

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.


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



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

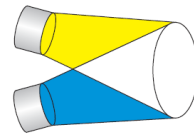
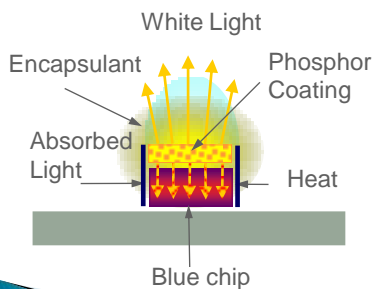


LED – Light Emitting Diode

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**



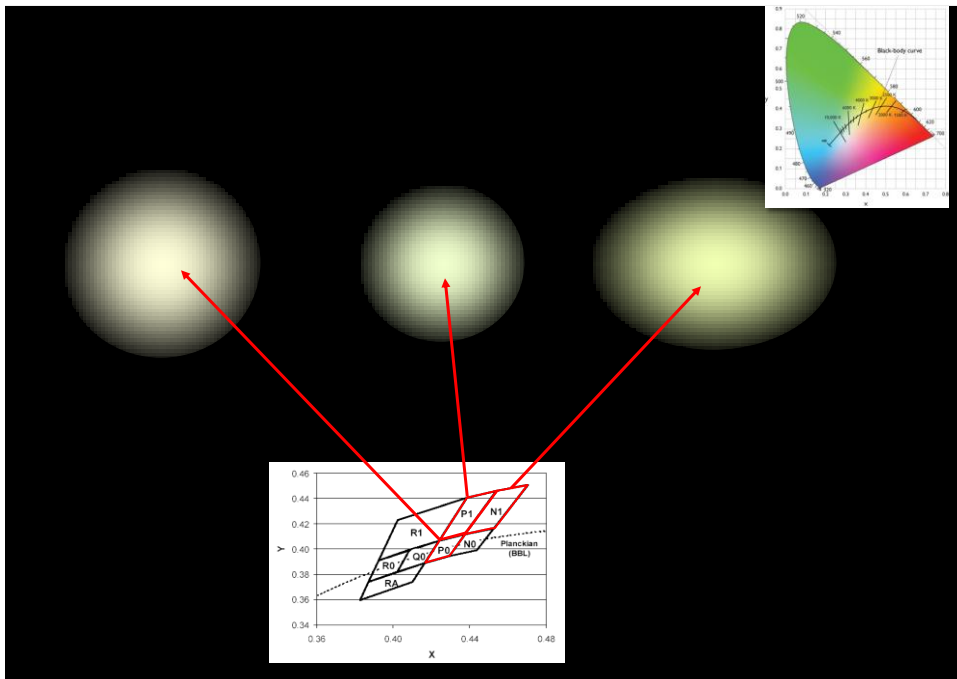
White light can be produced by combining the wavelengths of yellow and blue light only. Sir Isaac Newton discovered this effect when performing color-matching experiments in the early 1700s.

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



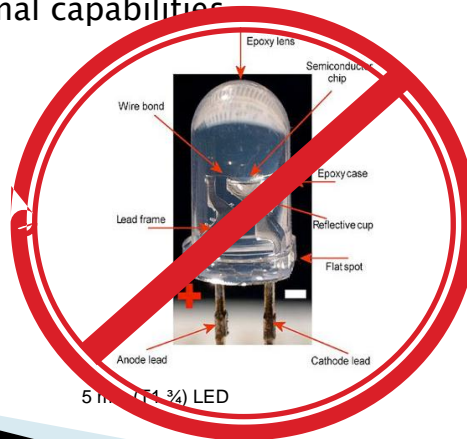
17



LED Color Inconsistency

1
9

- ▶ 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 (1 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



21

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

Light Output/Lumens
Measures light output. The higher the number, the more light is emitted.
Reported as "Total Integrated Flux (Lumens)" on LM-79 test report.

Watts
Measures energy required to light the product. The lower the wattage, the less energy used.
Reported as "Input Power (Watts)" on LM-79 report.

Lumens per Watt/Efficacy
Measures efficiency. The higher the number, the more efficient the product.
Reported as "Efficacy" on LM-79 test report.

IESNA LM-79-2008
Industry standardized test procedure that measures performance qualities of LED luminaires and integral lamps. It allows for a true comparison of luminaires regardless of the light source.

**Registration Number
Model Number
Type**

lighting facts
A Program of the U.S. DOE

Light Output (Lumens) 840
Watts 9.83
Lumens per Watt (Efficacy) 87

Color Accuracy
Color Rendering Index (CRI) 87

Light C-Info
CCT: 2900 (Warm White)
CCT: 2700K 3000K 4500K 6500K

Warm White Bright White Daylight

All results are according to IESNA LM-79-2008. Approved Method for the Electrical and Photometric Testing of Solid-State Lighting. The U.S. Department of Energy (DOE) reserves product test data and results.
Visit www.lightingfacts.com for the Label Reference Guide.

Registration Number: ABC43214780023
Model Number: 187962D776C2854F82H712345
Type: 187962D776C2854F82H712345

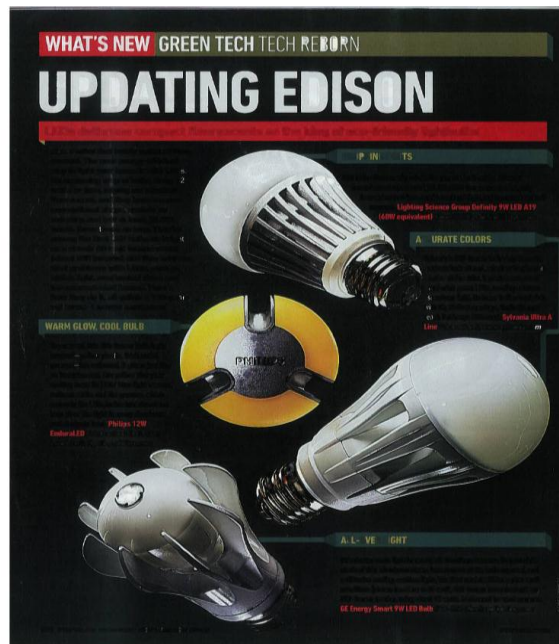
Brand

Color Rendering Index (CRI)
Measures color accuracy.
Color rendition is the effect of the lamp's light spectrum on the color appearance of objects.

Correlated Color Temperature (CCT)
Measures light color.
"Cool" colors have higher Kelvin temperatures (5000-6500 K).
"Warm" colors have lower color temperatures (2700-3500 K).
Color temperatures higher than 6500K are outside of the defined region for white light, but may be appropriate for outdoor applications.

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?

Questions