

The Emerging Market for LEDs in General Lighting

Over the last several years, the emergence of light emitting diodes (LEDs) as a leading form of lighting for residential, commercial and industrial applications has steadily gained acceptance. While still prohibitively expensive on a cost per watt or lumen basis, LEDs are expected to reach parity with traditional forms of lighting (incandescent, fluorescent and halogen) sometime around 2015. However, because LEDs have lifetimes up to 50 times longer than the standard bulb, they naturally appeal to a wide variety of commercial and industrial applications where fixed costs are high. Replacement for general lighting by LEDs is often viewed as the largest and last bastion of traditional lighting. Governments are legislating changes which seek to ban or phase out inefficient and chemically toxic technologies.

The total General Lighting market, including lamps, ballasts, controls and fixtures is today approximately \$55B and is expected to grow to \$73B by 2015, an annual rate of 6%. The leading market segments are residential (42%), commercial (23%), industrial (12%) and outdoor (23%). Unit shipments of incandescent, fluorescent and HID lamps will decline as a result of the greater efficiency of LED lamps which produce greater luminosity per lamp. Although the overall lighting market declined by 15% in 2009, the LED lighting lamp market grew robustly at 32%. In 2010, the market started to see major outdoor area and commercial retrofit adoptions using LED modules, pushing LED penetration of General Lighting to a little above 2% of the total market. Products are still highly variable in terms of quality, but improving rapidly.

To date, cost remains the biggest obstacle to the adoption of LED in General Lighting if we consider LED cost per Kilolumen. Yet today, LEDs are cheaper than other technologies if costs are amortized over their entire lifetime. Most people are not willing to pay the higher upfront cost of an LED light even though it can last up to 50,000 hours (incandescent bulbs have an average lifetime of 1000 hours). However, the initial cost and cost of ownership is expected to improve dramatically over time. Manufacturing of LEDs is a semiconductor process that requires high tolerances and precision process control and cost reduction are still in an early stage. Board assembly for LED light bulbs is highly automated, but still involves a considerable amount of manual labor for attaching components, heat syncs and optics. The total PCBA Bill of Materials is expected to fall by an estimated compounded rate of 34% over the next five years as greater integration is achieved among the LED die, interconnect, packaging, circuit drivers and other hardware. Box assembly costs, including ordinary materials such as glass, plastic, reflectors and metal base, will not decline nearly as sharply.

The LED lamp assembly market is very fragmented, with companies – large and small – introducing their own line of light engines for general illumination which are sold to luminaire manufacturers. Many suppliers, mostly Asian, tend to eliminate margin from finished products in an attempt to establish market share. Strong unit growth and declining ASPs combine to generate positive revenue growth, but solid earnings are difficult to achieve. Because the market is over populated and so highly fragmented, suppliers then tend to push costs to the margin leaving very little for profits. There has been a slow trend toward consolidation, generally resulting in a loose collection of smaller divisions that cater to different application segments. Only multinational companies like Philips, Osram, General Electric, Panasonic, Toshiba, NEC and Hitachi are

quickly building manufacturing scale and process discipline. LEDs are expected to emerge as the dominant lighting technology beginning sometime in 2015.

Though designed for local markets, the manufacturing of mass produced SSL fixtures is being increasingly outsourced to low-cost manufacturers in geographies such as China, Vietnam, India and Bangladesh. There are hundreds of Chinese / Taiwanese and Japanese LED suppliers that are looking for manufacturing scale and distribution. Outsourcing seems to be only attractive for export, except among leading manufacturers / suppliers.

- Taiwanese LED chip companies like Epistar are already following a foundry type strategy. Other LED makers, such as Cree and Seoul Semiconductors, are trying to extend their business by reaching further down the value chain into the LED modules and fixtures markets.
- The Japanese are very active in the LED chip business as well as partnering with OEMs such as Nichia, Panasonic, Sharp, Stanley and Toshiba. Panasonic in China obtains the LED light source in the USA, and sends it to Chinese factories for assembly, which is cheaper than in Japan. Sharp has reportedly adopted a massive outsourcing strategy to further reduce the cost of the LED and power supplies.
- The Koreans have targeted the LED market in a similar way to the LCD display market and are actively pursuing OEM component business via Seoul Semiconductor, LG Innotek and many other small suppliers. Outsourcing will likely not be the result as vertical integration is the normal business model.
- The wild-card in the LED market is OSRAM, who appears to be pursuing a strategy of internal manufacturing (former Sylvania with facilities in Malaysia and China) and outsourcing with long-term partners with leading EMS firms.
- Foxsemicon Integrated Technology (FITI), part of the world's largest contract manufacturer Foxconn International, has formed close partnerships with major global semiconductor equipment, LED chip manufacturers and suppliers such as Charm and Ci out of Korea. The focus of FITI's products is to provide a quick retrofit solution for many applications. The company is generally viewed as a competitor in LED outsourcing similar to their component supply business.
- Cree has contracted with Flextronics International, the world's second largest contract manufacturer, in addition to extending its Durham, North Carolina LED manufacturing facility by 275 people in 2009 and plans to fill another 300 jobs by the end of 2012. Flextronics provides final assembly services in its plant nearby in Charlotte, North Carolina.
- The third largest contract manufacturer, Jabil Circuit, also is interested in the LED lighting business but only on a limited basis. It is believed that relationships with OSRAM and Avago are in discussion.
- Sanmina-SCI has specifically targeted LED Lighting as part of its Renewable Energy market program. No assembly programs or customers have yet to be identified although Avago is being pursued.
- In March 2010, Philips Lighting announced its selection of Elcoteq for a global growth partner of its SSL business. Elcoteq has already started the production of SSL products in its factory in Dongguan, China. Production will expand to other Elcoteq locations including Mexico and Hungary still during the year 2010.

For more details on the emerging market for LEDs in General Lighting, see the recently released market research report, ***The Worldwide Electronics Assembly Market for LED General Lighting - 2011 Edition*** by New Venture Research. This is the company's first foray into this market although the company is widely recognized for its work in manufacturing cost analysis and quantifying the total Cost of Goods Sold (COGS) for a variety of electronics products, now including LED lighting. This report sizes the market for LED chip or ICs, chip packaging, thermal management, optics, printed circuit board (PCB) assembly including drivers and related electrical components plus final (box) assembly and test of the LED fixture for a wide variety of end applications. For more information see www.newventureresearch.com/

Randall Sherman and Frank Klomps of NVR are the authors of ***The Worldwide Electronics Assembly Market for LED General Lighting - 2011 Edition*** and this article.