LED Lighting with

SuperGreen Solutions

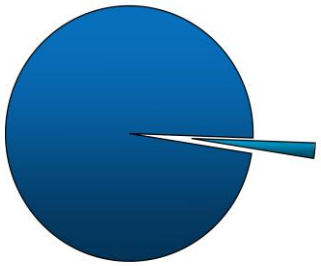
Energy Efficient Products

LED Lighting

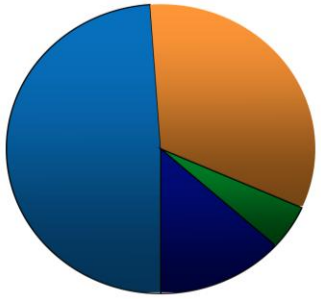
LED Revolution

- *Within the next 20 years, every lighting device everywhere will be SSL based.*

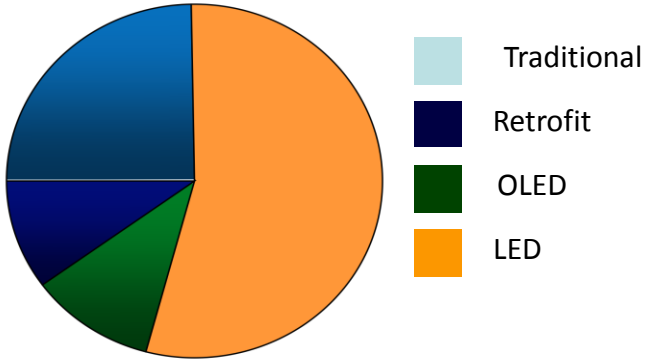
J. Brodrick, DOE, 2010



2009
$75 Billion
99% Traditional
1% Solid state lighting



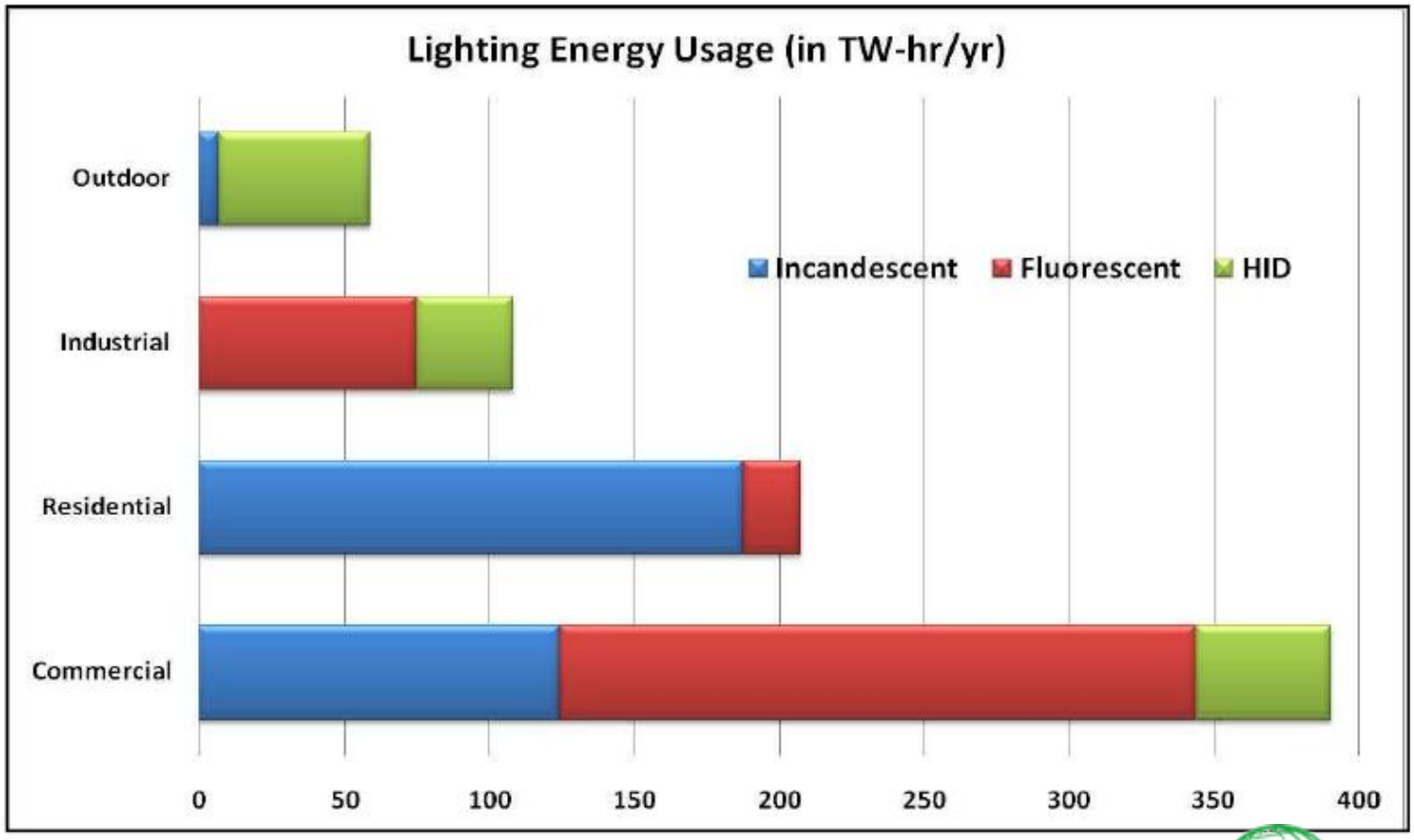
2014
$91 Billion
48% Traditional
52% SSL



2019
$122 Billion
25% Traditional
75% SSL

SuperGreen Solutions
Energy Efficient Products

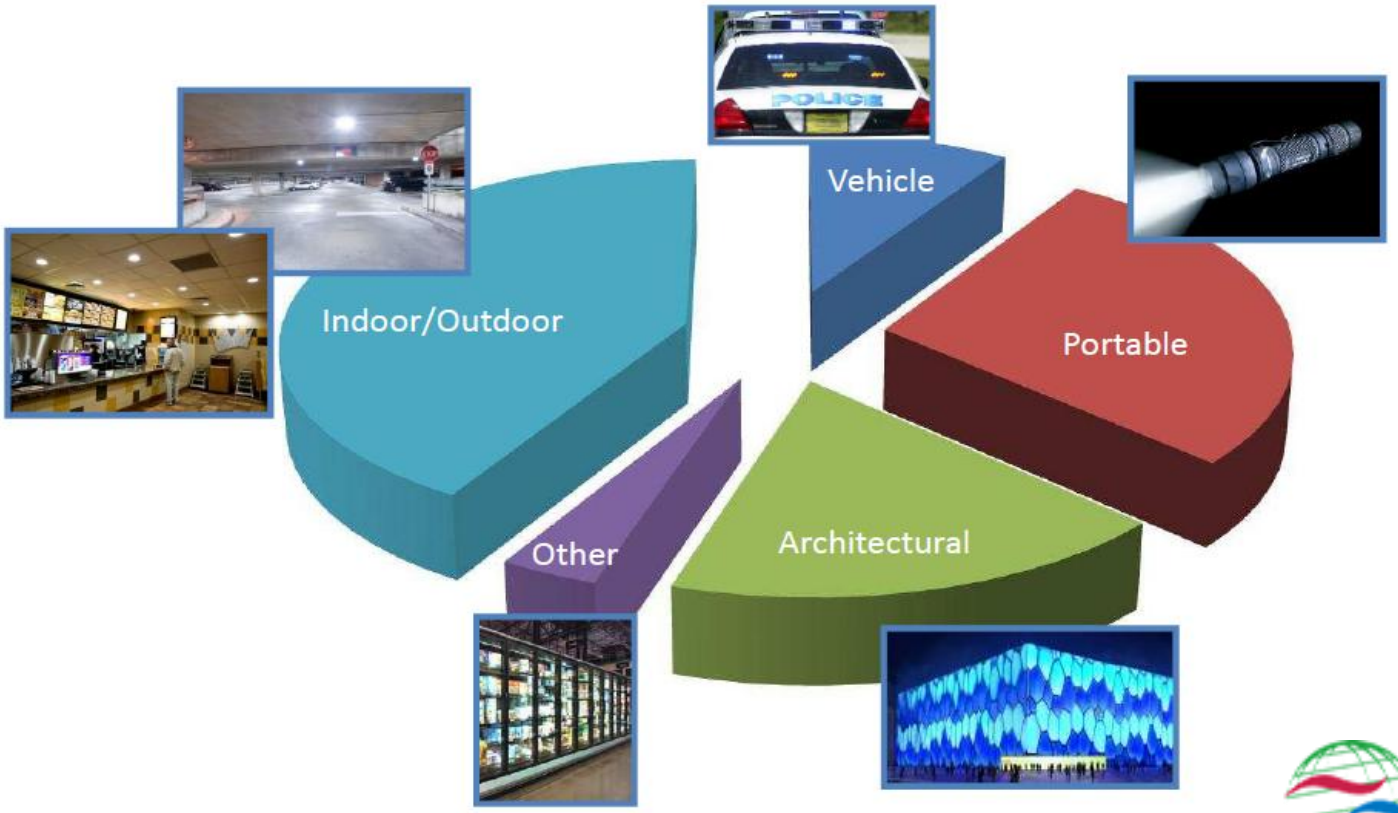
Current Lighting Energy Usage



HID = High Induction Density such as Metal Halide – Arc Lighting

SuperGreen Solutions
Energy Efficient Products

Current LED Usage



SuperGreen Solutions
Energy Efficient Products

Lighting Energy Consumption

- Lighting currently accounts for 20% of the worlds energy consumption
- Regulation and rising Energy costs will drive conservation.
- Simply Put, Spend some money on LED and Save allot, (Not just Money)

SuperGreen Solutions
Energy Efficient Products

Advantages of LED lights

- High-levels of brightness and intensity
- High-efficiency
- Low-voltage and current requirements
- Low radiated heat
- High reliability (resistant to shock and vibration)
- Small size and instant-on allows new applications
- Highly directional
- No UV Rays
- No Mercury
- Longest life of any lighting source
- Can be easily controlled and programmed

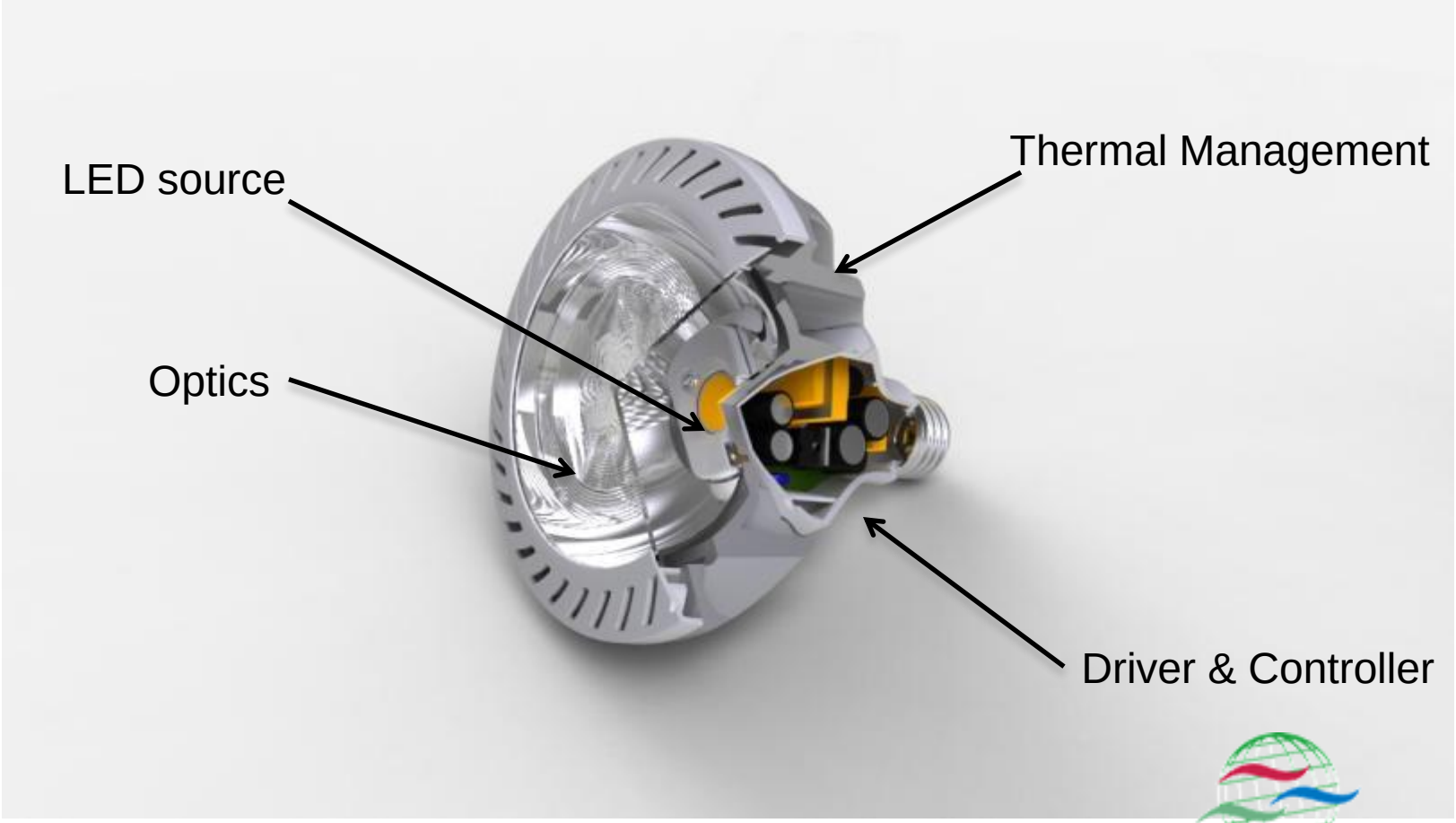
SuperGreen Solutions
Energy Efficient Products

Applications Areas

- Security Lighting
- Parking Lot Lighting
- Car Dealerships
- Street Lighting
- Area Lighting
- Service Stations
- Canopy Lighting
- Malls
- Hospitals
- Retail

SuperGreen Solutions
Energy Efficient Products

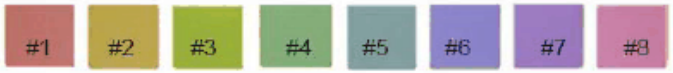
Every LED Lamp is a Light Engine



SuperGreen Solutions
Energy Efficient Products

Color and Color Quality

- Correlated Color Temperature (CCT) used for color
  - from 2700K (incandescent warm white)
  - to 6500 K (daylight)
- Color Rendering Index (CRI) used for color quality
  - A measure of the ability to show colors realistically as compared to a standard source
  - Based on a standard series of 8 different colors



  - By definition, incandescent bulbs have a CRI of 100

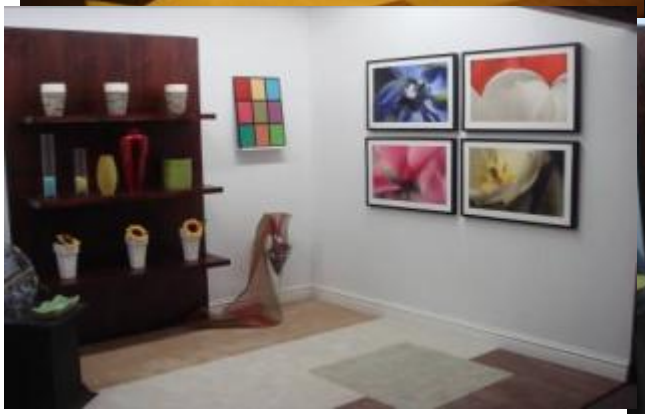
SuperGreen Solutions
Energy Efficient Products

CCT Examples

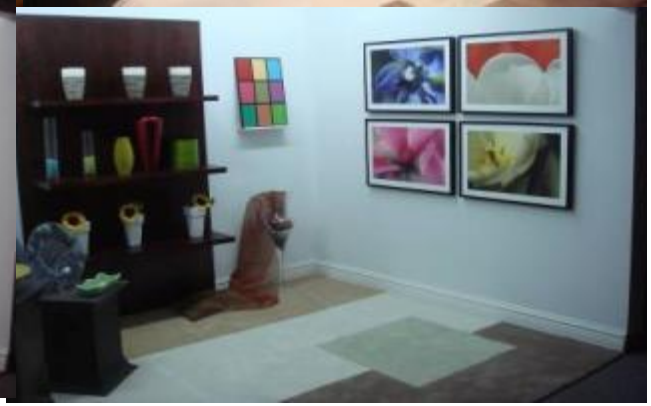
2700K

3000K

4000K



5000K



SuperGreen Solutions
Energy Efficient Products

CRI Examples

CRI = 62

CRI = 80

SuperGreen Solutions
Energy Efficient Products

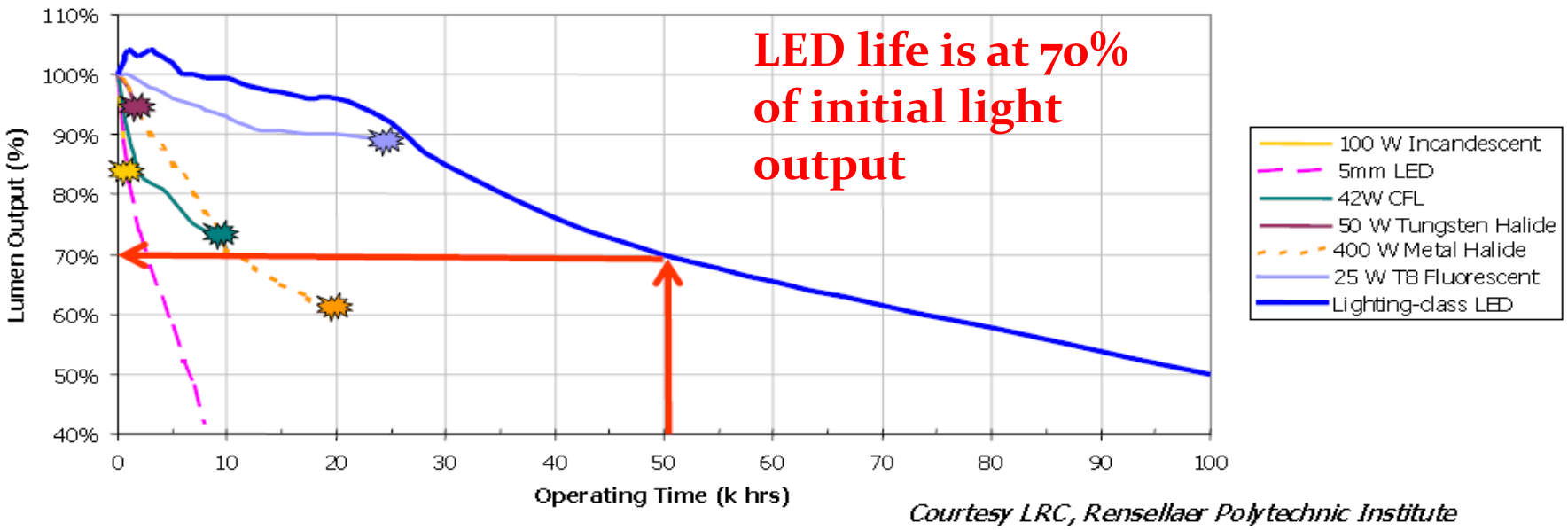
CRI Examples

CRI = 93

CRI = 92

SuperGreen Solutions
Energy Efficient Products

Longevity of Different Lighting



Courtesy LRC, Rensellaer Polytechnic Institute

Light Source	Lifetime in Hours
Incandescent	1000 – 2000
Fluorescent	5000 - 24000
Mercury Vapor	10000 - 20000
Sodium Vapor	24000
Metal Halide	10000 - 20000
High Power LEDs	> 50000

SuperGreen Solutions
Energy Efficient Products

LED vs. HID

- Metal Halide
  - Good Color Rendering
  - Short Life
- HPS
  - Poor Color Rendering
  - Longer Life
- LED
  - Good Color Rendering
  - Longest Life

SuperGreen Solutions
Energy Efficient Products

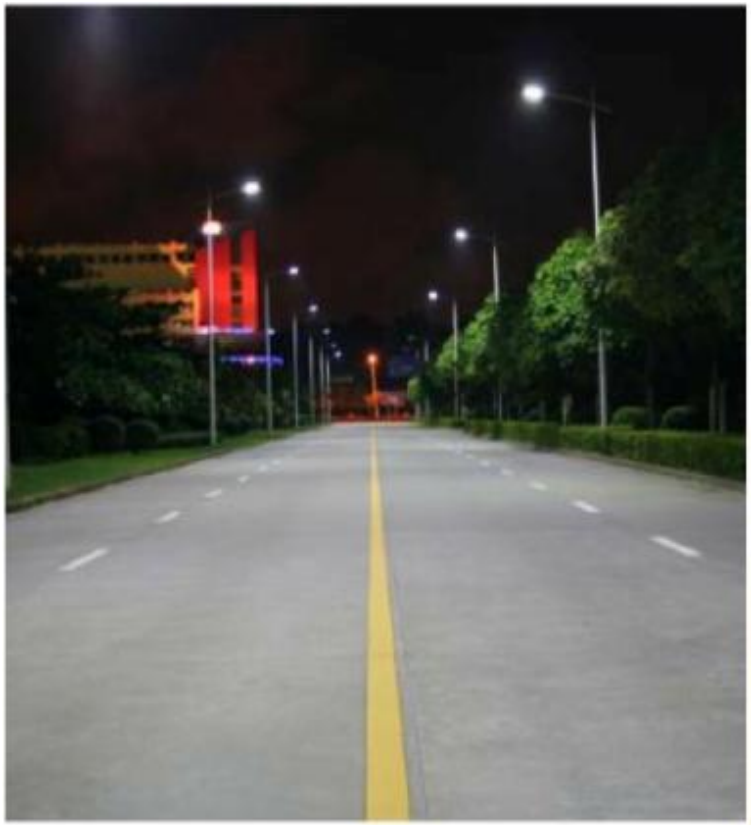
LED Lighting Benefits

- Social Responsible Green Solution
  - Reduce carbon footprint
  - Reduce landfill
  - No toxic metals
- Cost savings solution
  - Energy Saving reduce electric bill
  - Long life reduces maintenance
- Customer Retention with quality light
  - High color rendering showcases products better
  - Cool color promote security and safety

SuperGreen Solutions
Energy Efficient Products

Light Color & Color rendering

Street lighting with LED lamps



Street lighting with HPS lamps

SuperGreen Solutions
Energy Efficient Products

DOE/EPA Lighting Facts Label

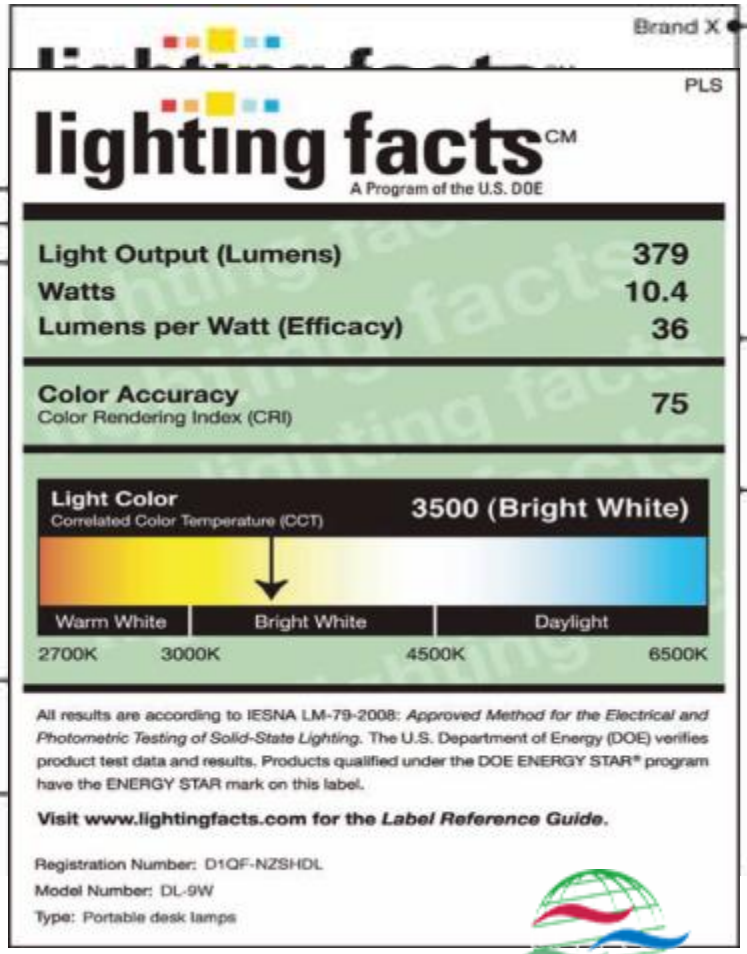
Light Output/Lumens
Measures light output. The higher the number, the more light is emitted.
Reported as "Total Integrated Flux (Lumens)" on LM-79 test report.

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



Brand

Missing Information:
1.Dimming
2.Rated Life

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 (3600–5500 K); "warm" colors have lower color temperatures (2700–3500 K). Color temperatures higher than 6500 are outside of the defined region for white light, but may be appropriate for outdoor applications.

Certifies specs are correct, **but …**
The label does not mean that it is good product

SuperGreen Solutions
Energy Efficient Products

Certifications

- Underwriters Laboratories (**UL**)
  - safety listing agency that certifies products as safe to use
    - electrical, fire, or physical hazard
  - certification required by most major retailers
  - UL 8750 covers the SSL products including:
    - drivers, controllers, arrays, modules and packages
- Restriction of use of Hazardous Substances (**RoHS**)
  - restricts the use of lead, mercury, and others within electrical and electronic equipment (including SSL)
  - EU adopted legislation requirements in 2006
  - US will soon
- International Dark-Sky Association (**IDA**)
  - Certification for luminaires that minimize glare, reduce light trespass, and don't pollute the night sky
  - Proposed for LED Street Light Energy Star Criteria

SuperGreen Solutions
Energy Efficient Products

Incentive Programs

- Government and Local utility programs
  - Tax incentives
  - Grants
  - Rebates
- Types
  - Energy reduction
  - Qualified products

SuperGreen Solutions
Energy Efficient Products

A Utility Perspective

- Benefits
  - Energy Efficient
    - Supports efficiency metrics and carbon reduction targets
  - Environmentally friendly
    - no hazardous waste, recyclable components
  - Operational Life
    - reduced maintenance, parts stock and customer complaints
- Concerns
  - Component product quality
    - LED's, Drivers
  - Lack of standardization
    - performance variability, analytical life
  - Manufacturer integrity
    - engineering, fabrication and photometric quality, warranty