

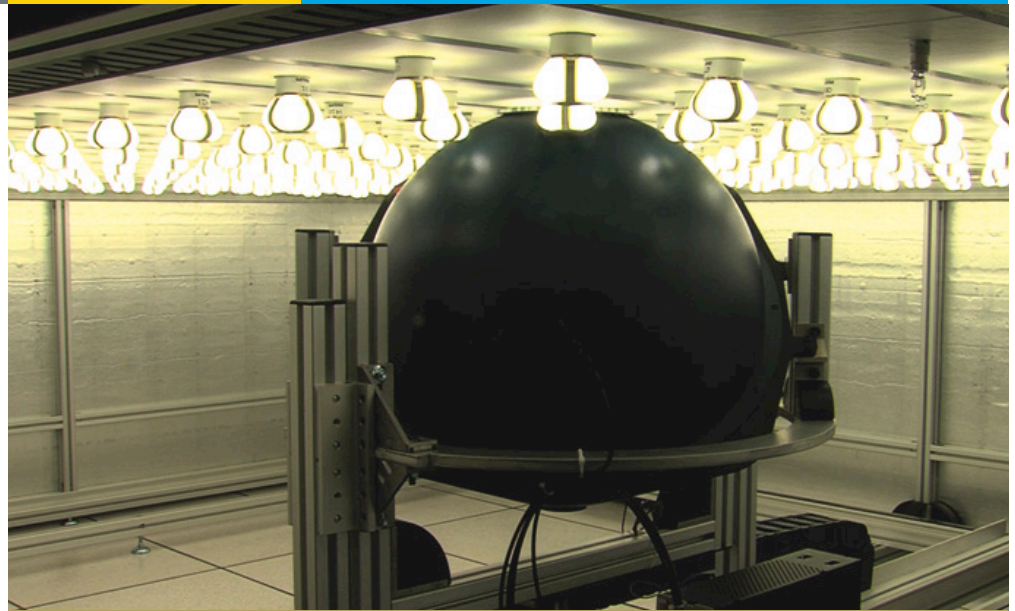
L Prize® Competition Drives Technology Innovation, Energy Savings

In challenging manufacturers to develop high-quality lighting products that set leading-edge performance benchmarks for the industry, the L Prize became a gift that keeps on giving.

Lighting accounts for one-fifth of all the electricity consumed in the United States, and most lighting products are far from energy efficient. That's why, at the behest of Congress, the U.S. Department of Energy launched the L Prize competition in 2008. The goal was to challenge industry to develop high-quality, high-efficiency solid-state lighting (SSL) products and to move the market to adopt those products much more quickly than would otherwise occur.

DOE recognized that rewarding innovation without regard to practicality wouldn't have an impact on the country's energy use. To win the L Prize, it wasn't enough for an entry to meet the competition's ultra-high standards for energy efficiency, output, light quality, distribution, and lifetime—its manufacturer had to also demonstrate the capacity for mass production, a substantial amount of which had to be done in the United States.

Thirty-one utilities and energy efficiency organizations from across North America signed on as partners to provide real-world insight and feedback to the L Prize competition.



Long-term testing of the L Prize entry was conducted in a specially designed high-temperature apparatus at Pacific Northwest National Laboratory.

The Winner

In late 2009, the L Prize competition received its first entry—a product from Philips Lighting North America intended to replace the 60W incandescent bulb. The 2,000 samples submitted by Philips went through a rigorous 18-month evaluation that included industry-standard photometric testing, stress testing under extreme conditions, and long-term lumen maintenance testing at elevated temperatures. In addition, field assessments were conducted by L Prize partners to see how the product performed in real-world settings.

The Philips entry met all requirements and, in August 2011, was declared the L Prize winner in the 60W replacement category. The product hit retail shelves on Earth Day 2012. This energy-saving lamp was comparable to a 60W incandescent in color quality (CRI = 93, CCT = 2727 K), light distribution, and light output (940 lumens) but consumed less than 10W (a savings of 83%), and at 25,000 hours of testing, the actual lumen maintenance was 100%, with chromaticity change at less than .002.

MARKET IMPACTS

of L Prize Competition

When DOE launched the competition in 2008, most LED replacement bulbs were of poor quality and wouldn't satisfy consumers looking for an LED lamp to replace a 60W incandescent bulb.

- Philips' entry helped catalyze market competition and pushed industry toward a clear target. As a result, prices dropped and performance improved to the point where there are now many competitive LED 60W replacement bulbs on the market.
- Technology advances developed by Philips for the L Prize entry inspired a new technology platform, accelerating enhancements to the company's successive product designs.
- Philips estimates that this family of products reached sales representing more than \$51.3 million in energy savings in the first two years alone.

Spawning Generations of Energy Savings

When the L Prize competition was announced, the performance targets were a huge stretch. The few omnidirectional LED replacement lamps on the market were more like 25W or 40W incandescent lamps in output, with wide variations in size, shape, and color quality—not to mention exaggerated performance claims. Today, LED 60W replacement products are ubiquitous and have light output equivalent to a 60W or higher incandescent, and 75W and 100W LED replacement bulbs are also widely available. Consumers are benefiting from this steady improvement in LED replacement lamp performance, along with significant price decreases.

Philips' L Prize entry helped catalyze market competition and pushed the whole industry toward a clear target, setting the bar for consumer satisfaction and success. The technology innovations in the L Prize winner—including more-efﬁcacious LED chips, electronic miniaturization, better heat transfer, improved optics, and remote phosphors—have had a lasting impact on the company's LED offerings, finding their way into millions of subsequent products that continue to save massive amounts of energy each year. Philips estimated that after the prize was awarded, this family of products reached sales representing more than \$51.3 million in energy savings in the first two years alone.

Ed Crawford, head of Lamps and Lighting Electronics at Philips Lighting North America, credits the L Prize with pushing his company to focus its research efforts on LED bulbs—accelerating those efforts three to five years ahead of where they would have been without the competition.

Increasing Our Knowledge

The L Prize competition has also significantly increased our knowledge about SSL technology and its capabilities. In order to win the competition, the Philips entry had survived more than 8,000 hours of accelerated long-term testing in a specially constructed apparatus at Pacific Northwest National Laboratory under elevated ambient temperatures (45° C). After the prize was awarded, those samples—which, when new, emitted at least 900 lumens while consuming less than 10W—continued to be tested, with 31 of them randomly selected to continue the testing through more than 50,000 hours of continuous operation.

The average lumen maintenance for those 31 lamps after 50,182 hours (reached in August 2016) was 93.0%—well above the commonly used industry benchmark of 70%—and not a single lamp among them had failed. What's more, the average chromaticity change ($\Delta u'v'$) of the lamps after 50,182 hours of operation was 0.002—a minuscule difference indicating that there was no detectable color shift, and that the light emitted today is indistinguishable from the light emitted five years ago. The fact that the L Prize-winning bulbs were still going strong after more than 50,000 hours serves as a powerful reminder of the exceptional performance possible with well-designed LED products, and validates the methods being used for predicting performance. ■

What is the L Prize?

The Energy Independence and Security Act of 2007 directed DOE to establish the L Prize competition, which is designed to spur development of ultra-efficient solid-state lighting products to replace two of today's most widely used and inefficient technologies—60W incandescent lamps and PAR38 halogen lamps—as well as create a 21st Century Lamp that delivers more than 150 lm/W.

- The L Prize for the 60W replacement category was awarded in August 2011.
- The PAR38 competition was suspended in June 2014 because no entries had been received during the 11 months the solicitation was available.
- The complete competition requirements for the 21st Century category have not yet been published.



Philips Lighting North America's L Prize-winning technology has enabled subsequent generations of energy-saving products.

U.S. DEPARTMENT OF
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For more information, visit: energy.gov/eere/solid-state-lighting

DOE/EE-1141 • October 2016