



# LUMEN INSIGHTS®

November/December 2011

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Now Launched

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Transformation



## UL Teams Up with Labsphere Now providing turn-key photometric testing labs

*By Matthew Sallee / Global Business Innovation, Solid State and LED Lighting Manager*

UL acquired Lighting Sciences Inc. (LSI) of Scottsdale, Arizona in March 2011. The UL LSI Moving Mirror Goniophotometer Series 6400T was awarded the Illuminating Engineering Society Progress Report honor for 2010, as a “unique and significant advancement to the art and science of lighting.” (IESNA, 2010)

UL now will be promoting and selling Labsphere integrating spheres systems with proprietary Spectrafect® 99% diffuse reflectance coating.

“The addition of the UL high-end goniophotometers to our extensive product line allows us to further extend our total

solutions mission and better service companies in the rapidly expanding Solid State Lighting markets”, said Greg McKee, Vice President of Engineering at Labsphere. “The lighting industry is undergoing a technology transformation toward LED-based energy efficient lighting products, and once again, Labsphere proves it is a leading provider of world class light measurement systems and standards to help our customers develop their innovative lighting products to meet global lighting test specifications.”

“UL is pleased to announce the collaboration with Labsphere,” said Todd

Straka, Business Development Director for UL, “We believe we can now provide our lighting manufacturing customers with the highest quality in-house photometric test laboratories available. This relationship couples the speed and accuracy of the UL Lighting Sciences goniophotometers with high-quality Labsphere integrating spheres, spectral management accessories, and highly advanced software for a turn-key photometric testing solution.”

Read more: link to test equipment page on new [www.ul.com/lighting](http://www.ul.com/lighting)



### A Letter from Alberto



*As we look back at 2011 in Lighting, it certainly has been quite a busy year. Solid State Technology continues to advance with LED and*

*OLED. Energy Efficiency programs, like ENERGY STAR® and Lighting Facts have started, and growing and maturing with technology.*

*Industry continues to find creative ways to adapt to applications, making strides in Retrofitting, outdoor area lighting, daylight controls and night sky protection. The challenges of heat and interoperability are being actively addressed, as technical leaders around global work quickly to develop interoperability programs with the Zhaga consortium.*

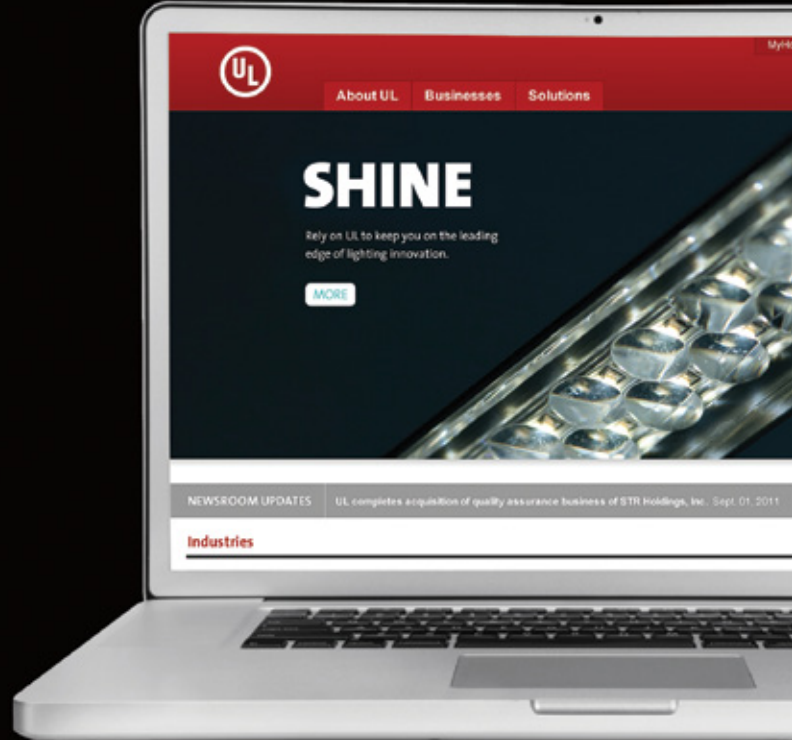
*Finally, UL continues to keep pace, helping safely accelerate new technology into the marketplace with industry-leading technical engineers in safety, performance, energy efficiency and sustainability.*

*It's my distinct pleasure to work in an industry filled with people of your caliber, driven to change the world, one light at a time.*

*Thank you for a great 2011. Let us know how we can help in 2012.*

*With Regards,*

*Alberto Uggetti  
VP and GM Global Lighting*

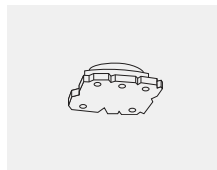


## New Lighting Web Site Launched

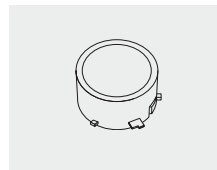
[www.UL.com/lighting](http://www.UL.com/lighting)

**By Matthew Sallee / Global Business Innovation,  
Solid State and LED Lighting Manager**

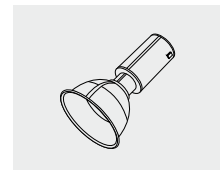
You asked and we listened. UL is pleased to introduce you to our new lighting website, developed to help you quickly understand which safety, energy efficiency, and performance programs apply to your products.



LED Package



LED Engines



Luminaires

Simply look for the product icons, to find applicable UL safety standards and conformity programs. Visit us at [www.ul.com/lighting](http://www.ul.com/lighting)

## ENERGY STAR® Progress

By **Todd Straka** / Global Lighting Business Director

The U.S. Environmental Protection Agency (EPA) recently distributed Draft 1 of the ENERGY STAR® Lamps V1.0 specification for partner and stakeholder review and comment. This new specification is intended to replace the existing Compact Fluorescent Lamps and Integral LED Lamps specifications, as well as the qualification requirements for GU24-based fluorescent lamps previously detailed in the Residential Light Fixture specification. The first draft was developed with consideration of comments received in response to the Lamps Specification Framework released on March 22, 2011. You can find more information at: [www.energystar.gov/index.cfm?c=new\\_specs.lamps](http://www.energystar.gov/index.cfm?c=new_specs.lamps)

Additionally, EPA expanded their Frequently Asked Questions section of their website, answering many of the questions UL receives. You can find the FAQs at: <http://energystar.supportportal.com/link/portal/23002/23018/ArticleFolder/1544/Lighting-Product-Certification>

### Popular questions and answers

**The Luminaires specification has a tighter color angular uniformity requirement than the color maintenance requirement. Is this an error?**

No. The Luminaires specification's chromaticity provisions detailed in the Correlated Color Temperature Requirements

allow a 7-step MacAdam ellipse (Fluorescent, HID) or a 7-step quadrangle (SSL), but for the Color Angular Uniformity requirement for directional luminaires, the specification restricts chromaticity variation to 0.004 from the weighted average point on the CIE 1976 (u'v') diagram.

### Has the effective date for the Luminaires specification been finalized?

Yes, the effective date for the Luminaires specification is April 1, 2012. Certification Bodies may no longer certify products to the old specifications (Solid-State Lighting Luminaires and Residential Light Fixtures) as of September 15, 2011 at which time only the Luminaires V1.1 specification will be available for qualification of luminaires.

### How can I get my lighting product certified for ENERGY STAR®?

ENERGY STAR® requirements cover most indoor residential lighting products and led integral lamps, as well as some commercial luminaires. UL's global network of ENERGY STAR® recognized laboratories and ULs status as an EPA recognized Certification Body can accelerate your time to market. Contact us at [todd.straka@ul.com](mailto:todd.straka@ul.com)



## New Mexican Law for Sustainable Use of Energy

By **Mike Shows** / Global Technical Team Manager, Verification Services

A New Mexican Law for Sustainable Use of Energy was issued per the Official National bulletin on 10 September 2010 and will become mandatory beginning 11 September 2011.

Lighting products specified in the bulletin exported to Mexico after 11 September shall be in compliance with new Mexican Law for Sustainable Use of Energy. Per Article 25 of the Law, any new equipment and appliances distributed or sold into Mexico must include, clearly and visibly, the information regarding their energy consumption. In addition, all manufacturers and importers shall submit to CONUEE (National Commission for Energy Efficiency) as well as to PROFECO (Federal Attorney's Office of Consumer) the energy consumption information of their appliances and equipment.

UL is fully prepared to assist you through the entire process of complying with the Mexican Law for Sustainable Energy Use. UL can:

- Conduct the required testing (or review your Energy Star test report);
- Prepare the entire submission package; and
- Submit the submittal package to CONUEE and PROFECO on your behalf and act as a liaison between you and CONUEE/PROFECO to resolve any issues/questions that may arise during the entire process

Upon receipt of approval from CONUEE and PROFECO, UL will issue a Certificate of Compliance.

To get started, you can contact us at: [EEC@us.ul.com](mailto:EEC@us.ul.com).

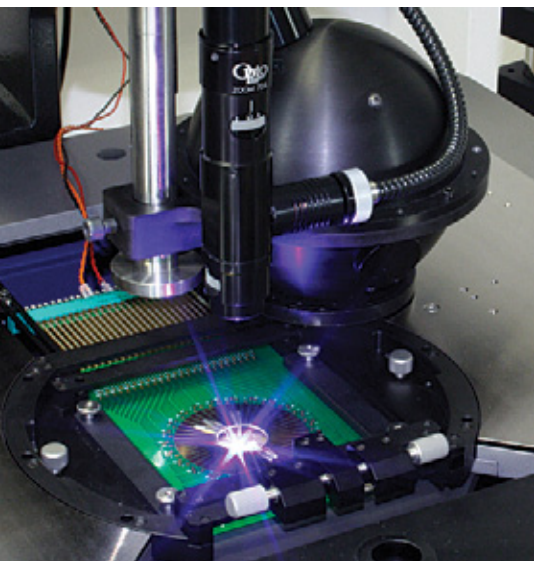
GUEST ARTICLE

# OPTICAL TESTING FOR THE EMERGING LED MARKET

By **Dan Scharpf** / General Manager, Systems Business Unit, Labsphere

*The explosive growth of light-emitting diodes (LEDs) as a replacement for fluorescent and incandescent light sources is driving tighter requirements on LED performance by the designers of displays and luminaires.*

FIGURE 1. Devices are tested on a prober using an integrating sphere to assess performance characteristics during the sorting process known as binning.



The performance of LEDs must be well characterized during production to ensure the devices meet end-user requirements across a range of operating parameters.

Optical testing during the manufacturing process is essential to increase yields and achieve accurate binning, thereby reducing the overall cost of manufacturing. Optical testing now occurs at several steps in the process, starting with wafer probing, followed by testing raw die, taped die, and finally packaged LEDs. Then, after packaging, the LEDs are used in displays and luminaires and these devices also need optical testing. In addition, the end users of the components are often interested in further testing to be sure the light source works well in the intended environment. Due to the sensitivity of LEDs to temperature and installation effects, each stage in the value chain alters LED output and requires testing to validate performance.

In order for LED technology to continue growing and gain industry acceptance the performance and economy of LEDs must exceed that of the components they are replacing. Quantifying the optical performance of an LED device requires measuring intensity (I), flux ( $\phi$ ), color, directivity, and power consumption. Each parameter provides specific information about device performance for a given

application and specific testing procedures are provided from the various standards bodies throughout the industry.

Testing speed during the manufacturing process is essential to maintain production volumes. An integrating sphere in combination with a spectrometer is typically used to capture the total flux along with the spectral content, and hence the color characteristics of the LED. Powering the LED during test also requires special consideration as the pulsed current waveform to the LED is intended to prevent temperature rise in the die yet still produce sufficient and representative light for measurement and qualification. This high-speed process requires precise synchronization between the drive current and the spectrometer.

## **Binning LEDs**

At the initial wafer stage, flux and intensity are required to ensure the desired power and the primary directional properties of the LED. From here, the die is separated from the wafer and again tested for its color characteristics.

At the die stage, the LEDs are sorted based on flux and color criteria — called binning. The process can vary among manufacturers, and recent binning criteria such as NEMA SSL3-2010 are being developed to help standardize the process

for the end user. Among the possible binning parameters are radiant flux, dominant wavelength, correlated color temperature, chromaticity, and color rendering index (CRI).

Packaging the LED requires bonding the device die to the silicon and/or heat sink and includes some form of lens to protect the die and provide focusing optics. To create white light, the lens may be coated with a phosphor for diodes that emit short wavelengths. In other white LEDs, a three-die, RGB (red-green-blue) approach is used whereby the color output levels of each die are balanced to produce the white light. In each case, variations in manufacturing processes can yield different color temperatures and color shifts that must be quantified. As before, an integrating sphere is used to bin the packaged devices and provide groups of matched LEDs for specific applications (see Fig. 1).

Light-emitting diodes generally don't fail catastrophically, as do standard incandescent lamps, so the lifetime rating is not easy to predict and there is currently no standard for extrapolating the expected life, or degradation of a LED. Instead, the IESNA-LM-80 standard is used to define the lumen maintenance of the package and define the expected time when the device will produce 70% of its initial light output. Testing at this level requires running a LED for at least

6000 hours at 55°C, 85°C, and a third temperature of the manufacturer's choice. Light measurements are taken every 1000 hours.

### Testing luminaires

Luminaire manufacturers must select packaged (binned) LEDs that meet their requirements for a given application. The junction temperature of a LED can significantly impact its optical output power and color shift, which is the reason for the different temperature settings during LM-80 testing. Since the performance of the LED die and package data is provided at 25°C (and 55°C and 85°C if LM-80 data is supplied), the luminaire designer must design the driver and heat management system to optimize the efficacy (flux/input power) or maximize the appropriate optical parameter for the application. This involves simultaneously varying the drive current and controlling the junction temperature at a prescribed value.

An integrating sphere with a thermal controller on the LED package is used to enable the designer to determine the operating envelope in terms of drive current or voltage and junction temperature. With this arrangement, a junction temperature can be fixed for a range of drive currents or vice versa. As this temperature setting is changed, a map of the optical parameters can be created for the complete range

of drive current and temperature.

Increased junction temperatures cause reduced light output and shift the dominant wavelength to higher values, resulting in lower correlated color temperatures. Understanding the impact of junction temperature on LED performance allows a designer to determine the acceptable range of operation for the complete luminaire.

Once the optimal operating condition of the LED is determined, the luminaire fixture is designed for performance, form, and aesthetics. Optical testing at this level is again required to verify the output and efficacy of the complete luminaire. Standards such as IESNA-LM-79 provide details on the test methods using an integrating sphere and goniometers so that equivalent comparisons are possible across similar devices.

Since the luminaire housing can impact the thermal management of the LED, LM-79 requires that the solid-state device be tested in the orientation in which it will be used. At this stage in the LED value chain, the housing can be only slightly larger than the LED, or it can be very large, such as in the case of street lamps. Hence testing at this level requires an integrating sphere sized for the housing. For testing omnidirectional devices, the luminaire is placed in the center of the sphere (4 $\pi$  arrangement).

## Optical Testing for the Emerging LED Market (continued from page 5)

For directional devices, the luminaire can be directed through a port in the side of the sphere ( $2\pi$  configuration). In each case, the sphere surface area relative to the device area should be maximized. For a  $4\pi$  configuration the general rule of thumb is that device diameter should be 1/10 the sphere diameter. In the  $2\pi$  configuration, the sphere port should be less than 1/3 the sphere radius. For street lamps and other large devices, spheres can easily be required to be of 3 m diameter or more.

For directional lighting, a hemispherical integrating sphere allows the thermal management components of the luminaire to be kept out the integrating sphere during testing. The hemisphere also provides

twice the signal to the spectrometer and allows a smaller hemisphere relative to a complete sphere for the same size device. Since the luminaire must also be positioned in its standard orientation as described in LM-79, a hemispherical system also allows for easy rotation for positioning the device under test (DUT).

In all of these measurements with integrating spheres, the introduction of the DUT to the sphere alters the ideal spherical configuration upon which integrating sphere theory is based. These additional surfaces change how the light is reflected and absorbed in the sphere and can be corrected through the use of an auxiliary correction lamp. By performing spectrometer scans

with the auxiliary lamp illuminated with the calibration lamp and the DUT in position, the ratio of these two scans is used when measuring the output from the DUT and compensates for any reflection or absorption introduced by the DUT.

As described here there are similar requirements for optical testing at every step from wafer to end user. In each step requirements for the integrating sphere and control of the LED vary and must be designed appropriately to achieve measurements within the accuracy range desired.

For more information visit [www.labsphere.com](http://www.labsphere.com)

## LED Safety Standards Across North America

*By Robert Williams / Vice President, Standards*

As UL continues to develop and refine LED Lighting requirements under UL8750, we've also been approached by industry to assist in the development of Canadian requirements. Earlier this year, ULC published a draft ORD (ULC S420), a Canadian version of UL8750, developed with industry to harmonize the requirements for LEDs across the United States and Canada. Only minor differences existed, mainly

surrounding electrical code requirements: NEC in the US, vs. CEC in Canada.

It is UL's goal to write and promote standards that are in-line with industry needs and are as focused as possible across adjoining geographic areas.

Therefore, we support the development of a Canadian safety standard for LED Lighting, which we understand is based on UL 8750.

Harmonized standards can result in lower compliance costs for manufacturers, which ultimately facilitates faster adoption of new technology into both the United States and Canada.

UL is supportive of transparent, consensus-based standards development activities in LED lighting, and would urge manufactures to join and participate in standards writing activities, both through UL's Standards Technical Process and the Canadian standards activities to ensure your voice is heard.

Participate in UL Standards Development Process: [www.ul.com/global/eng/pages/corporate/standards](http://www.ul.com/global/eng/pages/corporate/standards)

Participate in CSA Public Review: <http://publicreview.csa.ca>



## China Incandescent Phase Out

By **Nicole Chan** / Greater China Lighting Business Manager

On November 1, 2011, the National Development and Reform Commission, the Ministry of the Commerce, the General Administration of Customs, the State Administration of Industry and Commerce and the General Administration

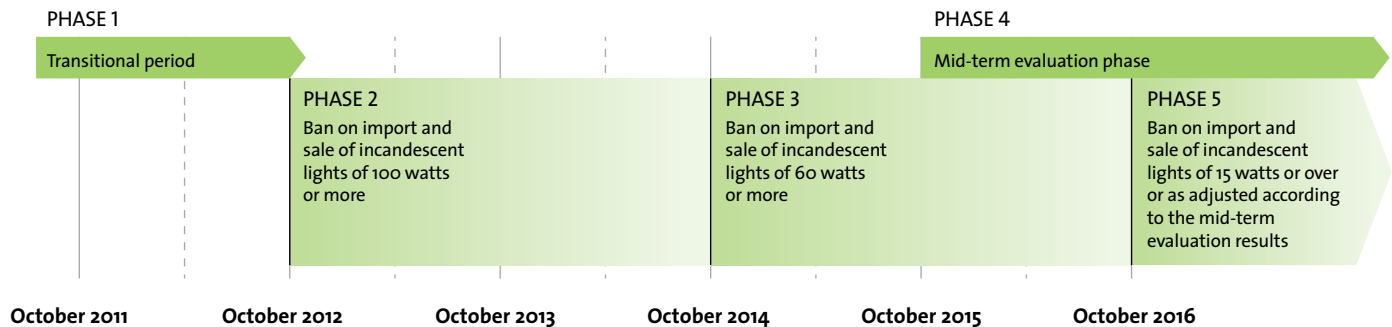
of Quality Supervision, Inspection and Quarantine jointly finalized a notice on gradually banning the import and sale of common incandescent lights in China.

From October 1, 2012, the import and sale of incandescent lights will be gradually

phased-out based upon wattage.

The phase out is phase stages (below).

The Chinese government estimates this phase-out will further develop the semiconductor lighting industry in China, doubling production within 5 years.



## Environmental Product Declaration

By **Colin Proietto** / Environment Business Manager, Lighting

An Environmental Product Declaration (EPD) reports the environmental impact of goods or services. Also known as a Type III Environmental Declaration, EPDs are based upon an established set of Product Category Rules (PCRs) and independently verified life cycle assessment data, allowing for comparability of impacts across products in a specified category. Traditionally, EPDs disclose life cycle based environmental impact information such as the carbon footprint of a product. Depending on how category specific PCRs are written, EPDs may disclose additional relevant information including toxicity and human health impacts.

UL offers three main registration programs for EPDs and lighting products;

EPD Validation and Registration, EPD Certification and Registration, and Systems EPD Verification and Registration. Contact us to learn more and get started promoting sustainable lighting products

### Interpreting Pre-Consumer Recycled Content Claims

There is a great deal of debate within the environmental and manufacturing communities about which materials can be claimed as pre-consumer recycled content. UL Environment encourages an end to this debate and has developed a white paper to provide clarity on interpreting existing guidelines to validate claims of pre-consumer recycled content and to serve as a reference for manufacturers.

Click here to download the full industry report: [www.uluniversity.us/common/lmsform.aspx?Form=WhitePaperAccount&Doc=ULE\\_RCC\\_070810.pdf](http://www.uluniversity.us/common/lmsform.aspx?Form=WhitePaperAccount&Doc=ULE_RCC_070810.pdf)





# UL PRESENTS THE “SMART GRID HOME” AT THE 2012 INTERNATIONAL CES®

The “Smart Grid” and “Energy Efficiency” are attractive concepts to a variety of stakeholders. But what do these terms mean to your business and to you as an individual? How can you maximize any benefits? How can you participate safely in the Grid? Are

there any red flags? Join UL and its partners in thought leadership as they explore energy savings and generation.

With LED, technology in lighting can now come to your home. American Lighting Association leaders will showcase the future

of LED lighting in the home at CES 2012. Sponsored by UL, panelist include Terry McGowen from Lighting Ideas Inc, Dr. Pekka Harrarainen from Lutron, Todd Manegold from Philips and Matthew Sallee with UL.



Click to Download Video

The Led Transformation:  
Lighting and Beyond  
1:00-2:00 pm



Click to Download Video

Energy Generation:  
How to Play in the Space  
2:30-3:30 pm



Click to Download Video

Energy Savings:  
Shaping the Future  
4:00-5:00 pm

Space is limited, register today at [www.ul.com/ces](http://www.ul.com/ces)

## ZHAGA AND UL

As Zhaga interoperability standards continue to develop, UL is pleased to be an active regular member of the consortium.

Recently, UL’s Principal Engineer Joseph Fredrick has been appointed chairman of Task Force 11: Zhaga’s testing protocol work group. Additionally, Matthew Sallee, UL’s business manager for Solid State and

LED Lighting, has been appointed co-chair of Zhaga’s Promotions work group.

UL is also pleased to announce that UL labs have been chosen to perform testing to the Zhaga books, and UL is the first to offer Zhaga testing services for: LED Engines (socketable downlights and LED modules with separate electronic control gear), Bases and Holders, and Luminaires.

To get started with Zhaga testing on your products contact [Matthew.Sallee@ul.com](mailto:Matthew.Sallee@ul.com)

[www.ul.com/zhaga](http://www.ul.com/zhaga)



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Managing Editor: [Matthew.Sallee@matthew.sallee@us.ul.com](mailto:Matthew.Sallee@matthew.sallee@us.ul.com)



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