DOE Lighting Program Update
LED Validation Activities
Legislative Mandate

The DOE is directed by U.S. government policy (EPACT 2005, Section 912) to:

“…support research, development, demonstration, and commercial application activities related to advanced solid-state lighting technologies based on white light emitting diodes.”
By 2030:

• Potential to cut U.S. lighting electricity use by 25%
• Cumulative energy savings: $120 billion
• Annual energy savings equivalent to:
  – 190 terawatt (billion kilowatt) hours
  – Output of 24 1,000 MW power plants
  – 31.4 million metric tons of greenhouse gas emissions

• Additional benefits
  – Global leadership in SSL technology
  – High-tech, value-added jobs

Source: *Energy Savings Potential of Solid-State Lighting in General Illumination Applications* (February 2010)
www.ssl.energy.gov/tech_reports.html
DOE SSL Program Strategy

Guiding technology advances from laboratory to marketplace
Key Messages

• LED technology continues to improve rapidly
  – New/revised/improved LED products introduced regularly

• LEDs can save energy and provide high quality lighting in a growing number of applications

• Beware of generalizations
  – Few are good; many are not
  – Most LED products are new-to-market
  – Field experience is limited

• Ask questions and validate information
How does DOE validate LED performance?

- Laboratory testing
- Field demonstrations
- Product labeling
- Competitions
Lots of marketing hype, but where do we get the truth?

- Which products are good? Which products aren’t?
- How do they compare to what we know?
- How do we avoid the early negative CFL experience?

CALiPER
CALiPER Scope

- SSL
- General illumination
- White light
- Market-available
CALiPER Round 10

- Parking Garage Fixtures
- Cove Lighting
- Exterior Wall Packs
Parking Garage Fixtures

LED versus Fluorescent, Induction, Metal Halide
Parking Garage Fixtures

Initial Illuminance at Floor (foot-candles) and Throw

<table>
<thead>
<tr>
<th>Name</th>
<th>Watts</th>
<th>Lm</th>
<th>lm/W</th>
<th>Mounting Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH BK 09-110</td>
<td>211W</td>
<td>10388 lmi</td>
<td>50 lm/W</td>
<td>9 ft</td>
</tr>
<tr>
<td>LED 10-05</td>
<td>117W</td>
<td>7238 lmi</td>
<td>63 lm/W</td>
<td>9 ft</td>
</tr>
<tr>
<td>LED 09-104</td>
<td>86W</td>
<td>4496 lmi</td>
<td>52 lm/W</td>
<td>9 ft</td>
</tr>
<tr>
<td>LED 09-87</td>
<td>110W</td>
<td>6764 lmi</td>
<td>61 lm/W</td>
<td>9 ft</td>
</tr>
<tr>
<td>T5 FI. BK 09-108</td>
<td>103W</td>
<td>5787 lmi</td>
<td>56 lm/W</td>
<td>9 ft</td>
</tr>
<tr>
<td>LED 09-88</td>
<td>118W</td>
<td>3815 lmi</td>
<td>33 lm/W</td>
<td>9 ft</td>
</tr>
<tr>
<td>Induction BK 09-109</td>
<td>75W</td>
<td>4250 lmi</td>
<td>56 lm/W</td>
<td>9 ft</td>
</tr>
<tr>
<td>LED 07-43</td>
<td>71W</td>
<td>2310 lmi</td>
<td>33 lm/W</td>
<td>9 ft</td>
</tr>
</tbody>
</table>

**Uniform Distribution SSL**
- Hot spots (> 9 fc)
- Fair-high (5-9 fc)
- Optimal (1-5 fc)
- Low (< 1 fc)

(Based on 9 ft mounting height)
Parking Garage Fixtures

Zonal Lumen Density for Garage Luminaires

Percent Luminaire Output per Vertical Region (%)

Vertical Region (Degrees from Nadir)

- 100°-180° (UH)
- 90°-100° (UL)
- 80°-90° (BVH+FH)
- 60°-80° (BH+FH)
- 30°-60° (BM+FM)
- 0°-30° (BL+FL)

Legend:
- BK 09-110 MH 211W
- BK 09-109 QL 75W
- BK 09-108 T5HO 103W
- 10-05 LED 117W
- 09-104 LED 86W
- 09-88 LED 118W
- 09-97 LED 110W
- 07-43 LED 72W
GATEWAY Demonstrations
GATEWAY Demonstrations

- Showcase products in real applications
- Provide valuable data on performance, energy savings, payback
- Lessons learned
- Reports and technology briefs available

New York, NY  West Sacramento, CA  Leavenworth, KS  Oakland, CA

www.ssl.energy.gov/gatewaydemos.html
New GATEWAY Demonstrations

Outdoor area and roadway lighting
• FDR Expressway and Central Park, NYC
• Parking lots and parking structures with members of Retailer Energy Alliance

Photo credit: Ryan Pyle

Photo credit: Ryan Pyle
New GATEWAY Demonstrations

Increasing focus on indoor sites:
• Hotel Intercontinental, San Francisco
• The Field Museum, Chicago
Municipal Street Lighting Consortium

– High interest in LED street lighting demonstrations
– Leverage efforts of multiple cities evaluating LED street lighting products
  • Minimize duplication of effort, spread risk
  • Collect, analyze, and share information and experiences
  • Contribute to and tap into large pool of knowledge to maximize individual investment
– Open to municipalities, utilities, energy efficiency sponsors
SSL Quality Advocates and the Lighting Facts Label
What is Lighting Facts?

- Nutrition Label for SSL
- Web-based product performance reporting initiative
  - LightingFacts.com
- Product list backed by verification and (soon) 3rd party testing
- Buyer’s guidance tool
  - Target retailers, distributors, lighting designers, utilities
  - Resource to evaluate reported product performance data

Example
Progress to Date

- Dec. 2008—Website launch
- Spring 2009—Program announced via DOE SSL Update and various industry/utility conferences
- Partners and Products (as of April 1, 2010)
  - 300 Manufacturers
  - 85 Retailers/Distributors
  - 100 Utilities and Lighting Designers
  - 506 Registered Products

... and counting!

Product and partner lists at

www.lightingfacts.com
• Created by EISA 2007
• Two key lamp replacements:
  – 60W Incandescent
  – PAR 38 Halogen
• Cash prizes, federal purchasing, utility programs
• Technology competition to spur innovation and exceptional performance
• 30 utility/energy efficiency partners across North America
L Prize Requirements

- Exceptional efficacy
- Long life
- Form factor identical to lamps they replace
- Additional details specified for
  - Quality
  - Performance
  - Mass manufacturing

### Competition Requirements

**60W Incandescent Replacement Lamp**
- More than 90 lm/W
- Less than 10 Watts
- More than 900 lumens
- More than 25,000 hour life
- More than 90 CRI

**PAR 38 Halogen Replacement Lamp**
- More than 123 lm/W
- Less than 11 Watts
- More than 1,350 lumens
- More than 25,000 hour life
- More than 90 CRI

**21st Century Lamp**
- To be defined in a future L Prize Program Announcement
First entry: Philips 60W replacement

Philips

New York Times

TIME
The 50 Best Inventions of 2009
L Prize Short-Term Testing

- IES LM-79-08 test procedure
  - Luminous flux
  - Intensity distribution
  - CCT, chromaticity coordinates
  - CRI
  - Power factor
- 200 samples
- Integrating sphere
- Goniophotometer
L Prize Long-Term Testing

• At least 6,000 hours of testing
• 200 samples
• Elevated temperature (45°C) environment
• Field assessments with L Prize Partners
  – 15 Partners participating
  – 45 sites
  – 1,400 samples

Field Assessment

- Energy use
- Lighting system performance
- Reliability
- Customer acceptance
- Cost-effective deployment

www.lightingprize.org
The race is on!

- **Late 2009**: 1st entry
- **Early 2010**: LM-79 testing
- **Spring 2010**: Long term testing
- **Summer 2010**: Field assessments
- **Fall 2010**: Expect winners announcement

Additional entries expected
SSL Technology Fact Sheet Series

- 34,000 downloads in ’09
- LED Basics
  - Energy Efficiency
  - Thermal Management
  - Lifetime
  - Color Quality
  - Basics
- Application Series
  - Recessed Downlights
  - Undercabinet
  - Portable Desk/Task
  - Outdoor Lighting
- Measurement Series
  - SSL Standards
  - CRI and LEDs
  - Luminaire Efficacy
  - Luminaire Reliability

www.ssl.energy.gov/factsheets.html
Annual Workshops and National Conferences

DOE SSL workshops

• Manufacturing R&D, April 21-22, San Jose, CA
• Market Introduction, July 20-22, Philadelphia, PA

Visit the DOE booth at Light Fair:
- May 12-14
- Las Vegas
- Booth #2121
Thank You!

For more information, go to www.ssl.energy.gov

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