

PRESS KIT

**VALEO INNOVATIONS
AT THE EPICENTER OF THE
REVOLUTIONS IN MOBILITY**

VALEO AT CES 2019 – LAS VEGAS (NV)

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Valeo at CES 2019 in Las Vegas – Summary

From January 8 to 11, 2019, Valeo is taking part in the CES trade show in Las Vegas, presenting its latest technological innovations, which are at the epicenter of the revolutions in mobility. The technology disrupting today's automotive industry is a game changer for our way of life, the way we travel, where we choose to live and how we conceptualize the towns and cities of the future. The three revolutions shaping the automotive industry are also shaping societal trends as electrical systems become an integral part of mechanical systems, driving assistance technology is increasingly put to use for safer, more autonomous vehicles, and digital solutions pave the way for the development of new services and new forms of travel.

As the world leader in CO₂ emissions reduction, Valeo is working on a range of innovative 48V electrical systems that help reduce fuel consumption in vehicles. With their affordable price tag, these solutions help make hybrid and electric vehicles – synonymous with cleaner mobility – more broadly accessible. Better yet, at a time when urban mobility is changing shape each day (electric scooters, robo-taxis, etc.), Valeo is demonstrating that its 48V electric motors can be readily adapted and applied across all of these new segments.

In autonomous driving, Valeo is pursuing the same goal of making its advanced technologies more widely accessible. The Group already boasts the automotive industry's largest range of sensors, comprising ultrasonic sensors, cameras, radars and LiDAR (Light Detection And Ranging) systems. These devices act as the vehicle's eyes and ears. At CES 2019, Valeo will be unveiling the full scope of its expertise in autonomy and connectivity. Three major innovations will be on show: Valeo Drive4U[®], the autonomous vehicle which will be navigating the streets of Las Vegas fitted solely with series-produced sensors; Valeo Drive4U[®] Remote, which is used to remotely control autonomous vehicles strictly when needed for safety reasons; and Valeo Voyage XR, which is able to simulate the virtual presence of a person – based in a fixed location – on board the autonomous vehicle during the journey.

Lastly, since usage patterns are changing, with digital tools giving access to new ways of getting around, Valeo is developing technologies to promote their widespread take-up. One example of this is the real-time map of urban air quality. Another is the Valeo Clean Road app, which calculates the best routes to avoid peak pollution areas.

Innovation is at the heart of Valeo's strategy, with 1.9 billion euros invested in Research and Development in 2017, or close to 12% of original equipment sales. Valeo's innovative technologies offer clear insights into the shape of mobility to come and are all conducive to the development of electric, autonomous, connected cars that are widely accessible yet adapted to individual needs.

Contributing to the advent of the autonomous vehicle

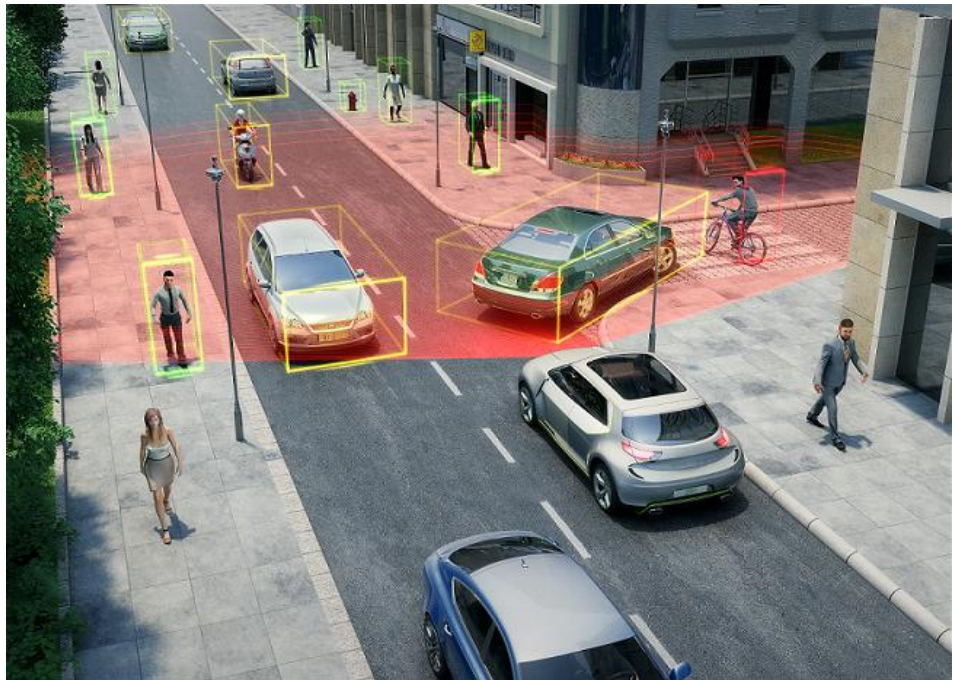
After organizing a number of world-first autonomous driving trial runs, including 24 hours around the Paris beltway and roadtrips around Europe and the United States, Valeo is once again leading the pack with its technological achievements in the field, which will be on display at CES 2019 in Las Vegas. Autonomous driving in dense and complex urban environments is a major technological challenge that Valeo is tackling head-on. The Group took to the streets of Paris for a first trial run in autumn 2018 and, in 2019, its autonomous car will operate in the streets of Las Vegas.

Valeo Drive4U[®], the autonomous car for city driving

Demonstration on the open road in Las Vegas

Valeo Drive4U[®] will be navigating the streets of Las Vegas autonomously, with no human intervention except an engineer behind the wheel to supervise operations. The demo car is unique in that it uses only series-produced Valeo sensors. These include ultrasonic sensors, cameras, radars and, most importantly, eight Valeo SCALA[®] laser scanners, the automotive industry's only series-produced LiDAR (Light Detection and Ranging) technology on the market today. Positioned all around the car, they offer a 360° view of the vehicle's surroundings. The calculation algorithms and artificial intelligence developed by Valeo aggregate the data from the sensors and analyze them in real time, enabling the vehicle to make the right decisions, without compromising safety. The vehicle's self-learning capabilities, based on deep learning, also play a fundamental role. The technologies behind Valeo Drive4U[®] mean it is able to:

- formulate a 3D model of surrounding vehicles and predict their trajectories, including those not in the vehicle's immediate field of vision;
- define the vehicle's position in a precise and robust manner, thanks to a geolocation and mapping system developed by Valeo that uses the Valeo SCALA[®] laser scanners. This enables the vehicle to drive without human intervention through tunnels, in enclosed parking lots, and in other environments where a GPS signal would be lost;
- learn in real-time, in real life and with each new trip. The vehicle will gradually become able to handle an increasing number of traffic situations by itself.



With an autonomy level of 4 in urban environments, Valeo Drive4U[®] can handle the following without human intervention:

- driving along an undivided road, including where there are little or no markings;
- intersections, traffic lights and road signs;
- other road users (pedestrians, bicycles, scooters, etc.);
- travel during the day and at night, even under adverse weather conditions.

DID YOU KNOW?

Cities that are looking to reinvent themselves with autonomous vehicles

It was in November 2018 that Singapore city state inaugurated its first autonomous buses and shuttles as a prelude to the wider deployment of other driverless vehicles, such as street cleaning and delivery vehicles. With more than 5.6 million residents, dense urban traffic congestion is a daily problem as it is in many other major cities around the world. But Singapore is determined to turn things around by encouraging car owners to switch to sharing autonomous vehicles. The Energy Research Institute at Singapore's Nanyang Technological University has announced that the goal is to **"make having your own car completely unnecessary by 2030."**

On September 18, 2018, the Knight Foundation announced a new initiative aimed at encouraging the **development of autonomous vehicles in five pilot cities in the United States**. The cities will be awarded 5.25 million dollars to carry out different projects. In **Detroit**, the aim will be to address challenges getting to and from bus stops that connect Detroiters to employment hubs. In **Long Beach**, California, to improve air quality by providing more multi-modal transportation solutions, in particular for short-distance travel. In **Miami**, to develop driverless, on-demand shuttles as an alternative to buses that drive a fixed route. In **Pittsburgh**, to sustainably develop and support certain neighborhoods while at the same time slowing the number of single-occupant vehicle trips. In **San Jose**, California, to use autonomous vehicles to create closer ties between residential and business districts.

In the United States, the City of **Boston** partnered the World Economic Forum and The Boston Consulting Group in an autonomous vehicle impact study whose findings indicate that the advent of autonomous vehicles **should lead to a 48% reduction in the number of parking spaces needed** today. As the co-chair of the Mayor's Office of New Urban Mechanics explained **"it would be the biggest land grab in Boston since we filled in the Back Bay in the late 1800s."** [Newsweek, December 14, 2018]

Valeo, global leader in driving assistance sensors



Valeo is the world's leading manufacturer of driving assistance sensors, which act as the eyes and ears of the vehicle. Valeo entered the market in 1991, with the first ultrasonic sensors for parking maneuvers. Today, Valeo offers the most comprehensive portfolio of driving assistance sensors on the market, comprising ultrasonic sensors, radars, cameras and the Valeo SCALA[®], the first and only series-produced LiDAR laser scanner in the automotive industry.

The Group has already produced around one billion sensors, of all types, and will produce over a billion more in the next four years. Valeo also specializes in merging the data generated by these sensors for autonomous driving.

DID YOU KNOW?

Traffic congestion costs more than all the gold in London

The economic impact of urban and suburban congestion is colossal, racking up billions of dollars in losses for local authorities around the world! By easing traffic flows, allowing car-sharing and increasing safety, **the challenge for autonomous driving is to help reduce this bill**. In 2017, the INRIX Research Institute analyzed and measured the time spent in traffic congestion* in 1,360 cities across 4 continents (Africa, America, Asia and Europe). Based on its findings, the 15 most congested cities in the world are as follows:

City	Number of hours spent in congestion in 2017
Los Angeles	102 hours/driver
Moscow	91 hours/driver
New York	91 -
São Paulo	86 -
San Francisco	79 -
Bogotá	75 -
London	74 -
Atlanta	70 -
Paris	69 -
Miami	64 -
Bangkok	64 -
Jakarta	63 -
Washington	63 -
Boston	60 -
Istanbul	59 -

For the United States alone, INRIX estimated that congestion in the country's 296 largest cities cost local authorities and businesses **305 billion dollars** in direct and indirect costs, which equates to a little more than the **value of all of the gold housed in the vaults of London**. A report published by the London Bullion Market Association in March 2017 ranks London as the world capital of the gold market, with 596,000 gold bars weighing a combined 7,449 metric tons and valued at 298 billion dollars – and still congestion costs more.

** Source: INRIX Global Traffic Scorecard – INRIX Research – February 2018*

Improving road safety with innovation from Valeo

At the end of 2017, the US Department of Transportation, and more specifically its agency, the National Highway Traffic Safety Administration (NHTSA) found that 94% of road accidents were caused by human error (*see also the figures published by the WHO below*). One of the key challenges when it comes to autonomous vehicles is road safety. Driver fatigue or falling asleep at the wheel, distractions, driving under the influence of alcohol, speeding and reckless driving are causes of accidents that will no longer apply in autonomous vehicles that are controlled by robust, safe and unalterable systems that always respect traffic regulations and practices as well as road users.

When it comes to safety, Valeo has set itself stricter targets than the aeronautics industry of less than one major incident for every billion kilometers driven.

To meet these targets, the Group equips its autonomous vehicles with different types of physical sensors (ultrasound, image, radar, light, etc.) and intelligence. Producing the most reliable data needed to make the safest decisions is what characterizes the systems designed by Valeo. The different situations with which autonomous vehicles can find themselves confronted are virtually infinite and unpredictable. To prepare for the largest number of possible scenarios, Valeo has designed an all-new solution that allows operators to take control of a vehicle remotely and see what is happening inside the moving car from the outside.

Valeo Drive4U[®] Remote, remote driving becomes reality

World premiere – [Demonstration on the test track](#)

Valeo Drive4U[®] Remote allows operators to take control of an autonomous vehicle and control it remotely. The technology is designed to assist drivers, relieve them of certain driving tasks or even switch to manual driving mode when the vehicle is unable to handle a given situation by itself. Anything can happen on the road, from sudden severe weather conditions to an unexpected medical problem, which is when being able to take remote control of a vehicle is a relevant and necessary option. Valeo has mobilized all of its expertise in autonomy and connectivity to safely and securely design this latest feature. Valeo has also opened the way for new solutions in fleet management, automatic valet systems and remote assistance for autonomous shuttle buses.

Valeo Voyage XR, a virtual voyage? Bringing teleportation to life!

World premiere – [Demonstration on the test track](#)

Although Valeo's sensors act as the eyes and ears of the vehicle, providing a 360° view of the vehicle's surroundings, knowing what is going on inside a vehicle that is remote controlled is just as important. Any driving decision has to be an "informed" decision because safety is critical. Valeo's innovation, Valeo Voyage XR, is able to simulate the virtual presence in the vehicle of a person based at an outside location during the journey.

Building on this innovation, the Group has even designed a new and unique voyage experience via which, as if by teleportation, drivers can bring their friends and families onboard. Drawing on the broad range of technologies developed by Valeo (cameras, sensors, telematics, human-machine interface, etc.), Valeo Voyage XR can create the illusion that the person you choose is right by your side, even if they are not in the vehicle and even if they are actually on the other side of the world. Interaction is achieved by sound and image in real time. The avatar of your co-passenger appears in the rearview mirror while the "stationary" virtual passenger enjoys an immersive experience using a virtual reality headset and controls. As well as the safety of remote controls, Valeo Voyage XR opens the way for a whole new world of onboard communications.

DID YOU KNOW?

Road accidents, when the WHO triggers the alarm

On Friday, December 7, 2018, the World Health Organization (WHO) published a report on the growing number of deaths resulting from road traffic accidents, with 1.35 million fatalities each year. In fact, road traffic accidents are the leading cause of death among children and young adults between the ages of 5 and 29. “*These deaths are an unacceptable price to pay for mobility,*” said WHO Director-General, Dr. Tedros Adhanom Ghebreyesus in a press released quoted by AFP (December 7, 2018). “*There is no excuse for inaction. This report is a call for governments and partners to take much greater action to implement [new] measures.*”

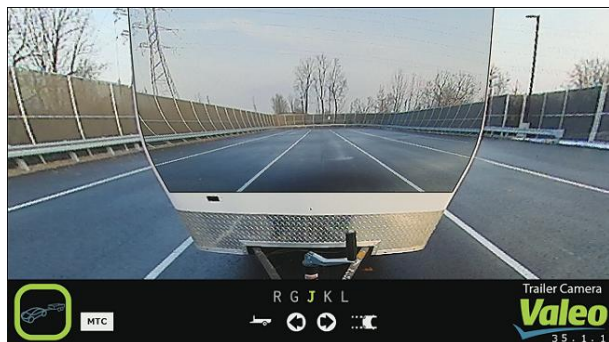
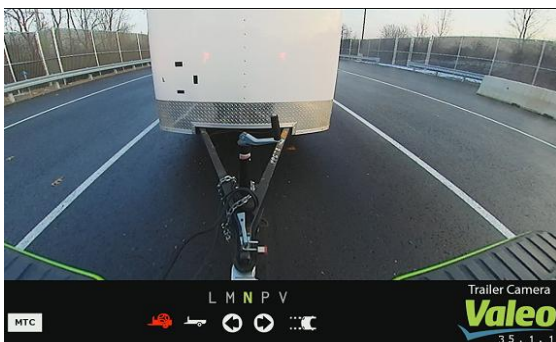
The development of autonomous vehicles is a means to increase road safety, shielding drivers from human error, the main cause of accidents.

Valeo XtraVue Trailer, towing an invisible load

World premiere – Demonstration at the Valeo booth

The first of its kind on the market, Valeo XtraVue Trailer is an innovation that enables drivers to see what is happening on the road behind their trailer or caravan, an invaluable driving assistance system that makes vehicles easy to maneuver and safer to drive.

The system uses video cameras fitted at the rear of a vehicle and the rear of a trailer or caravan. Feeding into a single homogeneous image, it allows drivers to see what is going on behind their vehicle on a small display located in front of them, as if their trailer or caravan had disappeared, making maneuvers easier than ever, whatever the size of the trailer or caravan being pulled. Drivers can change lanes, reverse and park, all with full control over their environment.



High definition lighting, the ultimate in protection for nighttime driving

World premiere – Demonstration at the Valeo stand

Valeo will also be presenting Valeo PictureBeam Monolithic at CES 2019 in Las Vegas. The new system generates a high definition beam of light on the road without ever blinding other road users and projects information and images onto the pavement.

The innovation is the product of the partnership between Valeo and CREE, the US market leader in the manufacture of light emitting diodes (LEDs). CREE developed the LED Monolithic chip while Valeo contributed all of its technology in automotive lighting.

In the case of Valeo PictureBeam Monolithic, the pixels of the light beams are formed directly at source on the chip. The module is therefore smaller and weighs less than other HD lighting systems on the market, making it easier to integrate into cars. This new type of LED chip enables a definition of thousands pixels. Each pixel can be lit, switched off or adjusted at will, and is entirely controlled by an electronic system designed by Valeo.

Valeo's aim is to offer a solution that improves road safety as well as providing new features for customization and comfort.

Valeo's 48V technology, the easiest way to electrify vehicles – all vehicles!

A world leader in electrification, Valeo offers a range of products to power all types of vehicles, from small urban cars to premium sedans and SUVs. To do this, the Group develops cutting-edge technologies running the gamut from low-voltage solutions to high-power motors with outputs of 300 kW, or more than 400 horsepower. These motors are manufactured by the Valeo-Siemens eAutomotive joint venture formed in December 2016.

Valeo's solutions are complete powertrain systems that encompass the motor, battery charger, transmission and torque control device, and are suitable for all engine power ratings and architectures.

Electric mobility is changing, simultaneously becoming more diverse and more widespread. Valeo is helping to increase access to emerging forms of transportation by making the underlying powertrain systems less complex and more affordable and seamlessly aligning performance to usage patterns.

Did you know?

Half the length of Paris... in a car 4 meters long

If you were to line up all of the electrical cables in an average-sized sedan (around 4 meters long), they would stretch between 2 and 5 km. Considering that Paris, France, measures 9.5 km from north to south, that means that you could cover half the length of the city with the cabling in some cars. The cables are made up of conductive materials, copper, aluminum, alloys and insulation to protect them from heat, vibrations, fluids and other outside interferences. As a result, the cost is high.

This is where the innovative 48V system proves its true value. It does not require any specific protection around its electrical cabling, as it poses no risk to users or repair workers. For 60V technologies and above, however, regulations require specific insulation systems to eliminate all potential hazards. Given the length of cabling involved, this increases the cost and weight of the vehicle even more. The technical simplicity of Valeo's innovation is what makes it so accessible.

Valeo's 48V technology, a response to all forms of electric and electrified mobility

In just one year, Valeo has extended the possible applications of its 48V technology to include various types of vehicles, such as:

- an autonomous shuttle seating six passengers;
- an electric scooter with 125 cc equivalent power;
- a hybrid delivery truck offering a 5% to 10% reduction in fuel consumption and CO₂ emissions;
- a family-sized plug-in hybrid. Valeo provides the complete system, including the motor, onboard charger and converter. Use of the 48V system can lead to savings of around 40 percent compared with conventional high-voltage technology. The vehicle offers the best of both worlds: it can drive 40 km in all-electric mode at speeds of up to 70 km/h in urban environments, and switch to the internal combustion engine for longer distances and on motorways.
- a new demonstration vehicle unveiled by Valeo at the 2018 Paris Motor Show, capable of reaching speeds of up to 100 km/h and with a range of 150 km, all thanks to a fully electric 48V system, as technology for urban applications continues to improve.



In 2019, Valeo will reveal yet another innovation specially designed for customers in Asia, the fastest-growing electric vehicle market in the world, in the form of a fully electric three-wheeler prototype equipped with a Valeo 48V powertrain. Providing a tangible response to the strong demand in the region, the vehicle will be configured to achieve the regulatory minimum speed of 45 km/h, with a range of 75 km, and take between 4 and 5 hours to fully recharge in full from a conventional power socket.

Did you know?

65 billion packages delivered worldwide... and yet diesel delivery vehicles are denied access to certain cities

According to a study by international transaction company Pitney Bowes (2017 Parcel Shipping Index), deliveries of packages worldwide have increased by nearly 48% in two years, from 44 billion units in 2014 to 65 billion in 2016. This reflects the development of e-commerce. The study predicts that growth in home deliveries could reach around 30% by 2025, which seems inevitable given that consumers are becoming more and more connected. Nearly 45% of the world's population currently has access to the Internet, compared with 7% in 2000.

However, cities are increasingly restricting access to vehicles, especially delivery trucks, with diesel engines or CO₂ emissions above a certain threshold. Last-mile logistics are becoming more complicated – and this is where Valeo's innovative vehicle electrification solutions using affordable technology such as 48V really demonstrate their value. For example, they could give rise to new vehicle applications, such as **droids**, designed specifically to make deliveries in city centers – even ones with major traffic restrictions.

Mobility in the digital age: more services, improved convenience, greater well-being and comfort

Valeo MyMobius, the Valeo take on the smart car

Demonstration at the Valeo outdoor area

Valeo MyMobius is a unique solution that transforms the relationship between driver and vehicle. This human-machine interface combines Valeo technologies with artificial intelligence developed by CloudMade¹.



In concrete terms, the vehicle's Valeo systems, including sensors and connectivity modules, send data collected in the vehicle into the cloud for analysis by CloudMade's profiling solutions.

MyMobius learns from drivers' habits to anticipate their needs, customize the onboard environment and enhance safety. The data collected and processed in the cloud is used to activate vehicle functions without the need for user intervention. For example, without requiring direction from the driver, the car can propose personalized itineraries based on drivers' habits and agenda. To improve safety, it can also automatically maintain a safe distance from other vehicles.

Valeo Smart Cocoon: a thermal comfort bubble adapted to each passenger

Demonstration at the Valeo outdoor area

The Valeo Smart Cocoon is a system offering a localized thermal comfort bubble adapted to each passenger according to his or her physiological characteristics. Biosensors and infrared cameras gage



the thermal profile of each passenger based on heart and breathing rates, clothing, age, gender and body type in order to fine-tune the vehicle's internal temperature.

Valeo Smart Cocoon provides personalized comfort while minimizing demand on vehicle energy, with up to 30% energy savings (in winter). This is particularly important for optimizing electric vehicle range.

In summer, a mist dispenser and fans activate automatically by following the movements of passengers and, in winter, radiant panels heat the inside of the vehicle to quickly reach the desired

¹ CloudMade is a 50%-owned pioneering start-up in machine learning and artificial intelligence, with a focus on designing applications for the auto industry.

level of warmth and comfort, thereby reducing overall consumption and noise. The use of color in the interior lighting enhances the sensation, with warm shades for heat and pale shades for cool. Specifically, at equal temperatures, red lighting gives the sensation of a 2°C (~4°F) increase and blue light an impression of a 2°C (~4°F) decrease.

Air quality, a crucial challenge for urban mobility, addressed by Valeo’s digital innovations

Air quality is a prime concern for Valeo, and one of the reasons for the Group’s increasing focus on electric products that reduce vehicles’ pollutant emissions.

Valeo is now going one step further by developing solutions that improve knowledge of air pollution events in urban areas. The Group’s aim is to harness innovative methods to collect a significant sample of reliable data – a prerequisite for designing new mobility technologies for its automaker customers.

In line with its commitment to air quality, Valeo is presenting a variety of individual solutions at CES 2019 in Las Vegas, including a cabin air purifier, a real-time pollution map, a route planner that limits exposure to polluted areas, and a system that tailors thermal comfort to each passenger.

Valeo Oxy’Zen: purer cabin air for city drivers

Demonstration at the Valeo outdoor area



Valeo Oxy’Zen purifies the air inside the car, which, according to research, can be up to four times as polluted as the air outside. An ultra-high-efficiency filter eliminates 98% of ultrafine particles from cabin air, while a high-performance ionizer cleans and deodorizes the cabin and pollution sensors provide real-time updates about the air quality in and outside the vehicle. The system is activated automatically when necessary. Passengers can switch the air purifier on remotely from their smartphones to pre-condition the cabin before entering the car.

Valeo Clean Road

Valeo has also developed an application called “Clean Road” that can calculate the best route in terms of air quality. It takes into account the number of kilometers to be traveled, the time it will take and the air quality along the way. Leveraging vehicle-to-cloud connectivity, an algorithm works in real time to refine its knowledge of the data collected (real-time information from the vehicle’s sensors and public data) and calculate the cleanest route.



Valeo's real-time air quality map



Valeo is presenting a map that serves to track urban pollution levels in real time. An innovative system created in partnership with ARIA Technologies², the map instantly displays air quality levels in a city, illustrating how pollution varies according to area and time and allowing users to visualize the state of the air they breathe, much like maps that represent traffic conditions.

Valeo's air quality mapping solution on display at CES 2019 in Las Vegas is the product of a trial carried out over 28 weeks in the streets of Paris, France, which will continue throughout January 2019. As part of the tests, 20 vehicles fitted with Valeo sensors collect information on the concentration levels of six pollutants: fine particles (PM 10 and PM 2.5), carbon monoxide, nitrogen dioxide, sulfur dioxide and ozone. The inputs from these mobile sensors is then aggregated with existing public data to create a map of the air quality, resulting in a dynamic and "hyper-local" vision of pollution hotspots. The map is based on calculations of an air quality index.

Did you know?

What is an air quality index?

An air quality index (AQI) is a rating that aggregates data from several sources into a single value.

AQIs are typically used by governments and municipalities to advise the population on forecasted air quality risks, so that citizens can adapt their activities accordingly. Existing AQI models have several constraints: they are static, with limited monitoring capacity and infrequent updates.

By using mobile sensors, Valeo's model is able to generate a dynamic and highly accurate monitoring of air quality in real-time. And since urban air quality can significantly vary within a short distance and short time frame, instant mobile monitoring can give a more precise view of which areas are most or least impacted.

² ARIA Technologies develops atmospheric modeling in France, bringing together an experienced team of engineers and researchers specialized in air. Headquartered in the Hauts-de-Seine department of France, the company works alongside major institutions and research centers in the field in France and the rest of Europe.

Valeo, the automotive supplier driving the mobility revolutions

Valeo is an automotive supplier, partner to all automakers worldwide. As a technology company, Valeo proposes innovative products and systems that contribute to the reduction of CO₂ emissions and to the development of autonomous and connected cars. The high-tech products imagined, designed and produced by Valeo place the Group at the heart of the three revolutions disrupting today's automotive industry now more than ever before: vehicle electrification, autonomous vehicles and digital mobility.

One in every three vehicles worldwide is fitted with a Valeo electric system that reduces CO₂ emissions. In intuitive driving, Valeo boasts the widest range of sensors on the market. The Valeo SCALA[®] is the only LiDAR (Light Detection And Ranging) scanner specifically designed for the automotive industry in series production today. World-first runs by Valeo autonomous vehicle demonstrators include 24 hours around the Paris beltway and tours of Europe and the United States.

Valeo also develops digital solutions that improve everyday convenience for vehicle users, such as Valeo In'Blue[®], a securely shareable virtual smartkey for locking, unlocking and starting a vehicle from a smartphone.

Innovation is at the heart of Valeo's strategy, with nearly 1.9 billion euros, i.e., close to 12% of the Group's original equipment sales, being spent on R&D in 2017. Valeo filed more than 2,000 patent applications worldwide in 2017. Innovation is clearly instrumental in driving Valeo's growth, with products introduced less than three years ago representing 50% of order intake in 2017.

Innovation at the heart of the strategy

Valeo's approach to innovation starts with a detailed worldwide analysis of major trends in society (demographics, population aging, urbanization, shifts in mobility needs, etc.) over a timeframe of 30 to 50 years, providing input for drawing up a detailed ten-year technology roadmap.

Across the Group's 20 research centers, some 20,000 researchers are currently working on around 2,800 R&D projects in fundamental research, advanced engineering and the development of new technologies. Valeo also has 36 development centers. Through the study and analysis of major social trends, Valeo is developing a technology roadmap looking ten years into the future, which anticipates the future demands of customers and end users.

For more than ten years now, Valeo has been working to develop its innovation ecosystem, built on partnerships with universities, laboratories and research centers, start-ups and pioneers from other industries. Through multi-party development programs, participants pool their knowledge, reducing costs, development cycles and time to market.

Key figures

18.5 billion euros in sales in 2017

50% of 2017 order intake was for innovative products introduced in the last three years

1.9 billion euros in R&D spending in 2017 (nearly 12% of the Group's OEM sales)

More than 2,000 patents filed in 2017

115,000 employees, including **20,000 R&D engineers**

185 plants, 20 research centers, 36 development centers and 15 distribution platforms in 33 countries