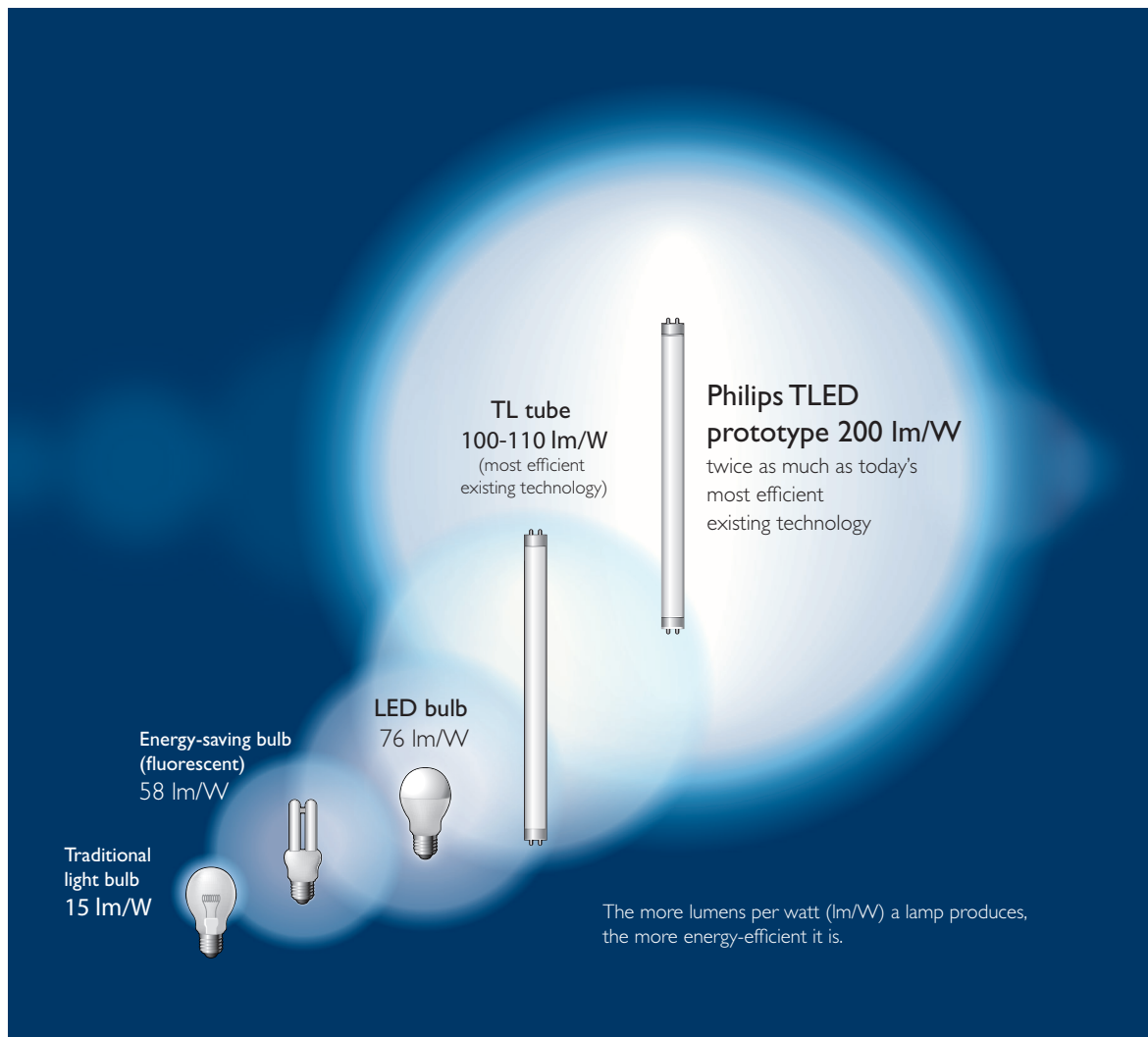


PROF

Lighting world first: Philips breaks 200 lumens per watt barrier



How many lightbulbs does it take to change the world? In this case, just one.

Lighting accounts for one fifth of the world's total electricity consumption. By creating the most energy-efficient LED lamp prototype ever at 200 lumens per watt, Philips hopes to cut business and household lighting bills by at least half. This innovation, which produces warm white light, is a huge leap forward from today's standards: it's twice as efficient as current fluorescent lighting and more than 10 times as efficient as a traditional light bulb. Philips expects to launch the lamp in 2015.

New lighting benchmark

Philips has taken energy-efficient lighting to a whole new level. Its new TLED prototype, designed to replace fluorescent tube lighting, produces a record 200 lumens per watt (200 lm/W). By creating the world's most efficient warm white LED lamp that uses half the energy of the current most efficient lamps on the market, Philips has set a new benchmark in LED innovation.

Breaking the barrier

"The new prototype lamp marks the first time that lighting engineers have been able to reach 200 lm/W efficiency in a real-life lamp without compromising on light quality," says Rifat Hikmet, the Principal Scientist at Philips Research who made the breakthrough. Reaching even higher numbers in the past was possible, but such high values were reached at a cost of light quality (it was too green, for example), which was unacceptable for general lighting purposes in every day settings.

To be suitable for using in homes, shops and offices the light has to fall within certain technical parameters. Namely the color point needs to be on what is known as the 'black body line', the so-called 'color rendering index' needs to be larger than 80, and the light needs to contain enough red. The theoretical maximum for a light source satisfying these conditions is around 390 lm/W. This can be reached when LEDs can convert electrical power to optical power with 100% efficiency, but such a value is far from being in reach in the near future.

Why this innovation matters

Twice as efficient: lower energy bills, lower carbon emissions

New form factors possible: produces less heat = fewer cooling parts needed

Warm white light: same high quality light that people prefer

Cheaper: less expensive to own within just one year

The 200 lm/W lamp compared to the most efficient lamp currently on the market.

What does lumens per watt mean?

A **lumen** is a measure of how much visible light is emitted by a source. **Lumens per watt (lm/W)** refers to the energy efficiency of lighting: how much visible light you get for a given amount of electricity. For example, a traditional 60 watt incandescent bulb in the US produces 860 lumens. By dividing 860 by 60 watts you can calculate that for each watt of power it uses, the bulb gives out 14.3 lm/W. Each single watt of power used by the new prototype TLED produces 200 lumens. This means it would need less than 5 watts of energy to produce the same amount of light as the traditional 60W bulb.

How much more efficient?

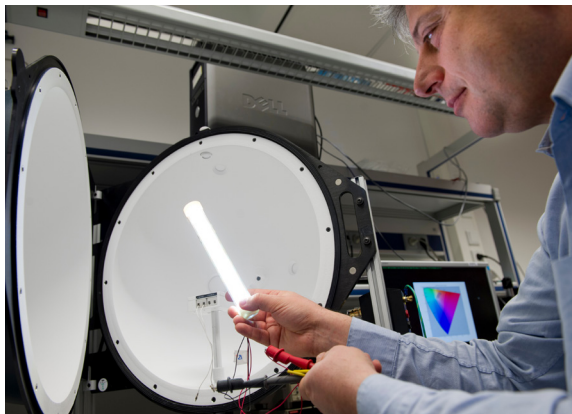
Until now, the relative energy efficiency of fluorescent lighting (100 lm/W) has seen it dominate in office and industrial environments such as warehouses and factories. Homes and shops, meanwhile, have tended to stick with the gentler, warmer light produced by conventional bulbs (operating at around 15 lm/W) or halogen lights (25 lm/W). Philips' new 200 lm/W LED is set to leave all three technologies in the shade.

In 2015, TLEDs will be available for businesses to retrofit their offices and warehouses – which will cut their lighting bills by 50%. Over time Philips will incorporate the technology into home and shop lighting, cutting those bills by even more.

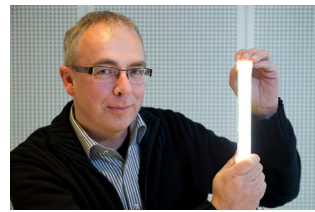
In the US alone, for example, fluorescent lights consume around 200 terrawatt hours of electricity annually. If these lights were all replaced with 200 lm/W LEDs, the US would use around 100 terrawatt hours less energy. This equates to an annual saving of more than \$12 billion and 60 million metric tons less CO₂ being released into the atmosphere, equivalent to the emissions of around 17 coal-fired power plants, 12 million passenger vehicles, or 140 million barrels of oil consumed.

As an added bonus, because the new LEDs generate less heat they do not need bulky heat sinks to keep cool – which will result in greater design freedom, less material usage and lower production costs.

"This is a major breakthrough in LED lighting and will drive the transformation of the lighting industry," says René van Schooten, CEO Light Sources & Electronics for Philips Lighting. "It's exciting to imagine the huge energy and cost savings it will bring to our planet and our customers."



Rifat Hikmet with the 200 lm/W lamp prototype



“It’s the real deal: a warm white LED that produces 200 lm/W at lamp level, within all the technical parameters required for real-life applications.”

Coen Liedenbaum, Innovation Area Manager Lighting for Philips Research

How are white LEDs created?

There are currently two ways to make white light with LEDs. One method mixes multiple wavelengths of different LEDs to make white light (i.e. RGB – red, green, blue); allowing the lighting designer to tune the white light to a specific color ‘temperature’. The second method uses a blue Indium-Gallium-Nitride (InGaN) LED with a phosphor coating to create white light. This is the method that results in the more commonly seen ‘white LED’. “But this innovation represents a new approach to creating high quality white light. It’s a combination of red and blue LEDs, with part of the blue light converted to green using phosphor,” explains Coen Liedenbaum, Innovation Area Manager Lighting for Philips Research who led the project. “It’s the real deal: a warm white LED that produces 200 lm/W at lamp level, within all the technical parameters required for real-life applications.”

This LED significantly boosts efficiency from the earlier generation, which itself won the L Prize winning replacement 60W bulb for outstanding energy efficiency. This breakthrough is the culmination of years of commitment to LED research and the sheer breadth of knowledge and experience within Philips, says Rifat Hikmet. “Because Philips is a world leader not just in LED technology, but also in materials, luminaires, systems and applications, we were able work from every angle to maximize light conversion and minimize energy loss,” he explains.

A heritage of innovation at Philips

This latest creation takes its place in a long tradition of innovation at Philips, which stretches back to when the company first brought Edison’s light bulb to the market more than 100 years ago. More recent lighting breakthroughs include Hue, the world’s first and smartest web-enabled LED home lighting system.

The TLED prototype will help to make all LED lights from Philips more efficient. Early derivatives are already being incorporated into the company’s commercial LED products. The 200 lm/W TLED lamp is expected to hit the market in 2015 and will ultimately be used in a wide range of applications for the home and retail, as well as professional services.

Technical specifications for TLED prototype

- ▶ Efficacy 200 lm/W
- ▶ CRI >80
- ▶ CCT 4500-3000K
- ▶ BBL R9>20

See also: http://youtu.be/E4QWdd6_wVs

Philips 200lm/W lighting technology breakthrough

Blue LEDs create light very efficiently... ...but blue light is not suitable for general use Optimized green phosphor material absorbs the blue light and reemits energy as green light

Color balance is critical for light quality and efficiency

Blue, green and red light is combined to create high quality white light 7.5watt TLED emits the same amount of light as a traditional 100watt bulb

At the heart of the new TLED is the Philips Lumileds InGaN LED, recognized as the world’s highest performing blue LED.



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