

# SSL Postings

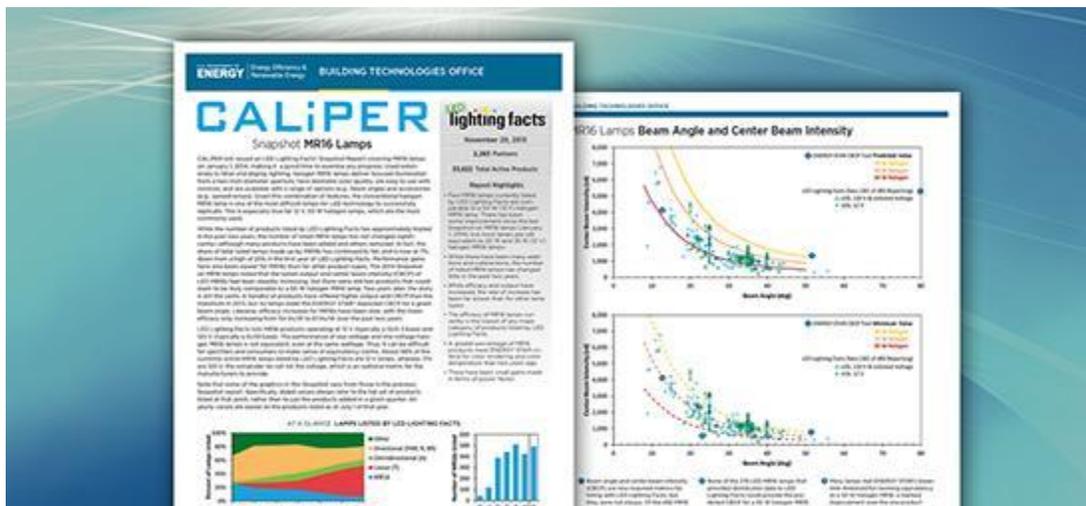
U.S. DEPARTMENT OF ENERGY

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## Another Look at LED MR16s

Used extensively in retail and display lighting, halogen MR16 lamps deliver focused illumination from their 2"-diameter apertures, have desirable color quality, are easy to use with controls, and come with a range of options (e.g., beam angle) and accessories (e.g., spread lenses). This combination of desirable attributes makes the halogen MR16 a challenging competitor for LED technology to successfully replicate — and this is especially true for 12V, 50W halogens, the highest wattage that's commonly available.

DOE's [CALiPER program](#) has just published a [new Snapshot Report on LED MR16 lamps](#), which updates a similar [Snapshot Report published in January 2014](#) and sheds considerable light (pun intended) on this important product category. In the past two years, LED technology has progressed rapidly, but the progress has been much slower for LED MR16s.



While the number of products listed by [LED Lighting Facts](#)<sup>®</sup> has approximately tripled in the past two years, the number of listed MR16 lamps has not changed significantly — although many products have been added and others removed. In fact, the share of total listed MR16 lamps has continued to fall and is now at 7%, down from a high of 25% in the first year of LED Lighting Facts — although the market penetration for LED MR16s is among the highest for any product category. Performance gains have also been slower for MR16s than for other product types. The 2014 Snapshot noted that the lumen output and center beam intensity (CBCP) of LED MR16s had been steadily increasing, but there were still few products that could claim to be truly comparable to a 50W halogen MR16.

Two years later, the story is still the same. A handful of products have offered higher output and CBCP than the maximum in 2013, but no lamps meet the ENERGY STAR® *expected* CBCP for a given beam angle. Likewise, efficacy increases for MR16s have been slow, with the mean efficacy only increasing from 54 lm/W to 61 lm/W over the past two years — the lowest efficacy of any major category of products listed by LED Lighting Facts.

LED Lighting Facts lists MR16 products operating at 12V (typically a GU5.3 base) and 120V (typically a GU10 base). The performance of low-voltage and line-voltage halogen MR16 lamps is not equivalent, even at the same wattage, so it can be difficult for specifiers and consumers to make sense of equivalency claims. About 66% of the currently active MR16 lamps listed by LED Lighting Facts are 12V lamps, whereas 17% are 120V, with the remainder not listing the voltage, which was previously not required for listing.

On the bright side, a greater percentage of MR16 products meet ENERGY STAR criteria for color rendering and color temperature than was the case two years ago, and there have been small gains made in terms of power factor.

The MR16 category was an early target for LEDs, because their attributes seem well suited for the technology: small size, directional output, and a low-efficacy incumbent. Now these conditions may be contributing to the stagnant performance. For example, LED MR16s are already much more energy-efficient than halogen lamps, and there are no other source types that can match the other features of halogen lamps (e.g., dimmability), so there's less incentive to improve the efficacy of LED MR16 lamps compared to, say, linear lamps (TLEDs), which must compete with high-efficacy linear fluorescent lamps. In contrast with MR16s, the efficacy, output, and number of TLEDs have been growing rapidly. Given the limitations of the MR16 form factor and need for high color quality, the market may be dictating that energy-performance improvements are a secondary consideration to cost-competitiveness, CBCP, and perhaps light output.

Still, efficacy improvements can help alleviate thermal-management challenges associated with the small form factor, for example, which may help a true 50W halogen MR16 equivalent to emerge. Many performance considerations are not captured in basic photometric data. For example, LED MR16 lamps require an integral driver that must fit into the form factor and, in commercial applications, must operate at 12V, necessitating the use of a transformer. This combination may result in compatibility issues, where performance is degraded in one or more areas (e.g., flicker). This is sometimes a result of tradeoffs that must be made, such as between flicker and power quality. More information can be found in the DOE SSL [fact sheet on MR16 lamps](#). Long-term performance is another key consideration, and will be the focus of an upcoming CALiPER investigation, so stay tuned.

Best regards,  
Jim Brodrick

As always, if you have questions or comments, you can reach us at [postings@akoyaonline.com](mailto:postings@akoyaonline.com).