CALiPER

Snapshot **Outdoor Area Lighting**

Featuring **Area/Roadway Luminaires**
Parking Garage Luminaires
Canopy Luminaires

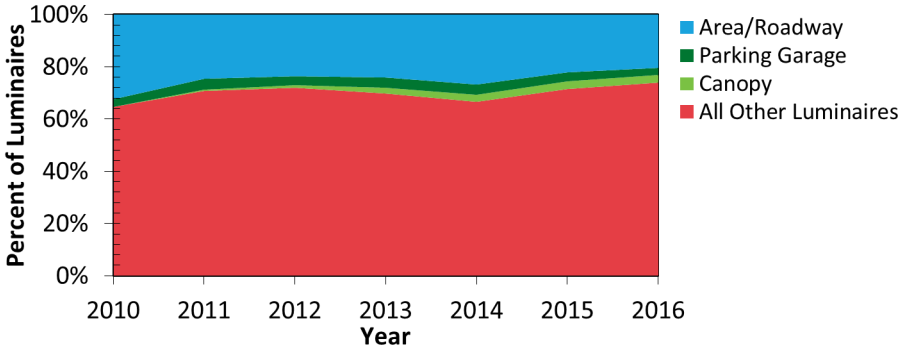
Outdoor area lighting is a major contributor to nationwide energy use, and the market segment has been an important player in the transition to solid-state lighting. Lately, the segment has also been making news based on concerns about the difference in spectrum between conventional and LED sources. Although LED Lighting Facts® does not capture data for products' spectral power distributions, which limits examination of these issues in this report, understanding the basic characteristics of available products is more important now than ever before.

LED outdoor area luminaires now easily outclass conventional products, such as fixtures using high-pressure sodium (HPS) lamps, in terms of energy efficiency. Some LED products offer the same amount of light for one-third of the power of an HPS-based luminaire, more so for lower-output versions, such as 70 W HPS. At the same time, these LED products can provide superior color rendering, 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 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 moniker *outdoor area lighting luminaires*, the included products may be used in applications that are not strictly outdoors (e.g., parking garages). Also, while all three categories have retrofit kit products available, this report focuses on dedicated LED luminaires.

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 August 29, 2016, area/roadway products alone comprised 15% of the database, with the other two product categories featured in this report collectively comprising approximately 4%. This is, however, slightly lower than at times in the past, perhaps indicating market saturation, or simply the growing presence of LEDs in other categories.

AT A GLANCE **LUMINAIRES LISTED BY LED LIGHTING FACTS**



LED lighting facts®

August 29, 2016

2,545 Partners

49,471 Total Active Products

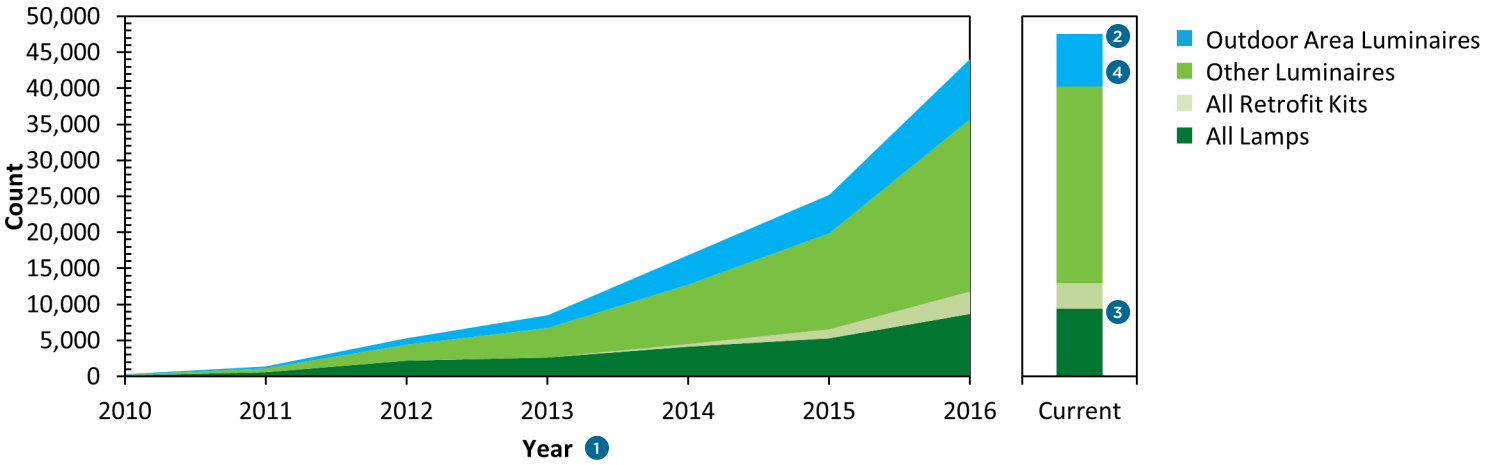
News and Notes

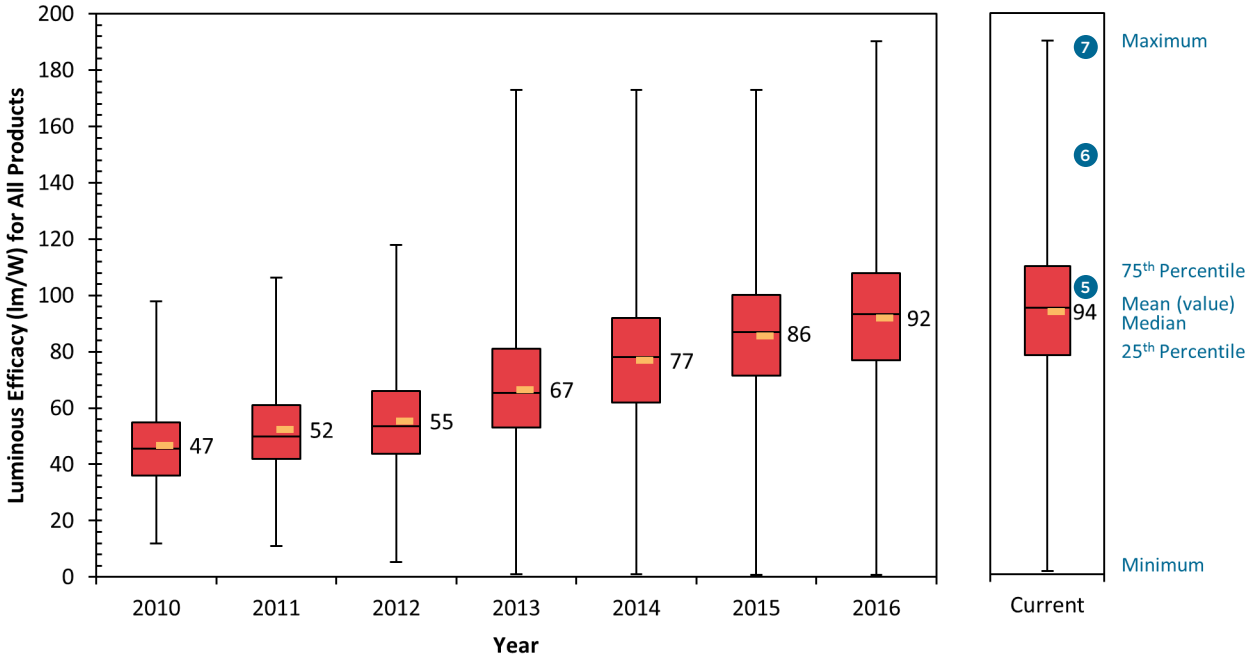
- On August 1, 2016, LED Lighting Facts suspended acceptance of all new LED lamp submissions, in response to the newly adopted DOE test procedure required for integral LED lamps and recently proposed test procedures for non-integral LED lamps that will take effect at a later date.
- While current LED lamp listings will remain in the database, the program is determining the scope of these new provisions and will notify all partners with a final decision soon.
- LED Lighting Facts continues to accept submissions for LED luminaires and retrofit kits.

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 nearly 20% of the 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.
- There is a wide range in efficacy at any given correlated color temperature.

All Products **Listings & Efficacy Over Time**





1. All yearly data corresponds to a CALiPER Snapshot of the LED Lighting Facts database in June of that year.

2. As of August 29, 2016, there were nearly 50,000 products listed by LED Lighting Facts, which is almost double the total from June of 2015.

3. The ratio of lamps to luminaires has remained steady for the past two years. Approximately 73% of the database is luminaires, with the remainder split between lamps and retrofit kits. With the new LED Lighting Facts policy regarding LED lamps (see Page 1), the mix of listed products is likely to change. In the future, this may affect overall trends, such as the efficacy of products shown on this page.

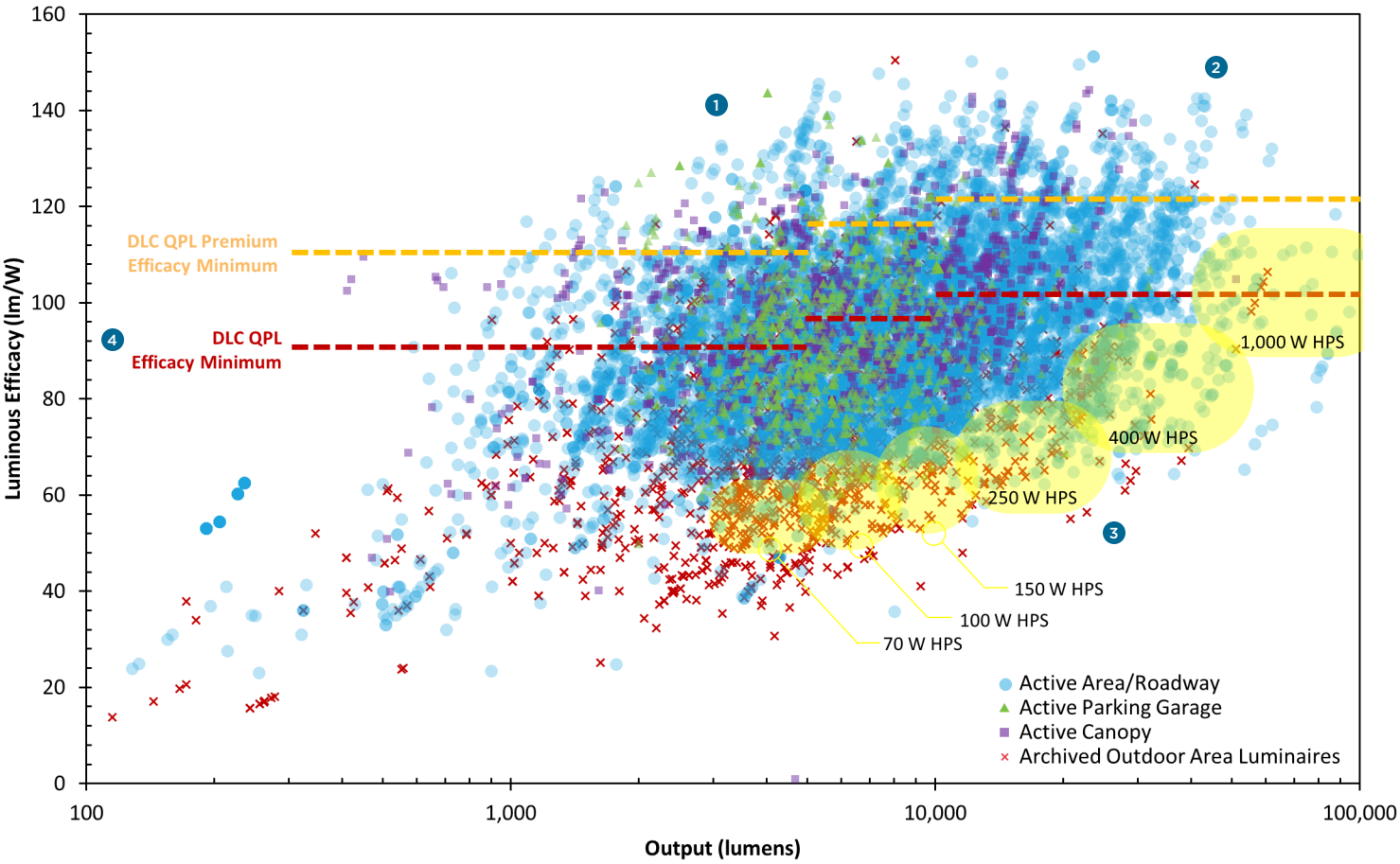
4. On the date of capture, there were 9,205 products classified as area/roadway, parking garage, or canopy luminaires. This group, collectively referred to as outdoor area luminaires, accounts for nearly 20% of the listed products. A majority of those products are classified by the submitting manufacturer as area/roadway luminaires.

5. The rate of increase for mean efficacy of all listed products has been slowing. (It is still going up, but not as fast.) While the efficacy of many product types is much higher than for conventional sources, typical products are still well below the maximum of what is currently available in other LED products, and even further below the projected limits for LED technology.

6. More than 200 currently listed products exceed 150 lm/W. These products include industrial fixtures, troffers, linear fixtures, area/roadway fixtures, and TLEDs. They come from a number of manufacturers, and almost all have a CRI greater than 80 and vary in CCT between 3000 K and 5000 K. The availability of more options at the high end of the efficacy range is important for achieving greater energy savings.

7. The most efficacious product currently listed by LED Lighting Facts (190 lm/W) is a TLED. It has been listed since January 2016, and has passed verification testing.

Outdoor Area Luminaires **Efficacy & Output**



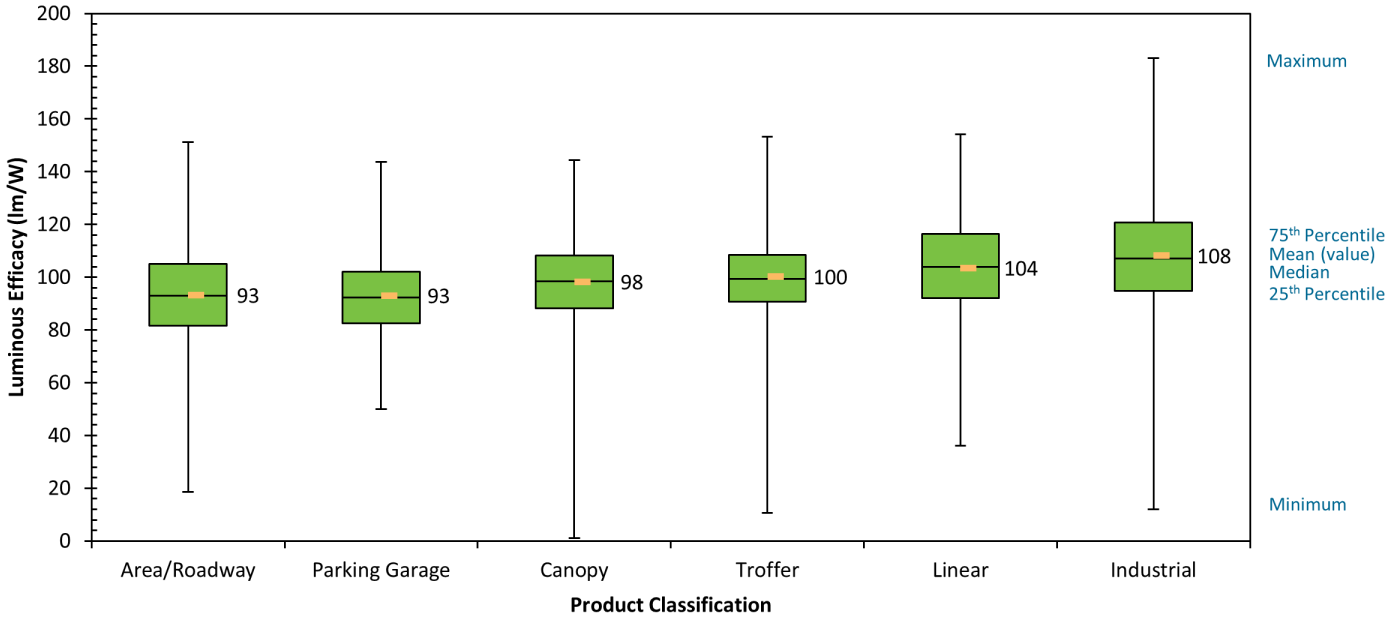
1. The range in efficacy and output of outdoor area luminaires is vast, extending from 20 to 150 lm/W and from less than 500 to more than 125,000 lumens (not shown). This is indicative of the variety of applications in which the products are used, and is a reflection of the growing market share of LED products.

2. In terms of output and efficacy, the performance of all three categories of products considered in this report are fairly similar. Some area/roadway luminaires have higher output, which is appropriate given the needs of the three applications.

3. LED products offer energy-saving alternatives to 70, 100, 150, 250, 400, and 1,000 W HPS products, the typical performance of which is 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.

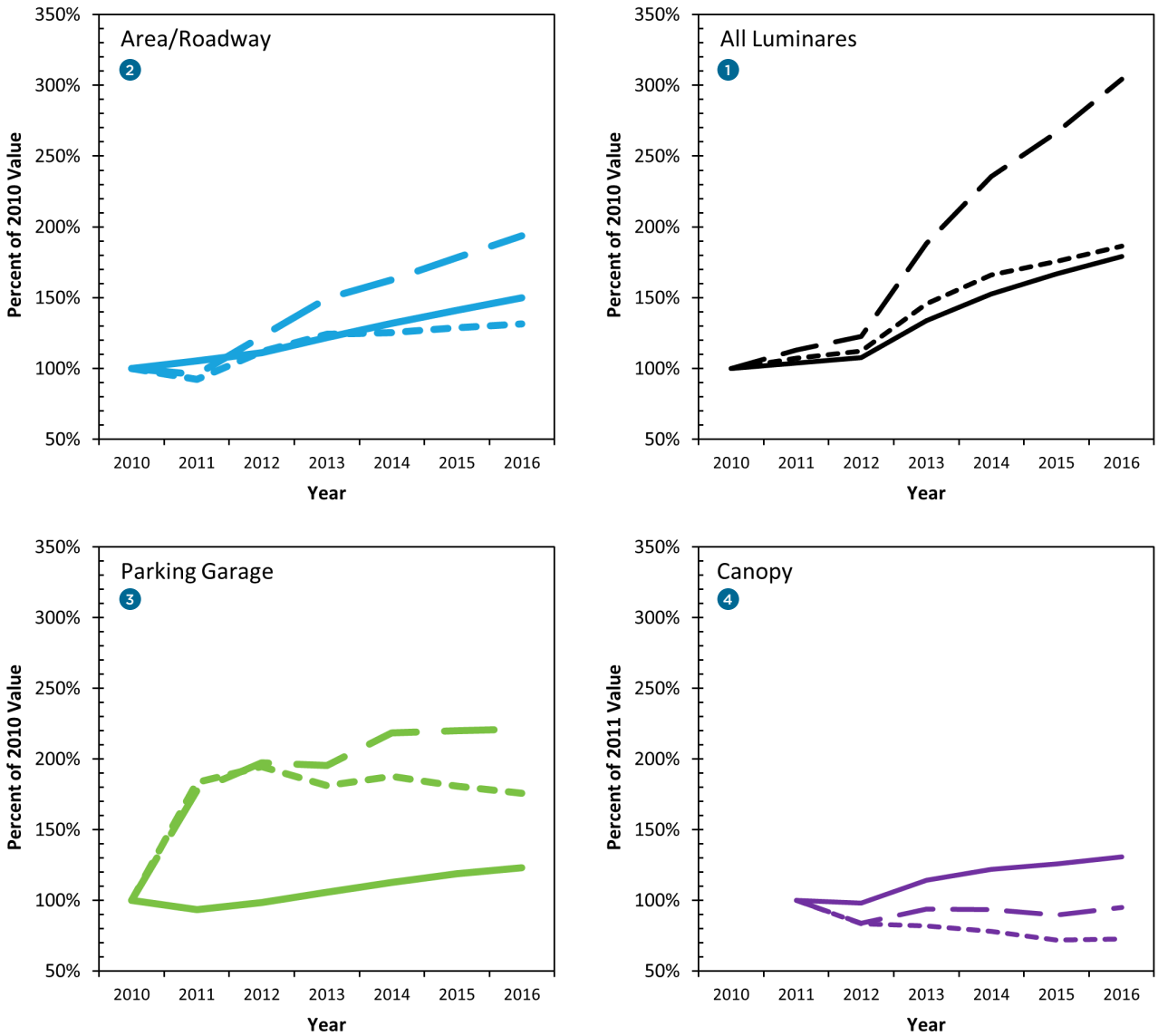
4. Approximately 46% of the outdoor area luminaires listed by LED Lighting Facts meet the output and efficacy specifications for the DesignLights Consortium™ Qualified Products List, with 10% achieving the more aggressive output and efficacy levels needed to reach Premium status. (The products may not meet other criteria.)

Outdoor Area Luminaires **Current Efficacy Versus Other Product Types**



This chart compares the efficacy of the three categories of outdoor area luminaires to three types of interior products used for ambient lighting: troffers, linear fixtures, and industrial fixtures. All three types of outdoor area luminaires have a lower mean efficacy than the three types of interior luminaires, although the differences are relatively small. One contributing factor to the differences may be the need for area/roadway and parking garage luminaires to have more-carefully engineered luminous intensity distributions.

Outdoor Area Luminaires **Efficacy Trends Versus Other Product Types**



Input Power (W)
Luminous Efficacy (lm/W)
Output (lm)

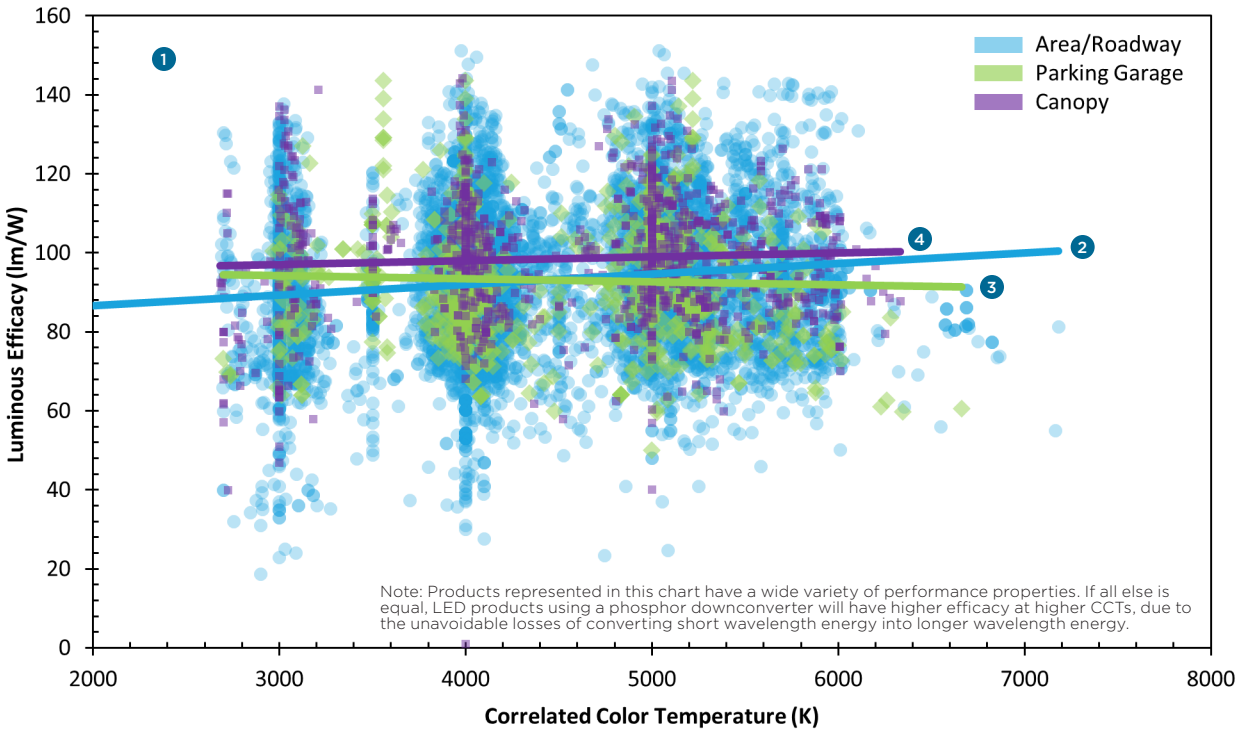
1 When all luminaires listed by LED Lighting Facts are considered, average trends indicate that both input power and efficacy are increasing, leading to substantial gains in lumen output. This trend reflects the improvement of LEDs and their ability to meet the needs of more applications, but at some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

2 Compared to all listed LED luminaires, 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 products listed in 2010. 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 Luminaires **Efficacy Versus CCT**



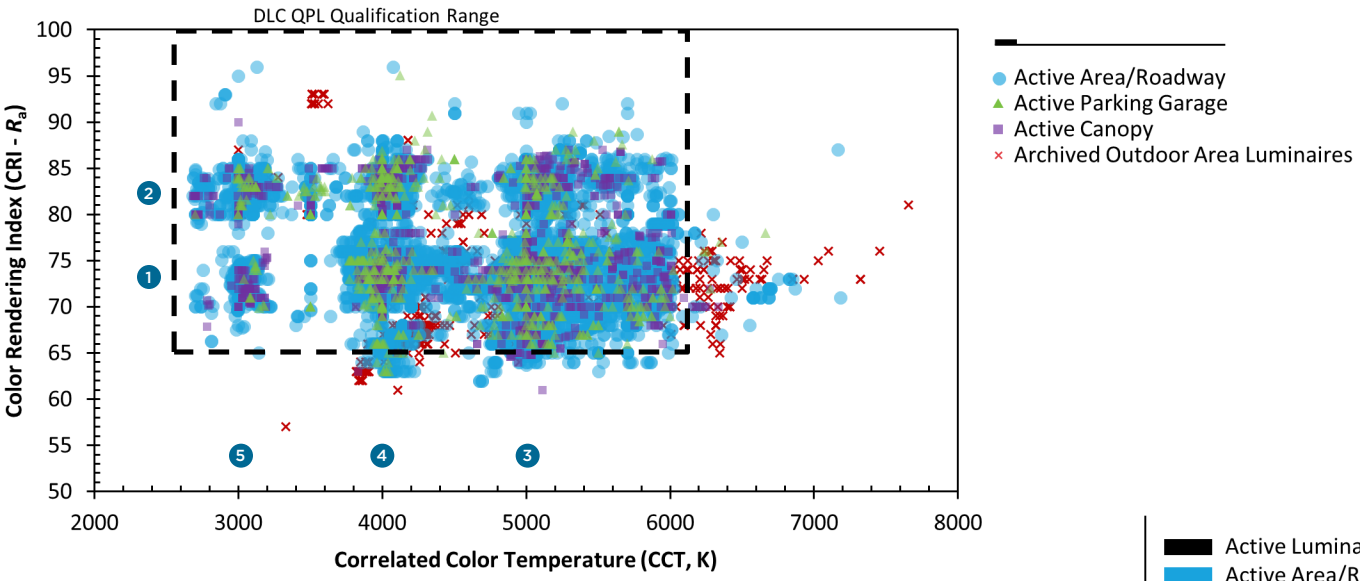
1. At any given correlated color temperature (CCT), there is a very wide range of efficacy for all three product types. This does not counter the fact that when everything else is equal, higher-CCT phosphor-coated LED sources will be more efficacious than lower-CCT phosphor-coated LED sources, due to Stoke's shift losses.

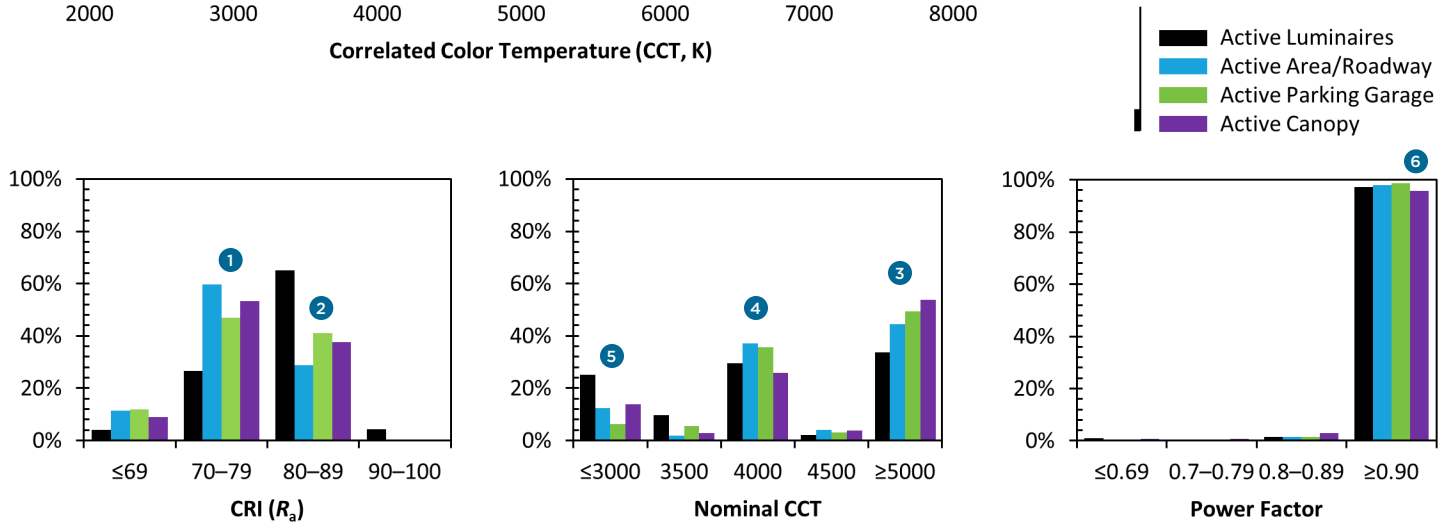
2. For area/roadway luminaires, the average linear trend indicates that for every 1000 K increase in CCT, efficacy increases by 2.7 lm/W. In other words, an average 3000 K source would be about 9.5 lm/W less efficacious than a 6500 K source. As shown, few 6500 K sources are available today.

3. In contrast with the area/roadway luminaires, the linear trend for the parking garage luminaires indicates that for every 1000 K increase in CCT, efficacy *decreases* by 0.8 lm/W. This is likely because more high-quality products are being produced at lower CCTs. In other words, not everything else is held equal.

4. For the canopy luminaires, the linear trend line shows that for every 1000 K increase in CCT, efficacy can be expected to increase by about 1 lm/W. Note that the correlation is poor for all three product categories.

Outdoor Area Luminaires **Color Quality & Power Quality**





1. In all three categories, the greatest percentage of products (around 50%) have a CRI value in the 70s. Note that not enough IES TM-30-15 data is available to make statements about those new metrics.

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

3. Slightly less than 50% of outdoor area luminaires listed by LED Lighting Facts have a nominal CCT of 5000 K or greater. While this is higher than the number of products in any other bin, the average CCT of products listed in 2016 is about 150 K lower than for earlier products, indicating a shift toward lower-CCT products.

4. About 37% of listed area/roadway luminaires have a nominal CCT of 4000 K, with a similar percentage for parking garage luminaires and a slightly lower percentage for canopy luminaires. Canopy luminaires have relatively higher percentages at 3000 K and 5000 K.

5. About 12% of area/roadway luminaires (or nearly 900 products), 6% of parking garage luminaires, and 14% 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 (July 2014), providing another indicator of a shift in color characteristics for outdoor area lighting.

6. A vast majority (98%) of outdoor area luminaires that are currently listed by LED Lighting Facts (and that report this optional metric) have a power factor of 0.90 or greater. About 49% of the listed outdoor area lighting products provided data on power factor.

Discussion **LED Outdoor Area Luminaires**

The three types of luminaires 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 the DOE's LED Market Adoption Report,[1] LED outdoor lighting had a 10.1% market share in 2014. By 2015, that number was 17.9%, according to the DOE's Solid-State Lighting R&D Plan.[2]

Roadway lighting was one of the first major product categories to see competitive LED products, with GATEWAY demonstration projects dating back to 2007.[3] 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 93 and 98 lm/W, with some products as high as 150 lm/W. This has occurred simultaneously with decreases in mean 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.

Looking at comparative changes in efficacy, output, and power indicates some differences in the state of development for the three product types. For area/roadway lighting, average output and power continue to increase, perhaps reflecting the emergence of LEDs in applications where greater output is needed, such as high-mast 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. 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. Numerous LED products with a nominal CCT of 3000 K or less are available with an efficacy greater than 100 lm/W. 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 Available from: http://energy.gov/eere/ssl/downloads/solid-state-lighting-2016-rd-plan

3 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 retailers, distributors, 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 the largest of its kind, and 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.

U.S. DEPARTMENT OF ENERGY

Energy Efficiency & Renewable Energy

For more information, visit: www.lightingfacts.com

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