

Status of the LED Industry

INDUSTRY, MARKET & TECHNOLOGY REPORT - NOVEMBER 2010

The packaged LED market is experiencing tremendous growth with an expected CAGR of 28.2% between 2009 and 2015

THE 3 CYCLES TOWARD \$30B: MOBILE DISPLAYS, LCD TV AND GENERAL LIGHTING

The initial growth cycle driven by small display applications is essentially over and the LED industry growth is now driven by large LCD display applications. This segment will mature by 2015 but by then, the third growth cycle driven by general lighting applications will have kicked in, therefore limiting the risk of any significant and industry wide downcycle in the period.

In our base scenario, packaged LED revenues will reach \$8.9b in 2010 and grow to \$25.7b in 2015 and approach \$30b in 2020. Growth will be driven by large LCD backlight applications through 2013-2014. In terms of volume, LED die surface will increase from 6.3b mm² to 51b mm² in 2015, a 41.6% CAGR. This will prompt substrate volumes to growth from 12.7M x 2" equivalent (TIE) in 2009 to 84.4M TIE in 2015, a 37.1% CAGR (smaller than the die surface increase due to significant expected manufacturing yield improvements).

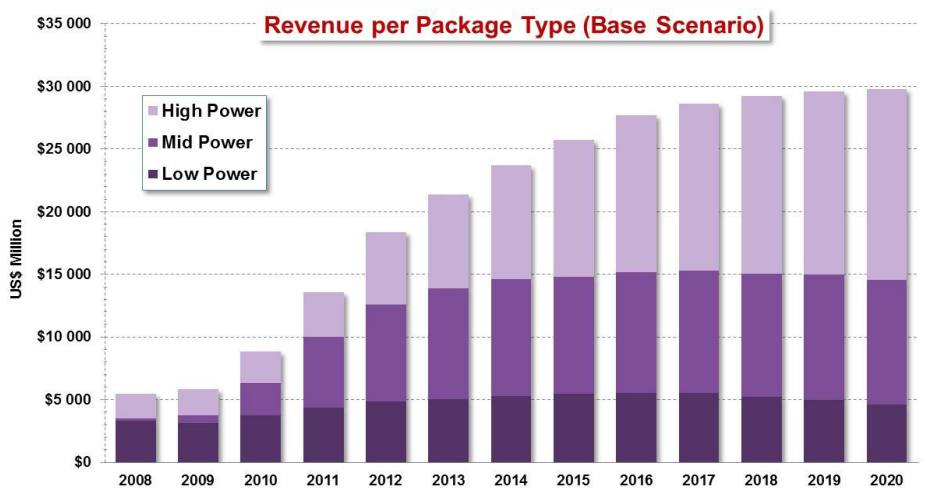


Figure 1: Sales revenue of packaged LED to 2020, split by type

GENERAL LIGHTING: A QUESTION OF REPLACEMENT CYCLE...

The adoption of LEDs for general lighting applications is strongly dependent on technology and manufacturing improvements needed to drive the cost of LED solutions to a trigger point where massive adoption can start. The exact trigger point varies per application. As a result, LED will progress into the market from niche to niche and progressively spread into all application segments. Ultimately, the long lifetime of solid state lighting technology will completely transform the lighting market by dramatically increasing the length of the replacement cycles.

For consumers, the initial large exposure to LED for general lighting applications will come in the form of LED bulb replacement that can be used in existing sockets. As the initial perception of the technology by consumers will come from this first exposure to bulb replacement, their quality and performance will be critical to the future of the industry. Standards and regulations are therefore needed to ensure simplicity of operation and a reasonable level of quality. Dedicated LED modules will come in a second wave and deliver the full benefit of the technology. Additional standardization effort is however needed to ensure a minimum level of upgradability and interoperability.

Growth in general lighting applications will be enabled by significant technology and manufacturing efficiency improvements that will allow the cost per lumen of packaged LED to be reduced 10-fold between 2010 and 2020:

- Economy of scale
- LED efficiency improvement, including at high power (droop effect)
- Improved phosphors
- Improved packaging technologies
- Significant improvements in LED epitaxy cost of ownership through yield and throughput.

Organic LEDs (OLEDs) are still in their infancy. However, progress is steady. We expect AMOLED to capture a significant portion of the small-display market by 2015 and to start penetrating the large-display market by 2016. For the general lighting market, massive investment and significant technology developments are required. We expect the technology to start being offered to consumers in large volumes in 2016.

1400 NEW EPI-REACTORS IN THE 2010-2012 PERIOD

The equipment market will experience a dramatic growth cycle with demand driving the installation of close to 1400 reactors in the 2010-2012 period. Anticipation of future demand and generous subsidies in China will trigger the installation of another 700-1000 reactors in the same period, leading to a short period of oversupply starting in late 2011. However, since this extra capacity will be mostly in hand of newcomers with little LED manufacturing experience, oversupply will mostly affect the low end of the market. There are already more than 60 companies involved in the epitaxy of GaN-based LEDs. This number will keep increasing in the next couple years, but we expect a significant amount of consolidation starting 2013 as many companies will not have reached the critical mass and technology necessary to survive and will disappear or be absorbed by larger players. LED manufacturing will be dominated by Asian countries, with already 90% of the epitaxy capacity located in Taiwan, Korea, China and Japan. This report, co-branded with EPIC, provides a complete analysis of the LED industry along with key market metrics and company positioning. It provides updated volume and \$\$ forecast for packaged LED, split by application with capacity analysis and price trends. In addition, an extensive review of the LED manufacturers is provided, offering the most complete view of the LED industry available to date.

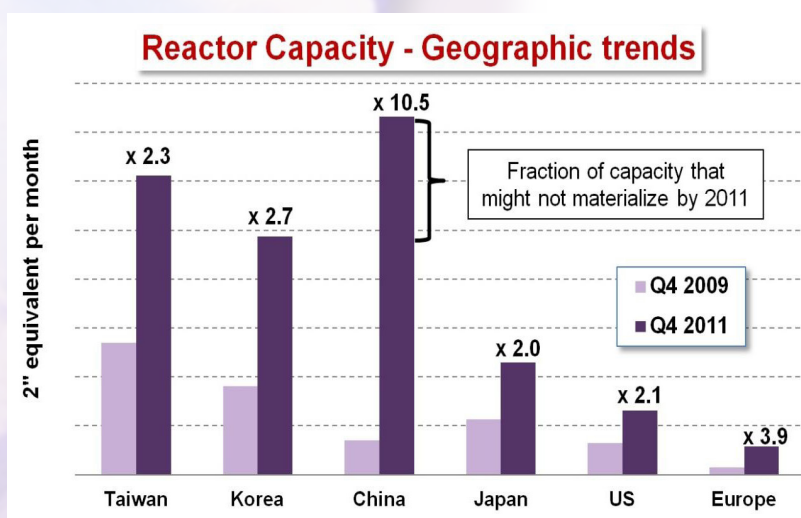


Figure 2: T LED epi-reactor capacity expansion analysis

INDEX OF COMPANIES MENTIONED IN THE REPORT

A-Bright, Advanced Photonics, American Bright, American Opto Plus, AOT, ApexScience & Engineering, APT Eeltronics, Aqualite Co, Arima, AUO, Avago, Bridgelux, Bright LED, Brightview electronic, CDT, Century Epitech Co., Chi Mei Lighting Technology Corp, Citizen Electronics, CREE, CS Bright, Daina, Dominant Semiconductors, Edison, Elec-tech, Enfis, Epiled, Epilight Technology Co. Ltd, Epistar, EpiValley, Everlight, Excellence Opto, Fangda Group, Formosa epitaxy (Forepi), Galaxia Photonic, GE, Genesis Photonics, Golden Valley Optoelectronics Co. Ltd, Hangzhou Silan Azure Co. Ltd, Harvatech, HC SemiTek, Heesung, High Power Opto Inc., Hi-Light, Hueyjann, Huga, Huiyuan Optoelectronic, Hunan HuaLei Optoelectronic, Hunin Electronic, Idemitsu Kosan, Illumitex, Invenlux, Itswell, KingBright, Kodenshi Corp, Konica Minolta, Korea Photonics Technology Institute (KOPTI), Kwaliti Group, Lattice Power Corporation, LedEngin, LEDTech, Lemnis, Lextar/Lighthouse, LG Display, LG Innotek, Lighting Science, Ligitek, Lite-On, LongDeXin (LDX), Lumei Optoelectronics, Lumenmax, Lumex, Lumileds, LumiMicro, Lumination, Luminus, Lumitek Corp., Lustrous Technology, Luxpia, LuxtalTek Corp., MokSan Electronics, Moser Baer, Nanosys, Nanya, Nationstar, Neo-Neon, Nichia, NiNEX, Oasis, Optek Technology, Opto Tech, Osram, ParaLight, Philips, Power Opto, Powerlightec, Rainbow Optoelectronics, Rohm, Samsung SEMCO, Sanan Optoelectronics, Sanken Electric, Seiwa Electric, SemiLED, Semileds, Seoul semi / Optodevice, Shandong Huaguang Optoelectronics, Sharp, Shenzhen Mason Technology, Shenzhen Mimgxue, Shenzhen Yiliu Electronic, Shenzhen Refond, Showa Denko, Stanley Electric, Sunpu Opto, Supernova, Sylvania, Tekcore, TESS, Tonghui Electronic Corporation, Toshiba, Toyoda Gosei, TSMC, Tyntek, UDC, Unity Opto, Visera Tech, Vishay, VPEC, Walsin Lihwa, Wellipower, Wenrun Optoelectronic, Wooree LED, Xiamen Changelight, Xiamen Hualian, Ya Hsin, Yangzhou Huaxia Integrated Photoelectric Co., Ltd (DarewinChip), Yangzhou Zhongke Semiconductor, YoungTeck, Yuti Lighting Shanghai, Zoomview (Xi An Zoomlight)

BIO



EPIC: Tom Pearsall & EPIC fellow

In 2003, Tom started EPIC, the European Photonics Industry Consortium. Before EPIC, he works among others for Bell Laboratories, Thomson/CSF and Corning. He is a Fellow of the American Physical Society and a Fellow of the IEEE



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6.2 The Buyer agreed not to disclose, copy, reproduce, redistribute, resell or publish the Product, or any part of it to any other party other than employees of its company. The Buyer shall have the right to use the Products solely for its own internal information purposes. In particular, the Buyer shall therefore not use the Product for purposes such as:

- Information storage and retrieval systems; - Recordings and re-transmittals over any network (including any local area network); - Use in any timesharing, service bureau, bulletin board or similar arrangement or public display; - Posting any Product to any other online service (including bulletin boards or the Internet); - Licensing, leasing, selling, offering for sale or assigning the Product.

6.3 The Buyer shall be solely responsible towards the Seller of all infringements of this obligation, whether this infringement comes from its employees or any person to whom the Buyer has sent the Products and shall personally take care of any related proceedings, and the Buyer shall bear related financial consequences in their entirety.

6.4 The Buyer shall define within its company point of contact for the needs of the contract. This person will be the recipient of each new report in PDF format. This person shall also be responsible for respect of the copyrights and will guaranty that the Products are not disseminated out of the company.

6.5 In the context of annual subscriptions, the person of contact shall decide who within the Buyer, shall be entitled to access on line the reports on I-micronews.com. In this respect, the Seller will give the Buyer a maximum of 10 password, unless the multiple sites organisation of the Buyer requires more passwords. The Seller reserves the right to check from time to time the correct use of this password.

6.6 In the case of a multisite, multilicence, only the employee of the buyer can access the report or the employee of the companies in which the buyer have 100% shares. As a matter of fact the investor of a company, the joint venture done with a third party etc... can not access the report and should pay a full licence price.

7. Termination

7.1 If the Buyer cancels the order in whole or in part or postpones the date of mailing, the Buyer shall indemnify the Seller for the entire costs that have been incurred as at the date of notification by the Buyer of such delay or cancellation. This may also apply for any other direct or indirect consequential loss that may be borne by the Seller, following this decision.

7.2 In the event of breach by one Party under these conditions or the order, the non-breaching Party may send a notification to the other by recorded delivery letter upon which, after a period of thirty (30) days without solving the problem, the non-breaching Party shall be entitled to terminate all the pending orders, without being liable for any compensation.

8. Miscellaneous

All the provisions of these Terms and Conditions are for the benefit of the Seller itself, but also for its licensors, employees and agents. Each of them is entitled to assert and enforce those provisions against the Buyer.

Any notices under these Terms and Conditions shall be given in writing. They shall be effective upon receipt by the other Party.

The Seller may, from time to time, update these Terms and Conditions and the Buyer, is deemed to have accepted the latest version of these terms and conditions, provided they have been communicated

to him in due time.

9. Governing law and jurisdiction

9.1 Any dispute arising out or linked to these Terms and Conditions or to any contract (orders) entered into in application of these Terms and Conditions shall be settled by the French Commercial Courts of Lyon, which shall have exclusive jurisdiction upon such issues.

9.2 French law shall govern the relation between the Buyer and the Seller, in accordance with these Terms and conditions.