2014-2020: a new era of LED lighting?

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Despite their energy efficiency, LEDs have been used almost exclusively in electronic devices (screens for cell phones, computers or TV screens), largely due to high production costs. However, technological advances have progressively reduced manufacturing costs. Coupled with a regulatory focus on energy efficiency, these reductions are opening up new opportunities for LEDS to enter the lighting sector. With a further decline in production costs expected and growing environmental concerns, the LED lighting market is set for promising growth in the years ahead.

Light Emitting Diodes, better known as LEDS, are electronic components designed to convert energy into light; they were first manufactured in the 1960s in the form of infrared diodes, but entered the lighting sector only 40 years later, when technological advances made possible to provide a bright, white-coloured light.

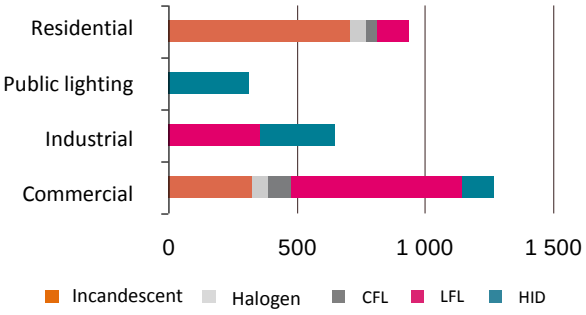
The lighting sector had previously been limited to:

- Incandescent lights (traditional incandescent light bulbs and halogen lights) mainly used in the housing sector;
- Fluorescent lighting (compact fluorescent light bulbs (CFL) and fluorescent tubes (LFL)) was mostly used in industrial and commercial settings;
- High intensity discharge lamps (HID) used for street lighting.

Incandescent light bulbs have begun to be replaced in the past few years by compact fluorescent tubes and halogen bulbs, both in France and elsewhere, as they offer better lighting and energy efficiency compared to incandescent light bulbs, which lose a considerable amount of energy as heat.

LEDs also present distinct advantages over compact fluorescent light bulbs: better lifetime and composition, shorter response time and more varied applications. Consequently, they are likely to edge out compact fluorescent lights fairly rapidly.

Figure1. Overall electricity consumption per sector



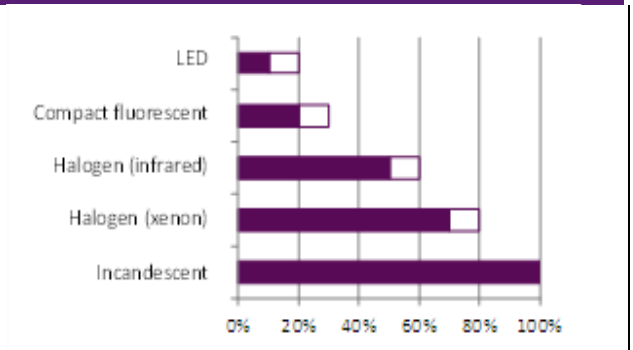
Source : AIE 2006 / Mirova 2014

Clear environmental benefits for the lighting industry

Until now, LEDs were mainly used for backlighting the LCD screens of cell phones, laptops, tablet computers and televisions, or else for vehicle headlights because of their high production costs. Since most of these LED backlighting applications were new and did not replace less energy efficient existing technologies, the environmental savings associated with the growth of this technology have been limited.

Applied in the lighting industry, however, LEDs are a whole different story. LED lighting could consume up to 90% less electricity than incandescent bulbs (see Figure 2) and offer lower energy consumption than other low–energy technologies such as compact fluorescent light bulbs. Moreover, the energy performance of LEDs should continue to improve as according to laboratory testing 3.5 times as high.

Figure 2. Energy consumption of various lighting technologies



Source: Mirova 2014

Since electric lighting accounts for 6% of global greenhouse gas emissions and consumes 19% of the world's total electricity production (IEA, 2006), LEDs could provide significant environmental benefits. In the construction sector more specifically, lighting represents about 35% of the total electricity consumed by a tertiary building unit.

From an environmental perspective, it is essential to reduce energy consumption; a life cycle impact assessment of the various lighting technologies shows that the usage phase of bulbs is overwhelmingly the most demanding, making it the focus of interest in their energy efficiency. Furthermore, LED light bulbs offer other environmental benefits. Their lifetime greatly exceeds that of lights based on other technologies (~40 000 hrs. as opposed to ~8 000 hrs. for compact fluorescent lights and ~1 000 hrs. for incandescent lights – ADEME, 2013). Such bulbs require less frequent maintenance and replacement, resulting in decreased waste in the end of life phase.

Finally, the environmental risks associated with LED lights' end-of-life phase are limited in that, contrary to fluorescent lights, they contain no mercury.

However, while LEDs provide real environmental advantages, particular attention must be paid to the social risks associated with manufacturing light-emitting diodes. Because most factories are located in Asia, where working conditions are less supervised than in Europe, the existence of such risks should not be underestimated.

Strong levers for growth

Owing to successive technological achievements, the cost of producing LEDs has been greatly reduced. In fact, cost per lumen has reduced tenfold every ten years, while performance (the amount of light produced per unit) has increased threefold every three years. Coupled with the overproduction prompted by State subsidies (particularly China), this structural trend, also called Haitz's law,[1] is driving signs of market penetration in the lighting sector.

Thanks to further technological developments, costs should continue to decline in the years ahead. Moreover, from a geographical standpoint, most of the actors involved in LED light manufacturing are currently located in China, Japan and Korea. Following a general trend in the electronics industry, production may be "relocated" to other Asian countries where the workforce is cheaper, thus providing continued cost reductions.

[1] *The counterpart to Moore's law in the electronic sector.*

LED lights should also benefit from increased adoption in the medium term due to other factors, among which:

- **A reinforcement of the legislative framework**: according to France's 2012 Thermal Regulations, marketing energy-consuming household lamps is prohibited in France, and similar regulatory measures have been implemented in other countries (see Figure 3). Measures designed to reduce energy consumption and greenhouse gas emissions are expected to harden, as suggested by the European 2050 Roadmap (goal of achieving a 20% reduction in total energy consumption and GHG emissions).
- **LEDs' longer life cycle**: While primarily a matter of convenience for the residential sector, LEDs' long life cycle is also an economic benefit in commercial and industrial applications, thanks to lower maintenance costs.
- **LEDs' greater lighting comfort**: The quality of compact fluorescent light bulbs' white and cool-coloured light is often criticized, whereas LEDs have been able to provide warmer lighting that answers a broad variety of needs. In addition, LEDs ensure immediate lighting, while the longer ignition time of compact fluorescent lights is a frequent topic of customer dissatisfaction.
- **Increasing numbers of technological applications:**

  Thanks to their small size, resistance to impact, colour and temperature, LEDs are increasingly finding technological applications, for instance in the tablets and smart phones that have appeared in the last few years.

Figure 3. Ban on sales of incandescent lights global review

	2009	2010	2011	2012	2013	2014	2015	2016
United States				100W	75W	60W&40W		
Europe	100W	75W	60W	40W&25W				Halogens delegalized
Japan				Voluntary termination of all incandescent light bulb production in 2012				
China				≥ 100W		≥ 60W		≥ 15W
India		CertainsStates began to ban incandescent lighting in government buildings as of 2010. In 2009, India announced a program to replace incadescent light bulbs w ith compact fluorescent lighting.						

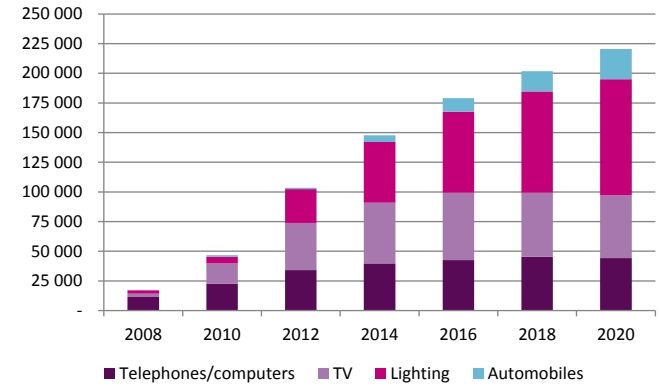
Source: US DoE, EC, NDRC UBS / Mirova 2014

These various trends should drive a steep increase in the market for LEDs for years to come (See Figure 4). And now that prices have fallen significantly, with a quality of light offered by LEDs comparable to —if not better than— other available lighting technologies, 2014 may be the year LEDs take off in the lighting sector. Several encouraging signs are already visible. China has set a 2020 goal for LED production equivalent to 164 billion dollars, 70% of which is expected to be devoted to lighting. New York City has undertaken the task of replacing its public lighting with LEDs, a project that is set to be completed in 2017.

This growth should provide benefits all along the value chain, especially among:

- LED manufacturers such as Epistar, Osram, Everlight electronics, Acuity Brands, Nichia, Cree, Philips electronics, General Electric and Zumtobel
- Suppliers of process systems (MOCVD systems) such as Veeco or Aixtron.

Figure 4. LED market growth by application



Source : BAML / Mirova 2014

For investors, this market offers an opportunity to concretely address environmental issues while at the same time affording considerable prospects for growth. It seems therefore wise to pay attention to companies all along the value chain associated with LEDs, given that they are likely to benefit from the observed trends.

Figure 5. LED lighting's contribution to the revenues of sector leaders

Providers of process systems (MOCVD systems)	
Aixtron	100%
Veeco	100%
LED manufacturer	
Epistar	25%
LED and finished product manufacturers	
Osram	15%
Cree	40-50%
Everlight electronics	20%
Philips electronics	10%
Suppliers of integral lighting solutions	
Zumtobel	25%
Acuity brands	30%

Source : UBS / Mirova 2014

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