

# LED Lamps: What Performance Criteria & Information Matter to Consumers?

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**Asia-Pacific  
Economic Cooperation**



**Australian Government**  

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**Department of Climate Change  
and Energy Efficiency**

# Soft! Pleasing! Relaxing! Comfortable! Bright! Crisp!



# So Many Unfamiliar Choices for Consumers...



# Top Three Performance Criteria: Consumer Perspectives

1. **FIT:** Does it fit in my fixture (luminaire)?
2. **FUNCTION:** Does it give me enough light, where I need it?
3. **COST:** Is it a reasonable cost for the service I expect?

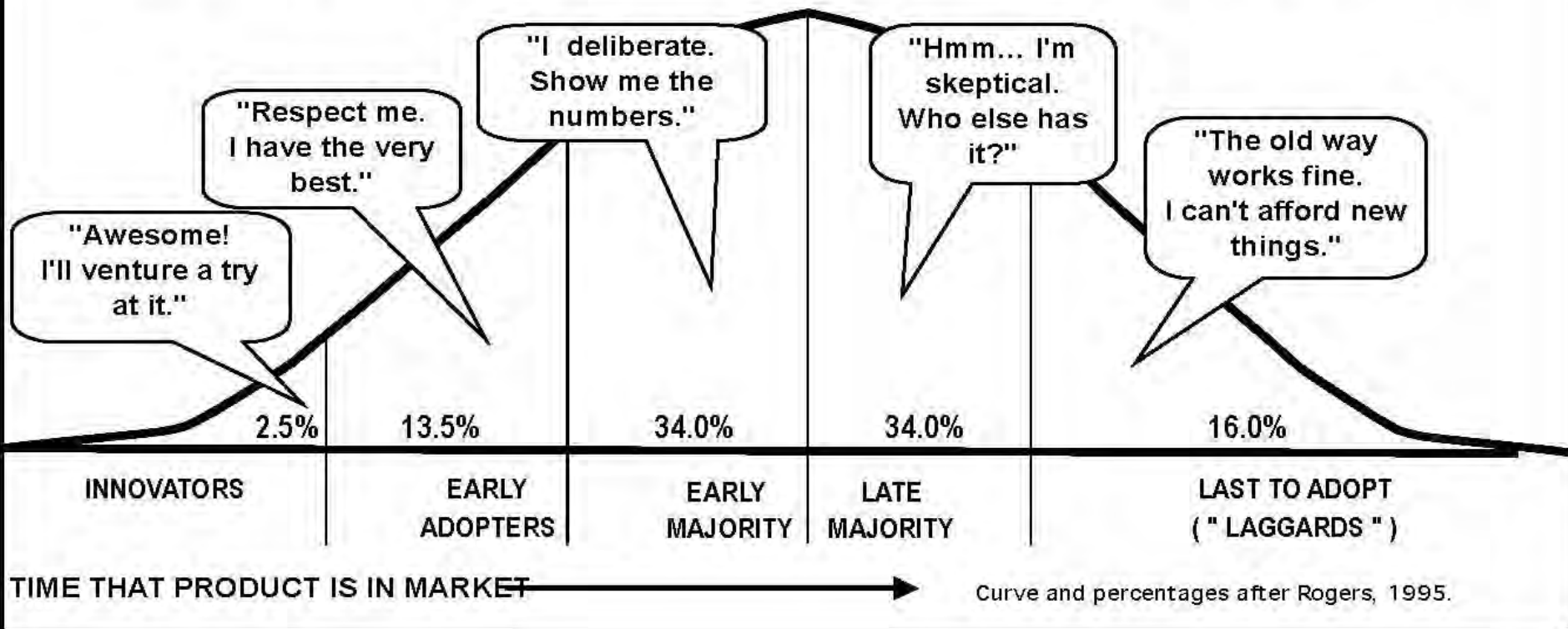
# Performance Criteria: Consumer Expectations

- **Same lighting service** (or better than) what was delivered by their legacy lamp, in their unique situation.
- **Same light distribution and intensity pattern.**
- Note: Total luminous flux (lumens) is not sufficient info!
- **Good color** rendering, at a similar **color temperature.**
- **Temporal control:** instant on; smooth dimming; automatic off/on with sensing.
- **Do no harm:**
  - “Don’t blink, buzz or blow up!”
  - “Don’t disable me with glare.”
  - “Don’t mess with my electronics gear.”
  - “Don’t put mercury in my home or near my kids.”
  - “Don’t leave me in the dark when I need to read!”

# Consumer Marketing: Art & Science

- LED lamps are like anything else that's for sale...
- **Psychographic profiles** help target and influence buyers.
- **Multiple messages** required to appeal to each type of buyer

HOW WILL YOU PERSUADE THESE DECISION MAKERS TO BUY YOUR PRODUCT?



# “Hurry, Just Show Me the Right Lamp!”



Singapore, 1-2 November 2011

# What Do Consumers Need to Know ?

- **Need to know** what service and performance they can expect... they don't need a semiconductor graduate degree!
- Lamps are an **insignificant item**—not a big investment, like a car or computer.
- Describe these **characteristics**:
  - Form factor: shape, size, & lamp base;
  - Light distribution pattern and total luminous flux;
  - Color temperature and color rendering;
  - Useful hours (or years);
  - Wattage;
  - Warranty terms; and
  - Costs.
- **Info must be accurate**: consumers need third-party measurement, verification and enforcement!



# lighting facts®

A Program of the U.S. DOE

Light Output (Lumens) **950**  
Watts **13**  
Lumens per Watt (Efficacy) **73**

Color Accuracy **88**  
Color Rendering Index (CRI)



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) verifies product test data and results.

Visit [www.lightingfacts.com](http://www.lightingfacts.com) for the *Label Reference Guide*.

Registration Number: R31N-DHE7FF  
Model Number: ECS A19 V2 CW 120  
Type: Replacement lamp - Omnidirectional (A Lamp)



# lighting facts®

A Program of the U.S. DOE

Light Output (Lumens) **850**  
Watts **13**  
Lumens per Watt (Efficacy) **65**

Color Accuracy **85**  
Color Rendering Index (CRI)



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) verifies product test data and results.

Visit [www.lightingfacts.com](http://www.lightingfacts.com) for the *Label Reference Guide*.

Registration Number: R31N-43CAEB  
Model Number: ECS 19 V2 WW 120 (Updated Feb 2011)  
Type: Replacement Lamp - Other



# What Appeal & Benefits Do LED Lamps Offer?

- **High-tech appeal:** just like digital devices that are ubiquitous worldwide. Many consumers first get to know LEDs through their (or their friends') much-loved entertainment systems. 😊
- **Last a long time...** LED lamps may outlive the consumer!
- **Cost savings:** Substantial energy and operating cost reductions over the useful life of the lamp.
- **Eco-friendly:** contain no mercury, reduce energy use.
- **Good warranties:** If consumers are unsatisfied with performance, they can get their money back.
- **Better color rendering (possibly):** Obvious enhancement ???

# Light from LEDs

## Color (hue) of light

- Each LED emits light in only one specific color per diode. Color is specified by wavelength, in nanometers (nm).
- Emissions from ultraviolet (UV) to infrared (IR).

## “White” light: created several ways:

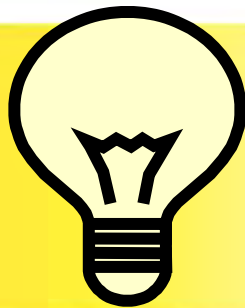
- RGB: red+green+blue chips
- Complementary: blue (or UV) chips + yellow phosphors.
- “Enhanced”: add amber or red chips to above.

**Human visual system integrates the intensities of all wavelengths to “see white.”**



# Correlated Color Temperature (CCT)

- Measured in degrees Kelvin (K).
- Indicates how “warm” or “cool” the white light is.
- Lower number means warmer white (like sunrise/sunset); higher number means cooler white (like a sunny noontime).
- Residential lighting is very personal, so consumers may have a strong, preconceived preference for warm or cool white.
- Marketers all over the world use *creative vocabulary* to describe white light. Instead, use a simple graphic to help consumers:



2700K

3000K

3500K

4000K/4100K

5000K

# Color Appearance: Difficult to Quantify

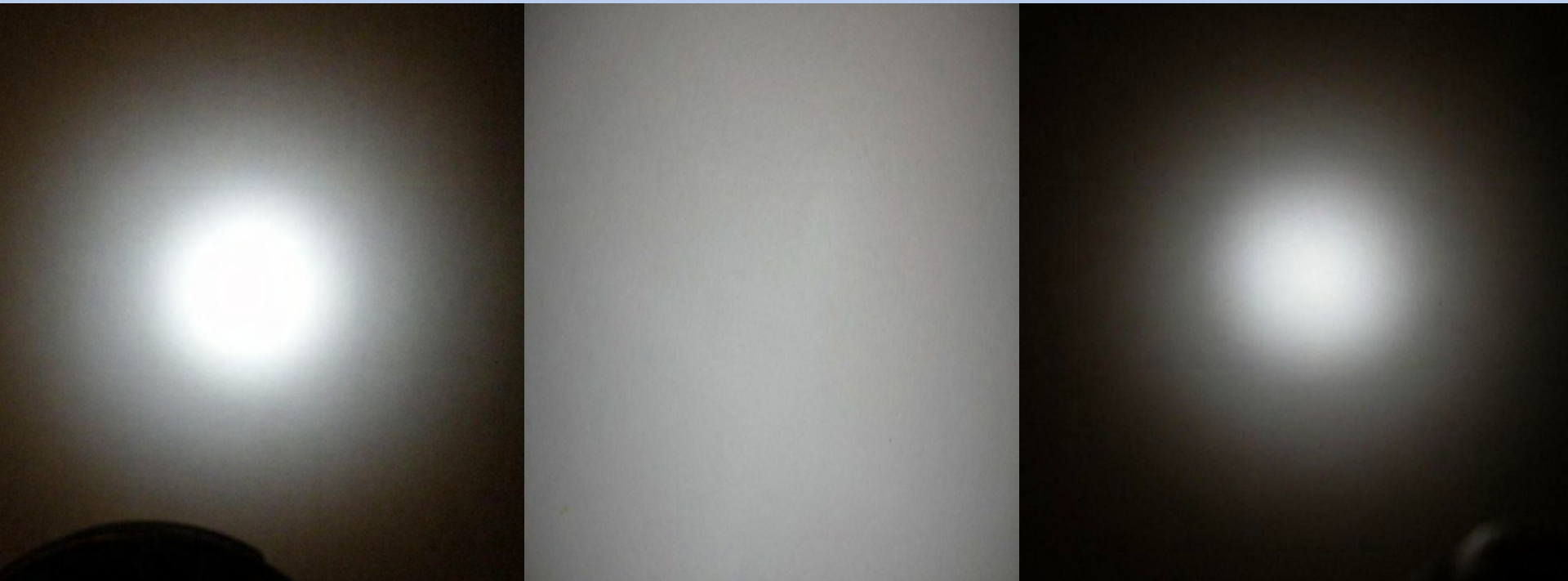


# Temperature, Age and Poor Process Control Can Cause Phosphor-Converted Light to: “Color Shift” & Color Rendering to Decrease



# Light Patterns

- The same amount of light delivered to a similarly-sized area (from lamps at the same distance from the surface) can give radically different-looking results.
- The optics of the lamp determine the result.
- Thus, initial light output (lumens) is not sufficient info for buyers.



# Lamp Beam Patterns: Directional, or, Omnidirectional (More Useful Than “Bulb-Type” Naming Methods)





# Who Should Provide LED Lamp Information?

- **Manufacturers, retailers and advertisers:** standardized, model-specific technical and performance info.
- **Government and independent, third parties:** general education and motivation (for energy & environmental benefits); product-specific performance evaluations.
- **Electric utilities:** Be ready to explain how LEDs can reduce demand, lower operating costs, and deliver good service. Consider demonstrations, providing leased products, offering rebates, or providing other incentives.

# Best Ways to Deliver LED Product Information

- **Social media:** Peer-to-peer communication is very important, and too often underestimated. Lighting is a social enabler... and an aesthetic means of communication. People will like what their friends and family like, so try to educate “social influencers.”
- **Product labels:** Best if standardized, with a clear and common vocabulary and graphics.
- **Point-of-purchase:** Have answers ready when consumers have questions! Use displays, and allow customers to compare effects.
- **Warning:** Negative info has much greater impact than positive... and is difficult to “undo.”

# Consumer Warranty

- **Social signal** that manufacturer/retailer wants to have an ongoing relationship with consumer/user of lighting services.
- Increases consumers' willingness to **try a new product** by decreasing economic risk.
- Gives manufacturer **more credibility**, and also limits damages if consumer has a problem.
- Offers a **legal process** for delivering “justice” if product is unsatisfactory or harmful.
- **Eases burden on third-parties** that are promoting energy-efficiency and environmental objectives via lighting programs.

# Thank You!



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