LED and CFL Solutions for the Home

Knowing where to use what

Mark R. Phillips
Director of Affiliate Sales, Energy Efficiency
Juno Lighting Group
Agenda

- LED standard and testing
- Undercabinet lighting
- Downlight
- Pendent lighting
Standard Update

- Standards have been released to the public and have been adopted relatively quickly
- Less confusion exists in the marketplace but still needs to be emphasized by manufacturers
  - IESNA – Generally covers Efficacy and Quality of LED’s
    - LM-79-2008 – Applies to “fixture” electrical and photometric measurements
      - ANSI C78-377A - Chromaticity
    - LM-80-2008 – Applies to “LED Manufacturer” Lifetime and lumen maintenance data
  - UL – Generally responsible for Life Safety of LED Fixtures and Power Supplies
    - UL-8750(OOI) - Proposed First Edition of the Standard for Light Emitting Diode (LED) Light Sources for Use in Lighting Products
    - UL-1310 – Class 2 Power Units
    - UL-1598 – Luminaires
    - UL-2108 – Low Voltage Lighting Systems
Downlights and Light Bulbs

• Energy Star for
  – SSL fixtures
  – CFL fixtures
  – CFL Light Bulbs
  – LED Light Bulbs – Not yet available

• CALiPER Testing
  – Commercially Available LED Product Evaluation and Reporting (CALiPER)
  – Validates Energy Claims
  – Self certified w/data, policed from that point on
Exaggerated Claims are being identified through CALiPER
The True Measure of Light Output

• Total system determines overall Luminous Efficacy
  – Follow the “Efficiency Chain”

- LED
  ~100 Lumens / Watt

- Control
  ~6% Loss

- Driver
  ~10% Loss

- Optics
  ~8% Loss

- Thermal
  ~25% Loss

- Fixture
  ~7% Loss

POWER IN

LIGHT OUT
~44 Lumens / Watt
Energy Efficiency solutions for the home
Residential Undercabinet

- Replace halogen (6K hrs) and xenon (20K hrs)
  - Fluorescent (3,000K)
    - 10,000 hours
    - 74% and greater savings
  - LED (3,000K)
    - 50,000 hours
    - 85% and greater savings

<table>
<thead>
<tr>
<th>Fixture Length</th>
<th>Pro-Halogen/Xenon</th>
<th>Pro-Fluorescent</th>
<th>Pro-LED</th>
<th>Energy Star</th>
</tr>
</thead>
<tbody>
<tr>
<td>9&quot;</td>
<td>20-watts</td>
<td></td>
<td>3-watts</td>
<td>85%</td>
</tr>
<tr>
<td>14&quot; (12&quot; Fluorescent)</td>
<td>40-watts</td>
<td>8-watts 80%</td>
<td>5-watts 88%</td>
<td></td>
</tr>
<tr>
<td>22&quot;</td>
<td>60-watts</td>
<td>14-watts 77%</td>
<td>7.4-watts 88%</td>
<td></td>
</tr>
<tr>
<td>30&quot; (34&quot; Fluorescent)</td>
<td>80-watts</td>
<td>21-watts 74%</td>
<td>9.5-watts 88%</td>
<td></td>
</tr>
</tbody>
</table>
Residential Undercabinet and Cove

**Cabinet / Cove**
- 5W LED modules: 1” Wide x ½” Tall x 12” Long
- 3000K, 4100K & 5000K
- 50,000 hours life
- Efficacy ranging from 29 to 53 lm/W for system
- Long life, energy efficient and cool operation
- Clear or Frosted Lens

**Track / Cove**
- 0.7W, 1.3W and 1.6W LED module
- Warm color – 3000K
- Cool color – 5000K
- 50,000 hours life
- Energy efficient and cool operation

**Images**
- LED modules and installations showing various colors and applications.

**Brands**
- DanaLite
- Schneider Electric
- Juno

**Colors**
- 3,000K
- 4,100K
<table>
<thead>
<tr>
<th>Fixture/Lamp Data (Nominal Performance @ 12-Volts)</th>
<th>TL201+TL901</th>
<th>TL201+TL903</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>84% savings</strong> Watts</td>
<td>4.3</td>
<td>8.5</td>
</tr>
<tr>
<td><strong>85% savings</strong> Lumens</td>
<td>22</td>
<td>44</td>
</tr>
<tr>
<td><strong>85% savings</strong> Efficacy (lumens/watt)</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>84% savings</strong> Color Temperature</td>
<td>2800K</td>
<td>2800K</td>
</tr>
<tr>
<td><strong>85% savings</strong> Rated Life (Hours)**</td>
<td>20,000</td>
<td>20,000</td>
</tr>
<tr>
<td><strong>84% savings</strong> Total Maximum Trac Length**</td>
<td>14'</td>
<td>7'</td>
</tr>
</tbody>
</table>

**Economic Comparison for 30' Cove**

<table>
<thead>
<tr>
<th># of fixtures (2* OC lamp spacing)</th>
<th>120</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td># of 12V Transformer Runs</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Total Wattage</td>
<td>516</td>
<td>1,020</td>
</tr>
<tr>
<td>Watts per Foot</td>
<td>17.2</td>
<td>34.0</td>
</tr>
<tr>
<td>Lumens per Foot</td>
<td>88</td>
<td>176</td>
</tr>
<tr>
<td>Total Annual Energy Cost**</td>
<td>$271.21</td>
<td>$536.11</td>
</tr>
<tr>
<td>Annual Energy Savings vs. 5-Watt Xenon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Energy Savings vs. 10-Watt Xenon</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note that Xenon life is based on 50% lamp failure. LED life is based on 0% failure with 70% lumen maintenance.

**Total Maximum Trac Length** is based on capacity of the trac (Trac 12 = 240W); to avoid voltage drop issues, a single transformer circuit may have to feed multiple runs, based on Maximum Trac Run Length chart on page 13, using separate feed points.

***12 hours per day @ $0.12 per kilowatt hour.
Energy Star Downlights

Cree
Energy Star Downlights

- Light output comparable to 65W BR30 or 18W CFL
- Less than 15W
- Dimmable with approved dimmers
- 5” and 6”
- IC and TC
- New Construction and Remodel
- 3000K, 3500K and 4100K
Energy Star Downlights

- Energy solution for 65W BR30 and 18W CFL
  - LED (78%) and CFL (72%) savings over inc.
  - LED savings over 20% CFL
- 7 plus year payback on LED
- Maintenance and “Green” solution
- Eco-friendly
  - No Mercury and RoHS compliant
- LED replacement impact on environment
Energy Star CFL Light Bulbs

- Thermals impact life
- Application to max. life
  - Base down
    - Table lamp
    - Chandler
  - Base out
    - Vanity or
  - Base up with airflow
    - Outdoor lighting
Self ballast vs. dedicated ballast

• Lamp life are the same

• Base up application
  – Thermals effect life
  – Lamp only vs self ballast
Life

• CFL compared to an incandescent
  – 3-4 times more efficient
  – Up to 10 times longer life
• LED compared to a CFL
  – Up to 4 times longer life
• CFL and LED
  – Less heat
  – Lower energy bills
IC-Rated 600 Lumen LED Downlight

Application: 18' x 18' x 8' room, reflectances 80/50/20, light loss factor =1.0, 9 Fixtures Total: Mounted 6' on center

### Fixture Performance Comparison

<table>
<thead>
<tr>
<th></th>
<th>IC LED 14W Open Trim</th>
<th>VS.</th>
<th>Incandescent 65W BR-30 Open Trim</th>
<th>CFL 18W Triple Tube Open Trim</th>
<th>CFL 26W Triple Tube Lensed Trim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamp Specification</td>
<td>65W BR-30</td>
<td>18W Triple Tube</td>
<td>26W Triple Tube</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Input Watts</td>
<td>60W</td>
<td>20.1W</td>
<td>25.3W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lamp Life (hrs)</td>
<td>2,000</td>
<td>12,000</td>
<td>12,000</td>
<td></td>
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</tr>
<tr>
<td>Watts Per Square Foot</td>
<td>1.81/W/FT²</td>
<td>0.56/W/FT²</td>
<td>0.70/W/FT²</td>
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<tr>
<td>Energy Star Qualified</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meets Requirements of T24 2008</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
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<tr>
<td>Illuminance Summary</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Average Illuminance</td>
<td>16.1fc</td>
<td>15.1fc</td>
<td>16.6fc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uniformity Ratio (Max/Min)</td>
<td>4.1</td>
<td>3.1</td>
<td>3.1</td>
<td></td>
<td></td>
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<tr>
<td>Operating Cost Summary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Energy Cost Per Fixture*</td>
<td>$18.98</td>
<td>$5.87</td>
<td>$7.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Relamping Cost Per Fixture**</td>
<td>$4.70</td>
<td>$3.20</td>
<td>$3.20</td>
<td></td>
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</tr>
<tr>
<td>$4.08 Per Fixture x 9 Fixtures = $36.72</td>
<td>$23.68 Per Fixture x 9 Fixtures = $213.12</td>
<td>$9.07 Per Fixture x 9 Fixtures = $81.63</td>
<td>$10.59 Per Fixture x 9 Fixtures = $95.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Operating Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Savings for a 9 Fixture Layout</td>
<td>$176.40</td>
<td>$44.91</td>
<td>$58.59</td>
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</tbody>
</table>

*Total input watts x 8 hours/day x 365 days/year x $0.10/kWh/1000
**Replacement cost per lamp x annual hrs. of operation/lamp life
Energy Efficiency never looked so good
Energy Efficiency never looked so good

5" IC-Rated 600 Lumen LED Downlight Ordering Information

For new construction or remodeling, you can add energy-efficient LED lighting from Juno. 5" housing is compatible with a variety of trims to complement virtually any design.

5" New Construction

IC260LD
Dedicated 5" LED new construction housing with integral 12W nominal light engine and universal 120/277V driver. Air-Loc fully sealed housing does not require separate gasket. IC housing designed for use in Cor or non-C construction.

12 1/8" L x 9 1/8" W x 7 1/2" H

Downlights
209S-White
209S-WH Black
209S-SC Black
209S-ABZ Black

Lensed
Flat Glass Shower Trim*
210-AEZ
210-SC
210-WH

Frosted Lens with Clear Center*
212-ABZ
212-SC
212-WH

White Baffle, Regressed Frosted Dome Lens*
2130WH-W2130WH

*No surface reflector shipped with trim for LED housing. Glass or opal reflector.

5" LED Downlight Trims

IC256LE-3K
Dedicated 5" LED remodel housing with integral 12W nominal light engine and universal 120/277V driver. Air-Loc gasket kit supplied with housing. IC housing designed for use in Cor or non-C construction.

12 1/8" L x 9 1/8" W x 7 1/2" H

Wall Wash
213BWH-White Baffle
213BWH Black Baffle

K22RL-E-3K
3000K LED color temperature

K22RL-E-3K
3500K LED color temperature

K22RL-E-4K
4000K LED color temperature

6" IC-Rated 600 Lumen LED Downlight Ordering Information

For new construction or remodeling, you can add energy-efficient LED lighting from Juno. 6" housing is compatible with a variety of trims to complement virtually any design.

6" New Construction

IC22LED
Dedicated 6" LED new construction housing with integral 18W nominal light engine and universal 120/277V driver. Air-Loc gasket kit supplied with housing. IC housing designed for use in Cor or non-C construction.

16 1/8" L x 9 1/8" W x 7 1/8" H

Downlights
240WH-White
240WH Black
240SC-Black
240ABZ-Black

Decorative, continued
Metal Band 9524-SC

Luminous Collar (Frosted) 9702

Frosted Lens with Clear Center 242-ABZ 242-SC 242-WH

Wall Wash 263WH-White Baffle 263WH Black Baffle

Lensed, continued
Decorative Swirled Etched Opal Glass 243-WH

White Baffle, Regressed Frosted Dome Lens 2320WH 2330WH

Octagonal 9024WH

Drip Opal 21WH Shower/Closet Light 21WH

K22RL-E-3K
3000K LED color temperature

K22RL-E-3K
3500K LED color temperature

K22RL-E-4K
4000K LED color temperature

*No surface reflector shipped with trim for LED housing. Glass or opal reflector.

6" LED Downlight Trims

K22RL-E-3K
3000K LED color temperature

K22RL-E-3K
3500K LED color temperature

K22RL-E-4K
4000K LED color temperature

Qualified Dimmers - 120V
Juno LED downlights have been qualified for use with 120V electronic low voltage dimmers (requires neutral wire in wall box). Consult Juno technical services for the most up to date list of qualified dimmers.

Regulatory Listings & Standards
UL and C-UL Listed for Damp Location and Wet Location when used with lensed trims
Listed for Direct Contact with Insulation
UL and C-UL Listed for Feed-Thru Wiring
ENERGY STAR® qualified to residential and commercial requirements for solid state recessed luminaires with baffle and cone trims
Juno’s sealed recessed IC LED housings meet EEC Airloc® Code requirements per ASTME283 for minimum leakage with IC housing
RoHS Compliant

*No surface reflector shipped with trim for LED housing. Glass or opal reflector.

Trim Finishes
ABZ = Classic Aged Bronze
SC = Satin Chrome
WH = White

K22RL-E-3K
3000K LED color temperature

K22RL-E-3K
3500K LED color temperature

K22RL-E-4K
4000K LED color temperature

14

Patents pending

19 of 25

2009

SOLAR DECATHLON

U.S. DEPARTMENT OF ENERGY

16

Patents pending
Energy Efficiency never looked so good

5" TC-Rated 900 Lumen LED Downlight Ordering Information

For new construction applications, you can add energy-efficient LED lighting from Juno. 5" housing is compatible with a variety of trims to complement virtually any design.

**5" New Construction**

TC2020LED
5" LED Downlight Trims
- **Downlights**
  - 205W-WH White
  - 205W-SC Black
  - 205B-ABZ Black
- **Lensed**
  - 210-ABZ
  - 2100-SC
  - 210-WH
  - **Options**
    - Dimmable Driver
    - 0-10V
  - Chicago Plenum

**6" New Construction**

TC22LED
6" LED Downlight Ordering Information

For new construction applications, you can add energy-efficient LED lighting from Juno. 6" housing is compatible with a variety of trims to complement virtually any design.

**6" LED Downlight Trims**

- **Downlights**
  - 240W-WH White
  - 240W-SC Black
  - 240-ABZ Black
- **Decorative, continued**
  - Decorative Twisted Etched Opal Glass 243 WH
  - Decorative Twisted Etched Opal Glass 243 WH
- **Lensed, continued**
  - Lensed, continued

**Regulatory Listings & Standards**

- UL and C-UL Listed for Damp Location and Wet Location when used with lensed trims
- UL and C-UL Listed for Feed-Through Wiring
- ENERGY STAR® qualified to commercial requirements for solid state recessed luminaires with non-dimming fixtures and select baffle and cone trims
- RH5S Compliant

**Trim Finishes**

- ARZ - Classic Aged Bronze
- SC - Satin Chrome
- WH - White

**Ordering Information**

Housing, trim, and accessories each ordered separately.

**Example: TC22LED 35K - DMBR**

- **Catalog No.**
  - TC22LED
  - 240W-WH
  - 240-ABZ
- **Color Temp.**
  - 35K
- **Voltage**
  - 120V
- **Options**
  - Dimmable Driver 0-10V
  - Lutron H-Lume® Dimmable Driver Emergency Battery Back-Up w/Remote Switch
  - Chicago Plenum

**Example: HB-26**

- **Accessories**
  - HB-1 Two 13 1/2" - 25" Real N3P 3 bar hangars
  - HB-26 Two 26" C-channel bar hangars
  - HB-50 Two 50" C-channel bar hangars
  - LB-27 Two 27" linear bar hangars

**Notes**

- Consult factory for a list of qualified dimmers.
- Listed for UL in the U.S. only.
- Chicago Plenum not available with emergency option.
Energy Efficiency never looked so good
Residential Pendant

- CFL
- Energy Star®
- GU24 CFL twist and lock bases with internal ballast
  - 13W
  - 18W
  - 24W
- 60% energy savings over halogen
- Lamp replacement costs are cut in half
Energy Efficiency never looked so good
Residential Pendant

LED Pendant

- Typically a 35W-50W halogen bi-pin
  - 2,000 Hours
- LED are available in a 4W
  - Proprietary silicone diffusion “ball” provides uniform shade illumination and outstanding downlight component
  - 3000K color temperature
- 50,000 hour expected life
- <85% energy savings
- Target availability – Jan. 2010
Any questions?

Thank you
For your
Time