

## ElectroniCast Consultants



### High-Brightness LED Global Market Forecast & Analysis (2011-2021)

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This is the ElectroniCast forecast of global market consumption of packaged high brightness light emitting diodes (HB-LEDs).

The light emitting diode (LED) market, despite exciting innovative devices driven by technological advances and ecological/energy-saving concerns, still face challenges in overcoming performance/price limitations and in attracting widespread consumption. The use of LEDs in general lighting is increasing, initiating from government-based retrofitting projects – then to commercial/business – and then to the consumer-level.

**High Brightness (HB) LEDs** High Brightness (HB) LEDs, defined by ElectroniCast, for the purpose of this study, are component-level bulbs with a lumens/Watt rating of 30 lm/W and above, face the challenge of creating definitive positions in the illumination market, as competing lighting solutions are readily available and accepted. While this does not limit the potential success of HB-LEDs, it does create some challenges. This report provides an independent examination and analysis of the changing market dynamics for various types of HB-LEDs and UHB-LEDs (ultra-high brightness) used in selected end-use applications.

The review of 2011 plus the market forecast (2012-2021) is presented for High Brightness LEDs with a lumens/Watt rating of 30 to 70 lm/W, as well as HB-LEDs with a lumens/Watt rating of over 70 lm/W. The HB-LED market forecast data are segmented by the following functions:

- Consumption Value (US\$, million in the Excel file and US\$ Billion in report text)
- Quantity (number/units: Million in Excel file and Billion in report text)
- Average Selling Prices (ASP \$, each)

The consumption value is determined by multiplying the number of units by the average selling price. The average selling prices are based on the price of the component-level LED bulbs at the initial factory level. The consumption values are based on the end-user application and the end-user region.

The market data are segmented into the following geographic regions, plus a Global summary:

- America (North America, Central and South America)
- EMEA (Europe, Middle Eastern countries, plus Africa)
- APAC (Asia Pacific)

The global HB-LED market is segmented into the following major application categories:

- Mobile/Portable Devices
- Signage/Professional Displays
- Solid-State Lighting – General Lighting
- Stationary Signals (not used in or on vehicles)
- Automotive/Vehicle (automotive, ships, rail/train, planes, etc)
- Consumer-Level TV/Desktop Monitor Backlighting
- Other/Miscellaneous (specialty, medical/science, test/measurement, etc)

The market data for HB-LEDs are also segmented by the following colors (type):

- Multiple-color multiple-chip packaged HB-LED
- Red, Orange or Yellow single color packaged HB-LED
- Blue, Green, Ultraviolet (UV) or Other Color single color packaged HB-LED
- White (WLED) packaged HB-LED

**LED Level Quantified in the ElectroniCast Study** A Light Emitting Diode (LED) is a solid-state semiconductor device that converts electrical energy directly into light. On its most basic level, the semiconductor is comprised of two regions. The p-region contains positive electrical charges while the n-region contains negative electrical charges. When voltage is applied and current begins to flow, the electrons move across the n region into the p region. The process of an electron moving through the p-n junction releases energy. The dispersion of this energy produces photons with visible wavelengths. Below, are four levels (or “food chain”) of LEDs. For the purposes of THIS ElectroniCast study, we quantify and provide a market forecast for “Level 2”

Level 1 - The chip or die

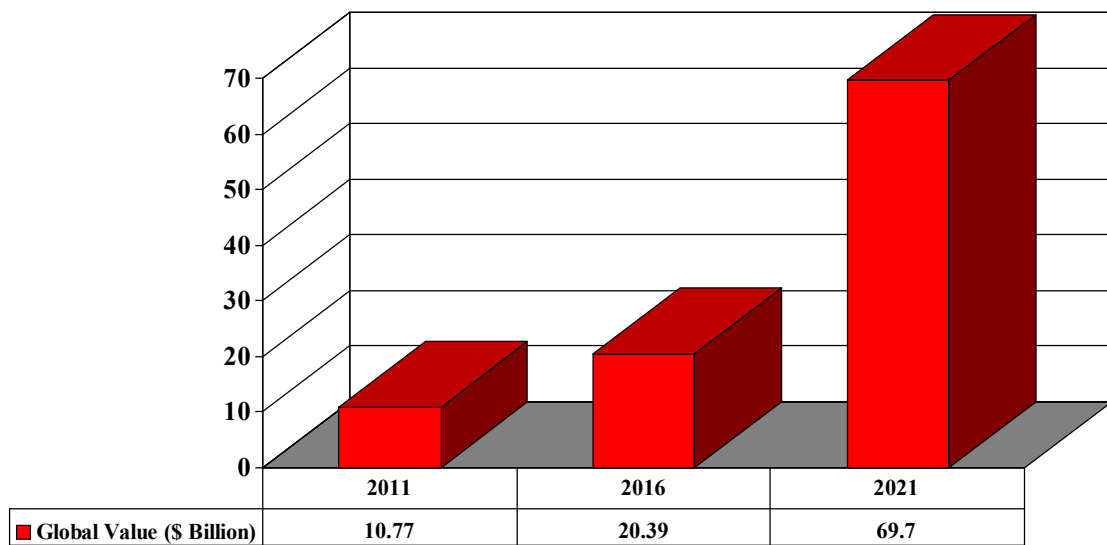
**Level 2 - The Packaged LED (component-level bulb)**

Level 3 - LED Lamp (consumer-level bulb/lamp)

Level 4 - LED luminaire (fixture/fitting)

**Consumption Forecast: \$69.7 Billion in 2021** According to ElectroniCast Consultants, the global consumption of packaged HB-LEDs in 2011 was \$10.77 billion. In the year 2021, the worldwide consumption value is forecast to reach \$69.7 billion. Market forecast data in this study report refers to consumption (use) for a particular calendar year; therefore, this data is not cumulative data.

**HB-LED Global Consumption Market Forecast,  
By Region (Value Basis, \$Billion)**



Source: ElectroniCast Consultants

**Market Analysis by Application** Decreasing average selling prices (ASPs) is forecast to cause challenging growth patterns in consumption value in some application segments (categories). Because of this, some application categories are forecast for declining consumption values in the 2nd half of the forecast period (2016-2021); however, the volumes (quantity/number of units) in all categories are forecast for positive growth throughout the forecast period.

Use of HB-LEDs in Mobile/Portable Devices is forecast to remain a strong segment; however, OLEDs continue to take market share. The sector is relatively mature and it already has a substantial consumption value in 2012.

In terms of consumption value (quantity x prices = value), the use of HB-LEDs in the Automotive/Vehicle category is forecast to multiply by a factor of more than 2-times (2x) from 2011 to 2016.

The use of HB-LEDs in stationary (non-vehicle) Signals is forecast to increase at an average growth rate of (only) 5.5 percent from 2011 to 2016; consumption value of HB-LEDs in stationary signals is forecast to decline sharply due to offsetting price declines, as well as market saturation; however, in terms of volume (quantity/units), the segment is forecast for a slight increase during 2016-2021. Note: Signals used in vehicles are quantified in the vehicle application.

General Lighting provides the main illumination of an area. In this study, we provide the consumption data for 2011 as well as our market forecast for 2012-2021 of the packaged HB-LED (component) used for general lighting stationary applications, including interior and exterior decorative and functional lighting for residential, commercial and government areas (lighting for vehicles is included in the vehicle application category).

For the purposes of this study, ElectroniCast includes Directional Lighting, Supplementary Lighting and Architectural Lighting in the General Lighting category; however, large-screen/panel(s) entertainment lighting is not considered in the General Lighting segment; therefore ElectroniCast counts LEDs used in signage, displays, in the Signage/Professional Display application category for this study.

Led-based lighting is used in interior/exterior residential, commercial/industrial and government buildings/facilities. Led-based lighting is also used in other general lighting applications, such as: theaters, photography, swimming pools, landscaping, fountains, parks/campus, parking lots/streetlights news-gathering (TV broadcasts, film, similar) and even in nightclubs on the dance floor, etc. The LEDs are used in luminaires (light fixtures) in stationary applications (non-vehicle) and are used to provide the main illumination of an area (general lighting).

LEDs are used in both functional and decorative light fixtures, with an advantage of energy savings. Compared to incandescent lighting, LED-based solid-state lighting (SSL) delivers visible light with reduced heat. In addition, its solid-state nature provides

for greater resistance to shock, vibration, and wear, thereby significantly increasing its lifespan.

The use (consumption value) of HB-LEDs in the Signage/Professional Display application is forecast to increase at an average annual rate of 22.1 percent from 2011 to 2016 and then increase at an impressive 35.9 percent per year (2016-2021).

Consumption of HB-LEDs in "Other" or miscellaneous (non-specified) applications is forecast to reach \$710 million in 2016, before decreasing during the 2nd half of the forecast period (2016-2021).

The use of HB-LEDs in backlighting of consumer-level TV/Desktop Monitors is forecast to maintain a strong market share (%) throughout the 1st-half of the forecast period (2011-2016), before slipping in market share during the 2nd-half of the forecast period (2016-2021), due to saturation in many markets as well as an increase in competition from OLEDs. Also, the number of white packaged light emitting diodes require in the back lighting unit (BLU) in the consumer-level LCD-TV (and desktop monitor) will decline, due to increased luminous efficacy and improvements (innovations) in supporting optics (components and packaging).

**About ElectroniCast** ElectroniCast Consultants specializes in forecasting trends in communication networks and in the products used in those networks. This includes technology forecasting, markets and applications forecasting, strategic planning and consulting. ElectroniCast Consultants, as a technology-based independent forecasting firm, serves industrial companies, trade associations, government agencies, communication and data network companies and the financial community. Reduction of the risk of major investment decisions is the main benefit provided. ElectroniCast's goal is to understand the challenges and opportunities facing clients and to provide timely, accurate information for strategic planning.

**Project Director** Stephen Montgomery, MBA/Technology Management, President – International Business Expansion at ElectroniCast Consultants. He has specialized in photonics and fiber optic components market & technology forecasting at ElectroniCast for over 20-years. He has given numerous presentations and published a number of articles on the use of Light Emitting Diodes (LEDs) in illumination and Optical Communication markets, technology, applications and installations. He is a member of the Editorial Advisory Board of LIGHTWAVE magazine (PennWell Publishing) and writes a monthly article covering the optical communication industry for OPTCOM Magazine in Japan (Kogyo Tsushin Co., Ltd.).

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