



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

ENERGY STAR SSL: Introduction and Approach

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Topics to be Addressed

- Why ENERGY STAR SSL? Why now?
- Scope of criteria
- Unique characteristics of SSL (vis-à-vis ENERGY STAR)
- Why luminaire efficacy?
- Two-category approach
- Why not SSL include in RLF?



Why **ENERGY STAR SSL**? Why Now?

- Many new products entering market
- Many appear to have greatly exaggerated performance
- DOE SSL commercial product testing is showing actual performance is much less than claimed



Example: Downlight claimed 40 lm/W; measured luminaire efficacy of 13 lm/W and 193 lumens; less than 1/2 the efficacy of typical CFL downlight, and ~1/3 the lumens.



Why ENERGY STAR SSL? Why Now?

- Meanwhile, LED technology is rapidly improving
- Manufacturers are announcing new performance records almost every month
 - Nichia announced 150 lm/W @ 20 mA in December (lab)
 - Seoul Semiconductor announced 100 lm/W @350 mA in December (commercial)
 - Lumileds announced 115 lm/W @ 350 mA in January (commercial)

Note: the above performance levels are typically done at 25°C for 25 ms with non-standard test; they are not meant to represent actual performance in a luminaire



Why ENERGY STAR SSL? Why Now?

- DOE expects market introduction in 07 and 08 of high performance products.

Example: 2700K CCT, 90+ CRI downlight, 60 lm/W (luminaire efficacy); twice the efficacy of a CFL downlight expected 2nd Q 07.



Why ENERGY STAR SSL? Why Now?

- Because the key standards and test procedures are on schedule to be final in time to support the SSL criteria.
- Should those standards and test procedures be delayed, SSL criteria will not become effective until the those key standards and test procedures are final.



Why **ENERGY STAR SSL**? Why Now?

- DOE wants to avoid a repeat of the CFL mistake
 - Early low performing products caused long-term market damage
- DOE Report, “Compact Fluorescent Lighting in America: Lessons Learned on the Way to Market” addresses this issue





Why ENERGY STAR SSL? Why Now?

- Key take away from report: Early consumer experience with fluorescent lamps and CFLs still defines attitudes towards CFLs, even though the technology has greatly improved since its introduction
- Guidance for buyers is needed now, to limit long-term market damage
 - Address performance and quality



Why ENERGY STAR SSL? Why Now?

In a Nutshell:

- Many low performing products in market that are likely to disappoint
- Many high performing products coming
- Key standards and test procedures will be done
- We don't want a repeat of CFL market introduction; we don't want to have long-term market damage
- Buyers need guidance; ENERGY STAR is best tool for that



Scope of Criteria

- General illumination
 - Not indication or decoration
- Both residential and commercial
 - Commercial customers need guidance; they know and understand ENERGY STAR
- Interior and exterior



Unique Characteristics of SSL (vis-à-vis ENERGY STAR)

- New Technology Characteristics
 - Performance rapidly increasing
 - Prices rapidly falling
 - Expect small number of products to initially qualify
 - Will require regular updating of criteria
- Physical Characteristics
 - Different spectral power distribution vs. fluorescent
 - Color measurement (e.g., quadrangles and angles)
 - Directional light vs. diffuse light (different optics)
 - High thermal sensitivity (good fixtures designed accordingly)
 - Failure mode (life); others

Fundamentally different from fluorescent technology

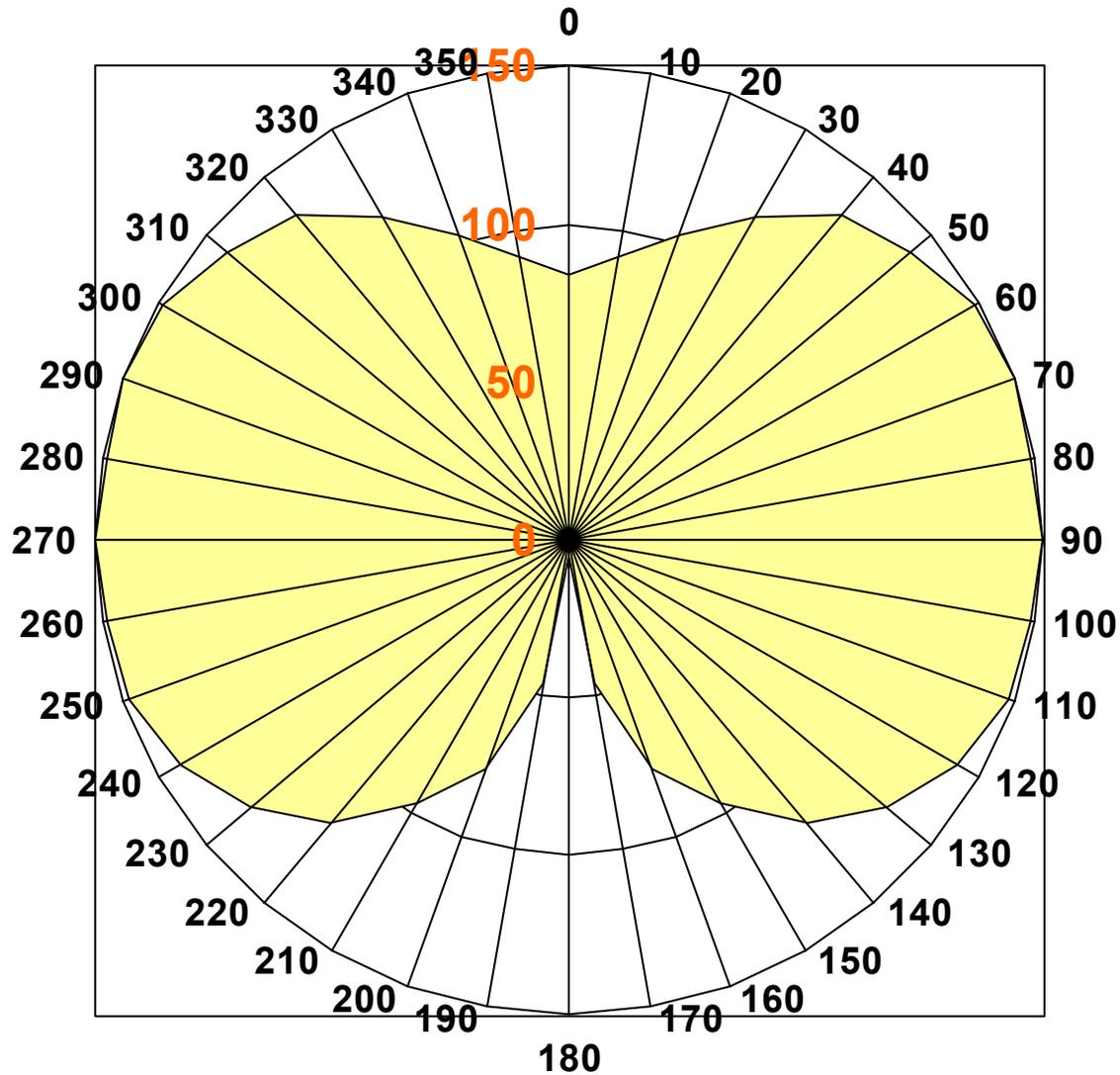


Why Luminaire Efficacy?

- System efficacy is a measure of lumens from the light source, divided by source plus driver power
 - It does not account for light losses in the fixture
 - It does not account for thermal effects fixture may have on flux
- Luminaire efficacy is a measure of lumens from the luminaire, divided by source plus driver power
 - It accounts for fixture light losses
 - It also accounts for thermal effects fixture may have on flux



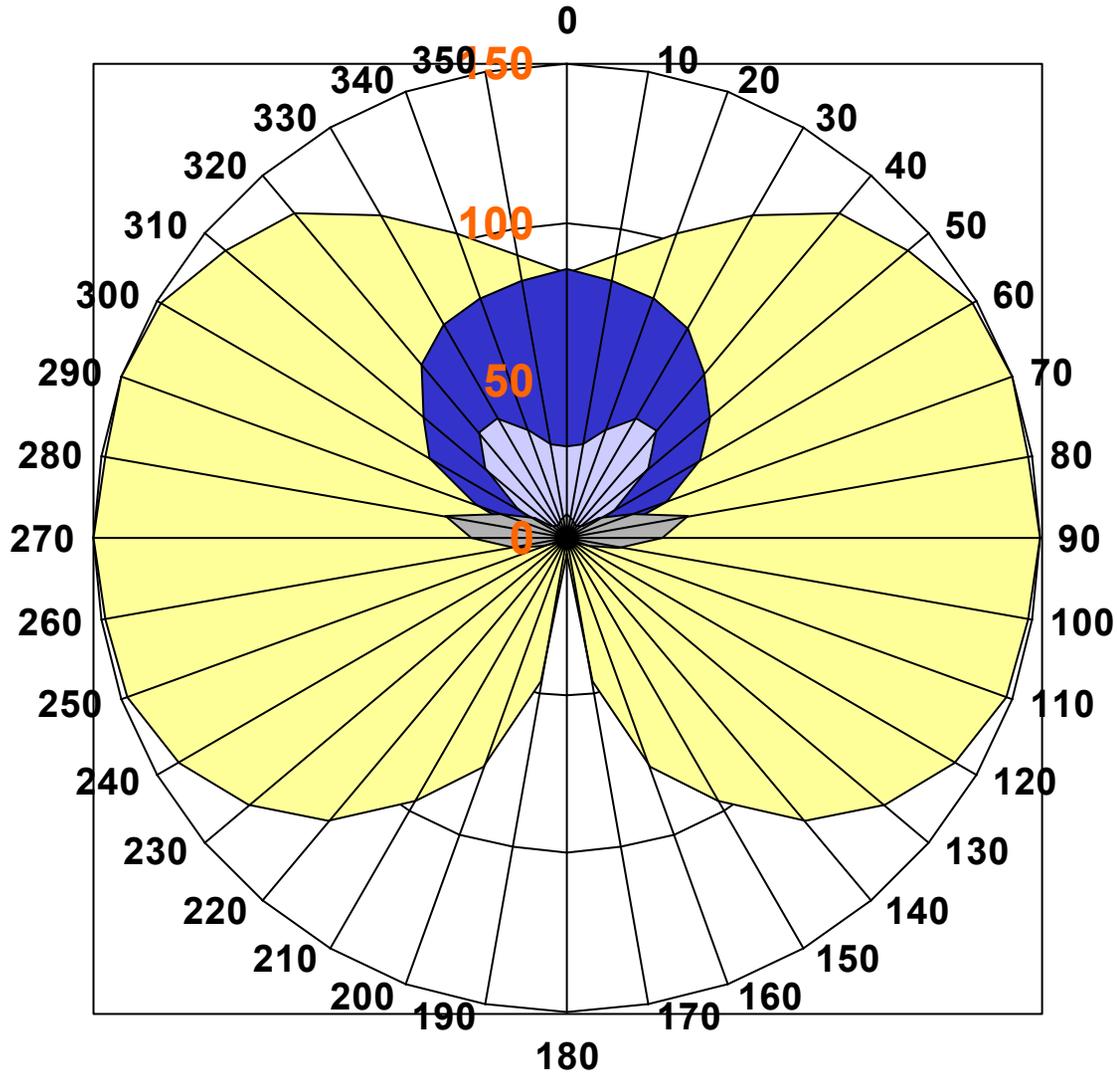
Candela Curve



100 W Incandescent



Candela Curve



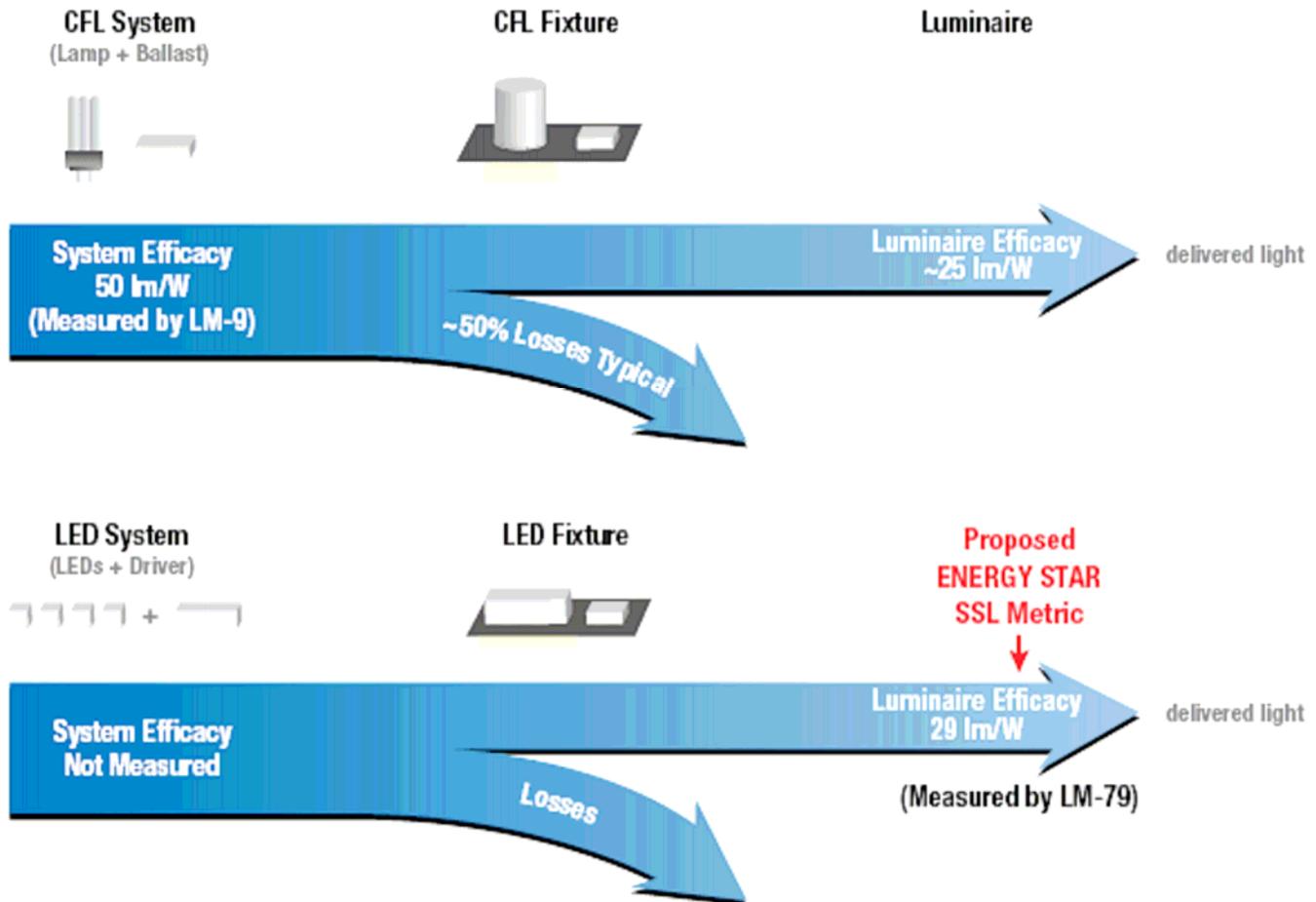
- 100 W Incandescent
- Z-LED P4
- Luxeon Batwing
- Luxeon Side Emitting



System Efficacy vs. Luminaire Efficacy

System Efficacy Vs. Luminaire Efficacy

(Recessed Downlights Example)





Why Luminaire Efficacy?

- Using luminaire efficacy will require photometric testing
- Yes, it will be more expensive for luminaire manufacturers than using system efficacy, and a lamp/driver matrix
 - We took a serious look at alternate methods, but found alternatives fraught with problems
- But luminaire efficacy is best suited for SSL
 - For thermal and optical reasons
- And only industry standardized test procedure (LM-79) requires luminaire measurement



Two-Category Approach

- Category A: for selected directional lighting applications (e.g. task lighting and downlights)
 - Applications selected require modest illumination
 - Applications selected have modest distances to illuminated surfaces
 - Efficacy requirements set to meet or exceed typical fluorescent (for level playing field)
 - Min. flux, and zonal lumen requirements to screen out products users likely to find unsatisfactory
 - Applications will be expanded as technology improves



Two-Category Approach

- Category B: for all general illumination applications
 - Aggressive efficacy requirements
 - Simpler; no total flux and zonal lumen requirements
 - Allows for non-directional lighting applications
 - Will add language that clarifies products will not be able to qualify under Category B in near-term; date for allowing Category B qualification TBD
 - Serves as future target for manufacturers



Two-Category Approach

- Approach recognizes rapidly changing technology
 - Allows early participation of limited range of SSL products for directional lighting applications (in Category A)
 - At some point (~3 years), Category A will be dropped entirely; Category B then becomes basis of criteria
- Consistent with a go-slow approach
 - Whole industry is learning the unique issues of applying SSL to general illumination
 - Going slow allows industry and DOE to learn, and adjust



Why Not Include SSL in RLF?

- Technology is radically different
 - Different standards, metrics, and test procedures
 - System efficacy not appropriate for SSL; SSL system efficacy test method doesn't exist
- There are separate ENERGY STAR specifications for residential ground source heat pumps, air source heat pumps, and furnaces
 - Different test methods, and different metrics