

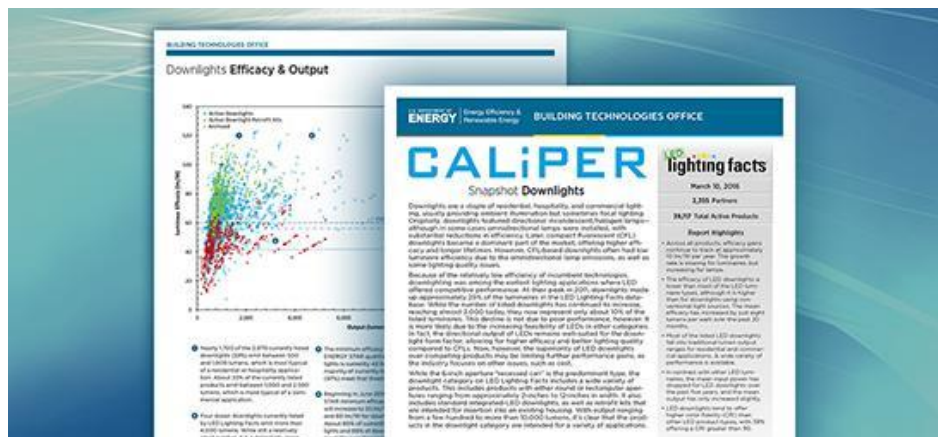
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U.S. DEPARTMENT OF ENERGY

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A New CALiPER Snapshot of LED Downlights

Downlights are a staple of residential, hospitality, and commercial lighting, usually providing ambient illumination but sometimes focal lighting. Because of the relatively low efficiency of incumbent technologies, downlighting was among the earliest lighting applications where LED offered competitive performance. DOE's [CALiPER program](#) has released a [Snapshot report on LED downlights](#), and the findings are instructive. Snapshots are based on the information in DOE's [LED Lighting Facts](#)[®] database, which currently includes more than 44,000 registered LED lighting products.



At their peak in 2011, downlights made up approximately 25% of the luminaires registered with LED Lighting Facts. While the number of downlights listed with LED Lighting Facts has continued to increase, reaching almost 3,000 today, they now represent only about 10% of all listed luminaires. This decline is not due to poor performance, however, but is more likely due to the increasing viability of LEDs in other categories. In fact, the directional output of LEDs remains well-suited for the downlight form factor, allowing for higher efficacy and better lighting quality compared to CFLs. Now, however, the superiority of LED downlights over competing products may be limiting further performance gains, as the industry focuses on other issues, such as cost.

While the 6"-aperture "recessed can" is the predominant type, the downlight category on LED Lighting Facts includes a wide variety of products. This includes products with either round or rectangular apertures ranging from approximately 2"–12" in width. It also includes standard integrated-LED downlights, as well as retrofit kits that are intended for insertion into an existing housing. With output ranging from a few hundred to more than 10,000 lumens, it's clear that the products in the downlight category are intended for a variety of applications.

Other key findings from the new Snapshot:

- Across all products listed with LED Lighting Facts, average efficacy gains continue to track at approximately 10 lm/W per year. The growth rate is slowing for luminaires but increasing for lamps.
- The efficacy of LED downlights is lower than that of most of the LED luminaire types but higher than that of downlights using conventional sources. The mean efficacy for LED downlights has increased by just 8 lm/W over the past 20 months.
- Most of the listed LED downlights fall into traditional lumen-output ranges for residential and commercial applications, but a wide variety of performance is available.
- In contrast with other LED luminaires, the mean input power has dropped for LED downlights over the past five years, and the mean output has only increased slightly.
- LED downlights tend to offer better color fidelity than other LED product types, with 38% offering a CRI greater than 90.

In the past two years, LED technology has progressed rapidly, which is reflected in the LED Lighting Facts database. The number of available products is increasing, along with the average efficacy and output. Today, based on photometric performance alone, there appears to be a downlight to fulfill just about every need. It's reasonable to suggest that the downlight category has stabilized, after being one of the first market segments to see viable products that clearly beat the competition from other source types. With a current mean efficacy of 68 lm/W and some products reaching as high as 120 lm/W, LED downlights are substantially more energy efficient than are halogen or CFL downlights. A large percentage of LED downlights also offer high color fidelity and good lighting quality in general — something that CFL downlights usually don't deliver.

While performance of LED downlights appears to have stabilized, it has not necessarily been maximized. Troffer, linear, directional, wall-wash, area/roadway, parking garage, and industrial luminaires all have higher mean efficacy than downlights, and all but wall-wash luminaires have higher maximum efficacy. Some of the discrepancy is due to different optical requirements; when additional optical materials and methods are needed to shape the light distribution and/or reduce glare, efficiency is generally reduced. But as was discussed in the last [CALiPER Snapshot report on MR16 lamps](#), the relatively low performance of conventional halogen and CFL downlights provides less incentive for continued efficacy gains in LED downlights, compared to luminaire types competing against linear fluorescent or high-intensity discharge incumbents. Further, efficacy gains for LED downlights have slowed in the past year or two; this mirrors a trend in troffers and other luminaire types, but is more notable for downlights because the efficacy is already low among those LED products.

For a closer look at the findings, download the [full report](#).

Best regards,
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As always, if you have questions or comments, you can reach us at postings@akoyaonline.com.

