

## Lessons Learned Bringing LEDs to Market

*The following is an Executive Briefing of a forthcoming report that details the experiences of governments around the world accelerating the adoption of LED technology in their lighting markets. This briefing has been issued to coincide with the launch of the Global Lighting Challenge<sup>1</sup> at the UN COP21 Climate Conference.*

Lighting is a significant factor contributing to our quality of life and productivity of our workforces. Artificial illumination extends the productive day, and enables people to work in enclosed dwellings, offices and factories where there is no natural light. Lighting, however, also consumes resources, both in the manufacturing and the operation of lighting equipment. And, as our economies grow and our populations expand, our demand for lighting increases along with power consumption. A recent global market study found that lighting consumes approximately 15% of end-use electricity (UNEP en.lighten, 2015).

Energy consumption can be reduced without compromising lighting service through market adoption of more energy-efficient, quality lighting products. But there is more to providing light than simply reducing power - as so many countries learned through the introduction of compact fluorescent lamps (CFLs). Even though they were introduced in the early 1980's, this light source was only moderately successful from a market-share perspective. Poor quality CFLs had led to unhappy consumers which in turn prevented greater market penetration and energy efficiency gains.

But consumers now have an alternative. A new lighting technology, based on Light Emitting Diodes (LEDs), creates an opportunity to cost-effectively reduce electricity consumption while increasing light quality and control. And while the market has been gradually expanding, policy makers have found that the introduction of LED lighting products have faced some similar challenges to the introduction of CFLs. LEDs are a new technology and are relatively expensive compared with conventional lighting technology choices. However, with careful planning and the right mix of policies and programmes, governments have an opportunity to introduce policies and programmes that will prepare their markets for quality, energy-efficient LED products and avoid the pitfalls and mistakes of the past.

This memo presents some of national-level approaches, initiatives and ideas to accelerate and support LED lighting in the market by the IEA 4E SSL Annex member countries. These best practices lessons can be grouped into three thematic areas:

- 1) Communication and Education – raising awareness of end-users and key stakeholders in the supply chain
- 2) Market Preparation – defining product quality and performance criteria, government leadership, coordination regionally and locally
- 3) Manufacturer Support – invest in domestic manufacturers, offer 'green tech' financing and assist the standardisation process

Across all the critical segments of the supply chain, governments are in the driving seat when it comes to raising awareness, providing tangible examples and ensuring widespread understanding and appreciation of the benefits of LED lighting.

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<sup>1</sup> For information about the Global Lighting Challenge: <http://www.globallightingchallenge.org/>

## Theme I. Communication and Education

LED lighting communications, channels and messages vary by audience. Communication and education strategies and approaches differ for the consumer market and the professional lighting market.

**Point-of-sale, a key channel for consumers:** For consumers, education at the point-of-sale is crucial. Consumers need to be able to quickly understand what they are buying and why they should pay more for it.

- To address this need, Sweden and Denmark developed smart phone applications to allow a consumer to quickly compare different lamp alternatives and associated energy and cost savings.
- In the United States, the voluntary Energy Star labelling program is used to differentiate the best performing products and allow consumers to quickly identify those products through a trusted government programme.

**Engage retailers as communication partners:** Dialogue and on-going cooperation with retail partners is important to ensure consumers are informed about product options at the point of sale. The shop-floor sales representative often serves as an on-site advisor to consumers, finding efficient LED lamps that would fit into their fixtures and satisfy their requirements in terms of quality and brightness.

- To capitalise on this opportunity, the Danish government developed a short (10-minute) e-training programme targeting retail staff. The video covers a range of technical aspects relating to lighting (e.g., colour, lumens, etc.) to enable them to better advise their customers.
- Australia has also developed a lighting training manual on lighting design and options for specialist retail lighting stores (with a video in preparation) and has worked closely with retailers to provide government-sponsored communication materials, such as posters and shelf strips in relation to key lighting regulation changes. These specialist stores were identified as a key player and government partner in educating consumers contemplating new lighting systems (e.g., in renovation or major refurbishment situations).

**Labelling programmes:** These can be an excellent tool for supporting a communications and education campaign.

- Labelling programmes can be either endorsement labels like the US Energy Star, or they can be categorical labels like the European energy label which has label classes that vary with efficiency.
- The USA has a “Lighting Facts” LED lighting label<sup>2</sup> which conveys lots of performance information about the lamp or luminaire in a concise way. In fact, one of the reasons US DOE started Lighting Facts was to promote the concept of ‘truth in advertising’ – that is, ensuring that the product performance reported on the box is accurate, reflecting the true performance of the product contained therein.
- In addition to programmes like these, governments can also assist end-users by providing web-based resources such as databases, fact sheets, education videos and other material. Taken together, these resources help support market transformation by educating the

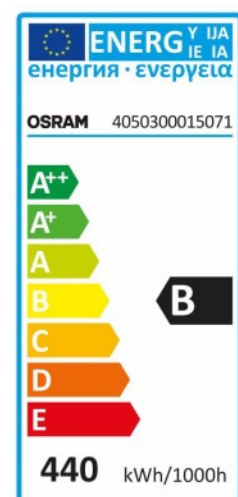


Figure 1. EU energy label for lighting

<sup>2</sup> For more information on Lighting Facts: <http://www.lightingfacts.com>

consumer and making sure they are discerning and demanding when purchasing LEDs.

**Professional lighting market:** The supply chain for the professional lighting market requires a different approach to the consumer market. For new or refurbished commercial buildings, experts are usually appointed who prepare lighting designs and specify the equipment to produce the desired effect. To reach these professionals, governments have written articles in trade journals, developed demonstration projects in large economic areas with free open-house / training, participated in trade expositions, and so on.

- For example, the French agency for energy and environment (ADEME) sponsors a long-standing continuous education programme for specifiers and installers of street-lighting<sup>3</sup>, which includes such topics as lighting design, energy efficient technologies including LEDs, and performance requirements.
- The Swedish Energy Agency also dedicates a lot of effort to educating municipalities, lighting designers, specifiers, and retailers on lighting technology, options, and considerations such as warranty issues, consumer protection laws, electrical safety, and EMC compatibility.

## **Theme II. Market Preparation**

Governments have used several policy tools to accelerate a national market for high-efficiency, high-quality LED lamps. These include promoting quality LED products through multiple channels, leading by example through procurement, conducting demonstration projects and coordinating regional and local initiatives.

**Avoid market spoiling.** Experience suggests that if a consumer has a negative experience with a poor quality LED lamp, they may subsequently have negative associations with all LED products. To address this, governments have put policies in place that help move the market toward high-performance LED lamps. These measures may be both mandatory and voluntary, including minimum quality requirements and product labelling. Furthermore, they can be linked to market promotion schemes with retailers, electric utilities or other local stakeholders.

- In Sweden, for example, following new regulatory measures on LED lamps, the Swedish Energy Agency made a strategic choice to focus on education and work through municipal actors and advisors as the channel to retailers and consumers. This included information about making choices between technologies, consumer protection issues, labelling, and other critical aspects. The Swedish government is also prepared to address consumer concerns about LED lighting products, including concerns about light related health impacts<sup>4</sup> and life-cycle assessment impacts<sup>5</sup>.

**Leading by example:** Governments also have the potential to lead by example by specifying and purchasing high-performing LED systems for their own facilities and buildings. Green procurement of high quality LED lamps are an excellent way to bring new and high-performing products into the market, providing experience to lighting designers and electrical contractors. Furthermore, green procurement projects also make excellent case studies, ensuring governments are perceived as being on the cutting edge of technology as well as being efficient with their budgets.

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<sup>3</sup> For information on Ademe's programme: <http://www.ademe.fr/collectivites-secteur-public/gerer-equipements-services/eclairage-public>

<sup>4</sup> For information on LEDs and Health: <http://ssl.iea-4e.org/health-environment/health-impacts>

<sup>5</sup> For information on LCAs of LED products: <http://ssl.iea-4e.org/health-environment/lifecycle-assessment>

- The Metro authority of Paris, for example, is currently replacing all metro lighting with LEDs and intends to finish this work by 2016.

**Market analysis and support:** Governments have a need to understand the market and how it is evolving, through for example collecting market sales data and conducting product testing.

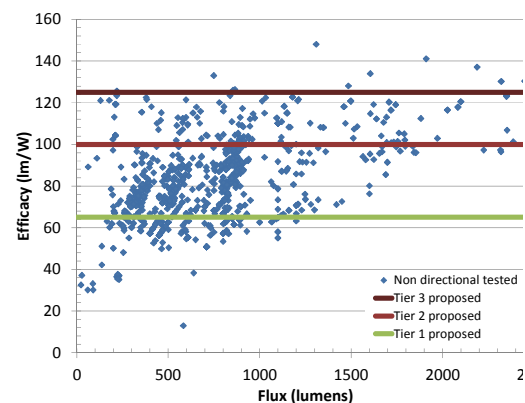
- Australia, Denmark, Sweden and other countries regularly test LED products in the market in order to inform development of policies and regulations.

A key step to understanding markets is to engage and work with industry to understanding and developing policy for a rapidly developing technology such as LEDs.

- For example, the Australian government has recently released a stakeholder consultation report on options for action on LED lighting<sup>6</sup> and held meetings and webinars to seek industry feedback on the introduction of possible policy measures.

**Leverage existing know-how and experience:** There are considerable economic and trade advantages from minimising the number of different national performance levels for the same product around the world. To the extent that requirements can be harmonised, it will help to reduce the costs of preparing specifications and to facilitate trade. Further, harmonisation will also help minimise compliance costs with SSL programmes and policies.

- The IEA 4E SSL Annex has published a set of quality and performance tiers<sup>7</sup> that cover a wide range of different product types, including non-directional household lamps, downlights, linear fluorescent LED lamps and street lights. These voluntary performance tiers were based on analysis of shared market and test data by lighting experts from participating countries and address product attributes such as colour, lifetime, power, and efficacy, and they could be used by government or non-profit and donor agencies when designing programmes and policies.



**Figure 2. Plot of draft SSL Annex Tiers vs LED lamps tested**

**Competition and stakeholder collaboration spurs innovation:** Governments have also run lighting design competitions, establishing prizes and awards, built around the use of quality LED products. These competitions, in collaboration with industry and other partners, can raise awareness around both the technology and the quality aspects, and help to accelerate adoption of LEDs.

- In the USA, the Energy Department established the L Prize competition<sup>8</sup> to spur development of replacement technologies for two common, inefficient technologies: 60W incandescent lamps, and PAR38 halogen lamps. The L Prize for the 60W incandescent replacement category was awarded in August 2011, including a US\$10 million dollar cash prize. L Prize winning products are also eligible for government procurement contracts, utility programs, and other incentives.

<sup>6</sup> The Australian consultation: <http://www.energyrating.gov.au/consultation/led-lighting-product-profile-consultation>

<sup>7</sup> To see the performance tiers: <http://ssl.iea-4e.org/product-performance/performance-tiers>

<sup>8</sup> To learn more about the L Prize: <http://www.lightingprize.org>

- There is also a global award for the most efficient lamps and luminaires called the “SEAD Global Efficiency Medal”.<sup>9</sup> This award is given by the Clean Energy Ministerial’s Super-efficient Equipment and Appliance Deployment (SEAD) initiative, and it demonstrates the levels of efficiency that are possible today while still maintaining a high degree of quality.

### **Theme III. Manufacturer Support**

Several of the governments involved in the SSL Annex recognised the emergence of this exciting new technology as an opportunity for national growth and development. Supporting research and developing domestic intellectual property (IP) translates into a recognition that the “the science of today is the surplus of tomorrow”.

**Invest in Domestic LED Business:** The US, Japan, Korea and China have invested heavily in LED research and manufacturing to build their domestic industry and patent base, which is helping to position these economies as global leaders in this highly efficient light source.

- One approach governments can consider is to establish business incubators which work to encourage support small and medium size enterprises entering the market. The investment in LED business can also be indirect, offering for example tax holidays or establishing green tech revolving funds that provide low interest loans or start-up capital to develop an idea or approach. And in the LED product supply chain, there are many stages ranging from chip manufacturing through modules, drivers, optical design and assembly, and finally finished product. Companies with some competitive intellectual property position can compete in any stage of the supply chain, whether it’s business to business or business to consumer.

**Support Test Standards:** Governments can also help to support the test standards process.

- For example, last year the SSL Annex published an LED lighting product measurement comparison of over 100 lighting test labs from around the world. This comparison, called the 2013 Interlaboratory Comparison<sup>10</sup>, was designed to (1) help support harmonisation of SSL testing around the world and (2) help establish a common proficiency test for accreditation programmes aimed at different regional test methods.



**Figure 3. Lighting metrology at VSL in the Netherlands, a nucleus lab in the 2013 IC**

Governments can also help support the development of an LED manufacturing base by helping to participate in international standardisation committees, so they have a robust understanding of the testing standards. And now, following the publication earlier this year of “Test Method for LED Lamps, LED Luminaires and LED Modules” by the International Commission on Illumination (CIE S 025/E:2015), governments can work to help facilitate the accreditation of test laboratories to this new international measurement standard.

<sup>9</sup> To learn more about the SEAD Global Efficiency Award for Lighting: <http://superefficient.org/LightingAwards>

<sup>10</sup> To learn more about the 2013 Interlaboratory Comparison: <http://ssl.iea-4e.org/news/2013-ic-final-report>

### **About the IEA-4E Solid State Lighting Annex**

Launched in July 2010, the IEA-4E SSL Annex is a joint initiative of nine countries working together to address common challenges with SSL technologies. The Annex member countries understand there are significant advantages in engaging in an international collaboration and joint activities relating to SSL performance and quality. Sponsoring governments of the SSL Annex include Australia, Denmark, France, Korea, the Netherlands, Sweden, the United Kingdom and the United States. China also participates as an expert member of the SSL Annex.

The Annex member countries believe that there are significant advantages in engaging in an international collaboration in order to develop a consensus on harmonised approaches to SSL performance and quality. The work of the SSL Annex spans a wide range of initiatives which can be found on the Annex's website <http://ssl.iea-4e.org/>, including guidance for policy makers, quality and performance tiers and support for laboratory accreditation.

### **About the IEA Implementing Agreement on Energy Efficient End-Use Equipment (4E)**

4E is an International Energy Agency (IEA) Implementing Agreement established in 2008 to support governments to formulate effective policies that increase production and trade in efficient electrical end-use equipment. Globally, electrical equipment is one of the largest and most rapidly expanding areas of energy consumption which poses considerable challenges in terms of economic development, environmental protection and energy security. Twelve countries have joined together to form 4E as a forum to cooperate on a mixture of technical and policy issues focused on increasing the efficiency of electrical equipment, including Electric Motor Systems (EMSA), Mapping and Benchmarking, Solid State Lighting (SSL) and Electronic Devices and Networks. The current members of 4E are: Australia, Austria, Canada, Denmark, France, Japan, Korea, Netherlands, Switzerland, Sweden, UK and USA. Further information on the 4E Implementing Agreement is available from: [www.iea-4e.org](http://www.iea-4e.org)

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