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# **Specifying and Setting Standards for LEDs: Some Sugestions**

**Third meetings of lites.asia**

**Sydney, 7 June 2011**

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**USAID Contractor**

**ECO-Asia Clean Development and Climate Program**



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## Setting Standards and Specifying LEDs

### Overview of Presentation.

- Review of ECO-Asia Report: Summary & Recommendations
- Elements of a Standard for LEDs
- Elements of a Consumer Guide
- Next steps





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## **ECO-Asia LEDs Report – Summary & Recommendations**

### **Summary:**

- LEDs will be more prevalent in many applications.
- More energy efficient products and options available to users.
- Help to meet demands for energy efficient lighting solutions.

### **But:**

- Lack of regional standards for lighting quality can be a major contribution to poor consumer experience in Asian markets.
- LEDs will need careful development to avoid these missteps: Performance & quality standards, procurement specifications, are key.





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## ECO-Asia LEDs Report – Summary & Recommendations

### LEDs – Near-term opportunities:

- Traffic signals, other transportation uses;
- Exit signs for commercial buildings, other architectural applications;
- Retail food and beverage refrigeration cases;
- Area lighting
  - Indoor, non retrofit
  - Outdoor/Area/Public/Street, non retrofit
- Decorative & Signage applications.





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## **ECO-Asia LEDs Report – Summary & Recommendations**

Considerations for Governments and Standard-Setting Agencies in Asia:

- A “roadmap” for LEDs-related policies;
- Regional focus on LEDs standards and labels;
- Focus on quality: energy efficiency, performance, lifetime;
- Use available regional institutions:
  - ♦ Asia Lighting Compact
  - ♦ [lites.asia](http://lites.asia)
  - ♦ Regional Center for Lighting
- Develop labeling and procurement guidelines for LEDs to help:
  - ♦ Municipalities & agencies
  - ♦ Consumers



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## LEDs Roadmap – Considerations

Consider:

- Promotional programs/adoption for mature LEDs products:
  - ♦ Traffic lights
  - ♦ Exit signs
- Develop standards/labeling/purchasing guidelines for LEDs products approaching parity in performance:
  - ♦ Street/outdoor luminaires
  - ♦ Other area lighting
  - ♦ Signage
- Educate/outreach to minimize impacts of immature products:
  - ♦ Linear fluorescent & incandescent replacements
- Review LEDs progress with industry and adjust, per US DOE.





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## Standards and Labels

Consider:

- More regional coordination on LEDs standards and labels:
  - ♦ Information sharing
  - ♦ Laboratory exchanges
- Focus on promoting (and setting standards for) quality:
  - ♦ energy efficiency
  - ♦ performance
  - ♦ lifetime
- Use lites as a way to keep up with LEDs standards development
  - ♦ IEC
  - ♦ CIE
  - ♦ IESNA
  - ♦ Roadmap, etc.



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## Focus on Quality: Procurement Criteria & Standards:

### Comparison of light sources for outdoor/area lighting (US DOE):

| Lighting Type                   | Efficacy (lm/W) | Lifetime (Hours) | Color Rendering Index (CRI) | Color Temperature (°K)     | Indoors/Outdoors |
|---------------------------------|-----------------|------------------|-----------------------------|----------------------------|------------------|
| <u>Fluorescent</u>              |                 |                  |                             |                            |                  |
| Straight Tube                   | 30–110          | 7,000–24,000     | 50–90 (fair to good)        | 2,700–6,500 (warm to cold) | Indoors/outdoors |
| Compact Fluorescent Lamp (CFL)  | 50–70           | 10,000           | 65–88 (good)                | 2,700–6,500 (warm to cold) | Indoors/outdoors |
| <u>High-Intensity Discharge</u> |                 |                  |                             |                            |                  |
| Mercury Vapor                   | 25–60           | 16,000–24,000    | 50 (poor to fair)           | 3,200–7,000 (warm to cold) | Outdoors         |
| Metal Halide                    | 70–115          | 5,000–20,000     | 70 (fair)                   | 3,700 (cold)               | Indoors/outdoors |
| High-Pressure Sodium            | 50–140          | 16,000–24,000    | 25 (poor)                   | 2,100 (warm)               | Outdoors         |
| Low-Pressure Sodium             | 60–150          | 12,000–18,000    | –44 (very poor)             |                            | Outdoors         |
| <u>Solid State Lighting</u>     |                 |                  |                             |                            |                  |
| Cool White LEDs                 | 60–92           | 35,000–50,000    | 70–90 (fair to good)        | 5000 (cold)                | Indoors/outdoors |
| Warm White LEDs                 | 27–54           | 35,000–50,000    | 70–90 (fair to good)        | 3300 (neutral)             | Indoors/outdoors |





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## Focus on Quality: Procurement Criteria & Standards

Elements for LEDs Standard: Area, Outdoor & Street Lighting:

### 1. Efficacy:

- ♦ Minimum lumens per Watt (range)

### 2. Quality/Performance:

- ♦ Lumen maintenance
- ♦ CRI
- ♦ CCT
- ♦ Others (uniformity ratio, coverage, cut-off, etc.)

### 5. Lifetime

- ♦ Minimum rated life



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## Focus on Quality: Procurement Criteria & Standards

Example of outdoor lighting products:

**BETA LED AREA LIGHT**



Source: Beta LED

**LEONIS LUMINAIRE FROM LUMEC  
DECORATIVE STREETLIGHT**



Source: Leonis

**GE EVOLVE LED AREA LIGHT**



**BETA LED CANOPY LIGHT**



Source: Beta LED



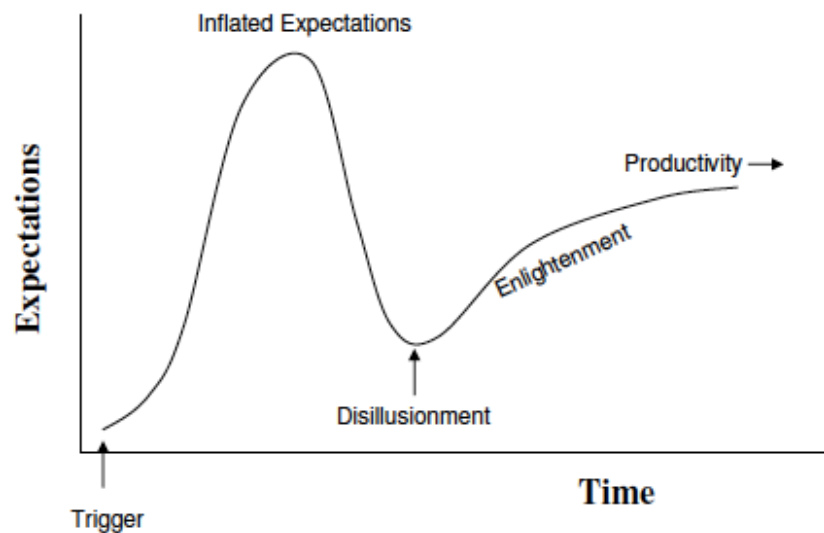
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## Focus on Quality – Standards & Labels

Keeping Expectations in Check:

### Gartner's Hype Cycle







## Focus on Quality: Procurement Criteria & Standards

### Efficacy:

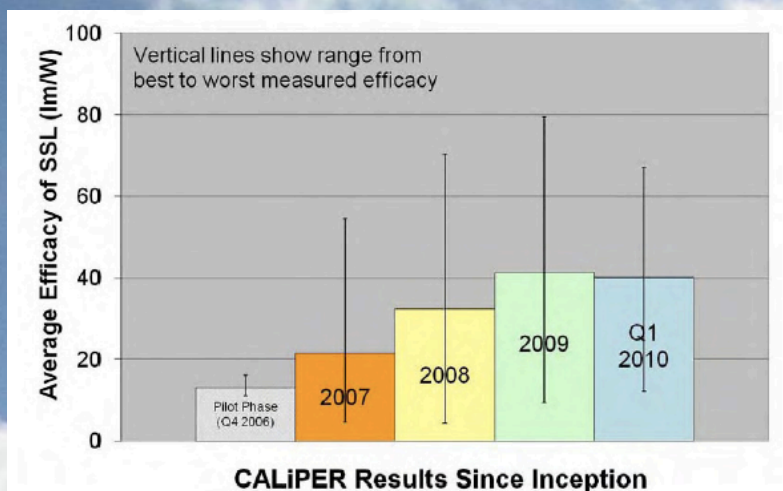


Table 2. Summary of Results for CALiPER Round 7 Streetlights

| –SSL testing following IESNA LM-79-08<br>–25°C ambient temperature | DOE CALiPER TEST ID | Total Power (Watts) | Output (initial lumens) | Efficacy (lm/W) |
|--|---------------------|---------------------|-------------------------|-----------------|
| SSL Streetlight  | 08-107              | 55                  | 1028                    | 19              |
| SSL Streetlight  | 08-108              | 58                  | 3179                    | 55              |
| SSL Streetlight  | 08-109              | 73                  | 3440                    | 47              |
| SSL Streetlight  | 08-110              | 37                  | 2588                    | 71              |
| SSL Streetlight  | 08-111              | 95                  | 3105                    | 33              |
| HPS Streetlight Benchmark  | 08-122              | 117                 | 6540                    | 56              |

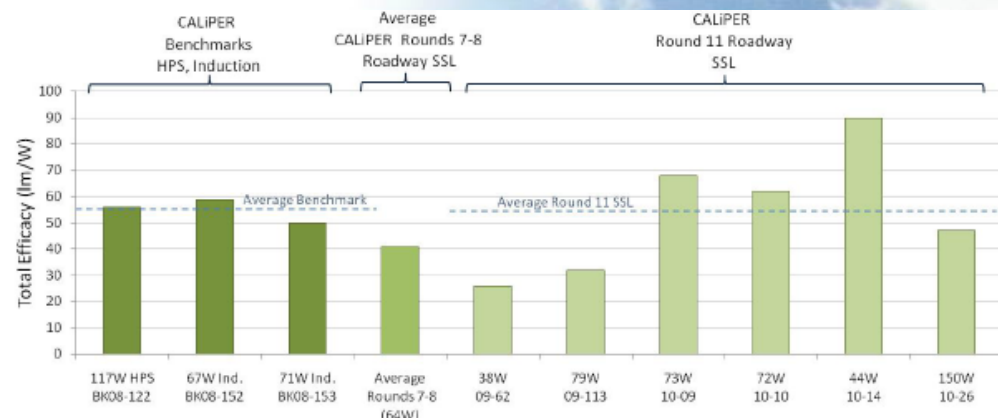


Figure 3. Luminaire Efficacy of SSL and Benchmark Roadway Luminaires



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## Focus on Quality: Procurement Criteria & Standards - Efficacy

### US DOE Specified Efficacy Range:

Cool White: 60 – 90 lm/W

Warm White: 27 – 54 lm/W

### Minimum Luminaire Efficacy by Luminaire Type:

Outdoor Wall-mounted Area Luminaires: 52 lm/W

Parking Structure Luminaires: 70 lm/W

Canopy Luminaires: 70 lm/W

### Outdoor Pole-mounted and Roadway Luminaires:

|   | Shielded<br>[uniform light pool extends less than 1.5 mounting heights (MH) behind the light pole (i.e., house-side)] |            |                                | Unshielded<br>[uniform light pool extends 1.5 mounting heights or more behind the light pole (i.e., house-side)] |            |                                |
|---|---|------------|--------------------------------|--|------------|--------------------------------|
| Initial Luminaire Output                      | Low Output<br>< 7,500 lumens  | Mid Output | High Output<br>> 23,500 lumens | Low Output<br>< 10,500 lumens  | Mid Output | High Output<br>> 33,000 lumens |
| Minimum Initial Fitted Target Efficacy (lm/W) | 30  | 38         | 48                             | 38   | 49         | 62                             |

Fitted Target Efficacy (FTE) evaluates how efficiently a luminaire delivers light to its estimated target area.



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## Focus on Quality: Procurement Criteria & Standards

### 1. Efficacy Testing:

LM-79-08: “IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products”

- ◆ Covers fixtures and LED retrofit products
- ◆ Provides procedures for measurements of total luminous flux (lm)
- ◆ Provides procedures measurements of luminous intensity (cd)
- ◆ Electrical information: current, voltage, and power.

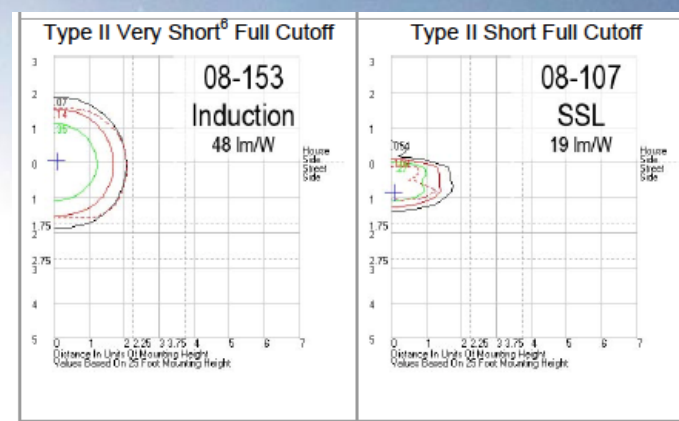
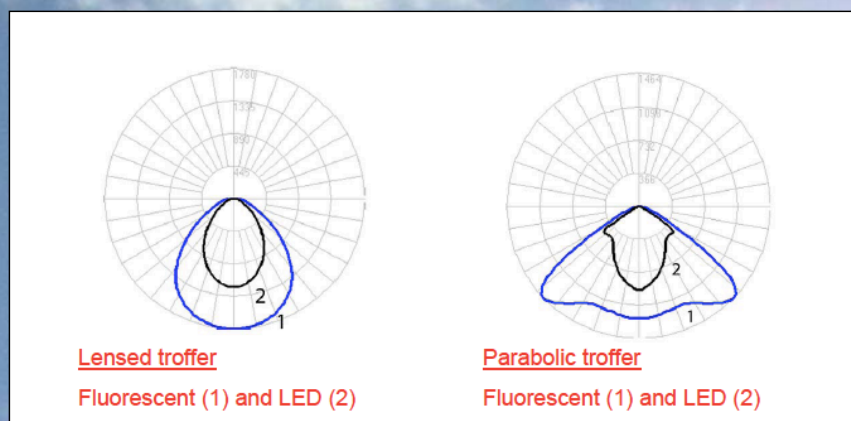




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## Focus on Quality: Procurement Criteria & Standards - Performance





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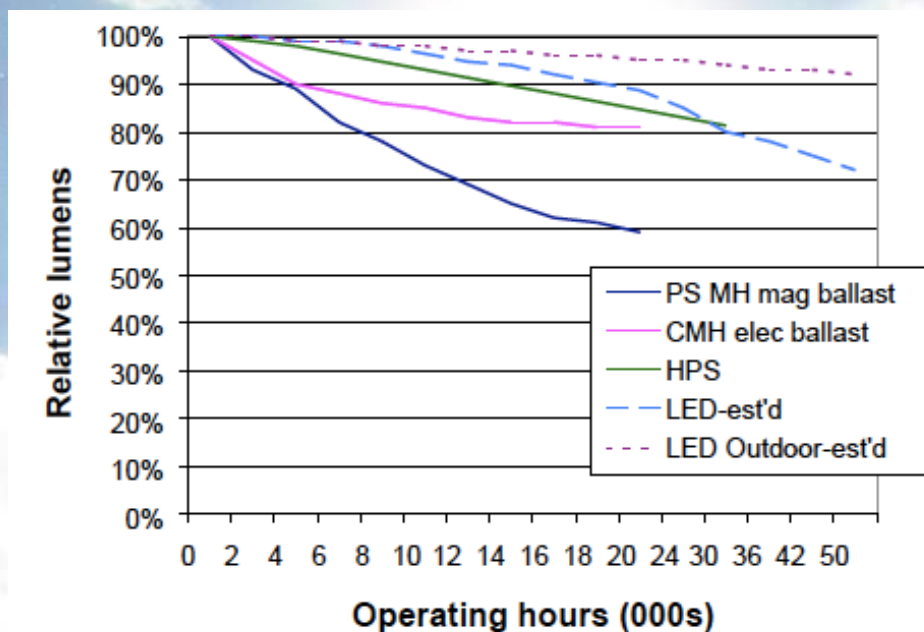
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## Focus on Quality: Procurement Criteria & Standards - Performance

Correlated color temperature (CCT): 3000 – 6000 (cool – daylight)

Color rendering index (CRI): 50 – 70 (fair – good)

Lumen maintenance: 85% @ 20000 hrs (HPS minimum, or mean lumens)





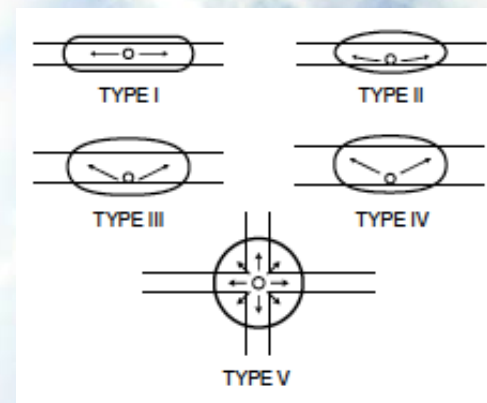
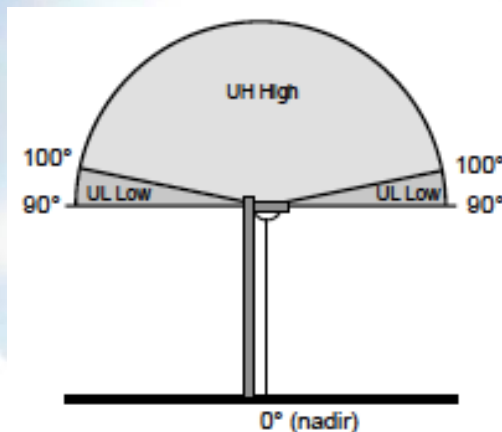
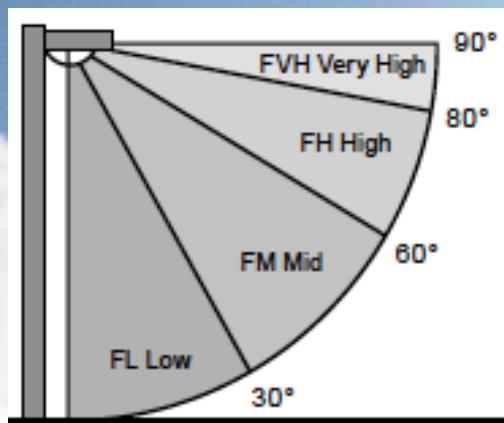
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## Focus on Quality: Procurement Criteria & Standards - Performance

### Other Performance Parameters:

- ♦ Uniformity Ratio
- ♦ Glare & Uplight
- ♦ Distribution



- ♦ Cut off
- ♦ Power factor, EMI, etc.





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## **Focus on Quality: Procurement Criteria & Standard - Performance**

### **2. Performance Testing:**

IES LM-79-2008: “Approved Method for the Electrical and Photometric Testing of Solid-State Lighting Devices:”

- ♦ Correlated color temperature (CCT)
- ♦ Color rendering index (CRI)

IES LM-80-2008: “Approved Method for Measuring Lumen Depreciation of LED Light Sources.”

CIE 177:2007: “Colour Rendering of White LED Light Sources”

CIE 127-1997: “Measurement of LEDs” (2nd ed)



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## **Focus on Quality: Procurement Criteria & Standards – Rated Life**

Product Rate Life: 25000 to 35000 hours

Minimum of HPS or linear fluorescent (20000 – 24000 hours)



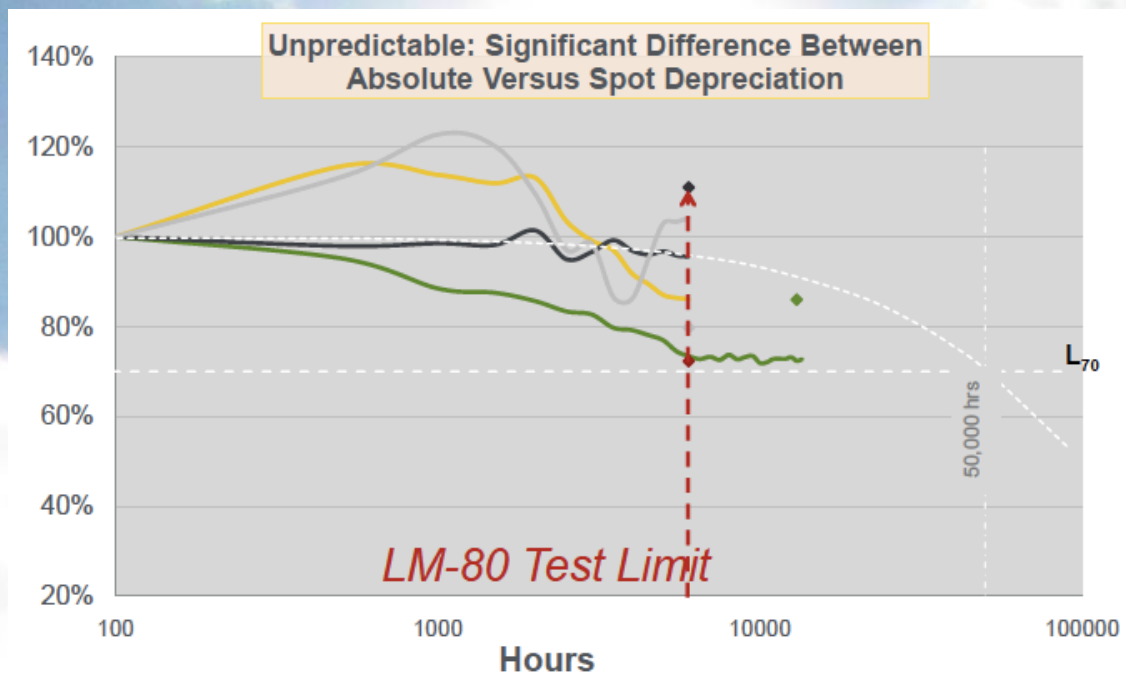
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## Focus on Quality: Procurement Criteria & Standards – Rated Life

### 3. Life Testing:

IES LM-80-2008: “Approved Method for Measuring Lumen Depreciation of LED Light Sources.”







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## Focus on Quality: Procurement Criteria & Standards

### Other Applicable LED Standards:

- IEC 62031 (2008): “LED modules for general lighting - Safety specifications.”
- IEC 60061: “Lamp caps and holders together with gauges for the control of interchangeability and safety.”
- IEC/PAS 60612 Edition 1: “Performance Requirements for Self-ballasted LED lamps.”
- IEC 60747-12-3: “Discrete semiconductor devices; Part 12-3: Optoelectronic Devices.”
- IEC 62384 Ed.1.: “Performance of control gear for LED modules D.C. or A.C. supplied electronic controlgears for LED modules.”



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## Focus on Quality: Procurement Criteria & Standards

### Other Applicable LED Standards:

- IEC 62471-2: “Photobiological safety of lamps and lamp systems.”
- IEC TS 62504: “Terms and Definitions for LEDs and LED modules in general lighting.”
- IEC 62560: “Safety Requirements for Self-ballasted LED lamps > 50V.”
- IEC/PAS 62612:2009: “Self-ballasted LED-lamps for general lighting services.”
- IEC 62663-1: “Non-ballasted single capped LED lamps for general lighting.”



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## Focus on Quality: Consumer Guide to LEDs

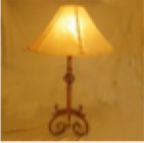
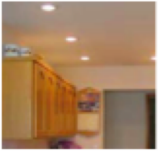


Example of a selection guideline for LEDs to help consumers:

### Overview on LEDs

FAQ on:

- Life
- Energy efficiency
- Warranty
- Quality indicators

Appropriate use guide

| Application                    | Typical Use   | Appropriate for LEDs? | Comment   |
|--------------------------------|---|-----------------------|---|
| General household illumination |    | Not yet               | LEDs are still not comparable, or not price competitive with CFLs         |
| Spot or area illumination      |   | Possible              | LEDs are not yet suitable for placement in high ceilings or intense spots |
| Decorative illumination        |  | Yes                   | LEDs are appropriate for this use   |
| Frequent switching or dimming  |  | Yes                   | LEDs are more suitable for frequent switching or dimming than CFLs        |





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## Focus on Quality: Where to Go From Here?

### Development of a “Roadmap”:

- ♦ Product categories to cover
- ♦ Working group composition
- ♦ Schedule

### Development of a “harmonized standard”

- ♦ Product category/check list
- ♦ Working group/Advisory committee (MSSLC as an example)
- ♦ Deliverable/schedule

### Development of a “Consumer Guide”

- ♦ Working group/Advisory committee
- ♦ Appropriate “Champions”
- ♦ Deliverable/schedule



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## Questions & Comments?

Thank You!

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