Lighting Consumer's Conundrum

Thursday, March 10, 2016 1:30 pm to 2:30 pm
What does the label mean... for a light bulb?
Trends & Specification Updates

• ENERGY STAR Luminaires Version 2.0
  – Shift away from pin-based fixtures
    • 3 options (serviceability encouraged)
      1. Fully integrated LED fixture
      2. Retrofit kits
      3. Fixture with replaceable light sources, LED light engines or screw based ENERGY STAR bulbs

• ENERGY STAR Lamps Version 2.0
  – Finalized Dec 31\textsuperscript{st} 2015
  – Effective January 2017
Connected (IoT) and controllable lighting! Also new shapes and styles
Omni-directional ENERGY STAR Bulbs

Omnidirectional Lamps

Omni/A lamp/General Purpose

- 67% of sockets
- Federal standards in 2020 for all technologies
  - backstop 45 lm/w or lumen based equation in GSL NOPR
- Current ENERGY STAR: 55 or 65 lm/w (15W break)
- 2017 ENERGY STAR:
  - 70 (90+CRI),
  - 80 (80-90CRI) lm/w
Dear CFL,

I find myself staring at the paper, not sure what to say. Maybe that's the way it is but we kept our issues in the dark.

You were on again, off again. It was fun and new at first, and I fell head over me. Looking back, maybe we let ourselves get too comfortable.

Things change. You know that. And I never imagined this day would come. But hey, a whole new light. You don't want to hear this, but I need to tell you ... I'm in love with LED!

It feels like I've woken up to find my world instantly bright. LED is so into me.

The time we spend together is like nothing I've experienced before. My mood – day or night. What's more, LED really understands the value of draining my energy.

I know that wasn't easy to hear, but it's the truth and I have to be honest.

CFL, I'll always remember the first time I saw your sweet spiral shape and our relationship is over, but I can see clearly now that LED is my future.

Fondly yours,

GE
Light bulb market trends

• Price: Quality LED lighting will be cost-comparable to CFL.
  – 2016 will see sub-$1 ENERGY STAR certified lamps with rebates.
  – 2016 will see $3 or less certified lamps, reaching cost-parity with incandescent.
  – Why have prices dropped? Automation.

• Performance….CFLs vs. LEDs:
  – LED bulbs don’t have the same technical challenges as CFLs
    • Though they do have their own unique technological challenges they are far superior to CFLs and incandescent bulbs
  – New ENERGY STAR specification sets efficacy levels above today’s CFLs
  – No one is investing in CFL technology anymore

Sources: Discussions with industry, LEDinside Market Trends, 11/10/2015, and LEDinside presentation on R&D presented at DOE, January 2015
Lighting Market Overview: A-Line

- Halogen share continues to rise
- LED market penetration continuing to gain momentum
- Approximately 1.9 billion lamps were shipped in the US in 2014. Only 15% were ENERGY STAR certified

Source: NEMA

2014 EPA ENERGY STAR
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- Halogen share continues to rise
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Source: NEMA
Lighting Market Overview: A-Line

“Actions by DOE, voluntary energy-efficiency programs, and standards organizations have helped the U.S. market to avoid some problems with early SSL products. Standardized testing, minimum performance and reporting requirements, and publication of testing and demonstration results have made it more difficult for poor-performing products to remain on the market, and rewarded manufacturers whose products perform well.”
Need help buying a new bulb?

**CHOOSING THE RIGHT COLOR**

- **Warm White, Soft White**
  - The standard color of incandescent bulbs.

- **Cool White, Neutral, Bright White**
  - Good for kitchens and workspaces.

- **Natural or Daylight**
  - Good for reading.

<table>
<thead>
<tr>
<th>Color</th>
<th>2700K</th>
<th>3000K</th>
<th>3500K</th>
<th>4100K</th>
<th>5000K</th>
<th>6500K</th>
</tr>
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Handy Resources

**LIGHTING MADE EASY**
Just Look for the ENERGY STAR®

Only bulbs that have earned the ENERGY STAR label have been independently certified and undergone extensive testing to assure they will save energy and perform as promised.

- Use 75% less energy than incandescent bulbs
- Last 10 to 15 times longer than incandescent bulbs
- Florida the same brightness (lumens) with less energy (watts)
- Save up to $100 or more on your electricity bill each year
- Help protect the environment and prevent climate change

**BULB TYPES**
- TABLE & FLOOR LAMPS
- PENDANT LAMPS
- CHANDELIER/RECESSED
- LIGHTING FIXTURES
- WALL/SCONCES
- WALL MOUNTED
- 벽등, 시트
- BATHROOM LAMPS
- SMALL LAMPS

**BRIGHTNESS**

For brightness, look for lumens, not watts. Lumens indicate light output. Watts indicate energy consumed. ENERGY STAR certified bulbs provide the same brightness (lumens) with less energy (watts). Use this chart to determine how many lumens you need to match the brightness of your old incandescent bulbs.

<table>
<thead>
<tr>
<th>Old Incandescent Bulbs (Watts)</th>
<th>ENERGY STAR Bulbs Brightness (Maximum Lumens)</th>
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<tbody>
<tr>
<td>40</td>
<td>450</td>
</tr>
<tr>
<td>60</td>
<td>800</td>
</tr>
<tr>
<td>75</td>
<td>1,100</td>
</tr>
<tr>
<td>100</td>
<td>1,666</td>
</tr>
<tr>
<td>150</td>
<td>2,069</td>
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**COLOR/APPEARANCE**

ENERGY STAR certified bulbs are available in a wide range of colors. Light color or appearance matches a temperature on the Kelvin scale (K), which ranges from warm (yellowish light) to cool (blueish white). Use this chart to choose your desired light color.

- Warm White: Soft white light that is similar to incandescent bulbs.
- Cool White: Neutral white light that is bright and evenly distributed.
- Natural or Daylight: Light that simulates daylight and is good for reading.
www.energystar.gov/lighting

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**COLOR/APPEARANCE**

ENERGY STAR certified bulbs are available in a wide range of colors. Light color, or appearance, matches a temperature on the Kelvin scale (K). Lower K means warmer, yellowish light, while higher K means cooler, bluer light.

- **Warm White, Soft White**: Standard color of incandescent bulbs.
- **Cool White, Natural White**: Good for kitchens and work spaces.
- **Natural or Daylight (think blue sky at noon)**: Good for reading.

![Color Temperature Chart](chart.png)
Light bulb labeling

Lighting Facts Per Bulb

Brightness: 870 lumens
Estimated Yearly Energy Cost: $1.57
Based on 3 hrs/day, 11¢/kWh
Cost depends on rates and use

Life: Based on 3 hrs/day, 5.5 years

Light Appearance
Warm 2700 K
Cool

Energy Used: 13 watts
Contains Mercury
For more on clean up and safe disposal, visit epa.gov/cfl.

Lighting Facts Per Bulb

Brightness: 820 lumens
Estimated Yearly Energy Cost: $7.23
Based on 3 hrs/day, 11¢/kWh
Cost depends on rates and use

Life: Based on 3 hrs/day, 1.4 years

Light Appearance
Warm 2700 K
Cool

Energy Used: 60 watts

Brightness: 820 lumens
Estimated Energy Cost: $7.23 per year
Bulb Packaging
LED Light Fixture labeling DOE Program

- Standardized summary of verifiable product performance data, measured by industry standards (LM-79, LM-80, TM-21)
- Web-based product performance reporting initiative
  - www.lightingfacts.com
- Industry tool to help buyers
  - Resource to evaluate reported product performance against manufacturer claims
- Label and product list backed by verification of performance testing
- A voluntary and free program
Your Guide to Dimmable Energy Star® LED Lighting

Most ENERGY STAR certified LED bulbs are DIMMABLE. Check out the package to be sure. Visit the manufacturer’s provided URL for a list of recommended DIMMERS.

3 out of 4 people surveyed consider dimmable lights IMPORTANT.

Dimmable LED BULBS let you create the right ambiance.

ENERGY STAR LED BULBS CAN LAST MORE THAN 20 YEARS.

Choose ENERGY STAR dimmable LED lights to save ENERGY and protect the CLIMATE.

Energy Star certified LED bulbs reduce greenhouse gas emissions.

Quality and performance. LED bulbs that have earned the ENERGY STAR are independently certified to deliver quality and performance.

Dimmable bulbs dim to at least 10% of light and come with a 3 year warranty.

Three Simple Tips for Better LED Dimming

1. Look for the ENERGY STAR. Every dimmable ENERGY STAR LED bulb will have the word “dimmable” right on the front of the package.

2. Be prepared to try different dimmable bulbs. Not every bulb works well with every dimmer switch, if you don’t find a good match with your current dimmer, consider changing the switch, or you can return the bulb and try a different one.

3. Choose the right dimmer/bulb combination. If you are putting in a new dimmer switch, check the website listed on the bulb package for recommended dimmers.
THREE SIMPLE TIPS FOR BETTER LED DIMMING

1. **Look for the ENERGY STAR.**
   Every dimmable ENERGY STAR LED bulb will have the word “dimmable” right on the front of the package.

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3. **Choose the right dimmer/bulb combination.**
   If you are putting in a new dimmer switch, check the website listed on the bulb package for recommended dimmers.
If all light bulbs sold in the United States in 2017 were ENERGY STAR certified, the cost savings would grow to more than $4 billion each year and more than 50 billion pounds of annual greenhouse gas emissions would be prevented, equivalent to the emissions from over 5 million vehicles.
Taylor Jantz-Sell
ENERGY STAR Lighting Program Manager
Jantz-Sell.Taylor@epa.gov

www.energystar.gov/lighting
www.energystar.gov/lightingresources
Extra slides
What is ENERGY STAR?

- Created by the U.S. Environmental Protection Agency in 1992 to reduce greenhouse gas emissions
- Voluntary product certification and labeling program
- Products that have earned the ENERGY STAR label meet strict energy efficiency & performance guidelines set by the US EPA with open and broad stakeholder engagement

1999 Residential Light Fixtures & CFLs → 2007 SSL Luminaires → 2009 LED bulbs
Builds Upon Intersection of Interests

- Consumer Preferences
- Environmental Protection
- Manufacturer/Retailer Interests
- Utility Program Sponsor Interests

Cost-effective
No sacrifice in performance
Gov’t backed

Consumer is Key
ENERGY STAR Certification for Lighting Products

WAY More than just efficiency
• Designed to ensure quality and performance consumers expect:
  – Minimum warranty requirement
  – 6 different requirements for color to ensure quality up front & over time
  – Light output and distribution requirements
  – Size and shape requirements for light bulbs
  – Temperature testing to ensure products perform as expected after installation and higher temperature scenarios, e.g. recessed can, enclosed fixtures and more…

• ENERGY STAR third-party certification and verification testing help confirm delivery on performance
ENERGY STAR Lamps Requirements

- Lamp Classifications & dimensions
- Equivalency claim guidance according to light output or CBCP
- Efficacy
- Luminous Intensity Distribution
- Correlated Color Temp
- Color Rendering (CRI, R9, TM30 metrics)
- Color maintenance
- Color angular uniformity
- Lumen Maintenance
  - At ambient and elevated temperatures
- Elevated Light Output Ratio
- Electrical safety
- Power factor
- Frequency
- Start time
- Transient protection
- Standby power limits
- Packaging & lamp labeling
- Dimming (max/min light, flicker, noise)
- Connected: open access & energy use reporting
- Toxics
- Warranty
**Test Methods – kidding not kidding**

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### 7 METHODS OF MEASUREMENT AND REFERENCE DOCUMENTS

<table>
<thead>
<tr>
<th>Organization</th>
<th>Identifier</th>
<th>Description</th>
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<tbody>
<tr>
<td>ANSI-INC154A</td>
<td>C01.2-2011</td>
<td>Specifications for the Chronology of Fluorescent Lamps</td>
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<tr>
<td>ANSI-INC154B</td>
<td>C01.2-2011</td>
<td>Specifications for the Chronology of Solid State Lighting Products</td>
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<td>ANSI-INC154C</td>
<td>C01.2-2011</td>
<td>Specifications for Performance of Self-Ballasted Compact Fluorescent Lamps</td>
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<tr>
<td>ANSI-INC154D</td>
<td>C01.2-2011</td>
<td>Single-Ended Fluorescent Lamps—Dimensional and Electrical Characteristics</td>
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<tr>
<td>ANSI-INC154E</td>
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<td>Single-Ended Fluorescent Lamps—Electrical and Electrical Characteristics</td>
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<td>ANSI-INC154F</td>
<td>C01.2-2011</td>
<td>Specifications for Excess Current for Electric Lamps</td>
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<td>C01.2-2011</td>
<td>Lampholders for Electric Lamps</td>
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<td>ANSI-INC154H</td>
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<td>Single-Ended Fluorescent Lamps—Performance Requirements</td>
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<td>ANSI-INC154J</td>
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<td>Light Emitting Diode (LED) Luminaire Non-Illumination Tests</td>
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<td>ANSI-INC154K</td>
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<td>Fluorescent Lamps—Excess Current Tests</td>
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<td>ANSI-INC154L</td>
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<td>Standards for Safety of Lamp Insulators</td>
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*Note: The table above contains only a subset of the actual documents referenced.*

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*Image Source: EPA*
Residentially focused scope: Not all inclusive

Energy saving replacements for the most common residential light bulbs and fixtures.

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<thead>
<tr>
<th>Eligible to Earn the ENERGY STAR</th>
<th>NOT Eligible to Earn the ENERGY STAR</th>
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<tbody>
<tr>
<td>General purpose CFL and LED lamps</td>
<td>Linear fluorescent lamps and their solid state retrofits</td>
</tr>
<tr>
<td>Accent lights (line-voltage and directional track lights)</td>
<td>High bay fixtures and recessed troffers</td>
</tr>
<tr>
<td>Down lights: recessed, pendant, surface-mounted, solid state retrofit kits</td>
<td>Outdoor street and area lighting: wall packs, garage, canopy lighting and wall packs</td>
</tr>
<tr>
<td>Wall sconces, chandeliers, bath vanities, ceiling and close-to-ceiling mount, floor and table lamps</td>
<td>Signage of any type, including EXIT signs and channel letter backlighting systems</td>
</tr>
<tr>
<td>Under cabinet or shelf-mounted task lighting</td>
<td>Linear fluorescent pendants</td>
</tr>
<tr>
<td>Ceiling and ventilation fans with lighting</td>
<td>Party or entertainment lighting</td>
</tr>
<tr>
<td>Portable desk task lights</td>
<td>Adapters or converters</td>
</tr>
</tbody>
</table>
- **27% of sockets**
- Baseline Efficacy: 6-12 lm/w
- **No federal standard**
- Current ENERGY STAR min: 45, 50, 60 lm/w depending on W
- **2017 ENERGY STAR: 65 lm/w**
ENERGY STAR Directional Bulbs

Directional

- Baseline Efficacy: 6 – 32 lm/w
- Some federal standards exist
- Popular exemptions e.g. BR30
- 6% of sockets
- Current ENERGY STAR: 40 lm/w
- 2017 ENERGY STAR: 61 (90+CRI), 70 (80-90CRI) lm/w
Progress: A-Type Lamps

- Total energy consumption of A-type lamps has decreased by roughly 10% to 756 tBtu since 2012.
- LED A-type market penetration in 2014 was 2.4%.

More than a billion light bulbs are sold each year in the U.S.

- 15% were ENERGY STAR certified

  - Compact Fluorescent Lamps (CFL)
    206,970 64% (of CFL shipments)

  - ENERGY STAR LED Lamps
    79,058 75% (of LED shipments)