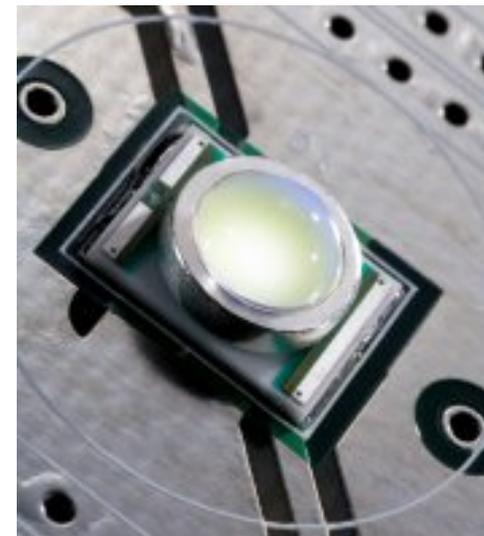




Light Emitting Diodes: Applications

Kelly Gordon
Pacific Northwest National
Laboratory
Energy 2006
August 8, 2006



Cree, Inc.



Outline

- **What do LEDs look like?**
- **LED energy efficiency**
 - System efficacy
 - Application efficiency
- **Identifying near-term niche applications**
- **Evaluating available products**
 - What questions should you ask?



What do LEDs look like?



Cree XLamp 7090



Philips Lumileds Luxeon K2

LED Devices



What do LEDs look like?



Osram OSTAR Lighting



Lamina Titan

LED Packages or Light Engines



What do LEDs look like?



Mule Lighting



Lighting Sciences Group



Enlux

LED Drop-in Replacements



What do LEDs look like?



Lighting Services Inc LumeLEX



Color Kinetics iW Blast

Integrated LED Systems



System Efficacy

- **Energy efficiency of CFLs based on system (lamp+ballast) efficacy**
- **LED system efficacy needs to account for all components**
 - **Electrical and thermal design is critical to actual performance**



LED System is More than LED + Driver

- **Light output depends on thermal management**
- **Fixture may BE the heat sink**
- **Often the LED cannot be separated from the fixture**
- **No standard package or interface**



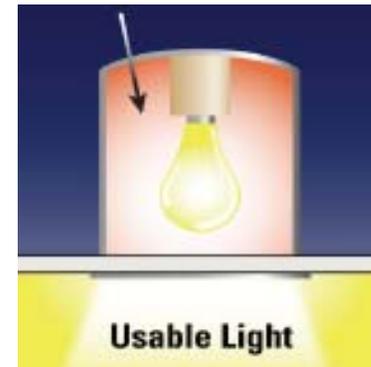
Permlight



Light Source Directionality

- **Inherent directionality of the LED light source**
- **Lower fixture losses compared to bulb-shaped lamps**
- **More delivered illuminance for lower total lumens and lower energy consumption**

Half of the light is lost in the fixture



PNNL



LRC



Identifying Niche Applications

- **Directed light applications**
 - Task lighting
 - Display cases
- **Source relatively close to illuminated surface**
- **Relatively modest illuminance requirements**
- **Applications in which typical fixture efficiency (with traditional light sources) is 50% or lower**



Refrigerated Case Lights



GELcore



Nualight

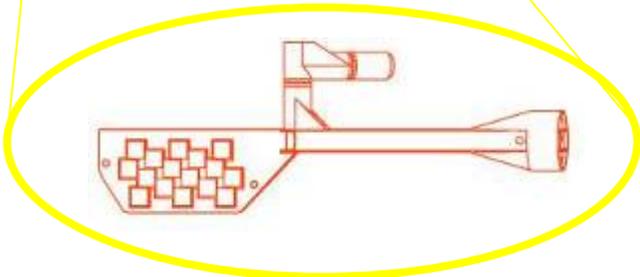




Portable Desk/Task



Lucesco Halley



Herman Miller Leaf





Undercabinet Lights



Albeo



Cyberlux



Color Kinetics



Alkco



Downlights



- **Product testing needed**
- **Thermal management critical**
 - **Especially in insulated ceilings**



What should you ask?

- How many lumens?
- How many watts?
- What's the color temperature?
- How is the heat managed?
- How does it compare to the most energy-efficient alternative?





More Information

<http://www.netl.doe.gov/ssl/>

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