

lighting | VALUE-CHAIN

Module development lights up the future LED value-chain

As the LED revolution causes major disruption in the lighting industry, many companies, particularly those in the LED sector, are contemplating how to position themselves for future growth and profitability. McKinsey's comprehensive research shows that current LED industry dynamics favor LED moduling, as **MICHAEL VIERTLER**, **DOMINIK WEE**, and **OLIVER VOGLER** discuss.

As in other industries that have been derailed by disruptive technology, the "LED revolution" is forcing the lighting industry to redefine itself. Many lamp and luminaire players are realigning their strategies, deciding how and when to adopt the new and innovative LED technology. LED manufacturers, who historically have been accustomed to a component business based on shipping large volumes of through-hole LEDs, are also thinking about their coverage along the value-chain and whether there are any strategic plays they can exploit by becoming more integrated or focusing on specialty lighting applications. Given that optoelectronics is one of the fastest-growing semiconductor segments, traditional semiconductor players are also looking for potential opportunities to enter the LED business.

Based on McKinsey's proprietary research on the professional lighting industry, this article discusses how the profit pool around today's traditional lighting value-chain will develop into the LED lighting value-chain of 2020, and the implications this has for companies at different steps of the value-chain. McKinsey's research shows that "moduling"—the development of LED-based modules—will be the most attractive value-chain step going forward.

Traditional lighting value-chain today

At present, the traditional lighting value-chain

MICHAEL VIERTLER is Partner in the Munich, Germany, office at McKinsey & Company. DOMINIK WEE and OLIVER VOGLER are Consultants in the Cologne and Munich offices, respectively, and are members of the LED competence center at McKinsey.

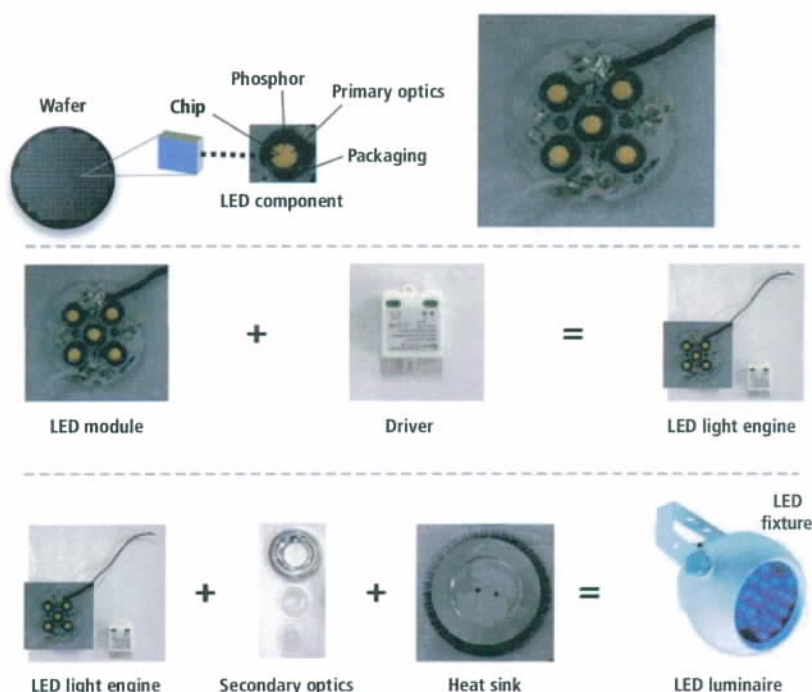


FIGURE 1. The LED value-chain consists of a variety of components and processes, starting with the chip and ending with the final luminaire .

consists of four major steps—lamp, ballast/optics, luminaire, controls—with the strongest industry focus on lamps. With Osram, Philips, and GE covering more than 60% of the worldwide market, there is only limited room for other players that mainly focus on specific lamp applications (e.g. Megaman for CFL). The situation in the luminaires market, which is highly fragmented but with one truly global market leader (Philips Lighting), is the

complete opposite—it has around 20 international players with strong regional leadership and more than 300 small- to medium-size players that are national champions or purely local players. This fragmentation is rooted in limited economies of scale and strong product localization (design, electricity regulations, and connectors).

The global annual revenue for traditional lighting was around €40 billion in 2008. Professional luminaires account for the majority share (€25 billion), followed by lamps (€11 billion), and then ballasts and controls (€2 billion each).

lighting | VALUE-CHAIN

McKinsey estimates the current total profit pool for the entire professional lighting value-chain at around €3.5 billion worldwide. Our analysis shows that 70% of global profit goes to luminaire manufacturers because they cover the most value-add, and because there are many specialized applications and significant demand for customized fixture designs.

LED lighting value-chain today

In the LED world, the professional lighting value-chain steps are very similar to those in traditional lighting: epi/chip, packaging, moduling/light engine, driver/optics, luminaire, and controls (see Fig. 1). Right now this industry is still in its infancy, with revenues of around €1.5 billion and a global profit pool of around €100 million.

Since color conversion is key nowadays, despite its association with high price premiums, packaging constitutes the highest proportion of the current profit pool (see table). Not only is there on average more value-add in packaging than in the epi/chip step, but manufacturing is also less capital-intensive. Moreover, we are seeing a sharp increase in proprietary IP build aiming to uncover the secrets of converting blue LEDs into broad-spectrum white light.

From a technology point of view, the ability to deliver high lm/W chips is highly attractive. However, chip manufacturers

Profit pool development for traditional and LED lighting

	Traditional lighting share of profits		LED lighting share of profits		
	Today ¹		Today ¹	2020 ²	Rationale for change
Lamp	20%	Epi/chip ³	10%	Lower	<ul style="list-style-type: none"> One or two big players expected to dominate Typical commoditization
Ballast/optics	5%	Packaging	50%	Lower	<ul style="list-style-type: none"> Commoditization will happen Still significant share due to white light conversion
Luminaire	70%	Moduling	25%	Higher	<ul style="list-style-type: none"> Increasing technical integration needs (e.g. chip on board)
		Driver/optics	3%	Flat	<ul style="list-style-type: none"> Growingly integrated into moduling part Potential differentiation via including driver and optics in module step
		Luminaire ⁴	10%	Slightly higher	<ul style="list-style-type: none"> Exploding variety of applications and solutions Threat of standardization
External controls	5%	External controls	3%	Slightly higher	<ul style="list-style-type: none"> Standard component However, more sophisticated controls needed
Total = €3.5 billion			Total = €0.1 billion	Total = €1.5 billion to €2.0 billion	

¹ 2007, worldwide. Source: McKinsey.

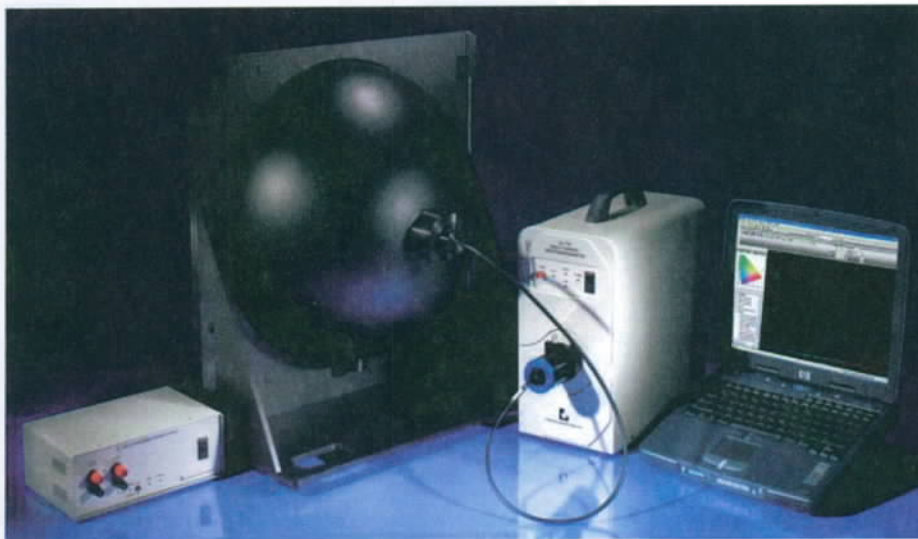
² Includes LED applications for general illumination only. Source: Amadeus, Bloomberg, analyst reports, expert interviews, McKinsey.

³ Margins for white high-brightness LEDs higher, but all current LED players need to have broader portfolios due to binning variation.

⁴ Professional segment only.

are still struggling to depreciate huge investment volumes and amortize R&D spend. Non-top-five players are not earning much

money with high-power LED chips, while more and more players seem to be overcoming the critical 100 lm/W hurdle.



Accurate and Affordable LED Measurement Solutions

- High sensitivity and dynamic range
- 25+ scans per second
- High-speed USB interface
- Meets CIE guidelines for Conditions A & B

Optronic Laboratories' OL 770-LED Spectroradiometer provides high precision, research-grade measurements to meet your demanding production application within your budget without compromising quality or consistency. Find out what the competition is learning - we deliver. Contact the factory today for a quote!

Optronic Laboratories, LLC

4632 38th Street, Orlando, FL 32811 USA
T: (407) 422-3171 F: (407) 848-5412 W: www.olnet.com

Moduling, which by our definition includes SMT, primary optics, and heat management, is already stronger than the luminaire part in terms of the profit pool. In absolute terms, the luminaire part will not change dramatically compared to the traditional lighting industry. As a result, the "light source" step in the LED value-chain increases significantly. This increase will also partly be brought about by new technical requirements, such as including driver electronics or heat management at the module level.

Hypotheses and implications

Our research shows that the global LED profit pool has the potential to grow to €2 billion globally by 2020, driven by energy saving/green technology initiatives, TCO, and superior light quality. Moduling will be the winner in relative terms, while epi/chip is expected to deteriorate the most (see table). This is subject to a series of hypotheses/trends we predict will occur over the next 10 years, bringing with them substantial

implications for existing players.

EPI/CHIP

Trends: Over the next 10 years, chip will be the loser among the different value-chain steps. IP barriers will finally be dismantled, at least in practical terms. Players in China and other parts of the Far East are already finding ways around current patent protection. One or two major players will eventually dominate, based on typical commoditization as witnessed in the semiconductor sector. The epi process will eventually be controlled and optimized further. As wafer sizes increase, so will yield. As in the semiconductor industry, scaling up production processes will require ever-increasing investment, as seen in traditional semifab investment cycles. Furthermore, several major, manufacturing-savvy, traditional semiconductor players are already thinking about entering the LED industry, which will also drive commoditization.

Implications: Chip players need to drive

the cost curve themselves and think about moving to low-cost locations. A strong focus on productivity and squeezing value from binning can further drive down the cost position. McKinsey LED benchmarking shows huge potential for improvement in this area. In addition, migrating further downstream can enlarge a player's individual slice of the profit pool and help secure demand for higher chip output. Finally, it is worth considering a "pure IP play," which entails outsourcing production to contract manufacturers and focusing on design and downstream integration.

PACKAGING

Trends: The packaging share is also expected to shrink over time due to commoditization within the industry. Material costs *per se* are already low, but IP-related costs will also decrease sooner or later. Still, the use of phosphor coatings to convert blue into white light will secure a significant share of the profits, since color rendering and color temperature

Thomas Research Products
Innovative & Energy Saving Lighting Controls


POWERING THE PROMISE OF LEDs

SWITCH MODE LED DRIVERS
QUALITY AND RELIABILITY

- CONSTANT CURRENT AND VOLTAGE
- INDOOR OR OUTDOOR APPLICATIONS
- ACTIVE POWER FACTOR CORRECTION
- 90-305V UNIVERSAL VOLTAGE
- 30W-300W MODELS
- HIGH EFFICIENCY MODELS AVAILABLE
- ULTRA LONG LIFE MODELS
- PROTECTED AGAINST:
OUTPUT OVER-VOLTAGE,
OUTPUT OVER-CURRENT,
OUTPUT SHORT CIRCUIT AND
THERMAL OVERLOAD

DIMMING MODELS
NOW AVAILABLE

CUSTOM OUTPUT NEEDED?
NO PROBLEM!



11548 SMITH DR. HUNTLEY, IL 60142 PH 847-515-3057 F 847-515-3047 WWW.THOMASRESEARCHPRODUCTS.COM
THOMAS RESEARCH PRODUCTS IS NOT AFFILIATED WITH HIGH-PERFECTION TECHNOLOGY

lighting | VALUE-CHAIN

will remain key factors for the performance of white high-brightness LEDs.

Implications: Even if the bulk of packaging already takes place in low-cost countries, it is still essential to continue optimizing manufacturing locations. McKinsey's LED manufacturing benchmarking shows that besides the cost component, companies cannot afford to neglect skill building for operators and engineers. If the phosphor mix can be improved further and eventually patented, this would give individual players a strong competitive advantage, at least for a while.

MODULING

Trends: Moduling will be the winner in the LED value-chain for professional lighting. Not only will technical integration increase (e.g. chip on board/wafer-level packaging), but the intensity and quality of light will be significantly influenced by smart moduling techniques that increase lumen output at light engine level while optimizing thermal management. Ultimately, the winning

design will be based on a de-facto standard, producing a shared platform at light engine level that includes driver electronics or is built on AC LED. This can be easily mounted by luminaire OEMs without any concrete electrical engineering competence.

Implications: For all players offering products at module and light engine level, the key lies in creating the dominant design. There are several areas for integration of electronics and primary optics at module level, which must be mapped out to develop new IP strategies. Installing professional patent management ensures IP is enforced and utilized. Players can drive standardization based on their own dominant design to ensure a sustainable profit base.

LUMINAIRE

Trends: The luminaires part will regain importance, thanks to continued optimization of heat management and an ever-widening variety of applications and solutions. However, the ongoing threat of

standardization as it relates to LED modules/light engines is eradicating luminaire players' value-added potential. In view of the go-to-market structure for luminaires, which is based on long-term customer relationships and regional particularities, there are few grounds for extensive consolidation in the luminaires market.

Implications: Luminaire OEMs should think about further integration along the value-chain, such as upstream toward moduling/light engines (where the value is). However, this would mean building additional electrical engineering capabilities and integration solution know-how. Moreover, these OEMs could think about exploiting the variety of additional functions available with LEDs, heading downstream toward more complex controlling systems. An alternative option would be to drive "de jure" standardization by having officially defined light-engine platforms, which would guarantee multiple sourcing and increase price pressure in the light engine segment. ☺

DMX512 LED Controller

Part Number	SC-WC2
Fit for	Microcontroller and multicolor LED product
Warranty	3 years

Technical Parameters

Input Voltage: 12V/24V DC
 Input Signal: DMX512(1990)
 Output Channel: 12 channels with dimming
 and 2 channels with dynamic colorspeed variation
 Output Current: 5A/12VDC and 2A/24V DC for each channel
 Function: All 35 modes

Features

Meet DMX512(1990) protocol. Can be used as a DMX512 decoder.
 A LCD screen shows controller current working status.
 33 normal color changing patterns and 2 DMX operating modes.
 256 levels brightness, totally 16.77 million colors, real full color (up to 85536 levels).
 0-255 speed adjustment levels for dynamic change
 RGB individual dimming function
 Automatic parameter memory
 XLR3 Male and Female interface



Try to find an economic solution to directly replace conventional CFL T8 tubes? E-tube™ works!



E-tube™ fluorescent LED tube T8
 more brightness, less power

MR16 5W



www.signcomplex.com
info@signcomplex.com

