



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

Solid State Lighting State-of-the-art of for General Illumination

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Pacific Northwest National Laboratory

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2007 ENERGY STAR® Lighting Partner Meeting



BrightFeet
Lighted Slippers

Lighted Slippers
That Let You See In The Dark!



BRIGHTEN YOUR VALENTINE'S DAY WITH BRIGHTFEET LIGHTED SLIPPERS!

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Night Time Just Got a Little Brighter!

Now you can easily move handsfree around a darkened house reducing the risk of tripping over objects or running into doors, furniture or anything not easily seen in the dark.

Brightfeet™ Lighted Slippers are nightlights for your feet. They are ideal for night time trips to the bathroom, kitchen, kid's room or anywhere in your house! Power outage? Use Brightfeet™ to locate candles, flashlights and other emergency lighting sources.

Comfortable and convenient, Brightfeet Lighted Slippers make the perfect gift for any occasion!

Copyright Boston Ideas, LLC 2005
Patent Pending

BrightFeet News...

THE MONTEL WILLIAMS SHOW (Friday, December 30, 2005) features BrightFeet Lighted Slippers in a segment about amazing new gadgets hitting stores in 2006.

FOX NEWS Channel's afternoon talk show, "Dayside" with Mike Jerrick and Juliet Huddy, feature Brightfeet Lighted Slippers on December 14, 2005.

BostonHerald.com's Holiday Gift Guide reviews and features Brightfeet Lighted Slippers.



Order Now! \$39.95



**See them
in Action!**







Top 5 Reasons not to own BrightFeet™ Lighted Slippers

- #5. They're not machine washable which means they will never be cleaned during their useful life..... Ewuuuu!!!
- #4. Do they come with parental controls to prevent your children from using them as flashlights..... outside?
- #3. Gee.... that's neeeeat..... but do they keep your feet warm?
- #2. Do they come with a strap so that they can be worn on your head for night reading?
.... and the #1 reason not to own BrightFeet Slippers:

Is it really a good idea to wake up your pet Doberman when all he can see are two "beadie" eyes staring him down???



New Product Announcements

- *“Philips Lumileds shatters 350 mA performance records with 115 lm/W LED”*

January 2007

- *“Seoul Semiconductor introduces world’s brightest LED, a 240 lumens single die light source” [100 lm/W]*

December 2006

- *“Nichia delivers 92 lm/W at 350 mA”*

November 2006

- *“Cree delivers first 160-lumen white power LED” [85 lm/W]*

October 2006



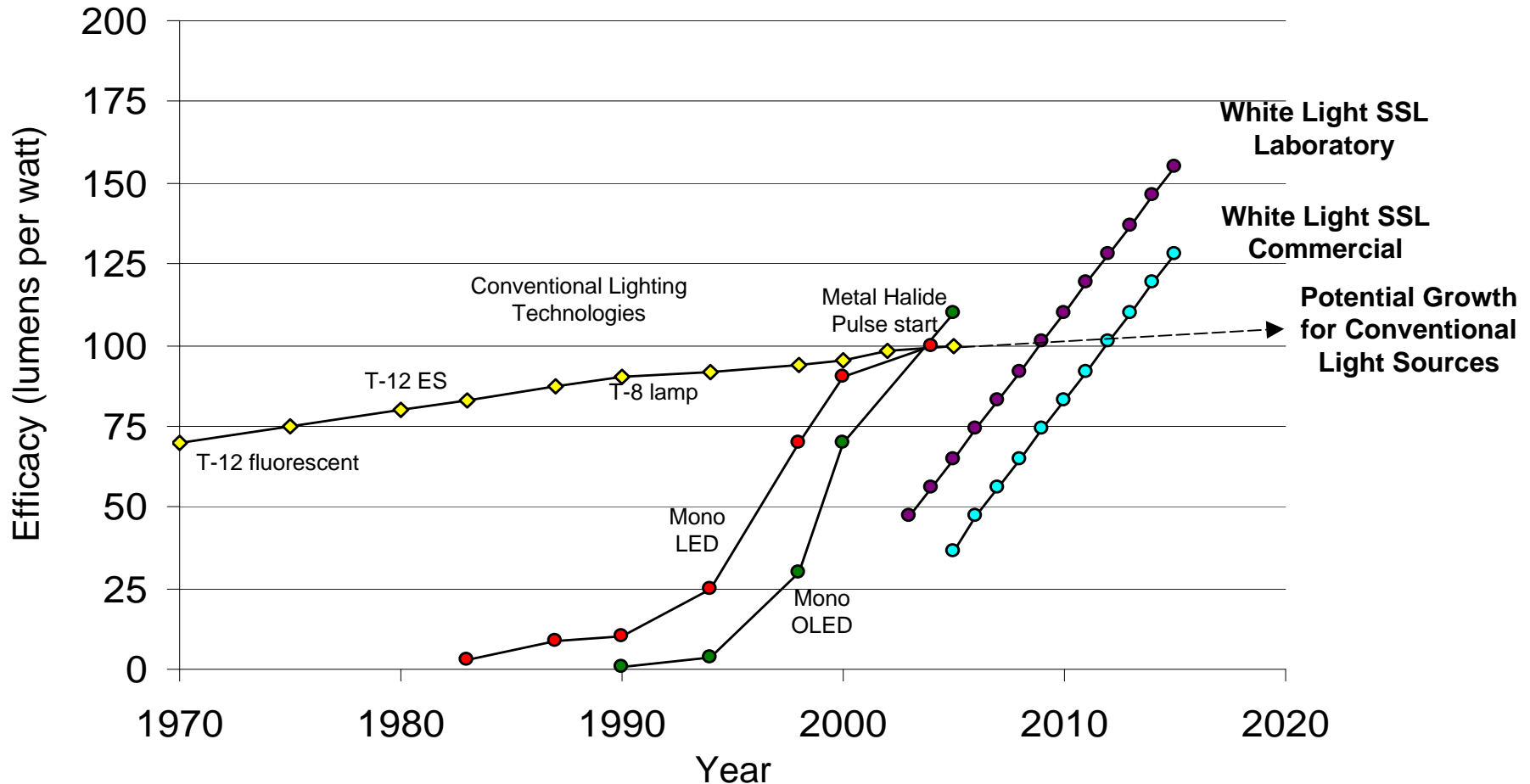
Seoul Semiconductor



Cree Inc.



Accelerated R&D for White Light SSL

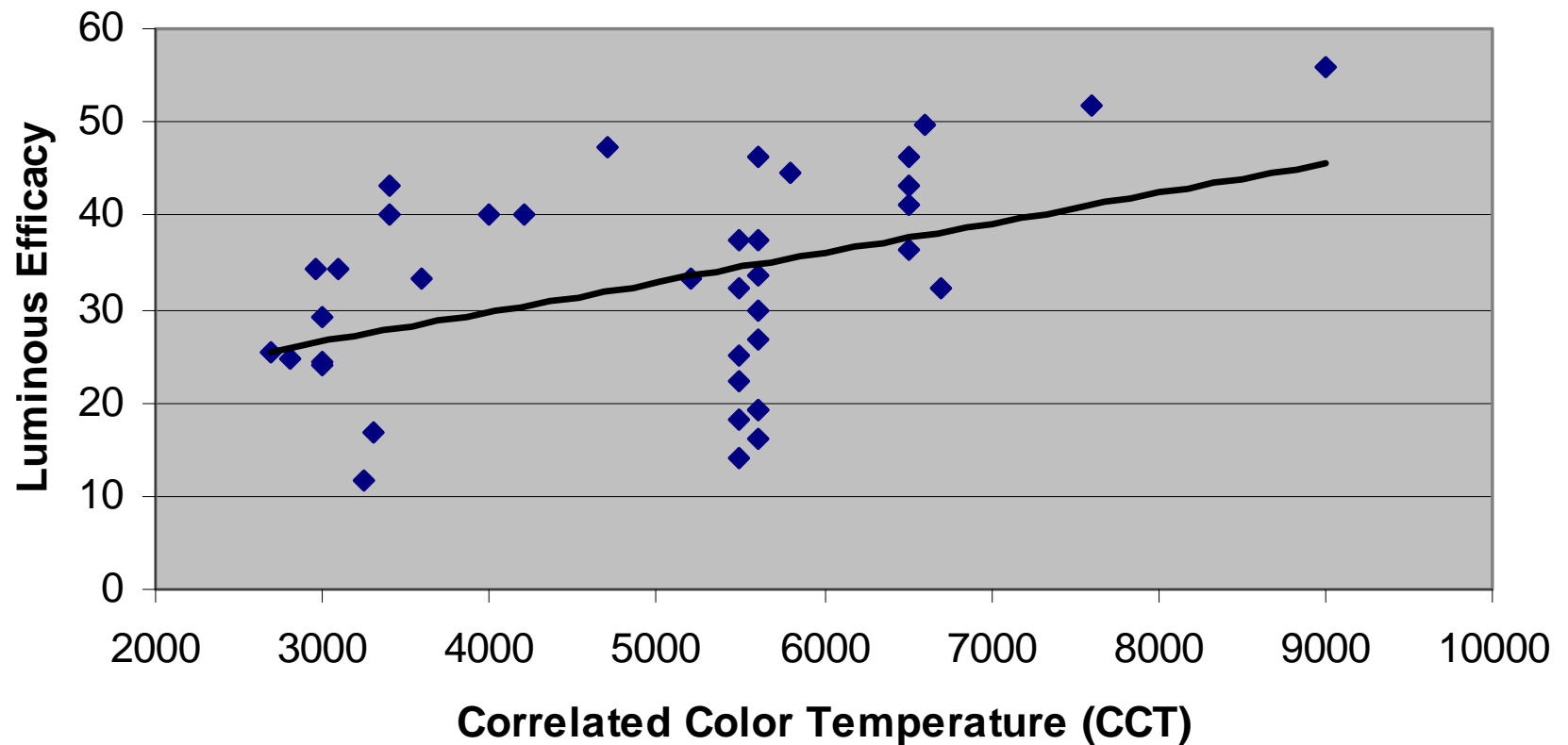


SSL Laboratory and Commercial Curves, revised May 2006



Production LEDs

as of 7/06





Terms

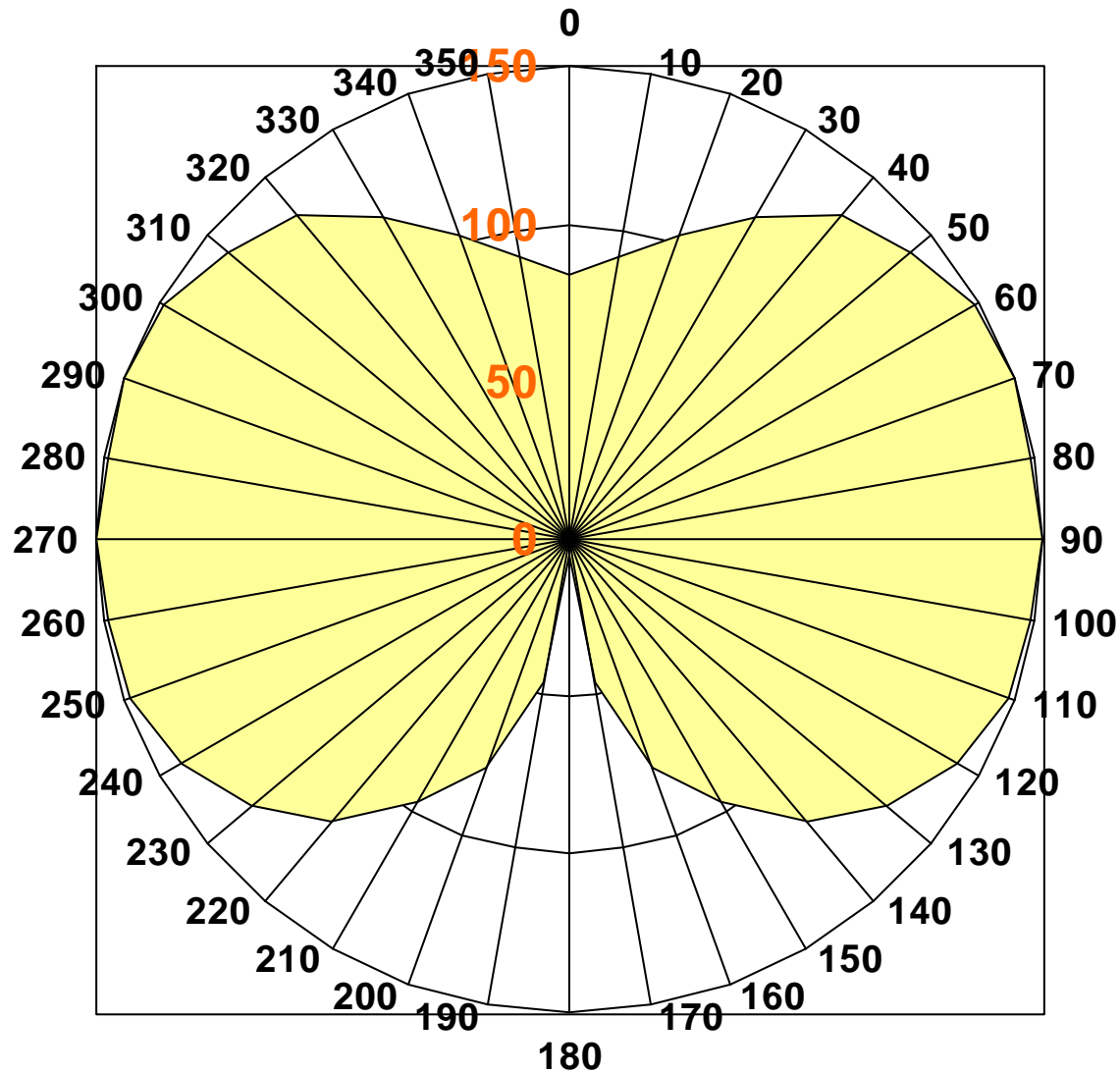
$$\text{Lamp Efficacy} = \frac{\text{Rated Lamp Lumens}}{\text{Lamp Input Power}}$$

$$\text{System Efficacy}_{\text{fluor}} = \frac{\text{Rated Lamp Lumens} \times \text{BF}}{\text{Ballast/Driver Input Power}}$$

$$\text{Luminaire Efficacy} = \frac{\text{Luminaire Light Output}}{\text{Ballast/Driver Input Power}}$$



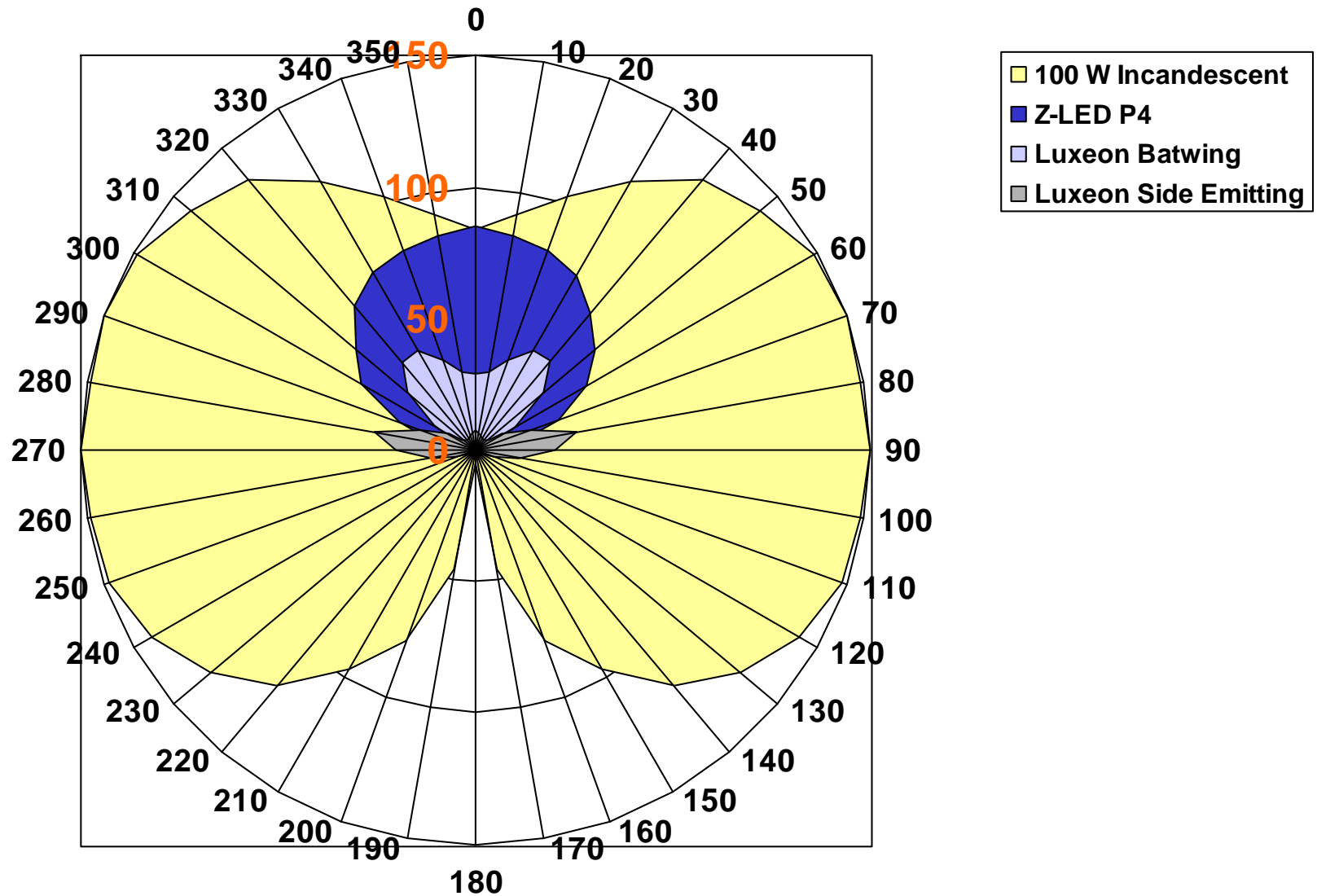
Candela Curve



100 W Incandescent



Candela Curve





Myth #1:

LEDs create no heat



So you heard LEDs don't create heat?

Power Conversion for "White" Light Sources

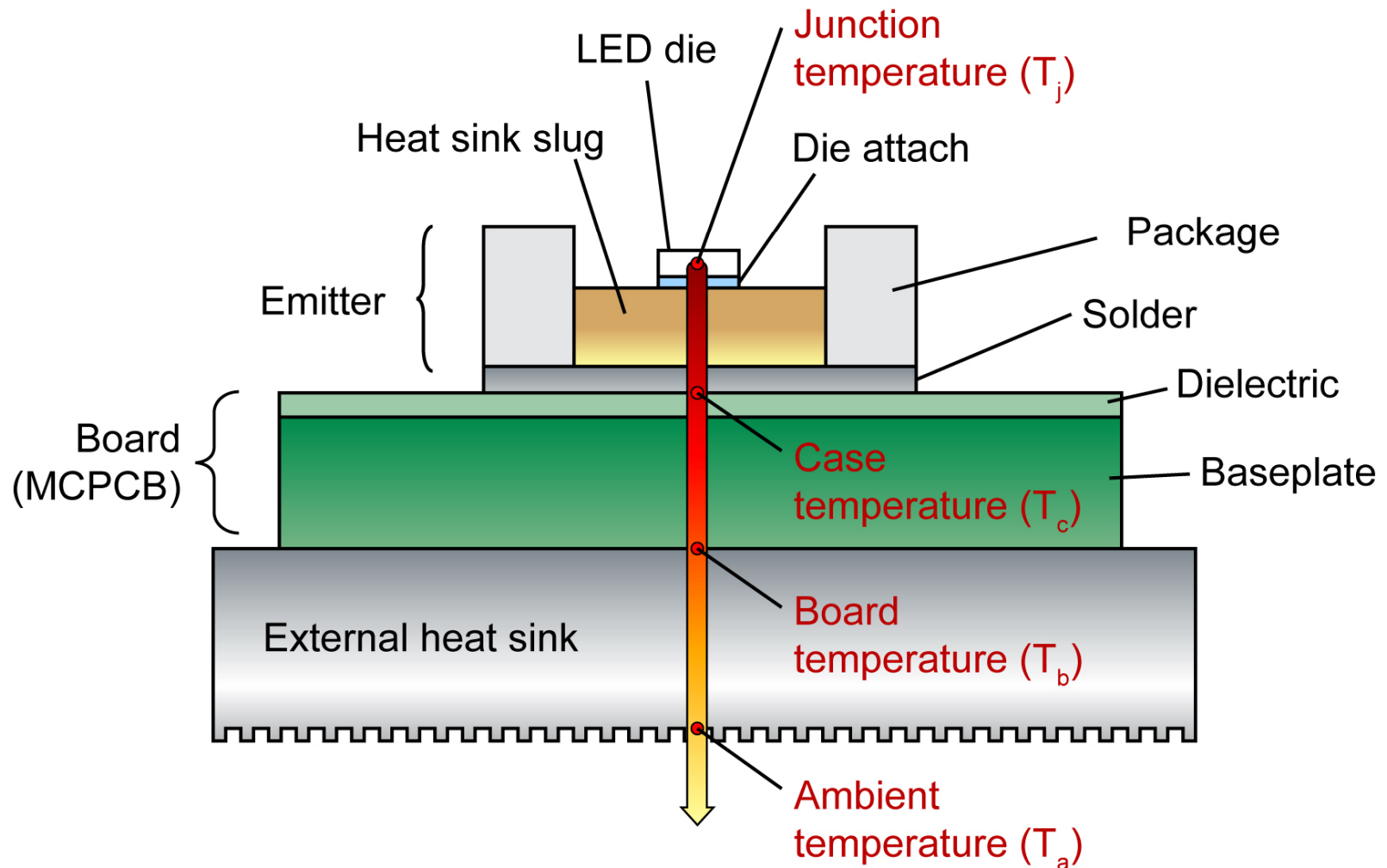
	Incandescent[†] (60W)	Fluorescent[†] (Typical linear CW)	Metal Halide[‡]	LED
Visible Light	7.5 %	21 %	27 %	10-15 %
Infrared	73.3 %	37 %	17 %	~ 0 %
Ultraviolet	0 %	0 %	19 %	0 %
Total Radiant Energy	80.8 %	58 %	63 %	10-15 %
Heat (Conduction + Convection)	19.2 %	42 %	37 %	85-90 %
Total	100 %	100 %	100 %	100 %

[†] IESNA Lighting Handbook – 9th Ed.

[‡] Osram Sylvania

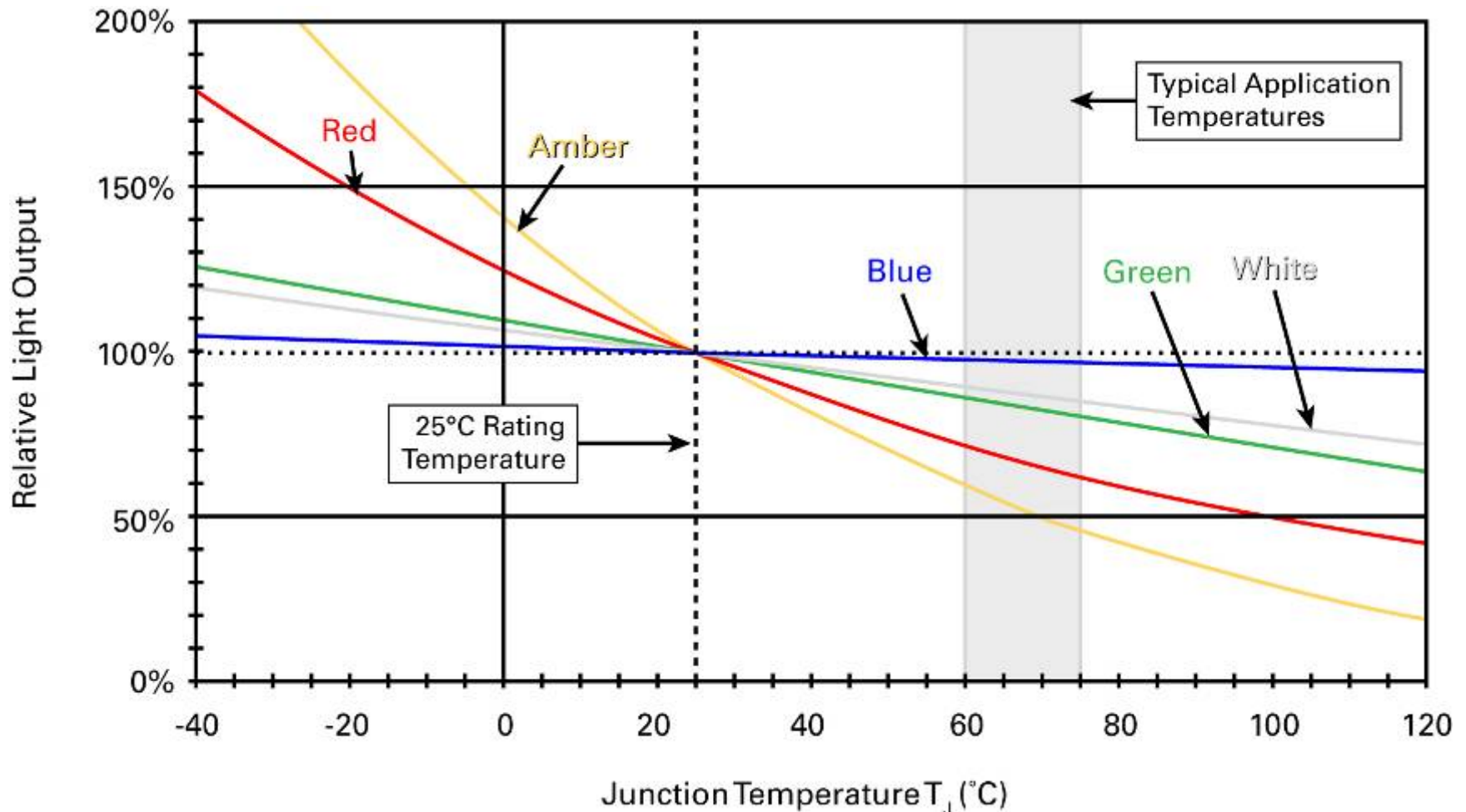


Anatomy of an LED





Light Output vs. Junction Temperature (T_j)



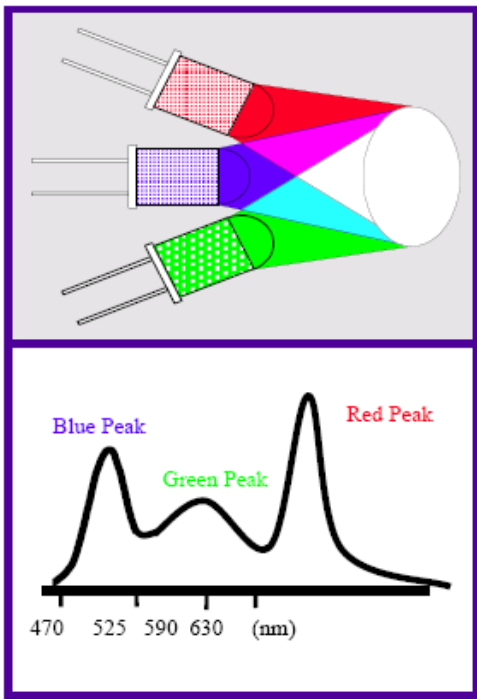


Myth #2:

LEDs are “White Light ”
Sources

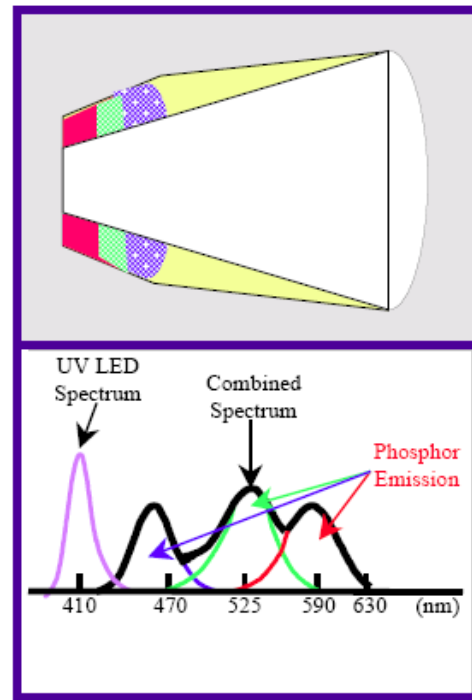
How do we make white light?

Red + Green + Blue LEDs



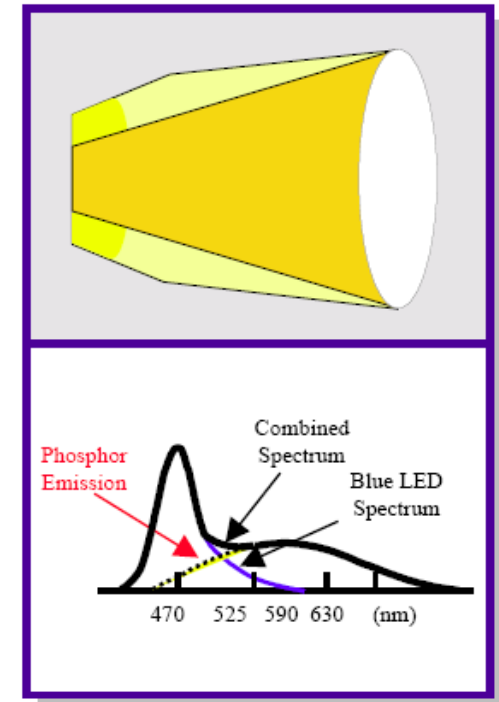
- Dynamic color tuning
- Excellent color rendering
- Large color gamut

UV LED + RGB Phosphor



- White point tunable by phosphors
- Excellent color rendering
- Simple to create white

Blue LED + Yellow Phosphor



- Simple to create white
- Good color rendering



Myth #3:

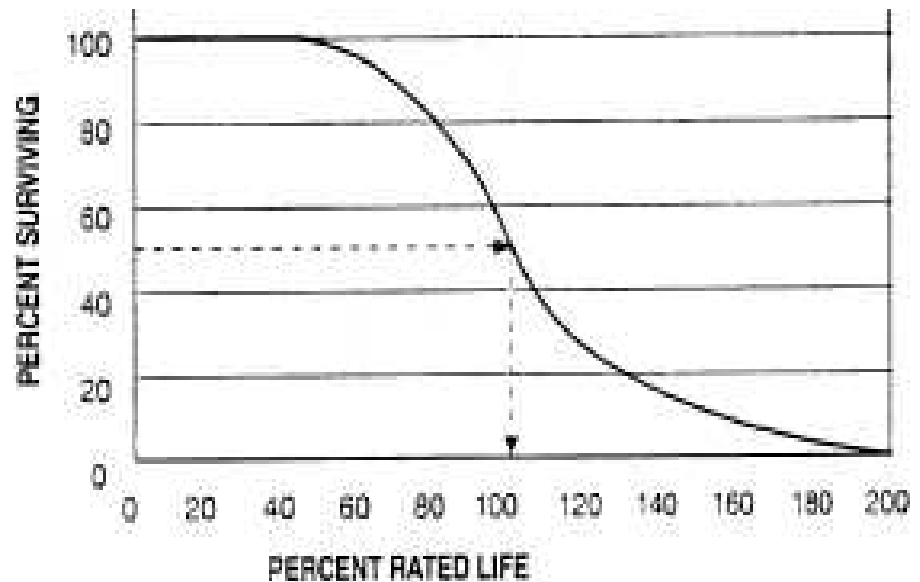
LEDs last 100,000 hours
(or forever depending who talk to!)



Traditional Lamp Life Rating

- Lumen depreciation vs. failure
- LED life definition
 - L_{70} for general illumination
- IESNA LM-80 in process

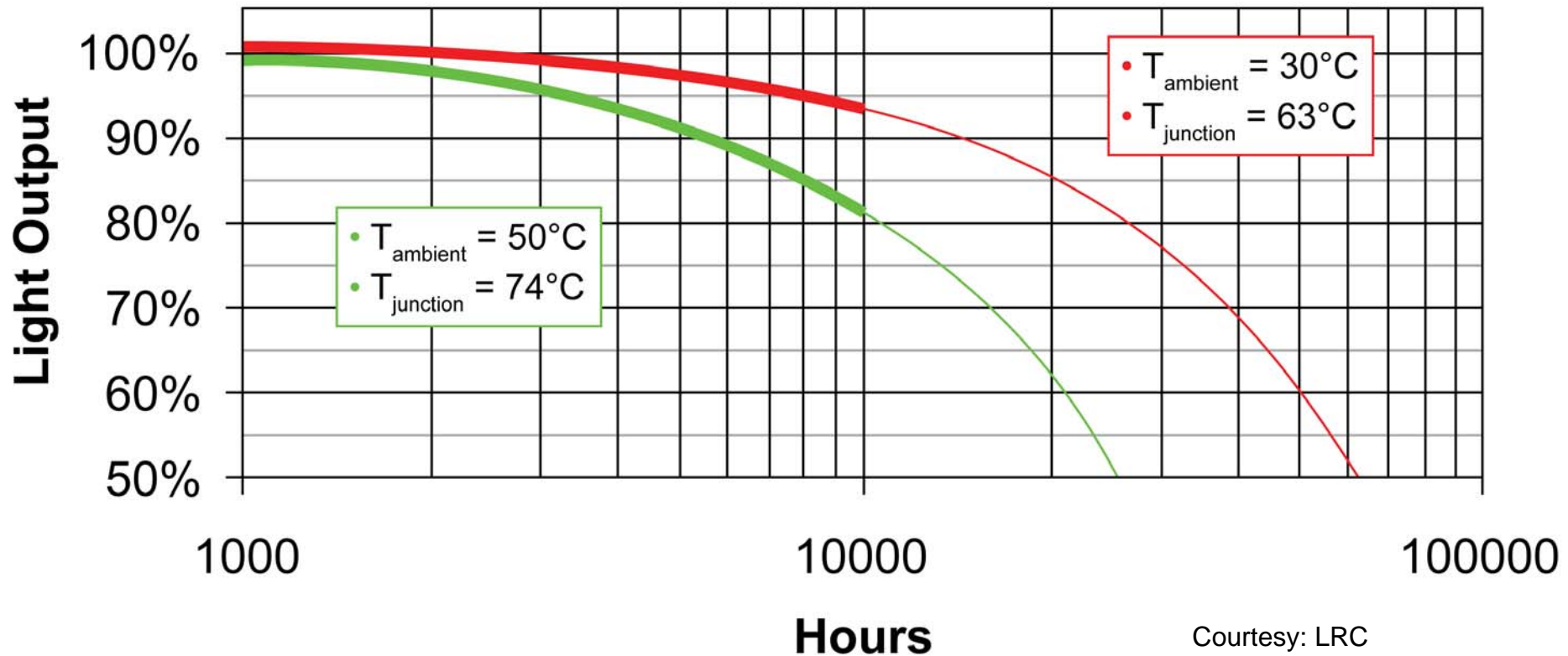
Typical lamp mortality curve





Light Output over Time

High Brightness White LED (350 mA)















Significant Standard and Test Procedure Activity

- Photometric measurements (IESNA LM-79)
 - In second committee Review/Approval cycle
- Chromaticity (ANSI C78.377a)
 - In second committee Review/Approval cycle
- Lumen Depreciation (Life) (IESNA LM-80)
 - First draft under development
- Driver Standard (ANSI C82.XX1)
 - In first committee review
- Definitions (IESNA RP-16)
 - In second draft and currently in working group review



Efficiency & Quality Trade-offs

Color Temperature*		Efficacy	
Color Temperature*		Efficacy	
CRI*		Efficacy	
Heat		Efficiency / Output	
Heat		Life / Durability	

* Phosphor-converted LEDs



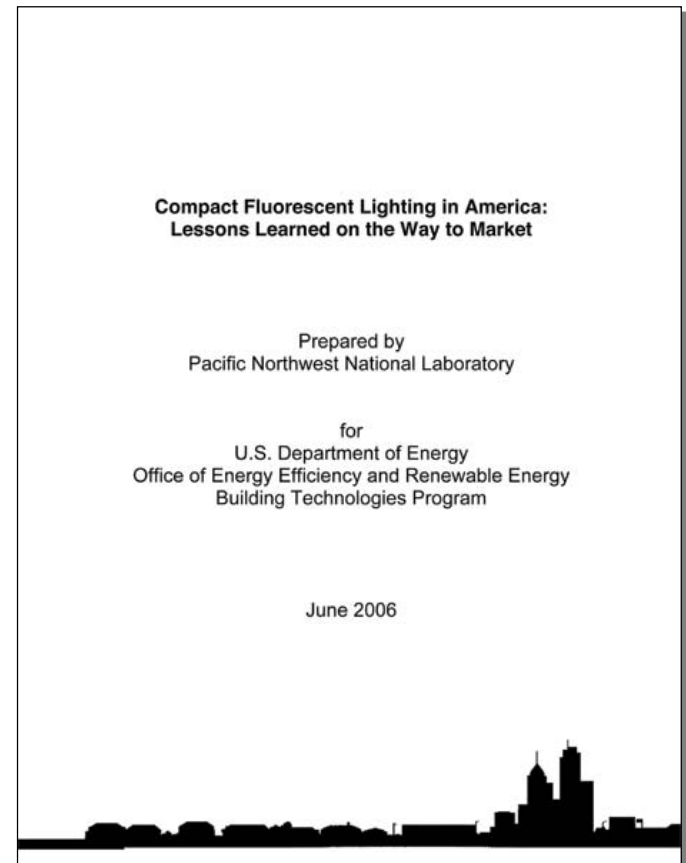
Questions EEPS & Retailers Should Ask

- Show me the lumens!
- Ask for test reports (LM-79, LM-80, etc.)
- Is blue is the new white?
- Ask how they manage heat



Compact Fluorescent Lighting in America: Lessons Learned on the Way to Market

- Valuable lessons
 - Be aggressive about dealing with technology failures that affect main benefit claims
 - Know and admit technology limitations
 - Don't introduce inferior products; first impressions are long lasting
 - Accurate incandescent equivalency on packaging is critical
 - Manufacturers and energy-efficiency groups should coordinate to establish minimum performance requirements
- Use to avoid "CFL Part II"
- Apply to SSL commercialization path





SSL Fact Sheet Series

- Written for efficiency program and facility managers
- Five completed in '06
- Five more coming in '07





Q & A

For more information, fact sheets, etc.:
www.netl.doe.gov/ssl/

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