

How LED is Revolutionizing the Lighting Sector

Navigating the market changes

There's a revolution in the lighting market, and the catalyst is light-emitting diode technology, better known as LED. Thanks to its advantages over traditional lighting technology and other advances, LED is ubiquitous in all kinds of applications. Players all along the lighting value chain are feeling the effects of this revolution. The onus now on all companies is to navigate these short-term market changes safely and become better prepared to operate successfully in the future.

The LED revolution in lighting technology is comparable to another technological transformation: transistors. When transistors replaced vacuum tubes in the 1940s, they were instrumental in the later development of personal computers, notebooks, and smart phones. LED has the ability to be similarly transformational. Like the transistor, LEDs are smaller and have a longer operating life and lower total cost of ownership than previous technologies.

LEDs boast several other advantages over conventional lighting (such as incandescent halogen, compact fluorescent, and high-intensity discharge lighting):

- Quality white-light source
- Instant, dimmable light
- No heat emission
- No mercury
- Small size (miniaturization)
- High efficacy

In particular, LED's high efficacy—the ratio of the perceived power

of light (in lumens) to input power (in watts)—has the potential to far exceed that of other technologies (see sidebar: *What is LED Technology?* on the following page). Note also that this contributes to meeting energy efficiency targets; consider, for example, the 2009 EU regulation for introducing energy-saving lamps. Ongoing research and innovations will help further expand the technology's potential. Already, LEDs—once used almost exclusively in indicator-type applications—are now applied in many different ways, including general illumination, portable devices, displays and signage, traffic signals, automobiles, and medical devices.

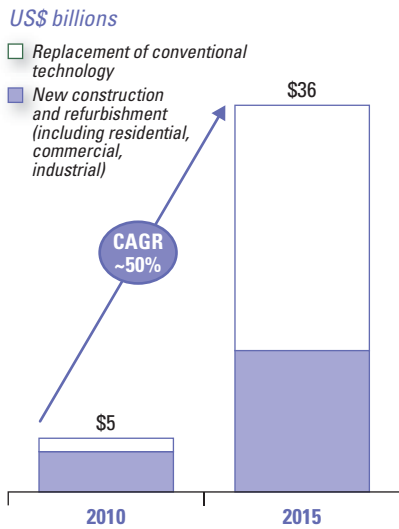
Value Chain Revised

LED is poised to dominate the market in the years ahead, with expected annual growth of roughly 50 percent through 2015 (see figure 1 on the following page). By 2020, the LED share of the lighting market could realistically



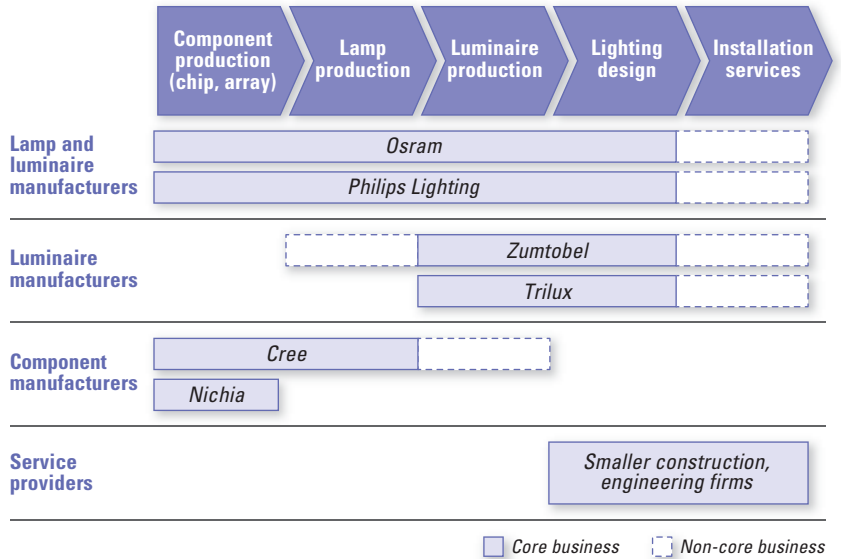
The growth of LED technology has led to a revolution in the lighting market. Leading companies will navigate short-term changes safely and build a long-term competitive advantage.

FIGURE 1: Global LED lighting market forecast



Source: A.T. Kearney analysis

FIGURE 2: Competitors along the LED value chain (non-exhaustive)



Source: A.T. Kearney analysis

reach 90 percent. The LED revolution is also gaining momentum in terms of market dynamics. While demand for replacement lamps has accounted for significant growth thus far, that market is dwindling as fewer replacements are needed given LEDs' longer life span. Also, new players from the semiconductor and consumer-electronics segments are entering the general lighting market with LED products.

All of these developments are having a substantial impact on players up and down the value chain—from manufacturers to distributors to service providers. Figure 2 illustrates where some of the major players are in the industry. When discussing the dynamics of the LED market with our clients, the conversation always turns to the players and their strategies. Depending on where a com-

pany is in the LED value chain, the strategies will be different. Let's look at a few examples.

Established lamp and luminaire manufacturers. Because the replacement business is on the downswing, manufacturers such as Samsung LED, Osram, and Philips Lighting will have to revise their market strategies, since the LED revolution calls for nothing less than a dismantling and recreation of current business models. As these companies battle to maintain market dominance, we are already seeing vertical integration along the value chain. Some are expanding their market positions; a good example is GE's recent acquisition of Israeli LED specialist Lightech. Others have created cooperative relationships, such as the comprehensive LED-patent cross-licensing agreement between Philips and Cree. Still others buy components and assemble, specializing in key sub-

What is LED technology?

A light-emitting diode (LED) is a semiconductor device that produces light. Essentially, it is a solar cell working in reverse. Instead of converting light into electricity, it converts electricity into light. Unlike conventional light sources—incandescent, halogen, fluorescent, compact, high-intensity, discharge—LED emits light in a narrow range of wavelengths such as red, green, or blue. For general illumination, various approaches (such as color mixing) are applied to obtain white light.

segments, a trend that is likely to continue in coming years.

Luminaire manufacturers. Luminaire makers, such as Zumtobel and Lithonia Lighting, have not experienced much impact on their production or business models since only the light source has changed, not the fixtures. Nonetheless, it is significant that Philips acquired Genlyte, the former number-two luminaire manufacturer in North America, in an effort to control fixture production. We expect similar industry acquisitions in the future.

New entrants. Companies in unrelated industries are entering the lighting market. They are predominantly from the semiconductor industry or television manufacturers; both Sharp and Panasonic have entered. This is not an easy industry to enter, however, as the entry barriers are high; chip and epi production and packaging are capital-intensive, there are significant intellectual property issues, and numerous players are already entrenched, including Seoul Semiconductor, Cree, Nichia, Philips, and Osram. Also, the modules and drivers business is fragmented (products are still not standardized), and the luminaire business has thousands of players. Here, the main hope for newcomers is to differentiate by understanding regional issues and building strong customer relationships.

Component manufacturers and service providers. Finally, the LED revolution represents a big opportunity for component manufacturers and service providers to expand their activities—identifying unique selling propositions and then occupying relevant positions along the value chain.

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Also, integration along the value chain is a viable strategy. For example, a company that provides installation services might consider backward integration by acquiring a semiconductor manufacturer, thus taking advantage of its existing base of commercial and industrial customers.

The Innovation Trilogy

The key to success in the LED lighting market is to focus on that which makes LED lighting unique: Because

of its technological flexibility, it offers numerous possibilities for design and application. With this in mind, we believe LED's main areas of differentiation are in what we call the LED innovation trilogy: technology, design, and application (see figure 3).

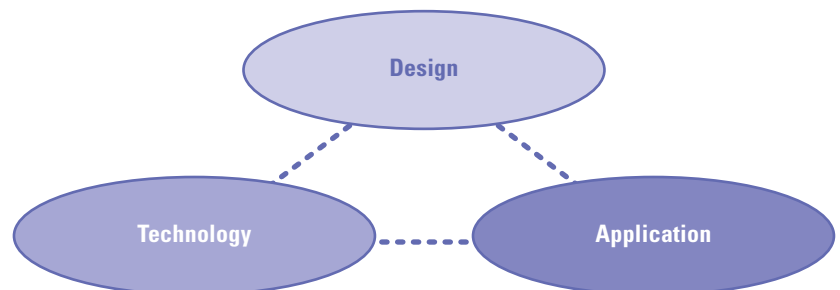
Technology. LED already outperforms traditional lighting technology, which it is rapidly replacing, but there is vast potential for improvements, which will come in the form of increased efficacy, miniaturization, and light color, to name a few.

Applications. The possible applications of LED are almost limitless—street lights, TVs, stadiums, automobiles, appliances, and so on. We expect to see numerous innovative concepts in the coming years as firms gain knowledge of the market and customer needs.

Design. Technology and new applications are tightly connected to new possibilities in design, and only a fraction of the possibilities have been realized so far.

To take full advantage of new opportunities, all three areas of the LED innovation trilogy must be considered.

FIGURE 3: The LED innovation trilogy



Source: A.T. Kearney analysis

Navigating a Revolution

New firms are entering the LED market, and traditional players are expanding to strengthen their market power. Who will succeed and who will fail? The answer depends on the unique characteristics of each firm and

the strategies deployed. Success does not necessarily depend on getting bigger or being active along the entire value chain. It can result from joint ventures or simply building cooperative relationships with selected partners in complementary businesses.

Three areas (technology, application, and design) will differentiate the winners from the also-rans. While each one alone can add value, together they form a potent, unbeatable force—the kind that can navigate revolutions.

Authors



Dietrich Neumann

Partner, Berlin

dietrich.neumann@atkearney.com



Arnold Rofner

Consultant, Vienna

arnold.rofner@atkearney.com



Sven Massen

Principal, Berlin

sven.massen@atkearney.com

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