Emerging Technologies

Residential Lighting: Lamps

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Acuity Brands, Next Generation Lighting Industry Alliance

Taylor Jantz-Sell
US EPA ENERGY STAR

Nicole Graeber
California Lighting Technology Center

Emerging Technologies Showcase
November 29, 2017
GoToWebinar Logistics

• Please use question pane to ask questions at any time, or if you have any technical issues
• TAG members – Audio will be unmuted after 1:00 PM for our discussion.

NOTE: Today’s presentation is being recorded and will be available at http://e3tnw.org/Webinars
Residential Lighting: Lamps

Jeff Quinlan – *Lamp Efficacy*
Acuity Brands, Next Generation Lighting Industry Alliance

Taylor Jantz-Sell – *Specialty Lamps*
US EPA ENERGY STAR

Nicole Graeber – *Linear LEDs*
California Lighting Technology Center
Residential Lighting

Jeff Quinlan
Acuity Brands
VP Engineering & Illumination
Chairman Next Generation Lighting Industry Alliance
Agenda

• What are the big trends
  – High Efficacy
  – Lower Cost
  – Smaller Aperture
  – Lamp Type / Performance
  – Retrofit

• Things you need to know
  – Spectrum or at Least CCT
  – Distribution
  – Glare
  – Dimming
    • Output & Color
  – Life
Efficacy Trend

Aperture Size & Shape

1” Aperture
Mini-LED Downlights and Adjustables
Reflector Lamp

- LED Efficacy
  - 100 LPW
- Warm Dimming
- Wide range of CCT
- Applications
  - Ambient
  - Soft, directional accent
A Lamps

- **LED Efficacy**
  - 83-133 LPW
  - Up to 200 LPW
  - Warm Dimming
  - Wide range of CCT

- **Applications**
  - Torchiers
  - Table Lamps
  - Vanities
  - Downlights
  - Decorative......

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Retrofit Downlights

- LED Efficacy
  - 60-90 LPW (Fixture)
- Warm Dimming
- Wide range of CCT

- Applications
  - Downlights
  - Wall Wash
  - Gimbals
  - Slope Ceiling

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Acuity Brands Lighting © 2017
Things you need to know

- Look at several things
  - Is there a Lighting Facts Label?
  - What is the color temperature?
  - What kind of LEDs are used?
  - Look for actual wattage not just replacement.
Efficacy is a function of Distribution
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Glare and Performance
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Dimming – Forward Phase

Energy Program
Bonneville Power Administration
Figure 8.1 Components of an LED Lamp

Thank You
The opportunity for savings

Taylor Jantz-Sell

ENERGY STAR Lighting Program Manager
What are we talking about?
LED Lamp Imports so far in 2017
### 2016 Estimated LED Penetration by bulb type

<table>
<thead>
<tr>
<th>Bulb Type</th>
<th>% of installed base</th>
<th>Units installed (millions)</th>
<th>Energy Savings potential (tBtu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A type</td>
<td>13.5%</td>
<td>436</td>
<td>491</td>
</tr>
<tr>
<td>Decorative</td>
<td>6.7%</td>
<td>58.9</td>
<td>283</td>
</tr>
<tr>
<td>Directional</td>
<td>15.3%</td>
<td>82.4</td>
<td>129</td>
</tr>
<tr>
<td>Small Directional</td>
<td>47.6%</td>
<td>21</td>
<td>58.9</td>
</tr>
<tr>
<td>Downlighting</td>
<td>19.8%</td>
<td>137</td>
<td>231</td>
</tr>
</tbody>
</table>

### National Savings Opportunity

- **Federal standards** that have taken effect address the most common A lamps, (there is still 491 tBTU in remaining savings for A lamps)
  - DOE estimates there remains 470.9 tBTU in potential savings for decorative and directional lamps (replace existing stock with LED)
- **Future (TBD 2020 or later) standards** could apply more broadly since DOE expanded definition of the General Service Lamp (GSL)
  - Lumen range of 310-3300
  - Reflector lamps
  - Decorative lamps

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Lamp types that would still be exempt after EISA Phase 2 (2020 or later)

- Appliance lamps
- Black light, bug lights, colored lights
- G shape with diameter ≥5 in e.g. G40s or bigger
- Linear fluorescent lamps (covered elsewhere)
- HID lamps
- Infrared lamps
- J types that don’t have screw bases
- Wedge or prefocus based lamps
- Left-handed thread lamps
- Special use lamps, e.g. Marine lamps, Mine signal service
- MR16 or bigger lumens ≥800 +“specialty MR”
- “other fluorescent lamps”
- Plant light lamps
- R20 short lamps
- Reflector lamps with diameters less than 2 inches and non Edison bases
- S or G shapes 1.5 inches in diameter or smaller
- Sign service lamps
- Silver bowl lamps
- Showcase lamps
- T shaped lamps with a diameter less than an inch that are not CFLs
- Traffic signal lamps
Dimmability

- Dimmability has improved: lower dimming levels and improvements in compatibility
- New STANDARDS + ENERGY STAR requirements
  - NEMA Lamp+Dimmer Compatibility Program
    - NEMA SSL 7A for dimmers and lamps for compatibility
    - NEMA 77 for dimmers and lamps for flicker
    - ENERGY STAR dimming requirements
    - Expected roll out of logo 2018

Look for this logo to find LED bulbs and dimmers that work together.
Decorative

- 27% of sockets
- Baseline Efficacy: 6-12 lm/w
- No federal standard...yet
- Current ENERGY STAR minimum efficacy: 65 lm/w
ENERGY STAR Directional Bulbs

**Directional**

- Baseline Efficacy: 6 – 32lm/w
- Some federal standards exist
- Popular exemptions e.g. BR30
- 6% of sockets
- **ENERGY STAR**: 61 (90+CRI), 70 (80-90CRI) lm/w
# BPA 2017 Market Intelligence & Incentives

## Payment

<table>
<thead>
<tr>
<th>TYPE</th>
<th>RETAIL</th>
<th>BY REQUEST</th>
<th>MAILED NON-REQUEST</th>
<th>DIRECT INSTALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Decorative and Minibase*</td>
<td>$4</td>
<td>$5</td>
<td>$4</td>
<td>$7</td>
</tr>
<tr>
<td>LED General Purpose and Dimmable, Three-Way (Omnidirectional)*</td>
<td>$4</td>
<td>$6</td>
<td>$5</td>
<td>$7</td>
</tr>
<tr>
<td>LED Globe</td>
<td>$4</td>
<td>$6</td>
<td>$5</td>
<td>$7</td>
</tr>
<tr>
<td>LED Refectors and Outdoor (Directional, includes R, PAR, BR, MR)*</td>
<td>$5</td>
<td>$7</td>
<td>$6</td>
<td>$9</td>
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<tr>
<td>Bi-Pin Multifaceted Reflector (MR)</td>
<td>$4</td>
<td>n/a</td>
<td>n/a</td>
<td>$5</td>
</tr>
<tr>
<td>Bi-Pin Non-Multifaceted Reflector (Non MR)</td>
<td>$4</td>
<td>n/a</td>
<td>n/a</td>
<td>$5</td>
</tr>
</tbody>
</table>

**Note:**
- *: Indicates cost includes both the bulb and installation.
- n/a: Not applicable.
Trends

- Filament style
- Vintage shapes
- Amber tint
- Dimmability improvements (including warm dim color shifting)
- Cost improvements but still higher than A line
- Color quality
- Connected
Globes $8 average for dimmable

- **GE LED 5 Watt G25 Soft White Frosted Globe**
  - $7.89 from 25+ stores
  - More size options

- **Feltechnic LED Light Bulb, White, 8 W**
  - $6.00 from 10+ stores
  - (5)

- **60W Equivalent Soft White (2700K) G25 Dimmable LED Light Bulb**
  - $16.52 from 5+ stores
  - (37)

- **Dimmable LED G25 Globe, 4.5W, 40W Equal, Medium Base, Green**
  - $10.68 from 5+ stores
  - More style options

- **6 Pack LED G25 Vanity Globe Light Bulbs - DIMMABLE - 6W (40 Watt)**
  - $29.99 from Amazon.com - Seller
### Candle Shape $3-10

<table>
<thead>
<tr>
<th>Price</th>
<th>Store</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9.43</td>
<td>Home Depot</td>
<td>LEIDEAL LED Filament Candelabra Bulbs E12 B10 2W LED Candle Bulbs</td>
</tr>
<tr>
<td>$32.39</td>
<td>Houzz</td>
<td>LED Chandelier Bulb, Vertical Filament 2W, 25W Equal, 2400K</td>
</tr>
<tr>
<td>$8.93</td>
<td>Home Depot</td>
<td>EcoSmart FG-02574 60W Equivalent Soft White B11 Filament E12</td>
</tr>
<tr>
<td>$11.35</td>
<td>Grainger Industrial Supply</td>
<td>40W Equivalent 2,700K Candle Torpedo Dimmable LED Light Bulb</td>
</tr>
</tbody>
</table>

- **LEIDEAL LED Filament Candelabra Bulbs E12 B10 2W LED Candle Bulbs**
  - $5.28 from Amazon.com - Seller
  - LEIDEAL LED Filament Candelabra Bulbs E12 B10 2W LED Candle Bulbs...
  - $5.28 from Amazon.com - Seller
  - More style options

- **LED Chandelier Bulb, Vertical Filament 2W, 25W Equal, 2400K**
  - $4.84 from 5+ stores
  - 5 stars (7)

- **EcoSmart FG-02574 60W Equivalent Soft White B11 Filament E12**
  - $39.78 from 2 stores
  - 5 stars (109)

- **GE 16106 - 9 Watt CFL Light Bulb Torpedo - 40W Equal - 2700K Warm**
  - $4.29 from 10+ stores
  - Also available nearby

- **40W Equivalent 2,700K Candle Torpedo Dimmable LED Light Bulb**
  - $5.60 from 5+ stores
  - 5 stars (2)
  - More size options

- **Dimmable LED Chandelier Bulb, Straight Tip, SW, 40W Equal, Medium**
  - $4.99 from 10+ stores
  - 5 stars (8)
  - More style options
ENERGY STAR Certified Selection
Simple Choice for Quality + Efficiency

- Amber Light (2200K-2500K) (126)
- Candelabra Screw Base (E12) (698)

Visit the product finder to look around with filter combinations e.g. CCT + dimmability

https://www.energystar.gov/productfinder/product/certified-light-bulbs/results
Tips for Utility Programs

• Focus on features
  – Quality performance is key – not all LED bulbs are the same. Only rebate bulbs that have earned the ENERGY STAR- rebates are still needed to differentiate between lower life/lower cost bulbs.
  – There will be a mix of color temperatures out there – this can often lead to a negative experience – manage expectations & educate on light color.
  – Specialty lamps like candles are often used with dimmers and people want them to dim really low for ambiance – promote good dimming, manage expectations e.g. not all dim the same, use with compatible dimmers.
  – Trendy + efficient – you can have both style and efficiency– market vintage differently because the look is so important – e.g. amber tint is a real customer preference for certain applications but not universal.

• Consider bulk packs
  – Most decorative fixtures (chandeliers, vanity) have multiple sockets. Incentivizing bulk packs will help transform spaces quickly, consistently and cost effectively.
• **Description:** How does it save energy?
  – Simply replace existing inefficient screw in bulbs and save 90% energy e.g. 6W deco bulb replacing a 60W.

• **Product Performance:**
  – Major progress in performance and aesthetics. ENERGY STAR requirements have helped guide performance levels to match incumbent technology.

• **Energy Savings:**
  – All ENERGY STAR certified bulbs are tested in accredited labs to industry standards and certified by accredited third parties. Typical savings would be 54 watts per bulb (replacing a 60W decorative bulb with a 6W ENERGY STAR decorative bulb) usage assumptions vary. Typical rated lifetime is 15,000 hours.

• **Non-Energy Benefits:**
  – One great non energy benefit for these lamps would be maintenance – many decorative bulbs are hard to reach in chandeliers, so not needing to change them for decades after they are converted to ENERGY STAR LED (minimum rated life of 15,000 hours) at least 20 years if operated 2hrs/day.
Assessing the Merits of Specialty Lamps

• **Technology, Market, and Program Readiness:**
  – Products are ready now, stocking is decent now and will continue to improve with more filament style and dimming compatibility marking in 2018.

• **Ease of Adoption:**
  – Really easy, but somewhat cost prohibitive. Pricing ranges from $3-$16 for a single dimmable decorative bulb and often there are many in a single fixture to replace at once for a consistent look. See tips.

• **Value:**
  – It’s a great value even when not rebated but a no-brainer when discounted. Depending on electric rates and usage the bulbs pay for themselves in energy bill savings in a matter of months. Bulbs that aren’t used as much will have longer payback periods.
Thank You