

Report on the Lighting Trade-Show LIGHTFAIR International 2010 (Las Vegas, May 10-14)

LIGHTFAIR® International (LFI), one of the world's largest architectural and commercial lighting trade-show and Conference, was held in Las Vegas on May 2010, organized and managed by AMC Inc. in collaboration with the International Association of Lighting Designers (IALD) and the Illuminating Engineering Society (IES).

More than 475 leading manufacturers presented products in the field of light sources, lighting systems, daylighting products, contemporary and decorative lighting, ballasts, fixtures, lamp-holders, switches, luminaires, high-end fixtures, lighting control components, control devices, mounting devices and meters. Over 20000 professionals and experts, including manufacturers, engineers, lighting designers, architects, distributors, electrical engineers, energy managers, consultants, public utility specialist and urban planners, attended the Lighting Trade show.

The LIGHTFAIR® International Conference offered a large number of courses in the field of lighting technologies, architectural and commercial lighting. Designed to educate attendees on the industry's latest trends, innovations and business solutions, the LFI 2010 Conference program covered a broad range of today's most relevant topics offering more than 200 hours of CEU / LU / HSW accredited courses.

Besides the main Exhibit Hall for light sources and lighting applications, four Pavilions were organized on specific subjects:

- the pavilion on "Building Integration", one of the leading topic of LFI 2010, introducing companies proposing system technologies used for energy efficient buildings and solutions focused on energy efficiency through optimization of the overall building performance;
- the "Global light + design" pavilion featuring decorative lighting designs from globally recognized manufacturers;
- the "Daylighting" pavilion showing the latest innovations for green and efficient lighting solutions;
- the "Design" pavilion presenting products in the field of decorative lighting design.



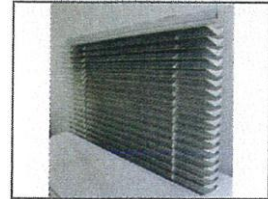
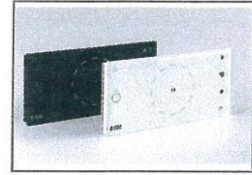
One of the most interesting event was the LFI 2010 Innovation Awards ceremony held to give a recognition to the most innovative products for technical advances and cutting-edge designs. The awards program received 200 submissions related to new products introduced by the companies and presented at the 2010 trade show: an independent panel of experts and renowned lighting professionals judged and chose the winners in 14 different designated categories.

Some of the main award winners were:

- Award for the Most Innovative Product of the Year — the highest award recognizing the most innovative new product → **Helieon Sustainable Light Module System by Bridgelux and Molex**: flexible, upgradable and replaceable LED modules offering 500- 1500 lumen in 24, 32 and 50° beam angles;



- Design Excellence Award— prize for important achievements in design and application → **Light-Drive Elite by Traxon USA**: glass-faced DMX controller with onboard RGB LED feedback and touch wheel interface for controlling RGB LED luminaires;
- Technical Innovation Award — award recognizing the most forward-thinking advancement in lighting technology → **SSL2102 by NXP Semiconductors**: Switched mode Power Supply Controller IC that operates in combination with a phase cut dimmer;
- Judges' Citation Award — special recognition of an innovative product at the judges discretion → **LightLouver Daylighting System by LightLouver**: panels for overhead window solution that enable deep daylight penetration.



During the LFI Innovation Awards that is an interesting opportunity for a overview of the latest lighting-related products, the additional winners in the different categories were:

- Research, Publications, Software, Unique Applications → **“Lighting and the Visual Environment for Senior Living: Recommended Practices” by the Illuminating Engineering Society (IES)**: online course addressing the special lighting needs of an aging population;
- Conventional Lamps → **Professional LED Bulb CTA by Ledzworld Technology SDN BHD**: a dimmable LED lamp with adjustable color tone and built-in protection against overheating;
- Ballasts, Transformers, Drivers → **Quicktronic QHE T5HO/SS System by Osram Sylvania**: T5HighOutput system with special electronic ballast offering 13% energy saving and 20% more life over standard T5HO systems;
- Chandeliers, Pendants, Sconces, Task Lights & Decorative Luminaires → **Locking Ring and Decorative Lights by Recesso Lighting**: system to transform outdated recessed lights into decorative surface luminaires in a few minutes;
- Downlights, Wallwashers, Accent Lights → **Element 3 LED Downlight by Generation Brands Tech Lighting**: 18W 3 inches LED recessed downlight emitting 845 lumen at 3000K with modular optics and choice of round or square apertures;
- Track, Low-Voltage, Cable & Rail Systems → **Paloma by W2 Architectural Lighting/WAC Lighting**: adjustable track luminaire featuring deep front cover for glare control;
- Fluorescent Based Troffers, Suspended, Surface Luminaires → **DSBL Bi-Level Stairwell Luminaire with Deco-SMART system by DECO Lighting**: fluorescent luminaire with integrated sensors to provide automatic bi-level lighting;
- Industrial, Vandal, Exit & Emergency Lighting → **SAFR Series LED Luminaires by AZZ/RAL Rig**



A Lite: a 754W glare-free LED hazardous & severe environment fixture rated for more than 60000 hours;

- Roadway, Sports, Outdoor Architectural, Site Lighting → **Sentinel Plasma Luminaire by PEMCO Lighting Products:** Plasma luminaire system that achieves IED Type III, IV and V distribution;
- Landscape, Pool & Fountain Lighting → **Luca by Structura:** 15W LED glue laminated wood bollard;
- Theatrical, Floodlights, Specialty Luminaires → **Series 6000 HP LED Cove Light featuring CANDLELED LEDs by TEMPO Industries:** 2200K warm LED cove light for 120-277 V operation.

Other interesting innovative products were presented at the fair:

- bulb-shaped LEDs and decorative LED lamps proposed by several companies to replace incandescent;



EnhanceLite A19
6,5W LED lamp (600 lm, warm white light with a 90+ CRI) by LEDNOVATION Inc.



Energy Smart LED Omnidirectional A19
LED lamp alternative to 40W incandescents (25 Khours, CRI 80+) by GE



EnduraLED Dimmable A-shape
7, 8, 12 W LED lamps (25 Khours) by PHILIPS



ULTRA LED Retrofit A-line Lamps 6W (50 LPW, 3000K) 8W (54 LPW, 3000K) 12W (67 LPW, 2700K) by OSRAM Sylvania



EnduraLED Decorative Candles
2 and 3W candelabras LED lamps by PHILIPS



LED Candle Series-LC0105CS
5W LED Candle lamp producing 180 lumens by MEGAMAN Inc.



LED Deco Lamps
Decorative LED Lamps producing 225 lumens by LITETRONICS.



ELIQUE LED Retrofit B10 Candelabra Lamp
7W LED Candle lamp for replacement of 25W B10 incandescent lamps by OSRAM Sylvania

- in addition, also a wide variety of reflector LED lamps (MR16, PAR20, PAR30, PAR38 LED Lamps) or LED based light tubes were shown for possible replacement of incandescent/halogen reflectors or of fluorescent tubes.



Family of MR16, Par20, 30 and 38 LED lamps ranging from 6 to 16W by Bulbrite



LED Par38 lamps 850 lumen, CRI 90 by GE



120 Volt AC LED device, designed to replace fluorescent tube by American Bright Lighting Inc.

- LEDs with high performances were presented by important producers:

Citizen → 6W LED series (CL-L103) with luminous efficacy up to 110 lm/W at 5000K and 13 W LED series (CL-L233) with up 105lm/W at 5000K;

Luminus Devices → CSM-360 40W LED (36mmx36mm footprint) offered in 3000-5700K with cool white efficiency exceeding 100 LPW;

OSRAM Opto → OSOLON SSL and OSOLON SSL wide Angle, the industry's smallest 1W package with efficacy up to 120lm/W at 6000K and 90 lm/W at 3000K, Golden DRAGON Plus LED with efficacies of more than 100lm/W.

- Cree announced the new LED based troffer LR24HE, the first indoor fixture which delivers more than 100 lm/W fixture efficacy; it can deliver 3200 lumens at 3500 K with a 90 CRI and last at least 50000 hours. The LR24HE will be commercially available in late summer 2010.



- Several LED based products for street lighting were proposed; the most interesting proposals were:

Philips lighting → Roadstar for the direct replacement LED Cobra head;

Luminus Devices/Almeco Group → a street light fixture using high output Phatlight LEDs and innovative reflectors;

Everlight Americas Inc. → SL-Dolphin II, a dimmable LED street light head with efficacy over 90 lm/W.

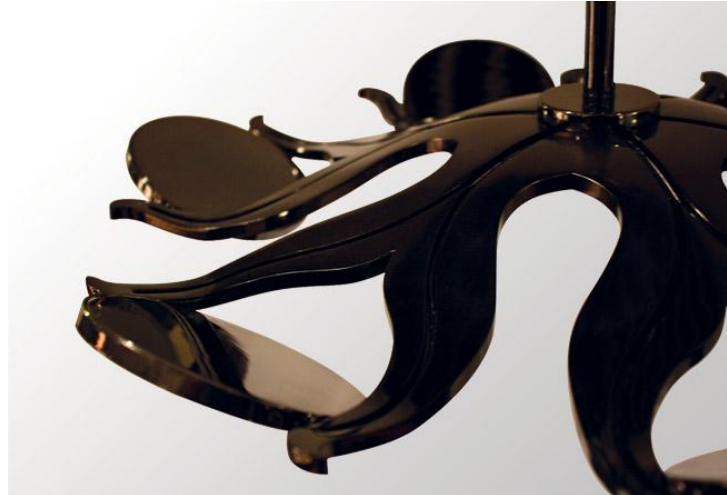
- Also very efficient gas discharge light sources were exposed to the fair:

- LUXIM → LiFi STA 41-01 Plasma lamp, a 273W Light emitting Plasma light source with 50 Khours life and CRI of 80 to replace 400W Metal Halide lamps;
- OSRAM Sylvania → METALARC POWERBALL 15W Ceramic Metal Halide TF lamp: lamp delivering 80 lm/W at 300K with CRI of 82 and rated life of 12 Khours;
- OSRAM → ICETRON Systems: Induction lighting systems available with a power of 40, 70, 100, 150 and 200W (efficacy between 70 and 80 lm/W); rated system life of 100 Khours;
- EIKO Ltd. → Cold Cathode Luminaire: dimmable 80 lm/W cold cathode lamps-based luminaire with 50 Khours life
- Philips → Energy advantage T5 25W Alto Fluorescent lamp and Energy advantage T5 49W Amalgam lamp providing, respectively, 2900lm and 5000lm with a rated average life of 25Khours
- OSRAM Sylvania → PENTRON HO Supersaver T5 lamps with power of 50, 47, 35 and 20W delivering, respectively, 5000, 4575, 3500, 2000 lumens

- OSRAM Opto → ORBEOS OLED Light source: round lamp of 80 mm diameter, 2.1 mm thick, having efficacy of 25 lm/W and CRI of 80.

- It is worth remarking that also many producers (TCP, Megaman, Maxlite, Litetronics-Neolite, OSRAM) of Compact Fluorescent lamps, energy saving lamps that are quickly replacing incandescent lamps in domestic applications, promoted products with improved efficacies up to 100 lm/W (i.e. Sylvania DULUX L Supersave 25W lamp delivers 100 lm/W with an average rated life of 20 Khours), attractive characteristics and reduced Hg content.

- the company WAC LIGHTING, leader in quality decorative lighting lines, presented an Organic LED Chandelier at LightFair International. “SOL” is an innovative proposal for the luxury market: a new decorative chandelier utilizing, as exclusive light source, the ORBEOS OLED Lighting system from OSRAM Opto Semiconductors.

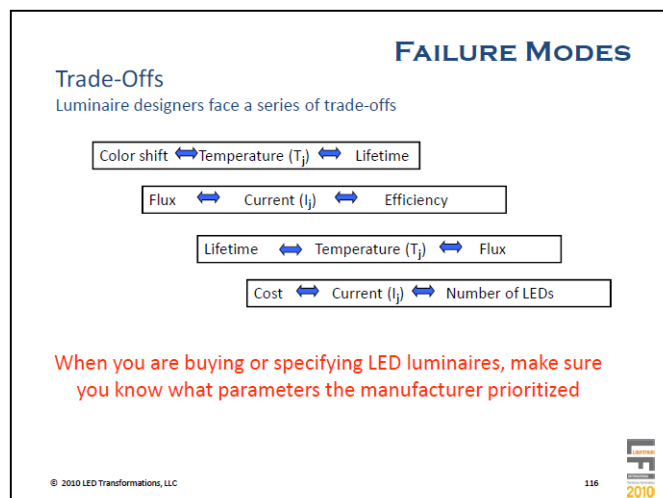


One of the most interesting courses of LFI 2010 Conference was the course “LED performance guidelines: good, bad and how to tell the difference”: the speaker, Dr. John Curran, President of LED Transformations LLC, examined the best and the worst of SSL applications and provided an interesting guide to understand the difference.

He explained key elements of LED system performances, including design compromises typically made by manufacturers.

Dr. Curran emphasized that it is important to understand the interactions between the various elements of an LED-based luminaire in order to recognize the limitations posed by the technology, to evaluate the role that the environment plays on the LED luminaire performances and to realize the consequent trade-offs that manufacturers must make in designing LED products; in order to know critical points and possible failure modes it is necessary to consider the trade-offs carried out by the producers.

Examples of good and bad LED applications were presented and discussed; good applications are those better exploiting the small form factor, the high efficacy and directionality of LEDs: downlights, exterior bollards, cove lighting, fixtures which require light output directionality, task lamps, desk lamps, street lighting. Bad applications are typically related to A-lamps (Bulb-shaped LED lamps) and LED reflector lamps with insufficient light output. Controversial applications concern LEDs based tubes for replacement of fluorescent lamps: in many cases the efficacy of fluorescent lamps is not yet achieved by SSL sources.




LED APPLICATIONS

Characteristics of Good Applications

Based on current device efficacy

- Replacing a low efficacy light source
 - Incandescent
 - Halogen)
- Replacing a fixture type with low optical efficiency
 - Downlights
 - Exterior bollards
 - Louvered products
 - Fixtures which require directionality
- As device efficacy increases and costs come down, this list will expand to encompass most traditional lighting sources

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LED APPLICATIONS

Good Ones

Downlights – Retail/Food Service

Friendly's Restaurant, Westfield MA



Incandescent 5,135 W



LED 948W

Source Cree

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LED APPLICATIONS

Good Ones

Roadway Lighting – I35 Bridge in Minneapolis, MN



Source: Eric Haugsgaard, Road Lighting



Source: Photonics Industry and Technology Development Association

15% energy savings over previous HPS

LEDs provide a better quality of light than HPS

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LED APPLICATIONS

Not so Good Ones

High wattage MR-16 (>20W)

Things to watch out for:

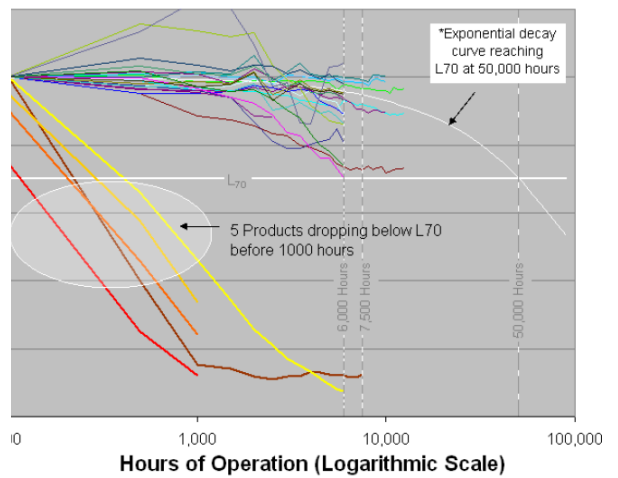
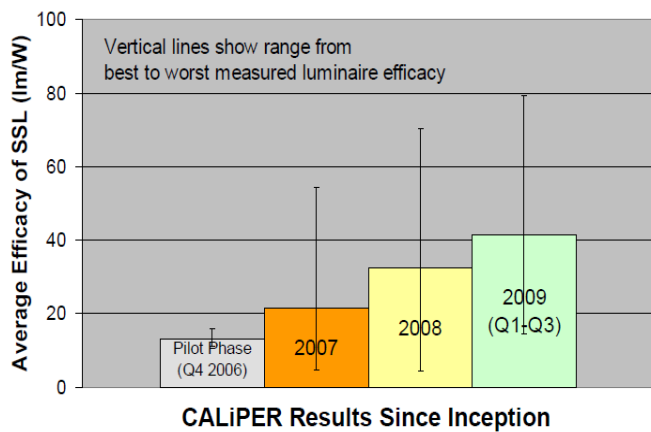
- CCT of halogen is typically 2800-3100K. LED CCT ranges from 2800 to 7000K.
- Wattage of LED product ranges from 1W to 10W.
- Efficacy is generally higher, but total lumens is much lower.
- Apples to oranges. Need to compare beam angle and candela ratings!!
- Lifetime claims do not match warranty. How does a product rated for 50k hours only come with a ONE year warranty?
- Voltage compatibility. Some products only work on DC or AC.
- Transformer and dimmer compatibility. Many products won't work with certain types of electronic transformers. Read the fine print!
- Thermal issues. Output and lifetime will degrade severely in enclosed fixtures!
- Cost is 10 times or more higher than a halogen equivalent.

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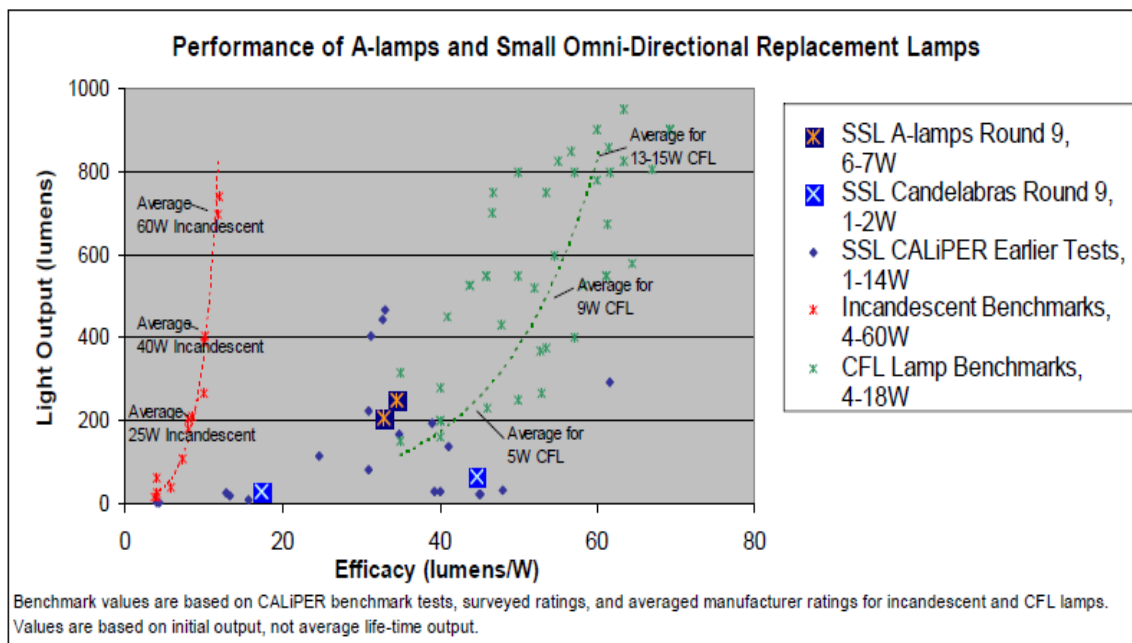
As known, the DOE CALIPER Program (Commercially Available LED Product Evaluation and Reporting program) supports testing of a wide array of SSL products available for general illumination: CALIPER test results guide DOE planning for SSL R&D and market introduction activities. Last round of testing, Round 9, for the CALIPER Program was conducted from June 2009 to September 2009. In this round, 30 products, representing a range of product types and technologies, were tested with both spectroradiometry and goniophotometry using absolute photometry. All solid-state lighting products were tested following the IESNA LM-79-08 testing method (the CALIPER summary report can be found at <http://www.ssl.energy.gov/caliper.html>).

LED based products tested in Round 9 showed a wide range of efficacy: from 17 to 79 lm/W. The overall average efficacy for products tested in Round 9 is 46 lm/W, while it was 36 lm/W in Round 8. The following figure illustrates the steady increase in performance of market-available SSL products since CALIPER testing began in December 2006. Essentially, the average efficacy of all SSL products tested has doubled between 2007 and 2009.

The second figure reports the long terms curves of lumen depreciation of 26 fixtures and replacements lamps products measured during round 9; as one can see in the figure the lifetime of 5 low quality products is not acceptable by the market: they can cause a negative impact on the feeling of the consumers in relation to the new SSL technology.



According to the results of CALIPER Round 9 measurements, efficacies of A-lamps and candelabras are significantly better than those of incandescent lamps, but overall light output is still quite low.



As shown in the following slides it is expected that, in the future, the usable efficacies (in luminaire) of Warm White and Cool White LEDs will significantly increase and the "costs per lumen" will decrease getting closer to those of incandescent lamps.

ECONOMICS

LED Economics

Efficacy of Various Light Sources

Light Type	Data Sheet lm/W	Usable* lm/W	Lifetime (hrs)	CRI
Incandescent	17	10-17	3k	100
Halogen	20	12-20	10k	100
T12 fluorescent	60	40-50	20k	62-85
Metal halide	65-70	35-40	10k-20k	60-90
Lighting-Class LED (Warm White)	80	55-65	50k+	80-85
T8 fluorescent	85-90	65-70	20-30k	78-85
High-pressure sodium	95-110	55-65	24k	22
Low-pressure sodium	120-140	65-75	16k	<5
T5 fluorescent	90	70-75	30k	85
Lighting-Class LED (Cool White)	105	70-80	50k+	75

* Typical expected performance in real-life applications. Based on mean lumens, and including ballast/driver, thermal equilibrium, and typical fixture Coefficient of Utilization losses.

Source: Mark McClellan, Cree

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ECONOMICS

LED Economics

Figures from a 2008 DOE Meeting

Year	Cool White Efficacy (Commercial) in lum/W	Warm White Efficacy (Commercial) in lum/W	Fixture Efficiency	Driver Efficiency	Overall Luminaire Efficacy (Cool White) in lum/W	Overall Luminaire Efficacy (Warm White) in lum/W	Cost / k-lumen
2007	84	59	77%	85%	47	33	\$25
2010	147	122	84%	89%	97	80	\$10
2012	164	139	88%	91%	121	101	\$5
2015	188	163	95%	95%	161	140	\$2

Source: Marc Ledbetter, Energy Star SSL Stakeholder Workshop, May 15, 2008

Even at \$0.002/lumen an LED light bulb with the same lumen output as a 60W incandescent would cost \$1.70

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