



EPIC response to Green Paper on Solid-State Lighting

22 February 2012

Summary: Solid-State Lighting using LEDs is being adopted rapidly with double-digit growth in Europe and around the world. The driver is economic added value. Economic valued-added comes from higher performance, less space used, less weight, access to colours, reduced maintenance and energy savings.

There are a number of market sectors where LED lighting is being deployed. This response is focussed on General Lighting: Commercial indoor lighting and Residential lighting. Solid state lighting offers an extraordinary opportunity throughout the entire value chain. European industry can capture this opportunity if SSL products offer added-value, in comparison to conventional lighting, that customers can perceive and appreciate.

1. Lighting is about people

Economic productivity is the result of people at work. People must have light in order to be productive. There are lighting conditions that optimise productivity.

Intelligent lighting is the concept that seeks lighting conditions that optimise human productivity, in the classroom, in the factory, in the hospital recovery room, on the stage, wherever people are living.

Although intelligent lighting is not a new idea, Solid-State Lighting is the first lighting technology that allows the full exploitation of intelligent lighting concepts. This is why Solid-State Lighting is different and better than other higher-efficiency lighting technologies like CFL or HID.

Like modern fluorescent lighting or HID, SSL brings benefits in energy efficiency. However these benefits are secondary when compared to the value-added by improved productivity from intelligent lighting.

The revolution brought on by SSL will cause lighting to be used in applications that no one can imagine today. There will be more kinds of lighting applications, and there will be more people using lighting. As a result, it is possible that more electricity will be consumed, albeit more efficiently.

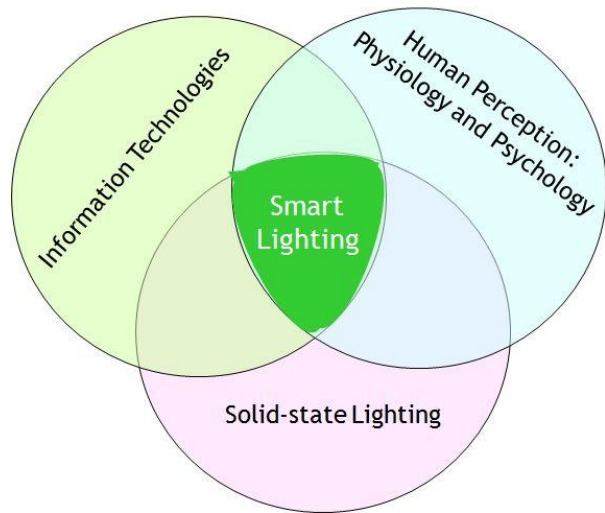
2. Intelligent Lighting: Solid-state Lighting, Information Technologies, Human perception, physiology and psychology

The concept of Intelligent Lighting is straightforward. The objective is to improve the productivity and performance of people. People need light in order to perform. With the right kind of light, they can feel better and perform better.

Students of all ages perform better; learn faster and more efficiently under the right lighting conditions. These conditions change according to the time of day and the number of students, and the type of activity. The class room will be lit differently in different areas according to these parameters.

Intelligent lighting parameters can be:

- Intensity
- Hue or colour temperature
- Diffuse and point source
- Sensing/information/communication (such as internet access)



What is more, the optimum parameters are variable, depending on:

- Time of day
- Presence of others: what is the scene?
What kinds of people and objects?
- Time of year
- Task
- Weather

Smart Lighting is a combination of SSL, IT and Human factors

The payback from intelligent lighting can be measured in several ways:

- Higher productivity
- Greater security
- Lower energy consumption
- Lower maintenance costs
- Greater synergy between lighting, cooling, security

The key to understanding why SSL is so revolutionary is to recognize that Light-emitting diodes are programmable semiconductor devices, similar to transistors and integrated circuits. They are digital

devices and they can be interfaced to computing systems. The possibilities are much greater: intensity, colour, information transmission and detection.

There are key areas where European support could lead the way to accelerated deployment of solid-state lighting. These are:

Research:

- Biology: Measurement of human factors, perception and performance using SSL capabilities

Development:

- Thermodynamics: Improve thermal management.
- Optics: Rethink and redesign lighting enclosures and projectors
- Electronics: Develop ultra-high reliability electronics with lifetimes commensurate with SSL service lifetime

Standards:

- Performance-related
- Interconnection-related

Systems:

- Intelligent lighting systems that integrate: Lighting, security, heating and cooling, and information exchange

These priorities are discussed where possible in the following as we respond to the questions and challenges posed by the Commission.

3. Response to questions

3.1 High initial purchase cost:

The purchase cost of a SSL light bulb is currently about 5 times more than that of a CFL low-consumption lightbulb having equivalent luminance. The initial purchase cost of SSL is an important component of the total cost of ownership. To encourage wider adoption, the price of an LED lamp should be within 1 or 2 euros of the price of a CFL for the same lumen output. A higher purchase price for SSL could be sustained if there is apparent added-value delivered by the SSL option. This could be greater comfort and well-being derived by the user, higher productivity in the workplace, fewer accidents on the road, etc.

One way to solve the “high initial purchase cost” is to phase out mercury-containing lamps by a progressive ban, essentially making the SSL LED the “low-cost” option. In our judgment such a decision might be politically feasible when the price of LED lamps is within a factor of 2 of CFL.

3.2 Which additional challenges do you see for a wider SSL market penetration in Europe and which solutions would you propose to resolve them?

The main areas where wider penetration can be achieved are commercial indoor lighting and residential lighting. The commercial lighting sector is by a very large margin the greater opportunity, accounting for 60% of electrical lighting consumption. In general SSL fixtures have a lower cost of operation and a higher initial purchase cost compared to conventional lighting sources. The rising cost of electrical power shortens the “pay-back” time and should act to encourage faster adoption of SSL on a cost basis. However, introducing higher added-value lighting with intelligent controls could dramatically accelerate adoption, despite a higher initial purchase price. The Apple i-Phone is an eloquent demonstration that customers will pay much more up-front for a product that delivers greater added value. Cost of ownership and added-value are the determining parameters for increased penetration.

3.3 What can Member States do to reinforce market surveillance of product performance and safety in the area of SSL lighting products?

Member states have done a particularly poor job of introducing the CFL as an alternative to incandescent lighting. The CFL gives an improvement in power consumption of 4 or 5 times that required for an incandescent bulb. However, each lamp contains a few mg of mercury. There has been very little, if any preparation of merchants or citizens about how to dispose of these lamps when they burn out after 6 or 7 years. The present situation is surprising because procedures for collection and recycling of fluorescent tube lamps are both commonplace and efficient in the commercial lighting sector.

The first step that Member States can take right now to ease the SSL transition is to prepare the public and implement recycling procedures for the 100s of millions of CFL lamps now in deployment, saving the release of literally tonnes of mercury into the environment.

3.4 What could the lighting industry do to ensure the performance of SSL products?

The lighting industry actively supports development of standards for both performance and interfaces of SSL products with other systems. These activities are essential to the wider take-up of SSL.

We observe that the premature failure of SSL products is due frequently to failure of the associated electronics rather than the light sources. The lighting industry should consider development of electronics having the same extended lifetime as SSL products.

The Joint Research Centre of the European Commission has proposed in 2011 the European LED Quality Charter. This initiative focuses only on LEDs, while the whole SSL should be taken into account. It is nonetheless a good step in the right direction.

3.5 What can be done to raise awareness of consumers and professional users to SSL technologies and which specific measures and incentives would you propose for accelerating SSL uptake?

SSL will thrive in areas where it brings special advantages and added-value:

Architectural Lighting: 50-year lifetime, low maintenance, high luminance point light sources with access to colours with efficient light sources instead of filtered white light. This is a lighting source that can be projected efficiently to light up a surface at a distance.

Street lighting High-efficiency point light sources, easy to project, with reasonable colour-rendering and low-maintenance long-lifetime operation that can be connected in a smart lighting network.

Office and commercial lighting This is the application space where intelligent lighting can make a difference, by providing lighting conditions can optimise productivity of workers, students, help patients to get well faster, and so forth.

Residential lighting Lighting that goes beyond simple bulb replacement, and which leads to more comfort and well-being for the user.

Architectural and street lighting are applications that are highly visible to the general public. Visibility is key to raising consciousness. The successful performance of SSL in these four market sectors would be a strong argument to support increased deployment of SSL. Reports on performance from an “honest broker”, such as those issued by the US Department of Energy (http://www1.eere.energy.gov/buildings/ssl/gatewaydemos_results.html), would be a significant help. This is an activity that could possibly be taken up by the Joint Research Centre.

3.6 What could be done to overcome the landlord-tenant conflict?

In some commercial buildings, the landlord furnishes the lighting and the electricity consumption is included in the rent. In these cases, the landlord-tenant conflict can be avoided by a transparent business proposition between the landlord and lighting installer. The building owner pays the installer the amount of the current electrical billing plus the lighting maintenance budget. The installer puts in the energy-efficient lighting system for a low negotiated cost, or even at no cost to the landlord. The installer pays the new lower electricity bill and recovers the installation cost through the energy cost savings. The contract last for several years during which the installer also profits from the nearly non-existent maintenances cost.

The approach is based on the idea that the Lighting Installer knows that there are savings to be gained. He can lower the risk and the upfront investment of the building owner by taking on the conversion. As a result the Lighting Installer shares the cost savings with the building owner. Lower operational costs could also mean lower charges for the tenant, too.

3.7 Which additional measures could help accelerate SSL deployment in buildings?

In Europe the opportunity to introduce solid-state lighting lies principally in building renovation rather than new construction. Undoubtedly, new construction will involve intelligent lighting systems with LEDs, but the amount of new construction in Europe is small relative to the existing park of commercial buildings. The most significant savings in energy will come from building retrofitting.

Requiring the installation of energy-efficient lighting as part on the permitting process would seem to be a productive approach. Offering fiscal incentives for going a step further to install intelligent lighting might also be used.

3.8 *What measures, beyond the ones above, could further support research and innovation and the reinforcement of the SSL value chain in Europe?*

Better understanding of human performance and lighting. This will identify new effects, new relationships, opportunities for added-value and new lighting opportunities.

3.9 *Which other actions could be taken by industry to reinforce sustainable SSL manufacturing capacity in Europe?*

Let's examine some elements of the Value-Chain for SSL

- Materials
- SSL manufacturing equipment
- LED manufacturing
- Luminaire manufacturing
- Lighting design
- Smart Lighting systems : SSL + IT + Sensors

There are strong and competitive European companies that are manufacturing state-of-the-art products in each of these segments of the value chain. As the SSL market develops, the European presence can be reinforced by directing new investment and resources in areas of the value chain that improve competitive position and create the most economic value.

3.10 *Which additional actions can reinforce cooperation along the value chain, in particular with architects and lighting designers, electrical installers and with the construction and building industry? What should be the role of the Member States and the EU in making it happen?*

Here are some of the more helpful actions that Member States and the EU could take concerning the opportunity for SSL in the commercial indoor lighting sector:

- Encourage inclusion of intelligent lighting systems in the building codes for both new construction and building refits.
- Aggressive phase-out programmes for mercury-containing light sources (HID and fluorescent)
- Develop a system for efficient and non-polluting recovery of mercury-containing lamps

3.11 *Are there gaps in standardisation today which hamper SSL innovation and deployment? If yes, where are such gaps and how can they be addressed?*

Yes

There are 2 kinds of standards: Performance and Interconnection

Performance standards: Labeling: colour temperature, lifetime, lumens, efficacy. These help the consumer to make intelligent choices. Right now, standards covering performance are being developed with help of CELMA, the CIE and other organisations

Interconnection standards: what does the socket look like? What are the dimensions of the package? How big is the chip that goes into the package? What is the focal length of the micro-optics? The Zhaga consortium is a recent industry-wide cooperation aimed at interchangeability between products made by diverse SSL manufacturers. (<http://www.zhagastandard.org>)

Standards development in both of these areas should be encouraged.

3.12 Which actions should Member States and industry take to support education, vocational and lifelong learning and training on SSL and to address the adaptation of educational curricula to include the latest lighting technologies?

The adoption of i-Phone technology by almost everyone on the planet shows that people will learn and adopt sophisticated new technologies when they can see the added-value. It is not yet clear that the public may need additional targeted education to appreciate the value of SSL.

Education and training of electrical installers in SSL systems will of course be needed, but in the usual way to ensure safe and effective operation of new installations. The role of Member States is to assure that certification of lighting installers includes knowledge of SSL properties.

SSL is the best route toward increased added value in the economy, while using electrical power wisely and efficiently. Strong economic growth during the next decade may require greater access to electrical power for lighting. The European economic region needs to invest in additional sources of clean energy generation as a way of enabling this growth. Education could focus on the need to develop additional clean sources of energy, rather than on the benefits of adopting SSL.

About this Vision Paper:

This document has been prepared by EPIC and has been approved by its Governing Board.

About EPIC:

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