor.

Outdoor Area Correlated Color Temperature (CCT) Over Time



1 The typical CCT of outdoor area lighting products continues to decrease, with a current mean of 4360 K and a current median of 4109 K. These values are approximately 1000 K lower than they were six years ago.

2 A small number of LED area/roadway luminaires are listed with a CCT of less than 2100 K. Though not common, this illustrates that the spectral power distribution of LED products can be tailored to meet desired goals.

Discussion LED Outdoor Area Lighting Products

The three types of products discussed in detail in this Snapshot report are the core products used to light surfaces or large areas outdoors (or in parking garages), and are categories where LED technology has made significant inroads. According to DOE's 2017 LED Adoption Report,¹ LED area/roadway lighting has achieved 28.3% market penetration, with parking garage fixtures achieving 32.5% market penetration. In general, LED outdoor area lighting has the second-highest penetration rate of all types of products, behind only small directional fixtures. Penetration rates for outdoor area lighting have approximately tripled since 2014.

Roadway lighting was one of the first major product categories to see competitive LED products, with GATEWAY evaluations dating back to 2007.² While those early products are inferior to what is available today, they provided an important starting point for a product type that is now seeing widespread deployment and providing substantial energy savings.

Using the LED Lighting Facts database, it is possible to track and understand how performance has changed over time. As with the broader set of products, the efficacy of LED outdoor area products continues to improve. Mean efficacies for the three product categories are between 99 and 106 lm/W, with more than 30 products exceeding 150 lm/W. Mean efficacies have risen by 8 to 9 lm/W over the past year. This has occurred simultaneously with decreases in average CCT. While many early LED area lighting products were 5000 K or higher, there has been a measurable shift toward 4000 K products, and there is now a sizeable percentage of products available at 3000 K or lower.

Comparative changes in efficacy, output, and power indicate some differences in the state of development for the three product types. For area/roadway lighting, average output continues to increase, perhaps reflecting the emergence of LEDs in applications where greater output is needed, such as high-mast lighting and sports lighting. In contrast, the average output for parking garage and canopy luminaires has remained relative steady over the past few years, indicating that LED products can already meet all demands of the application, providing more opportunity for energy savings. Accordingly, reduction in power can then be realized through gains in efficacy.

Across the board, LED luminaires offer an energy-efficient alternative to luminaires using HPS lamps, and simultaneously offer improved color rendering characteristics. Although it is not analyzed in this report, LED products often require fewer lumens to produce equivalent illuminance levels on the surface they are lighting, thanks to better luminous intensity distributions than lamp-based luminaires have. All these trends indicate a broader range of choices for specifiers, which allows improved balancing of competing needs.

1 Available from: <http://energy.gov/eere/ssl/led-adoption-report>

2 Results available at: <http://energy.gov/eere/ssl/gateway-demonstration-outdoor-projects>

The Fine Print About LED Lighting Facts Snapshot Reports

Snapshot reports analyze the dataset—or subsets—from DOE's LED Lighting Facts product list. They are designed to help lighting distributors, lighting designers, utilities, energy-efficiency program sponsors, and other industry stakeholders understand the current state and trajectory of the solid-state lighting market. Product classifications are at the discretion of the manufacturer, and Snapshot reports generally reflect the raw data listed in the LED Lighting Facts database. Minimal action is taken to adjust for inconsistencies.

The LED Lighting Facts database is not a statistical sample of the overall market. LED Lighting Facts is a voluntary reporting program in which manufacturers submit data for products tested in accordance with IES LM-79-08. Within any category, the data may be skewed not only by what is submitted, but also by the reporting practices of different manufacturers (e.g., reporting each small variation of a product). Given the broad nature of some of the predetermined categories, not all individual products may be directly comparable (i.e., the form factor may be substantially different). Despite these limitations, the LED Lighting Facts database is generally considered indicative of market trends. The product list includes a wide variety of product types, from manufacturers large and small, lighting industry veterans and brand new companies alike.

LED Lighting Facts and Snapshot reports focus on five core metrics: lumen output, input power, luminous efficacy, color rendering index, and correlated color temperature. Data for other performance metrics can be voluntarily submitted, and all data are available on the LED Lighting Facts website. Specifiers should thoroughly consider all aspects of performance when evaluating different products.

