



U.S. Department of Energy
Energy Efficiency and Renewable Energy

DOE Solid-State Lighting Commercialization Support Overview

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2006 DOE Solid-State Lighting Workshop
Orlando, Florida
Feb 1-3, 2006



DOE SSL Commercialization Support Background

- DOE has long-term commitment to supporting SSL; commercialization support increases likelihood that its investment will pay off
- Potential benefits from payoff are large: 1.5 quads and \$25 billion cumulative by 2025
- Commercialization support must be coordinated with research
 - Inappropriate application of SSL products put potential benefits at risk, causing buyer dissatisfaction, and delaying market development
- SSL could fundamentally change the lighting market
 - Likely to spark innovations that could change the way lighting is delivered to the market



Commercialization Support Activities Coordinated with NGLIA

- DOE places high value on coordinating its commercialization support with NGLIA
- NGLIA reviews and contributes to plans
- NGLIA has established an ENERGY STAR Task Force to work with DOE on ENERGY STAR criteria development for SSL





Why Now? Why not Wait Until Technology is More Mature?



- SSL not currently appropriate for most general lighting applications; but they are appropriate for a small and growing number of applications
- Help consumers, businesses, government agencies differentiate good products and applications



Why Now? Why not Wait Until Technology is More Mature? (cont.)

- Help counter misinformation, common in the market
- Communicate performance targets to industry
- Increase likelihood of favorable buyer experiences with early generation LED products
- Inform and assist the standards development process





SSL Commercialization Activities Underway

- CFL lessons learned study
- ENERGY STAR criteria development
- Consumer, business, and government technical information
- Design competitions (Lighting for Tomorrow)
- Government agency and program coordination and outreach
- Technical support for testing and measurement standards

GELcore

External Use

LED Refrigerated
Display Light





Comprehensive SSL Commercialization Activities Pending

- Technology procurements
- Technology demonstrations
- Technology tracking and information services
- Retailer technical information programs
- Builder technical information programs
- Lighting designer programs
- Student educational materials
- Utility promotion and incentive programs





Activities Underway

- CFL Lessons Learned Study
 - Draft report complete (review and analysis of literature on market introduction of CFLs; what went right and what went wrong)
 - Interviews with leading industry participants underway





Activities Underway (cont.)

- Technical Information for Consumers, Businesses, and Government Agencies
 - Presentations by PNNL and DOE staff in key venues
 - Fact Sheets
 - Web pages under development

Building Technologies Program

Energy-Efficient Lighting and Light Emitting Diodes (LEDs)

Q: Why are we hearing so much about LEDs today?

A: Light-emitting diodes (LEDs) have been around since the 1960s, but are just now reaching the levels of luminous output and power that open the door to more applications. LEDs are solid-state lighting (SSL) devices, which produce light from semi-conducting materials. Colored LEDs offer energy efficiency, maintenance savings, impact resistance, durability, and other benefits for traffic signals, exit signs, and other specialty applications. White LEDs are approaching performance levels that make them attractive for use in automobiles, aircraft, and elevators. For most general illumination applications, however, current LEDs cannot yet compete with traditional sources on the basis of either performance or cost.

Q: I've seen a lot of white-light LED products available now... what should I look for?

A: Some of the LED products available today are marketed as "energy-efficient," but actually have very low light output compared to typical light sources. The combination of high price and low light output may make them a poor replacement for current technology. It is important to compare new LED products to the most efficient conventional technology (such as fluorescent, incandescent, or metal halide) that could be used in your specific application. The following checklist will help you determine if an LED product is right for your application:

- Ask how many watts the product consumes and how many lumens of light it produces. Lumens per watt (lpw) is the measure of how efficiently the light source is converting electricity into useable light. For comparison, incandescent lamps typically produce 12-15 lpw. Compact fluorescent lamps (CFLs) produce at least 50 lpw. The best white LEDs available today can produce about 30-35 lpw, and products in the 45-50 lpw range are expected to be available this year (2005). For some applications, LEDs can provide enough light on the task, even though their total lumens are lower than comparable incandescent or fluorescent sources. This is because LEDs emit light in a more concentrated beam than other light sources. Still, it is helpful to know how much total light the LED product provides.
- Evaluate the cost. A 75-watt incandescent light bulb typically produces about a thousand lumens and costs less than \$1.00. The problem is, it only lasts about 1,000 hours and only converts about 5% of the electricity it consumes into light. A comparable CFL is 5 times more efficient, lasts 10,000 hours, and costs less than \$5.00. Today's white LED products cost more than \$150 per thousand lumens. But that's only part of the story. If you have lights that are on most of the time, or in a hard-to-reach area, LEDs could save significant maintenance costs due to their potentially very long life.
- Assess the need for unique LED features. In some applications, the extra durability that LEDs can provide is worth a higher purchase price. Outdoor pathway and step lighting is an example of a sensible application for today's white LEDs. They provide a small amount of light right where it's needed, and can be powered by solar cells, eliminating the need for running wire outdoors. They are also good for applications where vibration often leads to early failure of conventional light sources. Being a solid-state device, LEDs are highly resistant to damage caused by vibration.
- Check the color of white LEDs. If you've ever tried to match white paint, you know there are actually many shades of white. White light is no different. White light varies from "warm" or more yellow in appearance, to "cool" or more blue. Today's white LEDs are typically "cooler" and bluer, even compared to fluorescent sources. Further, there is a trade-off between efficiency and color. The "warmer" colored white LEDs provide less light per watt of electricity consumed, compared to the "cooler" white LEDs.
- Get a sample of the product, so you can evaluate it yourself. Because of the current lack of standardized reporting practices among LED product manufacturers, there is not yet a reliable way to compare product performance based on information provided by the manufacturer. The best way to assess a product you are considering is to ask for a sample.

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Activities Underway (cont.)

- Technical support to lighting industry standards organizations for developing SSL testing and measurement standards
 - Dialogue with all key organizations underway
 - DOE working with IES to expedite photometric stds.
 - Planned workshop for standards organization





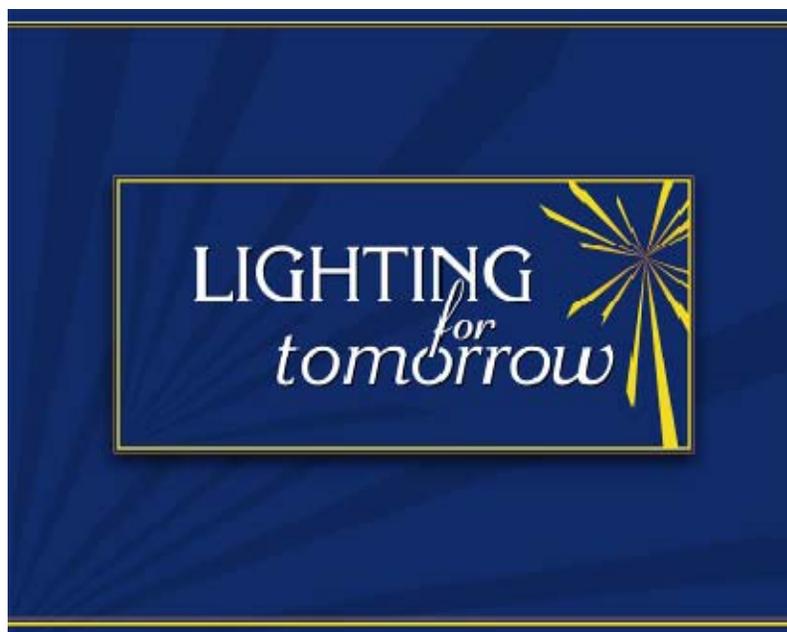
Activities Underway

- Energy Star Criteria
 - In development now
 - Will apply to LEDs for general illumination
 - Jeff McCullough will report





Activities Underway



- SSL Products Design Competition
 - Developed plan with ALA and CEE; DOE lead on SSL component
 - Designing competition to align with ES specifications
 - Kelly Gordon will report