

AUTOMOTIVE LIGHTING: TECHNOLOGY, INDUSTRY AND MARKET TRENDS

Market & Technology report - November 2018

Automotive lighting is becoming the new photonic hub.

KEY FEATURES

- Automotive lighting market analysis
- Automotive lighting industry analysis including Tier-I players
- Automotive lighting technologies analysis including LEDs, OLEDs and lasers
- Automotive lighting system development and manufacturing analysis
- Automotive lighting roadmap analysis

WHAT'S NEW:

The report provides a detailed analysis of:

- Automotive exterior lighting system design and manufacturing
- Emerging lighting technologies including those based on mini-/micro-LEDs, digital light projection (DLP)/digital micromirror devices (DMDs) and lasers
- Advanced front lighting system (AFLS) architecture, and synergies with Advanced driver assistance systems (ADAS) in sensors and software
- Non-visible lighting systems such as infrared and ultraviolet emitters used for automotive applications
- Future trends in automotive lighting

OBJECTIVES OF THE REPORT

- Analyze the automotive lighting market and applications' current status and future trends
- Review the automotive lighting industry's structure and future trends
- Discuss the main technologies used for automotive lighting, and associated roadmaps
- Examine the main lighting systems used for automotive applications, and associated roadmaps
- Provide market insights for 2013-2023 for automotive lighting applications

'LEDIFICATION' WILL PROPEL AUTOMOTIVE LIGHTING REVENUES TO \$37.3B IN 2023

With the integration of light emitting diode (LED) technology, lighting has evolved from a basic, functional feature to a distinctive feature with high-value potential in automotive. Indeed, LED technology has given manufacturers the opportunity for strong differentiation via lighting design and additional functionalities. This is particularly true for exterior lighting, which profoundly mutating in terms of both technology and supply chain. The integration of new solid state lighting (SSL) technologies is transforming automotive front lighting and rear combination lighting (RCL) systems and their applications, offering more design flexibility, increased efficacy, and intelligent functionalities.

LEDs are rapidly gaining popularity as their cost decreases and efficiency, luminance and package size improves. For example, full LED headlamps that first saw commercialization in 2008 on luxury cars like the V10 Audi R8 have since penetrated the compact, or C-segment, vehicle market in 2012, with the new Seat Leon, and are now being commercialized in emerging markets. Nowadays, nearly all car maker and Tier-I part suppliers have developed full LED-based headlamp systems and such technology is a must-have in the C and also the D – compact executive car – automotive segments.

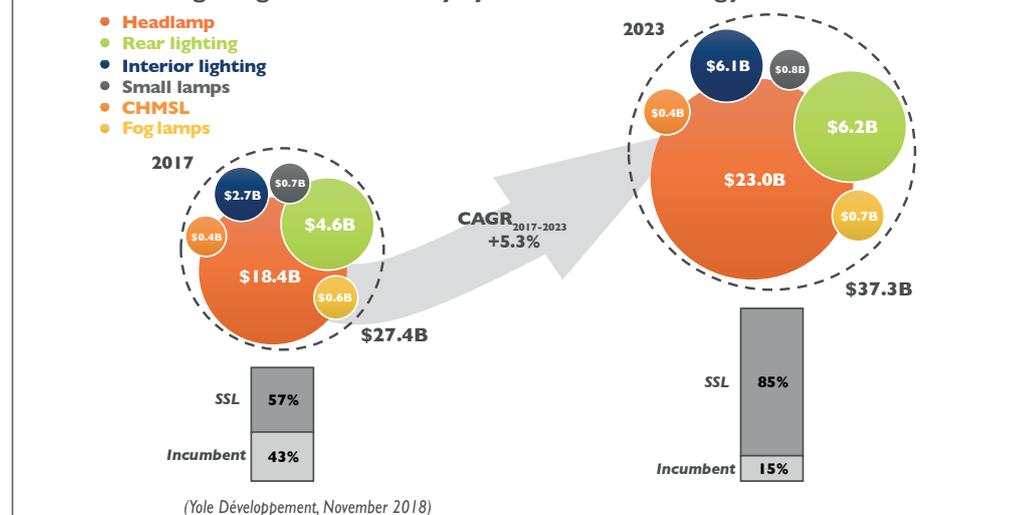
Laser and organic LED (OLED) sources are still emerging technologies but could also support the development of new functionalities:

- Laser-based headlamps could enable long-distance night vision, up to 600 meters, or be coupled with digital micromirror devices (DMDs) to provide high resolution lighting systems, up to 1M pixels.
- OLED RCLs could initiate a design shift from 2D to 3D light sources, made possible by the nature of the OLED device itself.

In this context, the automotive lighting market totaled \$27.4B in 2017 and is expected to reach \$37.3B in 2023 at a compound annual growth rate for 2017-2023 (CAGR₂₀₁₇₋₂₀₂₃) of 5.3%. This growth is driven by natural LED cost erosion coupled with standardization and optimization of LED modules, which result in more vehicles equipped with this technology. Indeed, whereas SSL technologies represented 57% of automotive lighting value in 2017, this share is likely to reach 85% by 2023.

This report presents all automotive lighting applications and the associated market revenue for the period 2013-2023, with details concerning integration status of different lighting technologies and systems, recent trends and market size by application.

Automotive lighting market size by system and technology in US\$ - 2017 vs 2023



DIGITAL LIGHTING WILL FURTHER REVOLUTIONIZE AUTOMOTIVE LIGHTING

Integration of new semiconductor/electronic-based components is also enabling the realization of full electronic systems, combining solid state lighting, sensors and software, and by extension the development of advanced lighting functionalities.

The main objective of these functionalities is to offer beam patterns that automatically adjust to the driving environment. Recently, the use of matrix LED systems combined with camera and image processing functions has allowed for creation of new

lighting functions like adaptive front lighting and glare-free lighting. And such evolution toward photonic and full electronic systems is opening a new era/revolution for automotive lighting: the implementation of digital light to further enhance the value of lighting.

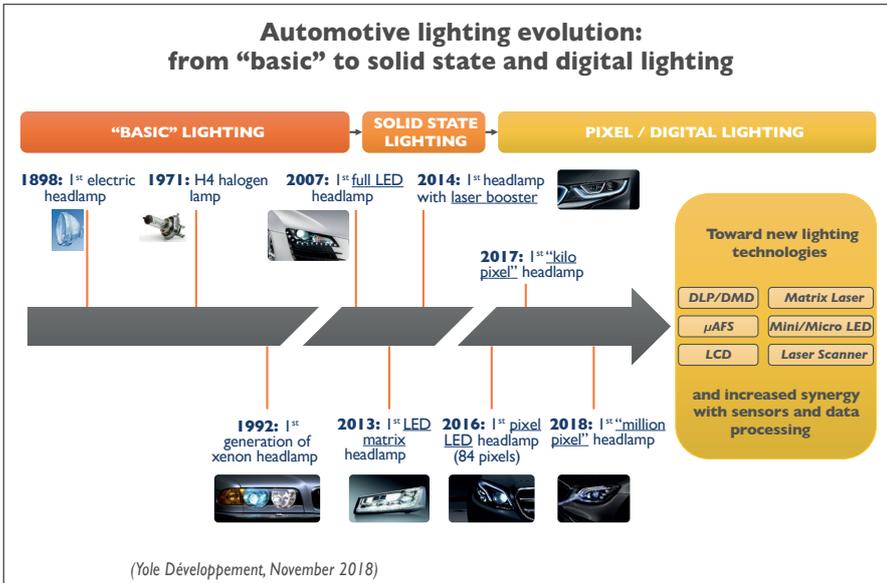
Overall, digital lighting enables high resolution front lighting systems, offering new low and high beam functions, to increase road safety and driver comfort, and can make automotive lighting more intelligent. Additionally, this trend of digitalization is supported by

the development of advanced driver assistance systems (ADAS), as lighting could serve as a communication tool within the environment of the car, for example for car-to-pedestrian communication.

Today, digital lighting is a key area of investigation for the automotive lighting supply chain as it represents the future of automotive lighting. And several new technologies/systems are being investigated, including DMD/digital light projection (DLP), laser scanners, liquid crystal displays (LCDs), and micro-/mini-LED. An interesting fact is that such lighting systems are providing ever more synergy with projection/display systems as their function is evolving toward communication, like projecting information onto the road. And new parameters now have to be taken into account for related developments, such as resolution, field of view (FOV) and pixel density.

However several barriers have still to be overcome in areas including technology, manufacturing, and regulation. Those challenges will be reinforced as digital light further tightens the relationship between lighting, automotive sensors and data processing.

This report presents a complete overview of new lighting technologies and advanced front lighting systems (AFLS), providing details regarding benefits and drawbacks, integration status, and development roadmaps. The report gives insights into the future of automotive lighting with analysis on synergies with ADAS.



AUTOMOTIVE LIGHTING: A MUTATING INDUSTRY

With such a booming market, and automotive lighting becoming one potential critical node for autonomous driving because lighting systems could represent a key location for integrating sensors such as local cameras, radio and light detection and ranging (radar and LiDAR), companies are paying ever more attention to this industry.

- Traditional automotive component suppliers are now expanding their business in this field. A good example of this trend is the recent acquisition of Magnetti Marelli by CK Holdings, a holding company of Calsonic Kansei Corporation, a leading Japanese automotive component supplier, for 6.2B€.
- Electronic companies seem also to be eyeing automotive lighting. Indeed, with the increased implementation of electronic components in vehicles, automotive electronics should surpass the

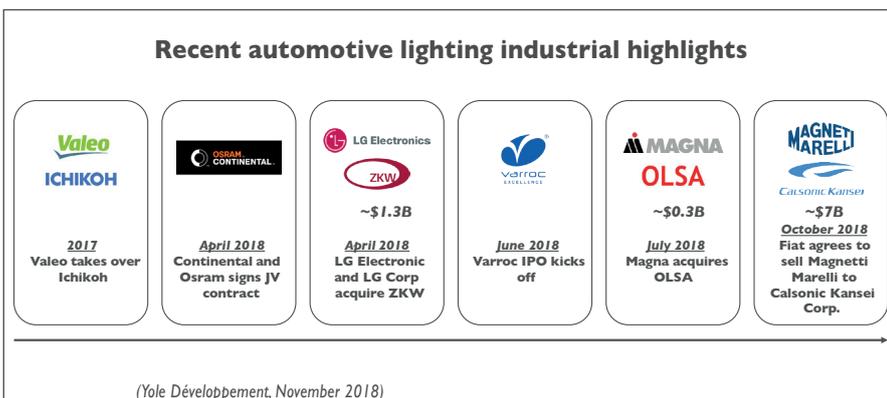
consumer electronic business in the middle/long term. LG has made the first move in this direction with the acquisition of ZKW for more than 1.1B€.

Several new players are likely to enter this market in the future, and some current leading automotive lighting tier-1s are therefore trying to reinforce their position. Valeo has taken over Ichikoh, Varroc has kicked off an Initial Public Offering (IPO) process to raise capital, and Magna has acquired Olsa.

But such moves are not restricted only to car maker and Tier-1s. Some Tier-2 and Tier-3 players also want bigger pieces of the pie. In this field, Osram has recently developed a joint venture with Continental to supply lighting modules and Electronic Control Units (ECUs), which will become the heart of lighting system development in the future.

This industrial evolution is likely to continue as solid state lighting technologies are integrated. The rapid evolution of these technologies coupled with the AFLS trend and increased use of non-visible lighting systems such as LiDAR, autonomous emergency braking (AEB) or driver monitoring systems might reshuffle the cards in an industry that's mutating.

This report presents an analysis of the automotive lighting industry with details about the top 15 suppliers' revenue and market share in total and by region. The report also includes a focus on the Chinese automotive lighting market and industry, non-visible lighting applications in automotive, and an in-depth analysis of automotive lighting system development and manufacturing.



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7. TERMINATION

- 7.1 If the Buyer cancels the order in whole or in part or postpones the date of mailing, the Buyer shall indemnify the Seller for the entire costs that have been incurred as at the date of notification by the Buyer of such delay or cancellation. This may also apply for any other direct or indirect consequential loss that may be borne by the Seller, following this decision.
- 7.2 In the event of breach by one Party under these conditions or the order, the non-breaching Party may send a notification to the other by recorded delivery letter upon which, after a period of thirty (30) days without solving the problem, the non-breaching Party shall be entitled to terminate all the pending orders, without being liable for any compensation.

8. MISCELLANEOUS

All the provisions of these Terms and Conditions are for the benefit of the Seller itself, but also for its licensors, employees and agents. Each of them is entitled to assert and enforce those provisions against the Buyer.
Any notices under these Terms and Conditions shall be given in writing. They shall be effective upon receipt by the other Party. The Seller may, from time to time, update these Terms and Conditions and the Buyer, is deemed to have accepted the latest version of these terms and conditions, provided they have been communicated to him in due time.

9. GOVERNING LAW AND JURISDICTION

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