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How to Get the LEDs You Really Want

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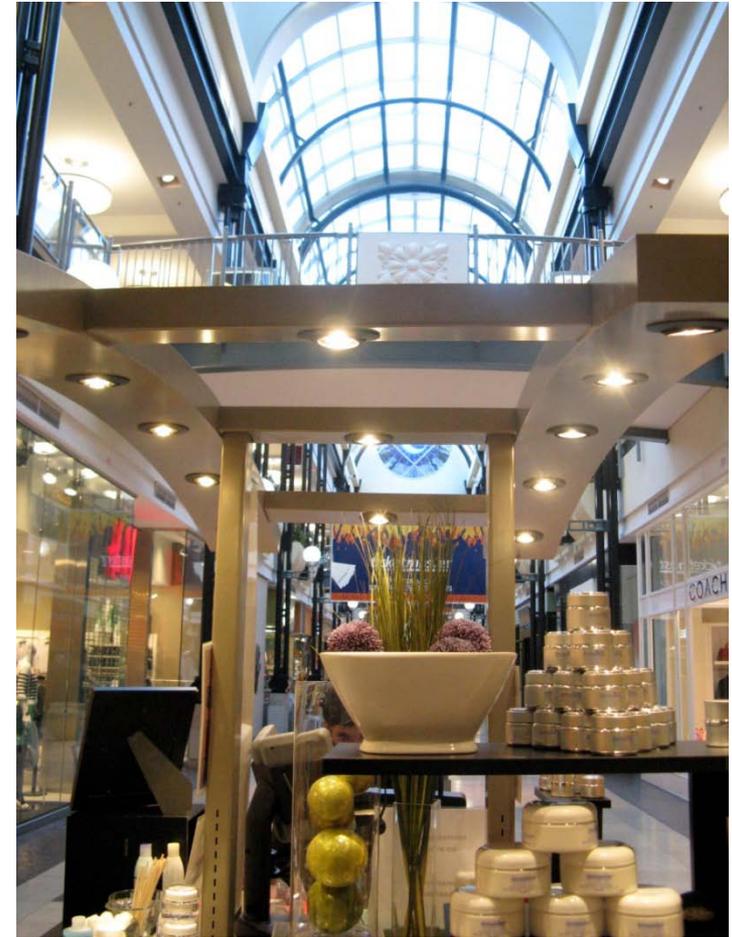
Associate Director, E Source

LED Attributes

- Long life
 - Vibration resistance
 - Small size
 - Directional light output
 - Efficiency is application dependent
 - Heat is conducted away
 - High performance at low temperatures
- Instant on, dimmable, controllable
 - No IR or UV
 - No mercury (but...)
 - Exaggerated claims
 - Color shifting
 - Expensive
 - Rapidly improving

Case Study: A lot Can Go Wrong

- A “simple” project:
 - LED MR 16s in mall carts (5 W to replace 20W and 35 W halogen)
- Good start
 - Light levels, distribution acceptable
- Site inspection identified a slight hum
- Transformers were at each lamp and rated to 80w



Even More Can Go Wrong

- Rewired multiple lamps on one transformer
- Change of scope—electrician needed
- Flickering if any disturbance on circuit
- New power supply
- Happy ending: now rolling out to all malls



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What's Are the Challenges?

- Expect the unexpected
- Performance varies widely
- Lots of pressure, misleading info from manufacturers and reps
- Recent round of DOE CALiPER tests showed:
 - Efficacy: 14 to 53 lm/W
 - >half of products with misleading, inaccurate literature
 - Equivalency claims (wattage) for replacement lamps almost always false

How to Evaluate a Product

- It is critical for designers, builders, contractors, and sellers to understand the basics of what to ask or to look for;
 - Get accurate information
 - Look for Standards-based data

Getting Accurate Information

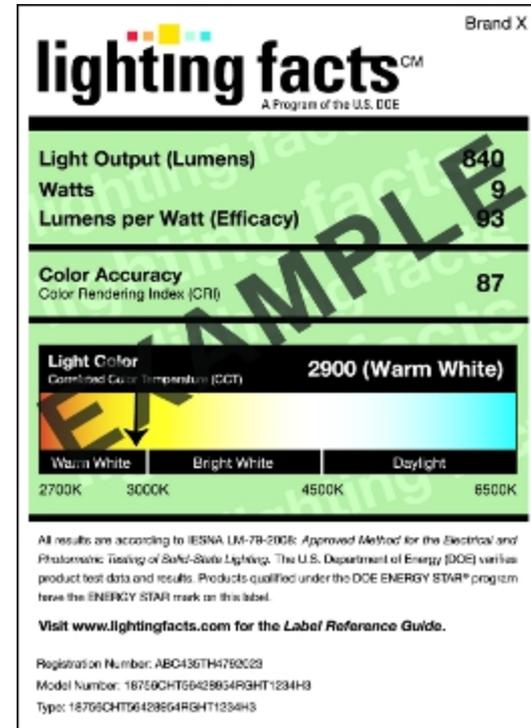
- Energy Star
 - Independent testing based on established standards
 - Only a handful of applications covered so far
 - Commercial applications, see http://www.energystar.gov/index.cfm?c=ssl.pr_commercial
 - New requirements coming, emphasis on residential applications

Getting Accurate Information

- DOE/CAIiPER: tests a wide array of general illumination products, see <http://www1.eere.energy.gov/buildings/ssl/caliper.html>
- Manufacturers can't use data for commercial purposes, but potential users can check for specific products.

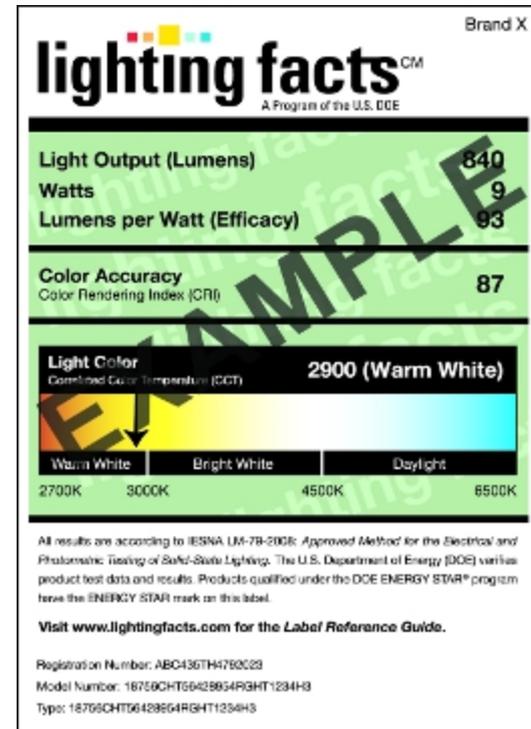
Getting Accurate Information

- SSL Quality Advocates: voluntary program to report data in a uniform, useful, honest way, based on established standards, via Lighting Facts label; see <http://www1.eere.energy.gov/buildings/ssl/advocates.html>



Lighting Facts Label

- Provides data on:
 - light output (lumens)
 - power (watts)
 - efficacy (lumens per watt)
 - correlated color temperature (CCT)
 - color rendering index (CRI)
 - www.lightingfacts.com



Accurate Photometric Data

- LM-79-08: The Approved Method for Electrical and Photometric Measurements of SSL Products specifies procedures for measuring:
 - total luminous flux
 - electrical power
 - luminous efficacy
 - color temperature
 - color rendering index

Accurate Lumen Maintenance Data

- LM-80-08: Approved Method for Measuring Lumen Maintenance of LED Light Sources.
 - Applies to LED packages, modules, arrays;
 - Requires at least 6000 hours of testing under specified thermal conditions.
 - Does not provide a method for predicting LED life

Determining Lamp Life

- TM 21 under development
 - Method to extrapolate 6000-hour LM-80 data
 - Will define how to use LM-80 data to estimate useful life (L_{70}) of LED packages, modules, and arrays.
 - Meanwhile ask for data showing temperature of LEDs inside the luminaire; or description of thermal management; eg integral aluminum fins with screens to prevent build-up of dirt

Determining Luminaire Life

- More than just the light source
- See DOE/NGLIA report:
http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led_luminaire-lifetime-guide.pdf
- Reliability factors:
 - Thermal design
 - Driver
 - Electrical
 - Mechanical
 - Optics, etc

Ensuring Safety

- New safety standard (UL 8750): "Safety Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products."
- For more details, visit the DOE's web page on "safety, installation, and other requirements"
(<http://www1.eere.energy.gov/buildings/ssl/safety.html>.)

Check existing installations

- Nothing beats real world experience
 - Efficiency, maintenance, economics, user reactions
- DOE's Gateway program
 - <http://www1.eere.energy.gov/buildings/ssl/gatewaydemos.html>
 - Street lighting
 - Parking lot
 - Parking garage
 - Freezer case
 - Residential downlight, undercabinet lighting
 - Walkway lighting

Other considerations

- Does the product do what you want it to do
- Cutoff, Glare
- Distribution, Uniformity, Color
- Quality Components
- Make the right comparisons
- Participate in demonstration programs
- Commission you own tests

Get Lots of Information

Ask Questions, get answers

Don't accept;

- “Product is in testing”
- “It passed all testing”
- “The manufacturer doesn't release the information”
- “It's proprietary information”

For More Information

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