Outline

• Conventional Lighting vs New Technologies
• UL’s Balancing Act
• Role of Third-Party Testing Lab
• Impact of SSL on Testing Lab
• Business Impact of SSL on Testing Lab
• UL approach to testing SSL
• Quality Assurance Testing
# UL and the Future of Lighting :: Solid State Lighting

## Technology Transition

### Traditional Lighting

| Lamp / “bulb” | Edison-era Technology  
|               | Filament / Vapor based |
| Luminaire     | “brass and glass”      |
| Ballast       | Low-tech electronics   |
| Switches & Dimmers | Simple and mechanical |

### Solid State Lighting

| Diode Package | Solid-state semiconductor, easily shipped, not fragile like glass, low & line voltage |
| Driver        | Current regulating power supply, breaks regional voltage barriers |
| Optics        | Integrated and standalone, control light focus and beam spread |
| Thermal Management | Most are passive heat sinks, active in high power applications (fan, water, and gas based) |
| Enclosure     | New shapes, sizes, applications based on small packages and large relative output |
| Connectors    | Daisy chain diode arrays, drivers and control products |
| Power Generation and Storage | ‘Green’ trends in power delivery, solar powered, battery backup streetlights and landscape spikes |
| Lamp Holders / Sockets | New interfaces for drivers, packages, enclosures, thermal management in development |
| Wiring and Wireless | Ceiling grids, fine wiring, t-bars, induction, power and control over microwave |
| Controls      | Electronic control light output, color temp, multiple locations, wireless implications, energy management |
| Software      | Programmable directions, plug and play recognizes led system, software safety is slow |
Components being used in combination to create both end products and more advanced components.

**UL is ready for components with industry leading recognition programs, new low-cost services in 2010 like Component Replacement and Conditions of Acceptability.**
**Lighting Terminology**

## SOLID STATE LIGHTING (SSL)

<table>
<thead>
<tr>
<th>LED</th>
<th>OLED</th>
<th>PLED</th>
<th>LEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>light emitting diode</td>
<td>organic LED</td>
<td>polymer LED</td>
<td>light emitting plasma</td>
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</tbody>
</table>

**LED**
- Semiconductor diode ‘packages’ include phosphors, substrate, anode and cathode and integrated lenses
- Require driver (power source) and luminaire (enclosure)
- ~ 100 lumens / watt

**OLED**
- Electroluminescent film comprised of carbon-based compounds
- Rigid or flexible, transparent or opaque
- Developing technology in TV, moving to Lighting
- 50 lumens / watt, lifetime and performance are issues

**PLED**
- Electroluminescent polymers, typically liquid, printable, paintable materials
- ‘bleeding edge’ lighting technology - in R&D presently
- Could reach 60 lumens / watt initially

**LEP**
- Uses solid-state amplifier to guides RF (radio frequency) signal into a bulb containing gas and metal halide materials, vaporizing them into a plasma state.
- Intense, >140 lumens / watt, high CRO, high lifetime

Source:
- PLED: [http://www.chem.ualberta.ca/~jveinot/research.html](http://www.chem.ualberta.ca/~jveinot/research.html)
UL’s Balancing Act Related to Global Standards
Facilitating Global Trade - Standards

UL Challenge: Stay technically relevant as new technology and new standards develop globally

- Safety NA
- Safety INTL
- Interoperability
- Wireless and EMC
- Energy Efficiency
- Environment Sustain
- Lifetime
- Software Controls
- Standards

Organizations: Zhaga, ZigBee Alliance, enocean alliance, Emerge Alliance, IEC, UL, Energy Facts, DesignLights Consortium, IDA, Lamprecycle.org
Lines are blurring ::
Standard requirements are blurring across Safety, Photobiological, Performance, EMC, Environmental, etc.

New Organizations Appearing ::
New organizations are entering the standards writing space in Interoperability (Zhaga Consortium), LV Power (eMerge Alliance). UL is there.

Fast-Track support from UL ::
UL wrote the standard on SSL – UL8750, and we are driving it forward with the help and support of the Lighting industry.

Today UL can provide industry-leading support in Safety, Energy, EMC, Photobiological, Environmental services and more.
Role of a Third-Party Lab

• **Support Energy Efficiency Programs**
  - Initial Evaluation & Qualification Testing
  - Issues Independent Test Reports
  - Serves as a Certification Body
  - Conducts Quality Assurance Testing

• **Optionally**
  - Conduct Inspections at Mgrs. facilities
  - Monitor Production Testing
  - Coordinate Challenge Testing
Role of Third-Party Lab

• Why use Independent Third-Party Labs?
  o Helps ensure confidence in DLC products
  o Not affiliated with manufacturer or end-users
  o No commercial bias is present
  o Specialized test facilities
  o High level of technical expertise
  o Accredited by third-party accreditation bodies
  o Participate in external & internal proficiency testing programs
Impact of SSL on Testing Labs

- Train the Technical and Sales Staff
- New Equipment & Instrumentation
- Adjust staffing levels to handle workload and increased capacity
- Develop new data sheets/testing reports
- Ensure turn-around-times meet expectations
- Expand Accreditation Scope
Business Impact of SSL on Testing Labs

• Develop a global approach to Energy Efficiency Testing

• Adapt organizationally to address multiple Programs globally

• Develop a high level of technical competency

• Participate in specification development with various programs

• Ensure consistency & accuracy in reporting globally
Globalizing Supply Chain

UL’s global network of labs is ready for the SSL challenge!
Industry Leading Lighting Technical Coverage

**SAFETY**
- UL
- IEC
- IEC62471
- PSE

**PERFORMANCE & ENERGY EFFICIENCY**
- ENERGY STAR
- DesignLights Consortium
- Zhaga

**Safety (US & IEC)**
- 20 locations in NA, EU, & Asia

**Performance (Energy Eff. + Zhaga)**
- Allentown, PA, Scottsdale, AZ
- Burago Italy, Manesar India, Nansha China
2012 Grand Opening of New Lighting Energy Efficiency Lab in Allentown PA

- Dedicated to Performance and Energy Efficiency testing of Lighting Products
- 38,000 sq. ft.
- Approximately 20-25 Technical Staff
- Designed to accommodate up to 10 Type “C” Goniophotometers
- Multiple integrating spheres up to 3 meter in size
- All testing done in one facility
- Photometric Training Center
UL’s Performance Labs & Experts – Americas

UL Allentown, PA - North American Region
Full Photometric Testing & Zhaga
UL’s Performance Labs & Experts – Americas

UL Scottsdale, AZ - North American Region
Full Photometric, & Ballast Testing, Manufacturing of Goniophotometers
UL’s Performance Labs & Experts - Europe

UL Burago, Italy - European Region
Photometric Testing and Safety Testing
Milan, Italy
UL’s Performance Labs & Experts – India/ASEAN

UL Manesar, India
Photometric Testing & HVAC Testing
UL’s Performance Labs & Experts – CHINA / ASIA

UL Nansha, China - Asia Region
Full Photometric Testing & Appliance Performance Testing
Types of Testing

Energy Efficiency Testing

- Energy Star Testing
- Design Lights Consortium
- CALiPER
- Utility Company Rebate Programs
- Verification Testing & Quality Assurance

- Ballast Testing
- Audible Noise Testing
- Start Up/Run Up Time
- Operating Frequency
- Temperature Spot Measurements
- Light Output over Temperature Measurements/Studies
- Angular Uniformity of Color
- Rapid Cycle Stress Testing
- Lumen Maintenance/Life Testing
- Transient Testing
- Custom Testing Protocols and Development of Protocols for Big Box Stores
Complete Photometric Testing Solutions

Sample of Measurement Capabilities:

- Luminous Intensity Distributions
- Luminaire Efficacy
- Total Luminous Flux
- Zonal Lumens
- Spectral Power Distribution
- Correlated Color Temperature (CCT)
- Color Rendering Index (CRI)
- Input/Output Electrical Measurements
- Operating Frequency
- Lamp Start & Run-Up Tests
- Iso-Candela Plots & IES Files
UL’s Lighting Test Capabilities

- Color Measurements
- Electrical Measurements
- Life Tests
- Photometric Measurements

Energy Star Test Equipment and Capabilities:
- In-Situ Temperature Measurement
- Noise Testing
- Operating Frequency
- Angular Uniformity
- Lamp Life Testing at both 25°C ambient and 45°C ambient
- Rapid Cycle Stress Testing
- Transient Testing
- Minimum Operating Temperature
- Start/Run up Time
- Environmental Temperature Test Chambers
- Ballast Testing Capabilities
Quality Assurance Testing

• **Effects on the lab?**
  - Sample selections can be challenging
  - Requires additional test equipment
  - Requires additional dedicated staff
  - Ensure that QA testing doesn’t impact TAT

• **Burdens on the lab?**
  - QA testing is normal for a Third-Party lab….
Thank You