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Valeo's growth strategy is based on international expansion in Asia and emerging countries and on innovation. The Group's goal is to help invent automobiles of tomorrow that are safer, smarter, more fuel efficient and more enjoyable to drive.

One of Valeo's ambitious objectives is to increase its sales from 12.7 billion euros in 2014 to above 20 billion euros by 2020. To achieve this, the Group is leveraging its expanding global reach, particularly in Asia, and its ability to invent the car of tomorrow through innovation.

Valeo invests more than 10% of its original equipment sales in R&D activities, which involve 10,400 researchers at around 50 R&D centers across four Business Groups. This strong commitment is reflected in the key figures for the year: over 1,100 patents filed in 2014, 40% more than in 2013, and out of the orders booked in 2014 with a value of 17.5 billion euros (up 18% on 2013), 35% were for innovative products, i.e., products that have been on the market for less than three years.

I.I An innovation strategy focused on CO₂ emissions reduction and intuitive driving

- Reduce CO₂ emissions and improve fuel efficiency

Although awareness about such issues as global warming or the need to reduce fuel consumption differs from one part of the planet to another, there is no getting around the fact that the transport sector accounts for a quarter of global CO₂ emissions and needs to find affordable solutions to reduce its oil consumption. This explains why increasingly ambitious standards are being put into effect around the world. By 2021, automakers' new vehicle fleets will have to comply with a maximum average CO₂ target of 95 g/km, in Europe. Achieving technological advances to reduce CO₂ and polluting emissions is one of the two main components of Valeo's innovation strategy.

The Group's main technological developments relating to improvements in fuel consumption, include: internal combustion engine efficiency, electrifying powertrains, making a vehicle's different functions more energy efficient and reducing component weight. Valeo's Hybrid4All® system, for example, will generate fuel savings of up to 15% at half the cost of current hybrid solutions. Valeo also offers comprehensive solutions to optimize a vehicle's thermal management, increasing internal combustion engine efficiency while reducing the energy needed for passenger cabin comfort. One example of this is the water-cooled charge air cooler, which paves the way for more compact and cleaner turbocharged engines.

Reducing fuel consumption is not the only way to shrink a vehicle's total environmental footprint. Valeo also takes care to make eco-design an R&D priority.
• Make cars smart, connected and fun to drive, in a concept known as intuitive driving by Valeo

In addition to fuel efficiency, motorists are looking for cars that are connected, automated, easy to use and fun to drive. Valeo is responding to these expectations with its "intuitive driving" vision, which aims to facilitate maneuvering in city driving, assist motorists in different driving situations and make it easier for vehicles to interact with other drivers and the surrounding environment.

Valeo's driving assistance systems offer a range of smart technologies that improve driving safety and comfort. Increasingly sophisticated functionalities are added each year to enhance safety and comfort in city driving. An example is Connected Valet Park4U®, an expanded version of the Park4U® Remote system, which makes it possible for drivers to monitor parking maneuvers via a smartphone. With Connected Valet Park4U®, smartphone-equipped drivers can leave their car at the entrance of a car park and instruct the vehicle to find a suitable space to park itself. Similarly, they can tell the car via smartphone to pick them up at the exit. The Valeo InBlue® smartphone-compatible smart key and Sightstream® smart mirror, which replaces the rearview mirrors with a camera, are examples of innovations that contribute to intelligent mobility and fuel consumption reduction.

And since the future starts today, the Group is studying forward-looking technologies that will allow drivers to count on their vehicle's "intelligence". Human Machine Interface (HMI) is of critical importance here, as it helps motorists understand clearly what is happening, thereby reducing the risk of accidents. The goal is to offer a set of smart systems that can work together, reduce complex driving tasks and, in certain conditions, perform functions autonomously such as automated driving in urban traffic jams or on the highway. These new systems are managed by a new, fully digital, connected interface adapted to increasingly autonomous vehicles. Automated driving will ease traffic flows via connected services or automated self-driving systems.
Valeo’s Areas of Expertise
Seven core business lines driven by two key trends

Reduction of CO₂ Emissions and Fuel Consumption

Intuitive Car

- Wipers
- Lighting
- HVAC / Engine Cooling / Compressors
- Interior controls
- Driving assistance
- Transmissions
- Electrical Systems
I.II An innovation-driven company

Valeo's missions are to imagine the cars of tomorrow, respond effectively to market demands, anticipate and stimulate customer and motorist needs through innovations and a thorough understanding of technology, and secure its technological edge. To fulfill these missions, the Group has embedded innovation in its corporate DNA.

Valeo's innovation policy and development methods are broadly recognized by its customers, who are turning to the Group more and more for the development of new technologies. Reflecting this trend, Valeo's innovative products account for 35% of orders.

To support innovation, Valeo spent 1.1 billion euros on R&D and filed 1,108 patents, which is 40% more than in 2013. The Group hired 2,000 engineers around the world in 2014, including several hundred in France, Germany, China, India and North America. Most of these new hires were in the electronics or electromechanical fields. To forge even stronger ties with students, the Group launched the second Valeo Innovation Challenge in 2014 targeting engineering students around the world. The finalists will present their projects in Paris to the Challenge jury. The top three teams will be announced on Tuesday, September 29, 2015. The jury will include experts from Valeo as well as eminent figures such as: Claudie Haigneré, who, after heading Univercience, resumed her work at the European Space Agency where she heads European research and international space research. She was the first French woman to visit the International Space Station and served as France's Minister for Research and New Technologies and Minister for European Affairs; Cédric Villani, a high-profile French mathematician who won the Fields Medal in 2010. He is the director of Institut Henri Poincaré and was appointed to the French Academy of Sciences in 2013; and Yotam Cohen, cofounder of Wibbitz, an application that automatically creates short recap videos from articles or text-based publications.

The jury will be chaired by Jacques Aschenbroich, Chief Executive Officer of Valeo and the winning team will receive 100,000 euros.
Valeo has to be both close to its automaker customers and intimately familiar with end-user needs, which are obviously different in each country. For this reason, it has deployed its R&D capabilities across all continents. For instance, the Group has three research centers and twelve development centers in Asia.

The Group also maintains a constant global innovation watch and enables young technological companies to bring their innovations quickly to the automotive market. Today, innovating means taking new approaches and working with new partners from other industries. For this reason, Valeo has deployed an open innovation approach. For example, in less than three years the Group has entered into:

- A technological cooperation agreement with LeddarTech (July 2013) to devise new active safety solutions, notably for emergency braking in urban environments.
- A technological partnership agreement (September 2013) with aerospace and defense equipment manufacturer Safran covering driver-assistance systems.
- A technological cooperation agreement with peiker (February 2015) to develop on-board telematics and connectivity solutions.
- A technological cooperation agreement with Mobileye (March 2015) for driving assistance systems.
II – Valeo unveils its latest technologies at the 2015 Frankfurt Motor Show (IAA)

II.1 Innovation for intuitive cars that are smarter, safer and more connected

WORLD FIRST – Launch of Remote Clean4U™
Visit Valeo’s demo zone F10.0 – Booth F1056

Valeo presents a world first: Remote Clean4U™, a remote windshield defrosting and cleaning system

Improving comfort and reducing overall vehicle energy consumption are strategic priorities in Valeo’s approach to innovation. In a world premiere, Valeo is unveiling Remote Clean4U™, a revolutionary remote windshield defrosting and cleaning system that is controlled via a smartphone application. This easy-to-use system is more efficient than other methods and improves driving safety. It was designed to meet the expectations of our end-customers who are unsatisfied with the windshield cleaning methods that are currently available. According to a 2014 study conducted by Valeo in the United States, the most common defrosting method is by hand using a scraper while the engine is running to heat up the windshield. 97% of end-users are not satisfied with this time-consuming, messy, ineffective and physically demanding method.

The Remote Clean4U™ system has two innovative functions that the user can control remotely from a smartphone: Defrosting, which automatically defrosts a windshield in less than 90 seconds, and Debugging, which washes away insects stuck to the windshield in record time.

The Defrosting function automatically defrosts the windshield in less than 90 seconds at a temperature of minus 20°C

Remote Clean4U™ distributes an environmentally friendly defrosting fluid through Valeo’s innovative and exclusive AquaBlade® windshield wiper system, which incorporates the cleaning function into the blades themselves. The fluid is not projected onto the windshield but distributed across its entire surface, cleaning it more evenly and uniformly without wasting fluid. This system is more efficient than a heated windshield and consumes 28 times less energy than an electric defrosting system. Not only is it environmentally friendly and more efficient, the system is also more convenient thanks to its remote Defrosting function, which allows the driver to defrost the windshield from the comfort of home without having to go out to start the engine. This innovative system is useful, efficient and reduces energy consumption.
The Debugging function leaves your windshield spotless while improving driving safety

Using a smartphone application, the driver can remotely start Remote Clean4U™’s Debugging function to wash away insects stuck to the windshield in record time. Thanks to its specially formulated cleaning fluid distributed through the AquaBlade® windshield wiper system, this innovative function improves visibility while using less fluid and energy.

AquaBlade® also makes the vehicle 2 kilograms lighter since only a small amount of fluid is needed to clean the windshield. CO₂ emissions are reduced by 0.2 grams as a result.
Valeo Mobius 2: second-generation technology for greater safety

On display outside at the IAA in demo zone F10 – booth F1056

Valeo is now offering second-generation Valeo Mobius cockpit, developed in response to visitor feedback on the model showcased at the 2015 CES and the results of consumer clinics. Valeo Mobius 2 combines technology from a number of Group innovations around the dashboard that allow motorists to switch smoothly from automated to manual driving mode in complete safety. It also offers a host of new services for drivers to use when the car is driving itself.

Smooth transitioning from manual to automated mode

Whenever Valeo Mobius 2 detects favorable conditions for automated driving, for example when the car is in a city traffic jam or on the highway, it suggests that the driver switch to hands-off mode by pressing the automatic pilot button located on the steering wheel. Similarly, the system emits a visual and audio alert as soon as it anticipates the need for the driver to take back control.

Reconfigurable digital dashboard screens and steering wheel controls

During periods of automated driving, Valeo Mobius 2 turns the digital dashboard into an extension of the user’s smartphone or tablet. This is because in hands-off mode, all driving-related information such as the GPS, speedometer and fuel gauge are relegated on the side so that the driver’s applications can be duplicated on the screen. Thanks to standard consumer electronic technology such as Miracast, Chromecast or Airplay (via WiFi), the driver can then view all of the smartphone’s or tablet’s content (or via HDMI). This means that when the car is driving itself, the driver is able to read e-mails, watch videos on the Internet, choose favorite music tracks and more. When the driver switches back to manual driving mode, all driving-related information once again returns to the main display.
Enhanced safety

Switching from automated to manual driving mode is now faster and safer:

- **Hands on the wheel, eyes on the road:** Using two miniature, smartwatch-like touch screen controls on each side of the steering wheel, the driver can access all applications without taking either hand off the wheel, allowing for a smooth, fast return to manual driving mode. The adaptable touchscreen dashboard display ensures that the driver stays focused on the road.

- **Information on driving conditions in real time:** A new dedicated space on the interface informs the driver about the surrounding environment in real time, thereby maintaining the driver’s awareness of what is around the car while improving confidence in the automated driving system.

- **Distraction detection system:** The Valeo Mobius 2 technology can detect the presence of hands on the steering wheel and uses a camera located at dashboard height to observe the driver. This detects moments of inattention, fatigue or distraction in real time and warns the driver of the hazard. This technology is especially important when switching from automated to manual driving mode, to ensure that the driver is ready to take back control.

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**Being in line with market expectations...**

Valeo is conducting yearly end-user surveys. Paving the way towards automated driving, the Group regularly assesses the end-users acceptance and expectations through focus groups in all regions (US, Europe, China and Japan).

For the first time this year, new interface concepts were tested in US, Germany and France, projecting end-users into automated driving situations.

For example, a study on automated driving conducted with the Fraunhofer institute IAO in Stuttgart showed that reaction times for emergency braking were 0.5 seconds shorter (Incresend in braking distance of 8.33 meters at 60 km per hour) with Valeo Mobius 2 instead of a smartphone. In addition, those surveyed found that Valeo Mobius 2 offered a better transition between automated and manual driving, making drivers feel safer and less stressed.
**Valeo SCALA: the laser scanner, enabling automated driving**

**On display outside at the IAA in demo zone F10 – booth F1056**

Valeo is showcasing its SCALA laser scanner at the Frankfort Motor Show (IAA). This technology will be a key enabler for highly automated driving thanks to its extended detection range, wide field of view and accuracy.

Valeo SCALA laser device scans the area in front of the vehicle and detects vehicles, motorbikes, pedestrians and static obstacles like trees, parked vehicles and guard rails – all with an extremely high level of accuracy. It works during the day and at night, when the car is driving at both high and low speeds. Using the collected data, the scanner creates a map of the environment allowing it to analyze and anticipate events around the vehicle. This technology serves to enhance active safety by initiating measures like evasion maneuvers and emergency breaking whenever vehicles or pedestrians suddenly appear in front of the vehicle. The scanner also collects information that is essential for highly automated driving systems and automated valet parking.

**Valeo SCALA laser scanner, playing a vital role in automated driving**

Valeo's technologically innovative SCALA can be used as part of the highly automated Drive4U® solution, as shown during a demonstration in real traffic conditions. When in automated mode, the system took full control of the vehicle's steering, acceleration and the brakes.

Thanks to the Valeo SCALA, the Drive4U® innovation also includes enhanced active safety features that not only make driving safer in both manual and automated modes but also help to increase the efficiency of car travel.

In addition, Valeo SCALA laser scanner is the main technology featured in the automated valet parking prototype Valet Park4U®. With Valet Park4U®, vehicles can find a suitable space and park by themselves without a driver.

**A full range of solutions for analyzing the vehicle’s surrounding environment**

Valeo SCALA technology complements the existing range of radar, ultrasonic, infrared and vision sensor systems on the market. This enables Valeo, which is already market leader in driving assistance systems, to promote innovative active safety features and autonomous driving.
Sightstream®: when a camera replaces the rearview mirrors

On display outside at the IAA in demo zone F10 – booth F1056

Sightstream® is a new camera system that replaces conventional rearview mirrors. It not only heightens the motorist's perception of driving conditions, thereby enhancing safety, but also reduces fuel consumption by improving the vehicle's aerodynamics. At the same time, the innovative technology opens up new vehicle design opportunities.

Cameras replacing mirrors

Cameras are installed where the exterior side mirrors are usually mounted, ensuring better visibility in all weather.

One technological step closer to automated driving

The Sightstream® system can also be incorporated into driver assistance features such as blind spot detection, and assist with door opening by detecting and displaying passing vehicles, motorbikes or bicycles. Sightstream® can also help during lane changes and overtakes by displaying information on the dashboard, directly in the driver's line of sight.

Enhanced aerodynamics for more fuel-efficient vehicles

Innovations that improve vehicle aerodynamics are one of the keys to achieving the EU regulatory fuel efficiency target of 4L per 100 km by 2020. With Sightstream®, Valeo enables automakers to eliminate up to 1.3 grams of CO₂ per kilometer. At the same time, the new side mirrors reduce the noise caused by conventional systems.

New design potential

Sightstream® offers new vehicle design potential by replacing the interior rearview mirror and exterior side mirrors with cameras. Removing the central rearview mirror, for example, makes it possible to rethink the rear of the vehicle and improve its aerodynamics.
Valeo InBlue®: second generation, greater connectivity

On display outside at the IAA in demo zone F10 – booth F1056

Valeo now offers a second-generation InBlue® vehicle entry/start system. With Valeo InBlue®, drivers can use their smartphone or connected watch to lock, unlock and start their car, control applications and remotely access certain vehicle data. The second-generation system features even greater connectivity, and now allows drivers to control their vehicle from any distance using either Bluetooth® or the cellular network:

- **Less than 30 meters away:** Valeo InBlue® uses Bluetooth® Smart technology to lock, unlock and start the vehicle as well as synchronize vehicle data and even control automatic parking via the Park4U® Remote and Valet Park4U® features.
- **More than 30 meters away:** Valeo InBlue® uses the cellular network, allowing drivers to remotely control a number of features such as Remote Clean4U, the vehicle locator, the virtual key sharing device and the door locks.

In this way, Valeo gives drivers extensive and secure control of their vehicle via their smartphone, all as part of an uninterrupted, fully digital experience. The technology offers the same level of security as smartphone-based payment systems.

With Valeo InBlue®, drivers can also permanently or temporarily transmit their car key remotely at any time, wherever they may be. All they need to do is send a digital key via smartphone to the person who is borrowing the car. This person can then use his/her smartphone to unlock, lock and start the vehicle.

A study by Valeo and Capgemini Consulting has revealed a significant – and rising – level of interest in virtual keys among automotive dealers, fleet managers, car-rental and car-share professionals, etc. This is because the breakthrough technology would allow them to take advantage of the benefits of the Valeo InBlue® system, for instance by making it easier for them to manage the keys to their fleets. The car-sharing market alone represents 1 billion euros and 70,000 vehicles, and is growing by 25% a year.

Valeo InBlue® is part of the European Dependable Embedded Wireless Infrastructure (DEWI) project.
Focus on telematics at Valeo

As part of its strategy to improve intuitive driving, Valeo is working with a number of firms to develop innovative telematics technologies:

- In November, Valeo will launch its first telematics device equipped with an emergency call feature. Developed with Chinese manufacturer Geely, the device will directly contact emergency services in Russia if the vehicle has an accident. This “ERA-GLONASS” service will be compulsory on all new vehicles in Russia by 2015. Valeo is also working on the equivalent standard for the European market, “eCall”, which will be compulsory from 2018 onwards.

- Valeo has begun production of the BMW ATM1 device, to be commercialized in late 2016, and development of a shared 4G LTE platform. These two milestones are the product of a technological cooperation agreement with peiker, a major player in onboard telematics and connectivity.

- Valeo is also working with Tsinghua University in Beijing, China, on an initial series of experiments in vehicle-to-vehicle communication technology, which allows vehicles to communicate with each other as well as with roadside infrastructure.
360Vue® 3D technology: full visibility, right around the vehicle

On display outside at the IAA in demo zone F10 – booth F1056

The intuitive and ergonomic 360Vue® 3D system is designed to help drivers maneuver their vehicles with greater accuracy. It brings automakers one vital step closer to commercializing highly automated vehicles. 360Vue® 3D works by giving the driver a bird’s eye view of the vehicle on the dashboard screen. The 3D, 360 degree image it provides of the surrounding environment ensures full visibility right around the vehicle.

With this technology, the driver can maneuver the vehicle or leave a parking space in total safety, with an excellent view of all blind spots and obstacles around the vehicle.

The system consists of four miniature digital cameras and image processing software. The cameras are fitted into the exterior mirrors, on the front bumper and on the tailgate. The image, displayed on the multi-function center console screen, gives the driver the impression of floating above the vehicle. The system can display one or more images simultaneously on a split screen. The driver can also select and zoom in on a specific image when performing maneuvers.

The 360Vue® 3D system already equips the Volkswagen Passat and the new Volvo XC90, and 360Vue® system is also available on many Audi, BMW, Citroën, Land Rover, Mercedes and other Volkswagen models.
**Interior lighting: future solutions for intuitive lighting**

**Demonstration at the Valeo booth**

Advanced interior lighting has been a key trend for some years now as automakers try to set themselves apart in a highly competitive market. Valeo has a range of innovative interior lighting solutions to offer that are destined to coincide with the arrival of autonomous vehicles by improving driver/vehicle interaction. The change in focus is visible, as interior lighting becomes intuitive.

To accompany this change over the coming years, Valeo is working in three main areas to make interior lighting more intuitive and driving safer:

- **Comfort**, to meet the expected levels of well-being of the driver and passengers, who want the car to be an extension of their home. Here, in a form of light therapy, variations of the interior lighting are used to accentuate the driver's and passengers' perceptions. A stark, cold white light, for example, prevents fatigue by stimulating the driver, whereas warm lighting creates a sense of well-being and harmony inside the vehicle.

- **Driving assistance**, to enhance safety. Here, light sources inside the vehicle alert the driver to anything requiring special attention. The light sources are activated by exterior sensors designed to warn the driver of potentially hazardous events outside the vehicle, for instance the approach of an overtaking vehicle.

- **Infotainment**. Here, interior lighting is used to communicate a wide variety of information through, for example, a Li-Fi system.

**In-Door Illumination: offering even greater possibilities for vehicle personalization**

At this year’s Frankfurt Motor Show, Valeo is presenting In-Door Illumination. This technology allows for the customization of the vehicle's interior lighting. Sources of light appear in unexpected areas of the cabin, such as from behind translucent or screen-printed design features. In-Door Illumination offers enormous potential for personalization as it draws attention to the cabin's design, roominess and trims while allowing for much more assertive branding. For example, the lighting could serve to create brand-specific designs when people are getting in or out of the vehicle.
LASER automotive lighting: the headlamp of the future

Valeo develops lighting systems to improve driver visibility in all conditions as part of its commitment to enhancing driving safety and comfort.

A hybrid Laser/LED lighting system to improve nighttime visibility

Valeo is offering a new lighting system combining a LASER beam with a conventional LED lighting system which allows drivers to see twice as far at night, therefore enhancing driving safety and comfort.

Combined with a conventional LED wide spread road beam which lights up the road over distances of up to 300m, the Laser spot activates as the car accelerates. Designed for higher speed driving on relatively straight roads, the laser-based system doubles the distance over which obstacles are visible, allowing the driver to see up to 600m in a straight line.

This system uses a laser diode which produces a concentrated high-beam spot directly in front of the car while the conventional road beam lights the road and the surrounding environment. Above a certain speed, the brighter beam allows drivers to see farther ahead so they can identify pedestrians, animals, debris or other obstacles and have time to respond appropriately.

In terms of functionality, laser has the advantage of being compact, opening up many new design possibilities for automakers. The first hybrid Laser/LED lighting system will be launched at the end of 2016 and will equip the premium vehicles of one of Valeo's biggest customers.

Matrix Laser: glare-free headlamps with laser precision

Valeo has developed Matrix-Laser, a new generation of the BeamAtic® Premium system, which, by automatically turning off the parts of the beam directed toward oncoming vehicles, allows drivers to keep their high beams on without blinding other motorists.

Matrix Laser is based on Matrix-Beam technology, which combines several dozen LEDs that turn on and off independently, as vehicles are detected in the vicinity. By replacing the LEDs with laser diodes, Matrix Laser system headlamps are far more precise and compact, improving road lighting while meeting carmakers' design and functional requirements.

The Matrix Laser technology will be available in 2018.
Smart wipers for the autonomous car's cameras

Valeo has invented a customized wiper that can clean the entire windshield while focusing especially on the area in front of the cameras that allow driving-assistance systems and autonomous vehicles to operate effectively.

The development of the autonomous car requires uncompromised camera operation and visibility, meaning that the camera must be pristine and automatically cleaned to ensure it stays that way. Current systems that spray water on the windshield – obstructing the driver's vision – would be even more distracting in an autonomous vehicle scenario as they are not triggered by the driver. With the AquaBlade® system, only the cameras are cleaned. This avoids distracting the driver and saves a considerable amount of water, resulting in a far greater amount of cleaning. The AquaBlade® system with camera cleaning is the optimal solution for perfect camera visibility. Already, cameras play a part in such driver-assistance systems as glare-free headlamps, pedestrian detection and emergency braking. In the next few years, these cameras will assist drivers in all situations by providing a broader and more precise field of vision than is available to the human eye. With the new wiper, the camera's vision will be clear at all times.
Valeo solutions for optimal cabin air quality

In order to protect the health of car users and improve their comfort and wellbeing, Valeo has developed new patented cabin filters that trap allergens, dust and particles with almost 100% efficiency.¹

A cabin filter with anti-allergen properties

Valeo offers Europe’s first patented cabin filter with anti-allergen properties. The new filter is suited to all drivers and passengers, no matter their sensitivity to airborne allergens.

In industrialized nations, the proportion of the population suffering from pollen-related allergies has doubled over the last 30 years. Current estimates predict that by 2040, 40% of Europeans will have an allergic predisposition². Allergy symptoms such as sneezing, watery eyes and itching are not only uncomfortable—they can also affect a driver’s concentration. In a vehicle traveling at 80 km/h, a sneezing driver has the eyes shut for approximately 25 meters.

Valeo has developed a filter that limits the risk of an allergic reaction inside the vehicle by neutralizing about 96% of allergens. This filter traps not only dust, harmful gases and odors, but also neutralizes allergenic pollen.

Designed and produced at Valeo’s Athis-de-l’Orne facility in France, this filter offers all the features of a conventional device, plus anti-allergen properties thanks to a natural polyphenol-based surface treatment. Found in certain plants and fruits, polyphenol neutralizes pollen allergens, making it possible to inhibit virtually all allergenic particles.

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¹ 93% efficiency on particles of 0.3µm

² European Academy of Allergy and Clinical Immunology
Valeo's very high efficiency PM2.5 filter

Valeo has developed a very high efficiency PM2.5 filter that traps almost 100% of particles in order to reduce the concentration of the pollutants in the cabin.

Made from close-knit, reinforced fibers, the very high efficiency PM2.5 filter reduces particle concentration inside a vehicle to levels that meet the World Health Organization Air Quality Guidelines (25 µg/m³ per day when peak levels in Chinese megacities can reach about 900 µg/m³).

To ensure the efficient operation of the air conditioning and heating systems and the well-being of passengers, Valeo recommends changing the filter regularly (at least once a year, and up to twice a year in very polluted areas).
II.II Innovation for higher-performance, more fuel-efficient vehicles

**An electric supercharger that combines lower fuel consumption and enhanced performance**

To comply with regulations calling for a reduction in vehicle CO$_2$ emissions in Europe (for 2021) and the United States (for 2025), automakers and OEMs must pursue and step up their efforts to downsize engines.

Downsizing is one of the main ways automakers cut fuel consumption in their vehicle. To maintain the same high levels of performance while reducing engine size, engine manufacturers generally opt for a turbocharger driven by the engine’s exhaust gas. The drawback is a long response time, known as 'turbo lag'.

Valeo is making this problem a thing of the past with its range of electric superchargers. Unlike turbochargers powered by exhaust gases, the electric supercharger is driven by an electric motor, using switch reluctance technology, resulting in almost zero lag (250 milliseconds).

Used with a 12- or 48-volt electrical architecture, the system reduces fuel consumption by 10%. Capable of replacing or supplementing turbochargers, it **enhances both driving comfort and in-gear acceleration, which improves by 27% without increasing fuel consumption.**

When coupled with a Valeo energy recovery system, **this electric supercharger can be used to create a cost-competitive hybrid solution that delivers fuel savings of 15% to 20%.**
Range extender generator

Electric vehicle range is a crucial challenge, and a frequently expressed source of anxiety for drivers. In response, Valeo has developed a high-voltage (300 V) electric generator which when paired with a small 650cc two-cylinder internal combustion engine can extend the range of an EV.

This system, which is already available as an option on the BMW i3, starts producing electricity as soon as the battery's charge falls too low.

The vehicle's nine-liter gas tank generates enough electricity to extend the car's range by up to 50%, taking it from 160 km for the basic model to between 240 km and 300 km, all while emitting only 13 grams of CO₂ per kilometer.

The EG high efficiency alternator: an award-winning innovation

Valeo was honored with a PACE Award in 2015 for its EG high efficiency alternator. The award crowns top innovations by automotive suppliers in the fields of technological advancement and business performance.

The EG high efficiency alternator is based on a technique known as synchronous rectification, which replaces diodes with metal-oxide-semiconductor field-effect transistors, or MOSFETs. Thanks to their micro-electronic structure, these transistors practically eliminate voltage drops when rectifying current, thereby improving the alternator's efficiency by 10%.
A high efficiency on-board charger for electric and plug-in hybrid vehicles

At the 2015 Frankfurt Motor Show (IAA), Valeo is presenting a 3.5 kW on-board charger with an eight-hour recharge time and minimal energy loss.

Valeo’s on-board charger offers optimum charging time for electric or plug-in hybrid vehicles. With its 96% power conversion efficiency rate – which means virtually no energy loss – the charger is setting all-new industry standards.

Under upcoming regulations, automakers will be required to provide information on the power conversion efficiency of their chargers in the same way as they do for CO₂ emissions. Labeling is expected to become mandatory in the next few years.

The simplest design possible was used for the charger, which is suited to different battery technologies. Its compact size and shape dramatically reduce volume, allowing it to fit snugly into any available space in an EV or plug-in hybrid. This reduced bulk also means less weight – a key issue for electric vehicles.

Valeo’s high efficiency on-board charger is currently in production on the Volvo V60H.
F910 facing material for Dry Dual Clutch

A finalist at the 2015 PACE Awards, the F910 clutch facings for Valeo’s dry dual-clutch transmission use an innovative friction material formulated from a compressed powder rather than the twisted yarns that are traditionally used.

The F910 clutch facings improve driving comfort, preventing jolting when starting the vehicle and improving the quality of shifting.

This product was specifically developed for dry dual-clutch transmissions, which include one clutch for even gears and another for odd gears. Dry Dual Clutches enable a fuel consumption and CO₂ emissions reduction of 6% to 10% compared to a conventional automatic transmission.
Valeo’s innovative water-cooled condenser for air conditioning

Valeo’s water-cooled condenser for air conditioning is part of a specific hot loop/cold loop thermal management architecture. The water-cooled condenser, in addition to the water-cooled charge air cooler, completes this architecture and links the engine cooling loop to the A/C system.

This innovative condenser uses water instead of air to liquefy air-conditioning refrigerant vapor. In comparison with conventional condensers, Valeo’s water-cooled condenser reduces fuel consumption.

It also reduces pressure fluctuations in the air conditioning system.

In addition, the water-cooled condenser does not need to be located in front of the radiator, and therefore:

- frees up space for additional components in hybrid models, and
- reduces the radiator fan’s electricity use by making it easier for air to circulate.

The condenser is mass produced for the new BMW 3 Series.
Valeo reinvents vehicle thermal management

Long-term trends in the automotive market, like autonomous driving and carbon emissions reduction, are forcing automakers to rethink their thermal management strategies. In a bid to make HVAC management more comprehensive and even more innovative, Valeo has included some of these new priorities in its roadmap.

Innovative technology

Thermal management has emerged as one of the keys to keeping CO₂ emissions down without compromising on passenger comfort. To this end, Valeo is now offering to equip new vehicles with a range of innovative technologies, such as:

- Multi-temperature hybrid-powertrain cooling architectures that combine various cooling functions on a single low-temperature circuit.
- Smart engine-water circuit management, which brings the engine to the right temperature faster by combining an electronically controlled valve with heat storage and recovery systems.
- A water cooled charge air cooler paired with a low-temperature water circuit to improve response time and charge-air stability.
- A battery cooling system running on refrigerant fed directly from the air conditioning circuit to optimize battery efficiency and life span.
- Active air grille shutters to regulate front-end air inlet, thereby reducing drag and heat loss.
- A dual-flow air conditioning system designed to reduce the need for ventilation and heating inside the vehicle, without misting the windows, etc.

Challenges on the horizon

Electric vehicles: In winter and urban driving conditions, a vehicle in full-electric driving mode uses practically as much energy to heat the cabin as it does to drive. The thermal management challenge in this situation is to ensure the vehicle is kept in an acceptable range. Valeo is rising to this challenge by focusing in particular on innovative architectures for heat pumps and smart cabin air management.

Hybrid vehicles: The vehicles of the future will push fuel efficiency to much higher levels, with new internal combustion engines and sophisticated hybrid functionality making all-electric driving possible in urban environments. The challenge these vehicles present is managing thermal systems in tandem with highly complex powertrains to achieve optimum efficiency, while at the same time rolling out new cabin temperature strategies that are adapted to the autonomous vehicles of the future.

In response to these issues, Valeo has invented new thermal management models for automobiles, with a particular focus on:
• Implementing a cooperative thermal management to minimize energy loss, including and combining the internal combustion engine, electric propulsion system, battery pack and HVAC. This "smart thermal network" will be able to monitor the sub-systems' transfer, storage and recovery of energy and adapt this to the vehicle's different operating modes in order to optimize energy efficiency.

• Shifting from the notion of overall cabin comfort towards one of individualized comfort, using more localized features to reduce energy needs to the bare minimum without affecting passenger comfort. This requires a better understanding of how the human body regulates heat.

Open innovation for improved thermal management

Open innovation can also offer solutions for enhancing thermal management. To this end, Valeo is working in close collaboration with universities, research centers and automakers' R&D teams to define a shared vision and develop the systems and components needed to make this "smart thermal network" a reality. The VEGA/THOP demonstration vehicle on display in the outdoor area is an example of this sort of cross-functional cooperation, here with the purpose of assessing the advantages of comprehensive thermal management. It shows that annual thermal-comfort-related consumption can be reduced by 50%.
Thermal management of batteries: a full range of innovative solutions

Battery packs for hybrid, plug-in hybrid and electric vehicles need to be thermally regulated to optimize longevity and performance. This means keeping the temperature of battery cells temperature at around 25°C.

Solutions to suit every vehicle architecture

Valeo has developed technological innovations to anticipate the needs of automakers, which are under increasing pressure to bring to market fast-charging hybrid and plug-in electric vehicles incorporating high energy and power density batteries. The Group offers innovative solutions that are compatible with all existing thermal management strategies either by air-, liquid- or refrigerant.

1. **Air cooling system**

Valeo has optimized one of its early innovations – **the battery air cooling system featuring a brushless-motor blower** – to make it quieter, lighter and more compact. The improved version will be used to manage 48 V Li-ion batteries starting in 2016. It was developed for Honda in 2002 and is currently available on the electric version of the Renault Fluence and the Ford Fusion hybrids.

2. **Liquid cooling system**

The **secondary-circuit glycol-based liquid cooling system for batteries** integrates a chiller and cooling plates located inside the battery pack. The technology equips the Mercedes S-Class since the second half of 2014 and was initially developed for the Smart EV.

3. **Refrigerant cooling system**

This third, ultra-light and compact battery thermal management system is based on direct exchange with refrigerant coming from a branch of the main A/C loop. It features a multi-stage, extruded-tube heat exchanger module with innovative circuiting, which will cool the battery pack of a German-made plug-in hybrid by the fall of 2015.
Comprehensive thermal management solutions

Committed to developing technologies that reduce CO₂ emissions, Valeo offers systems that reuse and recover energy to boost overall energy efficiency. Accordingly, the battery cooling function of its thermal management systems goes hand in hand with heating, for which Valeo provides a full range of electric solutions, such as the high voltage PTC air heater, the coolant heater, and the electric contact heater. It also offers highly energy efficient solutions like heat pumps and heat recovery and storage systems. These technologies have been rolled out in various regions of the world, including Asia, Europe and North America, to support automakers in all their markets.
Appendix

About Valeo

Valeo is a major player in the global automotive industry and ranks among the world's top automotive suppliers. As a technology company, Valeo is fully focused on the design, production and sale of components, integrated systems and modules for the car and truck industry in both the original equipment and replacement segments.

With its intuitive driving vision, Valeo develops innovative technologies that provide optimal safety, enhanced driving comfort and greater energy efficiency. The Group offers solutions that reduce the consumption of internal combustion engines, hybrid and electric vehicles, as well as the weight and energy use of components.

Major customers by alphabetical order include: BMW, BYD Auto, Chery, DAF, Daimler, Fiat/Chrysler, FAW, Ford Motor Company, Geely/Volvo Cars, General Motors, Great Wall, Honda, Hyundai/Kia, JAC, Mazda, Mitsubishi, PSA Peugeot Citroën, Renault-Nissan, SAIC, Suzuki, Tata Motors/Jaguar/Land Rover, Toyota, Volkswagen Group/Porsche/Scania/MAN and Volvo Trucks.

Key figures

- Sales of 12.7 billion euros in 2014, up 9% on 2013
- More than 10% of original equipment sales devoted to R&D, or more than 1.1 billion euros in 2014, an increase of 55% since 2009
- 1,108 patents filed in 2014, 40% more than in 2013
- 81,800 employees
- Operations in 29 countries
- 15 distribution platforms
- 16 research centers
- 34 development centers
- 136 production sites
**Valeo's four Business Groups**

Valeo's worldwide ranking

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**Powertrain Systems**

The Powertrain Systems Business Group covers all activities related to the vehicle's powertrain. Powertrain Systems develops innovative powertrain solutions designed to improve fuel efficiency and reduce carbon emissions, without sacrificing driving pleasure or performance. These innovations cover a comprehensive range of products, from the optimization of internal combustion engines through to the varying levels of vehicle electrification, and from Stop-Start systems to electric vehicles.

This means that the Group's opportunities are closely linked to its technological choices, as well as to growth in the global market, especially in emerging markets. The Business Group has a clear advantage given that it operates in all regions of the world: Europe, North and South America, as well as Japan, China, South Korea and India.

Valeo's Powertrain Systems Business Group is a world leader in electrical systems and transmission systems.

**2014 Facts & Figures:**
- 3.3 billion euros in sales
- 18,412 employees
- 37 production facilities
- 5 research centers and 16 development centers
Thermal Systems

The Thermal Systems Business Group develops and manufactures systems, modules and components to manage powertrain, gearbox and other cooling systems, and to enable individual passenger climate control, at every phase of vehicle use.

These systems help to significantly reduce fuel consumption, CO₂ emissions and other pollutants and harmful particles from vehicles equipped with internal combustion engines. In addition, the Business Group's engineers have designed systems to improve battery performance and to extend their life span in hybrid and electric vehicle applications.

The Thermal Systems Business Group has made the most of strong growth in emerging economies.

2014 Facts & Figures:
- 3.6 billion euros in sales
- 19,359 employees
- 44 production facilities
- 3 research centers and 8 development centers

Comfort & Driving Assistance Systems

The Comfort & Driving Assistance Systems Business Group develops innovative and intuitive driver-vehicle-environment interface systems that are vital to the emergence of tomorrow's more automated and connected cars. It contributes to improving comfort and safety, while putting an emphasis on intuitive driving.

Backed by both market and technological leadership, Comfort & Driving Assistance Systems is a key player in this segment and perfectly positioned to serve emerging markets.

2014 Facts & Figures:
- 2.3 billion euros in sales
- 14,195 employees
- 25 production facilities
- 9 research centers and 8 development centers
Visibility Systems

The Visibility Systems Business Group develops and produces innovative lighting and wiper systems aimed at improving driving safety in adverse conditions. Its solutions offer perfect visibility in all weather, both day and night.

The Business Group offers a full range of wiping and lighting solutions that integrate the latest technologies.

Valeo is among the major worldwide players in this segment. The presence of Valeo's visibility systems in high-growth markets is a key factor for the success of the Business Group, which aims to strengthen its position in Asian markets.

2014 Facts & Figures:
- 3.6 billion euros in sales
- 24,912 employees
- 36 production facilities
- 5 research centers and 15 development centers