

INTEGRATED LIGHTING DESIGN

Jeff Kramer, LC
Philips Lighting

In a lighting retrofit project, is the energy savings or the lighting more important?

Good lighting, quality lighting is as important as the energy savings and rebates.

Quality Lighting

- ▶ Know what type of activity or task to be performed in the area
- ▶ Know what the recommended light levels are
- ▶ Know what other lighting issues are important for the design – glare, uniformity, reflectances, etc.

(IES recommended light levels from IES Lighting Handbook 9th Edition)

IES Recommended Light Levels

Table 6.2 Office tasks.

I. INTERIOR LOCATIONS AND TASKS	Very Important		Important		Somewhat Important		Blank = Not important or not applicable																	
	Appearance of Space and Luminaires	Color Appearance (and Color Contrast)	Daylighting Integration and Control	Direct Glare	Flicker (and Strobe)	Light Distribution on Surfaces	Light Distribution on Task Plane (Uniformity)	Luminances of Room Surfaces	Modeling of Faces or Objects	Point(s) of Interest	Reflected Glare	Shadows	Source/Task/Eye Geometry	Spurious/Desirable Reflected Highlights	Surface Characteristics	System Control and Flexibility	Special Considerations	Notes on Special Considerations	Illuminance (Horizontal)	Category or Value (lux) ^(b)	Illuminance (Vertical)	Category or Value (lux) ^(b)	Notes on Illuminance - see end of section	Reference Chapter(s)
Offices (13)																								
Filing (see Reading)																								Ch. 11
General and private offices (see Reading)																								
Open plan office																								
Intensive VDT use																	(14,15)		D		B			
Open plan office																								
Intermittent VDT use																	(14,15)		m		B			
Private office																			m		B			
Libraries (see Libraries)																								
Lobbies, lounges, and reception areas																			C		A			
Mail sorting																			C		A			
Copy rooms																			C		A			
Reading (16)																								Ch. 11, 12
Copied tasks																								
Microfiche reader																								
Photograph, moderate detail																								
Thermal copy, poor																								
Photocopies																								
Photocopies, 3 rd generation																								


Integrated Lighting Design

Quality Lighting is achieved through an integrated approach

Integrated lighting design provides the highest quality lighting from the standpoint of comfort, productivity, aesthetics, and energy efficiency

In many cases, better lighting design not only produces higher quality lighting, but also can be more energy efficient.

Westminster City Park Recreation Center Swimming Pool Lighting Resign

- ▶ Replaced 400 watt metal halide indirect floods with new 6-lamp T8 fluorescent highbays
 - ▶ On average, quadrupled the nighttime light levels
 - ▶ Cut the lighting energy by more than 50%
- 

Before



After



Before



After




Before




After



Quality Lighting Issues


- ▶ Light on ceiling and walls
 - ▶ Control of direct and reflected glare
 - ▶ Uniformity
 - ▶ Daylight
 - ▶ Color rendering and color temperature
 - ▶ Lighting controls
 - ▶ Quantity of light (footcandles)
- 

Other Lighting Issues

- ▶ T5 / T5HO vs T8
 - ▶ LED's
 - ▶ Lighting controls
 - ▶ Daylight harvesting
- 

We have to get better at the lighting part

For the lighting professional

- ▶ Attend lighting trainings
 - ▶ Take a lighting class – IES Fundamental of Lighting
 - ▶ Join the Illuminating Engineering Society (IES)
 - ▶ Get your L.C. – Lighting Certification or CLEP – Certified Lighting Efficiency Professional
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We have to get better at the lighting part

For the building owner/ facilities manager

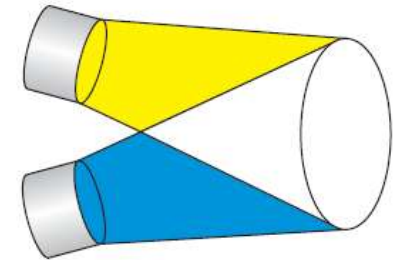
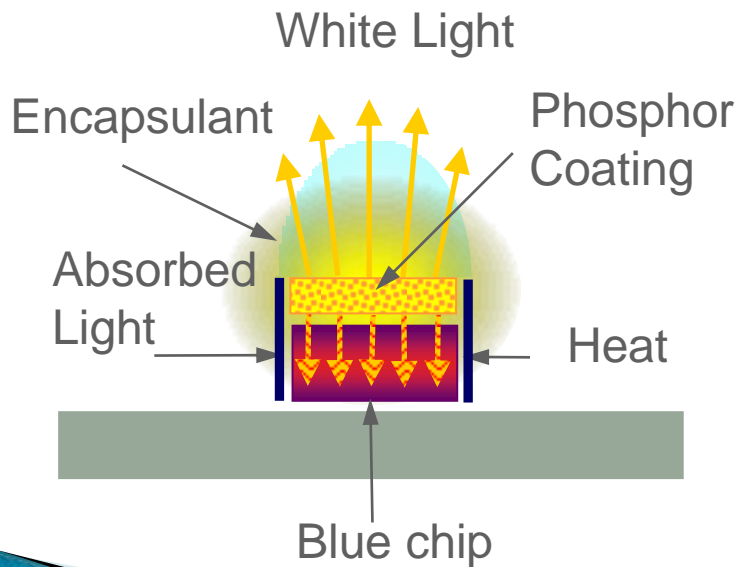
- ▶ Look for an experienced lighting professional that understands integrated lighting design and how to achieve high quality, efficient lighting

LED – Light Emitting Diode

How LEDs Produce White Light

There are three methods of producing white light with LEDs:

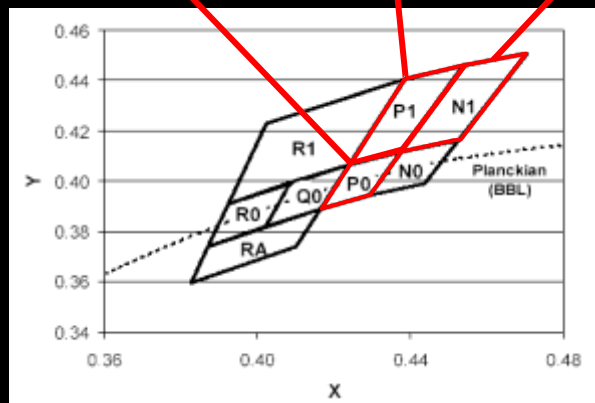
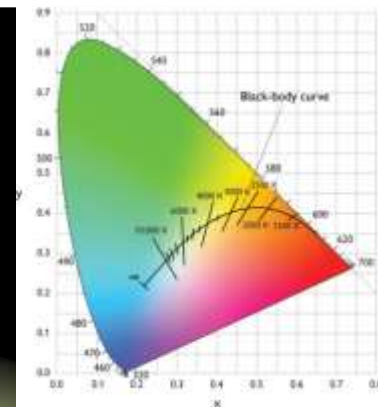
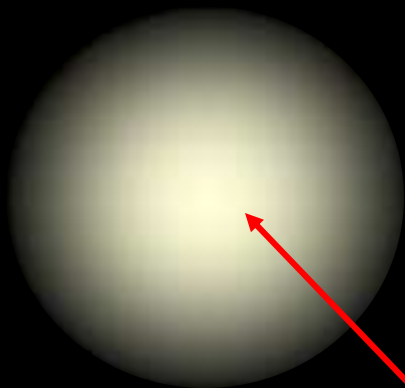
- ▶ The **RGB white** method produces white light by combining the output from red, green, and blue LEDs (similar to TVs or computer monitors)
- ▶ The **phosphor white** method produces white light in a **single LED** by combining a short-wavelength LED, such as **blue** or UV, and a **yellow phosphor coating**
- ▶ **Blue LEDs and Remote phosphors**



White light can be produced by combining the wavelengths of yellow and blue light only. Sir Isaac Newton discovered this effect when performing color-matching experiments in the early 1700s.

Color Binning

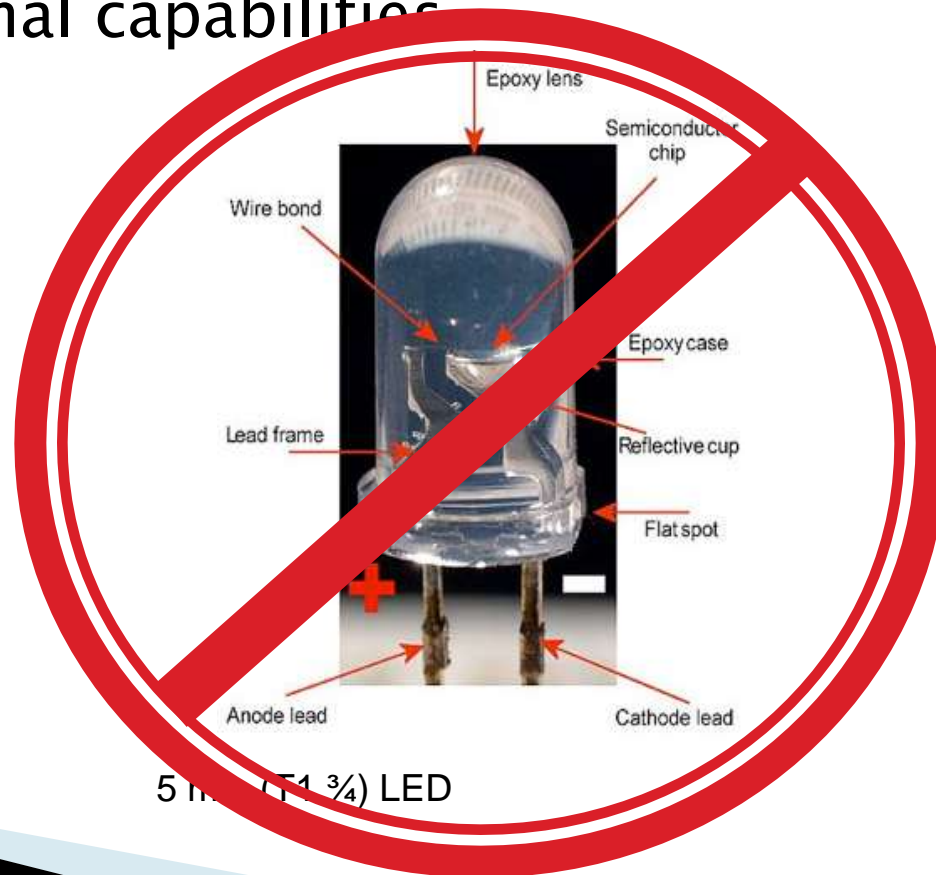
- ▶ Each color consists of several different “bins”
- ▶ The performance of each LED is unique
- ▶ Each LED is binned by three measurements:
 - Flux (light output)
 - Color
 - Forward voltage (power)
- ▶ Each manufacturer has different bins
- ▶ Tighter bins = higher costs



LED Color Inconsistency



- ▶ Use of 5 mm LEDs in LED Retrofit Lamps and fixtures!?!
 - ▶ Designed as indicator lights in the 1970s
 - ▶ Not illumination grade LEDs
 - limited thermal capabilities



5 mm (T1 3/4) LED

Lumen Maintenance & Life

- ▶ Standard lighting – Rated Average Life
- ▶ LED commercial life rating – L70
 - Rated life at 70% lumen maintenance
- ▶ B50/L70
 - Time at which 50% of lamps have *either* failed *or* are producing less than 70% light output

LED – Light Emitting Diode

Testing Standards and Approvals

ANSI C78–377–2008 Chromaticity (color temperature)

IESNA LM–79 Electrical and photometric

IESNA LM–80 Lumen depreciation and life

IESNA TM–21 Uses LM–80 data & extrapolates life

EPA Energy Star Rating

DLC Design Lights Consortium

Lighting Design Lab Lighting Design Lab's interim list

Energy Star LED Lamp Qualifications

Tests required:

1. LM-79 and lamp testing for 6,000 hours
2. LM-80 & In Situ Temperature Measurement Test (ISTMT)
(early initial qualification only)

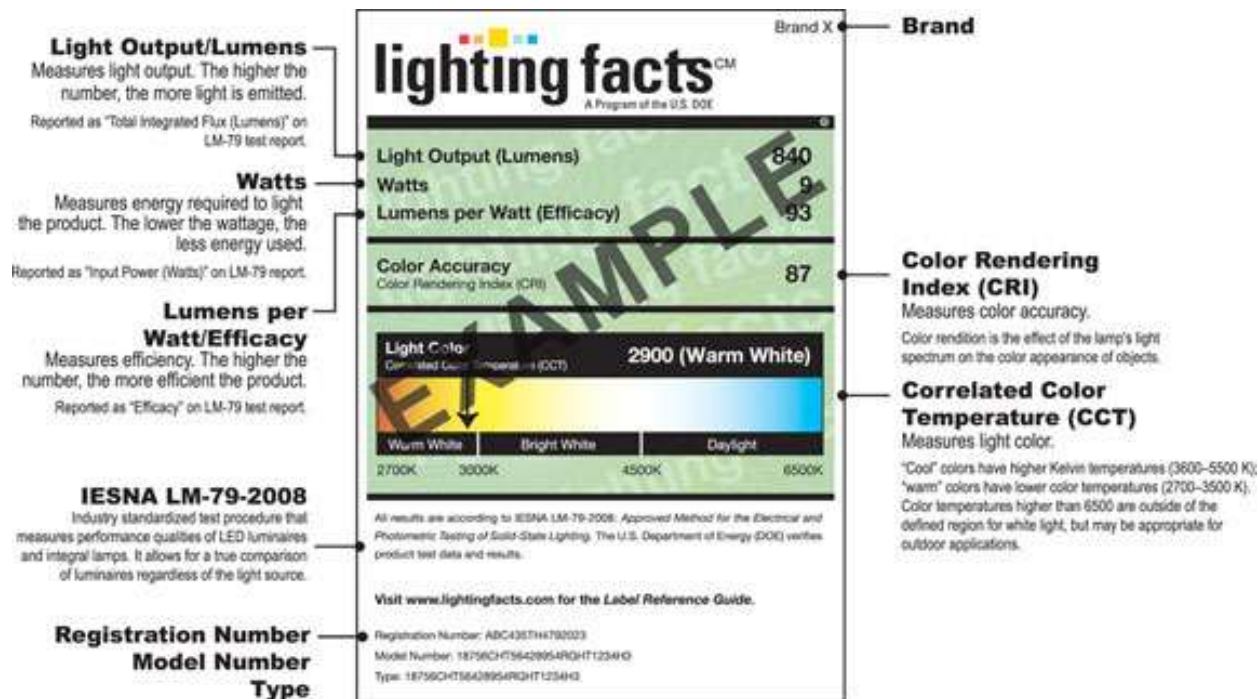
- To perform the LM-80 and/or LM-79 tests, a lab must be:
 - Approved through DOE's CALiPER program until 12/31/2010
 - Recognized by EPA
- To perform the ISTMT, a lab must be:
 - Approved by OSHA as a National Recognized Test Lab (NRTL),
 - Recognized by DOE's CALiPER program, or
 - Recognized through UL's Data Acceptance Program

1. Early Initial Qualification	2. Initial Qualification	3. Full Qualification (higher life claims only)
3,000 hours of testing + LM-80 and ISTMT	6,000 hours of testing	7,500 – 12,500 hours of testing depending on life claim



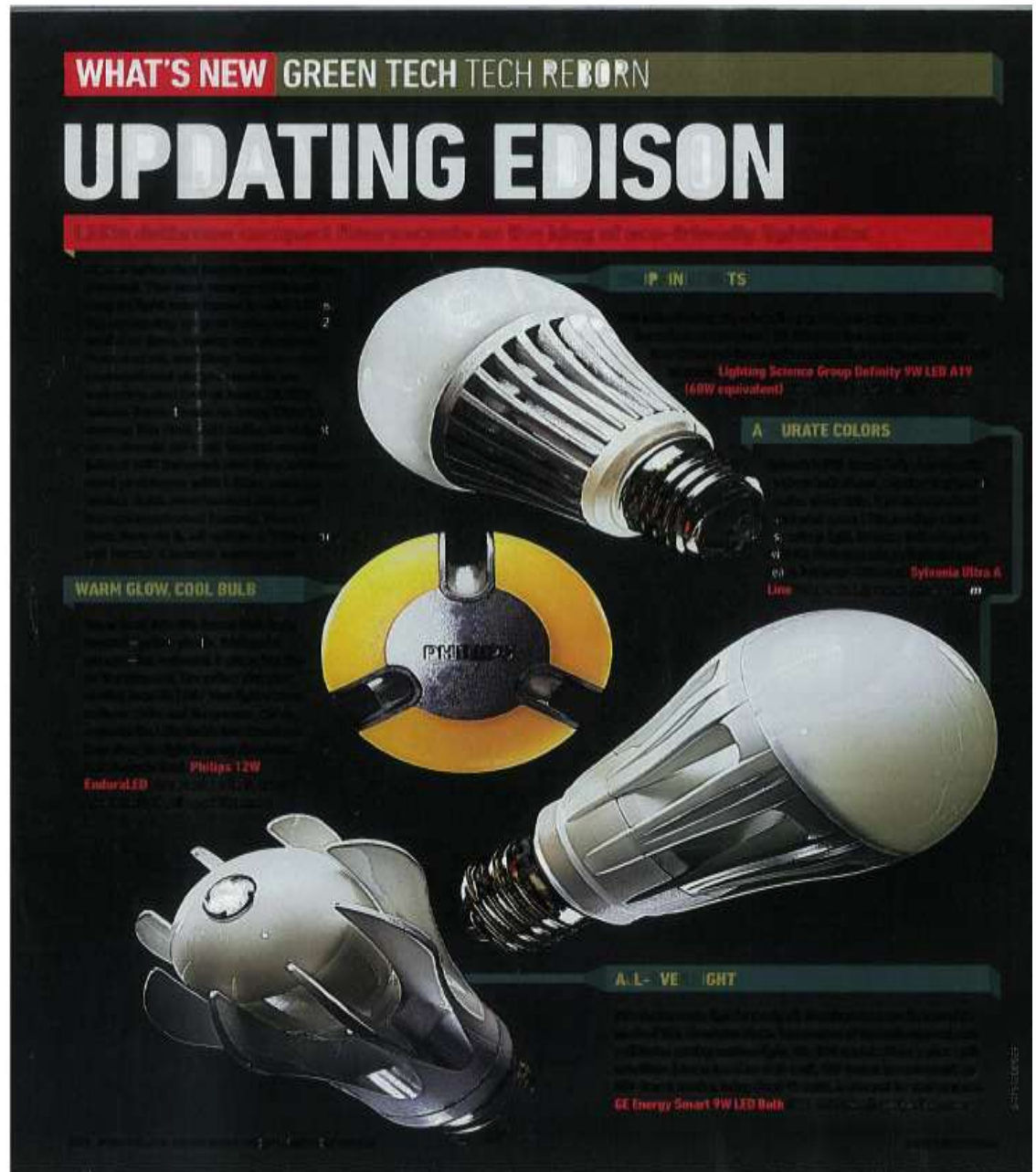
What is Lighting Facts?

- ▶ Called the “Nutrition Label” for SSL –quick summary of five key performance metrics
 - Web-based product performance reporting initiative www.lightingfacts.com
 - Product list backed by verification of performance testing
- ▶ Buyer’s guidance tool
 - Resource to evaluate reported product performance data
- ▶ A voluntary and free program, created by the DOE




Popular Science

July 2010



Dimming LEDs and other issues

- ▶ Who has had issues with dimming LEDs?
 - ▶ Who has had challenges with LEDs?
 - ▶ Who has had good results with LEDs?
 - ▶ Do LEDs work well in all applications?
 - ▶ What are the best applications for LEDs now?
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Questions