Policies to Protect and Educate the Consumer

Asia-Pacific Economic Cooperation

Australian Government
Department of Climate Change and Energy Efficiency

Welcome
& Introduction

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Australian Government

Department of Climate Change and Energy Efficiency

Session 1

LEDS: Where are we now and where are we going?

Consumer LED Lamps: Industry, Technology and What's Next

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LED Lamps: What Are We Talking About?

- For use in **residences, by consumers.**
- Wherein the light source is **one or more** light-emitting diodes (**LEDs**). Typically these are **blue-emitting LEDs** that are packaged with **yellow-emitting phosphors**, to create what we see as **white light**.
- Meant to be operated on **mains power**, and, where previously the consumer used a lamp of the **A-line** ("light bulb") or **G-line** ("globe") type.
- Where previously the light source would have been: incandescent (I), halogen incandescent (HI) or compact fluorescent lamp (CFL).

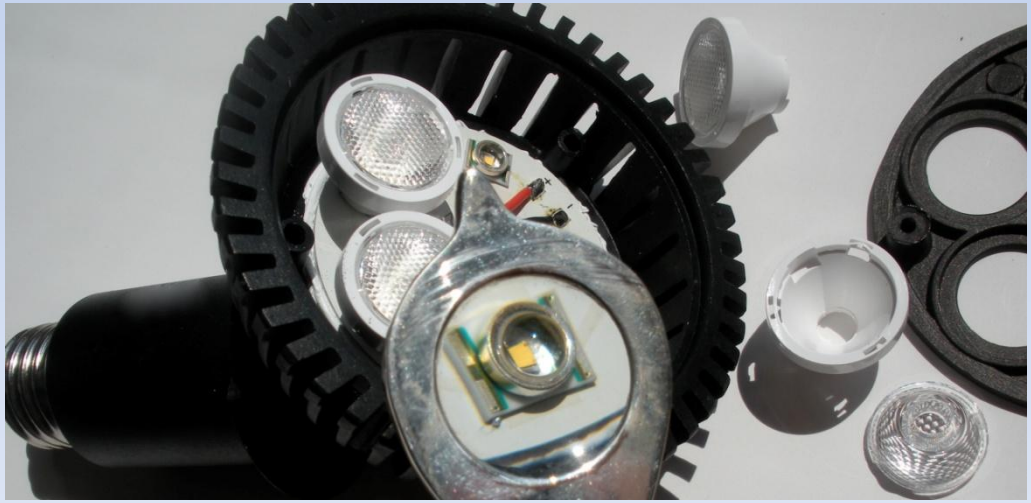
LED Lamps: What's Inside?

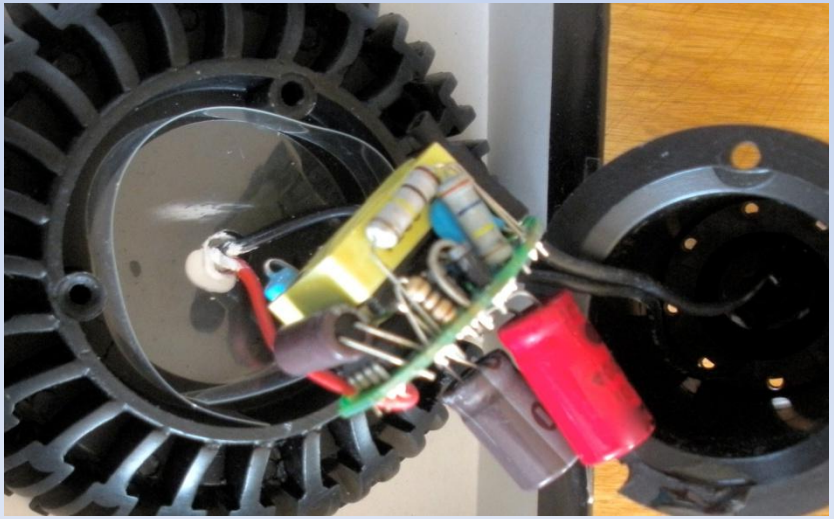
Light source: LEDs, in a package, or, mounted on a circuit board.

Optics: phosphors in silicone gel, or, in a plastic lens; micro-structured lenses for beam pattern control; reflectors.

Electrical/electronics: circuit board; AC to DC transformer; circuit driver; feedback loops & sensors; controls (on/off; dimming).

Thermal: conductive adhesives; heat sink.





LED Industry Status: Demand

- **Demand for illumination products is increasing;** they should exceed 10% of overall blue chip demand in 2012.
- Global LED chip leaders completed extensive build-outs of their **manufacturing facilities**.
- **Yields will improve,** lowering the per-chip cost for illumination-grade packages.
- Smaller manufacturers and start-ups have difficulty competing as large manufacturers clear out inventory. This may lead to **industry consolidation.**

LED Industry Status: Focus on Illumination

- **Illumination-grade LED packages: more difficult to make** than LED packages for displays. Must conform tightly to specifications, and, they may use multiple LEDs within each package.
- **China** invested heavily in LED chip manufacturing. Manufacturers must focus on quality control to get past the initial start-up of their production lines.
- Much of China's initial output of LED chips will be for displays & outdoors, not for indoor illumination. **LED lamps made in China for export often use blue chips imported from Europe, USA & Japan.**

LED Industry Status: Moving Toward Ecosystems

- LED **ecosystems** are clusters of companies, facilities and personnel that develop expertise in anticipating demand, designing and manufacturing just-in-time deliveries of products to customers. Often government supports research and funding for ecosystem development.
- Examples of **existing LED industry ecosystems** are the Optics Valley in South Korea; LED-industry-related companies in Taiwan; and, Silicon Valley in California. Singapore is the global center for Philips' chip manufacturing. Penang, Malaysia has a strong ecosystem for LED packaging.
- China is shifting toward funding more robust ecosystems and supply chains for LED packaging and LED lighting products.

LED Lamp Assembly

- **Hand-assembled** on small lines.
- LED lamp manufacturing requires many electronics, thermal and optical component **suppliers** nearby, to meet customer orders for rapid assembly and delivery.
- Extensive **testing facilities** are needed, too. Most lamps are tested for 24 to 48 hours before packing & shipping, to identify early failures.

LEDs Require Test Equipment & Quality Assurance at Each Step of Manufacturing

Images: Civilight Shenzhen Semiconductor Lighting Co., Ltd.

Technology Status and Forecast: Lumen Output & Lamp Efficacy

- LED chip, package and lamp **roadmaps** differ significantly.
- Industry has excellent record of achieving **laboratory milestones**; getting better at bringing high-efficacy lamps to market.
- Overall lamp quality varies considerably by country, due to **consumer protections** (or lack of them!)
- **Illumination-grade** chips and packages remain difficult for any but the leading manufacturers to produce consistently, in high volume.

Technology Status and Forecast: Lumen Output & Lamp Efficacy

- All components in the lamp must be **optimized as a SYSTEM** to take best advantage of the LEDs. The best LED chips won't perform well without an appropriate circuit driver.
- Examples: **If the chips are not driven properly** and they get too hot, the wavelength emitted shifts to blue, and will not fully energize the yellow/red phosphors. This leads to lower light output and lower efficacy.
- The **weakest link** in the system determines the LED lamp's performance. Often this is the circuit driver; seldom is it the LED.

LED Lamps: Different Than Previous Light Sources

Light Source	CCT: Correlated Color Temperature	CRI*: Color Rendering Index	Lamp Efficacy (lumens/ watt)
Incandescent	2700-2800	100	5—17
Halogen-incandescent	2775-4400	98—100	11—24
Compact fluorescent**	2400-6500+	70—92	35—70
LED***	2400-6500+	70—95+	15—90+

Sources: Manufacturers literature, online catalogs, literature reviews.

* *CRI may be replaced by a new metric, "color quality scale" (CQS)*

** *Requires special handling: contains mercury.*

Technology Status and Forecast: Lumen Output, Lamp Efficacy & Lighting Quality

- **Technical developments to improve lamp design and quality:**
  - Higher efficacy LED chips → less bulky heat sinks.
  - Higher voltage LEDs → increase lamp efficacy.
  - More consistent binning and use of multichip packages → increase light output.
  - Feedback loops → improve lumen maintenance and reduce color shifts.
- **High quality circuit drivers** and assembly line **QA** are most important for assuring quality to the consumer, because LEDs seldom fail. More often, the circuit driver or a solder joint fails, causing the LED lamp to fail, too.

Technology Status: Comparing LED to Incandescent Lamps

Range of Results, U.S. DOE CALiPER Testing*	Incandescent	Halogen-Incandescent	LED	*Consumer's View of LEDs*
Number of Models	**7**	**5**	**26**	**--**
Input Power (W)	**55 to 101**	**71 to 98**	**1 to 14**	***Great!***
Initial Efficacy (lm/W)	**7 to 17**	**11 to 24**	**16 to 97**	***Great!***
CCT (K)	**2491 to 2854**	**2805 to 3020**	**2643 to 7272**	***Buyer Beware!***
CRI	**99 to 100**	**84 to 100**	**49 to 93**	***Buyer Beware!***
Initial Light Output	*Predictable*	*Predictable*	*Varies*	***Caution!***

Results in rows 1 to 5 published by U.S. DOE CALiPER, July 2006 to October 2011.
Accessed November 2011 at: http://www1.eere.energy.gov/buildings/ssl/caliper/default.aspx
*NOTE: Opinions in row 6 and column 4 are those of the author, not of U.S. DOE.

Q: When does 43W = 60W?
A: Only when you buy light bulbs!

October 2011, USA Reality Check: LED Lamps in a "Big Box" Do-It-Yourself" Retailer

Initial light output (lm)	Input Power Demand (W)	Claiming to Replace (W)	Useful Life (hr or yr)	Warranty (Years)	Retail Price (USD)
240	7	25	25,000 hr 15 yr	6	14.97
240	5	25	25,000 hr 15 yr	6	24.97
450	8	40	50,000 hr	5	19.97
470	8	40	22.8 yr	6	21.97
510	8	40	23 yr	--	17.97
800	12.5	60	22.8 yr	6	24.97
850	13	60	25,000 hr	5	23.97
950	13	60	25,000 hr 23 yr	5	25.97

Inaccurate Performance Claims: What to Do?

- Require a **label or tech data sheet** with standardized test info for lamps (not just for LEDs).
- Conduct **outreach** to inform manufacturers and distributors of standards. Offer **recognition** for best performance. Example: Multi-million USD “L-Prize” awarded to Philips in August, 2011.
- Conduct **random testing. Publish the results.** Institute a third-party appeal procedure, but reserve the right to impose reasonable penalties for violations of the law.
- **Require “no-questions-asked” return or warranty terms** from manufacturers, distributors or retailers. Inform buyers of their legal recourse if the warranty is not honored.

“Best” Applications for LED Lamps*

- **Depends** on level of lighting sophistication in the home.
- **Essential lighting services:**
  - **Indoors:** (safe mobility and good orientation; face-to-face communication; fine-motor tasks such as reading, preparing food & grooming; extended work and leisure hours; aesthetics of the home)
  - **Outdoors:** (sense of security; safe mobility and good orientation; wide-area communication; enhance use of space during dark hours.
- ***Linear LED** lamps may eventually be suitable, but for now linear fluorescent lamps have higher light output, higher efficacy and lower cost.

Applications for LED Lamps in Residences

- Consider the **occupants' needs** for lighting services, available LED features & each room's **average hours of lighting use.**
  - **Outdoors:** thresholds; outdoor security.
  - **Indoor**s: kitchen, ambient and task; stairwells; tasks (especially reading, assembly and other fine tasks).
  - **Outdoors and indoors:** Any directional lamp application where the lamp is close to the illuminated surface; or, where the lamp is operated 12 to 24 hours per day.
- **Controls reduce wasted hours of lighting energy.** Choose LED lamps that are compatible with:
  - Occupancy sensors
  - Dimmers
  - Timers

LEDs: Changing the Lighting Industry

- LED lighting is more like other **consumer electronics,** no longer the exclusive domain of lamp companies.
- Consumer electronics companies **don't know much about illumination,** but are invading the territory of lamp companies.
- Therefore, **lighting manufacturers must "get savvy"** about manufacturing and marketing consumer electronics.
- **"To do list":** update consumer psychographic profiles, put more emphasis on social marketing, increase direct and online sales, and, better understand how to communicate life-cycle costs and benefits.

LEDs: Changing the Lighting Industry

- **LED lamps will become far more efficient** (system-level), but will require a more integrated manufacturing community to deliver quality at reasonable cost.
- Eventually, **disposable lamps will disappear!**
- Instead, we will have dedicated **LED luminaires,** and, **LED lighting systems** that are embedded in building and furniture infrastructure.


Thank
You!

LEDs Quality and Efficiency: What Are the Challenges?

My Ton

ECO-Asia Clean Development & Climate Program

Asia-Pacific Economic Cooperation

Australian Government
Department of Climate Change and Energy Efficiency

PRESENTATION OVERVIEW

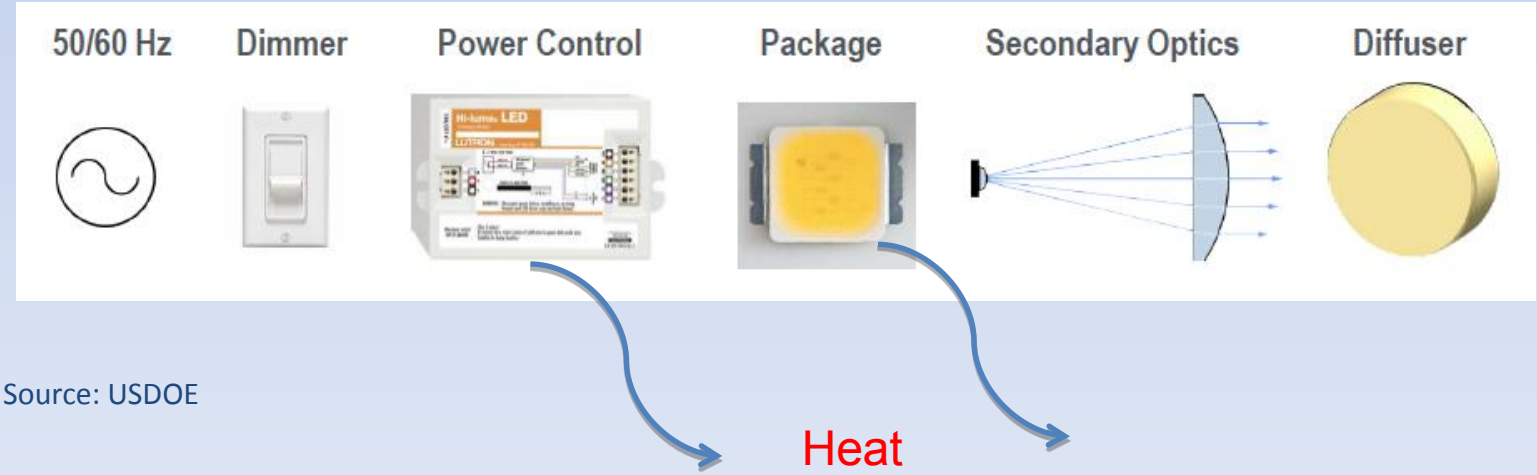
- The dimensions of LEDs challenges:
  - Industry: Technological, production, measurement
  - Consumers: Quality
- The way forward:
  - Standards
  - Regional Cooperation
  - Information

Industry challenges

- **Production:**
  - Ultra-high brightness (UHB) LEDs chips are are limited to expert-production manufacturing.
  - Much of the profit in the LED industry is in chip production, with much lower margins in the packaging and application stages.
  - LED chip production accounts for 70% of profits while LED chip packaging accounts for the remaining 30%.

Industry Challenges

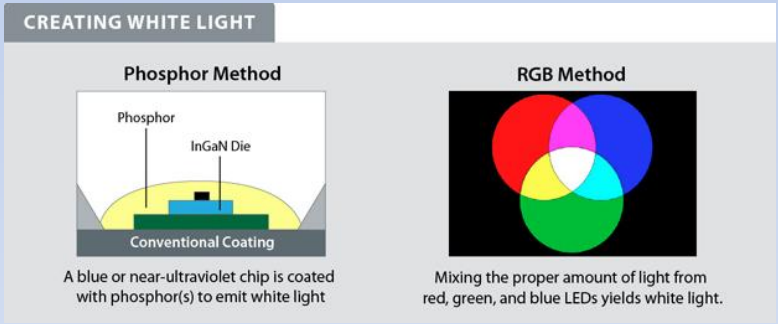
- **Technological**:
  - LEDs are directional – they are more ideally suited for fixtures than lamps.
  - LEDs require electronic "drivers" not unlike fluorescent ballasts.
  - High-power LEDs require good thermal management.



- Source: USDOE

Industry challenges

- **Measurement/Quantification of Performance:**
  - Measuring tools and metrics have not yet evolved to fully capture LED technology's unique features.
  - It is difficult to directly compare the characteristics of light from an LED source to a traditional source, and even to another LED source.



  - These present significant challenges when measuring and comparing LED performance against the performance of traditional light sources.

Industry challenges

- **Measurement/Quantification of Performance:**
  - CCT and CRI have been used for many years in describing conventional lighting, but they are not adequate for LEDs.
  - Two light sources with identical CCTs can render object colors very differently due to the differences in spectra.
  - CCT provides an indication of whether a light source may appear yellowish or bluish in color.
  - “Duv” is being used a supplemental metric to prevent excessively greenish or pinkish hues in LEDs.

INDUSTRY CHALLENGES

- **Measurement/Quantification of Performance:**
  - CRI has been found to be inaccurate for RGB (red, green, blue) LED systems.
  - CRI value is poor at predicting the quality of the appearance of saturated red objects, and doesn't correspond well to human perception of color quality.
  - The US National Institute of Standards and Technology (NIST) has developed a Color Quality Scale (CQS) that is intended to replace or supplement the current CRI.

Industry challenges

- **Performance and Efficiency:**
  - Currently, the most efficient white LEDs emit light in the 4500K to 6500K CCT range
  - LED light fixtures (luminaires) and lamps mix LEDs of various color temperatures to reach a target CCT by balancing the highest efficacy sources with warmer LEDs, which are less efficient.
  - The nominal CRI for neutral (4000K to 4500K) and cool white (5000K or higher) LEDs is typically 70 to 75 (CRI of 50 – 60 is adequate for street & outdoor lighting applications).
  - The leading high-efficiency LED manufacturers now claim a CRI of 80 for phosphor-converted, warm-white devices.

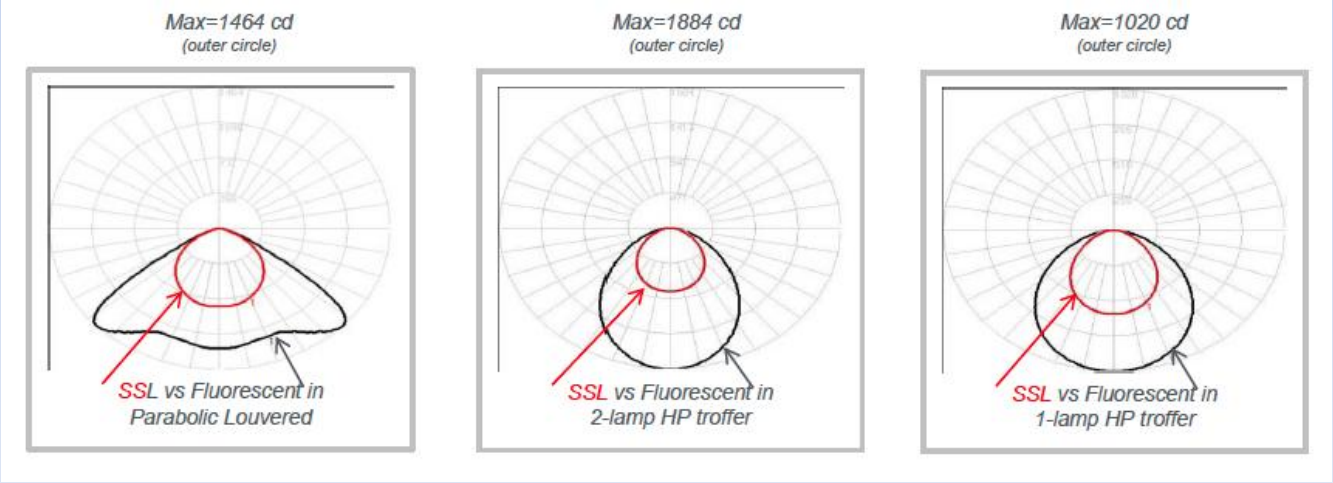
INDUSTRY CHALLENGES

- **Life and Reliability:**
  - LEDs don't "burn out," they get progressively dimmer over time.
  - LED rated life is based on the number of operating hours until the LED reaches 70 percent of its initial light output.
  - Good-quality white LEDs in well-designed fixtures and lamps are expected to have a useful life of about 30 000 hours.
  - A primary cause of LED failure is heat, which must be removed from the device by conduction or convection.

Consumer challenges

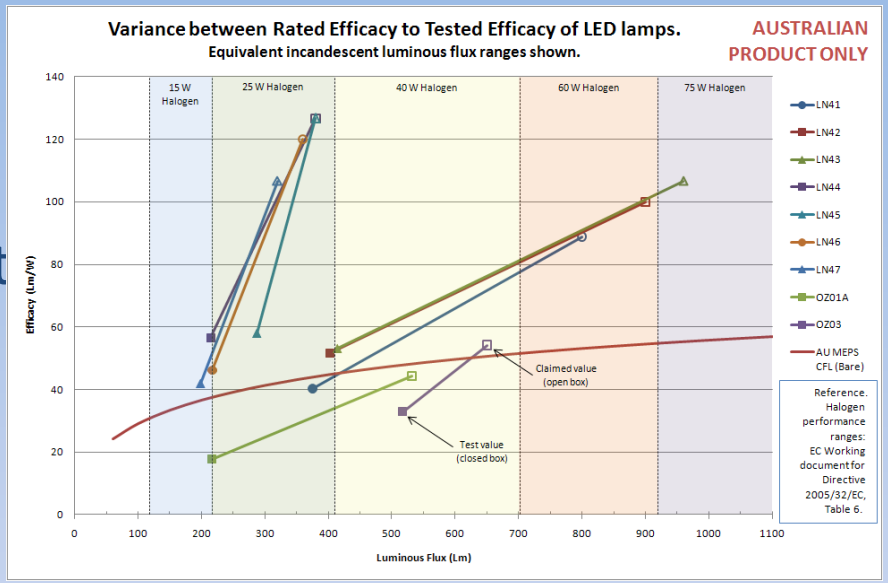
- **These challenges affect products in the market:**
  - Some products are not yet ready to compete with current technologies in the same category.

Manufacturer	CALiPER RL #	Likely to Meet Light Output Expectations	Likely to meet Color Quality Expectations	Likely to Meet Lifetime Expectations
1	1-A19	N	Y	Y
1	25-r30	–	N	Y
2	2-B10	N	N	N
2	19-r16	N	N	N
2	20-r16	–	N	–
2	24-r20	–	N	N
2	29-r30	N	N	N
3	3-A19	–	Y	–
3	4-A19 (LF)	N	N	–
3	6-B10	N	Y	–
3	7-C7	N	N	N
3	15-r16	–	N	N
3	16-r16	–	Y	–
3	17-r16	N	N	N
3	23-r20	–	N	–
4	5-A19	–	Y	Y
4	32-r30 (LF)	–	Y	Y

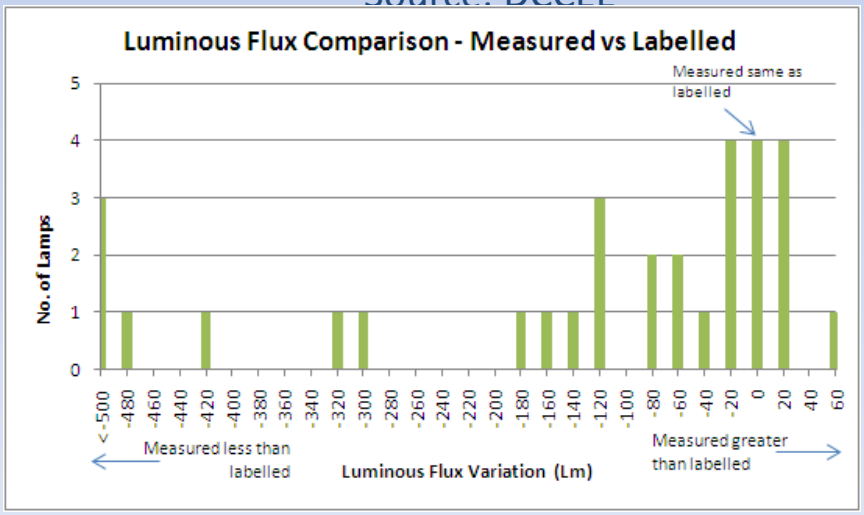


Consumer challenges

- **These challenges affect products in the market:**
  - Some products fail to meet manufacturers' performance claims.



- Source: DCCEE



The way forward

- Given the current situation with LEDs, policymakers need to address two critical areas:
  - Set standards for LED products.
  - Help users select quality, efficient products by providing useful information.

  Both of these areas require significant resources, and policymakers should consider regional cooperation.

SOME RECOMMENDATIONS

- **"Roadmap":** Policymakers should develop a "roadmap" for Asia based on LED industry development progress and potential impacts in order to streamline decision-making, maximize resources, and keep pace with the developments of the LED industry.
- **Harmonize:** A regional effort to harmonize standards and labeling for LEDs would help to speed up adoption of quality LEDs, reduce confusion, and send the right message to suppliers of quality LEDs in Asia.

Some recommendations

- **Emphasize quality:** An initial step for the would be to identify some common quality and performance characteristics for LEDs to ensure that minimum quality criteria like energy, light output, and lifetime performance would be uniform throughout the region.
- **Leverage regional institutions:** There are three regional initiatives that can serve as suitable vehicles for such a regional effort:
  - The Asia Lighting Compact
  - The Regional Center for Lighting
  - lites.asia.
    - *A coordinated effort from these organizations might foster uniform standards within the region*

The way forward

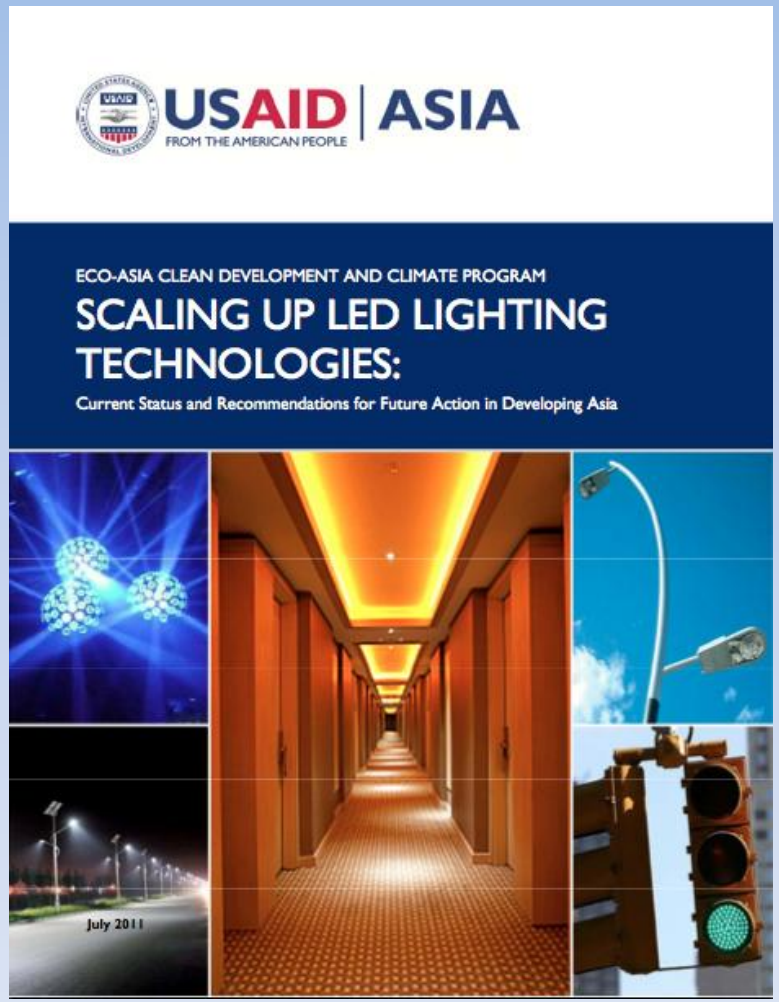
- **Policymakers and standards-setting agencies should focus on the following LED application areas:**
  - Area, parking, street, and/or outdoor lighting: These are high-duty applications and a high-interest area.
  - Traffic lights and transportation-related signals: These are also high-duty applications and can yield significant savings both in energy and maintenance costs.
  - Signage and architectural applications: These applications have been increasing in numbers.
  - Off-grid lighting applications: These have the potential to serve a large percentage of Asia not yet connected to the grid.

Some recommendations

- **Develop guidelines for municipalities**: Currently, many municipalities and agencies are in the throes of "LED-fever," which is sometimes the result of being misled by exaggerated and unverified claims of LED performance and quality. They need reliable information to help their procurement.
- **Develop guidelines (and labels) for consumers**: Consumers are also being misled by exaggerated and unverified claims. Standard guidelines and labels, as well as reliable selection guides should be developed to help consumers in making sound purchases. This would ensure consumer confidence in LED products in the long run.

THANK YOU!

www.cleanenergyasia.net



DISCUSSION:

What issues are governments and consumers facing with LEDs?

Session 2

Current Status of International LED Initiatives to Protect the Consumer

International Initiatives: Overview of Initiatives Underway

David Boughey

Asia-Pacific Economic Cooperation

Australian Government

Department of Climate Change and Energy Efficiency

International Response

- In recognition of the rapid emergence of LEDs as a viable efficient lighting alternative there are a range of initiatives being undertaken around the world.
  - International
  - Regional
  - National

International Electrotechnical Commission (IEC)

- Considering and developing standards for:
  - LED Modules - Safety specifications & Performance
  - Self Ballasted LED Lamps for GLS - Performance & Safety
  - Non-ballasted LED Lamps – Performance and Safety
  - LED lifetime prediction
  - LED Definitions
  - Also OLED and Tubular retrofit
- Technical Committee 34 - Lamps and Related Equipment
  - Follows on from ranges of performance and safety standards for incandescent and fluorescent lamps
  - More details in later presentation
  - Cooperation with CIE

International Commission on Illumination (CIE)

Worldwide cooperation and the exchange of information on all matters relating to the science and art of light and lighting, colour and vision, photobiology and image technology.

Division 3 - Interior Environment and Lighting Design

- Factors which influence the satisfaction of the occupants of a building with their environment, including the effects of both daylighting and electric lighting.
- Its objectives are to study and evaluate those factors to provide guidance on relevant design criteria, to study design techniques (including relevant calculations) for the interior lighting of buildings, to incorporate the findings and those of other CIE divisions into lighting guides for interiors in general or of particular types

International Commission on Illumination (CIE)

- TC 3-50: *Lighting Quality Measures for Interior Lighting with LED Lighting Systems*.
  - To review relevant CIE publications and standards to evaluate the suitability of existing lighting quality measures when applied to tertiary (commercial) interior light-emitting diode (LED) lighting systems.
  - To identify the gaps and weaknesses in existing quality measures, exhibited in one of two ways: either the criterion is valid, but the evaluation method is not (e.g., colour rendering) or a new criterion needs to be taken into consideration (e.g., overhead glare, binning).
  - To prepare a Technical Report, which will include the findings of the review and recommendations for new lighting quality measures and evaluation methods as well as suggestions for new research if appropriate quality measures and evaluation methods are missing.

International Energy Organisation (IEA) - 4E Solid State Lighting Annex

- Goal of the annex is to develop simple tools to help governments and consumers world-wide confidently identify which SSL lighting products have the necessary efficiencies and quality levels to quickly and effectively reduce the amount of energy that is currently consumed by artificial lighting.
  - Member Countries: Australia, Denmark, France, Japan, Sweden, The Netherlands, UK and the USA. Also technical participation by China.
  - 3 Task Groups:
    - 1. Quality Assurance Tools
    - 2. Protocols for SSL Performance and Campaign of Tests
    - 3. Lab Accreditation + Standardization
  - More information in later presentation

Global Lighting Forum (GLF)

- Forum of peak industry lighting organisations from around the world representing over 5,000 lighting manufacturers and US$50 billion annual sales. Established in 2007.
- Objectives:
  - liaising with stakeholders, including governments and international organisations, to ensure that the quality of LED products provide consumers with a good experience
  - assisting with international standards development and encouraging the harmonisation of standards in different regions of the world
  - producing educational material on solid state lighting, including the development of best practice guides and a guide to solid state lighting nomenclature
  - More information in later presentation.

Zhaga Consortium

- Consortium for the standardisation of LED Light Engines.
- Cooperation of independent companies.
- Aims to enable interchangeability between products made by diverse manufacturers.
- Covers physical dimensions, as well as the photometric, electrical and thermal behaviour of LED light engines.
- Benefit to consumers – standardization will prevent market fragmentation into incompatible products.

Other relevant International Organisations

- International Bureau of Weights & Measures (BIPM)
- International Laboratory Accreditation Schemes (ILAC, APLAC)
- Laboratory accreditation through national bodies.

Asia Regional Actions

- **Efficient Lighting Initiative (ELI)**
  - ELI is the Efficient Lighting Initiative, an international program for certifying the quality and efficiency of lighting products. It is operated by a non-profit organization, the ELI Quality Certification Institute, for the benefit of end users, policymakers, and lighting suppliers worldwide.
  - ELI is a “reach” standard for lighting efficiency in developing and transition economies. It provides an endorsement of the quality and efficiency of lighting products.
  - ELI voluntary technical specification for Self-Ballasted LED Lamps for General Lighting Services – from March 2011.
    - Lifetime, switching withstand, CCT, CRI, initial luminous flux, lumen maintenance, colour rendering stability, efficiency.
    - Labelling specifications including equivalency.

Asia Regional Actions

- **Asia Lighting Compact**
  - independent, non-profit organization dedicated to reducing greenhouse gas emissions by improving the quality of lighting products and encouraging the adoption of energy-efficient lighting in Asia.
  - works to reduce barriers to trade and mitigate climate change by harmonizing quality and energy-efficiency standards for lighting across the region. Membership includes national lighting associations in Asia, lighting manufacturers, and government agencies.

Asia Regional Actions cont'd

- **Asia Lighting Compact Cont'd**
  - Currently maintains a CFL product registry – using ALC 3 tiered performance standards.
  - 3 tiers ensure that minimum performance standards are observed while creating the opportunity for different adopters to opt for preferred performance standards that meet their specific needs
  - ALC has setup a LED committee that consists of members of various energy efficiency regulatory bodies within Asia. The ALC LED committee will identify the needs of their respective countries. While ALC will not work on creating new LED standards, ALC will chart and determine the most appropriate international initiatives that are relevant to Asia. The ALC LED specification and the ALC LED product registry are both works in progress.

Asia Regional Actions cont'd

- **lites.asia**
  - a regional network of lighting efficiency policy makers and regulators promoting regional cooperation on lighting energy efficiency issues
  - in particular to facilitate a greater involvement by Asian / APEC countries in the development of International Electrotechnical Commission (IEC) standards.
  - this should result in standards which are more appropriate for regional needs, thus enabling Asian / APEC countries to adopt IEC specifications with minimum local variations.
  - lites.asia aims to facilitate the phase-out of inefficient lighting and the move towards quality efficient lighting.
  - Established with support from Australian and US governments. Current ongoing support from Australian Government.

Asia Regional Actions cont'd

- **lites.asia cont'd**
  - Monitors lighting performance and quality related work by the IEC
  - facilitates participation by Asia region governments in IEC TC 34 activities
  - Participation to date by officials from Australia, China, India, Indonesia, Philippines, Sri Lanka, Thailand, Vietnam, Bangladesh, USA,
  - Now opening up to invite participation from Japan, Korea and Pacific Island countries.
  - Is discussing approaches to dealing with LED quality issues including consumer education, labelling, harmonised standards and cooperation on compliance.

National Standards

- Energy Star (USA) – for luminaires and integral lamps
- Energy Savings Trust (UK) – for LED Lamps and Modules
- European Commission LED Quality Charter
  - sets voluntary requirements for white LED lamps that can be used by governments, municipality, energy savings, utilities and other active parties to ensure the quality of LEDs on the market.

- China – technical standards for LEDs
- India – LED performance and safety specifications

- Standards can cover both efficiency and quality parameters
- National Standards can align with International Standards
  - Important in a global market.

Bringing things together

- LED lighting is a globally traded product
- All consumers are entitled to quality products that meet their needs and manufacturer claims
- Where possible harmonised performance standards can ensure that a broad range of products are available to consumers across a range of countries
- Minimum performance standards can help protect both the consumer and the reputation of LEDs as a quality, reliable efficient lighting product.

THANK YOU

The Global Voice of the Lighting Industry

Asia-Pacific Economic Cooperation

Australian Government

Department of Climate Change and Energy Efficiency

Who we are

- The Global Lighting Forum is a network of leading industry lighting organisations from around the world representing over 5,000 lighting manufacturers and US$50 billion annual sales.

GLF Objectives

- The Global Lamp Forum
  - shares knowledge of global trends and legislative developments and opportunities in lighting
  - shares information on the activities of individual associations
  - anticipates and initiates policies and actions on areas of common interest
  - seeks opportunities for communicating with government authorities and other stakeholders
  - provides governments with relevant product and market information

GLF priorities

- Network for industry information exchange
- Forum to develop joint industry positions
- Tool to communicate industry positions
- Accelerate the uptake of LED and OLED lighting solutions

GLF Solid State Lighting Objectives

- Promote the application of Solid State Lighting (LED & OLED) globally
- Communicate to stakeholders a realistic picture of the technology through global case studies
- Create and maintain a framework for distributing global information related to SSL applications, technology, standards and policies

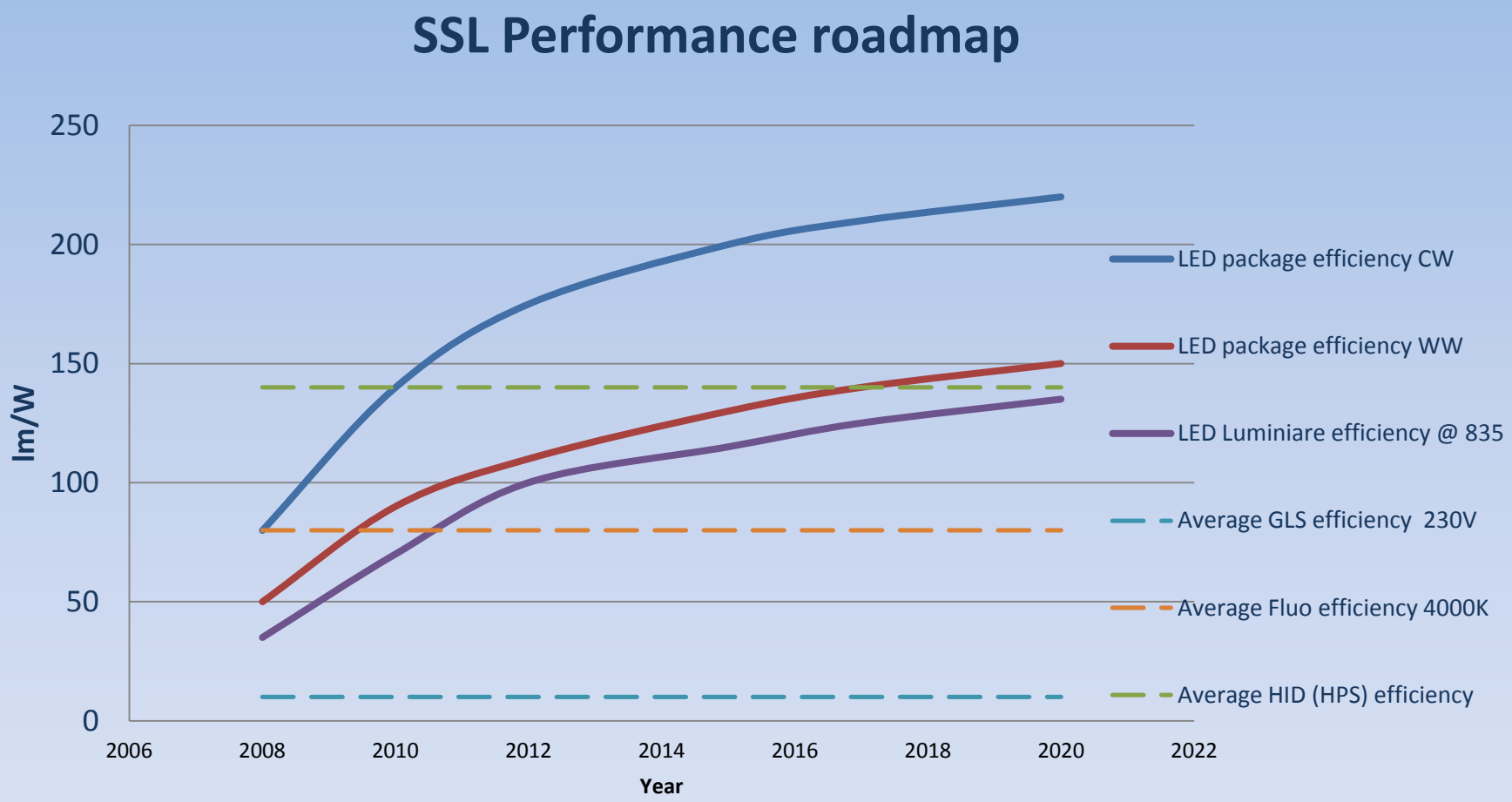
SSL Benefits

- The Energy Dimension
- The System Dimension
- The Environmental Dimension
- The Biological Dimension
- The Business Dimension
- The Design Dimension
- The Quality Dimension

The Energy Dimension

- Lighting is responsible for 18% of all electricity consumption in the built environment
- According to estimations made by DoE in the USA annual energy savings from solid-state lighting will be approximately 190 TWh
- This switch to LED can replace 24 (1.000 MW) power plants
- These savings would reduce greenhouse gas emissions by 31.4 million metric tons of carbon
- Total electricity consumption for lighting would decrease by roughly 25 percent (with an assumed market penetration of SSL <50%) relative to a scenario with no solid-state lighting in the market

The Energy Dimension



The Energy Dimension
Case Study from Japan

外観	防犯灯（現在）	全国設置台数（万台）※1	年間CO_2排出量（万t）※2
	水銀ランプ100W	150	27
	水銀ランプ40W 蛍光ランプ20W2灯用	150	11
	蛍光ランプ20W1灯用	700	26
	合計	1,000	64

外観	LED防犯灯	年間CO_2排出量（万t）※2	年間CO_2削減率（%）
	E-CORE LED防犯灯 （水銀ランプ100W相当）	8	70
	E-CORE LED防犯灯 （水銀ランプ40W相当）	4	64
	E-CORE LED防犯灯600 （蛍光ランプ20W相当）	9	65
	合計	21	67

Switching street light for pedestrian can save 67 % electricity
Annually CO_2 will be reduced 67 %,
Around 430 thousand ton CO_2 (in Japan only)

The System Dimension

- New **(ICT) opportunities** will result from a integrated systems approach.
- The use of **controls** like presence detection, daylight control etc. will be key to further reduce energy consumption but will also be applicable to the automation and cooperation of any system in relation to SSL lighting.
- Extension of **communication** and interaction between various control systems for improving or optimizing light quality thereby enhancing peoples life's in domestic, public as well as in road lighting (safety).
- **Innovation** platforms, standardization & new protocols will lead to high level **employment** & jobs in the industry.

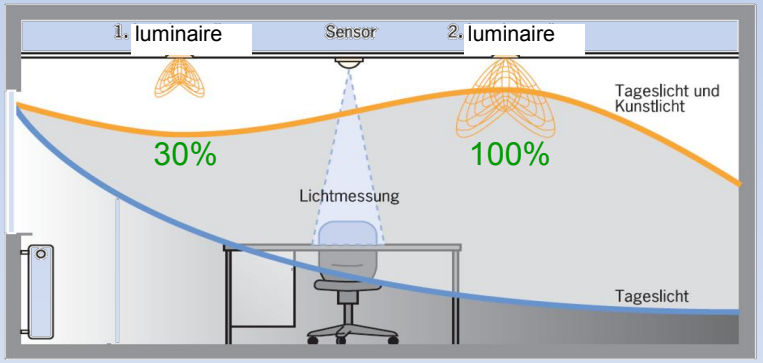
The System Dimension
Case Study USA – adaptive Street Lighting San José, Ca

The System Dimension

Lighting controls seems to be in the same condition as
electronic ballasts one decade ago.

… LED Solutions will be complimentary and value adding to this !

	Saving potential	Penetration indoor
Permanent (on-off)	0 %	**97 %**
Daylight linking	20-40 %	**< 8 %**
Presence detection	15-30 %	**< 8 %**
Time management	5-15 %	**< 4 %**
Constant illuminance level	10-25 %	**< 3 %**



The Environmental Dimension

- LED do not emit UV Radiation
- LED do protect biodiversity better than other lighting solutions
- LED do create less spill light

The Environmental Dimension

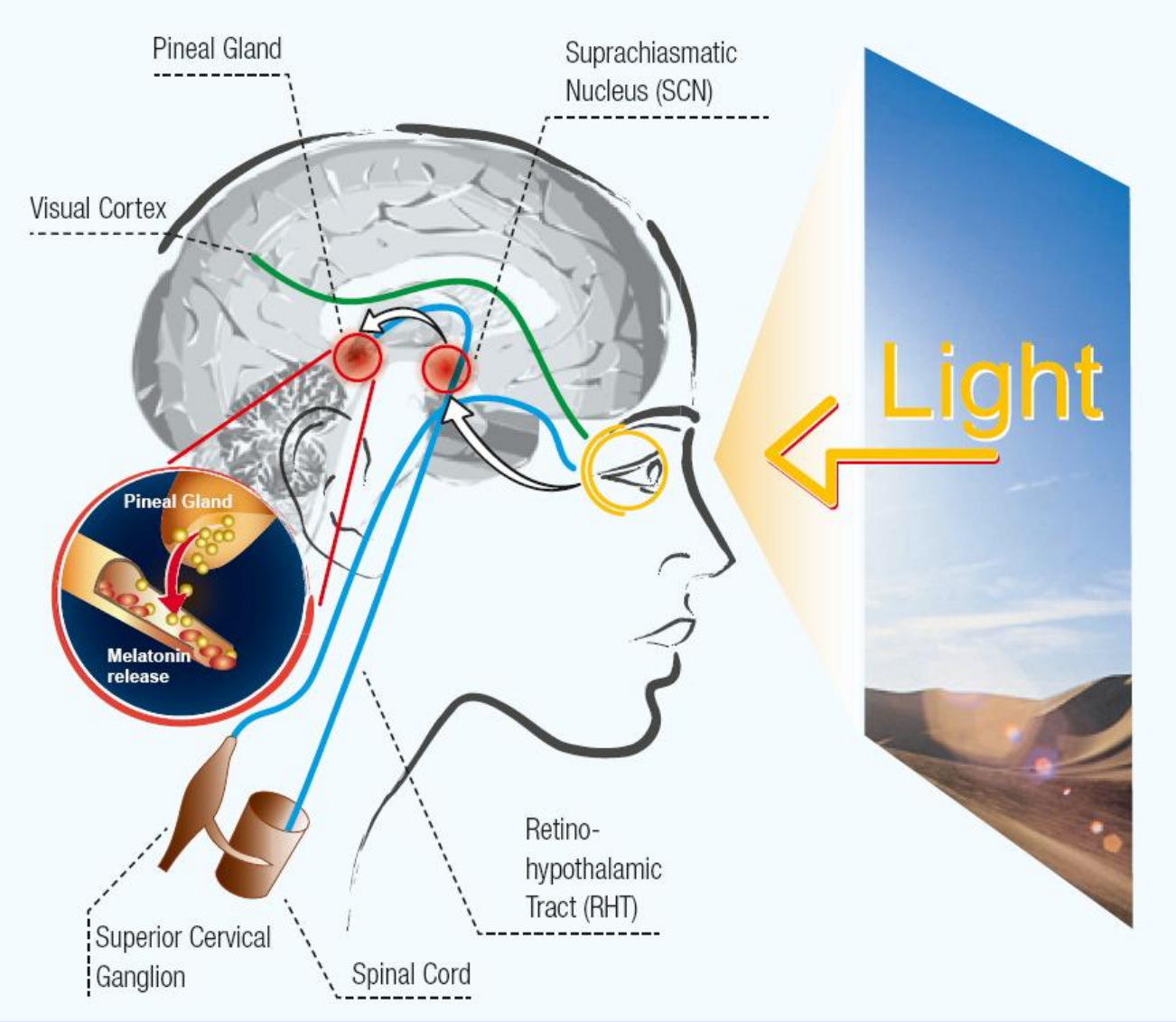
LED Street Light Assessment - City of San Francisco

The Biological Dimension

- **Biological effective** lighting is based on a recently identified receptor system in the human eye and its corresponding nervous pathway to the brain. This is influencing our hormonal system and sleep/wake cycle, alertness, cognition and in the end our **well being and health**.

- Artificial LED light optimized for the application can provide for better work & living conditions esp. for elderly people. It can also contribute to higher productivity at work places and educational facilities With these benefits, LED technology can strongly contribute to **manage demographic change**

The Biological Dimension



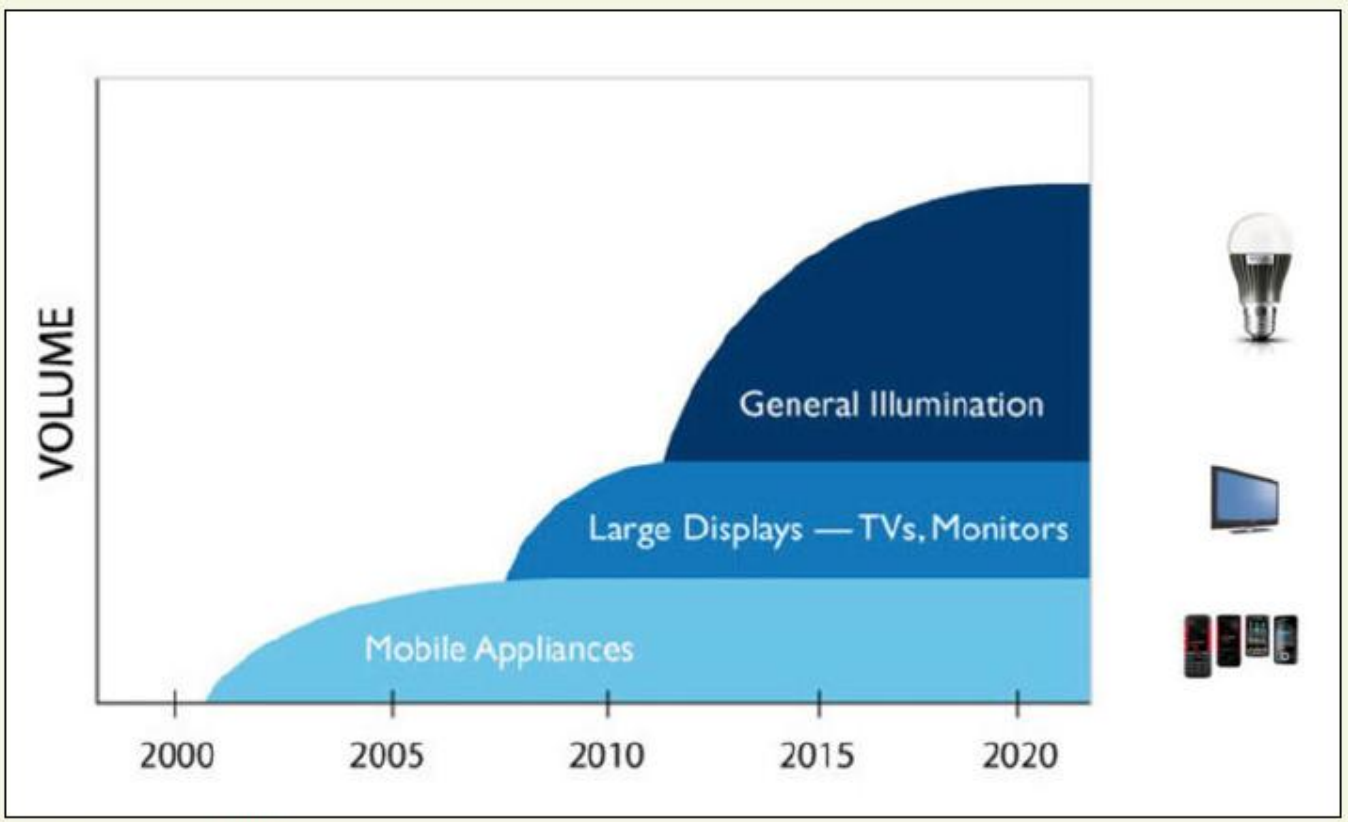
The Biological Dimension

- Wide distribution of light at ceiling and upper walls to effectively stimulate many receptor cells

The Business Dimension

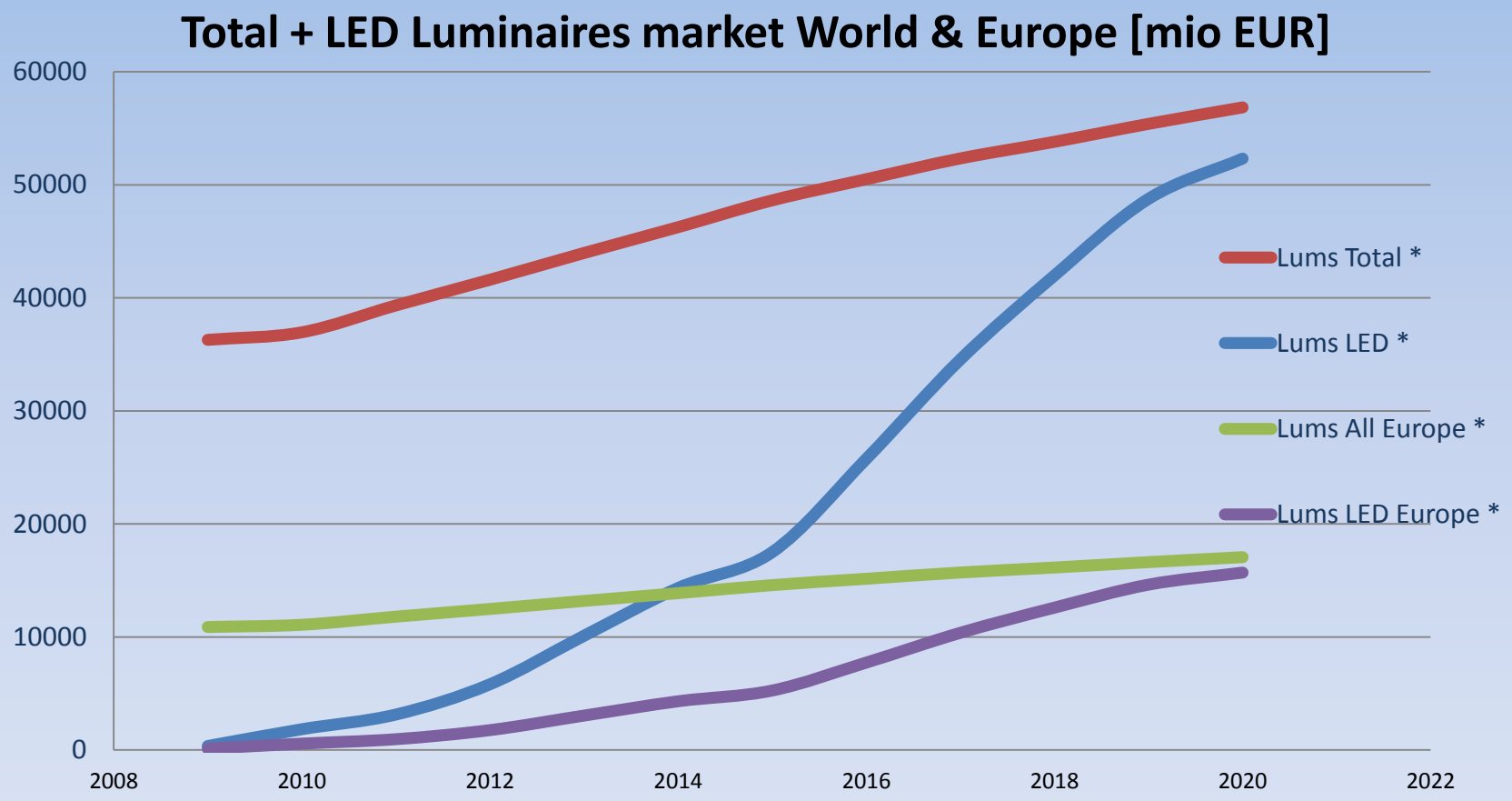
- The characteristics & benefits of LED lighting technology will lead to a **change in business models** in lighting.
- Lighting Services are expected to become highly value adding, leading to the need to deliver horizontally integrated solutions
- From recurrent revenues of replacement sales to revenues over life by energy savings, requiring new **innovative finance models** to appropriately accommodate lighting systems and services
- Intelligent & communicating systems will lead to **lighting system providers.**
- Tailor made solutions will become a **growth opportunity for many SME's** by taking up the possibilities the new LED technology offers to creative lighting design and cost savings.

The Business Dimension

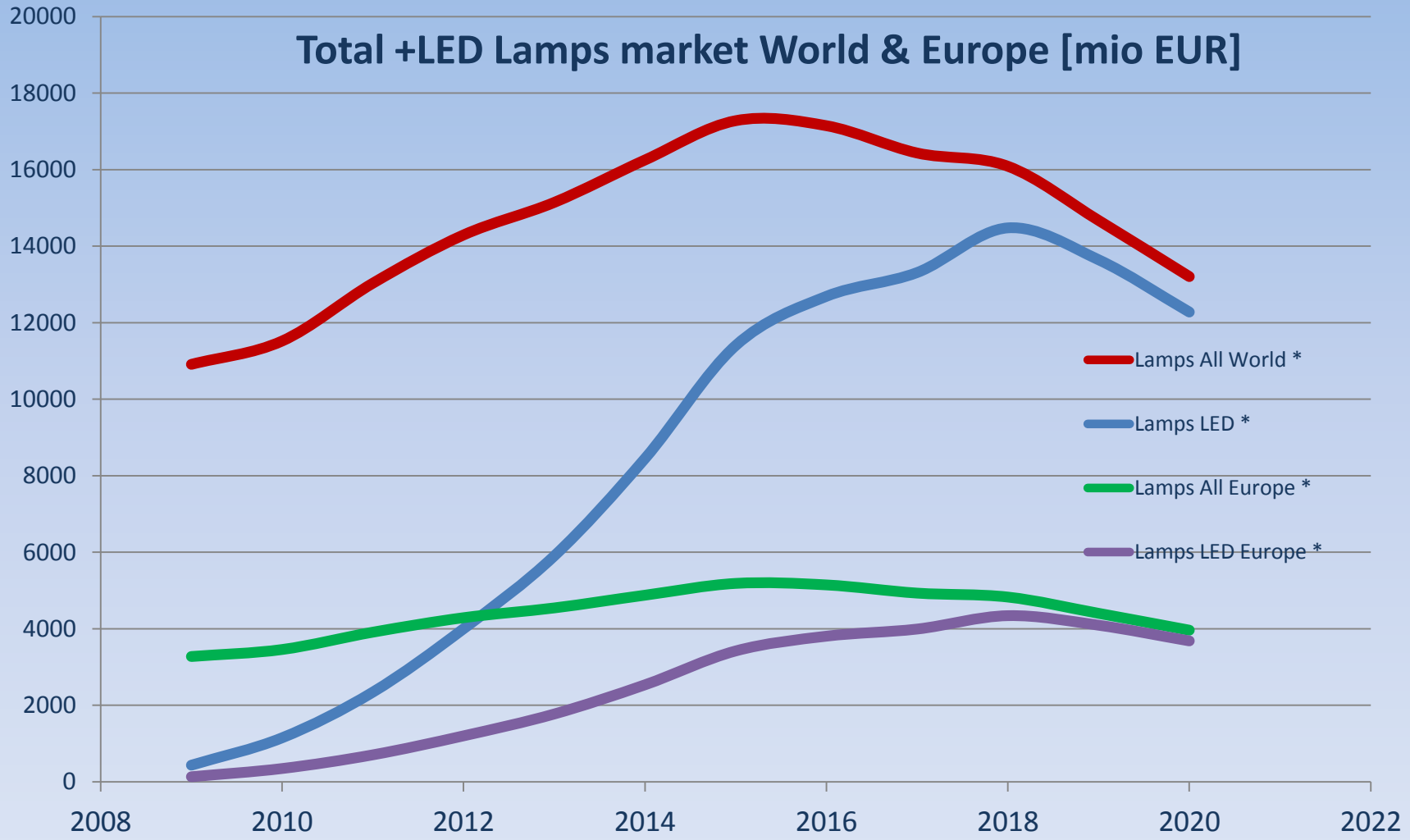


Graphic courtesy of Philips

The Business Dimension



The Business Dimension

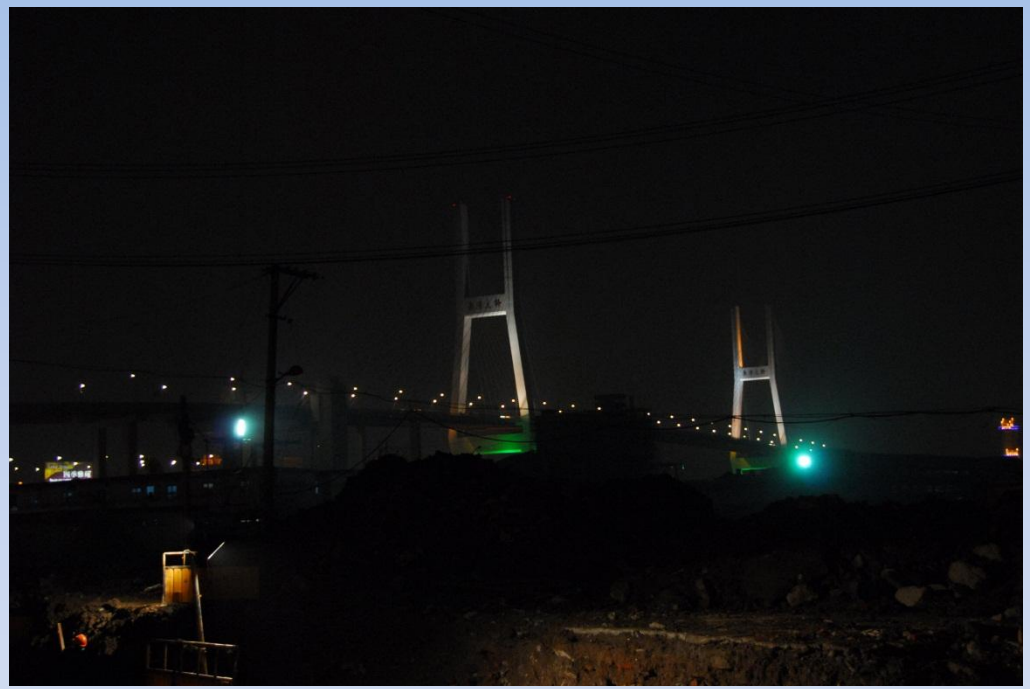


The Design Dimension

- Almost unlimited possibilities for creative lighting design
- Enhancing the feeling of safety in the built environment
- Redefine and re-invent lighting
- Make techno-aesthetics happen

The Design Dimension

The Design Dimension



Landscape lighting design of Nan Pu bridges at the Shanghai EXPO opening ceremony

The Quality Dimension

- New standards ensure that new LED products will be of high quality,
- Bridge the gap between expectations and the reality
- Good quality and high consumers' acceptance is the basis to achieve all dimensions of benefits

Conclusion

- Benefits over all other lighting technologies are unique, as only SSL combines all dimensions
- Highly environmentally friendly while not compromising on lighting quality
- A truly breakthrough technology in all aspects
- GLF is YOUR global platform to ensure successful deployment of Solid State Lighting

What‘s Next?

The Global Lighting Forum becomes the

Global Lighting Association

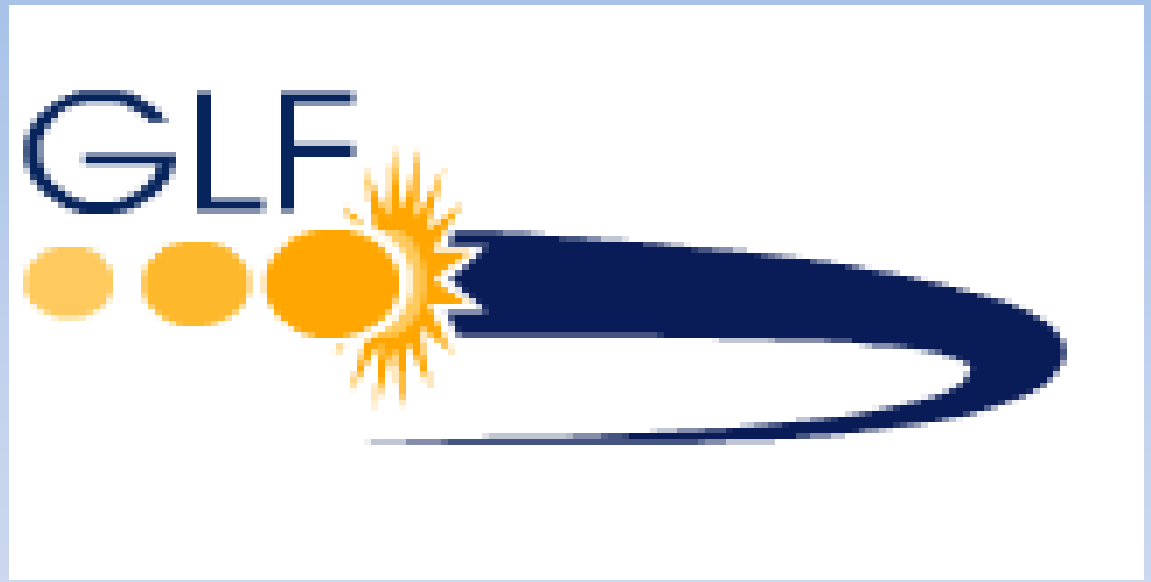
new identity,

new website,

new logo,

new activities

The Global Voice of Lighting



www.globallightingforum.org

info@globallightingforum.org

Session 2

Current Status of International LED Initiatives to Protect the Consumer Continued

ssl.iea-4e.org

INTERNATIONAL ENERGY AGENCY 4E SOLID-STATE LIGHTING ANNEX

MARC FONTOYNONT, OPERATING AGENT

SINGAPORE, NOVEMBER 1-2, 2011

Asia-Pacific Economic Cooperation

Australian Government

Department of Climate Change and Energy Efficiency

THE SSL ANNEX 2010-2014

- Preparatory document: France, USA, Japan
- 8 Funding countries:
  - France, Australia, The Netherlands, United Kingdom, Sweden, Denmark, Japan, USA
- Others member countries welcome

THE SSL ANNEX 2010-2014

Goal: to provide governments with the tools to assess the performance of SSL, inform energy-efficient lighting policies and harmonize test procedures and laboratory accreditation to increase confidence in Solid State Lighting.

- Definition of key performance characteristics
- Suite of minimum performance levels
- International specification for LED replacement lamp equivalency claims
- Test methods for testing performance characteristics
- Coordinate international accreditation of test labs

Management Committee (MC)

- The MC is comprised of delegated representatives of the **funding governments**
- Tasks:
  - Set the priorities for the SSL annex
  - Approve the timeline and budget
  - Validate and approve the results of the SSL annex expert group

Management Committee (MC)

Australia	Melanie Slade (David Boughey)
Denmark	Ture Hammar (Casper Kofod)
France	Bruno Lafitte
Japan	Masanori Sasaki (Norihiko Ozaki)
Netherlands	Daniel Bos
Sweden (*Chair*)	Peter Bennich
UK	Iain Notman
USA	Richard Karney

Participating Experts

United Kingdom
The Netherlands
Denmark

Sweden
Australia
France

China
Japan
USA

SSL Annex: Three main tasks

- Task 1: Develop SSL Quality Assurance
  - Create performance tiers, address equivalency claims
  - Collect data on Life Cycle Assessment, Health issues
- Task 2: SSL Testing
  - Harmonize testing protocols (CIE, IEC, ANSI, etc.)
  - Round Robin #1 to calibrate 4 Nucleus laboratories
  - Round Robin #2 to calibrate participating laboratories
  - Propose proficiency testing procedure for accreditation
- Task 3: Harmonize International Accreditation

Task 1: Quality Assurance

- Minimum Performance requirements for 4 product categories (released for comment November 1, 2011)

Non-directional Lamps

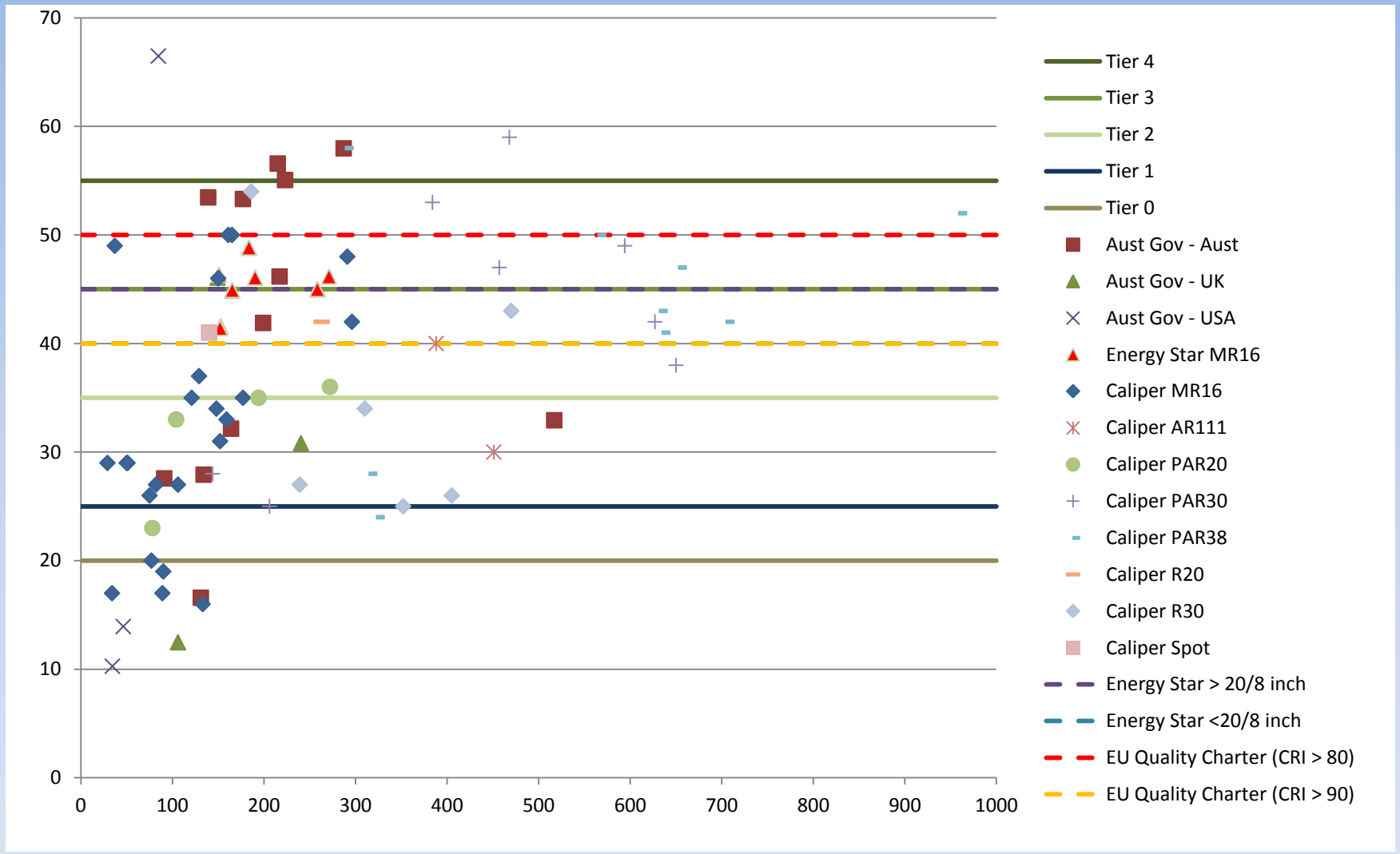
Directional Lamps

Downlight Fixtures

LED Linear Fluorescent replacement lamps

Defining Performance Tiers

- **Tier 0:** Minimum Acceptable Performance for Off-Grid Applications
- **Tier 1** Minimum Acceptable Performance for Grid-Connected Applications
- **Tier 2** Performance Required by Established Quality Programs
- **Tier 3** Current Highest Commercially Available Performance
- *Philosophy: health aspects non negotiable, SSL performance higher that product they replace.*


70
60
50
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100
200
300
400
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600
700
800
900
1000
Tier 4
Tier 3
Tier 2
Tier 1
Tier 0
Aust Gov - Aust
Aust Gov - UK
Aust Gov - USA
Energy Star MR16
Caliper MR16
Caliper AR111
Caliper PAR20
Caliper PAR30
Caliper PAR38
Caliper R20
Caliper R30
Caliper Spot
Energy Star > 20/8 inch
Energy Star <20/8 inch
EU Quality Charter (CRI > 80)
EU Quality Charter (CRI > 90)

Performance Tiers

4E Efficient Electrical End-Use Equipment
International Energy Agency

Solid State Lighting Annex 2010-2014

Participating Countries:
Australia, China, Denmark, France, Japan, The Netherlands, Sweden, The United Kingdom, The United States of America

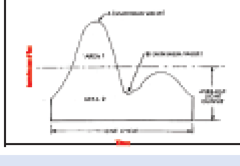
Comments on these Performance Tiers should be submitted in writing to: ssl.annex@gmail.com by February 1, 2012.

Date: November 1, 2011
Status: For Public Release
Author: IEA 4E SSL Annex

Lamp type	Non-directional lamp for indoor residential applications

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	CRI	[illegible]	Lumen Maintenance	Minimum Rated Lamp Life	Flicker	[illegible]	[illegible]	Dimmer compatibility	[illegible]	[illegible]	Warranty	RoHS Compliant	Recyclability	Rapid Cycling
Tier 0	N/A: a large number of these products will be used in off grid applications where light has never been used before. Equivalency in these applications has no meaning.	50 lm/W	N/A		N/A	N/A	N/A	N/A	At 5,000h Lumen Maintenance >70% of initial	At 5,000h, 50% of population will be operative	At full power (no dimming), percent flicker [illegible] ≤ 10%	Current Crest Factor [illegible] ≤ 3	N/A	N/A	Complies with IEC62471-2	[illegible]	Minimum 1 year warranty against catastrophic failure unless regional requirement is higher	Yes	Yes, following electronic component process	Product will survive rapid cycle for every hour of rated life.
Tier 1	[illegible]	[illegible]	Follow ANSI C78.377, excluding flexible CCT	[illegible]	<0.007	N/A	≥70	[illegible]	At 15,000h, Lumen Maintenance >70% of initial	At 15,000h, 50% of population will be operative.	[illegible]	[illegible]	[illegible]	[illegible]	Complies with IEC62471-2	[illegible]	Minimum 1 year warranty against catastrophic failure unless regional requirement is higher	Yes	Yes, following electronic component process	Product will survive rapid cycle for every hour of rated life.
Tier 2	[illegible]	[illegible]	Follow ANSI C78.377, excluding flexible CCT	[illegible]	<0.007	[illegible]	[illegible]	[illegible]	At 25,000h, Lumen Maintenance >70% of initial	At 25,000h, 50% of population will be operative.	[illegible]	[illegible]	[illegible]	[illegible]	Complies with IEC62471-2	[illegible]	Minimum 1 year warranty against catastrophic failure unless regional requirement is higher	Yes	Yes, following electronic component process	Product will survive rapid cycle for every hour of rated life.
Tier 3	[illegible]	[illegible]	[illegible]	[illegible]	<0.006	[illegible]	[illegible]	[illegible]	At 35,000h, Lumen Maintenance >70% of initial	At 35,000h, 50% of population will be operative.	[illegible]	[illegible]	[illegible]	[illegible]	Complies with IEC62471-2	[illegible]	Minimum 2 year warranty against catastrophic failure unless regional requirement is higher	Yes	[illegible]	Product will survive rapid cycle for every hour of rated life.

[illegible]



Life Cycle Assessment

- Greatest impact of lamp technology is related to luminous efficacy of system (energy, CO2)
- LED non-directional lamps are not better than CFL lamps
- LED directional lamps are better than Halogen
- Minimum lamp life guarantees benefits

Proposal of extended summary on public Web Site (Issues for governments)

- Specify minimum luminous efficacy and product lifetime if compared with fluorescent lamps
- Specify minimum efficacy and possible lower lifetime if compared with halogen lamps

Health aspects

- Photo-biological safety standard should be revised for LEDs
- The standard doesn’t take into account how lamps and lamp systems are really used
- Susceptible populations: children, ARMD patients, pseudo-physic, etc.
- Stroboscopic effects, EMF, circadian rhythms: poorly studied
- No labeling/marking

Health aspects

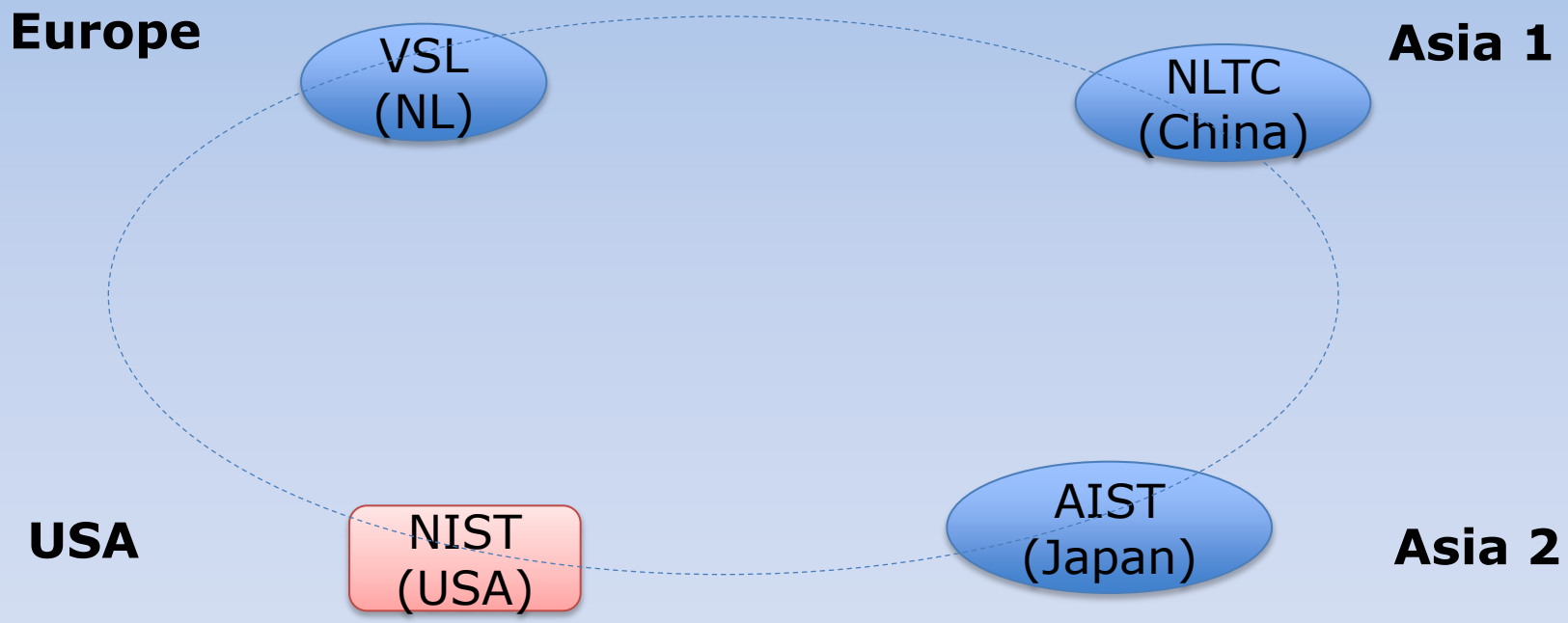
- Proposal of extended **summary on public** Web Site (Issues for governments):
  - Refer to risk categories, compare with other technologies, suggest approach for testing procedures.
  - Introduce photo-biological safety requirements for all lighting systems
  - Consumer market allow only LED products in Risk Group 1
  - LEDs in Risk Groups ≥ 2 restrict to professional use only
  - Prevent direct viewing of naked LED beams at distance *< X m*
  - Avoid using cold white and blue light in places frequented by children

Task 2: SSL Testing

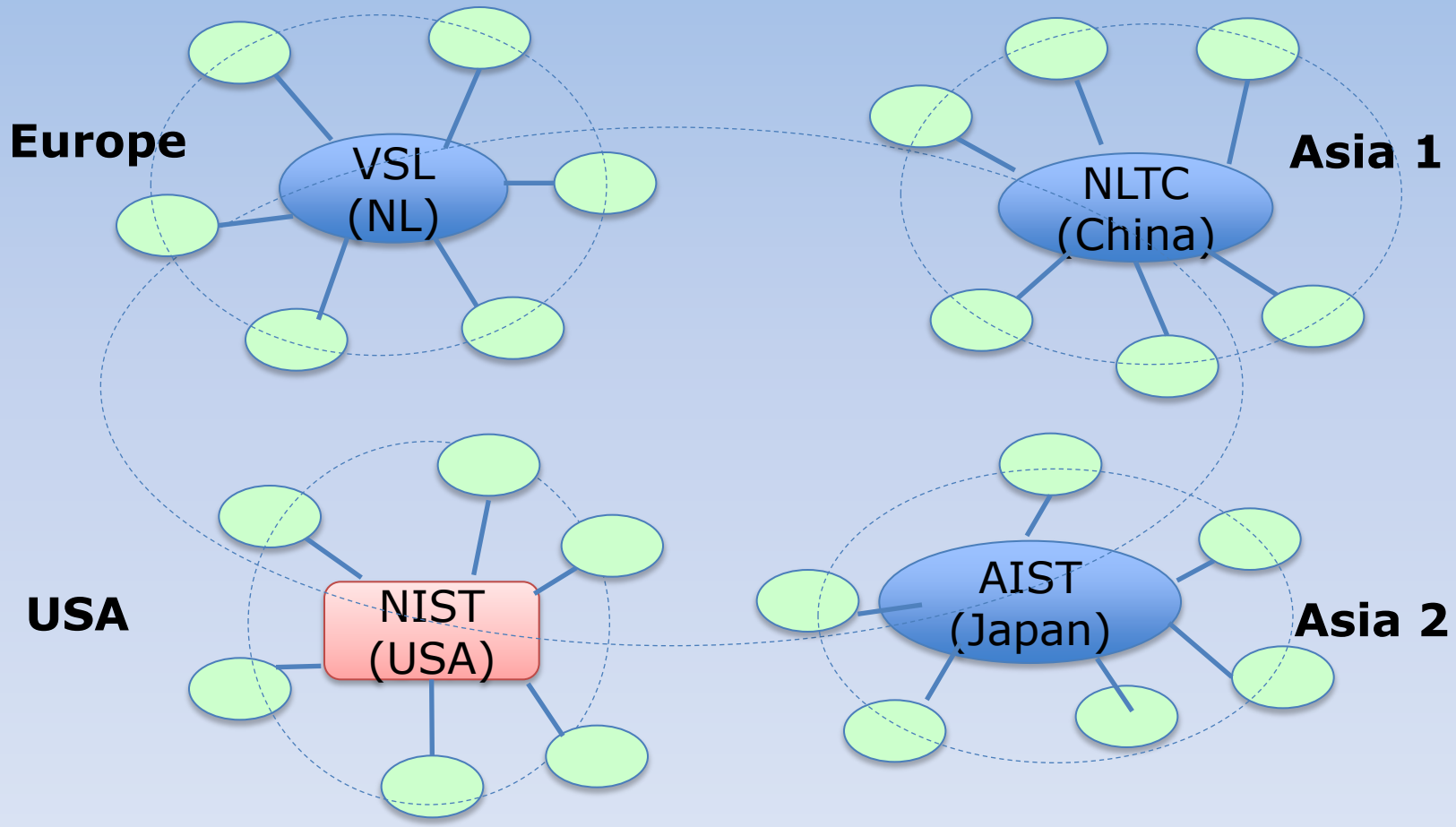
- Harmonize testing protocols (CIE, IEC, ANSI, etc.), suggest improvement
- Round Robin#1 will cross-calibrate 4 Nucleus laboratories
- Round Robin#2 will verify proficiency of participating laboratories
- Propose proficiency testing procedure for accreditation bodies

Tasuya Zama (AIST, JPN)
Wouter Koek (VSL, NL)
Qian Liu/ Hua Shuming (NLTC, China)
Yoshi Ohno (NIST, USA)

Round Robin 1: Calibrating Nucleus labs



Round Robin 2: Calibrating SSL labs



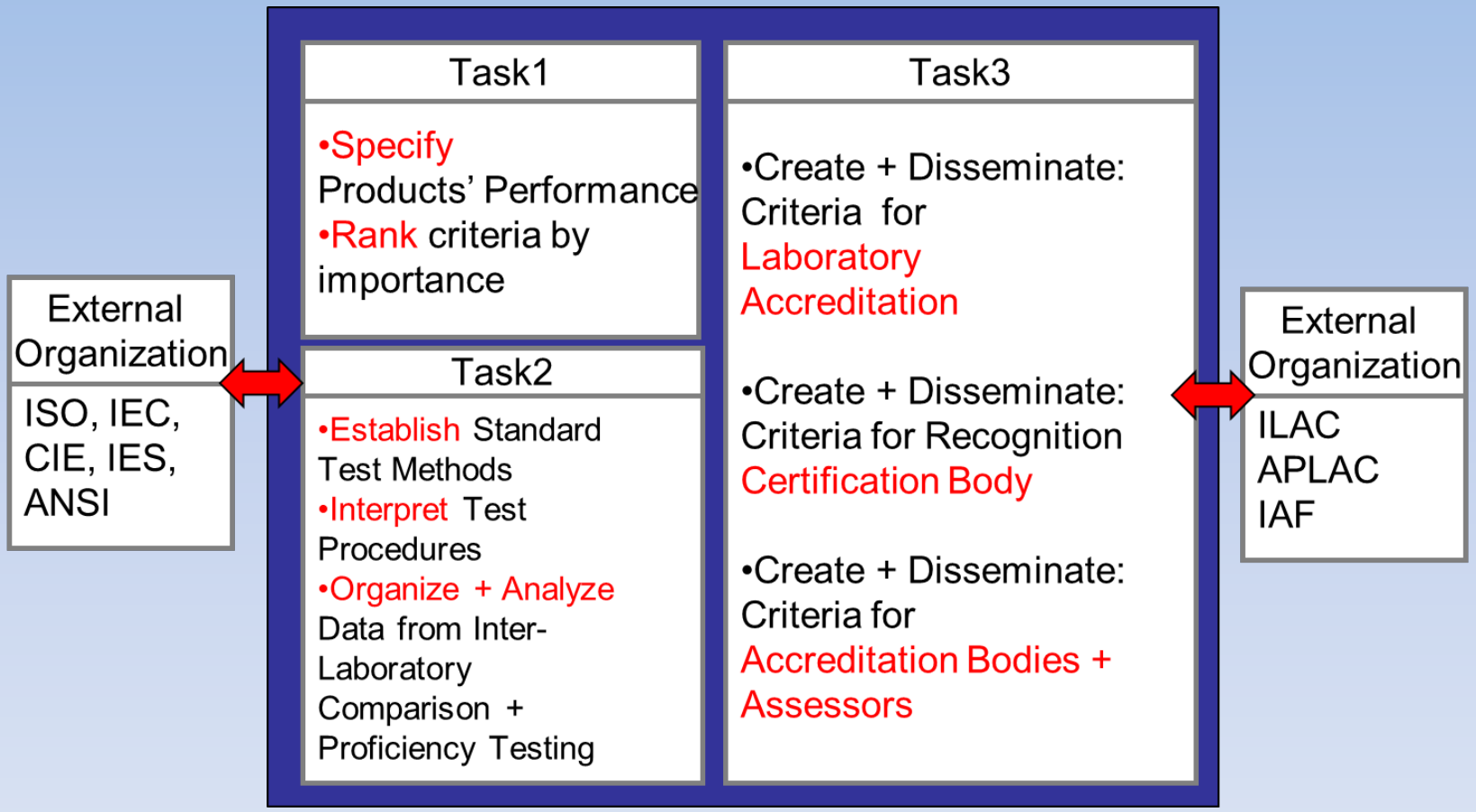
Round Robin #1

- **6 lamps test labs' ability to competently test SSL**
  - Philips lamp: measure remote phosphor products
  - LSI-G25 lamp: measure current waveform with large THD
  - CREE LR6: measure active feedback
  - Sylvania PAR20 : measure directional lamp
  - LED DC Linear replacement lamp: Measure high CCT
  - Incandescent standard lamp compares fundamental laboratory photometric measurement quality

Testing procedures

- Photometric measurements:
  - Improve and transform IES-LM-79 into a new CIE international standard method of measurement.
  - CIE Technical Committee 2.71, chaired by Dr. Yoshi Ohno, has 30 international members. It is expected to propose the standard in 2012.
  - Link with CEN TC169WG9 established
- Lumen maintenance and lifetime:
  - Work with IEC TC 34, transfer experience of IES-LM-80 and IES-TM-21.
- Photometric performance as a function of temperature:
  - IES LM 82, (IEC TC) published in 2012?

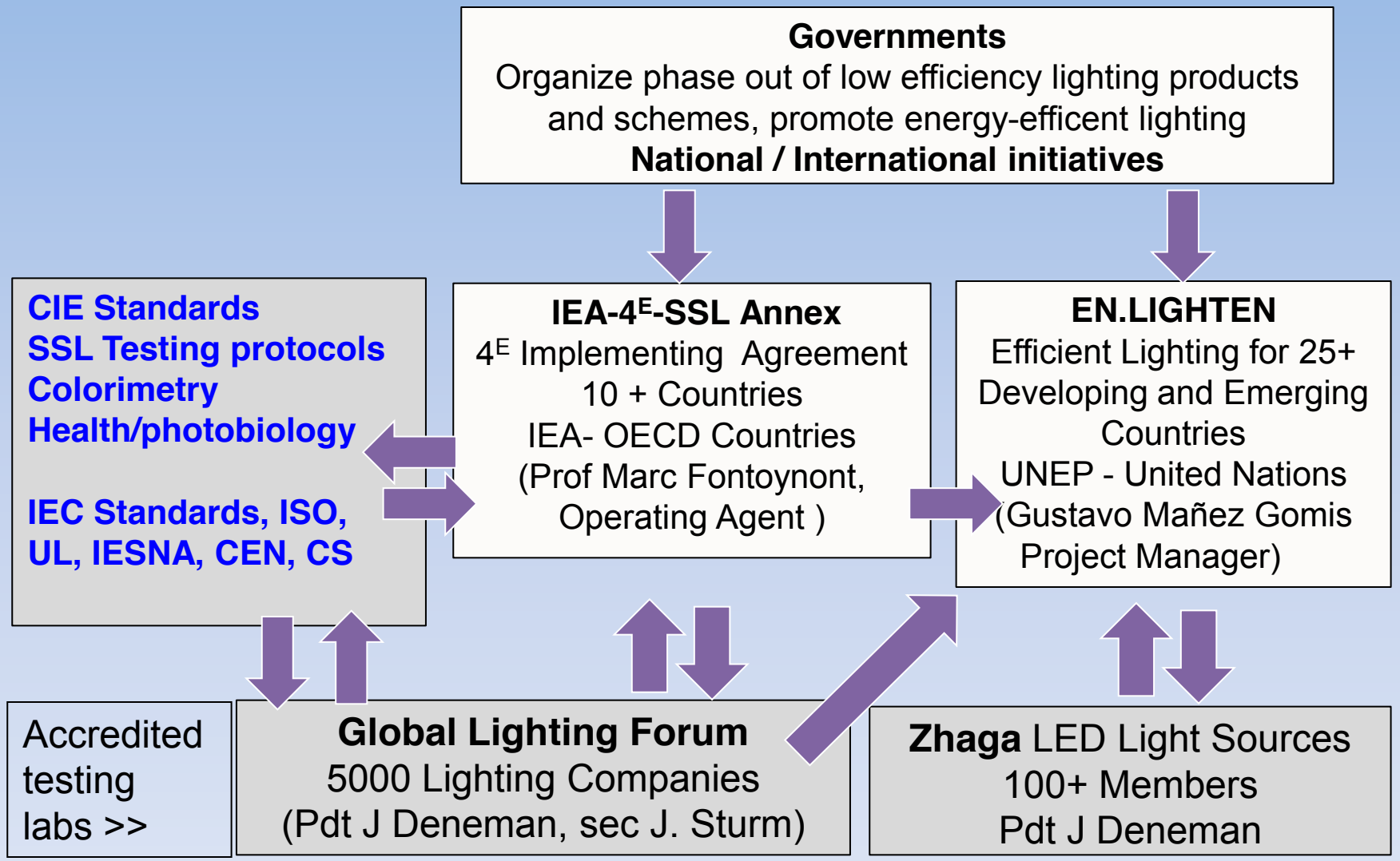
TASK 2+3 LINKS WITH LABS /ACCREDITATION ORGS



Task 3: Standards for Testing Reliability

- Propose proficiency test procedure, based on the procedure used in IEA-4E-SSL Annex Round Robin Campaign #2.
- Approach global accreditation organizations to determine if they will recognize Round Robin2 as valid Proficiency Testing.

Linking Initiatives



Interest Matrix

Manufacturer Interest	IEA 4E SSL Annex	National/International Initiatives
GLF (5000 + mnfrs) Zhaga (100+ mnfrs) Performance Standards Orgs: IEC, ANSI, ISO, UL etc.	Task 1: Performance	National EE Programs SEAD/CLASP en.lighten (UNEP) lites.asia APEC
Manufacturer /Third Party Labs Measurement Standards Orgs: IES, CIE, ANSI/UL etc.	Task 2: Testing	National Metrology Labs National Market Surveillance Programs
Manufacturer /Third Party Labs Independent Accreditation Bodies	Task 3: Accreditation	National/International Accreditation Organizations National Market Surveillance Programs National Metrology Labs

Thank you!

http://ssl.iea-4e.org/

- Contact:
  - Marc Fontoynont, Operating Agent
  - mrf.lights@gmail.com

  - Ku’uipo Curry, Program Associate
  - kuuipocurry@gmail.com

DISCUSSION:

Tiers of Performance??

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

Update on the Asia-Pacific Regional Centre

Damien Lee

Technical Officer

IEC Asia-Pacific Regional Centre

APEC
Asia-Pacific
Economic Cooperation

Australian Government
Department of Climate Change
and Energy Efficiency

Opening

- 21 February 2002
- Resource for members and affiliates
- Link to Central Office and IEC TC/SC Experts

IEC-APRC mission

- Promote awareness of IEC in the region
- Increase use of IEC International Standards
- Enhance participation of all countries in the region in the Commission's work
- All of the above will be achieved by improved communications with businesses, industries and governments in the region

Key activities

- Promotional
  - Participation in Regional Groups/Events
  - Information Sessions and Training Activities
  - Venue for AC/AG/WG/MT meetings
- Technical
  - Support to 57 TCs/SCs (from 6 TCs/SCs in 2006)

Participation in regional fora / events

- Promoting awareness
- Increase use of IEC International Standards and Conformity Assessment Systems

- ✓ ASEAN Consultative Committee on Standards and Quality Meeting, 14-18 Mar 2011, Siem Reap
- ✓ PASC 34 Meeting, 30 Mar-2 Apr 2011, Bangkok
- ✓ APEC JRAC EEE Meeting, 23-26 May 2011, Chicago
- ✓ ASEAN Railways CEO Conference/(UIC/RTRI Session), 20 Oct 2011, KL

Information Sessions and Training activities

- Enhance participation
- Directives and procedures for experts as well as new TC/SC Officers
- IT tools

- ✓ ISO/IEC Adoption and referencing IS Workshop, 9-11 Feb 2011, Singapore
- ✓ Dialogue with Lao PDR Stakeholders, 11 Mar 2011, Vientiane and dialogue with Institute of Cambodian Standards,16 Mar 2011, Siem Reap
- ✓ IECEx dialogue, 5 Apr 2011, Bangkok
- ✓ IEC/TC 49 Seminar, 16-17 Nov 2011, IEC-APRC
- ✓ JISC/IEC/APSG HRD Seminar, 6-7 Dec 2011, Manila

Hosting of meetings - 2011

- Hosting of IECQ Meeting, IEC-APRC, 4-8 Apr 2011
- Hosting of TC 26 WG Meeting, IEC-APRC, Apr 2011
- Hosting of ACEC Meeting, June 2011
- Hosting of IEC/TC 61 Edcom Meeting, June 2011
- Hosting of IEC/TC 49 Seminar, Nov 2011
- Year round training of new TC/SC Officers

Staff strength

- Regional Director
- 2 Technical Officers
- 2 Administrative Assistants
- 1 Technical Editor

Contact in the Asia-Pacific region

- Your resource in the region for the region:

IEC Asia-Pacific Regional Centre
(IEC-APRC)
Email : dch@iec.ch
Tel: +65 6377 5173
Fax: +65 6278 7573
Address: 2 Bukit Merah Central #15-04/05
SINGAPORE 159835
Visit us at Web : www.iec.ch

THANK YOU.

dle@iec.ch

www.iec.ch

Apples & Pears: *why standardisation of performance requirements for LED luminaires is important.*

Singapore 1-2 November

Kay Rauwerdink – Philips Lighting

Asia-Pacific Economic Cooperation

Australian Government

Department of Climate Change and Energy Efficiency

Agenda

1. Introduction
2. Apples & Pears
3. Quality criteria initial & maintained
4. Quality criteria over time
5. Take away

Standards & Regulations

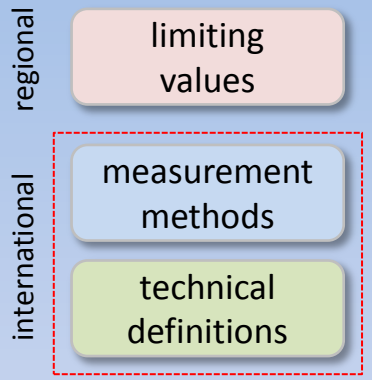
product standards
- product safety;
- product performance.




application norms
- lighting requirements;
- limiting performance values.


governmental regulations
- efficiency targets & timelines;
- product & application related.

Standards & Regulations



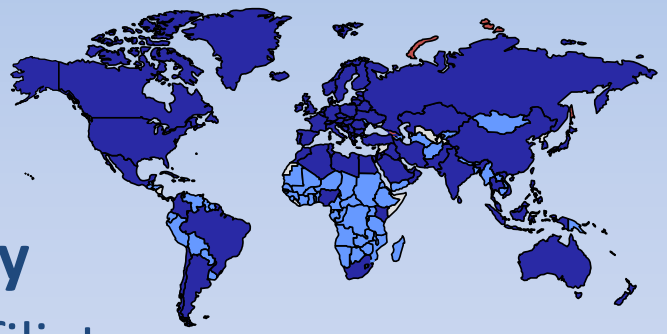
type	technical definitions	measurement methods	limiting values
product standards	yes	yes	safety
application norms	yes	yes	sometimes
regulations	by reference	by reference	yes

- **all standards are voluntary – till there is a legislative reference!**

IEC International Standards

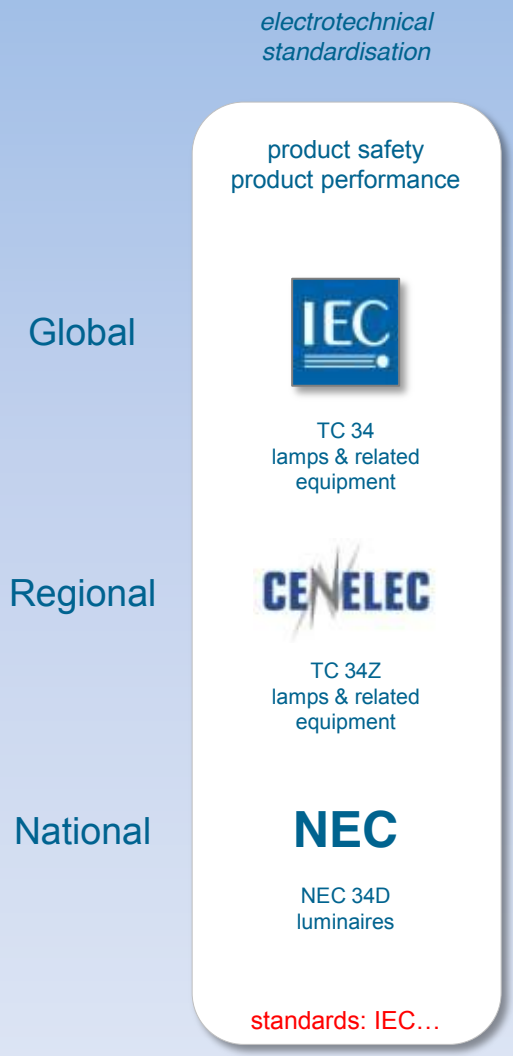
INTERNATIONAL ELECTROTECHNICAL COMMISSION

- **international standards**
  - consensus-based;
  - one vote per country;
  - best experience & experts.



- **whole world of electro technology**
  - 163 countries: 81 members - 82 affiliates.
- **TC34: lighting products & accessories**
  - product safety;
  - product performance.

TC 34 IEC International Standards For Lighting



BIS ET24
SAC/TCC224
JISC TC24
AS/NZS EL034

IEC TC34

Experts nominated by National Standards Committees from those countries around the globe who are members of IEC.

Maintenance Teams

34A: PRESCO – lamps
34B: EPC – components
34C: COMEX – control gear
34D: LUMEX – luminaires (40 members)

Preparation Panels

e.g. PAP – luminaires (8 members)

TC 34 IEC International Standards For Lighting

Public Available Specification (PAS)

1) Draft for Comment (DC) ➔ information document;
2) Public Available Specification (PAS) ➔ result of vote;
3) Published IEC/PAS.

International Standard

1) New work item Proposal (NP) ➔ vote;
2) Committee Draft (CD) ➔ comments;
3) Committee Draft for Vote (CDV) ➔ result of voting and comments;
4) Final Draft International Standard (FDIS) ➔ result voting document;
5) Published IEC International Standard.

Work In Progress

1) IEC TS 62405: definitions (in liaison with CIE);
2) IEC 62663-1: non-ballasted LED lamps – safety requirements;
3) IEC 62663-2: non-ballasted LED lamps – performance requirements;
4) IEC xxxxx: LED lifetime (lumen maintenance) prediction;
5) IEC xxxxx: LED double ended retrofit / conversion fluorescent lamps;
6) IEC 62471 / 62471-2: Photobiological Safety.

new work

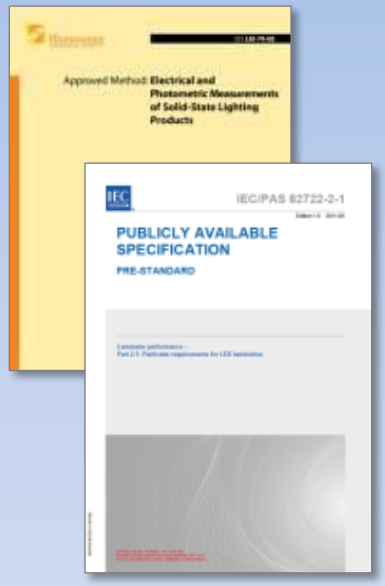
- binning (lumens and forward voltage);
- translation of IEC to other colour grids (e.g. ANSI);
- self ballasted LED lamps < 50V;
- OLED proposals from Korea.

Agenda

1. Introduction
2. Apples & Pears
3. Quality criteria initial & maintained
4. Quality criteria over time
5. Take away

Compare Performance Claims?

Made-in-China.com™
Connecting Buyers with China Suppliers



ENERGY STAR

DER BLAUE ENGEL
JURY UMWELTZEICHEN

DEKRA

energy saving trust

MIND THE GAP

LONGLIFE L.E.D TECHNOLOGY

Compare Performance Claims?

efficacy





LED Die	LED Array		Optics		Control Gear	LED Luminaire
90 lm/W	90%	81 lm/W	90%	73 lm/W	90%	66 lm/W
	85%	77 lm/W	50%	39 lm/W	70%	27 lm/W

performance

- technical definitions;
- product design.

Standardised Quality Criteria

Evaluate performance claims from different manufacturers it is important:

- to compare a standardised set of quality criteria;
- that are measured in compliance with the appropriate standard.

IEC/PAS Performance Requirements

	Product Type	Safety Standard	Performance Standard
	LED drivers	IEC 61347-2-13 Publication 2006	IEC 62384 Publication 2006
	LED lamps	IEC 62560 Edition 1 Publication 2010	IEC 62612/PAS Public Available Specification
	LED modules	IEC 62031 Edition 1 Publication 2008	IEC 62717/PAS Public Available Specification
	LED luminaires	IEC 60598 Edition 1 & 2 Publication 2008	IEC 62722/PAS Public Available Specification

recently published

- IEC/PAS 62717 – LED modules for general lighting;
- IEC/PAS 62722 – LED luminaires for general lighting.

Apples & Pears

manufacturers
&
certification bodies

IEC/PAS Performance Requirements

lighting designers
technical engineers
policy makers

CELMA Guide Apples & Pears

Agenda

1. Introduction

2. Apples & Pears

3. Quality criteria initial & maintained

4. Quality criteria over time

5. Take away

Quality Criteria Initial & Maintained

limiting values

measurement methods

technical definitions

scope

- initial & maintained claims of LED luminaires;
- to establish confidence in the product data provided;
- acceptance or rejection of quality over life is out of the scope!

(maintained values are measured at 25% of rated life time up to a max. of 6.000 hours)

Quality Criteria Mentioned In The IEC/PAS

1) Rated input power (*in W*);
2) Rated luminous flux (*in lm*);
3) LED luminaire efficacy (*in lm/W*);
4) Luminous intensity distribution;
5) Photometric code;
   - Correlated Colour Temperature (CCT in K);
   - Rated Colour Rendering Index (CRI);
   - Rated chromaticity co-ordinate values (initial and maintained);
   - Maintained luminous flux.

- *performance claims are always measured at a specific ambient temperature (t_q);*
- *maintained values are measured at 25% of rated life time up to a max. of 6.000 hours.*

Photometric Code

six digit photometric code displays important ‘quality of light’ parameters

8	3	0	/	3	5	9

- initial CRI value of 84 – code 8;
- initial CCT value of 3000K – code 30;
- initial spread of chromaticity co-ordinates within a 3-step MacAdam ellipse – code 3;
- maintained spread of chromaticity co-ordinates within a 5-step MacAdam ellipse – code 5;
- maintained luminous flux of 91% – code 9.

(maintained values are measured at 25% of rated life time up to a max. of 6.000 hours)

Agenda

1. Introduction

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Quality Criteria Over Time

> 6000hrs – lifetime claims

- lumen maintenance;
- luminaire life.

Lumen Maintenance Claims

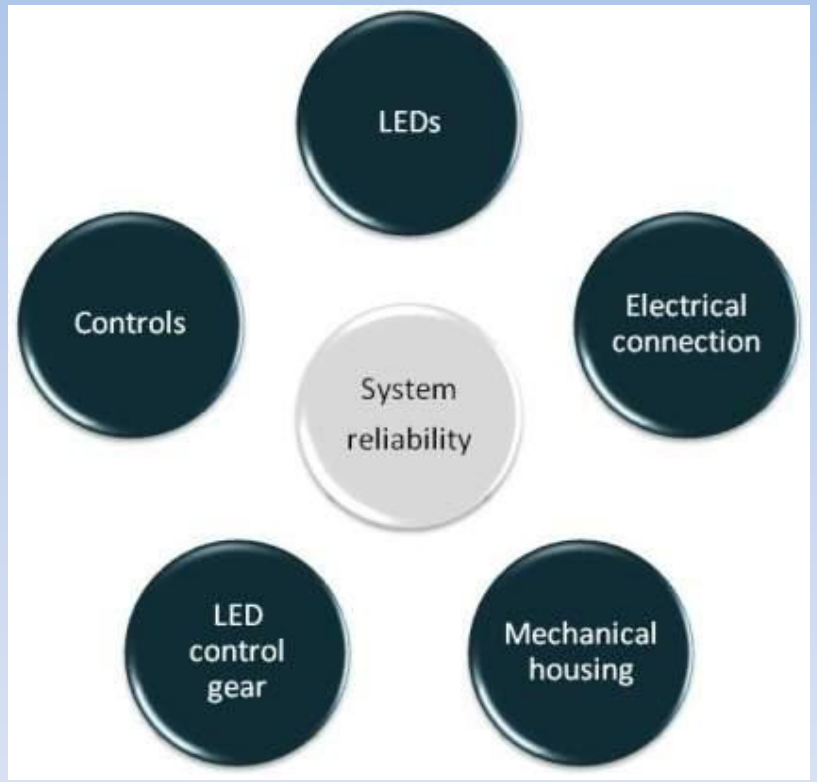
LM-80: 6-10K hrs real measurement.

TM-21: extrapolation 6x measurement .

lumen maintenance LED's used in a LED luminaire

- catastrophic failures of individual LED's are not taken into account;
- no validated way to translate maintenance curve LED's into luminaire.

Luminaire Life Claims



IEC Recommended Lifetime Metrics

LED luminaire life ($L_x F_y$)

lumen maintenance at rated life (L_x)

failure fraction (F_y) (gradual & abrupt)

combination of

- rated life (in h) of the LED module used in the luminaire and the associated rated lumen maintenance (L_x);
- failure fraction (F_y) corresponding to the rated life of the LED module used in the luminaire.

IEC Recommended Lifetime Metrics

gradual light degradation

$L_{70}B_{50}$

life time (hrs) where light output ≥70% for 50% of the population.

abrupt light degradation

L_0C_{10}

life time (hrs) where light output is 0% for 10% of the population.

IEC Recommended Lifetime Metrics

LED luminaire life ($L_x F_y$)

lumen maintenance at rated life (L_x)

failure fraction (F_y) (gradual & abrupt)

	L_xB_y						L_xC_y		L_xF_y					
X	70		80		90		0		70		80		90	
Y	10	50	10	50	10	50	10	50	10	50	10	50	10	50

Agenda

1.Introduction

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5.Take away

Take Away

Remember not to mix up 'Apples & Pears'

1. It is important to compare against a standardised set of quality criteria;
2. Ask for spec's measured in compliance with appropriate standards;
3. Lifetime claims based on 'lumen maintenance' and 'luminaire life' are two different things both taken into consideration;
4. Reputable LED luminaire manufacturers will publish product spec's measured in compliance with IEC/PAS performance requirements.

Take Away

IEC/PAS 62717 – *LED modules for general lighting*;
IEC/PAS 62722 – *LED luminaires for general lighting*.

FOR SALE via http://webstore.iec.ch/

CELMA Guide Apples & Pears: *Why standardisation of performance criteria for LED luminaires is important.*

FOR FREE via http://www.celma.org/

Apples & Pears: *why standardisation of performance requirements for LED luminaires is important.*

Thank You!

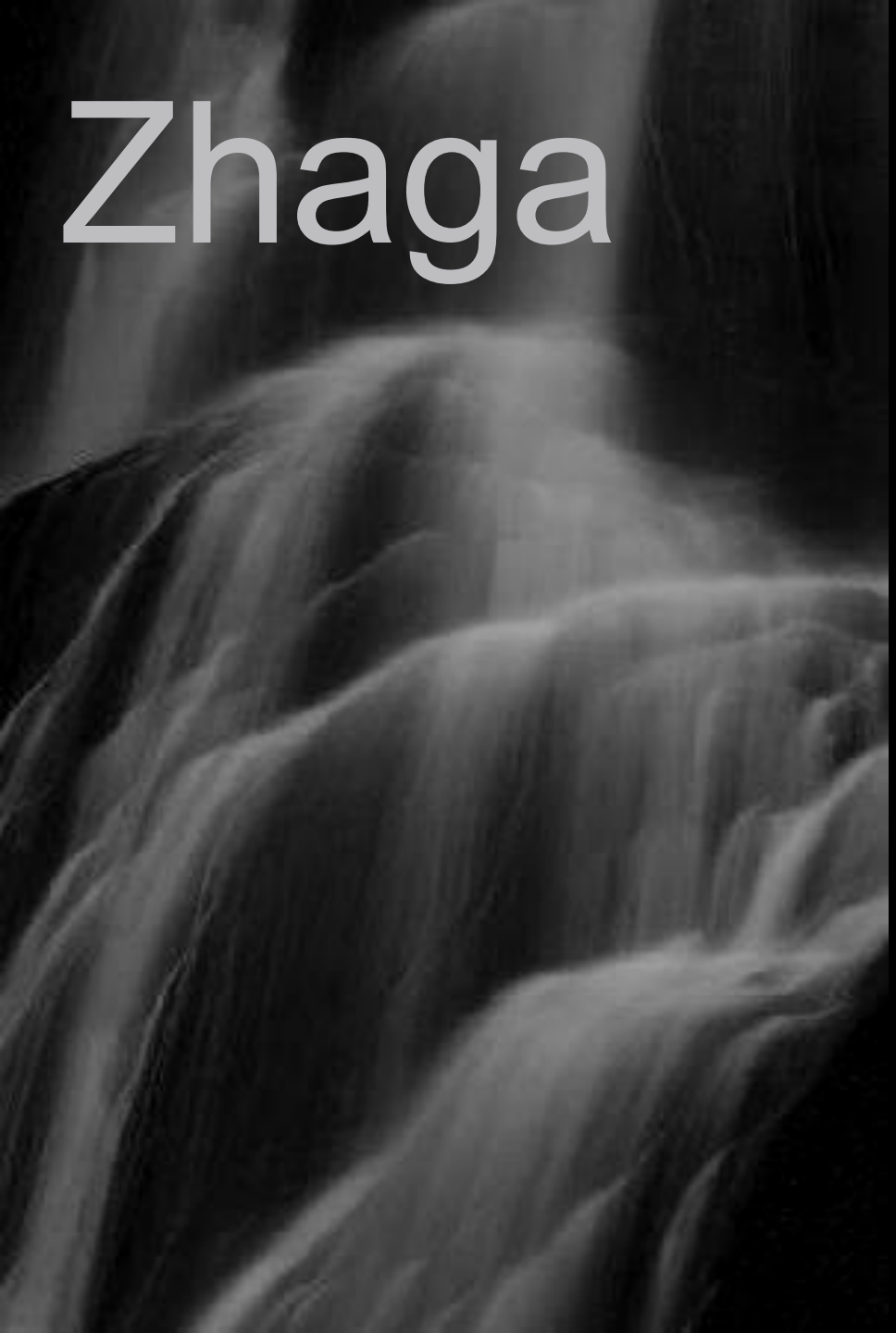
Consortium for the standardization of LED light engines

- Vision
- Way of working
- Progress

SWITCH TO SEPARATE PRESENTATION

Asia-Pacific Economic Cooperation

Australian Government
Department of Climate Change and Energy Efficiency



Zhaga

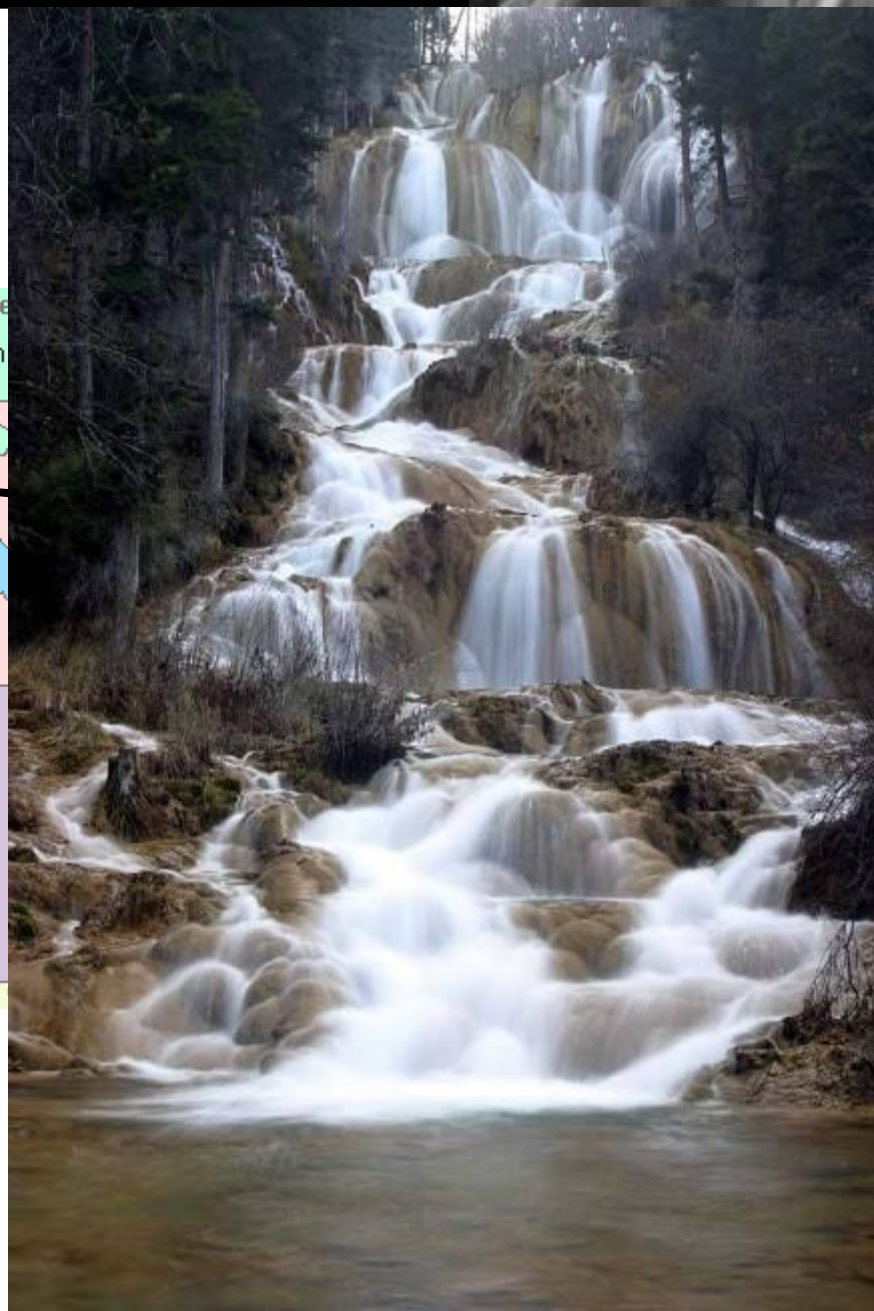
Consortium for the standardization of LED light engines

- Vision
- Way of working
- Progress

version 20111020 – non-confidential

What does Zhaga mean?

There is no special meaning.



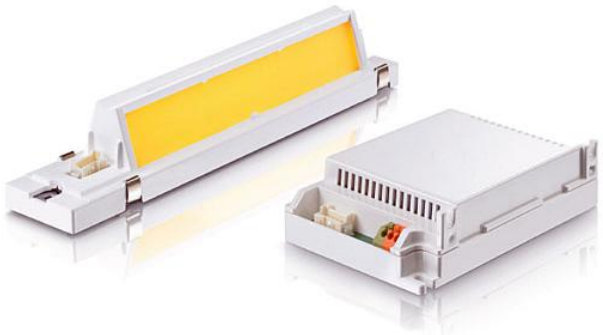
Zhaga is a waterfall in China

Zhaga is a cooperation between companies

- 144 members (54 members with voting rights)
  - From Asia, North America, Europe
- Meeting every 6-8 weeks
  - 3 day meeting
  - 80-90 participants

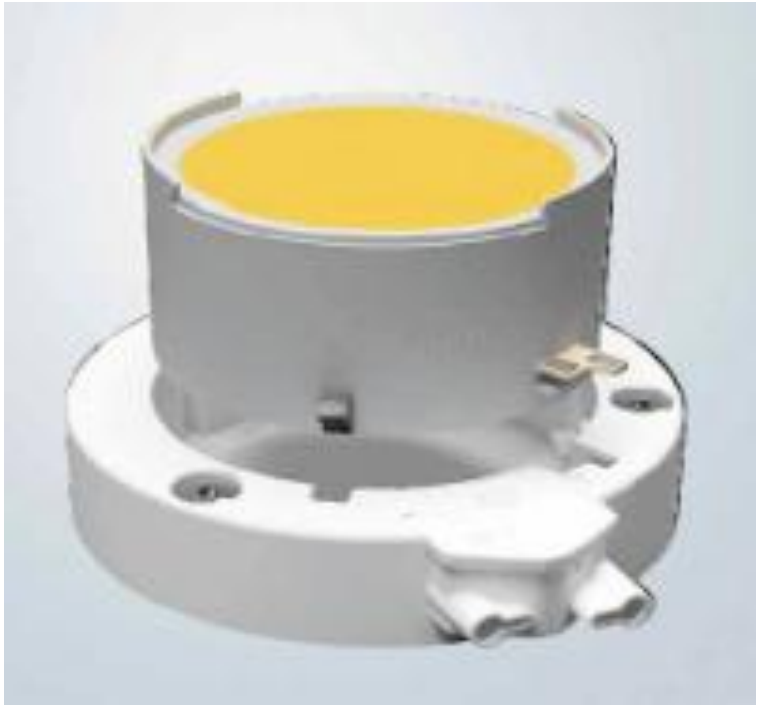
What is an LED light engine?

- An LED light engine is the combination of an LED module and its associated electronic control gear (‘driver’).



- An LED light engine can have integrated control gear, or control gear in a separate housing

Light engine with integrated control gear



Light engine with separate control gear

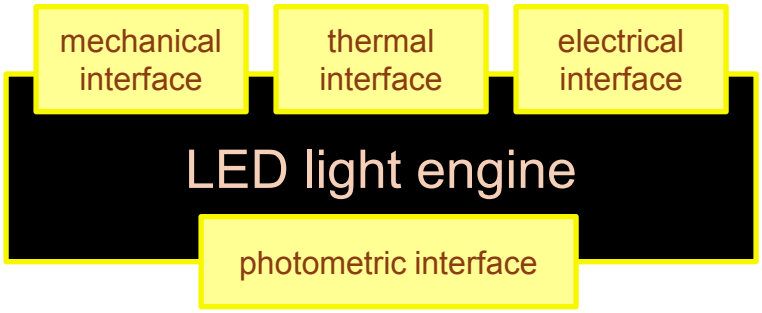
Interchangeable light engines

- The lighting industry is used to work with standardized light sources
  - the industry needs stability
  - the industry needs choice between suppliers
- LED light sources are *not* interchangeable, until now.
- Zhaga will make LED light sources also interchangeable

Stable interfaces – Rapid innovation

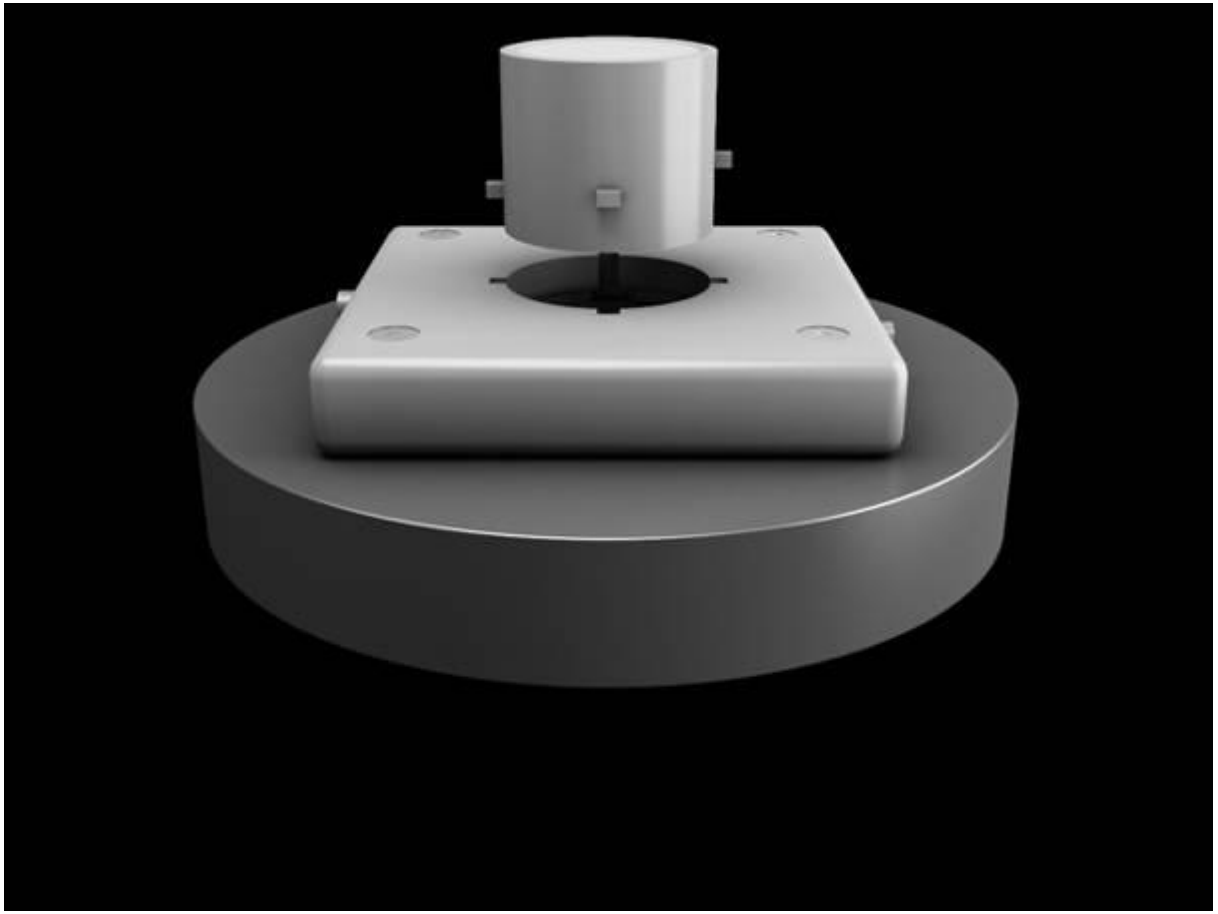
- Zhaga specifies *only* what is necessary to enable the *interchangeability* of light engines from different manufacturers.

- The design freedom inside the light engines and in the luminaires is maximized.



Zhaga treats the inside of a light engine as a 'black box'

What is an interface? – Mechanical interface

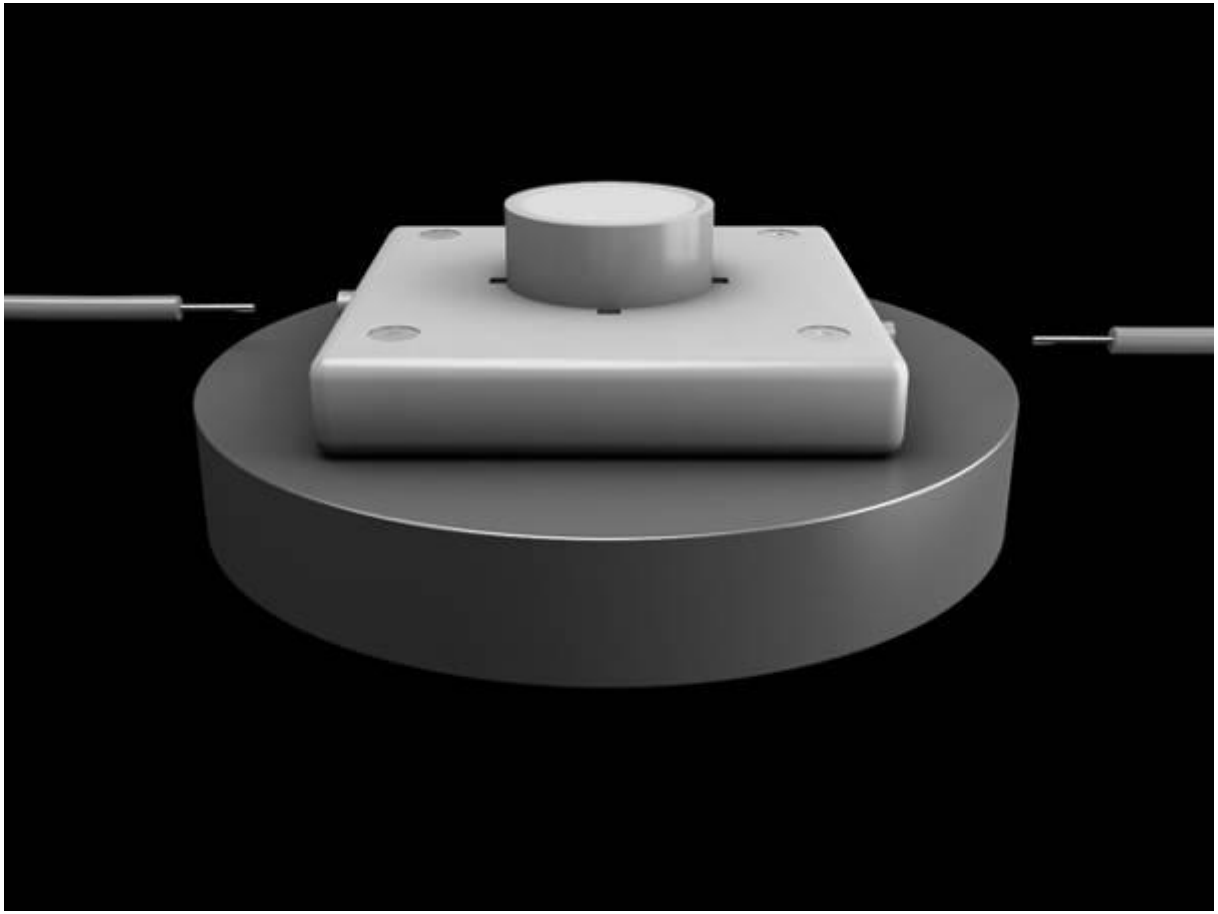


The fit between LED Light Engine and Holder

or heat sink

or luminaire housing.

What is an interface? – Electrical interface



The part of the system where the electrical connection is made

Zhaga will focus on interoperability through interface standardization, not on performance specification

Int'l Standardization organizations
Industry Consortia: Zhaga

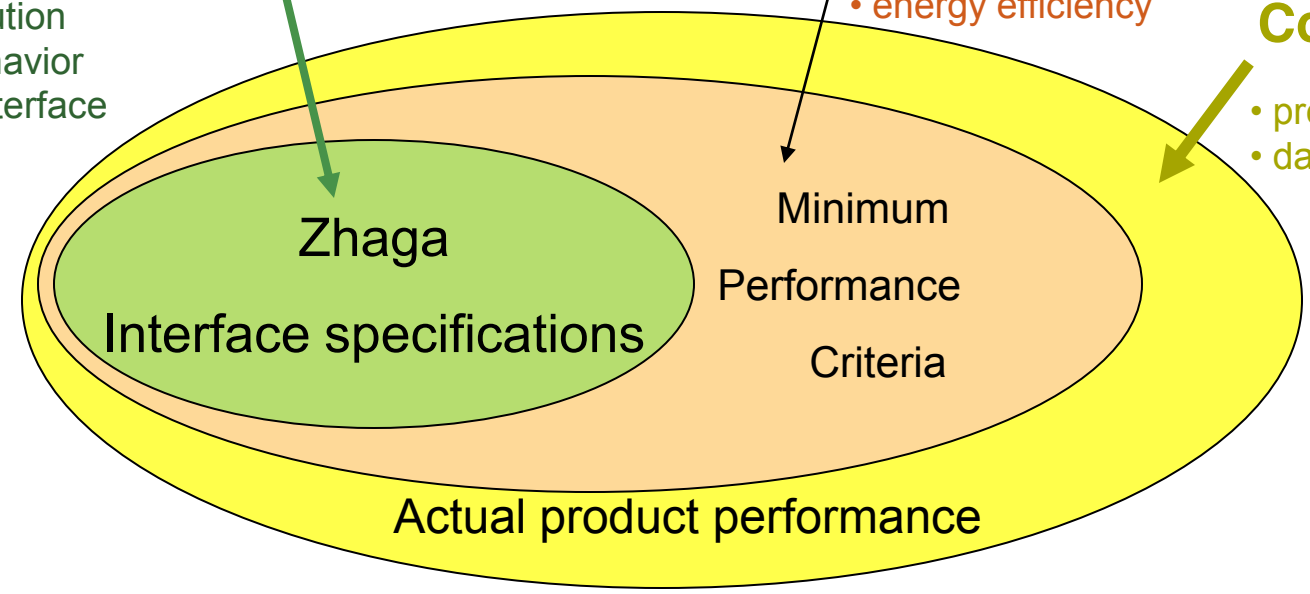
- mechanical fit
- light distribution
- thermal behavior
- electrical interface

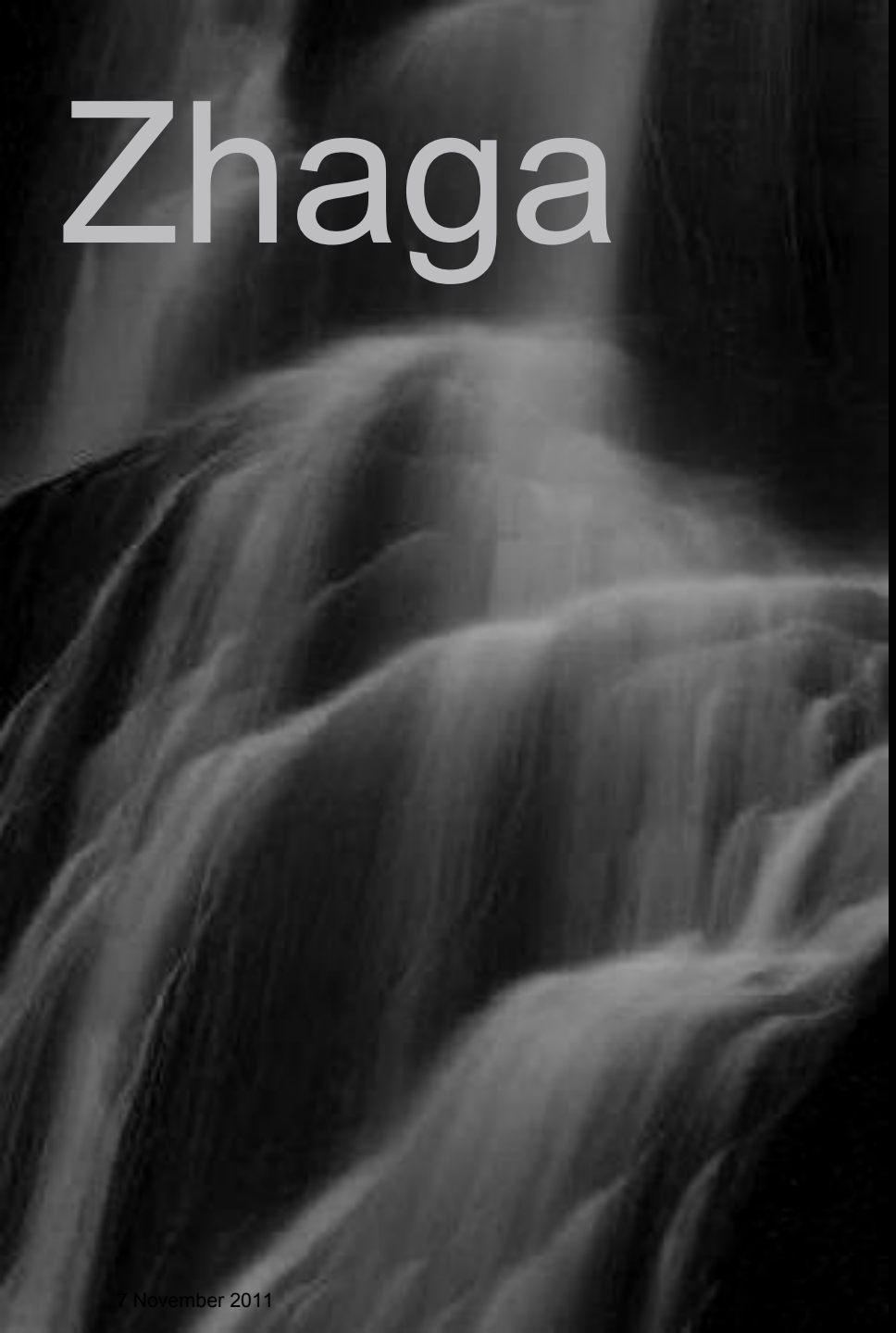
Governments
Quality label organizations
Voluntary industry agreements

- life time
- energy efficiency

Companies

- product specifications
- data sheet

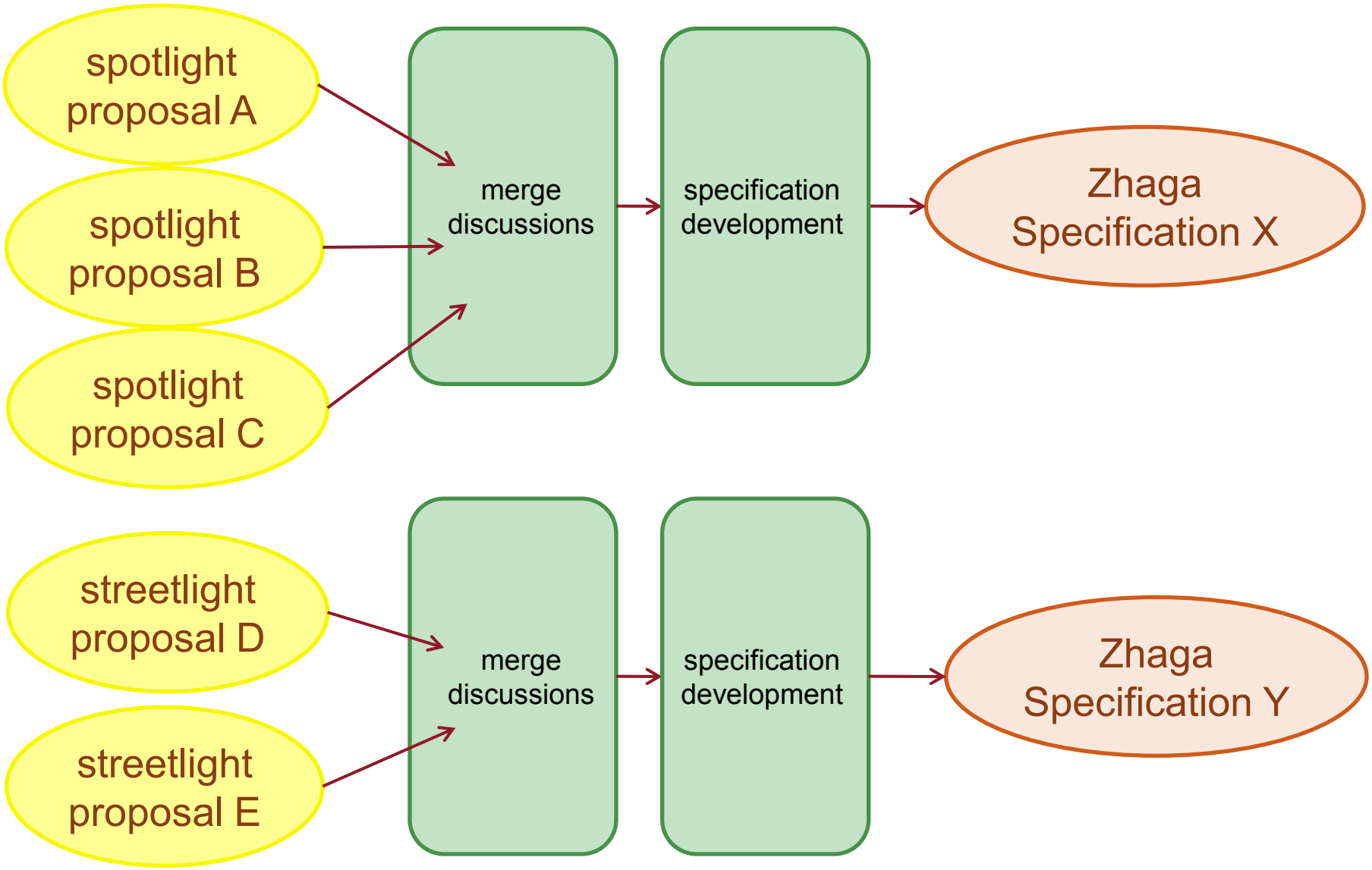




Zhaga

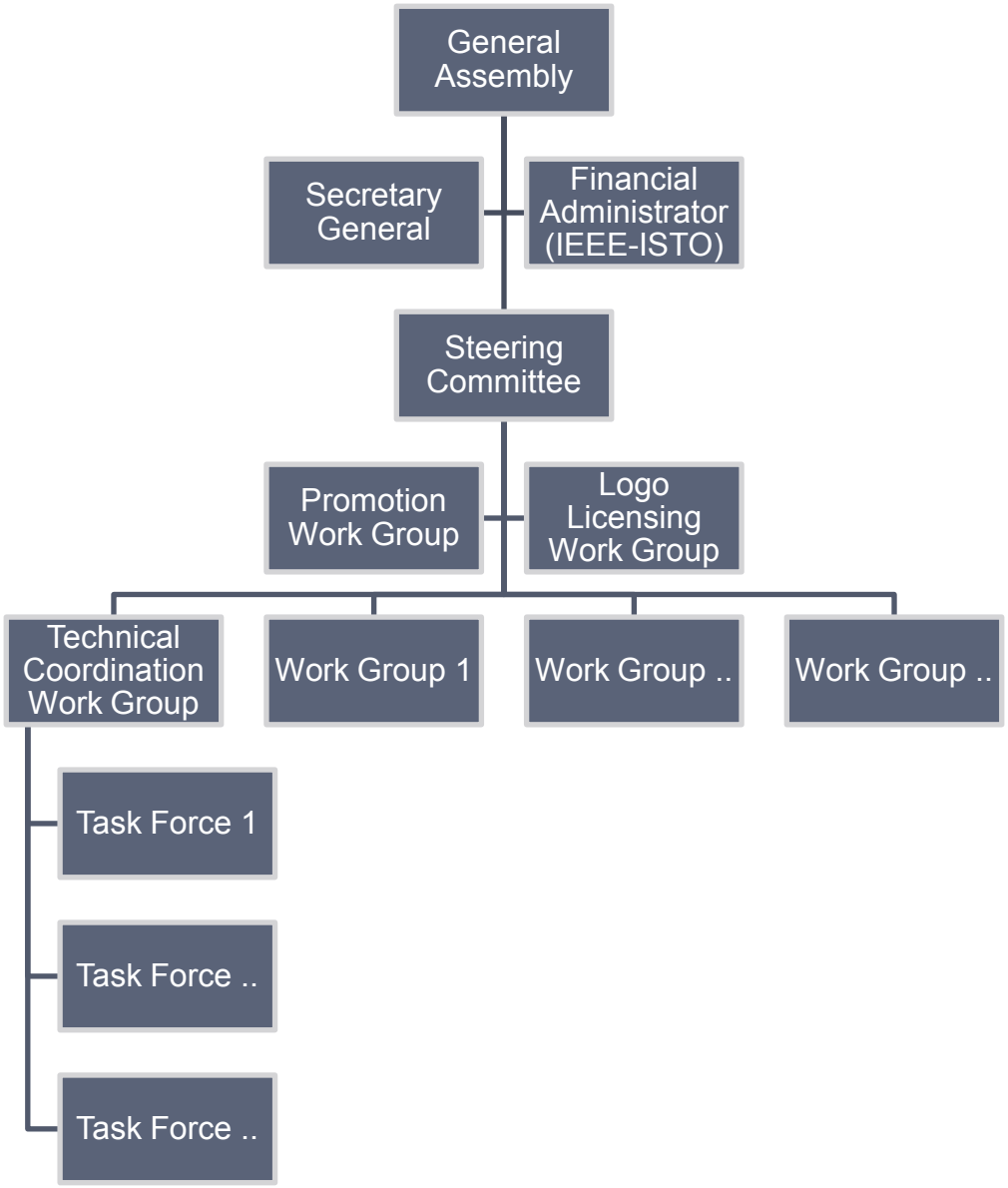
Way of working

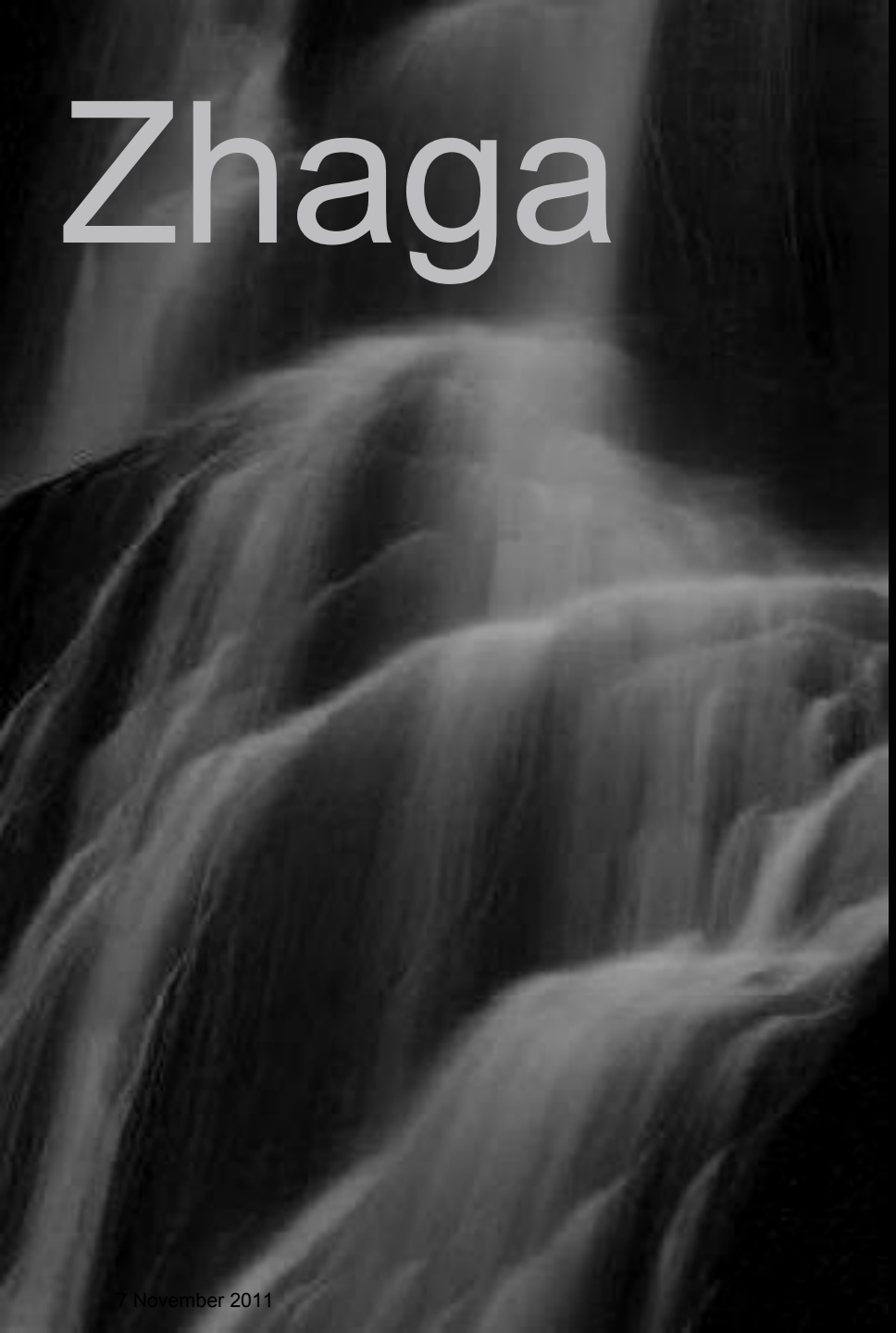
Illustration of Zhaga's standardization process



Merger phase is critical!

- Zhaga should not create two interface specifications with different mechanical fit for the same application
  - We must avoid arbitrary variations
- Differences between proposals must be analyzed and consequences understood before making choices.
- Choices must be based on technical merit


General Assembly
Secretary General
Financial Administrator (IEEE-ISTO)
Steering Committee
Promotion Work Group
Logo Licensing Work Group
Technical Coordination Work Group
Work Group 1
Work Group ..
Work Group ..
Task Force 1
Task Force ..
Task Force ..



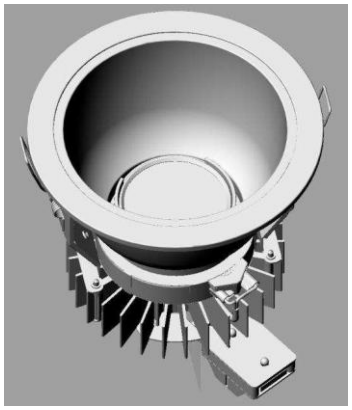
Zhaga

Progress

status September 2011

Progress: downlight engine specification

- In February 2011, the Zhaga Consortium approved the first light engine specification.
  - A socketable LED downlight engine with integrated control gear



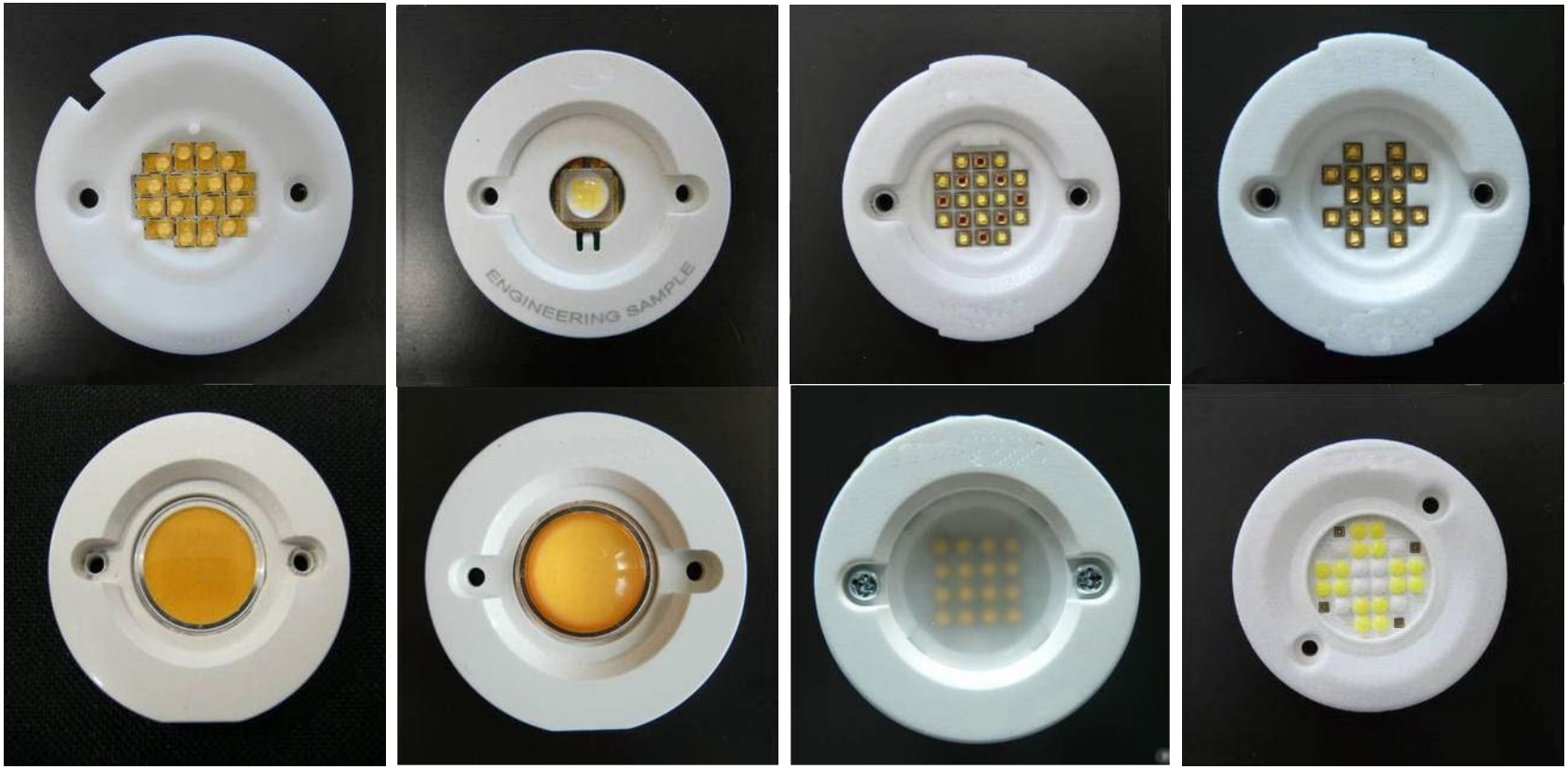
example downlight luminaire

prototype lamp holders

prototype light engines

Progress: spotlight engine ready

- In June 2011, the Zhaga Consortium approved the second light engine specification.
  - An LED spotlight engine with separate control gear



Progress: Socketable LED Light Engine with Separate Electronic Control Gear

- In September 2011, the Zhaga Consortium approved the third specification. This is a socketable spot light engine. The control gear of the engine is located in a separate housing.

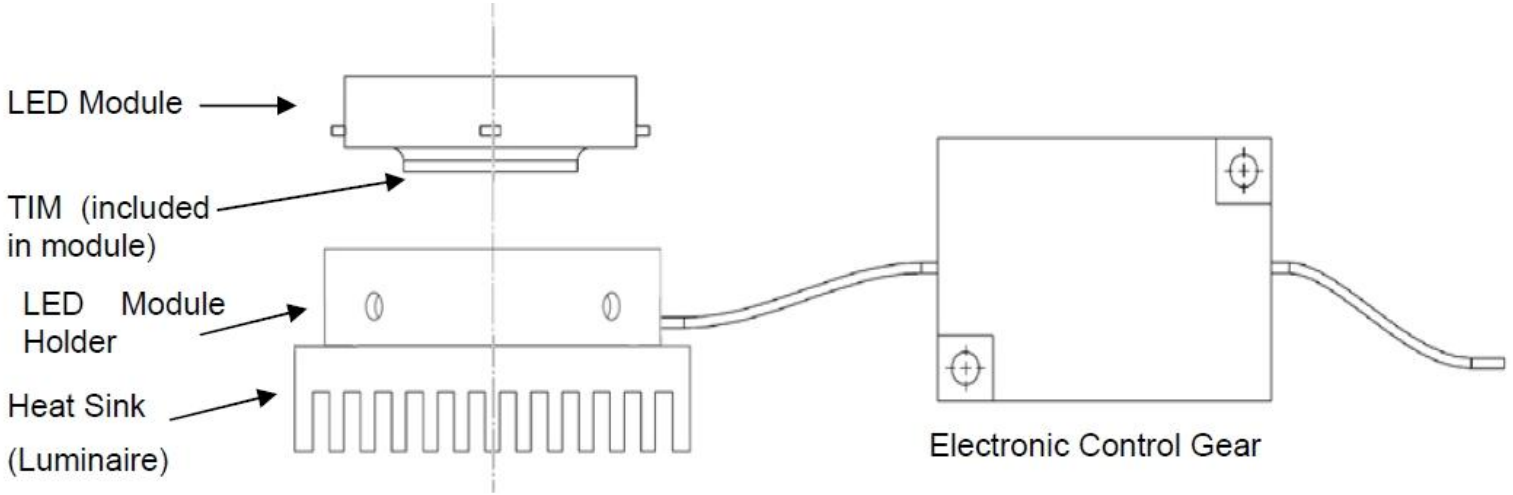
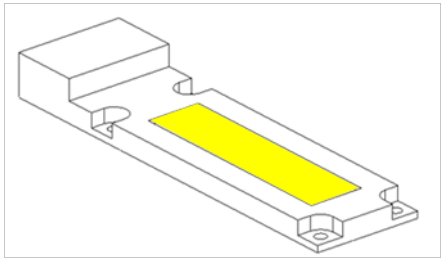
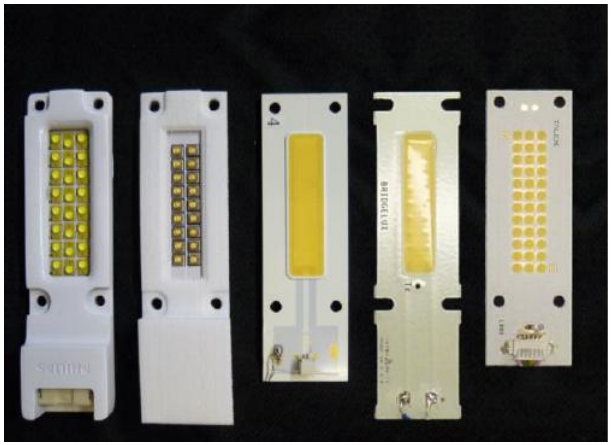


Figure 1: Schematic view of the assembly of LED Module, Luminaire with heat sink and Luminaire Optics, and Electronic Control Gear

Specifications under development

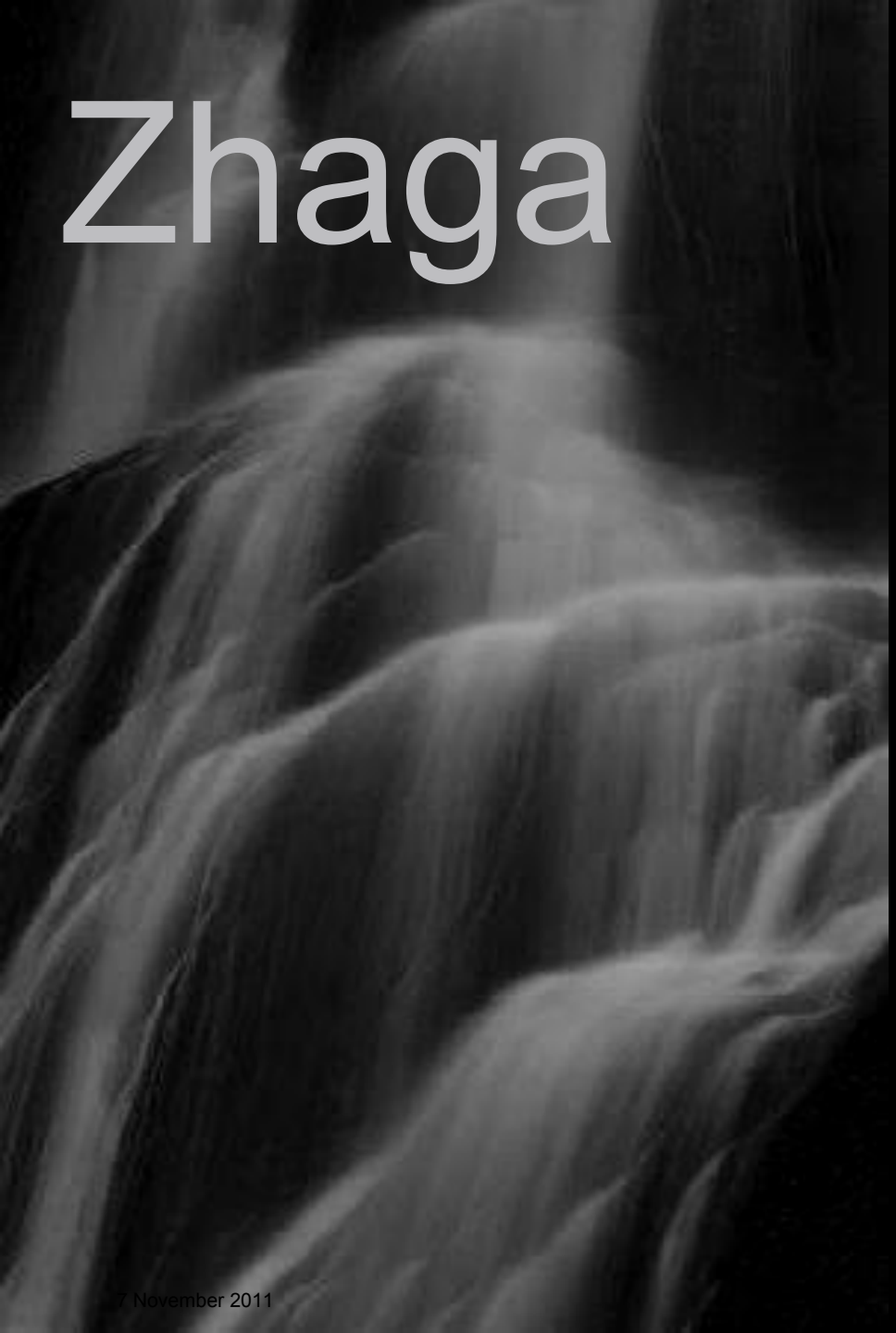
- A streetlight engine (non-socketable with separate control gear)





- Mechanical dimensions of control gear (drivers)
  - several form factors and fixation methods
- Other light engines that are in a less advanced stage of development
- Website has regular updates on progress

Zhaga



Logo

The Zhaga logo

- The Zhaga Logo can be used on products that implement a Zhaga specification

- Compliance with the Zhaga specification must be verified by an independent test lab.

Where are products with the Zhaga logo?

- Not available yet, because
- Certification (by independent test labs) is not available yet.

Summary

- Zhaga guarantees stable design platforms for luminaries
- Zhaga prevent market fragmentation into a large number of incompatible light engines
- Zhaga enables second source supply of LED light engines
- Zhaga brings LED lighting in line with common industry practice in the lighting industry


www.zhagastandard.org

DISCUSSION

Working Towards International Consensus:

How do these initiatives fit together to produce useful international harmonised testing and performance standards for LED products?

Session 3

LED Initiatives within the Asia Region

India
An LED Overview

P. K. MUKHERJEE

CONSULTANT, CLASP INDIA

Asia-Pacific Economic Cooperation

Australian Government

Department of Climate Change and Energy Efficiency

Background

- Limited availability of LED technology in India
- High initial cost of LEDs that makes the pay-back period very long
- Absence of National standards for LEDs, as a result industry is prone to import sub standard products
- Lack of testing protocols, facilities and accredited laboratories at the national level
- No incentive either to set up manufacturing facilities in India
- Consumer awareness very low

Why LED

- Virtually no risk of environmental contamination hence environment friendly
- No risk of personal exposure to hazardous materials
- Virtually no risk of fire/smoke
- No personal exposure to Ultraviolet radiation
- Artwork and other sensitive items are not degraded as a result of exposure to Ultraviolet radiation
- No concern about how often you turn on/off your lights
- Long life compared to other light sources
- No wasted time or electricity
- Very effective in cold temperatures usage and compared to CFLs
- Annual saving potential 12318750 million Wh

LED Lighting Focus

- Down lighters
- Street Lighting for Secondary Roads
- General Lighting

Steps Initiated for LED

- Preparing National Standards for LED
- Government Procurement
- Lab Capacity Building

Awareness Program

- Workshops / Seminars
- Exhibitions by the Industry Association
- Articles and advertisements in special magazines
- Media publicity

National Standardisation

- Separate technical committee to deal with lamps, control-gears and lamps caps/holders
- Members from industry, industry association, laboratory, academicians, R&D institutions, consumer organizations, regulatory bodies, other government bodies, professional bodies.

National Standardisation Process

- Approval of new subject by national committee
- Preparation of preliminary draft standard
- Circulation to members of national committee for comments
- Discussion on the draft standard and comments by the members of the technical committee
- Draft standard in wide circulation for public comments
- Discussion by the national committee
- Approval of draft standard by consensus
- Publication of standards

Indian Standards on LEC

- Terms and definitions for LEDs and LED modules in general lighting
- Self Ballasted LED-Lamps for General Lighting Services, Part 1 Safety Requirements
- Self Ballasted LED-Lamps for General Lighting
- Services Part 2 Performance Requirements
- LED Modules for General Lighting- Part 1, Safety Requirements
- LED Modules for General Lighting -Part 2,Performance Requirements
- Lamp Control gear-Part 2 Particular Requirements, Section 13, D.C. or A.C. Supplied Electronic Control-gear for LED Modules

Indian Standards on LED – contd.

- DC or AC Supplied Electronic Control Gear for LED Modules - Performance Requirements
- Method of Measurement of Lumen Maintenance of Solid State Light (LED) Sources
- Method Of Electrical and Photometric Measurements of Solid- State Lighting (LED)
- LED Luminaries for General Lighting purposes- Performance Requirements
- Photo biological Safety
- Indian standards are based on IEC publications
- Method of measurement for electrical, photometric and color characteristics are base on IESNA standards

Steps Initiated for LEDs in India

- Draft Indian standards have been approved for publication in July 2011
- Preparing specifications for led products
- Government procurement guidelines
- Lab capacity building
- Awareness programs - *Workshops / Seminars, Articles and advertisements in special magazines, Exhibitions by the Industry Association, Media publicity*
- LED Lighting focus - *Down lighters, Street Lighting for Secondary Roads, General Lighting*

Self-Ballasted LED-Lamps
Part 1 - Performance

- Rated wattage upto 60 W
- Rated voltage upto 250 V
- Tests
  - Cap interchangeability
  - Bending moment
  - Marking
  - Protection against accidental contacts with live parts
  - Insulation resistance and electric strength
  - Torsion test of unused lamps

…..Continued

Self-Ballasted LED-Lamps
Part 1 - Performance

- Torsion test of used lamps
- Cap temperature rise test
- Resistance to heat
- Resistance to flame
- Fault conditions
- Creepage distances and clearances
- Selection of lamps and sampling
- Conditions of compliance
- Classification of tests (acceptance and type)

SELF-BALLASTED LED-LAMPS

PART 2 - PERFORMANCE

- Marking
- Dimension
- Luminous flux
- Lamp wattage
- Centre beam intensity
- Beam angle
- Correlated Colour Temperature (CCT)
- Colour rendition index (CRI)

Self-Ballasted LED-Lamps
Part 2 - Performance

- Lumen maintenance
- Endurance test for ballast
- Harmonics
- Conducted and radiated emission
- Selection of lamps for testing
- Criteria for compliance
- Classification of tests (acceptance and type)

LED Module - Safety

- Marking
- Terminals
- Provisions for protective earthing
- Protection against accidental contact with live parts
- Moisture resistance
- Electric strength
- Fault conditions

LED Module - Safety

- Conformity testing during manufacture
- Construction
- Creepage distances and clearances
- Screws current carrying parts and connections
- Resistance to heat, fire and tracking
- Resistance to corrosion
- Heat management
- Classification of tests (acceptance and type)

LED Module - Performance

- Marking
- Dimension
- Module power
- Luminous flux
- Luminous intensity distribution
- Peak intensity
- Beam angle

LED Module - Performance

- Correlated Colour Temperature (CCT)
- Colour Rendering Index (CRI)
- Life
- Lumen maintenance
- Endurance
- Temperature cycle test
- Supply switching test
- Accelerated operation life test

LED Module - Performance

- Radiated and conducted emission
- Sampling plan

Methods of Electrical and Photometric Measurements

- General test Conditions
  - Air temperature
  - Mounting of sample
  - Air movement
  - Power supply characteristics
  - Stabilization of sample under test
  - Operating orientation
  - Electrical settings
  - Electrical instrumentation and calibration uncertainities

Method of Electrical And Photometric Measurements

- Test methods for total luminous flux measurement
  - Integrating Sphere with a Spectroradiometer
  - Integrating Sphere with a Photometer Head
  - Goniophotometer
- Luminous intensity distribution
- Luminous efficacy
- Colour characteristics

Method of Measurement of Lumen Maintenance

- Test Conditions
  - Sample marking
  - Sampling procedure
- Environmental condition
  - Vibration
  - Temperature
  - Humidity
  - Airflow
  - Operation orientation

Method of Measurement of Lumen Maintenance

- Electrical and thermal conditions
  - Input voltage
  - Voltage wave shape
  - Input current regulation
  - Case temperature
- Measurement procedure
  - Instrumentation
  - Photometry measurement
  - Photometry measurement temperature

Method of Measurement of Lumen Maintenance

- Lumen Maintenance Testing Method
  - Lumen Maintenance Testing Duration and Interval
  - Operating Cycle
  - Recording failure

Lamp Control Gear – Safety

- Marking
- Protection against accidental contact with live parts
- Terminals
- Provisions for protective earthing
- Moisture resistance and insulation
- Electric strength
- Thermal endurance test for windings of ballasts

Lamp Control Gear - Safety

- Fault conditions
- Transformer heating
- Construction
- Creepage distances and clearances
- Screws, current-carrying parts and connection
- Resistance to heat, fire and tracking
- Resistance to corrosion

THANK YOU

Japanese Strategies and Policies for LED Lighting

Masanori SASAKI

Assistant Director
Information and Communication Electronics Division
Commerce and Information Policy Bureau
Ministry of Economy, Trade and Industry
Japan

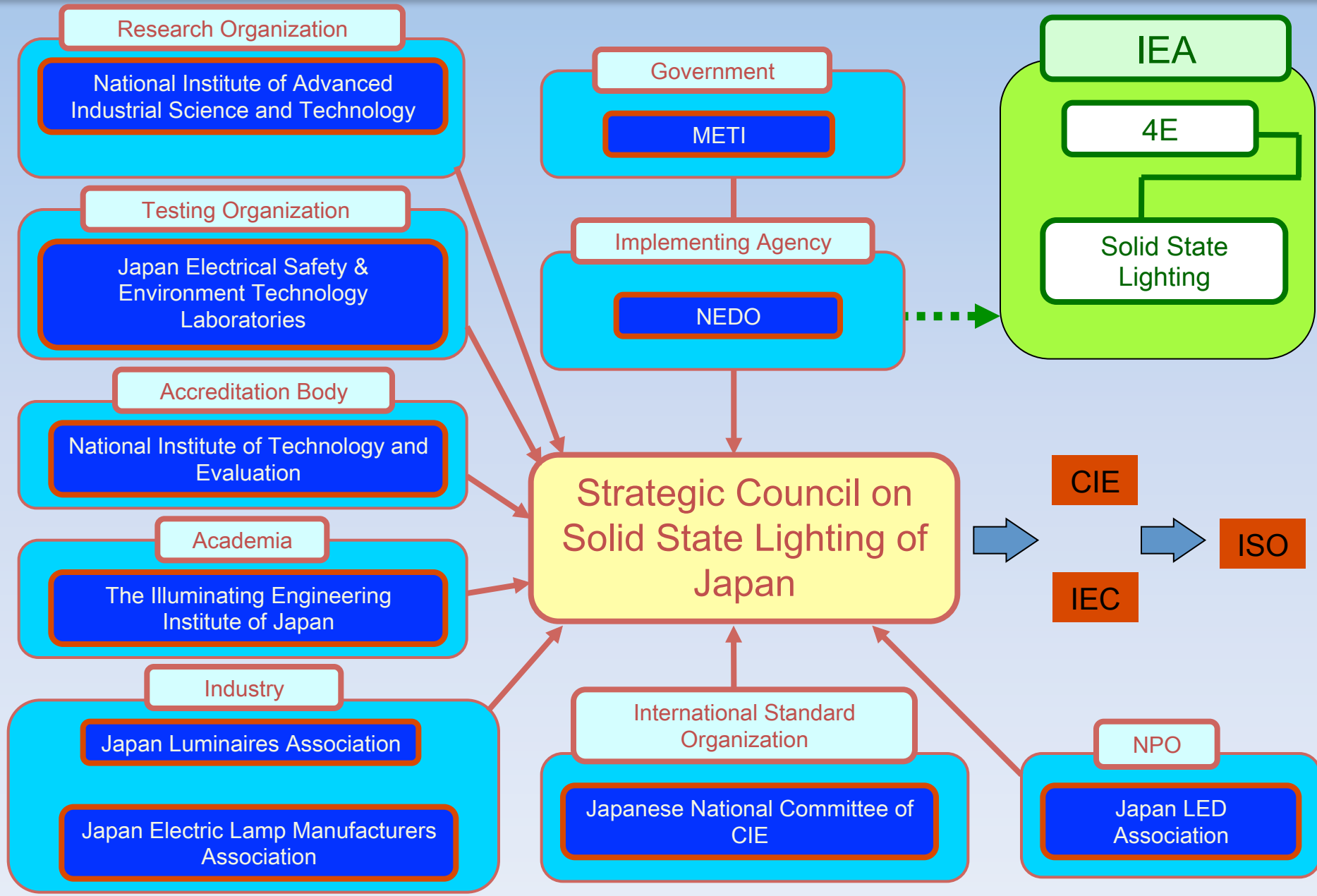
Contents

Strategies toward further growth of LED industry

“New Growth Strategy” and “the Strategic Energy Plan”

- “New Growth Strategy -Basic Policy-” was decided by the Cabinet on December 2009 and revised on June 2010. This strategy defined realization of the next generation lighting, including LED and OLED, by 2020.
- Japan declared to be a leading nation in environment protection and energy conservation by promoting the “Green Innovation” initiatives which are the core concept in the “New Growth Strategy” and the “the Strategic Energy Plan”.
- Japan aims to increase solid state lighting and organic EL lighting up to 100% in their flow by 2020, and up to 100% in their stock by 2030.
- Government of Japan, in collaboration with industries and related organizations, has launched the actions to realize this target.

Strategies toward further growth of LED industry



Contents

Implemented policies for LED industry

Policy package

- Government supports LED industry to be strong and to grow further through the following policy packages;
  - ✓ R&D for future growth
  - ✓ International standardization
  - ✓ Promotion of high efficiency LED lighting

Implemented policies for LED industry

Policy package

International Standardization

① Standardization of LED
- Basic and applied research on photometry.
- Basic and applied research on color and glare measurements.

② International Standardization of OLED

③ Support to SSL Annex activities

Promotion of high efficiency LED lighting

① Eco-Point program

② New electric charge rate for public street security lighting

R&D for future growth

① High Efficiency and High Quality LED development
- GaN Substrate
- GaN LED Structure

② High Efficiency and High Quality OLED
- Research on blue phosphate
- Production engineering

Implemented policies for LED industry

R&D for future growth

- The Government provides financial supports to R&D in universities and industries.
- These R&D are based on the concept of the “Green Innovation”. The “Green Innovation” Initiative is the core concept of the strategy for establishing Japan as a leading nation in environment protection and energy conservation.
- Objectives;
  - ✓ To enhance the energy efficiency of LED and OLED lighting 2 times higher than the current luminaries such as the high frequency fluorescent lamps.
  - ✓ To Innovate novel technology for GaN substrate production and for process improvement of producing OLED.

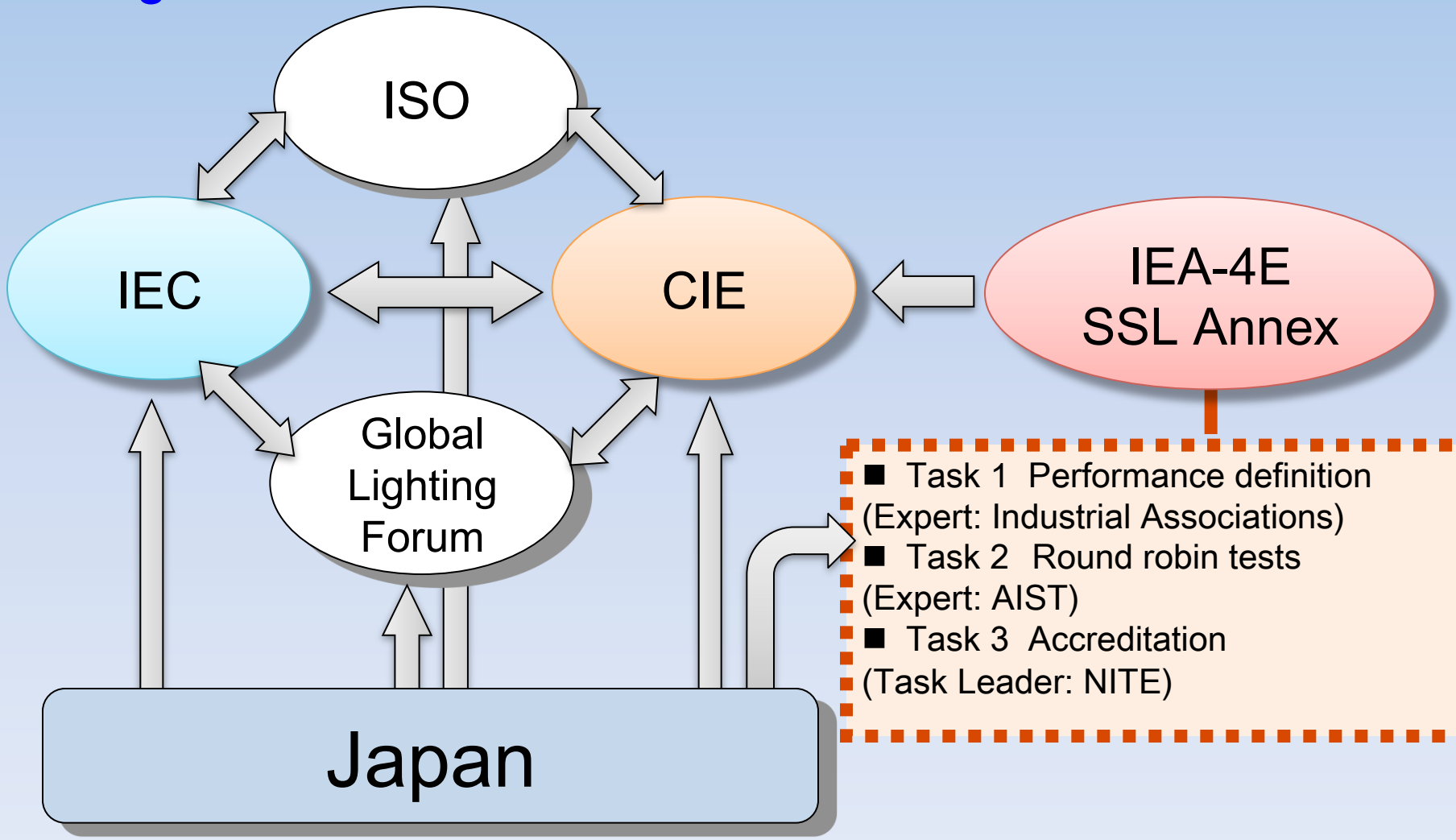
Implemented policies for LED industry

International Standardization

- International standardization aiming at developing sound LED market.
- International collaboration of proficiency testing.
- Developing uniform performance evaluation methodology for LED products.
- Helping consumers' confidence to LED products.

Implemented policies for LED industry

Strategic Collaboration for International Standardization



Implemented policies for LED industry

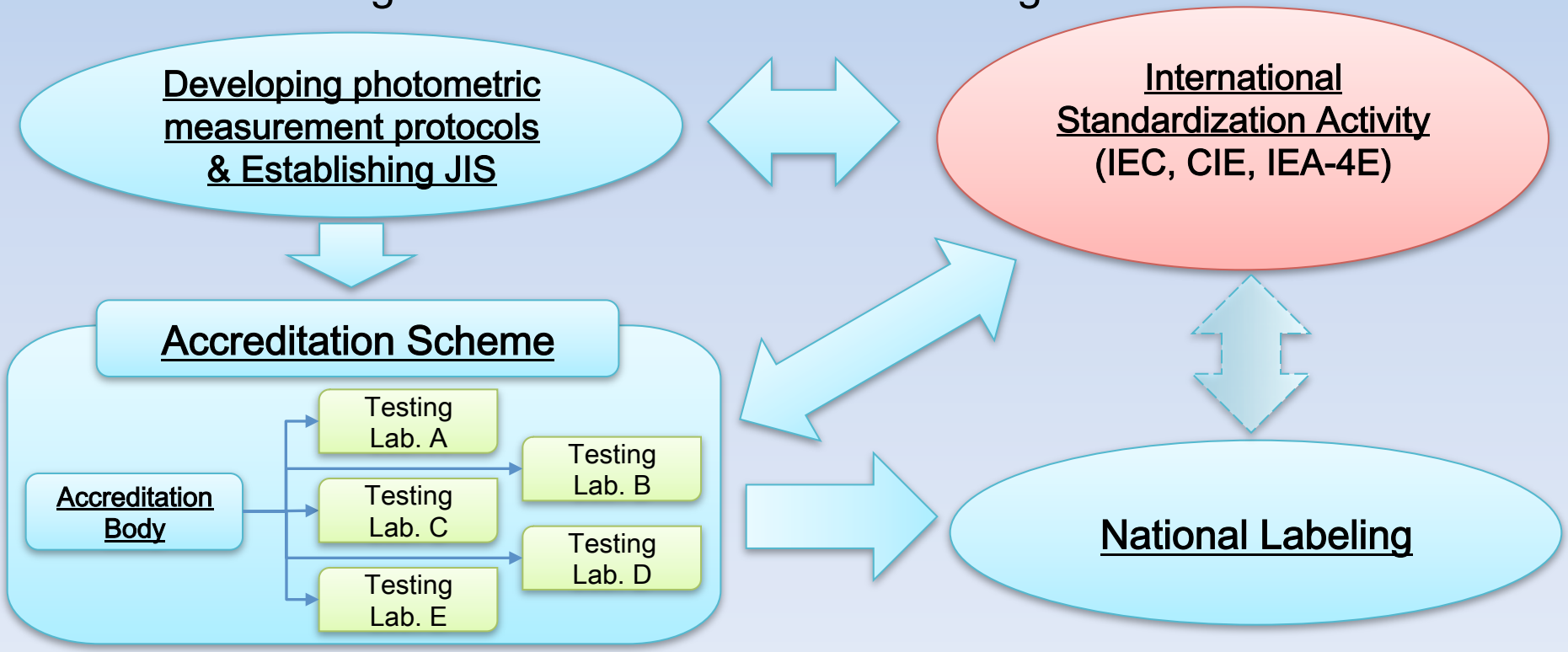
Standardization of photometric measurements on LED lighting (domestic)

- Photometric measurement protocols on LED lamps was implemented as the Japanese Industrial Standards (JIS-C7801). Those on LED modules and LED luminaires will be implemented by the end of this year as JIS-C8152 and as JIS-C8105-5, respectively.
- Domestic proficiency testing on LED lighting based on these Japanese Industrial Standards are to be executed on 2011~2012 in order to accredit domestic testing laboratories and establish labeling scheme.
- These activities are closely coordinated with IEA-4E SSL Annex.

Implemented policies for LED industry

Standardization of photometric measurements on LED lighting (domestic)

- Developing photometric measurement protocols and establishing them as Japan Industrial Standard (JIS)
- Establishing accreditation scheme for testing laboratories



Implemented policies for LED industry

Promoting high efficiency LED lighting

- On the LED lighting, Eco-Point subsidiary to customers directly was completed by the end of this March.
- New electric power charge rate in favor of LED was set for public street security lighting.

Implemented policies for LED industry

Eco-Point subsidiary

- "Eco-Point" scheme
  - ✓ When consumers bought "Green electronics" including energy efficient A/C, Refrigerator and Digital TV, they could get "Eco-Point" equivalent to about 5% of the purchase price.
  - ✓ Consumers got extra 5% (10% in total) in case of Digital TV for aiming the promotion of the digital broadcast.
  - ✓ Disposal cost for replacement is covered by the "Eco-point".
  - ✓ Consumers could use "Eco-Point" to buy eco-friendly products or service such as LED products.

Implemented policies for LED industry

Eco-Point subsidiary

- Total number of Eco-Point applications : 48 millions
- Eco-Point issued : 630 billion points = \630 billion
- Total number of merchandize exchanged : 55 millions
- Total amount of purchasing of Eco-friendly products
  - ✓ LED products of \7.4 billion or 2.6 million products
  - ✓ Installation UHF antennas for digital broadcasting
- The others
  - ✓ Donation to environment protection activities
  - ✓ Donation to earthquake and tsunami disaster recovery activities

Implemented policies for LED industry

New electric charge rate for public street security lighting

- New electric charge bracket will start at December 1st, 2011 in favor of low power consumption luminaires in street lighting.
- Japan promote LED into public street secure lighting.

New scheme

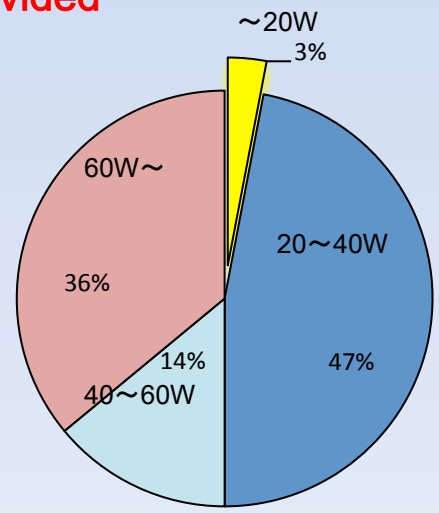
New bracket

- 10W	\75/month
10 - 20W	\109/month
20 - 40W	\175/month
40 – 60W	\243/month
…	…

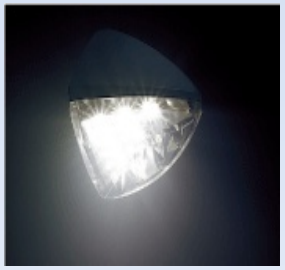
subdivided

*except basic charge

Estimated installation of public street security lighting



LED security lighting



Contents

Recent topics

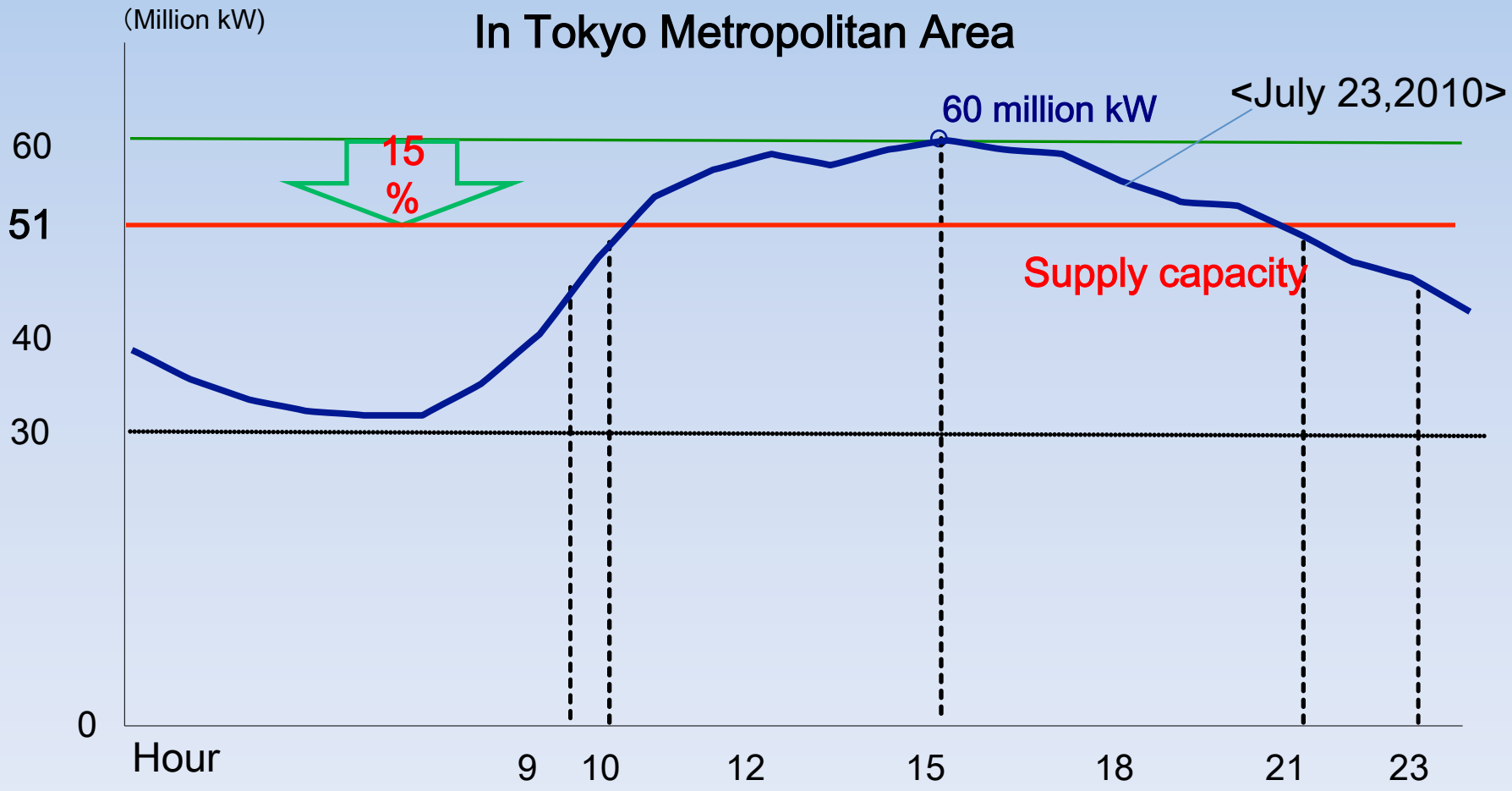
Huge earthquake and tsunami hit Japan on March 11th, 2011

Many thanks to international supports

- To date, 163 countries /regions supported Japan.
- Emergency rescue troops and medical teams from 23 countries and regions helped to rescue the persons who were attacked by earthquake and tsunami.
  - ✓Australia, China, France, Germany, India, Indonesia, Israel, Jordan, Korea, Mexico, Mongolia, New Zealand, Philippines, Russia, Singapore, South Africa, Sri Lanka, Switzerland, Taiwan, Thailand ,Turkey, UK, USA

Recent topics

Peak power demand on mid-summer



Recent topics

To avoid to power supply shortage; Restriction of Electricity Use

- The Government restricted electricity use of large electricity customers (contracted supply is 500kW or more), based on Article 27 of the Electricity Business Act.
- Restriction Period and Time
  - ✓ Tokyo EPCO service area : July 1 to September 22 (weekdays), 2011, 09:00 to 20:00
  - ✓ Tohoku EPCO service area: July 1 to September 9 (weekdays), 2011, 09:00 to 20:00
- The upper limit of power use was 15% reduced from the maximum power use (per hour) for the same period and time in 2010
- As a result, with significant efforts by Japanese industries, we could avoid power supply shortage. .

Recent topics

To avoid to power supply shortage; Setsuden Action (Coupon Program)

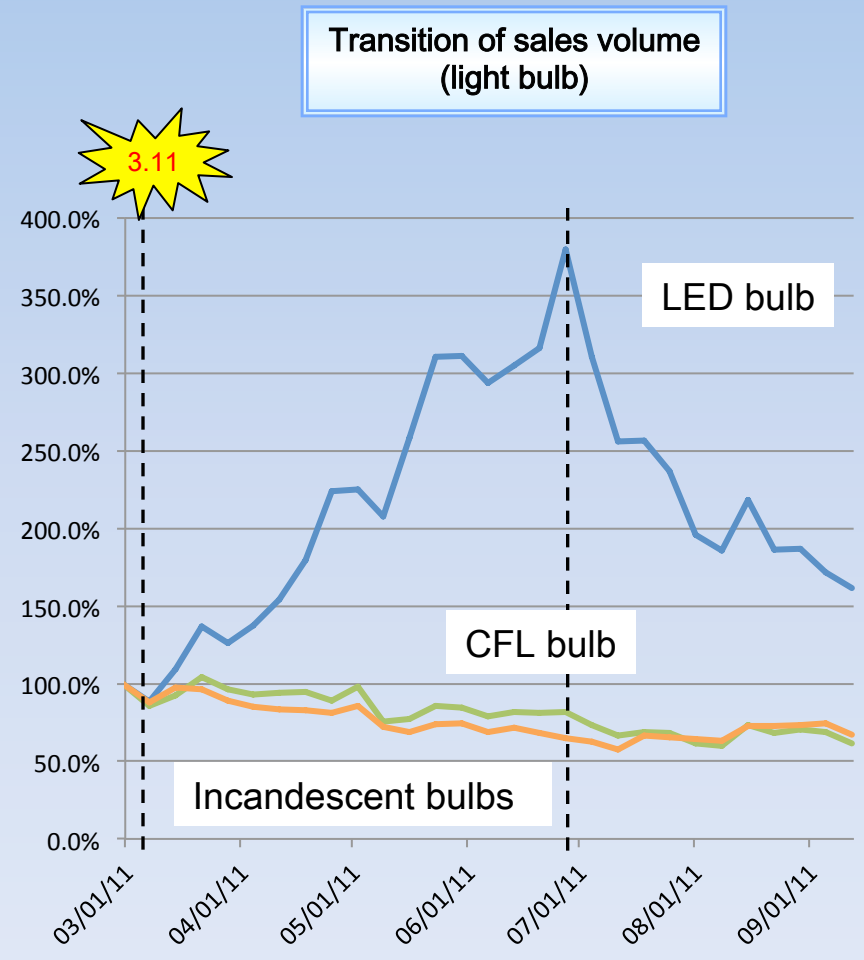
- After March 11th, energy efficiency appliance are strongly recommended to each household. In particular, LED lighting get heavy focus from Japanese people.
- The Government and major electric stores started discount coupon program for LED lighting bulbs on the web instead of Eco-Point program.
- In this coupon program, consumers could get LED lighting bulbs at 5% discount price at electronics stores.

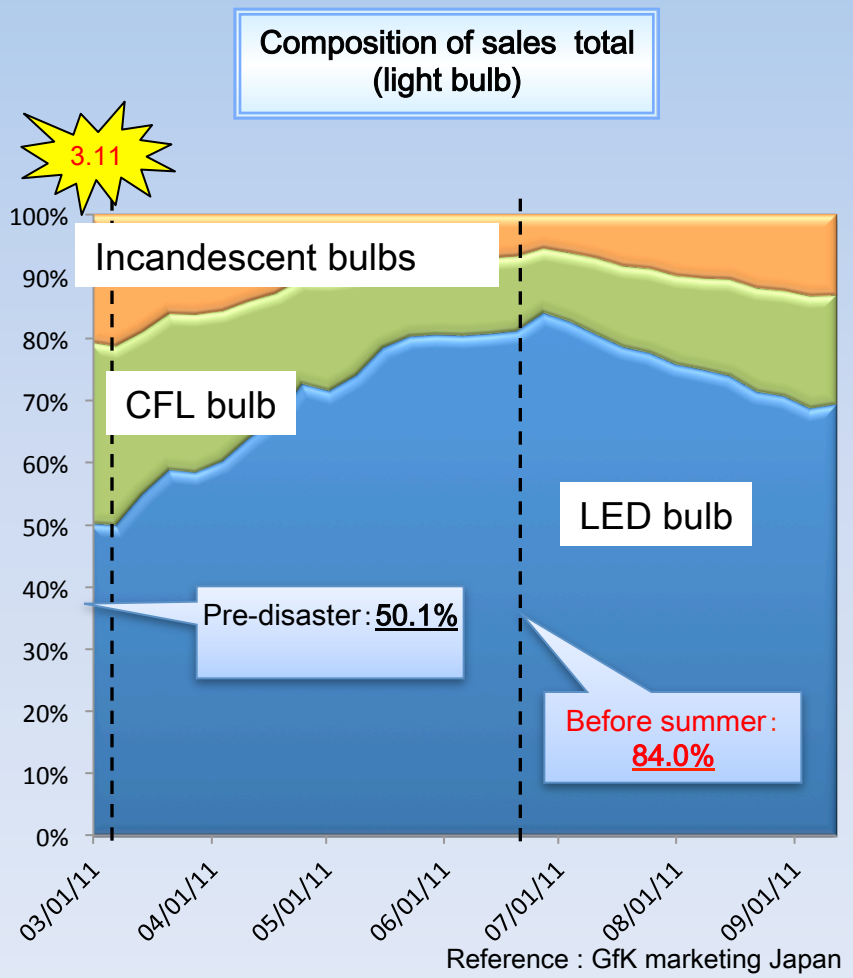
Sales Trends of LED Bulbs after March 11th

- Sales volume of the LED bulbs had been glowing gradually due partly to the eco-point program until the end of this March, when this program was terminated.
- LED bulbs sales had grown up rapidly after the earthquake and tsunami disasters on March 11th, because the resulting power shortage made consumers more conscious in saving electricity especially in summer season.
- Coupon program also contributed to the sales.
- Sales volume in shipment on the end of June, before summer, was about four times larger than pre-disaster level, and sales total was more than 80% of lighting bulb market in Japan.
- LED lighting bulbs have already formed the core of light bulb market.

Recent topics

Sales Trends of LED Bulbs after March 11th





Reference : GfK marketing Japan

LED Market Analysis

- Japanese consumer select LED bulbs for their home appliance mainly because of its high luminous efficiency. Energy conservation is the most important issues in Japan after huge earthquake and tsunami, and resulting power shortage on March 11th.
- Rapid prices decline accelerates consumer's behavior to select LED bulbs. Today, typical price of LED bulbs which are equivalent to 60 Watts incandescent lamp are approximately \2,000 (US$26) . In some discount shops, it is cheaper than \1,500(US$20).

The latest LED products in Japan

【Top Class Performance of Self-Ballasted LED Bulb】

Toshiba Lighting & Technology Corp

E26Cap “E-CORE” Self Ballasted LED Bulb

〈Specifications〉

E26Cap

Total Luminous Flux: 810lm（Day white)

Energy Efficiency: 93lm/w

【Top Class Performance of Down Light】

Panasonic Electric Work

LED Down Light

〈Specifications〉

Energy Efficiency: 105.3lm/W

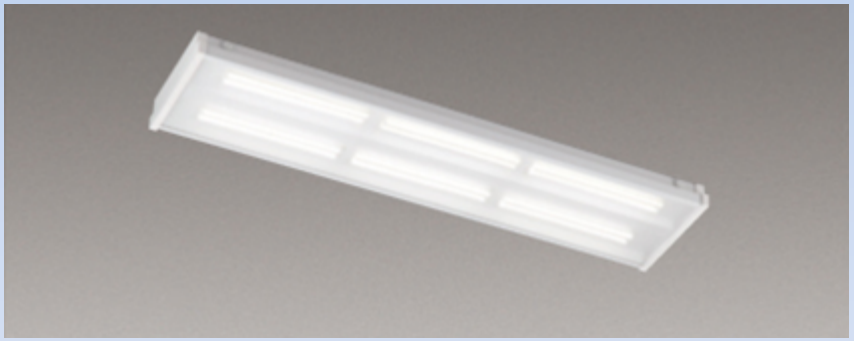
Total Luminous Flux: 9,450lm

The latest LED products in Japan

【Top Class Performance of Ceiling Lighting】
ODELIC Co.,LTD
LED Ceiling Light(for home use)

〈Specifications〉
Energy Efficiency: 79.9lm/W
Total Luminous Flux: 5,350lm
Life time of Light Source: 40,000hr

【Top Class Performance of Ceiling Lighting】
Toshiba Lighting & Technology Corp.
“E-CORE” LED Ceiling Light(for office use)



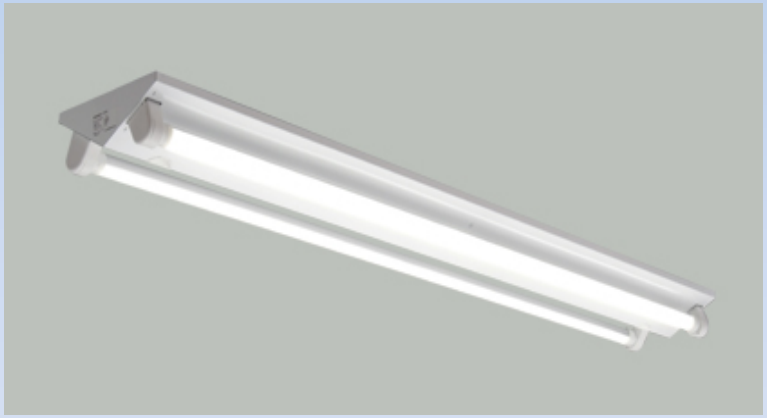
〈Specifications〉
Energy Efficiency: 113.2lm/W
Total Luminous Flux: 5,660lm
Electricity Consumption: 51W

The latest LED products in Japan

【Top Class Performance of Ceiling Lighting 】
IWASAKI ELECTRIC Co.,LTD
LEDioc CEILING HB(for industry use)

〈Specifications〉
Total Luminous Flux: 20000lm
Energy Efficiency: 96.6lm/W
Life time: 40,000hr
60,000hr(Separate Unit: Option)

【Top Class Performance of Linear Lighting】
Mitsubishi Electric Lighting Co.
Linear LED lamp Base Lighting



〈Specifications〉
Total Luminous Flux: 4730lm
Energy Efficiency: 86lm/W
Color Rendering: Ra84
Lamp cap: GX16t-5(new standard for LED linear lamp in Japan)

The latest LED products in Japan

【 Top Class Performance of Outdoor Lighting】
IWASAKI ELECTRIC Co.,LTD
“LEDioc ROAD” LED Street Light

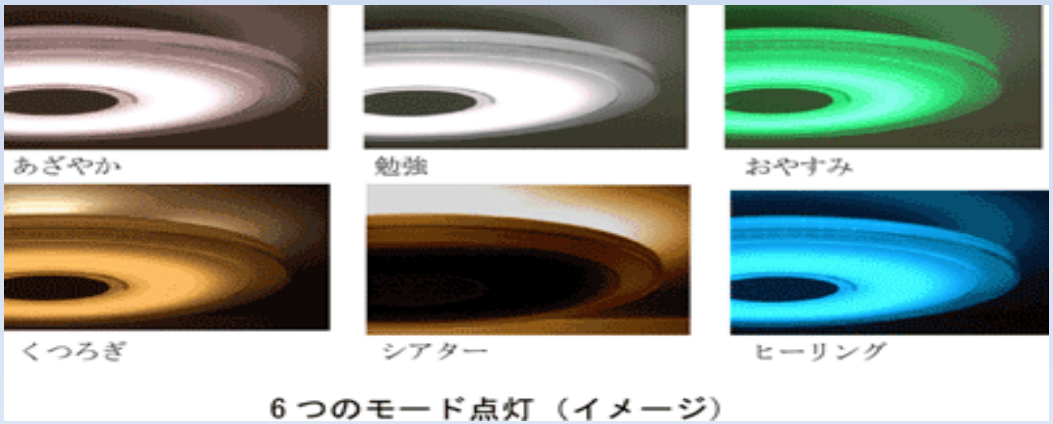
〈Specifications〉
Average Luminance on Street Surface: 1.0cd/m^2
Electricity Consumption: 130W(Equivalent to 400W Mercury Lamp, energy consumption is 70% less.)
Life time of Light Source：60,000hr

【Top Class Performance of Outdoor Lighting】
Panasonic Electric Work
LED Public Street Secure Light

〈Specifications〉
Energy Efficiency: 81lm/W
Total Luminous Flux: 680lm
Electricity Consumption: 8.4W（9.8VA）
Life time：60,000hr

New trends in LED application

- Intelligent dimming and color control make a life wealthy and healthy.



Source: Sharp,Toshiba websites

The next step for saving more energy

- Several energy-saving subsidy programs are now discussed in Japan.
  - ✓Home Energy Management System (HEMS)
  - ✓Building Energy Management System (BEMS)
  - ✓Li-ion Battery System into Home
  - ✓Solar Battery System into Home
  - ✓Power Saving Renovations of Existing Buildings
  - ✓High Efficiency Gas Air-Conditioners

Contents

Concluding remarks

- The Japanese Government set the “New Growth Strategy” as a national goal at December 2009, and the Government, in collaboration with industries, has started various policies for realizing “New Growth Strategy” since then.
- Our program includes three aspects: R&D, standardization and promotion for the LED products.
- The LED products have grown up to a major product in lighting in Japan due to the fact that Japanese consumers become very sensitive to energy conservation after the earthquake of March 11th and following power supply crisis.
- Japanese industry put the high level LED technology into the market.
- We understand international collaboration on standardization of the LED products is one of the most important issues.

Let’s work together !!

DISCUSSION

Working Towards International Consensus:

- *What initiatives are underway in other APEC economies?*
- *What issues are generic to APEC economies?*
- *What are the key lessons we can learn?*