

Technology and Innovation 1/2

SOLID STATE LIGHTING (SSL)

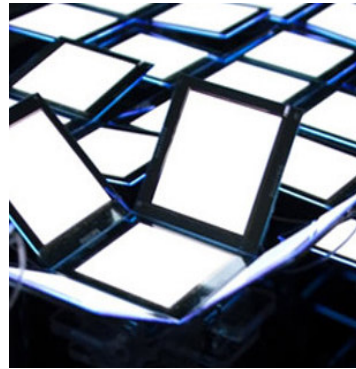


LED

Semiconductor based 'packages' include phosphors, substrates, anode and cathode and integrated lens

~ 150 lumens / watt

Combination diodes can produce CRI > 95



OLED

"organic" electroluminescent film comprised of carbon-based compounds.

~ 60 lumens / watt

Color uniformity and size are key challenges

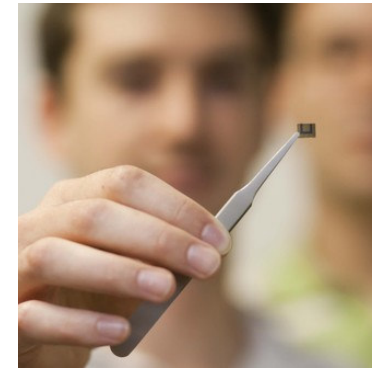


LEP - PLASMA

Solid-state amplifier to guide RF signal into a gas-filled bulb, vaporizing into a plasma state

Intense, > 150 lumens / watt

Very high CRI, fragile and implications with radio waves



NANO

'Graphene', honeycomb like carbon structure, awarded nobel prize in 2010 for electronic and optical properties.

Other technologies include PLEDs

In R&D stage

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TRADITIONAL LIGHTING

Lamp /
"bulb"

- Edison-era Technology
- Filament / Vapor based

Luminaire

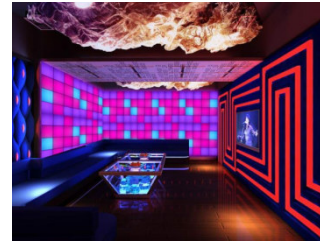
- "brass and glass" enclosure

Ballast

- Low-tech electronics

Switches
&
Dimmers

- Simple and mechanical



SOLID STATE LIGHTING

Diode Package, OLED Panel

Driver / ECG

Lenses and Optics

Thermal Management

Enclosure

Bases, Holders, Connectors

Power Generation and Storage

Lamp Holders / Sockets

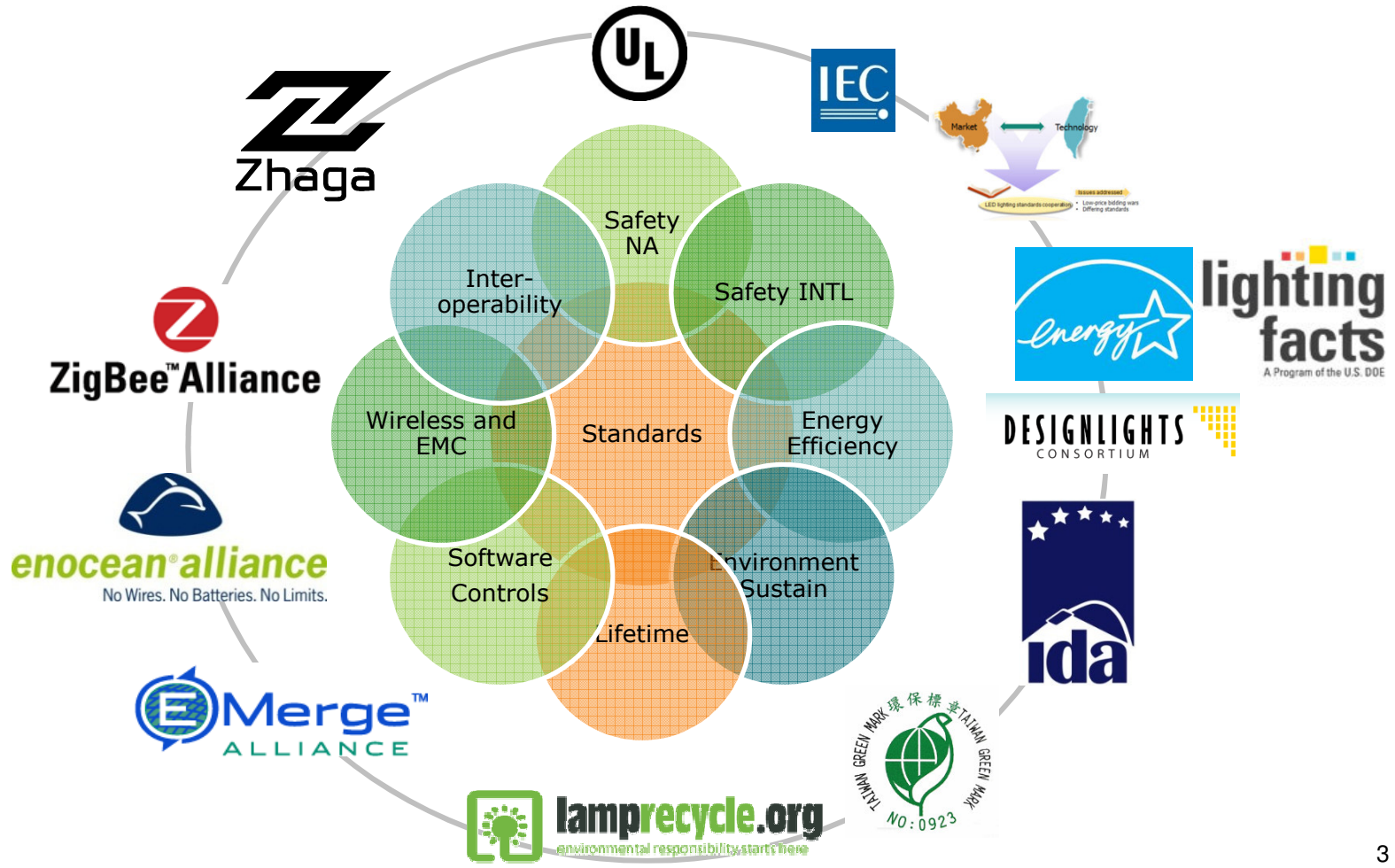
Wireless, Power Free Control Gear

Controls

Software

Facilitating Global Trade - Standards

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



Facilitating Global Trade

Challenge : Stay technically relevant in new LED safety standards for Domestic Asian market

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China and Taiwan Regulatory

Sinocon Industrial Standards Foundation holds an annual meeting to facilitate consensus regarding the creation of LED lighting standards between China and Taiwan. 8x to date.

Chart 36: Key points of consensus from the China-Taiwan technical standards forums



Source: China Taiwan technical standard forum 2011 compiled by Digitimes Research Research, August 2011

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Japan Regulatory

▼ Safety first for LEDs in Japan : safety standards dominate development activities, then performance. ▼

Table 10: Breakdown of national LED standard share by type in China Taiwan and Japan

Country	Basic and overkill/lighting	Product	Safety and environmental
China	10	30	1
Taiwan	20	30	40
Japan	20	30	40

Note: When we counted standards for each type, if a number of standard categories.
Note: The number of standards in each country, compiled by Digitimes Research, August 2011.

Chart 6: Areas covered by Japanese Industrial Standards (JIS) for LED lighting

Information and labeling	JIS C 6112	JIS C 6113	JIS C 6116
Measurement and labeling	Testing methods for LED light fixtures for general lighting use	LED modules for general lighting use (safety)	LED light bulbs (general lighting use - safety)
Safety	JIS C 6147-2-1	JIS C 6154	JIS C 6116
Interoperability	Lighting control devices - safety	LED modules for general lighting use - performance	LED light bulbs for general lighting use - performance
Product performance	LED modules for general lighting use - safety	LED modules for general lighting use - performance	LED light bulbs for general lighting use - performance
Environmental considerations	2007	2008	2009

Source: JEITA, compiled by Digitimes Research, July 2011

Chart 9: JIS C 6116 performance requirements for LED modules for general lighting

Refers to the performance requirements for white LED devices in the JIS C 6116 standard specifications.

- Items covered: Power supply properties, optical properties, luminous flux maintenance rate, lifespan, connection terminals.

Item	1	2	3	4	5
Rated output	LED and white module	High output LED module	LED module and LED module	LED module and LED module	LED module and LED module
Applications	Components	Components	Light sources	Lighting equipment	Lighting equipment
Performance requirements	Can be installed without lighting equipment	Complex with lighting equipment	Complex with lighting equipment	Complex with lighting equipment	Complex with lighting equipment
Class	JIS C 6116	JIS C 6116	JIS C 6116	JIS C 6116	JIS C 6116
Testing methods	Testing methods for white LEDs for general lighting use	Testing methods for white LEDs for general lighting use	Testing methods for white LEDs for general lighting use	Testing methods for white LEDs for general lighting use	Testing methods for white LEDs for general lighting use
Testing equipment	Integrating sphere	Integrating sphere	Integrating sphere	Integrating sphere	Integrating sphere

Source: JEITA, compiled by Digitimes Research, July 2011

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Korea Regulatory

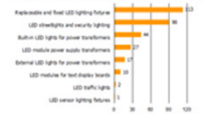
A variety of organizations are driving standards, ▼ Mandatory safety KC mark combines global requirements, KE mark includes performance based on ENERGY STAR ▼

Table 1: Mandatory certification standards for LED lighting products in South Korea and major regions worldwide

Region	Product	Certification standard name	Safety	EMC	Average time required
South Korea	LED display backlight	KS C 6116	✓	✓	8 weeks
US	LED general lighting	UL E83	✓	✓	8-10 weeks
Europe	LED general lighting	EN 60598-2-13	✓	✓	8-10 weeks
Japan	LED general lighting	JIS C 6116	✓	✓	8-10 weeks
China	LED general lighting	GB 7000.2-13	✓	✓	8-10 weeks
India	LED general lighting	IS 14543	✓	✓	8-10 weeks

Note: 1) In the US, the UL E83 certification scheme is a mark of compliance with the UL E83 standard and the UL E83 certification scheme is a mark of compliance with the UL E83 standard. The average when there is the possibility of options.
Source: The various regional authorities, compiled by Digitimes Research, August 2011

Chart 21: Total number of KC certified LED lighting products, as of July 2011

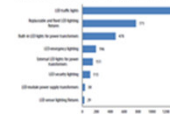


Note: All statistics of LED lighting products were based on the registration of manufacturers of LED lighting products. The total number of LED lighting products registered with the Korea Certification Authority and the Korea Certification Authority.

Table 2: LED lighting specifications in KC/CEC/UL/IEC

Specification	Product	Area of application	Remarks
KS C 6116	LED light bulb	General lighting	KS C 6116 is a standard for LED light bulbs for general lighting use.
UL E83	LED light bulb	General lighting	UL E83 is a standard for LED light bulbs for general lighting use.
EN 60598-2-13	LED light bulb	General lighting	EN 60598-2-13 is a standard for LED light bulbs for general lighting use.
JIS C 6116	LED light bulb	General lighting	JIS C 6116 is a standard for LED light bulbs for general lighting use.
GB 7000.2-13	LED light bulb	General lighting	GB 7000.2-13 is a standard for LED light bulbs for general lighting use.
IS 14543	LED light bulb	General lighting	IS 14543 is a standard for LED light bulbs for general lighting use.

Chart 22: Number of KC certified LED lighting products, July 2011



Note: All statistics of LED lighting products were based on the registration of manufacturers of LED lighting products. The total number of LED lighting products registered with the Korea Certification Authority and the Korea Certification Authority.