

The LED industry

*Building scalable operations
for rapid, profitable growth*

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The potential for LED technology - Lighting the way

Today's global lighting industry is responsible for approximately 19% of electricity use and 6% of greenhouse gas emissions¹. In this context, LED technology has the potential to be a game changer for the industry, with well-publicized environmental and technological advantages compared to conventional lighting (e.g., 50-70% lower energy consumption, no mercury content, and significantly longer life spans).

Commercial and industrial LED lighting is a major business opportunity as well, with a market size of \$12.5B in 2011 and projected growth of 40% per year through 2016^{2,3}. In the US alone, LED lighting has the potential to reduce US annual energy costs by \$53 billion if it can reduce lighting energy usage by 40%⁴. Given the huge market opportunity, how can LED manufacturers profitably serve it?

Solar industry transformation – A harbinger for LED lighting?

The global market for solar panels has grown an average of 66% over the past three years⁵. However, a significant over-investment in manufacturing capacity and excess supply has rapidly driven down average panel selling prices. Solar panel manufacturers have struggled to remain profitable in this highly competitive environment.

LED lighting has similar industry characteristics as the solar PV market – rapid growth, large investments in manufacturing capacity in low cost countries, and expectations for manufacturers to quickly reduce costs (see Figure 1 for additional industry comparison).

¹ Strategies Unlimited, "The Worldwide Market for LEDs Market Review and Forecast 2012", July 2012.

² Ibid.

³ GTM Research, "Enterprise LED Lighting 2012: Trends, opportunities, and leading companies in commercial and industrial LED lighting", August 2012.

⁴ The Climate Group and Philips, "Lighting the Clean Revolution: The rise of LEDs and what it means for cities", June 2012.

⁵ International Energy Agency, "Trends in Photovoltaic Applications: Survey report of selected IEA countries between 1992 and 2011", September 2012.

Figure 1: Industry Comparison – LED Lighting vs. Solar

| | LED Lighting | Solar |
|---------------------------------------|---|--|
| Value Chain | Components-Modules-Systems | Components-Modules-Systems |
| Component Manufacturing | Capital intensive, semiconductor based processes | Capital intensive, semiconductor based processes |
| Component Commoditization | Yes, growth and investment in China and Taiwan | Yes, growth and investment in China and Taiwan |
| Module Manufacturing | Primarily industrial manufacturing | Primarily industrial manufacturing |
| Value Chain Integration Trends | Component manufacturers moving downstream to capture value Downstream players developing partnerships with component manufacturers | Component manufacturers moving downstream to capture value |
| System-level Products | LED luminaries | Integrated solar systems |
| Retrofit Products | Yes | No |
| Tariffs | TBD | Yes |

Leveraging lessons learned from the solar PV market

As in the solar industry, we expect there to be winners and losers in LED lighting. LED market leaders should apply learning from the solar industry to best position themselves for sustainable, profitable growth. Specifically, companies can best adapt their business to both current and future market trends by focusing on four key operational strategies:

- Transforming the supply chain to improve flexibility and reduce costs
- Optimizing the global footprint
- Developing an integrated, solution-driven value chain strategy
- Delivering on product innovation

Transforming the supply chain to improve flexibility and reduce cost

Currently, the biggest roadblock for increased LED adoption is the high price of LED-based products. Many LED companies are driving market adoption by reducing product price and bidding aggressively on large projects, often at low margins. This pricing pressure, combined with short product lifecycles (typically 6-12 months) and volatile demand, often lead to high cost structures and operational complexity.

Companies need to employ proven supply chain capabilities to stay competitive. For example, developing planning capabilities such as supply/demand balancing and collaborative planning with customers will help manufacturers improve responsiveness to demand fluctuations. Also, building best-in-class strategic sourcing, supplier management, and end-to-end yield improvement capabilities will help players establish a more competitive cost structure.

Optimizing the global footprint

Asia is projected to be one of the highest growth regions and account for over 35% of the global lighting market and expected to rise to 45% by 2020³. The primary growth drivers in Asia are high construction rates, major government funding for high efficiency building lighting, and replacement of existing outdoor lighting infrastructure. In addition to becoming the major LED lighting consumer, Asia is expected to be the chief supplier of LED chips and packages with factories in China, Taiwan, Korea, and Japan.

With product demand and component supply moving to Asia, companies outside Asia need to optimize their portfolio and global footprint to stay competitive. Manufacturers need to develop tailored products that address the unique needs and preferences of the Asia market. Additionally, they need to redesign their supply chains to minimize the total cost to deliver products to customers in this region. This may require aggressively locking up top CM capacity and/or repositioning key value chain partners and supply chain resources to secure material supply and low-cost manufacturing.

Developing an integrated, solution-driven value chain strategy

As competition in the LED industry has increased, many LED chip manufacturers are moving down the value chain to capture incremental value in luminaires and solutions. Two recent, notable examples are Cree's acquisition of Beta-Ruud Lighting and Osram's acquisition of Siteco. As experienced in the solar PV market, downstream investments are a reaction to potential overcapacity and commoditization in the upstream LED chip market and an attempt to better control demand for their components.

As part of their value chain strategy, downstream players should evaluate the potential of collaboration and partnerships with upstream players developing next generation chips. Upstream players should explore partnering or acquiring downstream fixture manufacturers and system integrators developing innovative and customized solutions to sell higher margin integrated products and move closer to end users.

Delivering on product innovation

In a relatively short time span, the global LED industry has become extremely competitive. VC funding in the US almost doubled from \$167M in 2010 to \$305M in 2011. Global competition has also increased with major technology firms such as Sharp, Toshiba, and Samsung entering the market to compete with both LED chip manufacturers (e.g., Cree, Lumileds) and traditional lighting players (e.g., GE, Osram). Additionally, government funding has fueled manufacturing capacity investments across Asia, including China, Taiwan, Malaysia, and Singapore.

With increasing competition and the threat of commoditization, LED companies need to bring new products and solutions to market faster and efficiently. They should improve R&D productivity, streamline product development execution, leverage global design investments more effectively (e.g., design for cost, platforming across product lines), and collaborate with partners in the ecosystem (e.g., co-creation, open innovation) to launch new business models.

Shaping the future - Applying lessons learned from other industries

Lessons learned in solar and other technology growth industries can provide valuable lessons and help LED companies avoid pitfalls. With a compressed industry maturation timeline, LED companies should heed these hard-won lessons and invest early in the key operational strategies needed to build both scalable and profitable operation.

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