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Lighting the way: Perspectives on the global lighting market

Second edition

Lighting the way: Perspectives on the global lighting market

Foreword

The 2011 edition of "Lighting the way: Perspectives on the global lighting market" gave a comprehensive perspective on the global lighting market and received overwhelmingly positive feedback from across the lighting community. This year's edition features updates on the findings presented in that report. It addresses recent changes in the market environment and puts additional emphasis on the increasing volatility of the macroeconomic environment and the accelerated price erosion of LED components.

This year, McKinsey has leveraged an even broader variety of sources and stakeholders to cross-check key assumptions of the updated McKinsey 2012 Global Lighting Market Model and substantiate the views on development of the lighting market as well as key industry trends. The source base was expanded by a lighting industry panel consisting of multiple players along the lighting value chain – lamp and fixtures companies (Dialight, Gerard Lighting Group, Osram, and the Panasonic Corporation, among others); LED light engine and driver companies (including Bridgelux, NXP Semiconductors, and Xicato); and lighting product wholesalers (Rexel, Solar, and Sonepar, for example). Multiple companies from other value chain steps also took part, such as lighting control system providers and electrical product retailers.

McKinsey has been working extensively in the lighting industry for many years, investing over USD 3 million on primary research through McKinsey's global LED Competence Center. McKinsey is also heavily engaged in adjacent industries, such as the clean-tech industry, and has brought out publications such as "McKinsey on Sustainability & Resource Productivity" and "Capturing opportunities in energy efficiency."

This updated report "Lighting the way: Perspectives on the global lighting market" was funded by McKinsey and draws upon the firm's accumulated industry insights together with synthesized data from external sources. The appendix contains a full list of references and additional details of the assumptions supporting the findings in this report. We assume that readers will be familiar with last year's report, and often draw comparisons with statements and figures mentioned in that publication.

Forecasts in this publication cannot offer any guarantees of a specific future path, as many uncertainties underlie the development of the market and the industry. However, McKinsey's research reveals clear indications of the trends described, and we very much hope this report will be of assistance to stakeholders in this industry.

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Important notice

This market report has been prepared by a McKinsey team on the basis of public sources and proprietary information gathered by the McKinsey global LED Competence Center via market and industry surveys. Other information used includes McKinsey's 2011 Global Lighting Professionals and Consumer Survey; inputs from a broad industry panel; the Pike Research Global Building Stock Database 2012; the US Department of Energy 2012 Multi-Year Program Plan; and other sources (please refer to Appendix D for a full list of references). In preparing this market report, the team has relied on the accuracy and completeness of the available information and has not undertaken independent verification of the accuracy or completeness of such information.

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This market report contains certain forward-looking statements. By their nature, forward-looking statements involve uncertainties because they relate to events that may or may not occur in the future. This particularly applies to statements in this report containing information on future developments, earnings capacity, plans and expectations regarding the business, growth and profitability of companies operating in the market covered by the lighting market or any similar markets, and general economic and regulatory conditions and other factors that affect such companies. Forward-looking statements in this market report are based on current estimates and assumptions that are made to the McKinsey team's best knowledge. These forward-looking statements are subject to risks, uncertainties, and other factors that could cause actual situations and developments to differ materially from and be better or worse than those expressly or implicitly assumed or described in these forward-looking statements. The market covered by this report is also subject to a number of risks and uncertainties that could cause a forward-looking statement, estimate, or prediction in this market report to become inaccurate. In light of these risks, uncertainties, and assumptions, future events described in this market report may not occur, and forward-looking estimates and forecasts derived from third-party studies that have been referred to in this market report may prove to be inaccurate. In addition, McKinsey does not assume any obligation to update any forward-looking statements or to conform these forward-looking statements to actual events or developments.

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Executive summary

The findings in McKinsey's 2011 "Lighting the way" report – the first to provide a holistic view of the fragmented and complex global lighting industry – still hold true in general today. The market is on a clear transition path from traditional lighting technologies to LED. However, world events over the past year have given clearer contours to the lighting industry's development, and some market parameters have shifted or accelerated.

The market is on a clear transition path from traditional lighting technologies to LED

On the one hand, the world's ongoing financial turbulence and Europe's debt crisis have inevitably had a negative impact on global and regional economic growth, both actual and projected. This has also adversely affected the lighting market. On the other, regulation across the globe has become more stringent, fueling the penetration of more energy-efficient light sources, such as LEDs. For example, China has now passed legislation to ban incandescent lightbulbs. Governments have also reacted to the disaster in Fukushima by debating (and in some cases deciding on) a nuclear phaseout. This is expected to boost the uptake of low-energy light sources that help to close the looming energy gap.

Regulation across the globe has become more stringent, fueling the penetration of more energy-efficient light sources

Another vital metric has altered. LED prices have eroded more aggressively, pulling forward the payback time of LED lighting. The inflection point for LED retrofit bulbs in the residential segment, for example, is now likely to be around 2015. McKinsey's 2012 Global Lighting Market Model calculates the LED share in general lighting at 45 percent in 2016 and almost 70 percent in 2020 – 2 and 5 percentage points higher, respectively, than predicted in 2011.

LED prices have eroded more aggressively, pulling forward the payback time of LED lighting

Both the shifting macroeconomic context as well as the accelerating LED price erosion have affected long-term forecasts of the size of the lighting market. The updated McKinsey market model indicates revenues of around EUR 100 billion for the global market in 2020 – a decline of over 5 percent versus last year's forecast. The total market is expected to grow annually by 5 percent through to 2016, and by 3 percent thereafter until 2020. A breakdown by sector shows that general lighting has been impacted the most. The forecast of market size for this segment in 2020 is around EUR 83 billion – some EUR 5 billion lower than last year's projection.

The total market is expected to grow annually by 5 percent through to 2016, and by 3 percent thereafter until 2020

The figures for automotive lighting (representing around 20 percent of the total market) have changed only slightly. Adjustments to vehicle unit production and sales forecasts due to macroeconomic volatility have partially been offset by a modified methodology. In addition, lower exposure to LED price erosion given the smaller LED share in this segment has further reduced the impact of market changes. The revenue outlook has remained stable, at around EUR 18 billion by 2020. Backlighting, by contrast, is anticipated to shrink faster than previously estimated. Lower sales forecasts for LCD TVs and monitors, accelerated penetration of OLED (organic light-emitting diode) products, as well as higher LED price erosion are key contributors to a swift decline in market size, falling to EUR 1.0 - 1.5 billion by 2016.

As last year, general lighting was divided into seven applications: residential, office, shop, hospitality, industrial, outdoor, and architectural lighting. The faster LED price erosion has raised forecasts for LED penetration in many of the segments – office, shop, and hospitality, for example, while decreasing the size of the lighting market overall by value. Forecasts for LED uptake in the residential segment remain high, at almost 50 percent in 2016 and over 70 percent in 2020. Architectural lighting remains the early adopter, and its LED market share is expected to reach close to 90 percent by 2020.

In terms of the regional split, Asia is expected to account for approximately 45 percent of the global general lighting market by 2020. Asia currently leads the market transition to LED in general lighting, driven especially by swift penetration in Japan and China. A new analysis this year – market segment by product grade for global general lighting – reveals that the fastest growth is in the commodity segment, forecasting an increase of EUR 10 billion by 2020. Again, it is mainly Asia driving growth in this market segment.

Asia is expected to account for approximately 45 percent of the global general lighting market by 2020

Meanwhile, disruption of the industry structure is becoming more apparent. Value in the LED chip and package market is set to shift from backlighting to general lighting, and players are beginning to expand downstream along the value chain. The evolving LED market is impacting industry dynamics along the entire general lighting value chain, with effects on light engine standardization, the fixtures market, replacement versus new installation, and channel mix.

Value in the LED chip and package market is set to shift from backlighting to general lighting

New business opportunities are also emerging as the industry landscape is redrawn. The lighting control system market is already mushrooming, with a growth rate anticipated at almost 20 percent p.a. through to 2020. While office is currently the largest segment in this area, expansion is expected in residential and outdoor. Service-related businesses in the fields of maintenance, technical solutions, and financial services represent merely the beginning of what promises to be a new era of business models in the lighting arena.

The lighting control system market is already mushrooming, with a growth rate anticipated at almost 20 percent p.a.

The transition of the global lighting market towards LED is triggering and accelerating ever more pronounced discontinuity in industry structures. Players will be well advised to analyze the coming repercussions in their segment of the value chain, and position themselves for change.

1. Highly dynamic environment

The global lighting market is impacted by multiple factors – three are particularly important. The first is the macroeconomic situation, which is influencing new construction and consequently the number of new lighting installations. Second, energy efficiency regulations and greater energy awareness are redefining future lighting product portfolios. And third, government action limiting certain energy sources – key being nuclear power due to events over the last year – will result in additional demand for energy-efficient products, such as LEDs. Assessing these environments for change is vital to understand current and (probable) future shifts in the global lighting market.

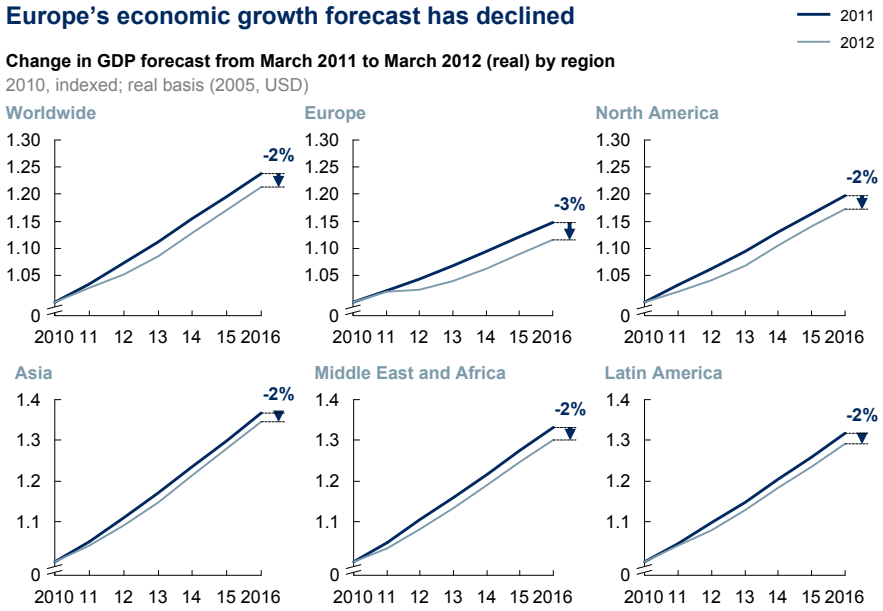
1.1 Volatile economic context

The global economic situation has developed less favorably than expected since mid-2011, leading to downward adjustments of the 2016 GDP forecast by approximately 2 percent.[1] This adjustment stems from a number of unfavorable developments fueled by the aftermath of the global financial crisis and Europe's ongoing debt crisis.

According to political commentators, Europe's debt crisis increasingly threatens the region's economic stability without a visible and unified strategy to counter the effects. Analysts have pointed to the bailout of Greece in Q1 2012, a parallel government crisis in the country, and disagreements between governments at an EU level on how to best tackle fiscal issues.[2] Europe's 2016 GDP forecast has been lowered by 3 percent compared to 2011 (Exhibit 1). Europe's struggles impact the world economy as the region contributes almost 30 percent to global GDP.[3]

Exhibit 1

Europe's economic growth forecast has declined



SOURCE: McKinsey analysis and additional sources (see footnote 4)

1 IHS Global Insight (March 2011); IHS Global Insight (March 2012) (b).
2 Financial Times Deutschland (June 2012).
3 IHS Global Insight (June 2011).
4 IHS Global Insight (March 2011); IHS Global Insight (March 2012) (b).

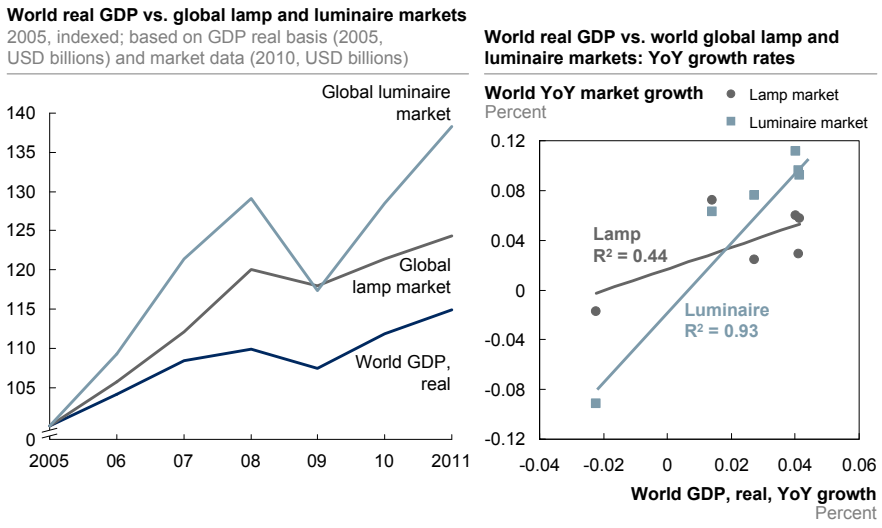
Emerging countries are no exception. Standard & Poor's has just recently downgraded India's debt rating due to the country's high deficits, relatively low growth rate, and the lack of much-needed economic reforms.[5] China and Brazil have also dipped below their long-term growth trend.[6]

These updated and more conservative economic forecasts are having an impact on lighting market forecasts. However, a clear distinction needs to be made between translating economic forecasts to the luminaire and the lamp markets. (Please refer to Exhibit 25 in Appendix C for a definition of the lighting product value chain.)

The market for luminaire and lighting system control components is predominantly driven by new installations. New installations are linked to construction activity, and there is a clear correlation with GDP. This is supported by the fact that heavy investments in the installation of fixtures are more likely to be postponed when the economy is under strain. However, the lamp market is mainly driven by replacements. The latter is a market by nature more resilient to overall macroeconomic trends: it depends almost solely on the number of installed sockets and the lifetime of the technologies in place. Even if incomes deteriorate significantly, consumers will still need to replace a failed light source. The lamp market therefore correlates with GDP to a lesser degree. A correlation analysis of both global lamp and luminaire markets with GDP for 2005 to 2011 substantiates these assumptions (Exhibit 2).

Exhibit 2

The global luminaire market has a high correlation with global GDP



SOURCE: McKinsey analysis and additional sources (see footnote 7)

5 Reuters (April 2012).
6 Center for Economic and Policy Research, Brazil (March 2012); Channel News Asia (March 2012).
7 IHS Global Insight (June 2012); CSIL (July 2011); Frost & Sullivan (August 2011).

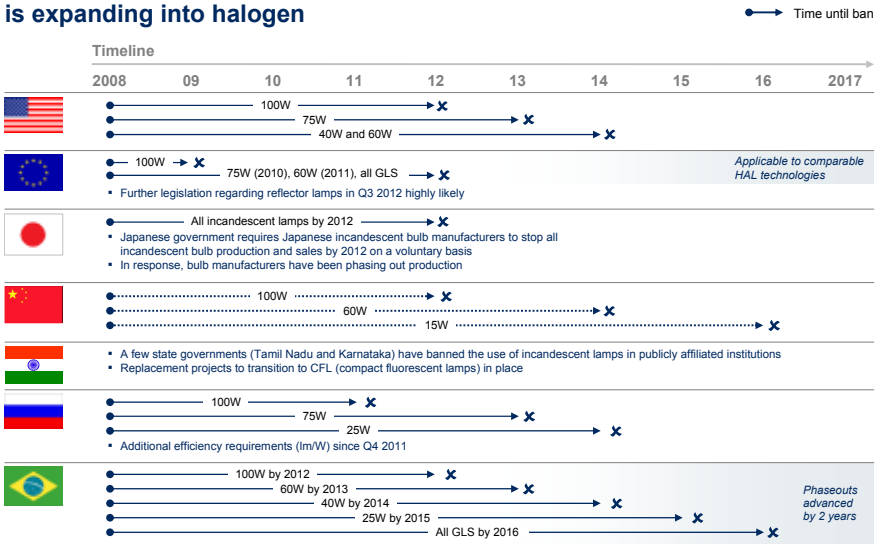
1.2 Accelerated regulatory intervention worldwide

Besides macroeconomic developments, regulation affecting lighting products is a key determinant of the future lighting market. Governments around the globe are accelerating initiatives in this field along two dimensions. Banning inefficient technologies is one. The other is to pass more stringent legislation on energy efficiency requirements and offer incentives for entire building infrastructures. This path will further propel energy-efficient lighting technologies, such as LEDs.

Bans on specific technologies are being passed in ever more countries for both residential (Exhibit 3) and commercial lighting products. China has recently amended a proclamation to ban incandescent lightbulbs[8] – legislation is backed by the country's energy conservation law.[9] Europe is further accelerating the switchover to more ecological lighting sources by extending its regulations to ban low-voltage halogen lamps.[10]

Exhibit 3

The incandescent ban is now a global movement in residential lighting and is expanding into halogen



Note: Time of year the ban comes into effect: US, Russia = January 1; EU = August 30; China = September 30; Brazil = June 30

SOURCE: McKinsey analysis and additional sources (see footnote 11)

Second, legislators are increasingly extending energy efficiency requirements and incentives to entire building infrastructures. The EU has for example ruled that by 2020, all new building structures should consume "nearly zero" energy.[12] Corresponding design standards and ratings classifying energy efficiency are finding widespread and growing adoption across geographies, such as BREEAM in the European Union,[13] CASBEE in

8 National Reform and Development Commission (2011).
9 The Central People's Government of the People's Republic of China (2007).
10 European Lamp Companies Federation (February 2012).
11 McKinsey & Company (2011); The Central People's Government of the People's Republic of China (2007); Bureau of Energy Efficiency (2010); European Union (2009); ConsultantPlus (2011); Government of Brazil (June 2011).
12 European Council for an Energy Efficient Economy (October 2010).
13 BREEAM (2012).

Japan,[14] and standards for green construction in China.[15] In the US, LEED and the newly introduced International Green Construction Code (IgCC) are being adopted by an ever greater number of local jurisdictions.[16] In South Africa, laws were passed in late 2011 to ensure that new buildings meet specific energy efficiency requirements.[17]

In addition to regulatory action, global campaigns to raise awareness have been put in place to emphasize the role that energy-efficient lighting can play in reducing global energy consumption. A prominent example of this is the en.lighten initiative by the United Nations Environment Programme (UNEP) and key lighting players.[18] Another is The Climate Group's LightSavers program, which has recently been further accelerating its activities.[19]

1.3 Transformation of the energy mix under way

As noted in our 2011 report, the nuclear disaster in Japan in Q1 2011 has already impacted energy requirements there. The majority of residents and local governments strongly oppose continuing on the nuclear power path,[20] and this is affecting the Japanese government's energy policy. Following the earthquake disaster, all Japanese nuclear plants were shut down. Only selective plants are being permitted to run again – a complete phaseout is currently being debated.[21] A definite policy shift would create huge electricity supply shortages and lead to hikes in electricity costs. Japan is generally highly dependent on nuclear power, which covered around 30 percent of Japan's energy mix before the disaster due to the country's lack of natural resources.[22] Although the Japanese industry is eager for nuclear power to avoid higher electricity prices, the future energy mix is expected to now shift towards more non-nuclear sources, including renewables.[23]

Germany's government has also implemented a fundamental shift in energy policy by shutting down eight of its 17 nuclear power stations and committing to nuclear-free energy production by 2022. These decisions were made less than a year after initially extending nuclear power station lifetimes.[24] These nuclear shutdowns will result in gaps in energy production based on today's energy mix. Nuclear energy supplied almost 18 percent of Germany's electricity demand in 2011.[25]

On the energy supply side, these developments will accelerate the penetration of renewable energy sources. The demand side will also need to alter its practices as greater energy efficiency will help to close the energy supply gap. The lighting market, which consumes approximately 20 percent of total electricity generation,[26] can greatly contribute by providing energy-efficient lighting solutions, such as LEDs. The broader application

14 Japan Green Building Council (2012).
15 Ministry of Housing and Urban-Rural Development of the People's Republic of China (MOHURD) (2012).
16 International Code Council (2012) (a); International Code Council (2012) (b); U.S. Green Building Council (2011).
17 Urban Earth (November 2011).
18 en.lighten (2012).
19 LEDs Magazine (February 2012).
20 The Mainichi (July 2012).
21 Spiegel Online (July 2012); BBC News (May 2012).
22 World Nuclear Association (June 2012).
23 The Wall Street Journal (March 2012).
24 Sueddeutsche.de (June 2011).
25 Spiegel Online (December 2012).
26 en.lighten (2012).

Exhibit 4

LED can contribute to reducing energy demand, supporting the feasibility of phaseouts/curbing the number of new nuclear power plants needed

	Nuclear policy	2011 reactor units	LED impact 2020, model base case[1]
	Currently debating phaseout	48	7 x
	Phaseout by 2022	9	3 x
	No major change announced	104	19 x
	Increase in nuclear power generation	15	17 x
	Increase in nuclear power generation	20	9 x

1 Equals the number of nuclear reactors that would become redundant based on energy savings through LED penetration, ceteris paribus

Assumptions
- Average capacity (MW) and utilization (percent) per nuclear reactor 945/88 in China, 1,341/81 in Germany, 331/62 in India, 887/67 in Japan, 969/91 in the US
- 8 - 12 hours operating time per light source across applications 365 days p.a.
- Wattage estimates based on proxy per light source for the residential segment and derived for other applications based on lumen estimates
- 5% energy efficiency gain for LED light sources p.a., 0% for traditional light sources
- Country data approximated based on (adjusted) GDP contribution to regions
- LED impact assuming ceteris paribus
- LED model base case assuming (adjusted) LED penetration of installed base of 57% in Germany, 56% in the US, 58% in Japan, 55% in China, 37% in India

SOURCE: McKinsey's 2012 Global Lighting Market Model; McKinsey analysis and additional sources (see footnote 27)

of LEDs would decrease energy consumption levels to such a degree that the energy output of multiple nuclear reactors could be saved across geographies (Exhibit 4). Assuming an average usage pattern per installed light source in any given country allows calculation of the energy consumption per technology. The energy efficiency of LED exceeds that of other existing lighting technologies. Thus, increasing LED penetration reduces total energy demand. In the case of Germany, the transition to the 2020 LED base – as calculated in this report's 2012 model – would save energy equivalent to the capacity of three nuclear reactors. It is worth noting that this will potentially not just benefit nations with concrete phaseout plans. It will also support those that plan to add to their nuclear production capacity.

Overall, the trend away from nuclear energy is therefore expected to give a further boost to energy-efficient lighting, fueling LED penetration.

27 Proprietary McKinsey Nuclear Model (Q1 2012); IAEA (2012); Enerdata (2012); POLES (2012).

2. Update on the global lighting market

Last year's report highlighted the size of the lighting market and its subsegments, as well as its swift growth due to LED penetration. For the 2012 report, McKinsey reviewed the forecast of the market size by conducting interviews with a broad range of industry insiders and experts as well as updating McKinsey's Global Lighting Market Model. McKinsey forecasts slightly faster LED penetration in the mid to long term than was anticipated in 2011 due to the more aggressive LED price erosion experienced over the last year. The depressed macroeconomic situation worldwide combined with faster LED price erosion results in an overall lighting market forecast for 2020 that is slightly lower than last year's forecast.

2.1 Macroeconomic change affecting all applications[28]

The three major sectors in lighting are general lighting, automotive lighting, and backlighting. General lighting is the largest, and was again (as last year) classified into seven applications for the purposes of this report: residential, office, shop, hospitality, industrial, outdoor, and architectural lighting. (Please refer to Appendix A for a detailed definition of general lighting applications.)

As in 2011, the scope of McKinsey's market model includes general lighting at the light source, ballast, fixture and lighting system control component levels, automotive light sources and fixtures, and backlighting at the light source level. Light sources are defined as bulbs/tubes in traditional lighting, and as LED modules/light engines and LED lamps in LED lighting. (Please refer to Exhibit 25 for a definition of the value chain.) As last year, this report does not include other lighting applications, such as signal, sign display, or medical lighting. Machine vision lighting, light sources for projectors, optical devices, sensors, and other electronic equipment are also not in scope.

The global lighting market is expected to have revenues of over EUR 100 billion in 2020, with 5 percent annual growth from 2011 to 2016, and 3 percent growth p.a. from 2016 to 2020 (Exhibit 5) based on McKinsey's updated 2012 Global Lighting Market Model. The overall market size in 2020 declined by around EUR 7 billion from last year's forecast. This is mainly caused by the heavier projected LED price erosion together with the slower macroeconomic growth expected compared to last year. As in last year's report, market sizes are calculated based on producer prices. If the model's calculations were based on retail prices instead, including both the wholesaler's and retailer's margins, market sizes would almost double.

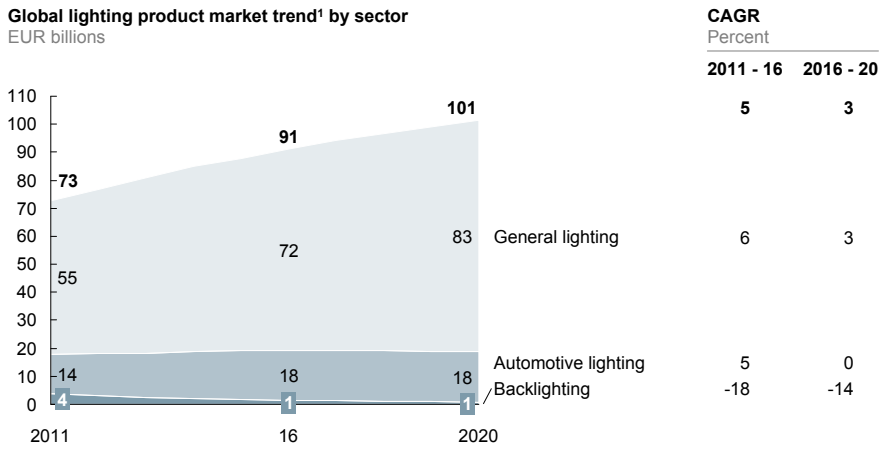
General lighting

General lighting is the largest lighting market, with total market revenues of approximately EUR 55 billion in 2011, representing close to 75 percent of the total lighting market. This is expected to rise to around EUR 83 billion by 2020 – around 80 percent of the total market. The 2020 market size estimate is EUR 5 billion lower than last year's forecast. While LED lighting is anticipated to penetrate faster (mid to long term) due to greater LED price erosion, the speedier drop in the price of LED lighting (described in the next section) is

28 Please also refer to section 1.1 (pages 11 to 13) in McKinsey's 2011 "Lighting the way" report.

Exhibit 5

The global lighting market is growing steadily, and is expected to exceed a market size of EUR 100 billion in 2020



1 Total general lighting market (new fixture installation market incl. full value chain, incl. lighting system control components and light source replacement market), automotive lighting (new fixture installations and light source replacement), and backlighting (light source only: CCFL and LED package)
NOTE: Numbers may not add up due to rounding

SOURCE: McKinsey's 2012 Global Lighting Market Model

likely to slow down overall growth in the general lighting market. This adds to the impact of slower GDP and construction investment growth being forecast.

A major change since last year's edition is that the scope of general lighting also includes the market for lighting system control components for the residential sector. This is due to an increase in the importance of lighting control systems in the segment.[29]

Our calculations of market size do not include OLEDs for general lighting, analogous to last year, as the extent to which OLEDs will penetrate the general lighting market is still unclear. This results from a number of current OLED penetration barriers. First, the price of OLEDs is far higher compared to non-organic LEDs, although they are less efficient and have a shorter lifetime.[30] Another aspect is that LED-based products – the emerging LED edge-lit light guides, for instance – can easily deliver the form and performance advantages of OLEDs at lower prices.[31] While OLEDs are enhancing their features, LEDs are also improving. OLEDs are aiming to achieve an efficacy of 140 lm/W in 2020, but LED packages are expected to achieve an efficacy of over 220 lm/W.[32] There will be no reason for OLEDs to more broadly penetrate the general lighting arena anytime soon unless they can provide clear benefits versus LEDs.

Chapter 3 will examine each of the applications in general lighting in greater detail by current status, revenue forecast, technology split, and geography.

29 NanoMarkets (February 2012).
30 The current OLED panel's efficacy is almost half that of LED packages, at one-third of the lifetime. OLED's luminaire price is more than 50 times that of LED lamps on a dollars-per-kilolumen basis (US Department of Energy, April 2012).
31 US Department of Energy (April 2012).
32 Ibid.

Automotive lighting

The automotive lighting market is growing steadily. The 2011 market size is estimated at EUR 14 billion, representing approximately 20 percent of the total market. This is expected to climb to EUR 18 billion by 2020. Our 2011 report used vehicle unit sales forecasts for both the new installation market and the aftersales market. The 2012 report's figures are based on vehicle unit production forecasts for the new installation lighting market and vehicle unit sales forecasts for the light source aftersales market to capture the lighting product market even more precisely.[33]

Change on the automotive lighting market is very limited compared to last year's forecast. Adjustments to account for the global economic situation mainly have short-term impact.[34] In addition to that, the effects of downward adjustment have been further reduced compared to last year's report due to McKinsey's updated model logic. Considering production unit rather than sales unit data antedates future sales growth by the lead time between production and sales dates. Moreover, forecasts for LED penetration are lower than in general lighting, limiting the impact of LED price erosion on the overall automotive lighting market. However, the uncertain recent economic downturn could affect the market more severely in some regions in the short term.

Backlighting

The backlighting market is estimated to have had revenues of almost EUR 4 billion in 2011 at the light source level. The light sources analyzed were LEDs and CCFLs (cold cathode fluorescent lamps). OLED displays are already penetrating the mobile/smartphone market, expanding the market share of OLEDs as they provide higher resolution than LCD displays.[35] Korean and Japanese companies are investing aggressively in OLED technology development, and OLEDs are expected to replace LEDs even in large-screen TVs.[36] However, our market report does not include the size of the OLED market as OLED displays use self-light-emitting technology without the need for backlighting, eliminating the concept of a light source.

The backlighting market (excluding OLED displays) is expected to shrink faster than last year's estimate, to EUR 1.0 - 1.5 billion in 2016. This is because of a lower LCD TV and monitor sales forecast,[37] the swifter penetration of OLED products anticipated in some applications,[38] and the greater LED price erosion.

2.2 Factors fueling the further uptake of LED

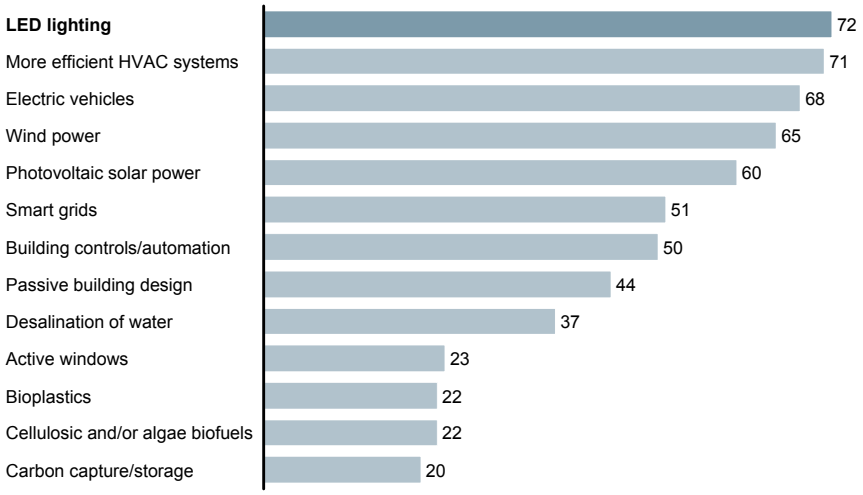
LED is regarded as the most promising technology in terms of commercial viability in 2020 from among several kinds of clean technology – such as photovoltaic solar power, wind power, and electric vehicles. This is the outcome of a proprietary McKinsey survey in November 2011 (Exhibit 6).

33 IHS Automotive (April 2012); IHS Automotive (March 2012) (a); IHS Automotive (March 2012) (b); IHS Automotive (March 2012) (c).
34 IHS Automotive (May 2011); IHS Automotive (April 2012).
35 Strategies Unlimited (September 2011).
36 Reuters (May 2012); Reuters (January 2012).
37 IMS (April 2012); Strategies Unlimited (June 2010); IMS (June 2011); Strategies Unlimited (September 2011).
38 Strategies Unlimited (September 2011).

Exhibit 6

LED lighting is expected to be the most promising technology in terms of commercial viability

Question: Which of the following technologies do you expect to be commercially viable by 2020?
Percent



SOURCE: McKinsey analysis (see footnote 39)

Indeed, the price of LEDs is tumbling even faster than anticipated, helping to further drive technology transition. The green revolution in lighting is also continuing apace, with other energy-efficient lighting technologies being acknowledged as a bridge towards full LED penetration. Several factors are coming together to drive even faster uptake of LED lighting than originally anticipated in McKinsey's 2011 report in the mid to long term.

Aggressive price erosion

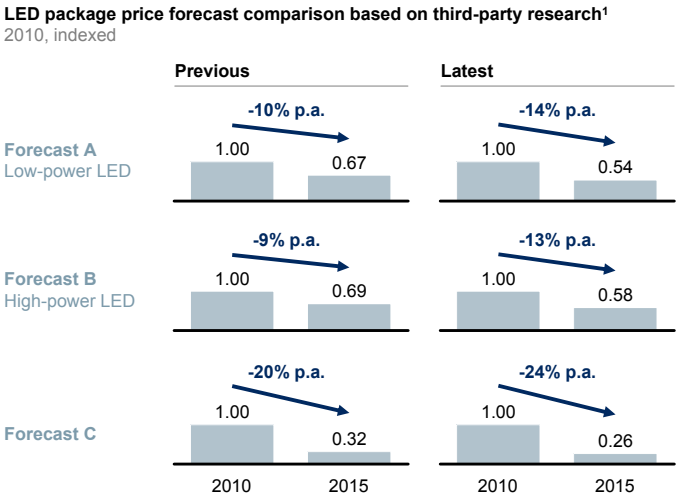
Reduction in the price of LEDs has accelerated over the past year, driven by several factors. One is that considerable overcapacity of LED chips and packages has built up due to huge investments in LED chip/package production lines in China.[40] The rise in demand for LEDs in the backlighting segment – currently still the largest LED package market segment – has also been slower than projected. The penetration of LED TV has been more sluggish, while OLED penetration in the mobile/smartphone market has been faster than previously anticipated.[41] Alongside the price reduction trends triggered in the backlighting segment, the low-price LED chips and packages have begun flowing into the general lighting segment,[42] especially low- to mid-power range LED components, which are mainly suitable for diffuse area lighting.

The change in the price forecast for LED packages between the period preceding last year's market report and afterwards is evident from Exhibit 7. LED package price reduction from 2010 to 2015 has accelerated by around 4 percentage points p.a.

39 Proprietary McKinsey survey, 2011. The respondent base consisted of over 4,000 management employees at a diverse set of companies across geographies, without any notable bias towards or against climate change or clean tech.
40 US Department of Energy (April 2012); Strategies Unlimited (September 2011).
41 Strategies Unlimited (June 2010); Strategies Unlimited (September 2011).
42 CENS.com (March 2012); Nomura (December 2011).

Exhibit 7

Forecasts for the reduction in LED package price have accelerated since McKinsey's 2011 lighting report



1 General lighting sector. Calculated by both value-based and unit-based market size

SOURCE: McKinsey analysis and additional sources (see footnote 43)

based on the comparison of various forecasts. LED packages are still one of the largest cost components of both LED lamps and luminaires,[44] so the lower LED package price is greatly affecting these two types of lighting products. Announcements of corresponding price reductions across the industry substantiate this assumption.[45]

The price premium on LED lighting products still remains high, and the initial purchase price represents a significant barrier to decision makers when considering an initial investment in general lighting applications. However, faster LED price erosion is pulling forward the payback time of LED lighting. Our analysis shows for example that faster price erosion in residential LED bulbs and office LED tubes is bringing forward payback time in 2016 by one to two years. It is expected to be less than two years by then in the residential segment, and around three years in the office application (Exhibit 8). McKinsey's Global Lighting Professionals and Consumer Survey last year revealed that lighting product decision makers will choose LED lighting with two to three years' payback time on average. This means that the inflection point for the LED retrofit bulb market in the residential segment could be around 2015 in an accelerated price erosion scenario. (Please refer to Exhibit 26 in Appendix C for last year's survey results.)

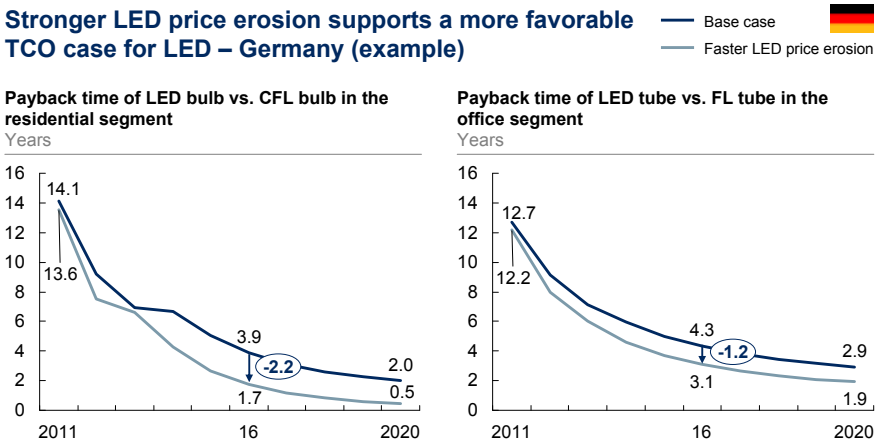
Accelerated technology transition[46]

Faster LED price erosion is expected to increase the LED lighting value-based market share in the mid to long term in all sectors except backlighting. McKinsey's 2012 Market Model has calculated that the LED lighting market share in general lighting is

43 Strategies Unlimited (September 2011); Strategies Unlimited (June 2010); IMS (April 2012); IMS (June 2011).
44 US Department of Energy (March 2011).
45 LEDs Magazine (March 2012); Smart Planet (April 2012).
46 Please also refer to section 2.2 (pages 20 to 22) in McKinsey's 2011 "Lighting the way" report.

Exhibit 8

Stronger LED price erosion supports a more favorable TCO case for LED – Germany (example)



Assumptions
- Electricity price: EUR 0.27/kWh for residential, EUR 0.13/kWh for office
- Operating hours per day: 4 hrs/day for residential, 8 hrs/day for office
- Lifetime of light source: 50,000 hrs for LED, 10,000 hrs for CFL, 20,000 hrs for FL
- Lumen output: 800 lm for LED and CFL in residential, 2,000 lm for LED in office, 3,000 lm for FL in office
- Light source efficiency: 75 lm/W for LED, 65 lm/W for CFL, 70 lm/W for FL
- Efficiency improvement: 6% p.a. for LED, 0% p.a. for CFL and FL
- Average sales price (ASP) for light source: EUR 35 for LED bulb, EUR 9 for CFL bulb, EUR 100 for LED tube, EUR 4 for FL tube
- Base case LED light source ASP reduction: -16% p.a. from 2011 to 2015, -5% p.a. from 2015 to 2020
- Faster price erosion case: -4 percentage points more aggressive than base case from 2011 to 2015 and -2 percentage points from 2015 to 2020

SOURCE: McKinsey analysis

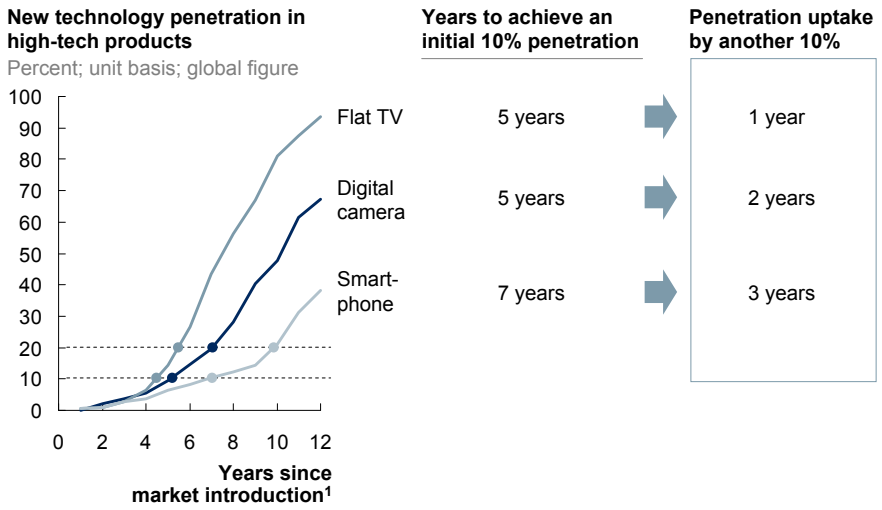
expected to be 45 percent in 2016 and almost 70 percent in 2020. These figures are 2 and 5 percentage points higher (respectively) than forecast in 2011. It is worth noting that the predicted growth rates of LED's value- and unit-based contributions vary over the short and mid term. The unit-based penetration speed of LED light sources is projected to accelerate over time. The annual unit share is expected to gain 2 percentage points on average through to 2013, while the increase averages 6 percentage points for the period from 2014 to 2020. In contrast, the value-based penetration speed is set to decrease over time due to a counter effect of declining average sales prices. Annual penetration is forecast to rise by an average of 9 percentage points through to 2014, while growth averages only 6 percentage points between 2015 and 2020.

These differences in the speed of penetration between the short and mid term are in line with related product analogies, such as flat TVs or digital cameras. The uptake of innovative technologies and products typically behaves in a so-called S-curve. The speed of penetration early in the life cycle accelerates in the mid term when crossing the inflection point (e.g., when a viable TCO – total cost of ownership – case comes into place). It then flattens out again in the longer term with a higher degree of saturation. As an example, flat TVs, digital cameras, and smartphones all took much longer to achieve the first 10 percent penetration than the next 10 percent (Exhibit 9).

This S-curve pattern also applies to LED light source and luminaire unit forecasts. All applications (with the exception of the architectural segment) have four- to six-year time windows for the first 10 percent penetration on a luminaire unit basis, for instance. Achieving an additional 10 percent penetration is estimated to take only one to three years. As the

Exhibit 9

Once new technology penetration hits 5 to 10%, the market penetration tends to accelerate



1 Market introduction estimated based on year with 0 - 1% sales penetration: 2001 for flat TV, 2001 for smartphone, and 1996 for digital camera
SOURCE: McKinsey analysis and additional sources (see footnote 47)

prime early adopter of LED, the architectural segment is demonstrating even swifter growth, taking less than a year for each incremental rise of 10 percent.[48] However, this is due to the fact that LED has expanded the application space for the segment by new products, such as media facades and new kinds of entertainment lighting. In addition, LED's advantages, such as RGB (red, green, blue) color controllability and flexibility, are far more important in this segment than in others, which further drives above-average penetration rates.

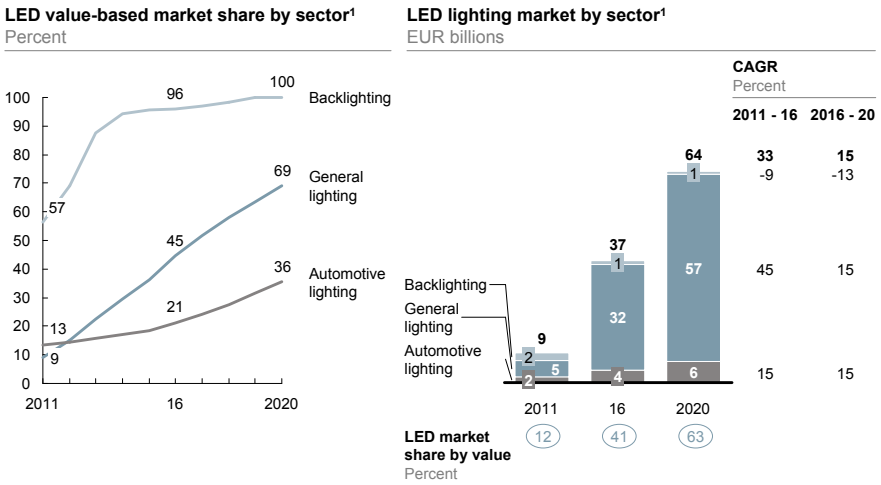
In the automotive lighting segment, the LED lighting's market share is expected to be just over 20 percent in 2016 and 36 percent in 2020 – only slightly above our forecast of last year. Backlighting is the only sector that is anticipated to slightly decrease its share of LED lighting in 2016 from last year's forecast, mainly due to the faster erosion of LED package prices than predicted in 2011 as well as increasing OLED substitution.

In the lighting market as a whole, LED lighting penetration is projected to be around 40 percent in 2016 and over 60 percent in 2020 (Exhibit 10).[49]

47 Strategy Analytics (May 2012); Strategy Analytics (May 2008); Strategy Analytics (December 2011); Gartner (August 2004); Euromonitor (July 2012); iSuppli, Worldwide Television Quarterly Market Tracker Q4 (2002 to 2012).
48 McKinsey's 2012 Global Lighting Market Model; assuming 2009 as first year of notable penetration.
49 Please note that penetration curves in Exhibit 10 are value based. These curves do not contradict S-curve type penetration behavior on a unit basis since value-based patterns include price effects that blur results.

Exhibit 10

LED lighting market is expected to increase very rapidly in the coming 10 years



1 Total general lighting market (new fixture installations incl. full value chain, incl. lighting system control components and light source replacements), automotive lighting (new fixture installations and light source replacement), and backlighting (light source only: CCFL and LED package)
NOTE: Numbers may not add up due to rounding

SOURCE: McKinsey's 2012 Global Lighting Market Model

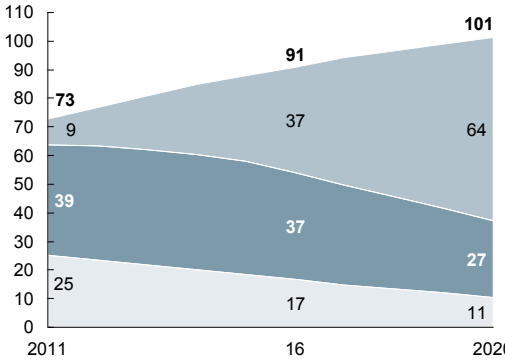
Although the share of LED lighting is expected to rise faster than forecast last year in the mid to long term, its market size appears similar to that expected in 2011 due to its accelerated price erosion. The LED lighting market size overall is anticipated to be around EUR 37 billion in 2016 and EUR 64 billion in 2020.

Swifter LED penetration also affects the traditional lighting market, especially green traditional lighting, by encroaching on traditional lighting sales. Green traditional lighting is defined as being in line with typical energy efficiency standards within the industry per product group. As a proxy in terms of simple energy consumption, green products are defined as providing an energy efficiency improvement of at least 20 percent versus comparable non-green products. The relevance of green traditional lighting in this context is that it plays a significant role as a bridge technology before full penetration of LED lighting. The market share of green traditional lighting in 2011 is already more than 50 percent of the total lighting market (Exhibit 11). Our forecast for the market size of green traditional technology has fallen by around EUR 3 billion for 2016 compared to last year's projection, and by approximately EUR 5 billion for 2020.

Exhibit 11

Currently, traditional energy-efficient technologies are the mainstream, but LED is forecast to take the lead position in around 5 years

Global lighting product market trends[1] for energy-efficient products
EUR billions



	CAGR Percent 2011 - 16	2016 - 20
Total	**5**	**3**
LED	33	15
Green traditional[2]	-1	-8
Non-green traditional	-8	-11

1 Total general lighting market (new fixture installations incl. full value chain, incl. lighting system control components and light source replacements), automotive lighting (new fixture installations and light source replacement), and backlighting (light source only: CCFL and LED package)
2 Due to the broad range of different lighting products, green is defined per product group in line with typical energy efficiency standards within the industry, e.g., Energy Star for CFL lightbulbs. All green products need to provide a 20% energy efficiency improvement vs. comparable non-green products
NOTE: Numbers may not add up due to rounding

SOURCE: McKinsey's 2012 Global Lighting Market Model

3. Deep dive on the general lighting market

As general lighting is the largest sector in the global lighting market, this chapter covers the individual applications and geographies on a more granular level. Accelerated LED price erosion is affecting the LED penetration and market size of each application differently, and each geographic market has diverging exposure to macroeconomics, energy policy/regulation, and other factors influencing its development path.

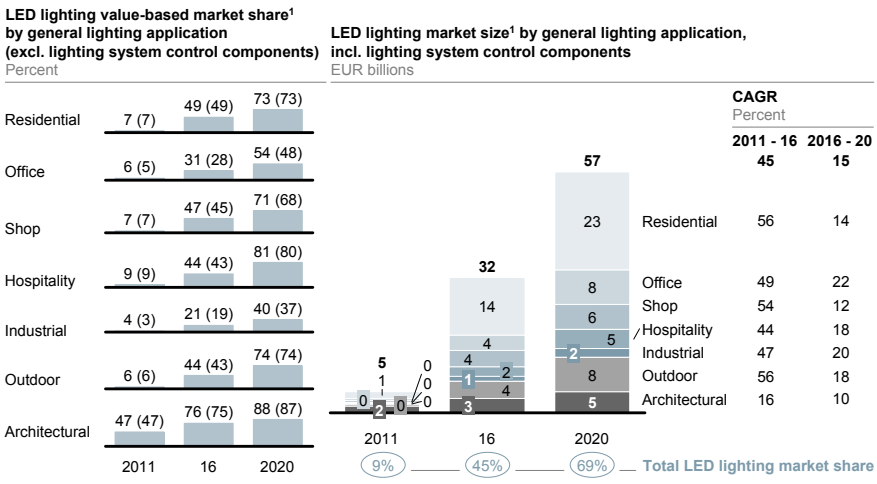
3.1 Applications: Faster LED price erosion having varying impact[50]

The first six general lighting applications – residential, office, shop, hospitality, industrial, and outdoor lighting – are defined by type of location and building. The seventh, architectural, is – in contrast – a functional application, the purpose of which is mainly decorative or to create mood. (Please refer to Appendix A for a definition of each application.) Changes in the market environment are affecting each application differently. The faster price erosion of LED lighting has implications for LED penetration as well as market size in every application.

First, swifter LED price erosion is increasing the forecast of future LED market share on a unit basis, but is also decreasing the size of the traditional lighting market measured in terms of both units and value. Second, faster LED penetration is leading to accelerated decline of the replacement lamp market due to the longer life of LEDs. Third, the falling prices are reducing the LED premium on the market even faster, thus decreasing market value. However, the impact of these three aspects differs by application. McKinsey's market model has calculated the gaps vis-à-vis last year for each application relating to the forecast of LED market share, the size of the LED lighting market (Exhibit 12), and total general lighting market size (Exhibit 13). The following section details the major changes to the forecast versus 2011 for each application.

Exhibit 12

Architectural is the early LED adopter, but residential is expected to become the most significant LED application soon



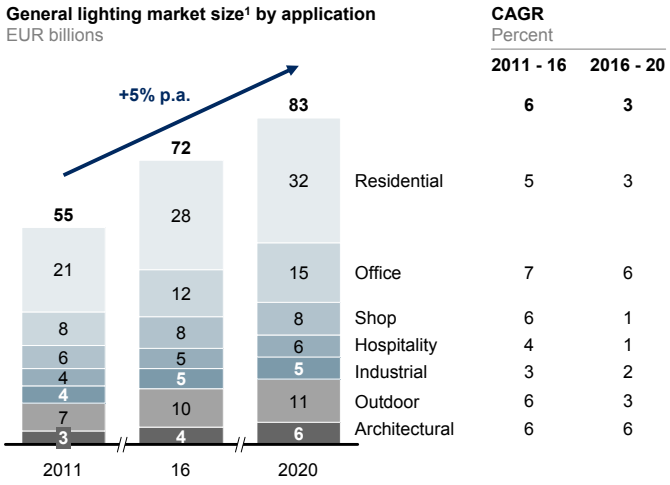
1 Total general lighting market: new fixture installations incl. full value chain, incl. lighting system control components and light source replacements
NOTE: Numbers may not add up due to rounding

SOURCE: McKinsey's 2012 Global Lighting Market Model

50 Please also refer to section 3.1 (pages 29 to 33) in McKinsey's 2011 "Lighting the way" report.

Exhibit 13

Residential is and will remain the largest market segment, followed by office and outdoor



1 Total general lighting market: new fixture installations incl. full value chain, incl. lighting system control components and light source replacements
NOTE: Numbers may not add up due to rounding

SOURCE: McKinsey's 2012 Global Lighting Market Model

Residential. The largest application market in general lighting, residential, represented almost 40 percent of the total general lighting market in 2011. The LED market share in residential was estimated at around 7 percent in 2011 and is expected to be almost 50 percent in 2016, rising to more than 70 percent in 2020. The mid-term forecast thus remains the same as that of last year. However, the long-term forecast reveals a higher penetration than anticipated last year. This accelerated uptake is driven by a shorter payback time due to the faster decline in LED prices. In some countries, the price of LED lamps is expected to become competitive with CFLs (compact fluorescent lamps) as soon as 2015,[51] which will further speed up the transition from CFLs to LEDs. Moreover, accentuated regulation roadmaps to phase out inefficient lightbulbs (particularly in China and Europe) will also contribute to and accelerate the LED market share in residential applications. The forecast for overall market size (full value chain) remained the same as last year, at EUR 28 billion for 2016 and EUR 32 billion for 2020. Although the size of the luminaire and lamp market decreased versus last year's forecast, the market for lighting system control components newly included in this edition compensated for this.

Office. The second-largest application market in general lighting accounted for around 15 percent of the total general lighting market in 2011. LED market share in the office application increased rapidly from 2010 to 2011, rising to around 6 percent in 2011 on a value basis. The future share is expected to be over 30 percent in 2016 and close to 55 percent in 2020. Nevertheless, LED penetration is facing certain barriers in this application that prevent even stronger penetration levels. First, the segment is highly penetrated by fluorescent technology that already has a high efficacy. LED technology therefore cannot materialize the same savings potential as in residential, where it

51 US Department of Energy (April 2012).

competes with inefficient technologies, such as incandescent. In addition to that, office infrastructure, including lighting, is usually maintained and managed by third parties, not the owner or tenant of the office space. As a result, the lighting technology purchase decision is not made by the party that pays the electricity bill. The lighting investment and the potential energy and electricity savings do not fall into the same pockets.

Analogous to residential, the long-term forecast suggests higher penetration than last year due to faster price erosion. However, McKinsey's 2012 Global Lighting Market Model reveals a forecast for the size of the office lighting market in 2020 that is around EUR 3 billion lower than last year's projection. This is mainly due to swifter LED price erosion reducing the size of the LED light source market, combined with a volume decline and a decrease in the size of the traditional light source market. The reason why the size of the LED lighting market in office is similar to that of last year is reallocation of the market for lighting system control components from traditional to LED. McKinsey assumed that LED office lighting is more suitable for lighting control systems than traditional lighting, and that the value of lighting system control components in LED is higher than that of traditional lighting due to the growing use of LED in high-end buildings going forward.

Shop. Current LED market share in the shop application is estimated at around 7 percent and is expected to grow to more than 45 percent by 2016, increasing to as much as 70 percent by 2020. Although LED market share is anticipated to be higher than last year's forecast on a unit basis, accelerated price erosion – especially in subsegments that are not very conscious of color quality – will overcompensate for this upside. The LED value-based market share forecast has gone down from last year's projection. We estimate a market size that is almost EUR 2 billion below last year's value forecast for 2020.

Hospitality. The application with the second-fastest uptake in LED penetration after architectural is the hospitality segment. Its current LED market share is estimated at around 9 percent and is expected to grow to close to 45 percent by 2016, increasing to around 80 percent by 2020. Although swifter price erosion supports faster LED penetration on a unit basis, the impact of the price decline exceeds the effect of the increase in LED penetration, which has also resulted in the lower forecast for the size of the LED lighting market compared to last year. The uptake in LED penetration is decreasing the traditional lighting market size, and our forecast for the overall size of the hospitality lighting market has gone down from that of last year for both 2016 and 2020.

Industrial. The industrial segment is the slowest mover to LED, with LED market share still at 4 percent in 2011 even when measured by value. LED market share is expected to grow more slowly than in other applications, rising to approximately 20 percent in 2016 and 40 percent in 2020. Similar to the office application, penetration is somewhat hindered for application-specific reasons. Again, existing and widely used technologies, such as fluorescent and HID (high-intensity discharge), already feature relatively high-efficacy performance. The efficiency benefits of LED are therefore not as prevalent. However, there is a strong case for LED in some industry applications that require intensive effort when it comes to light source replacement (if the location of the light source is hard to reach, for example). Although the value-based market share has remained almost the same as last year's forecast, the long-term forecast for the overall size of the lighting market has slightly decreased.

Outdoor. The third-largest application in general lighting accounts for more than 12 percent of the total general lighting market in 2011. In contrast to other applications, the outdoor

market is more exposed to government and municipality decision making, and thus also more directly influenced by public policy interventions. LED market share in the outdoor segment is estimated at around 6 percent at present. It is expected to climb to close to 45 percent by 2016, increasing to more than 70 percent by 2020. The forecast has been upward adjusted from last year due to faster LED price erosion as well as accelerated government and municipality initiatives, such as the LightSavers program by The Climate Group.[52] The swifter LED penetration triggers faster substitution of traditional lighting. As a consequence, our forecast for the market size of HID lamps, for instance, has decreased from that of last year. The market size forecast at a lamp and luminaire level has decreased from last year's projections, too. However, we expect further growth of the market for outdoor lighting control systems to offset the downside compared to last year's forecast on a full value chain basis.

Architectural. The early adopter of LED, architectural, had an LED market share estimated at close to 50 percent in 2011. This share is expected to be more than 75 percent by 2016 and close to 90 percent by 2020. Compared to last year's forecast, the market share forecast has slightly increased as the advantages of LED become ever clearer.[53] The RGB color controllability and emerging TCO benefits, for example, are compelling characteristics of LED in architectural applications, and lead to a gradual replacement of traditional technologies. It is mainly white LED packages for backlighting that have been affected by the accelerated fall in price: the price forecast for RGB LED packages has remained in line with McKinsey's 2011 projection. As a result, there has not been any decrease in the forecast for the size of the architectural lighting market compared to 2011 for either 2016 or 2020.

3.2 Geographies: Asia continues to lead the global LED general lighting market[54]

The market changes over the last year described in Chapters 1 and 2 have had an impact on regional markets, too, although the trends and effects differ by geography. In addition to reviewing region-specific statistical data and market reports, McKinsey conducted multiple interviews with lighting product wholesalers and retailers in the regions to update the 2011 regional perspective (Exhibit 14).

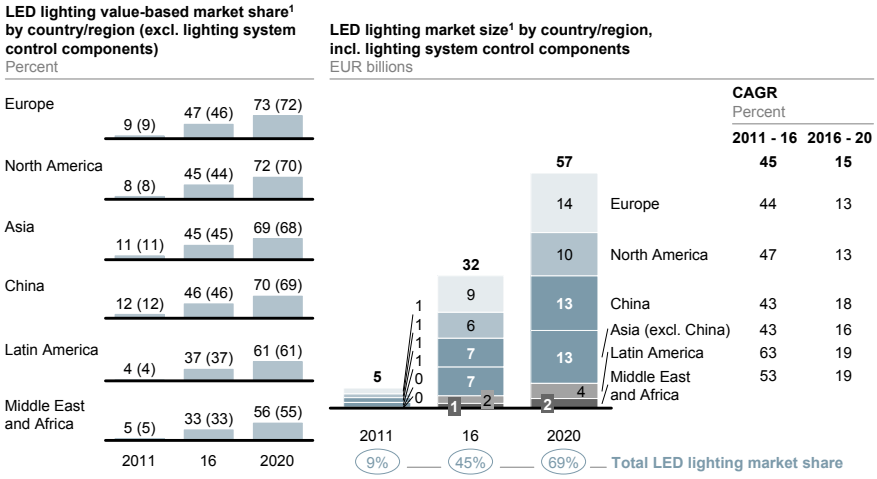
Actual data indicates that last year's estimate of the value-based LED market share in 2011 was slightly underachieved in the final event, especially in Latin America, the Middle East, and Africa. In line with the earlier sections, our forecast for the overall size of the general lighting market has been downward adjusted in all regions (except China) due to slower economic growth and faster LED price erosion (Exhibit 15).

All of Asia (including China, which is shown separately in the exhibits) remains the largest general lighting market as well as the largest LED lighting market despite some modifications made to regional market perspectives this year. The following deep dives on each regional market focus on the major changes since last year.

52 The Climate Group (June 2012).
53 Strategies Unlimited (September 2011).
54 Please also refer to section 3.2 (pages 33 to 37) in McKinsey's 2011 "Lighting the way" report.

Exhibit 14

Asia is an early adopter of LED, and leads the global LED general lighting market

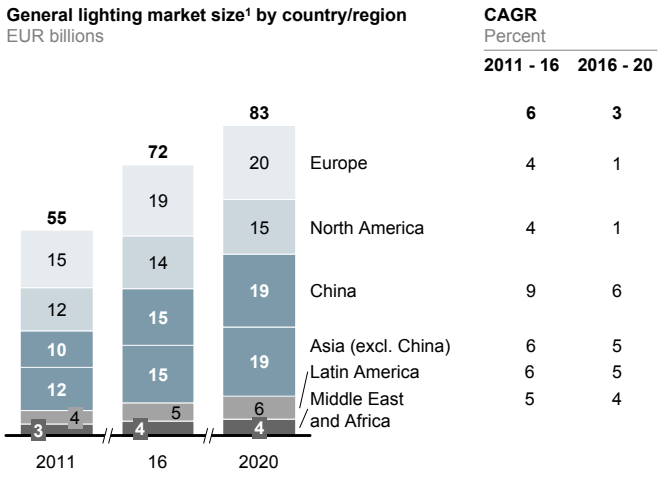


1 Total general lighting market: new fixture installations incl. full value chain, incl. lighting system control components and light source replacements
NOTE: Numbers may not add up due to rounding

SOURCE: McKinsey's 2012 Global Lighting Market Model

Exhibit 15

Asia is the largest general lighting market, and is forecast to strengthen its position going forward



1 Total general lighting market: new fixture installations incl. full value chain, incl. lighting system control components and light source replacements
NOTE: Numbers may not add up due to rounding

SOURCE: McKinsey's 2012 Global Lighting Market Model

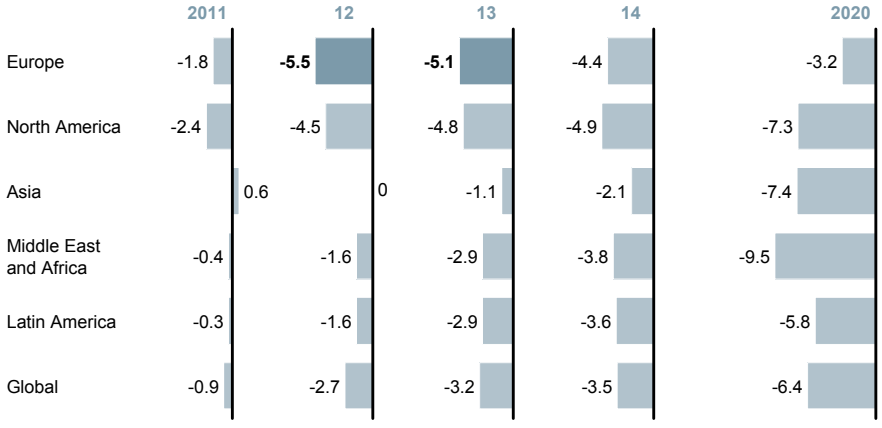
Europe.[55] The LED value-based market share in Europe is currently estimated at around 9 percent. This figure was slightly downward adjusted when compared to McKinsey's 2011 forecast, which was 10 percent, based on a review of actual 2011 results of selective industry players. The share is anticipated to rise to over 45 percent by 2016 and more than 70 percent by 2020. These projections represent a slight increase over the forecast in last year's report. In addition to the effect of faster LED price erosion and accelerated LED uptake, multiple factors have changed in Europe since last year, especially the nuclear phaseout plan in Germany and the European Commission's upcoming regulation on banning low-voltage halogen lamps,[56] all of which are expected to drive higher LED penetration.

As Europe is the region most affected by the recent financial crisis, the forecast for its overall general lighting market size was reduced by more than 5 percent for 2012 and 2013 (Exhibit 16). However, the McKinsey market model calculates that the upward adjustment of LED penetration combined with the premium for LED lighting (that will inevitably remain, even though it will shrink) is likely to compensate for the impact of slower economic growth in the longer term. These factors taken together will result in less of a gap versus last year's forecast than in other regions.

Exhibit 16

Recent changes in the macroeconomic forecast are likely to affect Europe most in the near term

Change in the size of the general lighting market[1] vs. McKinsey's 2011 model
Percent



1 Total general lighting market: new fixture installations incl. full value chain, incl. lighting system control components and light source replacements
SOURCE: McKinsey's 2012 and 2011 Global Lighting Market Models

North America. The value-based LED market share for 2011 is estimated at around 8 percent in North America. This is expected to grow to around 45 percent in 2016 and around 70 percent by 2020. These figures are downward adjusted from last year's forecasts by 1 to 2 percent. Faster LED price erosion is supporting the accelerated uptake of LED. However, the current shale gas revolution in North America could lower overall energy costs going forward, including electricity retail prices, which would have a negative

55 Including both Western and Eastern Europe. Eastern Europe includes the Commonwealth of Independent States.
56 European Lamp Companies Federation (February 2012); European Council for an Energy Efficient Economy (2012).

impact on LED's TCO case. Combined with the lower prices of LED light sources, the LED market share ended up with lower figures than expected last year.

The altered LED penetration and price erosion has also affected the size of the overall general lighting market on top of the impact of the economic slowdown. The forecast for the size of the general lighting market in North America in 2020 fell by around EUR 1 billion compared to last year's projection, and is expected to be approximately EUR 15 billion.

Asia.[57] At a share of the total of almost 40 percent in 2011, Asia represents the largest regional market in overall general lighting as well as LED general lighting. The value-based LED market share in Asia was over 10 percent in 2011 thanks to the fast penetration of LEDs in Japan and China. Following the Fukushima disaster in 2011, Japan's 2012 LED share is estimated at over 30 percent in the luminaire market due to the severe energy shortage and greatly increasing awareness of the need to save energy.[58] In the shop segment, the LED share in the luminaire market is expected to even exceed 50 percent this year.

The LED market share in Asia is expected to reach 45 percent by 2016 and approach 70 percent by 2020. These figures have been slightly upward adjusted versus last year's forecast due to the more favorable TCO that LEDs offer in many cases and the very strong LED uptake in Japan. However, the overall general lighting market in Asia was downward adjusted due to greater reductions in the price of LEDs as well as slower economic growth compared to the 2011 forecast. The total market size in Asia in 2020 is expected to be approximately EUR 38 billion – a drop of EUR 3 billion versus last year's estimate.

For our updated report, we also reexamined China's lighting market baseline using additional statistical data and market intelligence.[59] China represented 29 percent of GDP in Asia on a real basis in 2011. It also accounted for 60 percent of total construction investment in Asia, with construction investment being closely linked to the luminaire new installation market. Last year's estimate that China made up 40 percent of Asia's lighting market in 2011 has been upward adjusted to 45 percent (actual estimate for 2011). China also has a relatively high LED penetration, at around 12 percent in 2011. This is driven by non-residential applications, as CFL is still the dominant technology in the residential segment. The outdoor segment in particular has seen higher LED penetration due to government support.[60]

Rest of world. The rest of the world – Latin America, the Middle East, and Africa – makes up a much smaller share than the other regions in terms of the size of both their overall general lighting and their LED general lighting markets. The value-based LED market share in 2011 is estimated at 4 percent for Latin America and 5 percent for the Middle East and Africa combined. Last year's projections were slightly overestimated compared to the experience of industry players in local markets. Those regions are also seeing slower LED lighting growth, with a penetration of less than 40 percent forecast for 2016. Government industry policy may have a significant impact on LED penetration in Latin America. Import duties on lighting fixtures are

57 The term Asia as used here covers all the Asia-Pacific countries, including Australia and New Zealand, etc.
58 Fuji-Keizai (2012).
59 IHS Global Insight (June 2012); IHS Global Insight (March 2012) (a); CSIL (December 2011).
60 Nomura (December 2011).

high in Latin American countries.[61] Unless production facilities are locally available, LED fixtures could therefore become even more expensive. The size of the overall general lighting market has been downward adjusted in response to the lower LED penetration, faster LED price erosion, and slower economic growth. We forecast a total general lighting market for the rest of the world in 2020 of around EUR 10 billion – EUR 1 billion below last year's forecast.

3.3 Market segment by product grade: Commodity segment on the rise

This year McKinsey conducted further analyses on lighting product grades based on the demographic income data of each region.[62] We divided lighting markets into four categories depending on the grade of product: high-end, advanced, commodity, and low-end. The high-end grade is defined as top-end technology geared to energy efficiency that attracts customers whose primary purchase decision is based on product quality and performance. Advanced is the term used for technology geared to energy efficiency that attracts customers who are mainly buying based on quality and performance, with only a minor interest in price. Commodity grade refers to standard technology geared to energy efficiency that attracts customers focusing on a specific technology threshold and price. The low-end category designates simple technology and energy efficiency products attracting customers whose primary buying factor is price.

These product groups were then matched from high to low against four different value pools per geography that were derived based on the region's income distribution. Two basic assumptions were made in this analysis. The first was that the income level of each population would determine the size of each category market. People with higher income levels, for example, can afford to buy more expensive lighting products. Equally, the population figures of each income level were assumed to determine the sophistication level of buildings constructed both for work purposes and venues (including schools, hospitals, hotels, restaurants, etc.), as well as outdoor lighting. The second premise was that lighting system controls are not adopted in the low-end segment. The income-based segment output for the lighting system control market has therefore been adjusted accordingly.

The results indicate the importance of the commodity segment, representing one-third of the total market in 2011 (Exhibit 17). This is mainly driven by strong growth in Asia's lighting market among its middle- to low-income population (Exhibit 18). Around 70 percent of the EUR 10 billion market growth by 2020 will come from Asia.

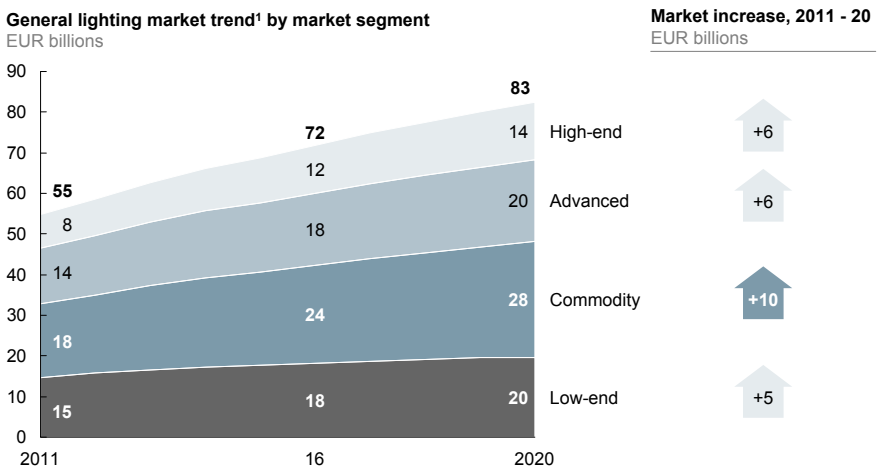
This analysis also reveals the size of the low-end segment in Asia. Currently, more than 50 percent of the Asian market is classified as low-end, and Asia makes up more than 70 percent of this total segment. It is thus a significant market, but the price level in this segment is predicted to be very low, with no great focus on quality.

The advanced segment is similary distributed in Europe, North America, and Asia, while the high-end segment is mainly led by Europe and North America. These segments give greater emphasis to quality and advanced technology. The penetration of LED as well as lighting control systems – regarded as high-priced advanced technologies – should be greater in these segments as a result.

61 Ministries of Economy (June 2012); ALADI (Latin American Integration Association) (June 2012).
62 C-GIDD (2012).

Exhibit 17

The commodity and advanced segments account for over 50% of the general lighting market

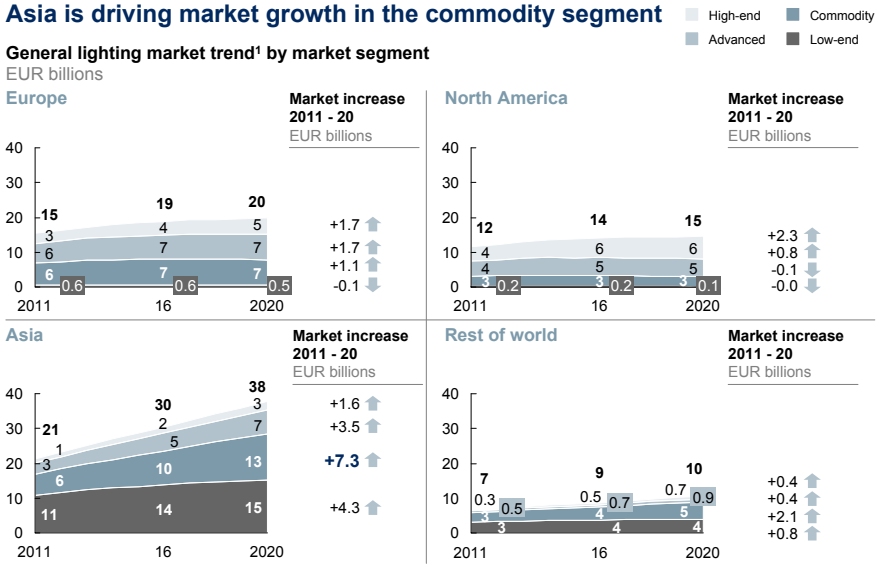


1 Total general lighting market: new fixture installations incl. full value chain, incl. lighting system control components and light source replacements
NOTE: Numbers may not add up due to rounding

SOURCE: McKinsey's 2012 Global Lighting Market Model

Exhibit 18

Asia is driving market growth in the commodity segment



1 Total general lighting market: new fixture installations incl. full value chain, incl. lighting system control components and light source replacements
NOTE: Numbers may not add up due to rounding

SOURCE: McKinsey's 2012 Global Lighting Market Model

4. Shifting industry landscape

The developments in the global lighting market just described are also impacting the lighting industry landscape, with first disruptions along the value chain already becoming apparent. These shifts also create new business opportunities that will become ever more important as the lighting industry transformation takes further shape.

4.1 Disruption of the industry structure

Value in the LED chip and package market is set to shift from backlighting to general lighting. Also, LED and lighting component players are shoring up their business by moving downstream. In fact, the evolving LED general lighting market is affecting lighting industry dynamics along the entire general lighting value chain, with potential impact on light engine standardization, the fragmented fixtures market, the replacement versus new installation market, and the industry's channel mix.

Move from backlighting to general lighting

Currently, the largest LED package market sector is backlighting, accounting for almost half of the global LED package market (within the scope of McKinsey's market model)[63] in 2011. While the size of the backlighting LED package market is shrinking due to LED penetration approaching saturation levels and swifter LED price erosion, value is shifting towards the emerging LED market in general lighting. The size of the LED package market in general lighting is expected to exceed that of backlighting from 2013. Many backlighting players are entering the general lighting market to compensate for the anticipated decline in backlighting business ahead. However, faster price reduction of LED packages will likely also cap the future growth of the general lighting LED package market. McKinsey's calculations show that LED package market growth in general lighting is expected to be around 25 percent p.a. from 2011 to 2016, and will then slow down to approximately 7 percent p.a. from 2016 to 2020. This is much slower than overall LED general lighting market growth, which is predicted to be around 45 and 15 percent p.a., respectively.

Many LED backlighting players are starting to expand into the general lighting downstream arena, i.e., the retrofit lamp and fixtures business.[64] Also, incumbent lighting players have recently been building further downstream businesses via M&A. Traditional lamp players have for example been acquiring fixtures players and even expanding into lighting control systems to capture the newly emerging business opportunities described in the next section. More than 70 M&A deals targeting downstream players have taken place in the past five years.[65]

Accelerating light engine standardization

As noted in McKinsey's 2011 report,[66] standardization of light engines is a key trend in today's LED world, and the movement towards standardization is seeing greater

63 McKinsey's Global Lighting Market Model covers general lighting, automotive lighting, and backlighting. It does not include other lighting applications.
64 Nomura (December 2011).
65 Dealogic M&A (June 2012).
66 Please refer to page 23 in McKinsey's 2011 "Lighting the way" report.

acceleration than last year. Zhaga, for instance – one of the most prominent light engine standardization consortia at present – has increased the number of its members from 140 to more than 230 over the past year.[67]

Standardization has several implications for the lighting industry. First, standardization benefits fixtures companies by increasing the usability and availability of light engines, especially for smaller companies that lack broader R&D capabilities and capacity. Standardization also allows light engine manufacturers to scale their production lines, increase volume output, and focus research on defined sets of parameters. Standardization therefore gives access to economies of scale and is likely to transform the lion's share of the light engine business into a commodity industry – similar to most other electronics component industries.

The light source and fixtures businesses used to be far less dependent in the traditional lighting world. The rise of LED has increased the importance of vertical play or collaboration between light source and luminaire players: in some cases, light engines have been fully integrated into luminaires. Once clear standards defining interfaces with the fixtures segment are set for light engines, light sources and fixtures could become more independent again.

Although standardization is a clear industry trend, specific standards are still unclear as finding a common denominator that satisfies every player is a challenge. Also, ambiguity around the timeline for standardization remains high across industry experts. It will take time for a landscape to develop where light engines are truly compatible, with standard interfaces across manufacturers as in the traditional lighting world. A scale-driven mass market light engine business – especially for low- to medium-end market light engines – will require full standardization. However, high-end light engines will allow for customization in terms of design, features, and performance.

We expect the currently highly fragmented landscape of light engine players to consolidate going forward, whereas EMS- and ODM-type[68] players may accelerate their business in this arena, too, similar to other electronics component industries.[69] Specialized light engine businesses will continue to compete with a focus on the higher-end market segments.

LED penetration impacting the fragmented fixtures market

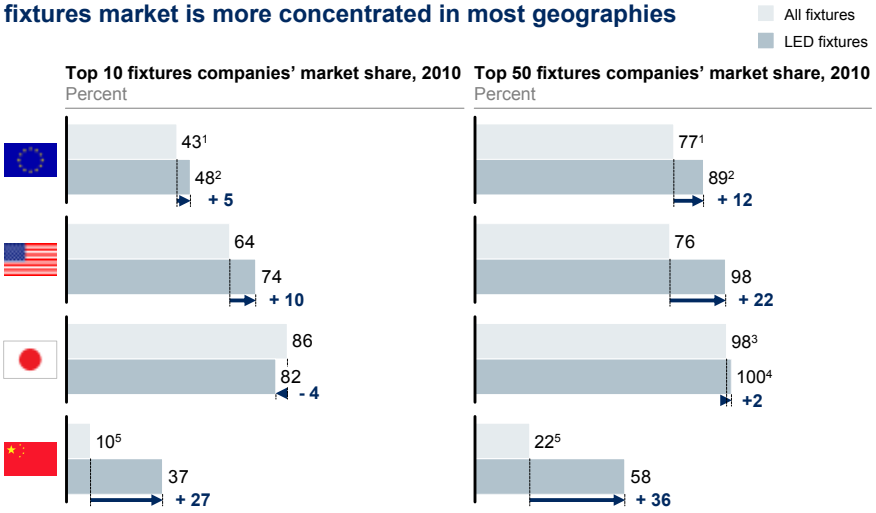
The general lighting fixtures market remains regionally fragmented, unlike markets for typical electronics products. This is mainly due to local product requirements and the importance of access to local decision makers, whether architects, lighting designers, or electrical installers. However, the level of market fragmentation differs by region. China, for example, is the most fragmented market: the top 50 fixtures companies have a market share of only around 20 percent. In Japan, by contrast, a mere 10 players account for over 80 percent of the market (Exhibit 19).

The industry transition driven by LED could potentially affect the structure of the fixtures market. The current top players in LED fixtures achieve overproportional market

67 Zhaga Consortium (June 2011/June 2012).
68 Electronics Manufacturing Services and Original Design Manufacturers.
69 EBNonline (October 2010).

Exhibit 19

Fragmentation of the fixtures industry differs by region/country; the LED fixtures market is more concentrated in most geographies



1 2011
2 Only Western Europe (Western Europe's LED lighting market accounted for more than 90% of the entire European market in 2010)
3 Top 34 companies
4 Top 35 companies
5 2011

SOURCE: McKinsey analysis and additional sources (see footnote 70)

shares – with the exception of Japan, where consolidation levels in the fixtures market are already high. As LED is a new technology with new characteristics and requirements for product design and development, introducing LED lighting fixtures may be an initial burden for small traditional fixtures companies. Leading LED fixtures players will have an opportunity to increase their market share, at least temporarily. Nonetheless, the lighting fixtures market will remain regionally fragmented given the nature of the fixtures business. And once standard light engines become available, the entry barrier to the LED fixtures business for small and medium-sized enterprises may disappear again.

Shift in the value chain from replacement to new installation

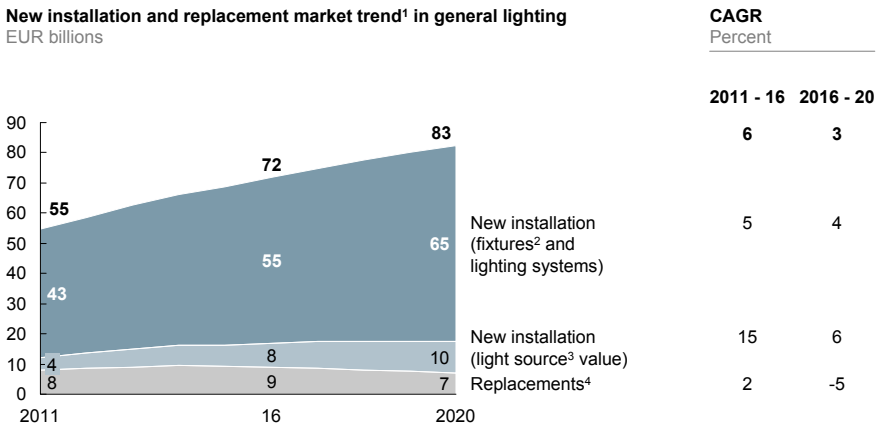
The shift towards more energy-efficient light sources with significantly longer lifetimes is impacting the replacement market. This market is seeing a natural decline because consumers no longer need to replace their light sources as frequently. In contrast, the new installation business is not being affected negatively since new installations follow renovation rather than lifetime cycles. The new installation market is even benefiting from LED penetration due to the average price increase this entails.

Last year's calculations indicated that the replacement market would peak in 2015 and then gradually shrink, while the total light source market was expected to continue growing until 2020.[71] However, the forecasts of faster price erosion have significantly impacted our estimates for the light source market. The peak of the replacement market has been pushed forward by one year, and the total light source market is now expected to flatten out after 2016 (Exhibit 20). This is expected to accelerate the value shift from light sources towards fixtures as well as lighting system controls.

70 CSIL (July 2011); CSIL (May 2012); CSIL (July 2010); CSIL (May 2011); CSIL (June 2011).
71 Please refer to Exhibit 19 on page 38 in McKinsey's 2011 "Lighting the way" report.

Exhibit 20

Value is steadily shifting to fixtures and lighting systems in the general lighting market



1 Total general lighting market: new fixture installations incl. full value chain, incl. lighting system control components and light source replacements
2 Fixtures include electrical components (ballasts)
3 Light sources include traditional lamps and LED modules/light engines, incl. packages
4 Replacement light sources are defined as lightbulbs/tubes in traditional lighting and LED modules/light engines in LED lighting
NOTE: Numbers may not add up due to rounding

SOURCE: McKinsey's 2012 Global Lighting Market Model

New channel mix

Accelerated LED penetration as well as the value shift from light sources and replacements to fixtures, lighting control systems and new installation are projected to also have an impact on sales channels.

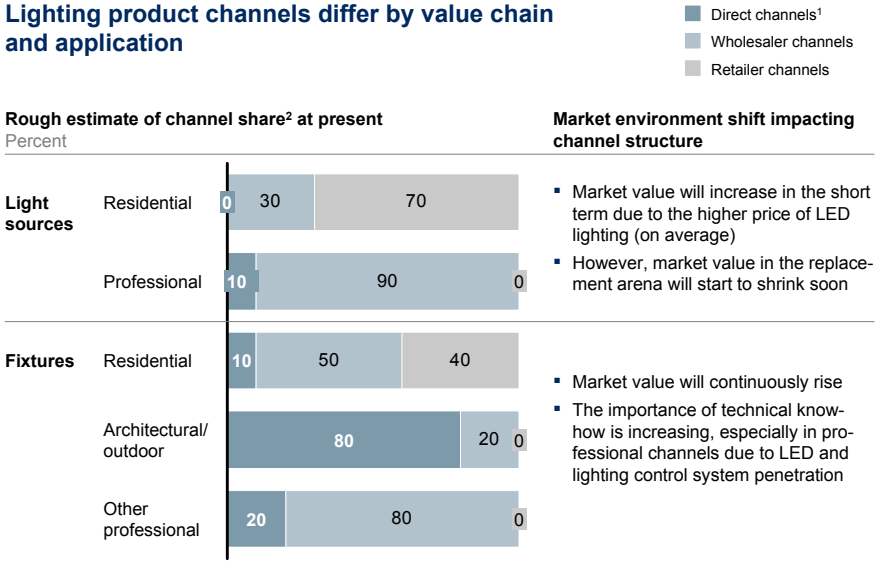
Sales channels for lighting products differ by value chain step and application. This analysis particularly differentiates three types of sales channel: direct, wholesale, and retail. The first category, direct channels, refers to a direct sales path from a lighting product manufacturer to the end user, be it an OEM further down the value chain (e.g., a lamp manufacturer selling components directly to a fixture manufacturer), a professional customer (e.g., a fixtures player selling directly to a building contractor, architect, light planner, or municipality), or a consumer (e.g., a luminaire player selling to consumers online). The electrical wholesale channel is the second and retail the third category, both acting as an intermediary between manufacturers and end users. Whereas the wholesale channel addresses the professional customer segment (especially installers), retail addresses the residential/consumer segment.

The implications of the changing lighting market environment on each channel vary depending on the current positioning of each channel. Exhibit 21 shows a rough estimate of each channel's current market share and the market environment shift that could affect the channel structure.

At present, wholesale and retail are the major channels in the light source market, mainly capturing the replacement business. The market value of light sources will increase in the short term with the growing penetration of energy-efficient technologies – including LED – that come at a price premium. However, McKinsey's market model calculations suggest that the light source replacement market will start to

Exhibit 21

Lighting product channels differ by value chain and application



1 Direct sales by lamp companies as well as fixtures companies
2 Most reference information comes from European and US market experts

SOURCE: McKinsey analysis (see footnote 72)

shrink after 2014. This will have implications for the channels. A trend that is already apparent is that both the wholesale and retail channels are proactively expanding the range of energy-efficient light sources they offer to tap the short-term opportunity from higher unit sales prices.

In the fixtures market, direct channels (straight from the fixtures manufacturer) and wholesale are the major channels in the professional segment, with wholesale also offering fulfillment services for direct channels. The residential fixtures segment is primarily served by wholesale and retail. In contrast to the light source market, the lighting fixtures market is expected to grow continuously. The increasing penetration of LED and lighting control systems will have major sales channel implications. Deep technical expertise in lighting has so far been especially important in architectural and outdoor lighting as well as in the high-end segments in other applications that are mainly supplied direct by lighting companies. However, in the emerging LED and lighting control system arena, technical know-how is required to explain the benefits of these technologies and influence lighting product decision makers, including electrical installers. Having these technical sales capabilities will become a key success factor in most general lighting fixture applications. Wholesalers are currently building their technical capabilities and enhancing their solution marketing to capture the potential market, while luminaire companies are also accelerating along the same dimension.

4.2 New downstream business opportunities

New business opportunities are also emerging as the redrawn industry landscape assumes clearer contours. The lighting control system market is expected to grow

72 McKinsey analysis based on discussions with the lighting industry panel.

strongly through to 2020. While office is currently the largest application, the residential and outdoor segments are set to expand going forward. Other service-related businesses will also flourish as the market for LEDs takes firmer hold.

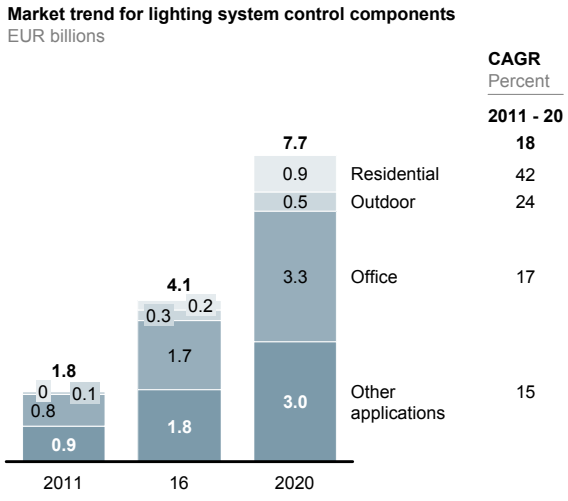
Lighting control systems

The growing global energy efficiency movement adds to the importance of lighting control systems in the general lighting sector year by year. Regardless of the efficiency of the light source, over 30 percent of lighting energy consumption is still wasted on average when spaces and rooms are not in use.[73] This means there is a strong incentive to reduce energy consumption via dynamic lighting controls, especially where electricity usage is high. Beyond saving energy, lighting control systems have several benefits when combined with LEDs. LEDs with a lighting control system can increase the lifetime of the LED light source, which improves the investment economics even further. As detailed in McKinsey's 2011 market report, dynamic lighting control can also create a better ambience, improve health and working efficiency, and even accelerate the growth of plants.[74]

These benefits of lighting control systems are expected to translate readily into new business opportunities for lighting companies. The market for lighting system control components is the fastest-growing value chain element in general lighting, with a growth rate of almost 20 percent p.a. from 2011 to 2020. The growth rate of overall general lighting excluding lighting system control components is projected to be less than 5 percent over the same period. Exhibit 22 shows the growth trend of the market for lighting system control components.

Exhibit 22

The market for lighting system control components is expected to grow very rapidly



NOTE: Numbers may not add up due to rounding
SOURCE: McKinsey's 2012 Global Lighting Market Model

73 US Energy Information Administration and Lumina Technologies (August 1996); Associated Schools of Construction (2012).
74 Please refer to pages 24 and 25 in McKinsey's 2011 "Lighting the way" report.

According to our definition, this market mainly covers the hardware element. It includes control panels for user interfaces and network components, such as ZigBee chips, as well as sensors to detect movement (as an intruder warning, for example). The sizes of most related software markets are not included. (Please refer to Appendix A for details of the definition/scope of the market for lighting system control components.)

Currently, office and other commercial applications account for more than 90 percent of the market for lighting system control components. Office is the largest application, with around 40 percent of the overall lighting system control components market, thanks to support by government programs, such as LEED in the US and BREEAM in Europe. Building energy management systems (BEMS) have so far been focused on controlling heating, ventilation and air-conditioning (HVAC) systems, as heating/air-conditioning systems consume the most energy in buildings.[75] However, the trend is now moving towards lighting system controls, too.[76] The architectural segment – classified under "Other applications" in Exhibit 22 – is currently the second-largest application, as most RGB-type LED lighting equips lighting control systems with dynamic color control.

Residential may be the fastest-growing application, although the market size is currently still small. Last year's report did not cover the residential sector in its calculation of the size of the market for lighting system control components. However, awareness of lighting control in the residential domain is gradually increasing, together with greater consciousness of home energy management systems. In the residential application, ambient lighting control systems are also gaining awareness, especially in the high-end segment. Although the current penetration of lighting control systems in the residential segment is low except for simple dimmers (which have been excluded from our market size calculation), the field may expand once prices for lighting control systems decline and a wider range of products becomes available.[77]

In the outdoor application, simple timers were once the only type of lighting control system used, but this is now another fast-growing area. More dynamic lighting control systems are emerging to improve the economics of investment by governments and municipalities by maximizing energy savings as well as improving the lifetime of light sources.[78] Dynamic lighting control systems can also enhance the safety or ambience of an area by adjusting light output according to the brightness of the natural light available.

New service-related businesses

Apart from the lighting control systems business described above, the transition of the lighting market is creating additional downstream business opportunities in the service arena.

Financial services. The high initial costs are the major barrier to LED penetration, so eliminating this obstacle will have a large impact on the entire lighting market. McKinsey's 2011 Global Lighting Professionals and Consumer Survey revealed that initial purchase price is an important purchase decision criteria, and that decision makers would choose LEDs if their payback period was less than two to three years on average in any lighting application (please refer to Exhibit 26 in Appendix C). The latter is still far from the current

75 US Department of Energy (2011).
76 NanoMarkets (February 2012).
77 Ibid.
78 The Climate Group (June 2012).

status in most applications. Providing end users with financing opportunities will clearly help to remove potential investment constraints in LED lighting, especially once a viable TCO case is in place.

Several types of financing scheme are available to support new lighting installation. These include traditional financing (such as leasing and loans), financing for government and municipality projects (public-private partnerships, private finance initiatives, etc.), and carbon financing under the Clean Development Mechanism.[79]

Interest is also growing in ESCO-type businesses from the perspective of new opportunities. The term ESCO (Energy Service Company) refers to businesses that manage the planning and implementation of energy-efficient equipment and also ensure continuous monitoring of (typically) real-estate projects meant to achieve higher energy efficiency and lower running costs. ESCO services are already a sizable market in the US,[80] Japan,[81] and China,[82] covering the energy consumption of entire buildings and facilities. A large portion of value creation still stems from HVAC due to the high energy consumption of air conditioning in buildings. However, energy consumption in lighting is now moving into the spotlight.[83]

Maintenance services. Beyond financial services, the long lifetime of LEDs and the growing awareness of energy efficiency may enhance the lighting product maintenance business. Although LEDs can endure for over 20 years, their overall performance can decline over time: they require maintenance to uphold their high lighting quality. Lighting maintenance could become more automated in the future by leveraging lighting control systems to monitor lighting performance remotely at regular intervals.[84] Spare parts sales are likely to become another revenue source in the lighting maintenance business, as is typical for other consumer durables.

Technical solution services. LED and lighting control systems require more technical knowledge than has traditionally been necessary in the lighting industry. An additional opportunity will arise when traditional lighting players and users request technical services, both in R&D activities and for the renovation or new installation of lighting assets. Services of this kind are already emerging.[85] Economic viability studies and assistance with documentation on applying for government and municipality subsidies may also be valuable services for buyers in the field of large-scale lighting solutions.

The new business models outlined above will doubtless represent just a fraction of the full downstream lighting industry spectrum going forward. Other new business models are bound to emerge as the lighting industry continues to evolve.

79 The Climate Group (June 2012).
80 National Association of Energy Service Companies (2011).
81 Japan Association of Energy Services Companies (2012).
82 Xiaoliang, S., Lin, Z., Taylor, B. (May 2011).
83 NanoMarkets (February 2012).
84 Electrical Construction and Maintenance (EC&M) (November 2011).
85 Electronic Engineering Times (May 2011); Sourcing Electricals & Lighting (June 2012).

Appendices

A. Definition and scope of each lighting market category

The same definition/scope as last year has been used for each market category to ensure consistency, except where this 2012 report contains specific divergent terminology and explanations. This also applies to McKinsey's 2012 Global Lighting Market Model. This section will only provide some updated points from last year's report. (Please refer to Appendices 1 to 3 in last year's market report for the definitions contained there in all other respects.)

Definition of lighting control systems

The 2011 market report used the terminology "system/solution" for the last part of the lighting value chain. However, this is somewhat ambiguous. "Lighting control system" may be a better term to describe this step in the value chain, and is more commonly used nowadays in the lighting industry.

As lighting control systems imply the involvement of information technology that goes beyond lighting products per se, they may include solution services, software as well as hardware components. However, McKinsey's calculation of market size focuses primarily on hardware except for some basic software that is already embedded in hardware components. To avoid confusion, the term "lighting system control components" is used to describe the hardware components.

Another point that is important to mention is that when calculating the market size of lighting system control components, simple traditional switches and a number of other old-fashioned technologies were excluded as it would be inappropriate to refer to a simple switch as a lighting control system. (Please refer to Exhibit 23 for the scope of our market size calculation.)

Exhibit 23

Scope of the market size calculation for lighting system control components

	Product type	Description
Included	Lighting control sensors	▪ Wall and ceiling sensors for lighting control
	Lighting controllers (user interface)	▪ Control panels include entire spectrum, from standard systems to advanced LCD panels
	Lighting management systems	▪ Master controllers that connect multiple control panels ▪ Network communications equipment and interfaces with BMS are included only for lighting-specific parts/interfaces
	Others	▪ Phase-cut dimmers/step dimmers are included ▪ Timers are included in some applications, but timers typically used in outdoor lighting that control only 1 individual fixture are not included
Not included	Ballasts	▪ Traditional ballasts and dimming ballasts are excluded from lighting system control components. All ballasts are separately modeled in the ballast value chain step (ECG/CCG)
	Services	▪ Services that pertain to lighting solutions for buildings, e.g., planning, installation labor ▪ Lamp replacement services, energy management services, etc.
	Software	▪ The market size only addresses hardware components on the lighting control system market. Some of these may have some kind of motherboard with inbuilt software to control the lighting systems on a stand-alone basis, but the market size is mostly hardware based
	Other	▪ Theatrical lighting (programmed lighting used specifically for entertainment) is excluded ▪ Wiring conduits, etc., used for installation of lighting controls are excluded ▪ Total building management systems are excluded

SOURCE: McKinsey

Definition of general lighting applications

As last year, general lighting has been categorized into seven applications – a residential application and six professional applications: office, shop, hospitality, industrial, outdoor, and architectural. Some of these definitions have been reworked to avoid any ambiguity.

Residential. The residential application includes both permanently installed fixtures (such as recessed sconces, undercabinet lights, and residential outdoor lights) as well as portable plug-in fixtures (pendants, table lamps, and floor lamps, for example). It also includes small-scale home offices and bed-and-breakfast accommodation/guest-houses that are similar in structure to residential houses.

Office. The office application comprises lighting for office buildings, healthcare institutions, educational buildings, and other buildings utilized for public or commercial purposes (including meeting rooms, workspaces, receptions, hallways/corridors, staircases, restrooms, and basements).

Shop. This application consists of display lighting, decoration, and general shop floor area lighting. The wide variety of products covered by this application – ranging from jewelry through to clothing, cosmetics, and food – require different types of lighting.

Hospitality. This covers general lighting for hotels, bars, restaurants, and cinemas. The hospitality application is often focused on decorative lighting and ranges from mood lighting to orientation lighting.

Industrial. This application consists of general lighting in production, assembly and storage spaces in factories, warehouses, indoor sporting areas, and halls. This includes downlights, linear lights, spotlights, high/low bay lights, and task lighting.

Outdoor. This application includes lighting for streets, highways, tunnels, and other public and non-public outdoor areas, such as parking lots, low bays, and stadiums. Outdoor lighting has to fulfill three criteria: safety, security, and esthetics. Safety means adequate lighting for visibility, security is required as a deterrent to crime, and esthetics is important to create an inviting, intimate atmosphere.

Architectural. This application is used for the illumination of building structures, with artistic integration of light source and architectural elements (including signage). Architectural lighting can be both functional and decorative, and can be applied both outdoors and indoors.

Gadgets (such as flashlights) have been excluded from all applications.

B. McKinsey's 2012 Global Lighting Market Model

McKinsey's market model was designed to capture the full lighting market for general lighting, automotive lighting, and backlighting, as was the case in 2011. Like last year, the model is differentiated by application, main lighting technologies, geographies, and value chain steps. (Please refer to Appendix 4 in the 2011 report for the basic structure of the model as well as some fundamental assumptions regarding general lighting.) The section that follows contains updated figures using tables that retain the 2011 structure.

General lighting

Table 1: Summary of the general lighting market*

	Unit of measure	2011	2012	2016	2020
Annual new installation					
Number of fixtures	m pcs	1,763	1,837	2,164	2,571
Residential	m pcs	1,340	1,389	1,617	1,896
Office	m pcs	113	120	148	182
Industrial	m pcs	44	45	50	56
Shop	m pcs	95	100	120	143
Hospitality	m pcs	87	91	97	106
Outdoor	m pcs	22	23	27	29
Architectural	m pcs	62	69	106	160
Technology mix					
Incandescent	%	23	19	5	2
Halogen	%	17	17	14	6
HID	%	2	2	2	1
LFL	%	23	23	19	13
CFL	%	31	30	25	16
LED retrofit	%	1	2	7	5
LED full	%	3	6	29	58
Number of light sources	m pcs	3,537	3,663	4,283	5,112
Incandescent	m pcs	867	758	229	111
Halogen	m pcs	607	640	612	329
HID	m pcs	48	48	39	24
LFL	m pcs	661	682	645	511
CFL	m pcs	1,224	1,251	1,170	852
LED retrofit	m pcs	29	73	290	264
LED full	m pcs	101	210	1,297	3,021
ASP per light source	EUR/unit	1.15	1.39	1.89	2.03
Incandescent	EUR/unit	0.17	0.17	0.19	0.20
Halogen	EUR/unit	0.54	0.56	0.53	0.45
HID	EUR/unit	7.31	7.14	6.25	5.37
LFL	EUR/unit	0.87	0.85	0.78	0.72
CFL	EUR/unit	0.91	0.87	0.71	0.58
LED retrofit	EUR/unit	6.58	5.11	3.12	2.70
LED full	EUR/unit	13.36	10.55	4.03	2.81
Total new installation market	EUR m	46,891	50,179	63,023	75,403
Lamp/module level	EUR m	4,054	5,093	8,078	10,366
Driver level	EUR m	3,964	4,440	7,323	10,770
Fixture level	EUR m	37,080	38,545	43,572	46,561
Lighting control system level	EUR m	1,794	2,101	4,051	7,705
Annual replacement business					
Installed base fixtures	m pcs	13,231	13,676	15,695	18,133
Incandescent	m pcs	6,423	6,190	4,927	3,526
Halogen	m pcs	989	1,184	1,874	2,042
HID	m pcs	464	479	513	483
LFL	m pcs	3,400	3,466	3,740	3,742
CFL	m pcs	1,762	2,113	3,219	3,651
LED retrofit	m pcs	46	58	325	759
LED full	m pcs	147	185	1,097	3,930
Installed base light sources	m pcs	26,426	27,382	31,982	40,029
Incandescent	m pcs	10,379	8,367	1,674	0
Halogen	m pcs	2,503	3,089	3,752	1,863
HID	m pcs	504	519	541	475
LFL	m pcs	5,553	5,677	5,890	5,195
CFL	m pcs	6,931	8,763	12,546	10,410
LED retrofit	m pcs	220	440	4,046	10,444
LED full	m pcs	335	527	3,532	11,643
Installed base LED full light sources	m pcs	335	527	3,532	11,643
Residential	m pcs	87	178	2,087	7,701
Office	m pcs	5	14	131	475
Industrial	m pcs	1	4	41	131
Shop	m pcs	9	31	403	1,249
Hospitality	m pcs	9	18	168	597
Outdoor	m pcs	2	4	35	111
Architectural	m pcs	222	278	668	1,378
Light sources up for replacement	m pcs	10,906	10,228	7,305	4,258
Incandescent	m pcs	6,821	5,484	1,503	8
Halogen	m pcs	1,350	1,741	2,263	1,199
HID	m pcs	193	201	223	206
LFL	m pcs	1,678	1,660	1,563	1,351
CFL	m pcs	865	1,141	1,753	1,494
LED retrofit	m pcs	n/a	n/a	n/a	n/a
LED full	m pcs	n/a	n/a	n/a	n/a
Light sources used for replacement	m pcs	10,906	10,228	7,305	4,258
Incandescent	m pcs	5,308	3,998	903	5
Halogen	m pcs	1,569	1,934	1,863	782
HID	m pcs	193	201	220	196
LFL	m pcs	1,678	1,654	1,497	1,093
CFL	m pcs	2,079	2,284	1,733	639
LED retrofit	m pcs	80	157	1,088	1,543
LED full	m pcs	n/a	n/a	n/a	n/a
Light source replacement market	EUR m	7,883	8,457	8,888	7,102
Total general lighting market	EUR m	54,774	58,636	71,911	82,505
Europe	EUR m	15,383	16,283	18,845	19,791
North America	EUR m	11,645	12,233	14,007	14,509
Asia	EUR m	21,137	23,097	30,414	37,813
Middle East and Africa	EUR m	2,952	3,131	3,742	4,385
Latin America	EUR m	3,656	3,892	4,904	6,007

* Note: Numbers may not add up due to rounding

General lighting

Table 2: Deep dive on general lighting – applications*

			Unit of measure	2011	2012	2016	2020
Residential	Total market		EUR m	21,296	22,471	27,672	31,623
	Excl. lighting control system market		EUR m	21,257	22,416	27,427	30,717
		Incandescent	%	26	22	5	2
		Halogen	%	27	26	19	8
		HID	%	0	0	0	0
		LFL	%	11	11	9	6
		CFL	%	28	27	18	11
		LED	%	7	13	49	73
	Luminaire market		EUR m	18,010	18,987	23,787	28,267
	Light source replacement market		EUR m	3,247	3,429	3,640	2,450
	Lighting control system market		EUR m	39	54	245	906
Office	Total market		EUR m	8,441	9,304	11,938	15,019
	Excl. lighting control system market		EUR m	7,648	8,366	10,198	11,736
		Incandescent	%	1	0	0	0
		Halogen	%	3	3	2	1
		HID	%	2	2	2	1
		LFL	%	73	69	59	47
		CFL	%	16	14	9	3
		LED	%	5	11	28	48
	Luminaire market		EUR m	6,641	7,219	8,893	10,330
	Light source replacement market		EUR m	1,006	1,147	1,305	1,405
	Lighting control system market		EUR m	794	939	1,741	3,284
Retail/shop	Total market		EUR m	5,904	6,565	7,958	8,317
	Excl. lighting control system market		EUR m	5,711	6,332	7,418	7,248
		Incandescent	%	4	2	1	1
		Halogen	%	5	5	3	1
		HID	%	16	15	12	7
		LFL	%	54	50	31	19
		CFL	%	14	13	8	4
		LED	%	7	15	45	68
	Luminaire market		EUR m	4,766	5,299	6,395	6,520
	Light source replacement market		EUR m	945	1,034	1,023	728
	Lighting control system market		EUR m	193	233	539	1,069
Hospitality	Total market		EUR m	4,300	4,704	5,282	5,561
	Excl. lighting control system market		EUR m	4,197	4,582	5,017	4,994
		Incandescent	%	9	6	1	1
		Halogen	%	13	13	10	4
		HID	%	2	2	1	1
		LFL	%	35	34	23	8
		CFL	%	32	31	21	7
		LED	%	9	14	43	80
	Luminaire market		EUR m	3,366	3,646	4,106	4,548
	Light source replacement market		EUR m	831	936	911	446
	Lighting control system market		EUR m	103	122	265	568
Industrial	Total market		EUR m	4,337	4,496	5,013	5,408
	Excl. lighting control system market		EUR m	4,124	4,260	4,626	4,848
		Incandescent	%	1	1	0	0
		Halogen	%	1	1	1	0
		HID	%	23	23	21	18
		LFL	%	66	65	57	44
		CFL	%	5	4	2	1
		LED	%	3	6	19	37
	Luminaire market		EUR m	3,294	3,392	3,724	3,929
	Light source replacement market		EUR m	831	869	902	918
	Lighting control system market		EUR m	213	236	387	560
Outdoor	Total market		EUR m	7,152	7,490	9,619	11,017
	Excl. lighting control system market		EUR m	7,080	7,400	9,360	10,523
		Incandescent	%	0	0	0	0
		Halogen	%	0	0	0	0
		HID	%	86	83	51	23
		LFL	%	8	7	5	3
		CFL	%	0	0	0	0
		LED	%	6	9	43	74
	Luminaire market		EUR m	6,167	6,472	8,378	9,481
	Light source replacement market		EUR m	914	928	982	1,042
	Lighting control system market		EUR m	72	90	259	494
Architectural	Total market		EUR m	3,344	3,606	4,428	5,559
	Excl. lighting control system market		EUR m	2,963	3,178	3,814	4,736
		Incandescent	%	0	0	0	0
		Halogen	%	0	0	0	0
		HID	%	27	23	13	7
		LFL	%	26	22	12	6
		CFL	%	0	0	0	0
		LED	%	47	56	75	87
	Luminaire market		EUR m	2,854	3,063	3,689	4,624
	Light source replacement market		EUR m	109	115	126	112
	Lighting control system market		EUR m	381	427	614	824

* Note: Numbers may not add up due to rounding

General lighting

Table 3: Deep dive on general lighting – regional split*

			Unit of measure	2011	2012	2016	2020
Europe	Total market		EUR m	15,383	16,283	18,845	19,791
	Excl. lighting control system market		EUR m	14,806	15,601	17,559	17,445
		Incandescent	%	15	12	2	0
		Halogen	%	16	16	13	6
		HID	%	17	17	13	6
		LFL	%	24	23	17	12
		CFL	%	19	18	9	4
		LED	%	9	15	46	72
	Luminaire market		EUR m	11,925	12,572	14,638	15,315
	Light source replacement market		EUR m	2,880	3,029	2,921	2,130
	Lighting control system market		EUR m	578	682	1,286	2,347
North America	Total market		EUR m	11,645	12,233	14,007	14,509
	Excl. lighting control system market		EUR m	11,121	11,640	12,947	12,614
		Incandescent	%	15	12	4	1
		Halogen	%	17	17	13	5
		HID	%	11	10	8	5
		LFL	%	32	30	22	16
		CFL	%	17	16	8	4
		LED	%	8	14	44	70
	Luminaire market		EUR m	8,985	9,378	10,692	10,982
	Light source replacement market		EUR m	2,135	2,262	2,255	1,632
	Lighting control system market		EUR m	525	593	1,060	1,895
Asia	Total market		EUR m	21,137	23,097	30,414	37,813
	Excl. lighting control system market		EUR m	20,500	22,335	28,821	34,562
		Incandescent	%	8	7	1	1
		Halogen	%	9	8	6	3
		HID	%	18	17	10	5
		LFL	%	36	34	26	17
		CFL	%	18	17	12	7
		LED	%	11	17	45	68
	Luminaire market		EUR m	18,466	20,059	26,123	32,149
	Light source replacement market		EUR m	2,034	2,276	2,698	2,413
	Lighting control system market		EUR m	638	762	1,593	3,251
Latin America	Total market		EUR m	3,656	3,892	4,904	6,007
	Excl. lighting control system market		EUR m	3,630	3,861	4,847	5,891
		Incandescent	%	13	11	4	3
		Halogen	%	12	12	8	4
		HID	%	24	23	16	10
		LFL	%	26	25	19	14
		CFL	%	21	21	16	9
		LED	%	4	9	37	61
	Luminaire market		EUR m	3,188	3,387	4,288	5,379
	Light source replacement market		EUR m	442	474	559	512
	Lighting control system market		EUR m	26	30	57	116
Middle East and Africa	Total market		EUR m	2,952	3,131	3,742	4,385
	Excl. lighting control system market		EUR m	2,923	3,098	3,687	4,288
		Incandescent	%	8	7	2	1
		Halogen	%	8	8	5	3
		HID	%	23	22	16	10
		LFL	%	40	39	32	24
		CFL	%	16	15	12	7
		LED	%	5	10	33	55
	Luminaire market		EUR m	2,532	2,683	3,231	3,872
	Light source replacement market		EUR m	391	416	456	416
	Lighting control system market		EUR m	28	33	55	97

* Note: Numbers may not add up due to rounding

General lighting

Table 4: Deep dive on general lighting – BRIC countries*

			Unit of measure	2011	2012	2016	2020
Brazil	Total market		EUR m	1,823	1,923	2,474	3,144
	Excl. lighting control system market		EUR m	1,812	1,911	2,451	3,092
		Incandescent	%	13	11	4	3
		Halogen	%	12	12	8	4
		HID	%	30	29	20	12
		LFL	%	21	20	15	11
		CFL	%	20	20	16	9
		LED	%	4	9	38	63
	Luminaire market		EUR m	1,600	1,683	2,175	2,830
	Light source replacement market		EUR m	212	228	275	262
	Lighting control system market		EUR m	11	12	24	52
Russia	Total market		EUR m	1,093	1,153	1,486	1,703
	Excl. lighting control system market		EUR m	1,083	1,143	1,469	1,672
		Incandescent	%	10	9	1	0
		Halogen	%	11	11	8	3
		HID	%	43	43	34	18
		LFL	%	17	15	10	6
		CFL	%	13	12	10	7
		LED	%	6	10	37	66
	Luminaire market		EUR m	882	930	1,211	1,407
	Light source replacement market		EUR m	202	213	257	265
	Lighting control system market		EUR m	9	10	18	31
India	Total market		EUR m	1,470	1,578	2,068	2,647
	Excl. lighting control system market		EUR m	1,466	1,572	2,056	2,620
		Incandescent	%	9	8	2	1
		Halogen	%	9	9	6	3
		HID	%	42	40	26	15
		LFL	%	19	19	14	8
		CFL	%	16	17	17	15
		LED	%	5	9	35	59
	Luminaire market		EUR m	1,325	1,417	1,833	2,356
	Light source replacement market		EUR m	141	155	223	265
	Lighting control system market		EUR m	4	5	12	27
China	Total market		EUR m	9,572	10,885	14,990	19,265
	Excl. lighting control system market		EUR m	9,410	10,682	14,533	18,279
		Incandescent	%	7	6	1	0
		Halogen	%	8	8	5	2
		HID	%	12	11	7	4
		LFL	%	41	39	29	19
		CFL	%	19	17	12	6
		LED	%	12	18	46	69
	Luminaire market		EUR m	8,250	9,359	12,891	16,721
	Light source replacement market		EUR m	1,160	1,323	1,642	1,558
	Lighting control system market		EUR m	162	203	457	987

* Note: Numbers may not add up due to rounding

General lighting

Table 5: Deep dive on general lighting – applications by region*

		Unit of measure	2011	2012	2016	2020
Europe	Total market	EUR m	15,383	16,283	18,845	19,791
	Excl. lighting control system market	EUR m	14,806	15,601	17,559	17,445
	Residential	EUR m	7,333	7,546	8,264	8,433
	Hospitality	EUR m	948	1,016	1,120	1,169
	Outdoor	EUR m	1,990	2,164	3,198	3,457
	Office	EUR m	1,899	2,104	2,497	2,913
	Architectural	EUR m	729	774	836	915
	Shop	EUR m	1,246	1,378	1,535	1,454
	Industrial	EUR m	1,239	1,301	1,395	1,449
North America	Total market	EUR m	11,645	12,233	14,007	14,509
	Excl. lighting control system market	EUR m	11,121	11,640	12,947	12,614
	Residential	EUR m	5,245	5,498	6,427	6,666
	Hospitality	EUR m	961	1,022	1,129	1,148
	Outdoor	EUR m	586	639	949	1,025
	Office	EUR m	1,592	1,702	1,952	2,211
	Architectural	EUR m	422	434	426	405
	Shop	EUR m	1,448	1,559	1,745	1,697
	Industrial	EUR m	1,392	1,381	1,379	1,357
Asia	Total market	EUR m	21,137	23,097	30,414	37,813
	Excl. lighting control system market	EUR m	20,500	22,335	28,821	34,562
	Residential	EUR m	5,978	6,507	9,172	11,968
	Hospitality	EUR m	2,241	2,500	2,848	3,050
	Outdoor	EUR m	3,174	3,265	3,743	4,091
	Office	EUR m	3,739	4,187	5,927	8,107
	Architectural	EUR m	2,000	2,190	2,931	3,966
	Shop	EUR m	2,710	3,064	4,036	4,541
	Industrial	EUR m	1,295	1,383	1,757	2,089
Latin America	Total market	EUR m	3,656	3,892	4,904	6,007
	Excl. lighting control system market	EUR m	3,630	3,861	4,847	5,891
	Residential	EUR m	1,882	2,007	2,633	3,165
	Hospitality	EUR m	77	84	93	98
	Outdoor	EUR m	851	865	1,071	1,513
	Office	EUR m	490	543	656	764
	Architectural	EUR m	70	74	85	98
	Shop	EUR m	187	209	242	236
	Industrial	EUR m	100	110	124	132
Middle East and Africa	Total market	EUR m	2,952	3,131	3,742	4,385
	Excl. lighting control system market	EUR m	2,923	3,098	3,687	4,288
	Residential	EUR m	857	913	1,175	1,392
	Hospitality	EUR m	74	83	93	96
	Outdoor	EUR m	551	557	659	931
	Office	EUR m	722	768	907	1,025
	Architectural	EUR m	123	134	151	174
	Shop	EUR m	313	355	399	388
	Industrial	EUR m	311	322	358	379

* Note: Numbers may not add up due to rounding

General lighting

Table 6: Deep dive on general lighting – applications by BRIC country*

		Unit of measure	2011	2012	2016	2020
Brazil	Total market	EUR m	1,823	1,923	2,474	3,144
	Excl. lighting control system market	EUR m	1,812	1,911	2,451	3,092
	Residential	EUR m	927	997	1,344	1,663
	Hospitality	EUR m	32	35	40	42
	Outdoor	EUR m	565	576	717	1,017
	Office	EUR m	167	177	215	252
	Architectural	EUR m	44	47	54	63
	Shop	EUR m	50	54	63	62
	Industrial	EUR m	36	37	42	46
Russia	Total market	EUR m	1,093	1,153	1,486	1,703
	Excl. lighting control system market	EUR m	1,083	1,143	1,469	1,672
	Residential	EUR m	388	399	466	522
	Hospitality	EUR m	9	10	13	16
	Outdoor	EUR m	462	500	735	863
	Office	EUR m	72	77	94	117
	Architectural	EUR m	95	98	97	97
	Shop	EUR m	35	38	46	48
	Industrial	EUR m	31	32	35	40
India	Total market	EUR m	1,470	1,578	2,068	2,647
	Excl. lighting control system market	EUR m	1,466	1,572	2,056	2,620
	Residential	EUR m	519	567	789	1,051
	Hospitality	EUR m	44	51	75	102
	Outdoor	EUR m	675	696	816	952
	Office	EUR m	60	69	109	171
	Architectural	EUR m	24	27	43	67
	Shop	EUR m	127	145	207	264
	Industrial	EUR m	20	22	29	39
China	Total market	EUR m	9,572	10,885	14,990	19,265
	Excl. lighting control system market	EUR m	9,410	10,682	14,533	18,279
	Residential	EUR m	2,183	2,441	3,679	5,124
	Hospitality	EUR m	1,363	1,553	1,824	1,979
	Outdoor	EUR m	873	889	1,035	1,184
	Office	EUR m	2,166	2,521	3,648	5,058
	Architectural	EUR m	756	832	1,140	1,573
	Shop	EUR m	1,493	1,783	2,522	2,947
	Industrial	EUR m	738	866	1,142	1,402

Automotive lighting

Table 7: Summary of the automotive lighting market*

		Unit of measure	2011	2012	2016	2020
Total automotive lighting market		EUR m	14,083	14,873	17,709	18,043
	Front/headlamp	EUR m	9,989	10,486	12,292	12,275
	DRL/fog	EUR m	1,123	1,284	1,803	2,072
	Side	EUR m	287	305	393	446
	Rear	EUR m	1,927	2,026	2,402	2,482
	Interior	EUR m	757	773	820	767
Total automotive light source market		EUR m	3,369	3,605	4,680	5,509
Front lighting – detailed view						
Technology mix						
	Incandescent	%	0	0	0	0
	Halogen	%	86	84	79	67
	HID	%	14	15	16	12
	LED	%	1	1	6	21
Content per vehicle lamp level						
	Incandescent	EUR	0	0	0	0
	Halogen	EUR	4.34	4.30	4.15	4.09
	HID	EUR	21.99	21.16	18.08	15.68
	LED	EUR	108.73	86.99	52.40	28.16
Total new installation market		EUR m	9,451	9,926	11,550	11,484
	Lamp/module level	EUR m	611	680	1,113	1,697
	Driver level	EUR m	495	558	776	904
	Fixture level	EUR m	8,344	8,687	9,661	8,882
Annual lamp replacement market		EUR m	538	560	741	791
	Incandescent	EUR m	0	0	0	0
	Halogen	EUR m	503	518	673	706
	HID	EUR m	36	42	69	85
	LED	EUR m	0	0	0	0

* Note: Numbers may not add up due to rounding

Backlighting

Table 8: Summary of the backlighting market*

		Unit of measure	2011	2012	2016	2020
Penetration rate (excl. OLED)						
LCD TV						
	CCFL	%	61	33	3	0
	LED	%	39	67	97	100
Monitor						
	CCFL	%	55	32	0	0
	LED	%	45	68	100	100
Portable PC						
	CCFL	%	3	2	0	0
	LED	%	97	98	100	100
Handhelds						
	CCFL	%	0	0	0	0
	LED	%	100	100	100	100
Backlighting content per device						
LCD TV						
	CCFL	EUR	8.33	8.16	7.53	n/a
	LED	EUR	12.94	7.66	3.47	2.30
Monitor						
	CCFL	EUR	5.13	5.02	4.63	n/a
	LED	EUR	4.11	2.60	1.02	0.63
Portable PC						
	CCFL	EUR	1.48	1.45	n/a	n/a
	LED	EUR	1.43	1.12	0.59	0.35
Handhelds						
	CCFL	EUR	n/a	n/a	n/a	n/a
	LED	EUR	0.22	0.19	0.12	0.08
Market size						
LCD TV						
	CCFL	EUR m	1,057	605	55	0
	LED	EUR m	1,050	1,154	802	532
Monitor						
	CCFL	EUR m	578	346	0	0
	LED	EUR m	379	380	244	158
Portable PC						
	CCFL	EUR m	14	9	0	0
	LED	EUR m	393	373	203	61
Handhelds						
	CCFL	EUR m	0	0	0	0
	LED	EUR m	320	283	117	19

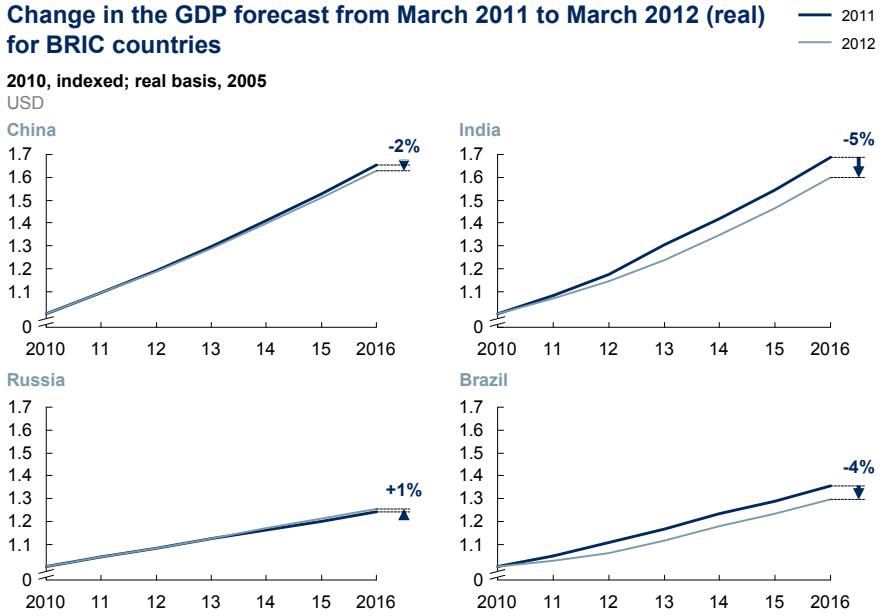
* Note: Numbers may not add up due to rounding

C. Additional key exhibits

The first exhibit below, Exhibit 24, is backup information on the changes to the GDP forecast mentioned in Chapter 1. The result shows the varying macroeconomic impact in each BRIC country.

Exhibit 24

Change in the GDP forecast from March 2011 to March 2012 (real) for BRIC countries



SOURCE: McKinsey analysis and additional sources (see footnote 86)

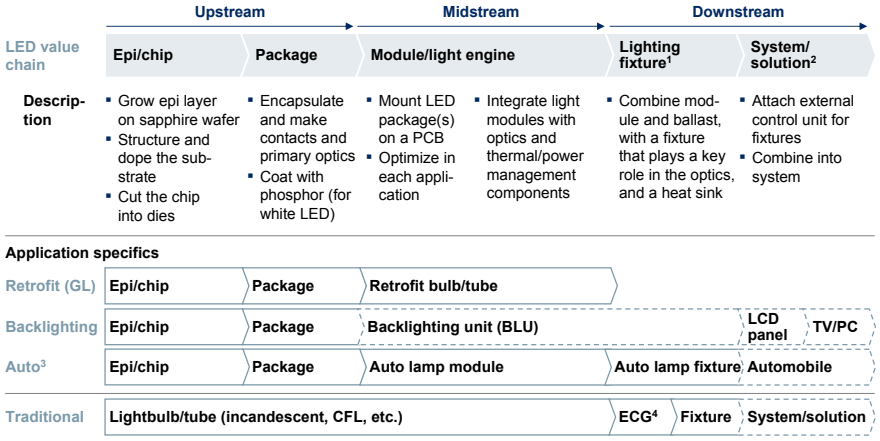
Exhibit 25 is from last year's market report and shows that the LED lighting value chain consists of three steps: upstream, midstream, and downstream. The upstream value chain covers the epi/chip process and LED packaging. Midstream is classified as the creation of modules/light engines. The downstream steps of the value chain comprise creating the LED lighting fixture and the final system or solution.

Exhibit 26 is from last year's market report and reveals that buyers of lighting products are not prepared to accept longer than two to three years' payback time for LED products, regardless of which application is concerned.

86 IHS Global Insight (March 2011); IHS Global Insight (March 2012) (b).

Exhibit 25

LED general lighting value chain (LED embedded-type fixtures)



1 The same definition as luminaire
2 Fixtures have a minimum number of external control components, but a more sophisticated controller/system can be added to LED lighting
3 Exterior lighting example
4 Electronic control gear (ballasts)

SOURCE: McKinsey analysis and additional sources (see footnote 87)

Exhibit 26

What payback periods are considered acceptable for LED?

At which payback period for LED vs. traditional lighting would you choose LED?
Percent; number of respondents[1]

	Residential N = 338	Office N = 399	Industrial N = 261	Shop N = 259	Hospitality N = 127	Outdoor N = 232	Architectural N = 235	Total N = 1,851
< 1 year	22	15	16	17	12	14	9	**16**
1 year	18	18	15	22	20	23	18	**19**
2 years	18	19	23	21	18	25	18	**20**
3 years	13	17	14	19	20	17	23	**17**
4 years	8	7	8	5	8	6	9	**7**
5 years	8	11	11	5	12	6	14	**10**
6 - 7 years	4	5	3	3	3	3	3	**4**
8 - 10 years	3	3	3	2	4	1	3	**3**
> 10 years	3	2	2	3	2	2	1	**2**
Not relevant	4	4	2	3	2	2	2	**3**
Average[2] =	3	3	3	2	3	2	3	**3**
Median[2] =	2	2	2	2	2	2	3	**2**

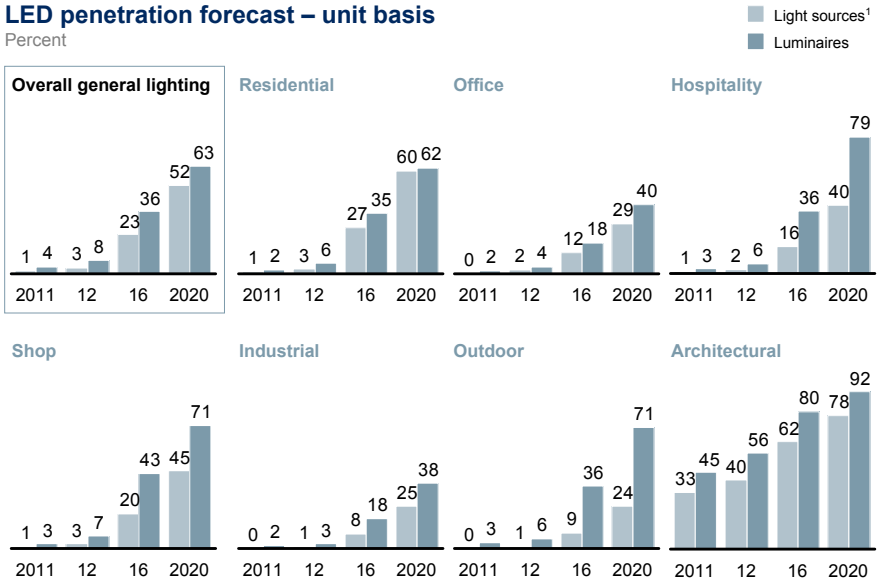
1 One respondent could respond with up to 3 applications in the survey
2 Assumed that "< 1 year" is 0.5 years and "Not relevant" means "0" in the calculation

SOURCE: McKinsey's 2011 Global Lighting Professionals and Consumer Survey

87 McKinsey & Company (2011); please refer to the 2011 report for detailed information on additional sources used and for further elaborations and definitions on Exhibit 25.

Exhibits 27 and 28 show LED penetration at a luminaire level as well as a light source level. The graphs highlight the varying speed of LED penetration among different applications and distinguish between unit-based penetration and value-based penetration (value-based market share).

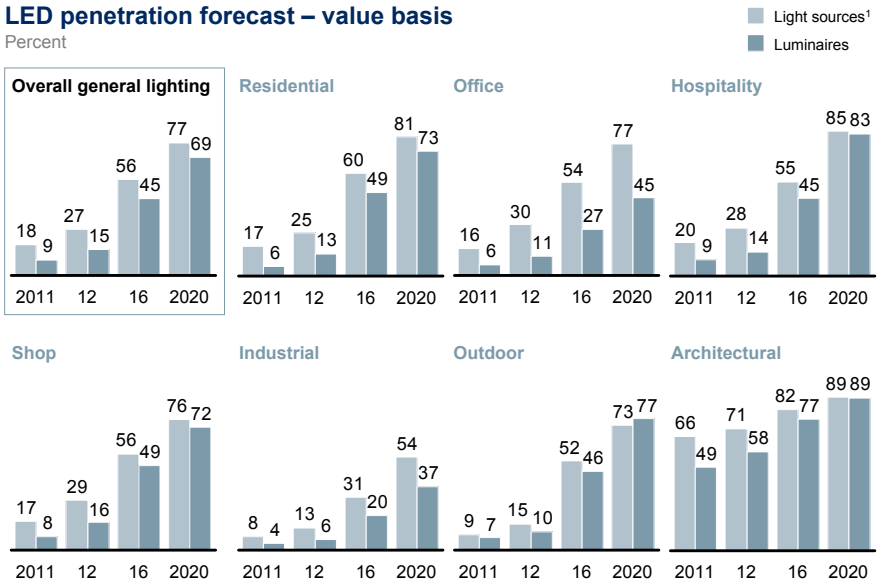
Exhibit 27



1 Includes the new installation as well as the replacement market

SOURCE: McKinsey's 2012 Global Lighting Market Model

Exhibit 28



1 Includes the new installation as well as the replacement market

SOURCE: McKinsey's 2012 Global Lighting Market Model

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Editorial staff

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Jörg Hanebrink, Editorial Production Manager, Düsseldorf

Contacts

Thomas Baumgartner
McKinsey & Company
Herrengassse 1-3
1010 Vienna
Austria
thomas_baumgartner@mckinsey.com

Florian Wunderlich
McKinsey & Company
Sophienstraße 26
80333 Munich
Germany
florian_wunderlich@mckinsey.com

Dominik Wee
McKinsey & Company
3075 Hansen Way
Palo Alto
CA - 94304
United States
dominik_wee@mckinsey.com

Arthur Jaunich
McKinsey & Company
Sophienstraße 26
80333 Munich
Germany
arthur_jaunich@mckinsey.com

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