

CALiPER

Snapshot Industrial Luminaires

“Industrial” luminaires are prevalent in both the commercial and industrial sectors, providing economical ambient lighting in large, open indoor spaces such as warehouses, manufacturing facilities, and big-box retail stores. Industrial luminaires are divided into two categories: low-bay and high-bay. Typically, low-bay fixtures are used for heights up to 20 feet, whereas high-bay fixtures are used where ceilings exceed 20 feet. Given the space demands, high-lumen-output luminaires are required, with low-bay options typically emitting between 5,000 and 20,000 lumens per fixture and high-bay options emitting between 15,000 and 100,000 lumens per fixture.

In 2015, industrial luminaires accounted for 15% of all lighting energy use, the second-highest energy consumption of all evaluated categories.¹ Although the number of installed industrial fixtures is not as high as the number of installed products in other categories, such as A-lamps, industrial fixtures operate for significantly longer periods (at least 12 hours a day) and thus offer similar energy savings. While LED products only comprised 6% of all industrial luminaire installations in 2015, market penetration is expected to grow to 86% by 2035.

Historically, industrial luminaires predominately used high-intensity discharge (HID) lamps (e.g., metal halide and high-pressure sodium), with fluorescent lamps (T8 and T5) entering the market in the 1990s due to their superior lumen maintenance, lack of restrike delay, and ability to switch with occupancy sensors. LED products must compete with these conventional technologies, which are both low-cost and relatively efficacious.

Early-generation LED high-bay luminaires lacked the lumen output to compete in the market, but by 2013, LED Lighting Facts® listed 379 industrial products, with more than half exceeding 15,000 lumens. LED Lighting Facts currently lists more than 8,000 industrial products, 41% of which emit between 5,000 and 15,000 lumens and 55% of which emit more than 15,000 lumens. Although LED retrofit kits are available for low- and high-bay applications, only 168 such products are currently listed with LED Lighting Facts—too few to be included in this Snapshot report.

¹ DOE SSL Program. Energy Savings Forecast of Solid-State Lighting in General Illumination Applications. September 2016 (https://energy.gov/sites/prod/files/2016/09/f33/energysavingsforecast16_2.pdf).



March 13, 2017

2,720 Partners

50,909 Total Active Products

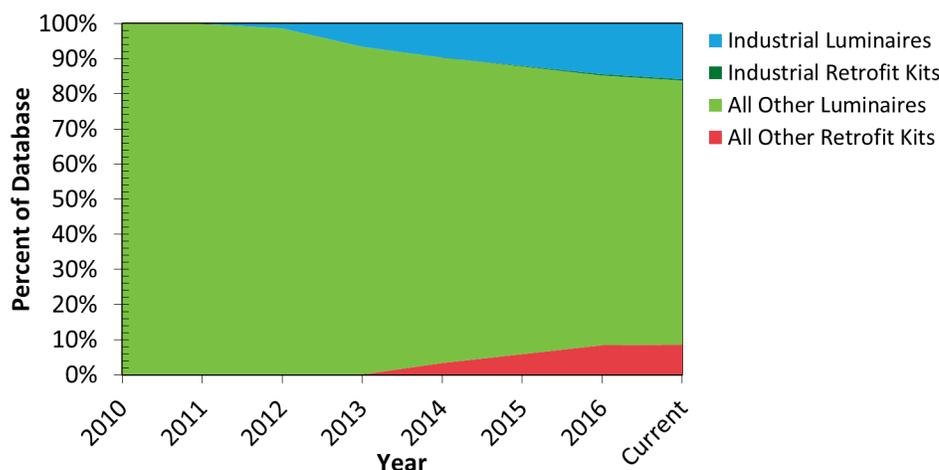
News and Notes

- Due to changes in the market as well as in LED lamp testing requirements, LED Lighting Facts is no longer listing replacement lamps. Previously listed lamps were removed from its database in December 2016. Luminaires and retrofit kits continue to be listed.
- Due to this change in listing status, all data for LED lamps, both current and historical, have been removed from the dataset used to generate this report. Accordingly, data for long-term trends may not exactly match previously published data.
- As of the CALiPER Snapshot report published in September 2016, lamps comprised approximately 20% of the products listed with LED Lighting Facts. This number had been steadily diminishing since the program's inception of in 2009.
- 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.

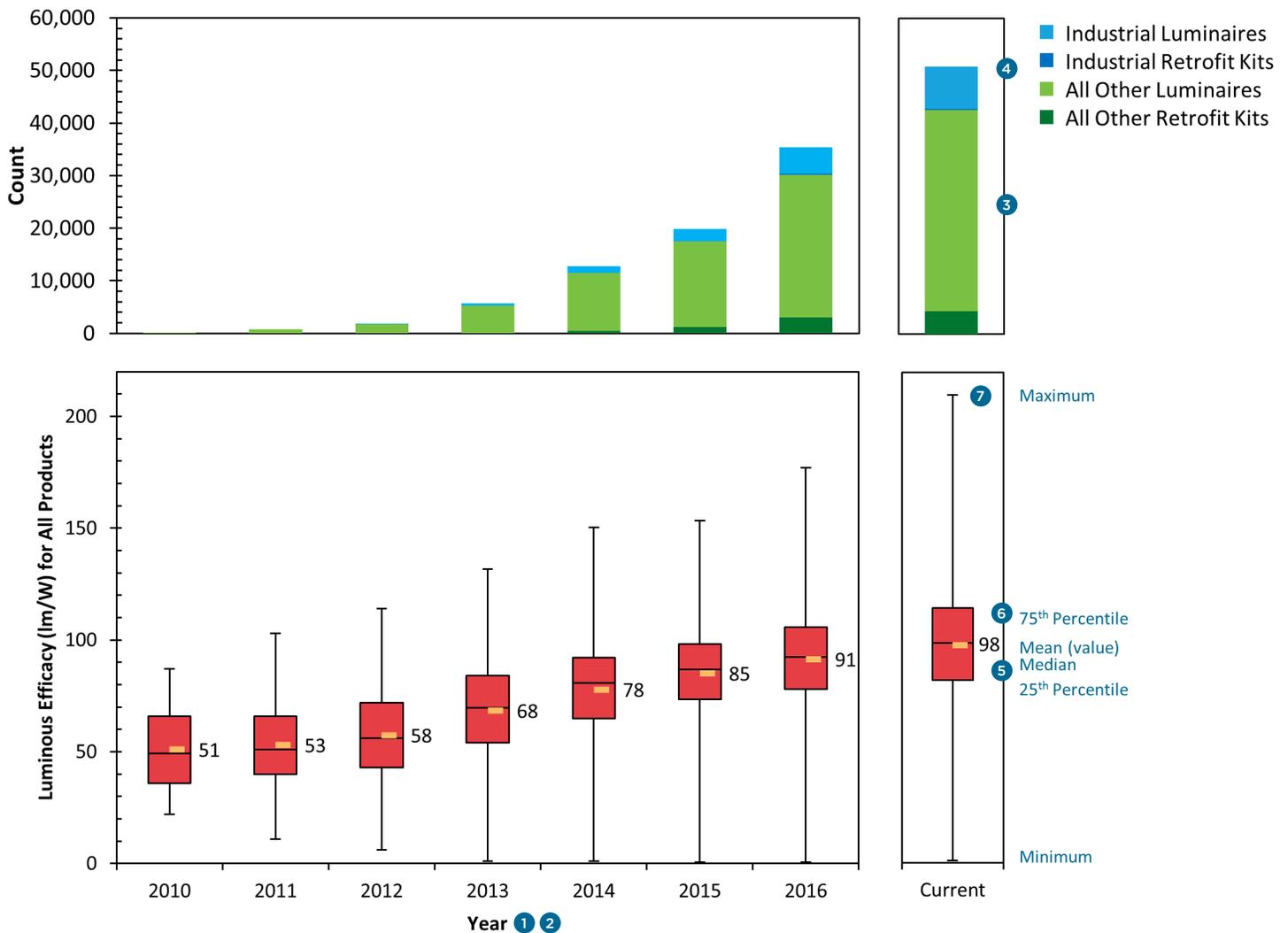
Report Highlights

- The efficacy of LED industrial luminaires is notably higher than what is typical of incumbent fixtures. About 23% of the listed with LED Lighting Facts products have a luminous efficacy greater than 130 lm/W.
- Listed industrial fixtures have higher efficacy performance than do listed linear, troffer, area/roadway, and parking garage fixtures.
- Color and power quality for industrial luminaires are similar to that of incumbent fixtures. The products have a variety of CCTs, with the majority (51%) at or above a nominal CCT of 5000 K; and 65% of the luminaires have a CIE R_a (CRI) in the 80s.

AT A GLANCE PRODUCTS LISTED BY LED LIGHTING FACTS

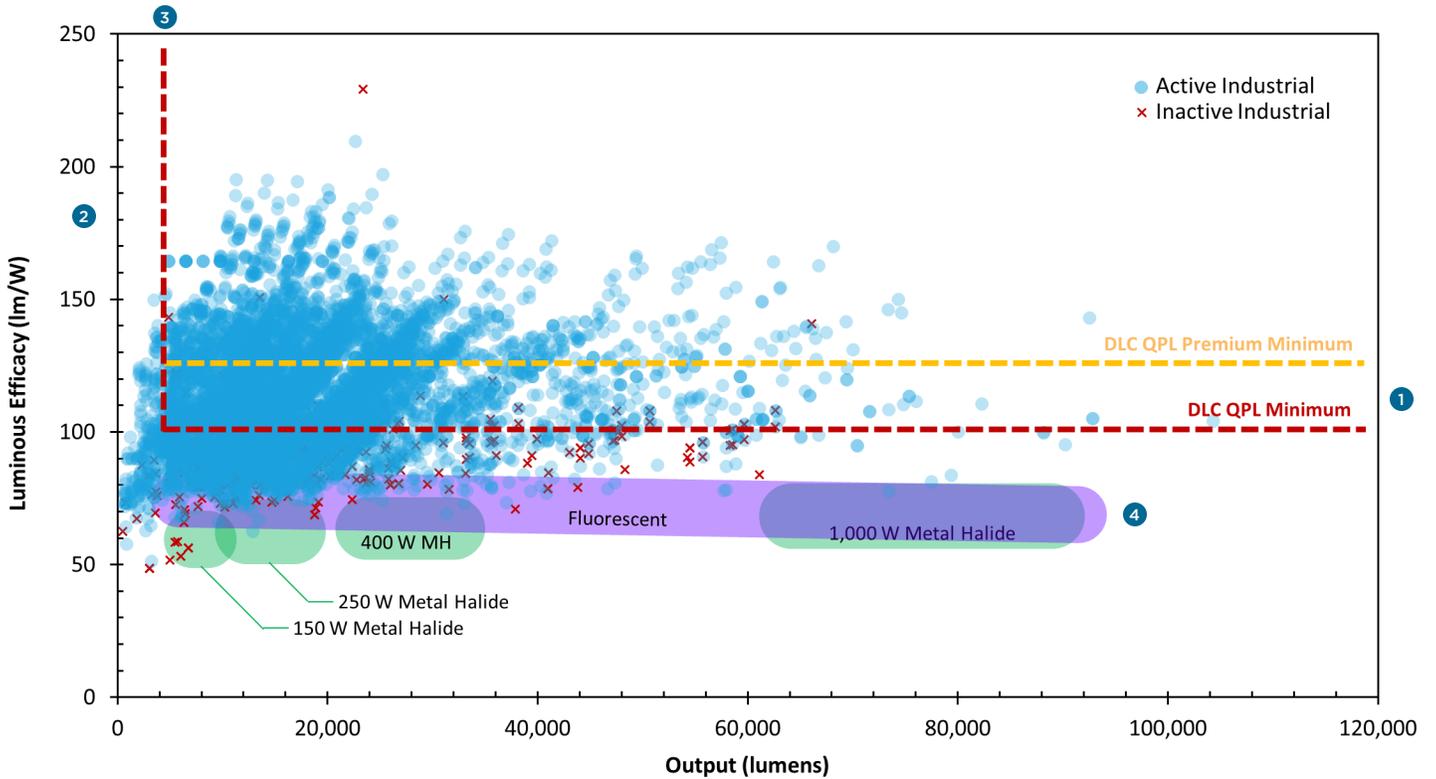


All Products Listings & Efficacy Over Time



- 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 March 13, 2017, there were more than 50,000 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 8,063 listed products classified as industrial luminaires, and an additional 168 retrofit kits for existing industrial fixtures. Together, this comprises approximately 16% of the total products currently listed by LED Lighting Facts.
- 5 The mean efficacy of all currently listed products is 98 lm/W, which represents an increase of 7 lm/W over the past nine months and is slightly larger than the gain for the entire 12-month period between June 2015 and June 2016.
- 6 As it has since the inception of LED Lighting Facts, the efficacy for the middle 50% of listed products covers a relatively small range (82 to 114 lm/W).
- 7 The most efficacious product currently listed by LED Lighting Facts (210 lm/W) is a high-bay fixture. At 108 W, it emits more than 22,000 lm, with a CCT of 5000 K and a CIE R_a (CRI) of 77. There are more than 550 currently listed products that exceed 150 lm/W, which was approximately the highest efficacy less than two years ago. These products are mostly industrial fixtures but also include streetlights, troffers, linear, canopy, and directional fixtures.

Industrial Efficacy & Output



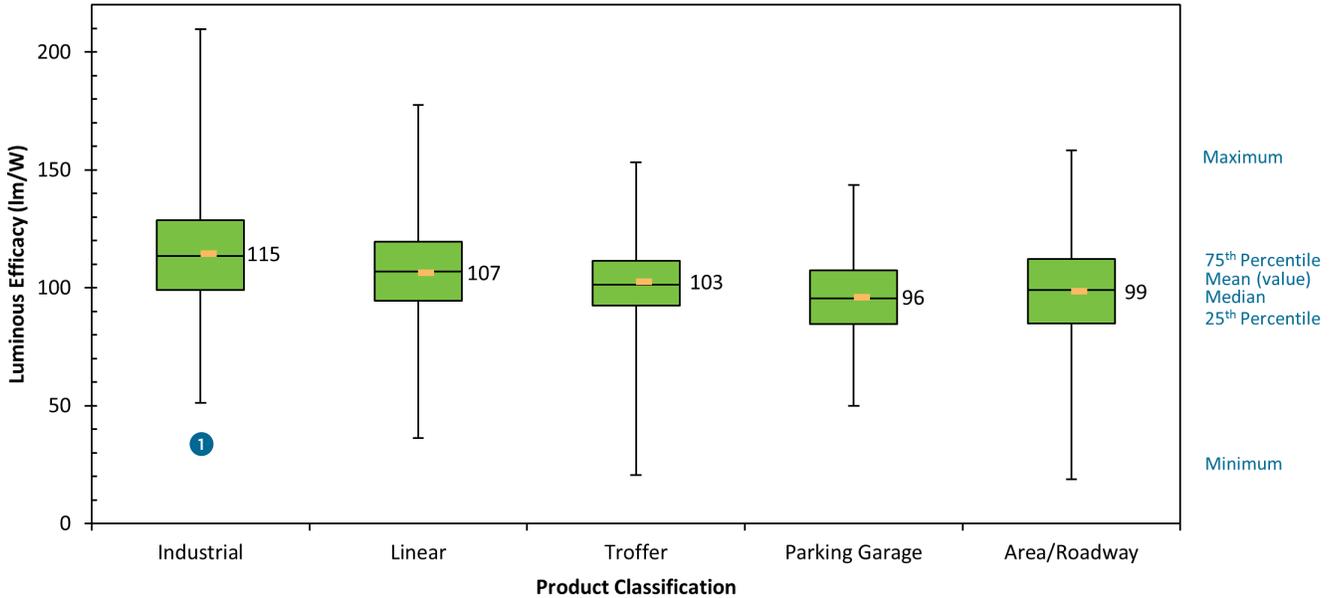
1 Of the listed industrial luminaires, 65% have a luminous efficacy above 105 lm/W, which is the minimum for the DesignLights Consortium™ Qualified Products List (DLC QPL). About 23% exceed 130 lm/W, the DLC QPL Premium minimum.

2 About 5% of the listed industrial luminaires exceed 150 lm/W, and 1% exceed 175 lm/W. This is the highest efficacy of any LED Lighting Facts category and results from a combination of optical, form factor, and color constraints that are less restrictive than for other product types.

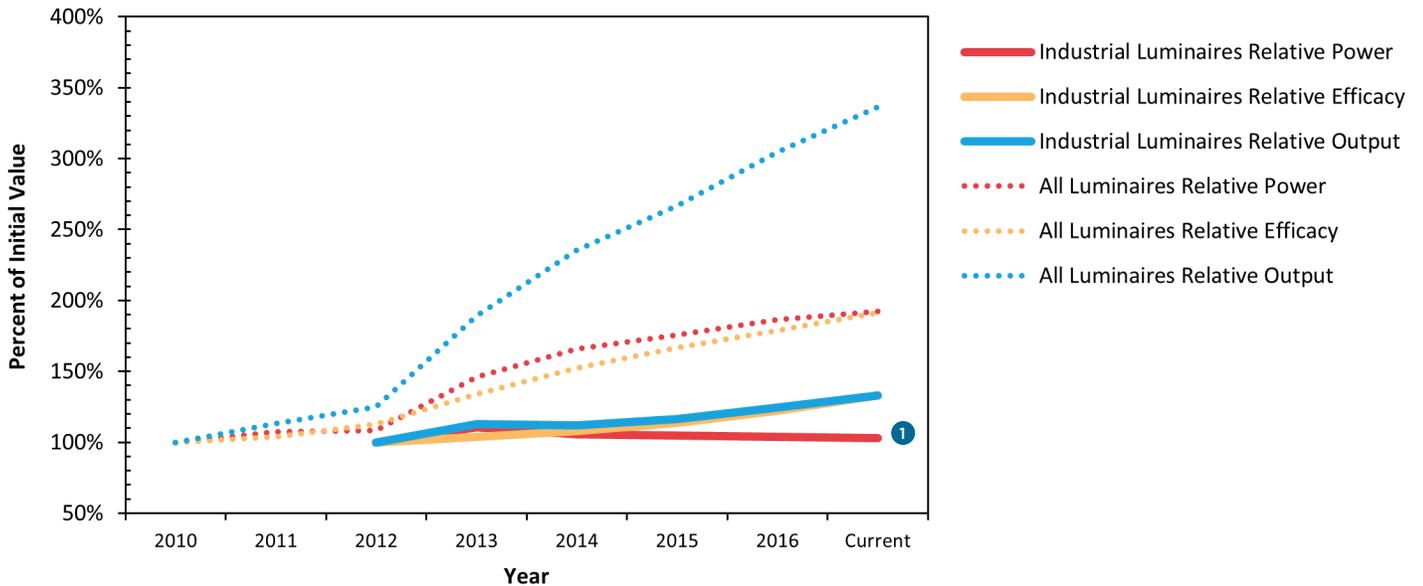
3 A vast majority of the listed industrial products exceed the DLC QPL requirements for minimum lumen output (5,000 lm). While the listed industrial products do not fall into clear output groupings, 50% emit between 11,000 and 22,000 lumens. The availability of products emitting more than 60,000 lumens is substantially less.

4 A majority of listed industrial fixtures have comparable lumen output and higher luminous efficacy than their metal halide and fluorescent counterparts. The ranges shown for conventionally lamped industrial fixtures are approximate.

Industrial Performance Comparisons

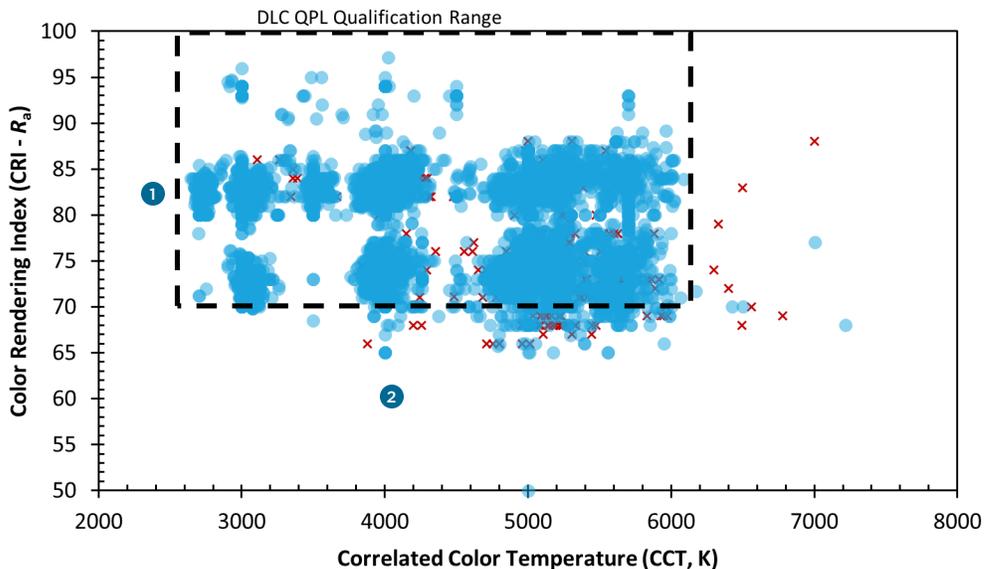


1 The efficacy of LED industrial products is higher than those of linear, troffer, area/roadway, and parking garage fixtures. The differences arise from the different needs of each application. Industrial luminaires typically do not require sophisticated optical control, nor do they usually have strict size and space constraints. In some cases, industrial applications also have more lenient requirements for color quality and glare control.

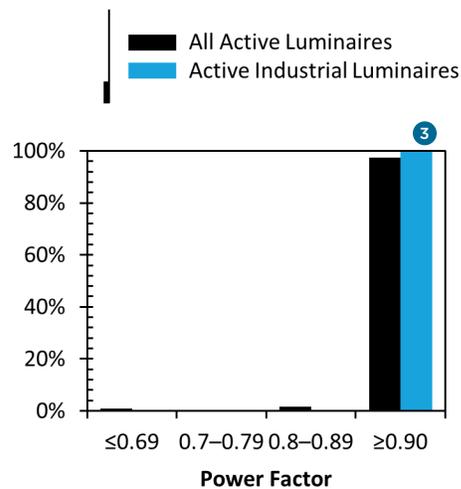
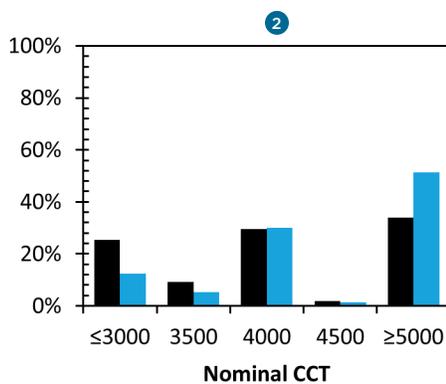
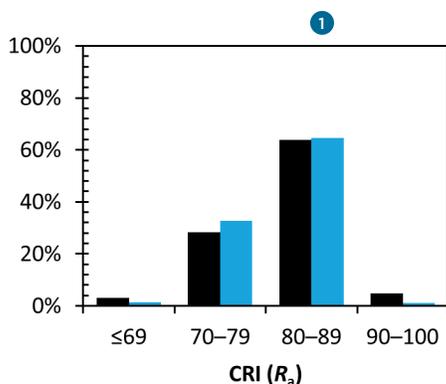


1 Unlike the broader set of all products listed by LED Lighting Facts, the relative input power for industrial luminaires has not substantially increased since they were first introduced in 2012. Gains in industrial luminaire efficacy are solely responsible for the increase in mean lumen output.

Industrial Color Quality & Power Quality



● Active Industrial Products
 × Archived Industrial Products



1 65% of the listed industrial luminaires have a CIE R_a (CRI) value in the 80s, with most of the remainder having a value in the 70s. This is comparable to the better incumbent technologies, and vastly superior to high-pressure sodium (HPS), which is used in some industrial installations. Not enough IES TM-30-15 data (which are optional) have been submitted to LED Lighting Facts to allow for meaningful comparisons. For high efficacy industrial products (at least 130 lm/W), almost 75% have a CRI value of 80 or higher.

2 A majority of the listed industrial luminaires have a nominal CCT greater than 5000 K, with a substantial number having a nominal CCT of 4000 K. A number of products are also available with nominal CCTs of 3500 K and 3000 K. This distribution of products is shifted somewhat toward higher CCTs, compared to conventional industrial luminaires lamped with fluorescent and metal halide lamps. For high efficacy industrial products (at least 130 lm/W), 46% have a nominal CCT of 5000 K or greater.

3 Of the listed industrial products that report the optional metric (38%), all (100%) have a power factor above 0.90.

Discussion **LED Industrial Luminaires**

Prior to this report, the last time a CALiPER Snapshot included industrial fixtures was in April 2014. A lot has changed since then. For one thing, the LED Lighting Facts database now has almost four times the number of products listed, and the average efficacy of listed products has increased by more than 25%. These changes are also apparent when specifically considering industrial luminaires. In June 2014, the mean efficacy for listed industrial luminaires was 93 lm/W; today, it is about 20% higher, at 115 lm/W. Approximately 23% of the listed industrial products have a luminous efficacy greater than 130 lm/W, with 5% exceeding 150 lm/W and 1% exceeding 175 lm/W. These values are substantially higher than the average efficacy of metal halide and fluorescent fixtures, which typically fall between 70 and 90 lm/W.

In aggregate, the output of the LED industrial products listed in LED Lighting Facts is more than sufficient to match that of their conventional counterparts. While 50% of the listed industrial luminaires fall between 11,000 and 22,000 lumens, the mean light output for that category is over 18,000 lumens, due to more than 150 products that exceed 50,000 lumens. This can match the output of conventional fixtures that use 1000 W metal halide or 16 high-output T5 (T5HO) lamps. Because of higher mounting heights, glare in industrial applications is less of an issue than in classroom or office applications, for example. This helps enable LED industrial fixtures to achieve very high lumen output and very high luminous efficacy.

In terms of color quality and power quality, LED industrial fixtures almost all offer the same performance as their metal halide and fluorescent counterparts. About 65% of the listed industrial luminaires have a CIE R_a (CRI) in the 80s, compared to the majority having a CRI in the 70s back in 2014. These CRI values are likely adequate for most industrial applications. About half of the listed industrial products have a nominal CCT of 5000 K or greater, which, although not uncommon, is higher than what is typical in conventional industrial lamps. These higher-CCT products likely contribute to the higher efficacy seen in industrial fixtures, compared to other types listed by LED Lighting Facts.

In terms of the data captured by LED Lighting Facts and reported here, LED industrial products offer a compelling alternative to incumbent products. While this report focuses on basic photometric characteristics, choosing a product for a specific installation requires a more comprehensive analysis, including light distribution, projected lifetime, lumen maintenance, visual comfort (glare), dimmability and restrike issues, ballast noise, durability, flicker, and cost.

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, 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.

