

LED Leadership Summit

Hotel Del Coronado
November 2006

SHOW ME THE LUMENS! REAL LIFE LED LIGHTING

LED Lighting for Architecture
and Buildings

James R Benya, PE, FIES,
FIALD, LC

BENYA LIGHTING DESIGN



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Who Designs Lighting?

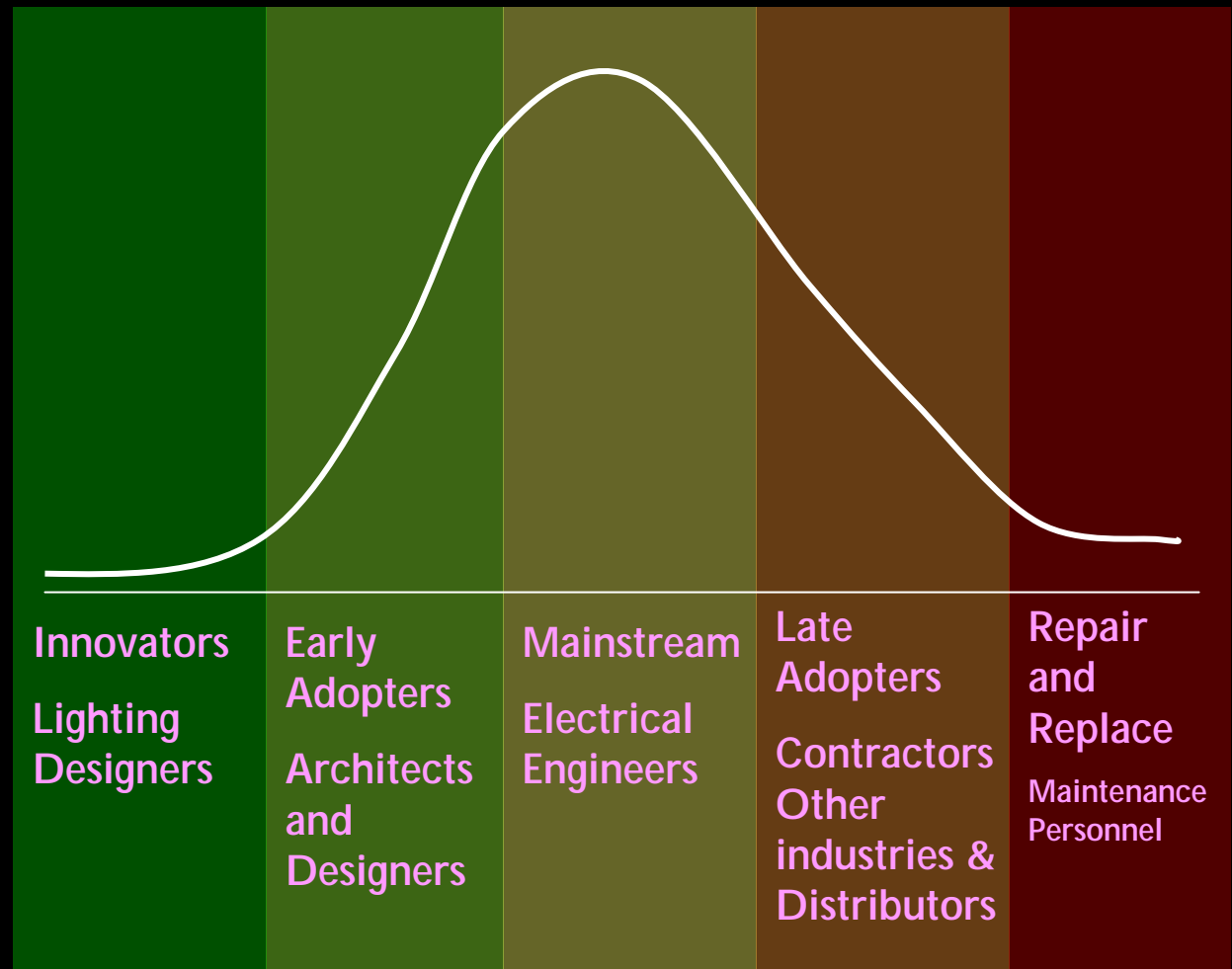
- Lighting Designers
- Electrical Engineers
- Architects
- Interior Designers
- Electrical Contractors
- Lighting Sales Representatives
- Electrical Distributors
- Homeowners
- Electricians
- Your Mother and Everyone Else



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Who Designs Lighting When (in the product life cycle)



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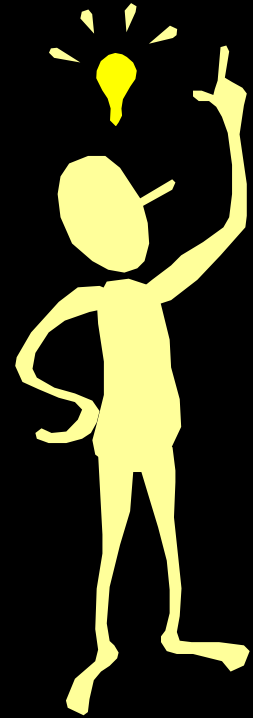
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What Matters the Most?

Innovators

- Coolness factor
- Versatility
- Uniqueness
- Performance



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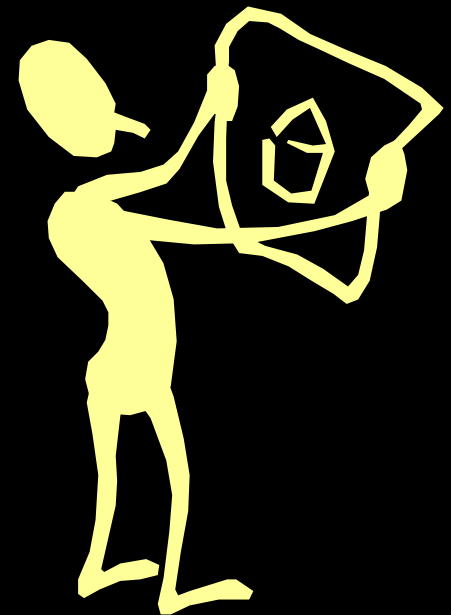
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What Matters the Most?

Early Adopters

- Energy efficiency
- Color temperature
- Color quality
- Life cycle costs
- Performance



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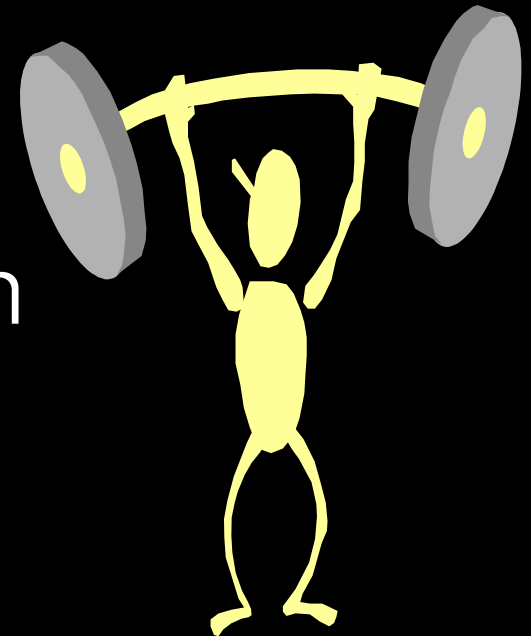
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What Matters the Most?

Mainstream

- First Costs
- Ease of Installation
- Energy efficiency
- Trendiness
- Color



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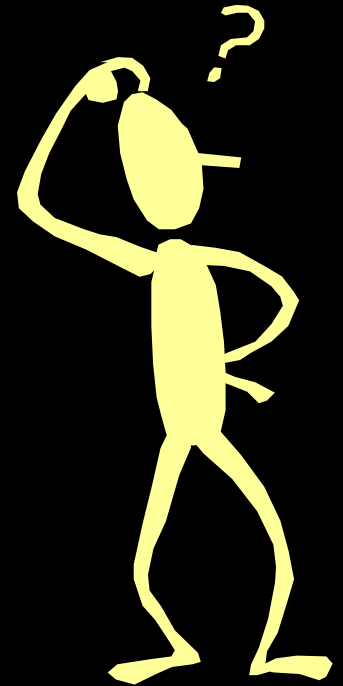
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What Matters the Most?

Late Adopters

- First Costs
- Ease of Installation
- Can I get it at Home Depot?



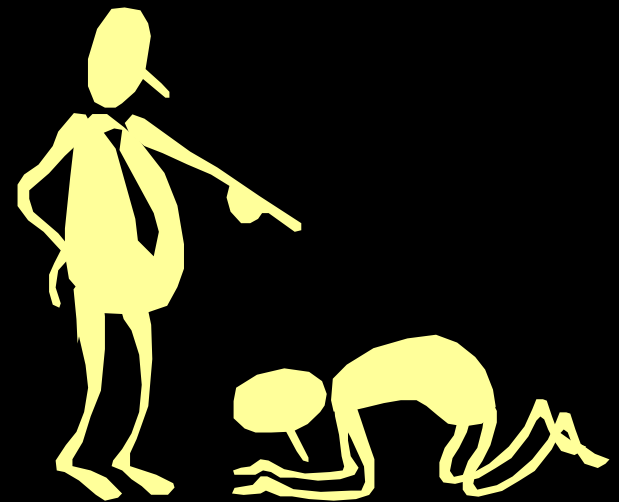
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What Matters the Most?

End of Product Life

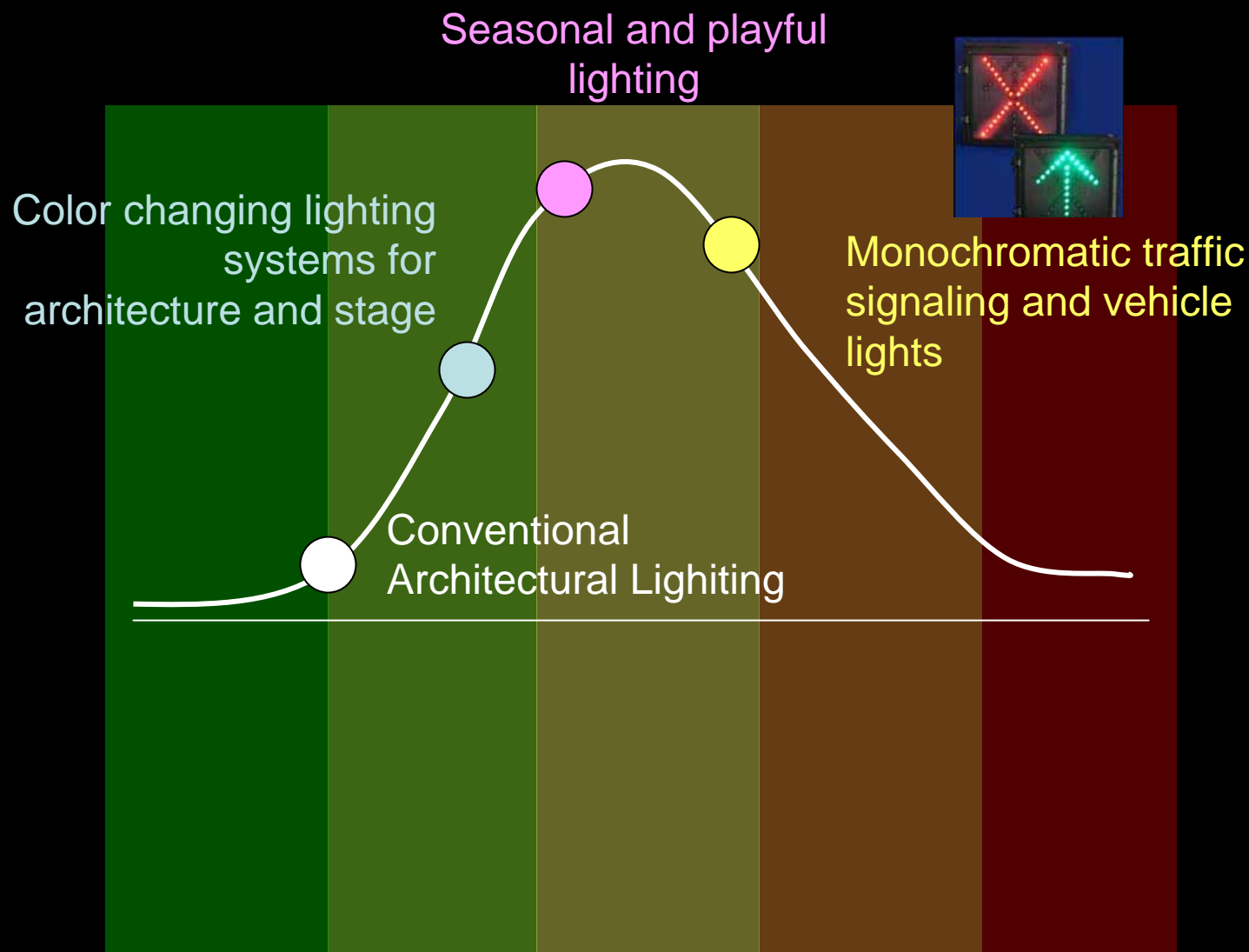
- First Costs
- Ease of Installation
- Can I get it at Wal-mart?



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Where Are LED's Today?



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Where Are LED's Today

- Energy efficiency
*30 mean lumens per watt for
a 3000K white light source
with CRI > 70*
- Color of White Light
*Acceptable 2800K
Mediocre 3000K
Miserable >3300K
Horrendous >4500K*
- Life cycle costs
You're kidding, right?
- Performance
Who knows?



Photos: LRC

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IALD Radiance Award 2006



Tourneau Dome, Las Vegas
Focus Lighting, New York

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IALD Award 2006



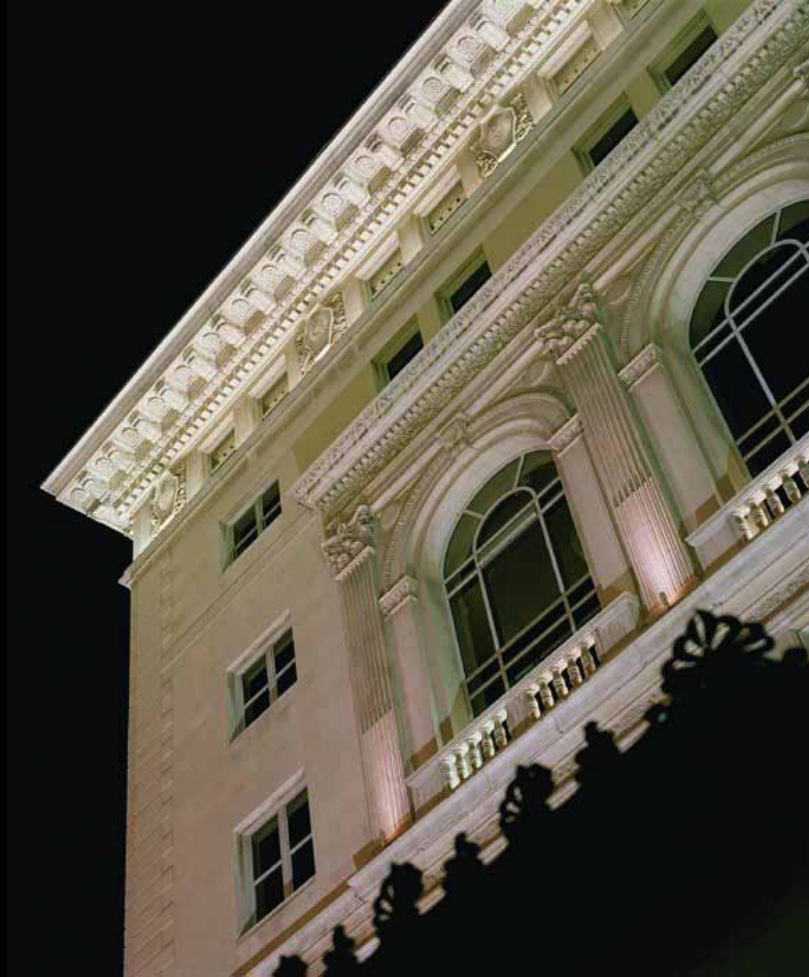
Chanel, Ginza, Tokyo

Tanteri Associates, New York

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IALD Award 2006



Detroit Athletic Club

The Smith Group, Detroit

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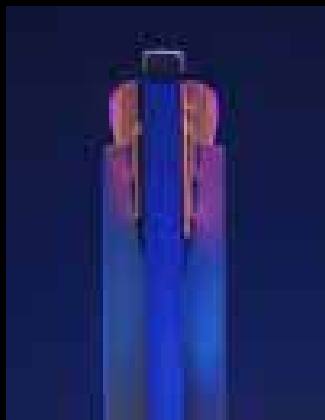
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Berlin Medical Society
L-Plan, Berlin



Semiramis Hotel, Athens
Focus Lighting, New York



Morongo Casino
Visual Terrain, Los Angeles

There were 41 other projects winning awards in 2005-2006 in which LED's were not significantly contributing to the winning design

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Good Current Architectural Uses of LED Lighting



Exterior lighting systems including marker lights, linear wall wash lights, handrail lights, and low level sconces



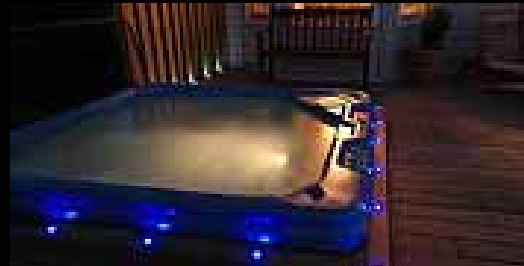
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Good Current Arcitectural Uses of LED Lighting



Interior lighting
systems including
step lights, shelf
lights, rope light,
candles and task
lights



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Why They're Acceptable

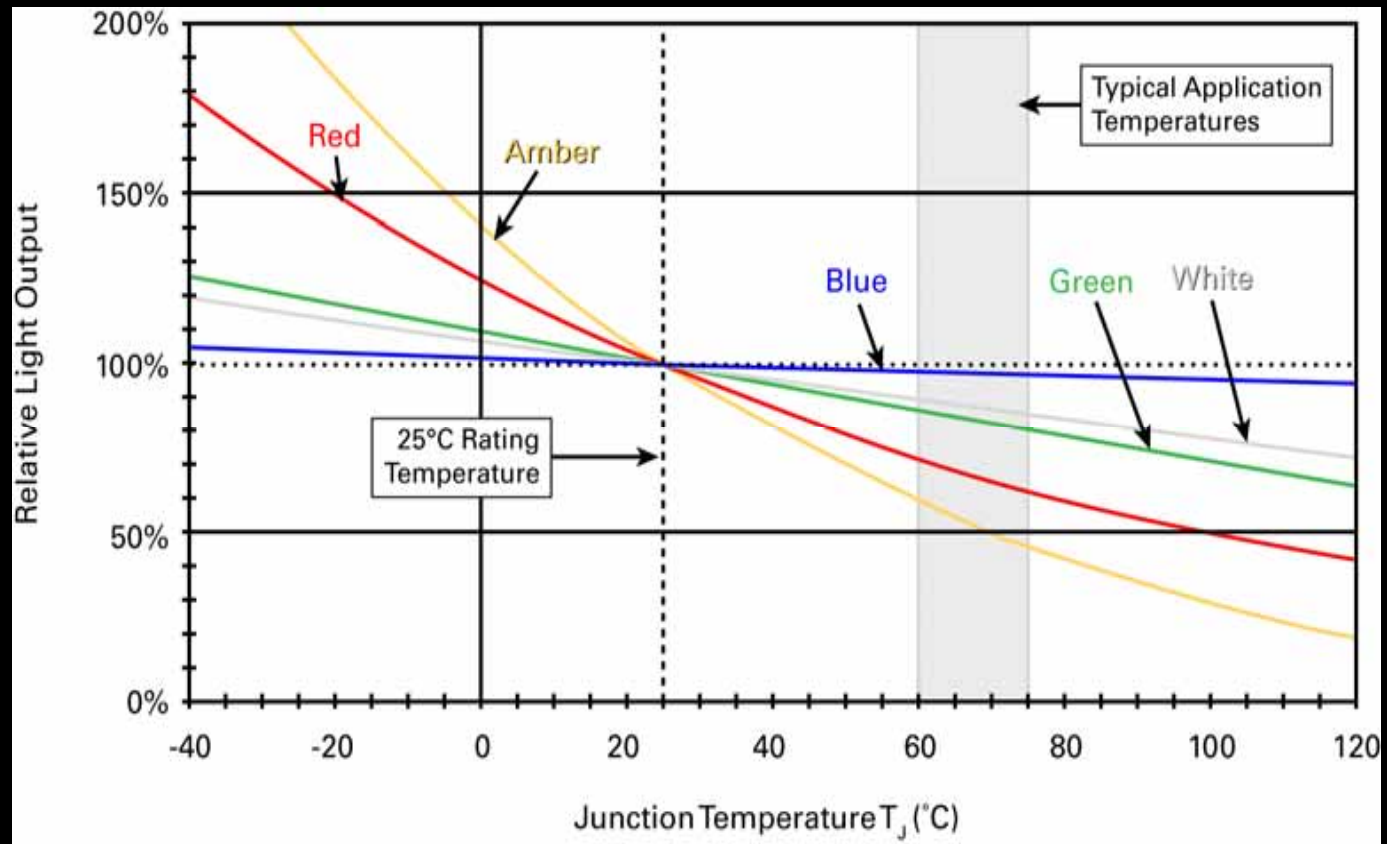
- Low level lighting
- Minimum lumen package
- Minimum expectation



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Why We're Concerned

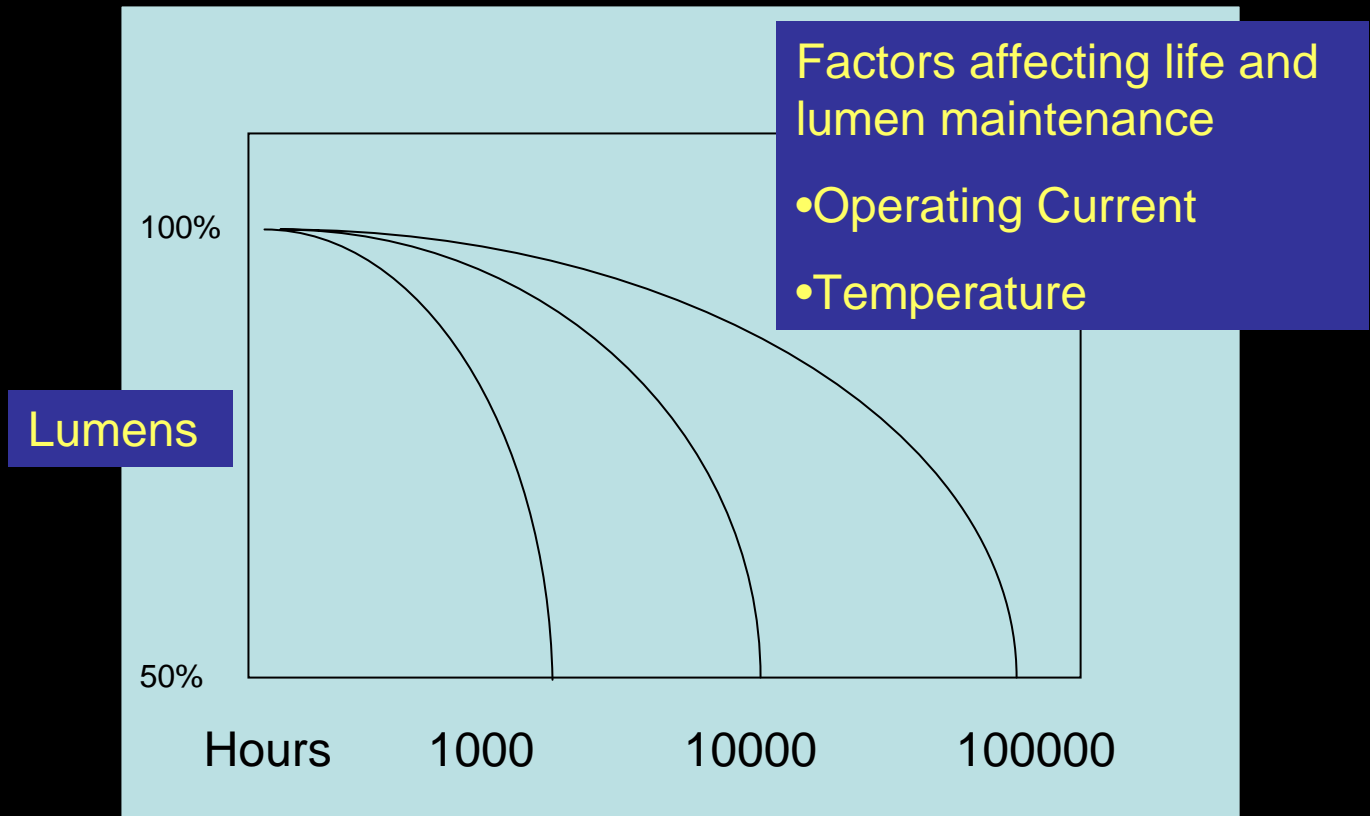


Source: US DOE

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Why We're Concerned



LED Lamp Lumen Maintenance from a program by
Dr. N. Narendran, PhD, Lighting Research Center

Why We're Concerned

Table 1. Pilot Round Test Partial Results¹

Photometrics based on LM-79 for <ul style="list-style-type: none"> • Complete luminaires • 25° C ambient temperature 	Light Output (lumens)	Luminaire Efficacy (lm/W)	Correlated Color Temperature (K)	Color Rendering Index
CPTP 06-01 Downlight² (manufacturer published LED luminous efficacy = 40 lm/W)	193	12.82	3012	70
CPTP 06-02 Under-cabinet Light (manufacturer published LED luminous efficacy = 55 lm/W)	166	13.07	<i>See note³</i>	
CPTP 06-03 Downlight (manufacturer published LED luminous efficacy = 45 lm/W)	298	19.3	2724	67.3

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Issues to Resolve

1. Efficacy
2. Temperature
3. Color
4. Price
5. Complexity



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Efficacy

- To US DOE and the LED developer, the principal issue appears to be efficacy
- Efficacy ratings appear to be inflated and optimistic
- Efficacy ratings do not include the driver losses, and that's a no-no
- Most press announcements of efficacy accomplishments are for unreal lamps or unacceptable color sources.



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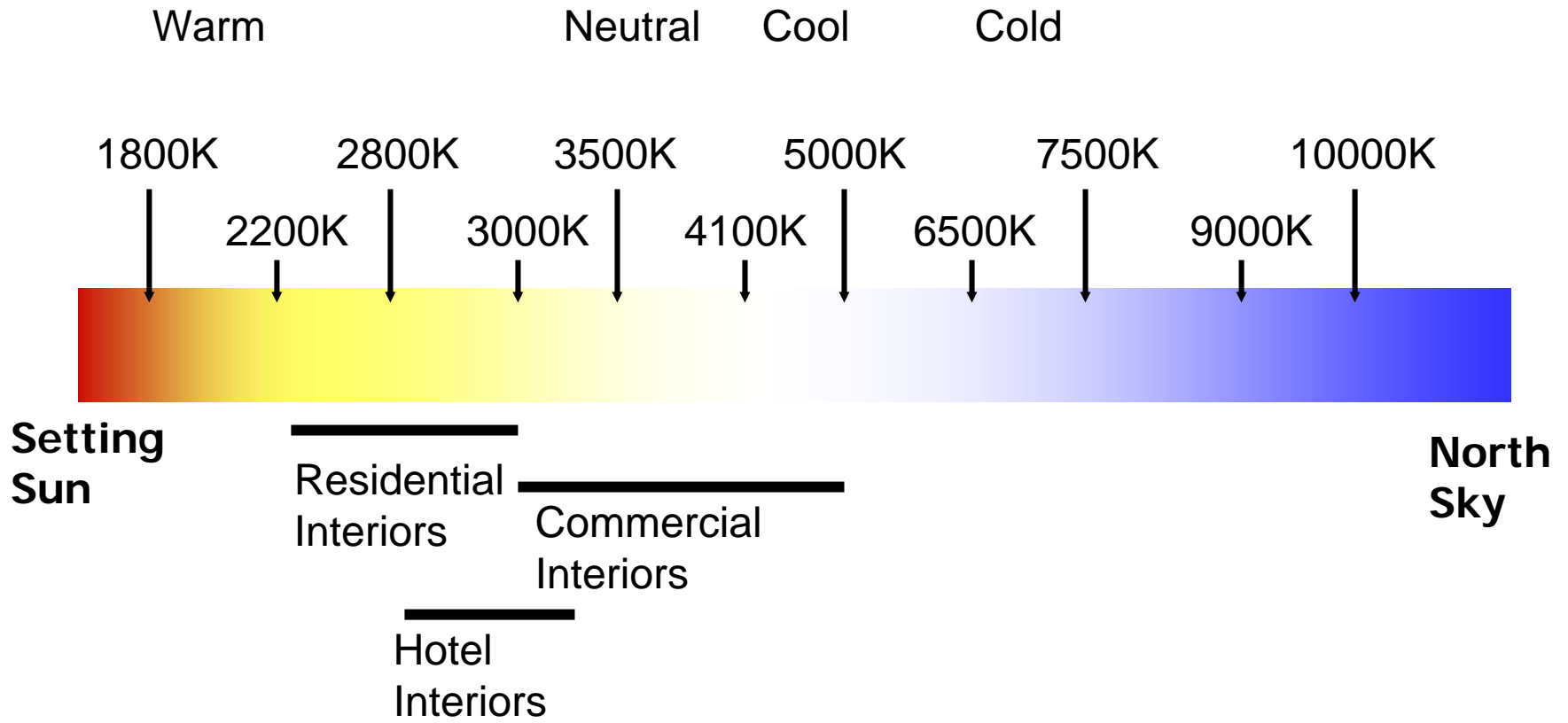


Temperature

- LED's now have the reputation of being temperature sensitive, hot little devils
- The average designer does not have the ability to assess temperature-related issues.



The Issue of Color



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Price

Lumen-hours per Dollar (including ballast)

- Incandescent 1.35 million
- Compact Fluorescent 9 million
- T-8 Fluorescent 8.4 million
- Current LED 0.1 million



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Complexity

- Driver
- Special Dimming
- Heatsinking
- Secondary Optics



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Things to Do

1. Learn the language and methods of architectural lighting
2. Develop and promulgate standards
3. Form a certification alliance
4. Produce credible marketing, advertising and announcements
5. When comparing to existing products, don't cheat or cherry pick

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Standards

Typical standards should include

- IESNA Photometric curves for complete luminaires
- IESNA Sphere lumen tests for lamps and lamp assemblies
- Lamp + driver efficacy

New standards might include

- Brightness
- Application specific hot spot



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Example: MR16 LED

LED 3 watt

6500K

85 lumens

10° 1128 cd

MR16/IR 20 watt

2950K

~350 lumens

10° 6000 cd

2900K

56 lumens

10° 760 cd



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Test Case: the Title 24 Downlight

- High efficacy light source is required by code
- The standard: a 75 watt 6" aperture, 7" overall height R30/PAR30 IC AT recessed tungsten/halogen fixture, \$25 with lamp, and it's dimmable
- The current alternative is a 26 watt compact fluorescent, \$75 with lamp, it does not dim, and it sucks



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Test Case: the Title 24 Downlight

A Leading Edge LED
product claims

- Acceptable warm color (it is)
- Dimmable (with warnings)
- >45 lumens per watt (no candlepower data)
- Use with a number of ICAT cans (list not available)



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Final Words

LED comes to
Lighting

- Conventional uses
- Conventional luminaires
- Conventional applications

Lighting comes to
LED

- New uses
- New luminaires
- New applications

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My Favorite New Ideas



Reinventing Outdoor
Lighting



Reinventing Indoor Lighting



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Show Me the Lumens!

www.benyalighting.com

