

In L Prize® Competition, Everyone's a Winner

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Despite dazzling advances in countless other areas of technology, the incandescent light bulb has changed very little since the days of Thomas Edison. Although back then it was considered a marvel of science, today it stands out for its inefficiency, converting into visible light less than 10 percent of the electricity it consumes. And with billions of the bulbs in use today, that amounts to a heck of a lot of wasted energy.

This is why, at the behest of Congress, the U.S. Department of Energy (DOE) launched the L Prize® competition in 2008 to challenge industry to come up with high quality, high efficiency solid-state lighting (SSL) products to replace the common light bulb. Why SSL? Because, being based on light-emitting diodes (LEDs) instead of filaments, plasma, or gas, it has the potential to be more energy efficient than any other known lighting technology.

Whereas some competitions reward innovation without a lot of focus on practicality, DOE recognized that in order to have any kind of meaningful impact on our nation's energy use, an L Prize winner would have to be adopted by buyers on a wide scale. Consequently, not only was the winning entry required to measure up to extremely high standards in terms of its energy efficiency, output, light quality, distribution, and lifetime, but its manufacturer also had to demonstrate the capacity for mass-production. Because the bar was set so high, it wasn't until late 2009 that the competition received its first entry—a product from Philips Lighting North America that was intended to replace a 60W incandescent bulb.

TAKING THE PRIZE

That entry became the most publicly tested light bulb in history, as the 2,000 samples submitted by Philips were put through an 18-month evaluation that was as thorough as it was multifaceted. In addition to industry standard photometric testing carried out by independent laboratories, a series of stress tests subjected samples to such extreme conditions as high and low temperatures, high humidity, and vibration. On top of that, long-term lumen maintenance testing was carried out at elevated temperatures (45°C) and field assessments were conducted by utilities and other partners to see how the product fared in real life settings.

The Philips entry came through with flying colors, exceeding the L Prize requirements on all fronts. It produces 910 lumens of light, which is more than a typical 60W incandescent bulb, yet it consumes less than 10 watts, yielding a wattage savings of 83 percent.

Just as important, its light distribution is as omnidirectional as that of a 60W incandescent, and its light quality is comparable—a correlated color temperature of 2727K and a color rendering index (CRI) of 93—for a decidedly “warm-white” look that buyers prefer.

As for longevity, based on measurements taken during the first 12,000 hours of operation, the L Prize winner's projected lumen maintenance at 25,000 hours—the minimum lifetime required for the L Prize winner—was predicted to be greater than 99 percent, far exceeding the required minimum of 70 percent. That means the Philips entry should last longer than 25,000 hours, whereas a typical 60W incandescent bulb lasts only around 1,000 hours.

Field assessments provided user feedback and performance verification in a range of fixture types and applications. At more than 40 different sites across North America—ranging from single and multifamily residential to commercial offices, hospitals, and retail stores—more than 1,300 samples of the lamp were installed by utilities, energy efficiency organizations, and other L Prize partners, who looked at such things as dimming, quality of light, and user perception. User feedback was highly positive, noting the light output and color quality of the lamp. Input from field assessment partners prompted design changes to improve dimming performance and to fine-tune application guidance for the production version of the winning lamp.

For its winning entry, Philips received a cash prize of \$10 million, which the company says it will invest in the product, not only in its production and marketing in the U.S., but also in further R&D to reduce costs. The lamp's LEDs are manufactured in San Jose, California, and the bulb will be assembled at a plant near Milwaukee, Wisconsin. The product is expected to hit stores in early 2012, and more than 30 L Prize partners—utilities and energy efficiency programs with access to more than 100 million potential customers—are making plans to implement incentives and other promotional efforts.



This is expected to help drive prices down quickly, which is especially important with new technologies because their high development costs often combine with low sales volumes to make products expensive.

A BROAD IMPACT

More than 970 million 60W A-19 lamps are in use in the U.S., most of them in the residential sector. DOE estimates that converting every one of them to the L Prize winner would save approximately 35 terawatt-hours of electricity in one year, which is enough to power the lights of nearly 18 million households, or about triple the annual electricity consumption of Washington, D.C. That translates into an annual savings of almost \$4 billion for users, not to mention the avoidance of 20 million metric tons of carbon emissions.

But the L Prize has already had a considerable impact—and not just on Philips. For one thing, some of the company's products that are already in stores incorporate technology Philips developed specifically for its L Prize entry. But more than that, there's the principle of "a rising tide lifts all boats." Competitions drive innovation and innovation drives market competition. The market as a whole has been catalyzed by the launch of the L Prize competition and the submission of the Philips entry.

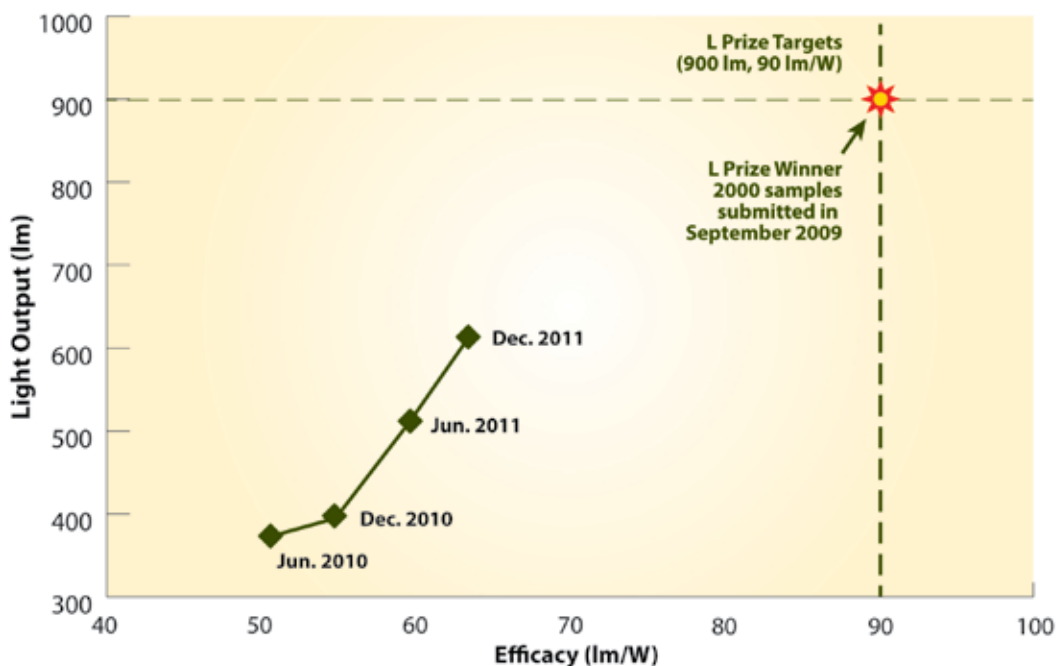
As a result, the industry has progressed further toward high-quality replacement lamps for the common light bulb, as evidenced by the steady improvement in LED replacement lamps since 2008. Back then, those tested in DOE's CALiPER

(Commercially Available LED Product Evaluation and Reporting) program only matched 10W to 25W incandescent bulbs for light output and also fell short of 60W incandescents in other important ways.

Today, we're seeing more and more LED replacement bulbs coming onto the market; on the whole, they perform much better than their predecessors. In December 2011, DOE reviewed 135 LED replacement lamps registered with its LED Lighting Facts program and found 26 that produced more than 800 lumens, equivalent to a 60W incandescent lamp. A couple even produced more than 1,100 lumens, approximately equivalent to a 75W incandescent. (However, please note: some of these products have high color temperature and/or low CRI; no other current products match the combined output, efficacy, and color performance of the L Prize winner.)

While the light output of most of those Lighting Facts-listed LED replacement lamps fell well short of 800 lumens, and many were comparable to 25W–40W incandescent lamps (250–450 lumens), the overall results represented a significant improvement from the state of the market just six months earlier. What's more, despite quite a bit of variation in the efficacy of those 135 products tested, their range—mainly between 35 and 80 lumens per watt—was also a considerable improvement. Although this falls short of the stringent L Prize requirements, the upward trend in performance is noteworthy and shows that the performance of the L Prize entry preceded the market by at least two years and probably more.

Average Light Output and Efficacy of LED A-Lamps



GETTING UP TO PAR

Because the L Prize competition targets the most widely used types of inefficient bulbs, it also has a PAR 38 category. That category was temporarily closed in 2011 to retool the competition requirements based on lessons learned from the 60W category. When it reopens, it will add even more impetus to the "rising tide" that's helping to bring energy-efficient lighting options to consumers who are, after all, the L Prize's real winners.

To learn more about the first L Prize winner as well as the competition in general, visit www.lightingprize.org. ©

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