Emergence of low-price LEDs pushing adoption for general lighting

...but cost reduction is changing industry structure and pushing M&A.

While growth in the LED industry came initially from small-display applications and has been driven by LCD display applications, in 2012 general lighting surpassed all other applications, representing nearly 39% of total packaged LED revenue, notes market research firm Yole Développement in its latest 'Status of the LED Industry' report. Indeed, the LED TV crisis of 2011 (following an overestimation of the market) had the benefit of decreasing LED prices and intensifying the competitive environment. In fact, LED-based lighting product prices have fallen more rapidly than expected, increasing the penetration rate of the technology.

Yole estimates that the packaged LED market will reach $13.9bn in 2013 and peak at $16bn in 2018. Growth will be driven mainly by general lighting applications (45-65% of total revenue during this period), complemented by display applications.

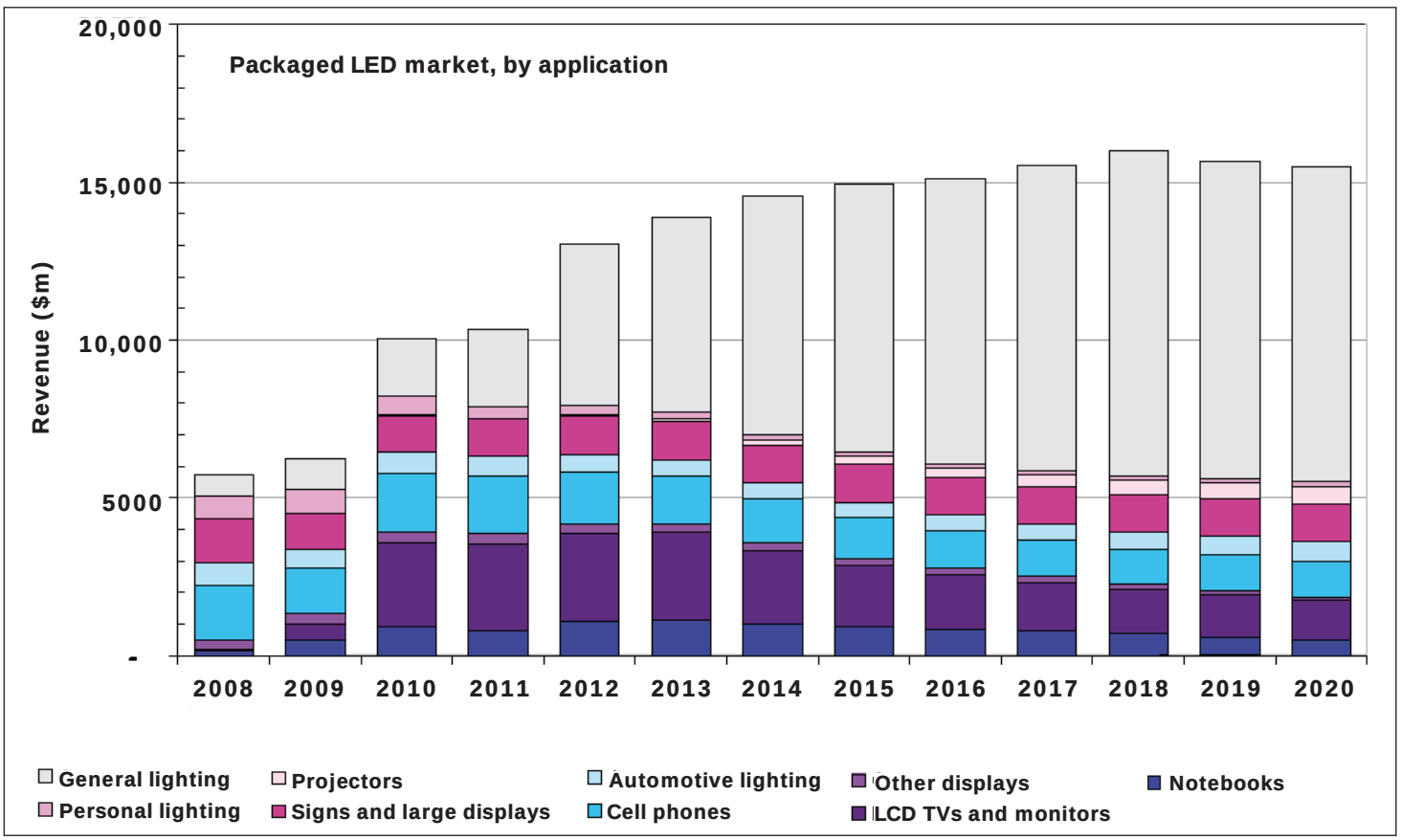
Other applications still in play

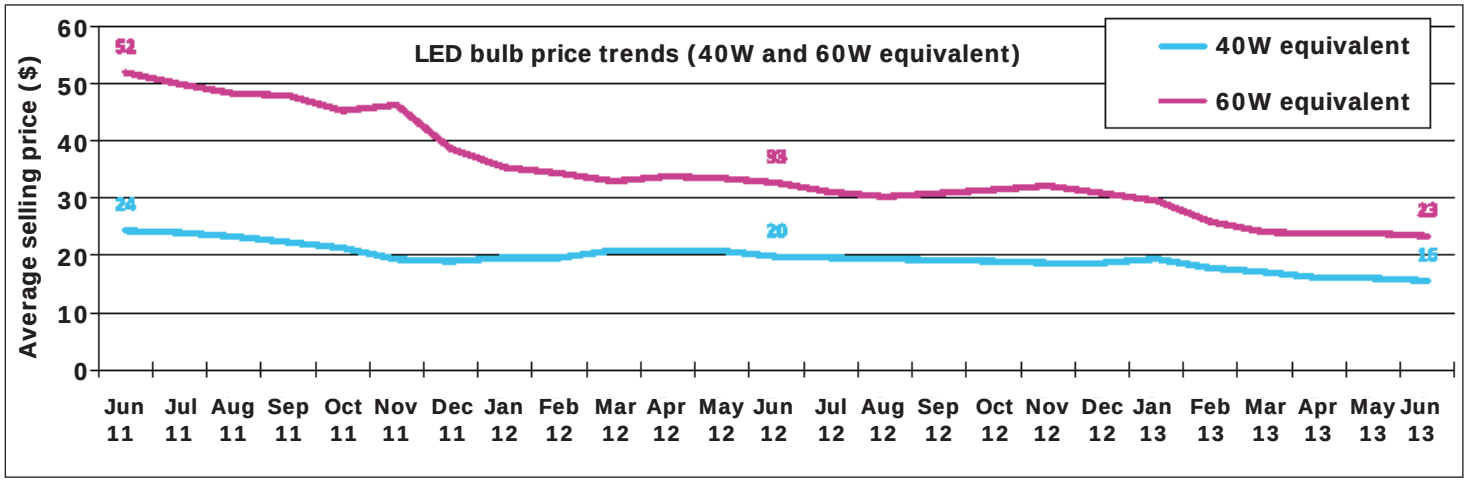
Regarding displays and other applications, most products now on the market integrate LED technology. But saturation mixed with strong pricing pressure and competition from organic LEDs will lead to most of these markets declining, starting in 2013/2014. In contrast to general lighting, overcapacity (inducing pricing pressure) has yielded a faster- than-expected decline in market size.

To maintain momentum, LED-based lighting product costs still need to be cut

"Cost represents the main barrier LEDs must overcome to fully compete with incumbent technologies," explains Pars Mukish, market and technology analyst, LED at Yole. "Since 2010, the price of packaged LEDs has sharply decreased, which has had the consequence of decreasing the price of LED-based lighting products."

However, to maintain the growth trajectory, more effort is needed in terms of price. LEDs still have some





potential for cost reduction, but widespread adoption will also require manufacturers to work on all components of the system (drivers, heat sink, PCB etc).

Merger of LED and lighting industries has begun

Over 2010–2012, the number of mergers and acquisitions (M&A) has continued to grow, reflecting increased consolidation in the LED industry. Yole counts about 60 significant M&A deals during this period. Also, 17 further deals have been identified during first-half 2013.

The main objectives of these deals are:

1. ***Vertical integration*** — A consistent trend in the LED space, reinforced by the promising boom in general lighting applications. Such deals are motivated by the need for firms to access new technologies, to close gaps in expertise in the LED supply chain, secure supply etc.
2. ***Strategic acquisition*** — The LED lighting market remains highly fragmented in all regions of the world (e.g. local features of fixtures). In this environment, strategic acquisitions are motivated mainly by economies of scale and the desire for improved market share, access to a wider customer portfolio, an increased sales force etc.
3. ***Geographical acquisition*** — Mergers and acquisitions, rather than organic growth, have proven to be the main market-entry strategy by overseas acquirers. Such deals have been driven primarily by firms seeking access to new markets and local distribution networks.

The number of M&As is likely to continue to grow, as LED technology has created a solid-state lighting (SSL) chasm, modifying all traditional aspects of the lighting industry (light source, system design, test) and forcing players in the supply chain to acquire new competencies.

Emerging substrates could change rules in sapphire-dominated industry

Sapphire — and silicon carbide (SiC)—- remain the most widely used substrates for the epitaxial growth of gallium nitride (GaN), but many research teams are working on finding better alternatives in terms of performance and total cost of ownership. In that context, silicon (Si) and GaN are the main new substrates being developed in the LED industry:

- The benefits of GaN-on-Si LEDs rely on reducing manufacturing cost by using cheaper silicon substrates but mainly by switching to an 8" substrate and using fully depreciated and highly automated CMOS fabs.
- The benefits of GaN-on-GaN LEDs stem from the lower defect density in the epitaxial layers, allowing the device to be driven at higher current levels and hence the use of a lower number of LED devices per system.

However, several barriers need to be overcome:

- GaN-on-Si LEDs are getting closer to GaN-on-sapphire LED performance, but greater manufacturing yields and full compatibility with CMOS fab still need to be achieved.
- GaN-on-GaN LEDs suffer from GaN substrate availability and its cost.

While GaN-on-GaN LEDs have some potential for specific high-end niches, Yole considers GaN-on-Si LEDs to be the more serious contender as a potential alternative to the widespread use of sapphire. However, the success of GaN-on-Si LEDs will depend on advances in LED performance and developments in manufacturing techniques, concludes Yole. ■

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