

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

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March 18, 2009

Lighting Partner Meeting

San Antonio

Scope



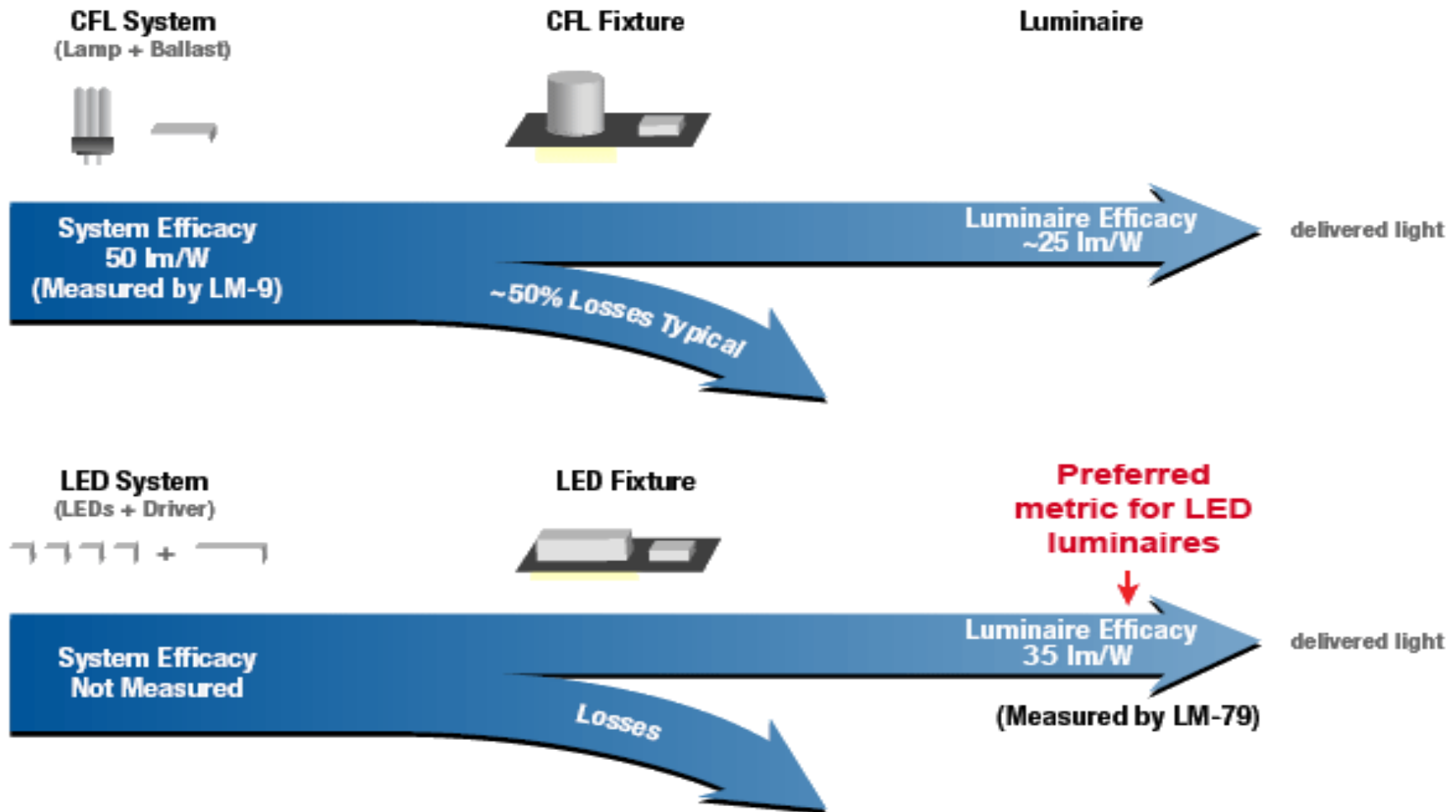
- Limits coverage to LED systems for general illumination only
- Commercial and residential
- Luminaire efficacy key metric
- Establishes 2-category specification:
 - Category A: prescriptive specifications for niche category lighting applications (near-term)
 - Category B: performance specification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



Niche Application	CFL System Efficacy	Typical Fixture Efficiency	Calculated Luminaire Efficacy
Under-cabinet Kitchen	58.8	40%	24
Under-cabinet Shelf-mounted Task	58.8	50%	29
Portable Task	58.8	50%	29
Recessed Downlight (residential)	58.8	60%	35
Recessed Downlight (commercial)	58.8	60%	35
Outdoor Wall-mounted Porch	58.8	40%	24
Outdoor Step	50	40%	20
Outdoor Pathway	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: ≥ 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
 - ≥ 0.7 Residential
 - ≥ 0.9 Commercial
 - Output Operating Frequency ≥ 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 ≤ 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	≥ 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



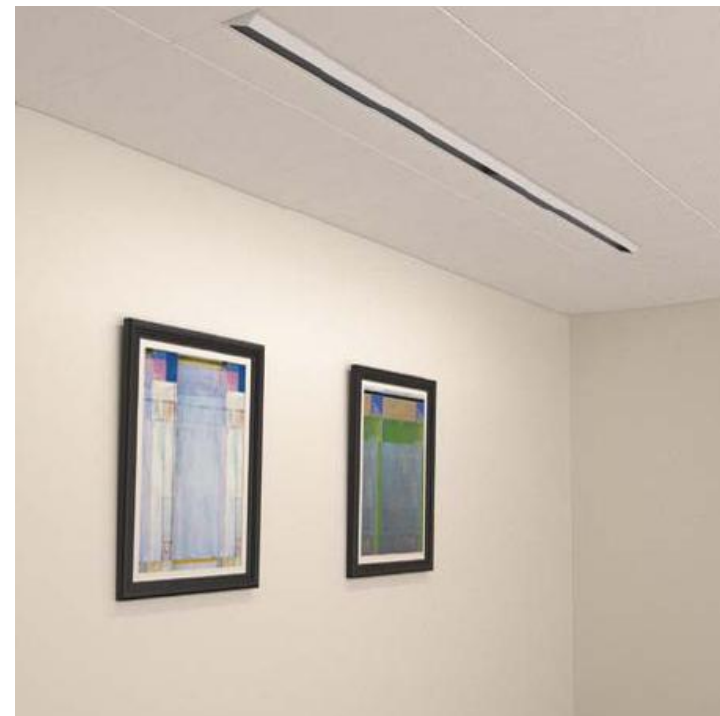
Outdoor Pole/Arm-mounted Decorative Luminaires



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

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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

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

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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?



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