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Adaptive Front Lighting Market Assessment, By Component [Sensors, Control System, Headlight Adjustment, Others], By Light Type [Halogen, LED, Others], By Technology [Adaptive High Beam Systems, Matrix LED Highlights, Predictive Adaptive Front System, Others], Vehicle Type [Passenger Vehicle, Commercial Vehicle, Others], Sales Channel [OEM, Aftermarket], By Region, Opportunities and Forecast, 2017-2031F

https://marketpublishers.com/r/A8539D89DF96EN.html
Date: March 2025
Pages: 229
Price: US$ 4,500.00 (Single User License)
ID: A8539D89DF96EN

Abstracts

Global adaptive front lighting market size was valued at USD 1.81 billion in 2023, which is expected to reach USD 3.31 billion in 2031, with a CAGR of 7.85% for the forecast period between 2024 and 2031. The changing dynamics of automotive lighting for better visibility in odd conditions are changing the market trend. Efficient lighting technology is flourishing the market growth. Notably, evolving LED technologies like matrix LED technology, integration with advanced driver assistance systems (ADAS), and smart lighting controls are shaping the market prospects. The use of light emitting diode (LED) technology in adaptive front lighting systems has become increasingly popular due to its energy efficiency, small size, and adaptable design in both high-end and entry-level vehicles. Furthermore, the high durability and instant illumination favor the usage of LED lights for automotives.

The use of adaptive front lighting systems is becoming increasingly systematic and capable of adapting to a wide range of conditions on the road, in the weather, and in traffic. Additionally, adaptive front lighting systems can respond to steering inputs and offer dynamic lighting patterns. Adaptive front lighting can take advantage of real-time

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information exchange to enhance road safety as connected vehicles become more prevalent and vehicle-to-vehicle (V2V) communication becomes more prevalent. For instance, a vehicle could modify its lighting based on information received from other vehicles and road infrastructure. Lastly, the government initiatives and safety regulations increase the adoption of adaptive front lighting systems. Other safety measurements such as ABS, ADAS, and cruise control systems are likely to integrate with new lighting systems.

Advanced LED Technology and Smart Lighting Control to Garner the Market Growth

The advanced LED technology with higher, quick, and efficient illumination is likely to speed up the adoption rate of adaptive front lighting. The adaptive lights play a crucial role in delivering enough vison to the driver, and thereby preventing accidents. Enhancing security is further added through the customizable lighting experience and advanced sensors. Manufacturers are providing a range of customizable lighting solutions to meet the needs of individual customers. It include features such as adjustable color temperature and mood lighting. Additionally, the utilization of sophisticated sensors, such as Light Detection and Ranging (LiDAR) and infrared sensors (IR), is becoming increasingly prevalent in adaptive front lighting system to improve their performance in varied weather and road conditions.

In July 2023, prior to the official introduction of the mid-sized electric SUV, Audi released several promotional images of the new Q6 e-Tron, as well as the introduction of its second-generation adaptive OLED headlight and taillamp system. Certain adaptive front lighting systems now have the capability to detect and adjust according to road conditions. For instance, they can modify the light beam to prevent reflections from wet road surfaces, thereby improving visibility in inclement weather.

Safety Regulations and Increasing Vehicle Production to Fuel the Market Growth

The implementation of stringent safety regulations and standards requiring advanced lighting systems to enhance road safety has been a major influence on the development of adaptive front lighting systems. These systems can adapt to varying driving conditions, thereby reducing the glare of incoming vehicles, and improving the driver's visibility. The automotive industry is expanding rapidly around the world. According to ACEA, in 2022, 85.4 million motor vehicles were produced around the world, an increase of 5.7% compared to 2021. It has resulted in an increased demand for sophisticated features from consumers and more vehicles equipped with adaptive front lighting.

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Additionally, urbanization around the world has resulted in an increase in the number of vehicles operating at night. It has necessitated the implementation of adaptive front lighting, which is particularly beneficial in urban settings with intricate road conditions. Furthermore, the technological integration with advanced driver assistance systems (ADAS) and vehicle-to-vehicle (V2V) communication systems have flourished the market expansion.

Governments are Supporting the Adoption of Adaptive Front Lights

Governmental bodies have established regulations and safety standards related to automotive lighting. Such standards prescribe the use of lighting technologies or specify the performance requirements of adaptive front lighting systems to meet safety requirements. Some governments provide incentives to promote the use of such sophisticated safety features, expected to include tax incentives, rebates, or subsidies on vehicles with such systems installed.

For example, the SIAM and major automotive trade exhibitions such as the auto expo have a significant impact on the development of the industry, while initiatives such as the 'Make in India' program are projected to bring significant growth in the coming years. Governments provide funding for research and development of adaptive front lighting technologies. This funding can facilitate the development of cutting-edge lighting solutions. In some countries, governments subsidize the development of innovative automotive lighting technologies, including adaptive lighting solutions. It involves funding research, development, and testing.

While in some geographies, the governments impose lenient regulations regarding road and vehicle safety. For instance, the car manufacturers and American Automobile Association are not satisfied with the United States' regulatory body National Highway Traffic Safety Administration (NHTSA). The body hasn't yet updated the rules about the utilization of adaptive front lights and hence companies are pushing American regulators to certify OEM adaptive front lighting systems.

LED Segment Leads the Market with Higher Energy Efficiency and Design Flexibility

Based on light type, the LED segment is expected to lead the market. The segmental growth garners with features like energy efficiency, durability, design, flexibility, advanced control, and color customization. LEDs are energy-efficient in comparison to conventional lighting technologies. They use less energy while providing a clear and

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concentrated illumination. This level of energy efficiency is in line with global efforts to reduce carbon emissions and enhance fuel efficiency in vehicles. Light-emitting diodes (LEDs) are renowned for their durability and resilience.

Compared to incandescent bulbs, the lifespan of LEDs is significantly longer, requiring lower maintenance and replacement expenses. LEDs are highly controllable, allowing them to be used in adaptive front lighting systems. These systems can dynamically adjust the direction and intensity of light beam in response to various driving conditions. Lastly, the environmental benefits and technological advancements are helping the segment to grow through the forecast period. LEDs do not contain any toxic metals, such as mercury, which are present in some earlier lighting technologies. Furthermore, their energy efficiency is in line with global initiatives to reduce energy use and carbon footprint.

In July 2023, OSRAM unveiled a revolutionary new technology in automotive forward lighting, EVIYOS 2.0. The advanced intelligent multipixel LED is capable of fully adaptive and dynamic headlight operation, as well as image projection. EVs 2.0 are capable of selectively illuminating the road ahead to enhance the driver's visibility in high beams without producing the glare typically associated with other road users.

Rising Sales of Automotive and Stringent Safety Regulations Fuels the Passenger Vehicle Segment

Based on vehicle type, the passenger vehicle segment is expected to hold the major portion of the market. The growth is attributed to the safety regulation and standards along with the urbanization and increased sales of personal vehicles. The latest technology, such as adaptive front lighting, is typically found in premium and luxury passenger cars. These vehicles are the first to adopt advanced lighting solutions, thus setting trends that mainstream models later adopt. To enhance road safety, a variety of safety regulations have been implemented in various countries and regions that promote or mandate the implementation of advanced lighting systems. These standards are applicable to passenger vehicles, and automotive manufacturers are often required to install adaptive front lighting to meet them. Hence, the adoption of automotive adaptive front lighting is increasing due to the rising sales of passenger vehicles.

Rapid Urbanization to Make Asia-Pacific the Leading Region

Asia-Pacific is expected to lead the global adaptive front lighting market. The rising disposable income of many countries in Asia-Pacific has increased the demand for

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luxury and premium vehicles. These vehicles are often equipped with adaptive front lighting, which has contributed to the expansion of the market. The rapid urbanization of many Asian countries has increased the number of vehicles being driven both during the daytime and at night.

For instance, Audi and Mercedes-Benz reports rise in sales of their luxury cars by 96.83% and 12.61% respectively in first half of 2023, as compared to first half of 2022. As a result, adaptive front lighting systems have become increasingly popular in these settings. Countries like India and China are investing in partnerships among companies and authorities as well. Higher number of accidents due to lack of proper lighting during the night drives are making the governments to focus on advanced lighting solutions. It doesn't just interest government authorities but let local automotive brands to align with the latest technology. Hence, the tie-ups between local automotive component brands and international companies are garnering growth of the region.

In July 2023, Marelli has partnered with Ams OSRAM to introduce h-Digi micro-LED module in series production.

Impact of COVID-19

COVID-19 damaged the market through constant supply chain disruptions, reduced demand, financial strain, and production halts. Alongside, the limited operations of automotive research and development damaged the market. In response to COVID-19, several automotive manufacturers temporarily ceased or reduced production. It resulted in supply chain disruption and a delay in the manufacturing and deployment of adaptive front lighting in vehicles. The economic effects of the pandemic, as well as the restrictions imposed by the government, resulted in a decrease in consumer demand for new cars. Consequently, manufacturers experienced a decrease in sales and had to revise their production plans. The pandemic had a significant impact on research and development in the automotive sector, potentially delaying the deployment of new technologies and advances in adaptive front lighting.

Impact of Russia-Ukraine War

Russia-Ukraine war has an adverse impact the automotives and components market. Ukraine has traditionally been a major manufacturer of electronic devices, including those utilized in automotive lighting applications. However, the ongoing conflict and economic crisis in the region have caused a disruption in the supply chain of these essential components, which potentially led to delayed product deliveries. The effects of

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the war have an impact on the fluctuation of the prices of essential raw materials for automotive lighting, including metals, plastics, and electronic components. These fluctuations impacted on the total cost of production for adaptive front lighting.

Key Player Landscape and Outlook

The competitive landscape of the global adaptive front lighting market is focused on advanced technologies. Companies focus on higher integration with safety modules, compatibility, light output, and energy efficiency. Some of the major players in global adaptive front lighting market are Robert Bosch GmbH, Valeo SA, Continental AG, Denso Corporation, Hyundai Mobis, Johnson Electric, Stanley Electric Co. Ltd, Hell GmbH Co. Ltd, Magneti Marelli S.p.A, and Koito Manufacturing.

In June 2023, Motherson, in partnership with Marelli declared the opening of its automotive lighting tool room, the first of its kind in India. The new facility is designed to capitalize on the existing strengths of Motherson, and Marelli, to satisfy the long-standing requirements of Indian Original Equipment Manufacturer (OEM) for the localization of sophisticated automotive lighting solutions.

In October 2023, KOITO MATERIALING Co., Ltd. and KONSO CORPORATION entered into an agreement to collaborate on the development of a system to enhance the object recognition performance. The lighting is expected to integrate with vehicle image sensors through the coordination of lamps and image sensors to enhance driving safety at night.

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