



# What's new with ENERGY STAR SSL? A Review of the Latest Criteria

Andre Javier-Barry, D&R International

March 18, 2009

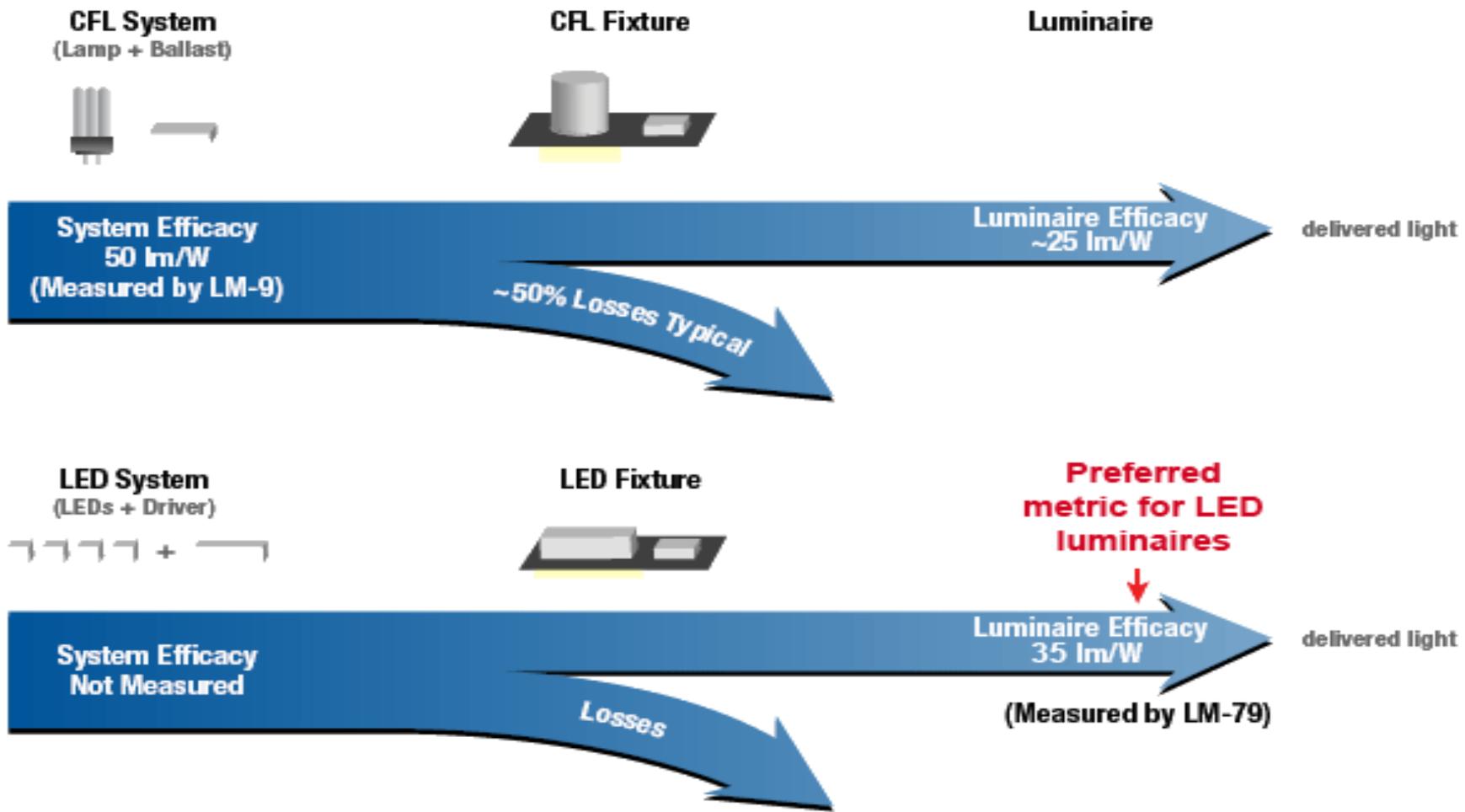
Lighting Partner Meeting

San Antonio

- Limits coverage to LED systems for general illumination only
- Commercial and residential
- Luminaire efficacy key metric
- Establishes 2-category specification:
  - Category A: prescriptive specifications for niche category lighting applications (near-term)
  - Category B: performance specification for all applications (long-term)
- Excludes OLEDs...for now

# The Preferred Metric

## System Efficacy Vs. Luminaire Efficacy (Recessed Downlights Example)



# Transitional Two-Category Approach



- Recognizes rapidly changing technology
- Allows early participation of limited range of SSL products for directional lighting applications in Category A
- Will drop Category A entirely in 2011
- Establish Category B as basis of criteria

*Lighting industry is learning the unique issues of applying SSL to general illumination. Going slow allows industry and DOE to learn and adjust.*

# Key Standards and Test Methods



- ANSI C78.377-2008
  - Specification for Chromaticity of SSL Products
- IESNA LM-79-2008
  - Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
- IESNA LM-80-2008
  - Approved Method for Measuring Lumen Maintenance of LED Light Sources
- IESNA RP-16-2005(amendment)
  - Nomenclature and Definitions for Illuminating Engineering
- ANSI C82.XX1
  - Power Supplies
- UL Outline of Investigation

# Category A: Overall Approach



- Establish minimum luminaire efficacy
- Benchmark to fluorescent
- Consistent with current ENERGY STAR lighting criteria

# Luminaire Efficacy Assumptions



<b>Niche Application</b>	<b>CFL System Efficacy</b>	<b>Typical Fixture Efficiency</b>	<b>Calculated Luminaire Efficacy</b>
<b>Under-cabinet Kitchen</b>	58.8	40%	24
<b>Under-cabinet Shelf-mounted Task</b>	58.8	50%	29
<b>Portable Task</b>	58.8	50%	29
<b>Recessed Downlight (residential)</b>	58.8	60%	35
<b>Recessed Downlight (commercial)</b>	58.8	60%	35
<b>Outdoor Wall-mounted Porch</b>	58.8	40%	24
<b>Outdoor Step</b>	50	40%	20
<b>Outdoor Pathway</b>	50	50%	25

# Overall Requirements



- Luminaire
  - 8 nominal CCTs
    - Most residential applications limited to 2700K, 3000K, and 3500K
  - Color Spatial Uniformity: 4-step
  - Color Maintenance: 7-step
  - CRI:  $\geq 75$  for indoor, silent on outdoor
  - Off-state Power prohibited
    - Exception for integral controls, limited to 0.5W
  - 3 Year Warranty
  - Thermal Management

# Overall Requirements (cont.)



- Modules/Arrays
  - Lumen Maintenance ( $L_{70}$ )
    - Residential Indoor  $\geq 25,000$  hours
    - Residential Outdoor and all Commercial  $\geq 35,000$  hours
- Residential Outdoor Luminaires
  - Attached to buildings and  $> 13$  watts requires photo-control
- Power Supplies
  - Power Factor
    - $\geq 0.7$  Residential
    - $\geq 0.9$  Commercial
  - Output Operating Frequency  $\geq 120$  Hz

# Original Category A Applications v 1.0



- Under-cabinet kitchen lighting
- Under-cabinet shelf-mounted task lighting
- Portable desk task lights
- Recessed downlights
- Outdoor wall-mounted porch lights
- Outdoor step lights
- Outdoor pathway lights

# Category A Additions: Overall Approach



- LED performance has improved
- Luminaire efficacy approximately 20% higher than CFL fixtures
- Other requirements to help ensure user satisfaction
  - Minimum light output
  - Zonal lumen density
  - Warm CCTs for residential

# Category A Additions



- SSL Criteria v1.1 Draft was published Aug 2008
- Stakeholder review and comment period
  - 173 comments received
- Final version published Dec 2008
- Version 1.1 took effect Feb 1, 2009

# Category A Additions



## Residential

- Surface- and pendant-mounted downlights (added to recessed downlights)
- Ceiling-mounted with diffuser
- Cove lighting
- Surface-mounted with directional heads
- Outdoor pole/arm-mounted decorative

## Non-Residential

- Surface- and pendant-mounted downlights (added to recessed downlights)
- Wall wash luminaires
- Bollards

# Surface- and Pendant-Mounted Downlights



Application Requirements	
Minimum Light Output	Aperture $\leq 4.5$ " : 345 lumens Aperture $> 4.5$ " : 575 lumens
Zonal Lumen Density	Minimum of 75% of total lumens within the 0-60° zone
Luminaire Efficacy	35 lm/W
Allowable CCTs	Residential: 2700 K, 3000 K, 3500 K Non-Residential adds 4000K, 4500K, 5000K



# Surface- and Pendant-Mounted Downlights



# Ceiling-Mounted Luminaires with Diffusers



Application Requirements	
Minimum Light Output	max luminaire width $\leq 8''$ : 375 lumens max luminaire width $> 8''$ : 750 lumens
Luminaire Efficacy	$\geq 30$ lm/W
Allowable CCTs	2700 K, 3000 K , 3500 K



# Cove Lighting



Application Requirements	
Minimum Light Output	200 Lumens/lineal foot
Zonal Lumen Density Requirement	Minimum of 35% of total lumens within the 120°-150° zone
Luminaire Efficacy	45 lm/W
Allowable CCTs	2700 K, 3000 K, 3500 K



# Cove Lighting



# Surface-Mounted Luminaires with Directional Heads



Application Requirements	
Minimum Light Output	200 lumens per head
Zonal Lumen Density Requirement	Minimum of 85% within the 0-90° zone
Minimum Luminaire Efficacy	35 lm/W
Allowable CCTs	2700 K, 3000 K , 3500 K



# Surface-mounted Luminaires with Directional Heads



# Outdoor Pole/Arm-Mounted Decorative Luminaires



Application Requirements	
Minimum Light Output	300 lumens
Zonal Lumen Density Requirement	Minimum of 85% of total lumens within the 0°- 90° zone (bilaterally symmetrical) No light above 110°
Luminaire Efficacy	35 lm/W



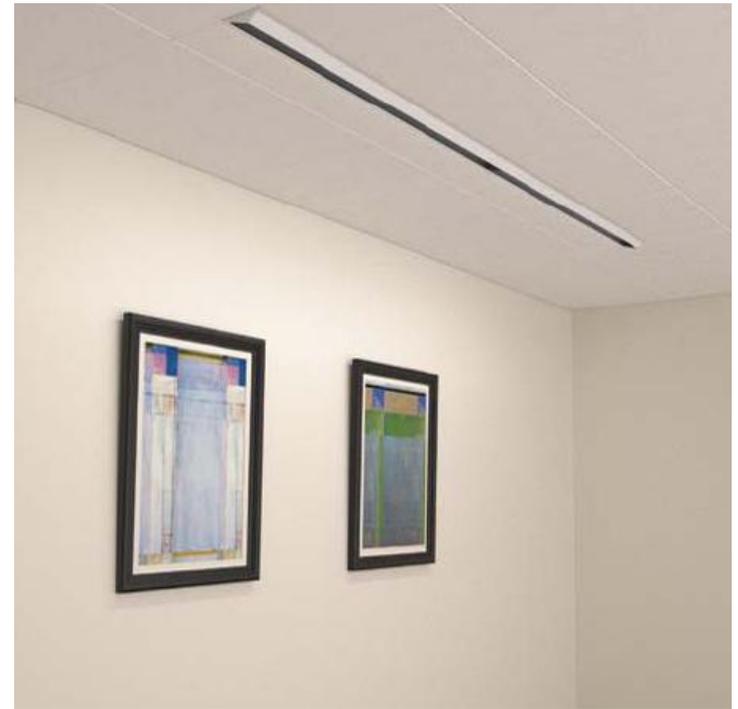
# Outdoor Pole/Arm-mounted Decorative Luminaires



# Wall Wash Luminaires (non-residential)



Application Requirements	
Minimum Light Output	575 lumens
Zonal Lumen Density Requirement	Minimum of 50% of total lumens within the 20°- 40° zone (asymmetrical)
Luminaire Efficacy	40 lm/W
Allowable CCTs	2700 K, 3000 K, 3500 K, 4000 K, 4500K, 5000K



# Bollards (non-residential)



Application Requirements	
Zonal Lumen Density Requirement	< 15% of total lumens in the 90°- 110° zone; no light emitted over 110°
Luminaire Efficacy	35 lm/W



# Manufacturer's Guide



- Checklist for qualification process
- Tests and laboratories that can perform them
- Product grouping process
- Two test options for Lumen Maintenance
- Temperature Measurement Point of LEDs and power supplies
- Testing for power supplies
  
- The Guide will evolve with the program

<http://www.energystar.gov/sslpartners>

# Lumen Maintenance (LM)



- LM-80 test report from the LED manufacturer
  - LM every 1,000 hours for at least 6,000 hrs
  - 55°C, 85°C, and a third temperature
  - Drive current
- Minimum useful life, 70% of initial lumen output ( $L_{70}$ )
  - 25,000 hr lifetime requires 91.8% LM at 6,000 hrs
  - 35,000, 94.1% LM

<http://www.energystar.gov/sslp partners>

# In-situ Temperature Measurement Test (UL 1598)



- The entire luminaire undergoes this test
  - Thermocouple to LED package
  - Thermocouple to power supply
- Meets the LM requirement if the drive current and the temperature of the LED in the luminaire is lower than that of the LED tested in LM-80
  - LM-80 test shows 91.8% or 94.1% LM
- Temperature of power supply is lower than the temperature warranted by the manufacturer

<http://www.energystar.gov/sslpayers>

# Category B: Efficacy-Based Performance



- Higher luminaire efficacy requirement: 70 lm/W
- Less restrictive on total flux and zonal lumen requirements
- Products can qualify under Category B in 2011, approximately
- Serves as future target for manufacturers

# Questions?



Andre Javier-Barry  
[ajavierbarry@drintl.com](mailto:ajavierbarry@drintl.com)

[ssl@drintl.com](mailto:ssl@drintl.com)

D&R International  
(301) 588-9387

[www.energystar.gov/led](http://www.energystar.gov/led)  
[www.energystar.gov/sslpartners](http://www.energystar.gov/sslpartners)