

LED Lighting vs Incandescent Lighting

Solid-state lighting has long been touted as the next generation of efficient bulbs, but technical challenges have so far limited product offerings to 40-watt equivalents—and consumers haven't exactly rushed shelves to purchase bulbs to read by. Developing light-emitting diodes (LEDs) that generate full-spectrum color—white light—is particularly difficult. Another hurdle has been finding a way to efficiently manage LED temperature: If the bulb gets too hot, it fails. Now, the first LED bulbs to rival the 60-watt, screw-in incandescent are finally poised to hit the market. If they win over consumers, the efficiency gains could yield impressive reductions not only in individual electricity bills but also in global carbon emissions. The Department of Energy estimates that replacing regular light bulbs with LEDs could potentially save 190 terawatt-hours annually the equivalent of lighting over 95 million homes.

The 12-watt EnduraLED, recently announced by Philips Lighting, has a rated life of 25,000 hours (nearly 3 years). The 9-watt Definity LED made by Lighting Science Group may last twice as long. But longevity in a super-efficient package doesn't come cheap. Each Definity LED will cost about 30 dollars and the EnduraLED may top 50 dollars—as much as the lighting fixture it's destined for. The price tag will almost certainly cause consumers to stop short and weigh the real benefits. But even with the current high price, LEDs are one of the most promising light sources available for consumers, beating out everything on the current market for reliability, efficiency and longevity.

Where CFLs Fall Short ...

Studies from the Program for the Evaluation and Analysis of Residential Lighting (PEARL) show that compact fluorescent bulbs often don't live up to manufacturer's claims. Glenn Reed of Energy Futures Group in Burlington, Vt., and his colleague Chris Granda at Grasteu Associates recently analyzed five years' worth of PEARL testing data on 1500 Energy Star-qualified CFLs. They found that some CFLs began to lose brightness quickly. For example, almost half of reflector CFLs—the kind used in recessed lighting—were more than a quarter dimmer before they had reached half of their rated lifetime. Although CFLs typically perform worse in recessed lighting, Reed found that these CFLs weren't even living up to their Energy Star ratings. One possible explanation is that the recessed cans that house reflectors trap heat that wears out the bulb.

The PEARL studies also revealed that the average lifespan of CFLs often fell short, echoing a common complaint among CFL users. Among eight frequently tested brands, including Philips Lighting and General Electric, early failure rates ranged from 2 to 13 percent. The National Lighting Product Information Program has found similar differences in quality among Energy Star-labeled brands. Reed notes that PEARL only tested 10 bulbs per brand and that the same brand wasn't necessarily tested all five years. These data limitations make it difficult to rank best and worst brands, but, says Reed, "it's definitely a yellow flag."



... LEDs Step In

Solid-state lighting can potentially overcome many problems with CFLs, including those highlighted by the PEARL studies. LEDs perform well in all lighting applications, including recessed lighting, and unlike all but specialized compact fluorescent bulbs LEDs are dimmable. Because of recent advances in optics, LEDs have a quality of light superior to all other types of lighting—and they deliver it more efficiently. For example, Lighting Science Group's Definity LED delivers 112 lumens per watt compared to a CFL's 50 to 70 lumens per watt.

Improvements in managing the LED chip's temperature have contributed to their marathon life span: LEDs can last up to 50,000 hours, more than eight times as long as CFLs. The bulbs are also likely to deliver on their lifetime claims because they won't face the same quality-assurance issues that have plagued CFLs. Energy Star only recently began performing "random, off-the-shelf testing" of Energy Star-qualified CFLs. In contrast, random testing has been a part of Energy Star's eligibility criteria for solid-state lighting since the

beginning. Even if CFL quality becomes more consistent now, they still can't compete with LED efficiency or, because of their mercury content, be recycled as easily.

Zach Gibler, the CEO of Lighting Science Group, says LED prices will begin to drop over the next 12 to 36 months. A lower retail price for the 60-watt replacement combined with rebates, which companies already offer on many CFL and LED purchases, will provide strong incentives for consumers to replace CFLs with LEDs. "Right now for day-to-

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day use, CFLs are still an inexpensive energy-efficient alternative to incandescents," Reed says, "but they are really just a transitional technology."