



Technology Highlights

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■ INTRODUCTION

Automotive megatrends are driving a technology revolution

The trends in today's automotive industry directly reflect our rapidly evolving society.

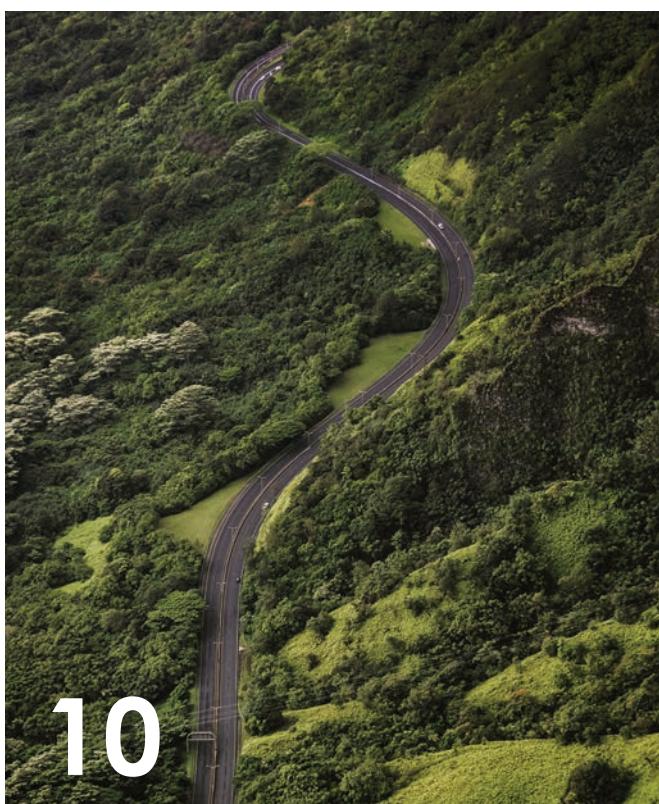
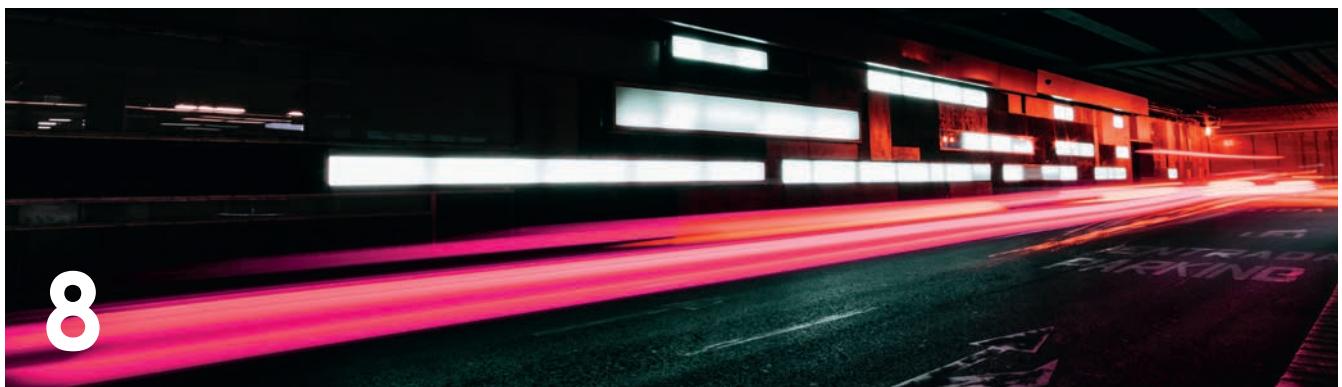
The industry as a whole is experiencing the most significant revolution in its history as it adjusts to increasing demand for connectivity, well-being, personalization and sustainability in tomorrow's vehicles.

Faurecia is inspiring tomorrow's mobility

Faurecia is at the forefront of these trends as it accelerates its development of Sustainable Mobility solutions for improved fuel economy and air quality, as well as Smart Life On Board technologies for the cockpit of the future.

Faurecia is accelerating its innovation to meet the changing needs of its OEM customers and is rapidly expanding its innovation ecosystem of innovation through partnerships, acquisitions and investment in start-ups.

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& FACTS FIGURES FAURECIA

Faurecia Seating

N°2 worldwide for frames and mechanisms

N°3 worldwide for complete seats

—

- Seat structures, electronic and pneumatic systems
- Seat comfort (products and systems, trim covers)
- Complete seats



€ 18.7 Mrd.

Sales



35

Countries

Faurecia Interiors

N°2 worldwide for car

interior systems

—

- Cockpits, instrument panels, center consoles
- Door panels
- Acoustic modules
- Decorative components



about 100,000

Employees



300

Sites (incl. R&D)



501

Patents per year

Faurecia Clean Mobility

N°1 worldwide for light vehicles

N°3 worldwide for commercial vehicle

—

- Complete emission control systems, hot and cold ends, catalysts, particulate filters, selective catalytic reduction (SCR)
- Energy recovery
- Acoustic systems
- Lightweighting, composites and powertrain electrification



6,000

Engineers and technicians



30

R&D centers



636

Running programs



Global cooperations and innovation ecosystem

Automotive supplier Faurecia relies on partnerships and knowledge transfer

The development of new technologies characterizes and challenges the automotive industry. As a leading automotive supplier, Faurecia has established itself with innovative networks, targeted partnerships and a focus on promising start-ups for the future. The strategy is based on two pillars: the establishment of a global innovation ecosystem and Faurecia Ventures, which enables technology and know-how transfer through partnerships and participation in innovative start-ups.

■ Ecosystem for knowledge transfer

As a global player in the automotive industry, Faurecia has implemented a comprehensive innovation ecosystem. An internal think tank, 30 research and development centers worldwide, a community of 350 international experts as well as 6,000 engineers and technicians ensure a constant exchange of knowledge.

In 2015 alone, Faurecia developed a total of 72 innovation projects in cooperation with its customers. They dealt with the optimization of the vehicle experience with HMI technologies, smart surfaces and decorative elements, modern comfort and safety solutions, sustainable mobility, weight reduction, energy recovery and biomaterials.



■ **A future based on partnerships**

Cooperations with other technology groups play a significant role in the global innovation ecosystem. For instance, Faurecia has entered into a close partnership with ZF, a world leader in drive and chassis technology. The goal is joint development of future-oriented interior and safety technologies for autonomous driving.

Thereby, emphasis is put on technologies that can be used for sustainable mobility and a smart vehicle interior. If a start-up appears to be particularly promising, by offering content-related synergies, for example, Faurecia concludes agreements or invests in the company directly.

■ **Scouting for technology and know-how**

With their ideas and concepts, start-ups have great influence on the automotive industry nowadays. They develop innovative solutions to revolutionize the vehicle of the future. With the help of Faurecia Ventures and a scouting network at technology locations like Silicon Valley, Boston, New York, Toronto, Paris, Munich, Shanghai and most recently also Tel Aviv, Faurecia is looking for promising companies.

Examples for partnerships, acquisitions and investments in startups:

- **ZF**
- **Parrot Automotive**
- **STELIA Aerospace Composites**
- **Amminex**
- **Tactotek**
- **Canatu**
- **Ad-Venta**

An aerial photograph of a winding two-lane asphalt road through a dense forest of green trees and bushes. The road curves from the bottom left towards the top right of the frame. A few small white cars are visible on the road. The surrounding terrain is hilly and covered in thick vegetation.

inspiring
mobility

New technologies for Smart Life On Board

Connectedness and autonomous driving will radically impact the driving experience. With Faurecia technologies the cockpit of the future will be connected, versatile and predictive.

smart life
on board

Energy recovery and less emissions

Faurecia technologies will make cars and commercial vehicles cleaner and lighter in order to improve fuel economy and air quality.

sustainable
mobility

smart life
on board





The increasing autonomy and connectedness of automobiles is radically altering the driving experience and, as a consequence, the vehicle interior. Different use cases are emerging for occupants in which allowing both drivers and passengers will be able to work or relax in certain situations.



Faurecia has taken full stock of this, pioneering a comprehensive technology offering that makes the cockpit of the future a reality today. Faurecia is innovating to provide enhanced safety, well-being and connectivity through the seamless integration of electronics, smart surfaces, displays and HMI. The end result is a versatile, connected and predictive on-board experience.

Faurecia has achieved this through its unique approach of working hand in hand with OEMs, from the drawing board. Faurecia can adapt its solutions, regardless of the vehicle or powertrain, helping car makers design and tailor vehicle interiors to meet their customers' expectations.

Safety first

Autonomous driving means that are now new uses for the interior. These can now double as offices and living spaces, with vehicle occupants free to carry out many more activities

than ever before. It goes without saying, that this has significant implications for safety as occupant positions no longer need to be fixed facing forward and upright, which means that new solutions for seat-belts and air bags will be needed.

Faurecia and ZF have developed an all-new frame concept called the **Advanced Versatile Structure (AVS)**. This provides intelligently powered kinematics to allow occupants to effortlessly recline, lift, adjust and swivel their seat, and then return it smoothly and quickly back to



the upright driving position. It is unique in that the backrest is divided into two parts, with a composite Upper Backrest Adjustment (UBA) providing the necessary support to ensure occupant comfort when the seat is reclined. The length of the upper backrest and height of the headrest and neck support can all be power-adjusted to provide a seamless experience for the occupant.

Crucially, the seatbelt and belt retractor are both integrated into the seat, meaning that the seatbelt can function optimally in different seat

positions. In addition, the UBA module on both the driver and passenger seats has airbags on their outer edges, protecting occupants in the event of an accident. These innovations contribute towards an overall advanced versatile structure, which provides a safety cocoon for every seat position. The AVS is designed as a platform that can easily integrate features such as new types of armrests, a device docking station or screen in the backrest.

Faurecia has drawn on its expertise in designing and making seat parts and mechanisms using a mix of materials - combining aluminum, new steel grades and composites to reduce seat frame weight by 8kg, improving environmental and technical performance alongside safety.



SPECIAL FOCUS // Faurecia & ZF: a strategic partnership to develop the cockpit of the future

In May 2017, Faurecia entered into a partnership with ZF, a leading global systems supplier in active and passive safety technology, to offer complete interior safety and comfort features to meet the future challenges of making the cockpit of the future safe, comfortable, connected, versatile and predictive.

Nine months after initial contact, the partners exhibit a Faurecia-ZF demonstrator at IAA in Frankfurt - a record in the automotive industry, and another demonstration of the partners' shared commitment to bringing added value technologies to their customers.

Faurecia's and ZF's product portfolios are highly complementary, enabling both companies to handle customer requests more efficiently and comprehensively. A clear joint target is to create a global system approach for the development and sale of innovative safety systems for new interior configurations.

Combining safety and comfort

All of the functions of the Advanced Versatile Structure (see above) have been integrated

into Faurecia's unique **kinematic seat** that is designed to adapt perfectly to the person's position by reclining, tilting and swiveling. In order to accomplish its core mission of optimal



comfort, Faurecia has created a composite Upper Backrest Adjustment (UBA). The UBA allows the angle of the upper part of the seat and adapts to the individual's activity. This is crucial for guaranteeing maximum comfort and preventing motion sickness. It also has an integrated headrest and neck rest for added comfort, with two air sacs that can be inflated via the smart control unit to provide extra neck support.

Beyond comfort, the UBA also provides opportunities for further features to be incorporated. For example, the back side of the UBA can be fitted with a docking station or a display, optimizing the space in the back of the car. The integrated headrest is designed with "wings" which can be moved 25°, and can also contain speakers. With this feature enabled, the system automatically adjusts the sound to a

comfortable level when the "wings" are positioned close to the individual's ears, and prevents other occupants hearing the background sound.

What's more, the armrests are designed in such a way that they can adapt and change position seamlessly according to the occupants' activity as well as for stowing things for the easy entry and exit of the vehicle. All the functions of the seat are controlled by a Smart Control Unit (see below) which is integrated into the armrest. For additional comfort when resting, the seat includes a footrest that can be deployed from the floor and has an adjustable height.

Finally, the seat is mounted on embedded and extended tracks, causing less of a hindrance to people in the backseat, whilst allowing for extended movement. ■

A CONNECTED AND PREDICTIVE ON-BOARD EXPERIENCE FOR OCCUPANT WELL-BEING



Faurecia has taken occupant comfort and well-being a step further by creating **Active Wellness 2.0™**, which employs a system of sensors in the seat and instrument panel to analyze data on the occupant's physical state (e.g. heart rate, head tilt, eye gaze and body movement). In this way, the system can provide the best level of comfort and enhances the occupant's overall safety by performing actions such as adapting the seat position, the lighting or audio settings. Importantly, the system can help the driver

remain alert by detecting drowsiness or stress and triggering the appropriate response. Moreover, it can 'remember' the driver's behavior and preferences, allowing it to predict and anticipate the individual's optimal comfort based on their physical condition, the time of day, road conditions and if the vehicle is in autonomous or semi-autonomous mode.

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An adaptive instrument panel

Faurecia has drawn on its expertise in mechatronics, kinematics and design for its **Morphing Instrument Panel**. When the driver switches from driving to autonomous mode, the display glides from the driver's side to a central position, the instrument panel surface simultaneously adapts its shape too. Both movements are managed by innovative micro-mechanisms. In this way, occupants benefit from an optimal display surface for

either navigation or entertainment purposes. In driving mode, the display can be used as a driving cluster giving driving information and safety signals, and can also act as a central screen for navigation and media. In autonomous mode, the display becomes a large entertainment screen visible for all passengers.

Integrated infotainment with Parrot Automotive

Faurecia has made considerable improvements in the domains of infotainment and connectivity through its partnership with Parrot Automotive. This demonstrator showcases the combined expertise of Parrot Automotive in electronics and software and Faurecia in the integration of smart surfaces. With this innovative connectivity system, users are able to access their favorite apps through a multi-media touchscreen.

The HMI brain runs the different displays while the Simple Box handles vehicle connectivity, telephone connectivity, radio reception and voice recognition. The Simple Box can operate at all frequencies, allowing it to be used anywhere in the world. In addition to this new way of integrating an HMI and connectivity, the center stack has a Bring Your Own Device (BYOD) dock. ■

Controls at your fingertips

Faurecia has developed a new generation on-board connected interface: **the Smart Control Unit**. Easy to reach at all times, the Smart Control Unit allows you to integrate your smartphone and replicate its functions to an NFC connection and on-board Wi-Fi and Bluetooth. It can then be used to control the displays, audio, seat positions, thermal comfort etc. and can be easily integrated into different elements of the vehicle's interior such as the seat armrest, center console or door panels.



A fusion of electronics and materials creates smart surfaces

Faurecia excels at integrating electronics into different surfaces in the vehicle's interior. Its smart **Collection Wall** is a unique compact panel of electronic tiles showcasing how electronic solutions can be effectively integrated into

different surfaces and materials, such as plastic, leather, aluminum and real wood. These tiles include functionalities such as lighting, touch surfaces, ventilation, or acoustics and can be integrated into the instrument panel (IP), door panels, center console or seats.

Acoustics also contribute to the comfort and well-being of the driver and passengers. Faurecia has integrated a very flat speaker bar into the instrument panel, covering it with sound-transmissive fabric and thus created a **Smart Acoustic Surface**. The speaker bar creates two distinct audio beams, one directed to the driver side and one directed to the passenger side. This creates two individual sound bubbles, allowing each occupant to listen to something different or have a telephone conversation, with no need for headphones. ■

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**THE INCREASING
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AND CONNECTEDNESS
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ALTERING THE
DRIVING
EXPERIENCE**
”



sustainable
mobility



Towards a zero-emissions world

The need to balance mobility aspirations with reduced environmental impact has led to ever more stringent regulations across the world aimed at minimizing the emissions of both passenger cars and commercial vehicles.



To meet the demand for better air quality, especially in cities, the industry needs to continue improving the performance of traditional powertrains, as well as accelerate the electrification process of powertrains. Faurecia provides clean mobility solutions for all types of powertrains and is expanding its digital services offer in order to play a leading role in providing technology solutions for the future of mobility which produces zero emissions.

Emissions-free electric mobility

The powertrain mix is evolving towards a range of electric and hybrid models in the quest for cleaner, emissions-free mobility solutions. Faurecia estimates that around 11 % of vehicles will be electric by 2030 including 2 % which will be equipped with fuel cells.

The electrification of vehicles presents a range of challenges for car manufacturers and mobility operators alike, including technical (range

and charging time), economic (battery cost) and societal (incentives and infrastructure).

Building on our composites and system engineering expertise, Faurecia Clean Mobility is developing a product offer for Hybrid Electric, Battery Electric and Fuel Cell vehicles.

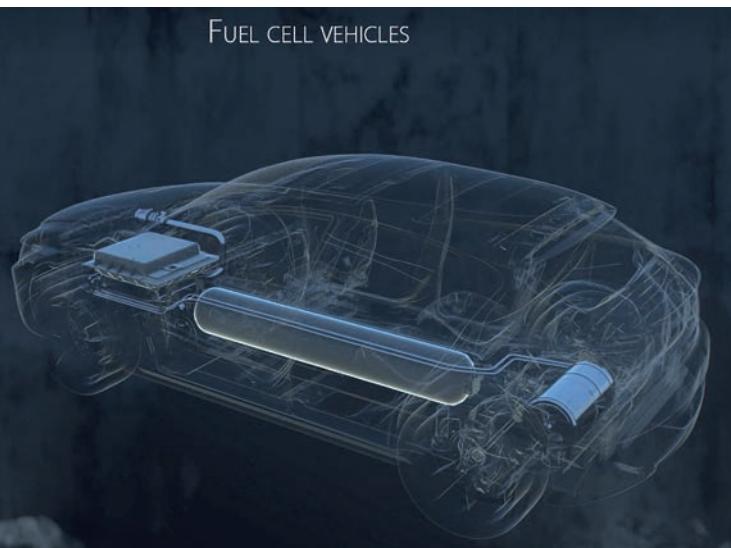
Fuel Cell technology, a complementary solution to Battery Electric Vehicles

While Battery Electric Vehicles (BEV) will continue to grow significantly, the sales of Fuel Cell

Electric Vehicles (FCEV) are expected to take off rapidly after 2025 due to their increased autonomy and shorter refueling time.

The automotive industry is already looking to Fuel Cell technology as a solution for long-range electric vehicles. Fuel Cell technology uses compressed hydrogen gas, stored in a high-pressure tank to feed a fuel cell stack to

FUEL CELL VEHICLES



generate electricity on-board. This new energy offers increased autonomy (over 500 km) and a quicker refueling time (4-5 minutes) compared to the electric battery.

Faurecia has been exploring ways to improve and industrialize fuel cell technology for the automotive industry by optimizing the high pressure tank and delivery of hydrogen to the stack.

Partnering with Stelia Aerospace Composites which draws on 30 years' experience in providing high pressure hydrogen tanks for the ae-

rospace industry, Faurecia is developing light-weight and cost effective storage for 700 bars hydrogen for fuel cell electric vehicles.

With the Ad-Venta partnership, Faurecia brings together cutting edge expertise in high pressure gas management and know-how from automotive system integration. This leads to a best-in-class compact valve that safely transforms 700 bars pressure to under 10 bars in one step.

Faurecia also brings its extensive experience in systems integration to combine the storage, pressure management and fuel cell stack technologies into a full solution to improve efficiency, capacity and power generation for the vehicle. Furthermore, Faurecia recently signed an agreement with the French Alternative Energies and Atomic Energy Commission (CEA) to collaborate in a research and development program about fuel cell stack technologies. Faurecia will benefit from more than two decades of CEA research and expertise in fuel cell stacks and the key components such as the bipolar plates, which is critical for altering the efficiency of the fuel cell stack. Combined with Faurecia's expertise in fluid dynamics and catalysis, the Group will be able to develop, mass-produce and commercialize a high performance fuel cell stack that will meet auto industry expectations.

Enhancing electric vehicle performance

Building on its expertise in composites, Faurecia is developing a range of battery pack solutions for all types of electrified powertrain:

HYBRID ELECTRIC VEHICLES

- The battery is usually a stand-alone pack of a medium size that has a zero-emissions range of ~50 km. The battery packaging is adapted to the vehicle's existing platforms and architecture designed by the carmaker.

FULL ELECTRIC VEHICLES - 2 USE CASES:

- Building on existing vehicle platforms, the battery pack is attached to the structure of the vehicle and integrates as much functionality as possible in its given environment.
- As part of dedicated BEV platforms, the battery pack becomes an integrated structural element of the vehicle's body-in-white, with increased functionality and contributing to the vehicle's safety protections.
- Battery packs for Fuel Cell vehicles as part of Faurecia's offer (hydrogen tank, valve and stack)

The wide flexibility of the design that comes with the use of composite materials enables automakers to redesign the vehicle structure, for example, by integrating the battery pack as a large-size structural element of the body-in-white, and turning the battery upper housing into the vehicle floor. This increases crash-energy absorption and enables further functional integration that helps to reduce the number of parts and assembly operations.

Lightweight and highly resistant, composites also contribute to improving thermal control and mechanical performance, as well as providing an ideal material for battery cell casing, which will increasingly manage a range of functions in the vehicle – from cooling, to the interface, with electronic components.



**“THE NEED TO
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INNOVATIVE SOLUTIONS TO REDUCE EMISSIONS

ASDS™, a breakthrough technology to reduce NO_x emissions

Over the next ten years, stricter emissions regulations for commercial vehicles will come into force to reduce NO_x and particulate emissions, especially in China and India.

In light of this, Faurecia introduced the Ammonia Storage and Delivery System (ASDS™) reduction technology for nitrogen oxide (NO_x) two years ago as a better alternative to liquid urea AdBlue® in terms of NO_x conversion efficiency at a low temperature. This system uses ammonia stored in salt, in a solid form called AdAmmine, that is converted to gas once the engine is started. When routed to the exhaust line, it converts NO_x into non-polluting nitrogen and water, reducing emissions within a few minutes after the engine starts and at low exhaust temperatures in tune with typical city driving conditions.

Faurecia is now looking to further develop the NO_x tracker linked to ASDS™ to provide a re-

al-time emissions monitoring solution. Measuring actual NO_x removal per journey will give city authorities and mobility operators important real-time performance data to monitor how they are meeting pollutant emissions-reduction targets, improving air quality and shedding light on where they need to focus attention. As part of its open innovation approach, Faurecia is currently exploring how to deliver a more accurate measurement solution, drawing on its experience of testing equipment and procedures, as well as its leadership in integrated powertrain systems.

Over 30 million kilometers of real driving conditions on buses have been monitored, showing that ASDS™ can eliminate up to 99 % of NO_x pollutants from vehicles, saving a total of 360 tons of NO_x. Faurecia also offers an ASDS™ solution for diesel passenger cars, in small cartridges of varying sizes, which can easily fit into the trunk or other available space. The solution can also be easily adapted to meet the industrial needs for cleaning intensive NO_x-generating processes.



Amminex

a Faurecia company

In June 2017, Faurecia won a contract to retrofit 20,000 buses and commercial vehicles in Seoul, Korea, following the successful adoption of ASDTM on 300 buses in Copenhagen, Denmark.

Faurecia is now looking to further develop the NO_x tracker linked to ASDTM to provide a real-time monitoring solution for emissions. Measuring actual NO_x removal per journey will give city authorities and mobility operators important real-time performance data to monitor whether they are meeting emissions-reduction targets, improving air quality and shedding light on where they need to focus attention. As part of its open innovation approach, Faurecia is currently exploring ways of delivering a more accurate measurement solution, drawing on its experience of testing equipment and procedures, as well as its leadership in integrated powertrain systems. Building on its commercial vehicle success Faurecia also offers an ASDTM solution for diesel passenger cars – called BlueFitTM – in a small-cartridge format of varying sizes, which can easily fit

in the trunk or other available space. This solution is also proposed in retrofit solutions to upgrade Euro 5 vehicles to reach Euro 6 NO_x levels and subsequently allow these vehicles to access to city centers. Finally the ASDTM solution can also be easily adapted to meet industrial needs for cleaning intensive NO_x-generating processes.



Other key CO₂ and NO_x reduction technologies

CO₂ emissions regulations for light vehicles have already imposed drastic reductions around the world, falling from above 180 g CO₂/km ten years ago to targets below 100 g CO₂/km for Europe, the US and China between 2021 and 2025. Faurecia offers different solutions to support the reduction in both CO₂ and NO_x, such as the following:

■ **Electric-heated catalyst:** an emissions control device able to accelerate the catalyst light-off, targeting near-zero-emissions for internal combustion engine.

■ **SCR BlueBox® Ultra-Compact mixers:** a family of Ultra-Compact mixers that enables more catalyst volume up to 0.5 L to improve the DeNox efficiency.

■ **Diesel/gasoline particulate filters** which improve air quality by removing particulate matter from diesel or gasoline vehicle exhaust to comply with the latest regulatory standards, especially in real life conditions.

■ **Low-pressure Exhaust Gas Recirculation for gasoline engines:** a technology that re-injects a precise amount of cooled engine exhaust gas back into the engine to improve combustion cycle efficiency, targeting up to 8 % fuel economy on highway conditions and 3 to 4 % on cycle.

■ **Compact Exhaust Heat Recovering System (EHRS)** which improve overall vehicle efficiency by recovering up to 75 % of exhaust heat for reuse in either warming up the vehicle cabin or heating the engine, providing up to 7 % fuel economy in cold conditions on hybrid vehicles.



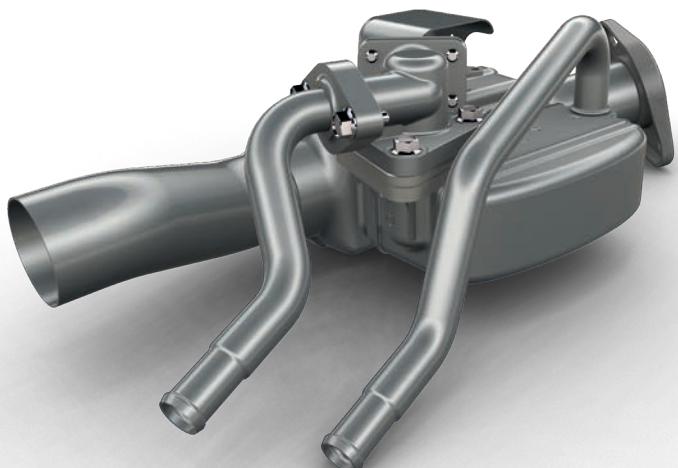
Composites, a key contributor to cleaner mobility

Composite solutions play a key part supporting manufacturers in improving the environmental and technical performance of the vehicles of tomorrow:

- Reducing the weight of all types of vehicle by up to 40 kg through the use of lightweight components
- Enhancing performance (e.g. thermal, mechanical, crash management and aerodynamics)
- Offering more flexibility in design and function integration

Composites are made from resins (matrix) mixed with fibers (reinforcement) made from glass, carbon or natural materials. When combined, they produce an exceptionally strong, stiff and lightweight material. Lighter and stronger than conventional steels and metals, composite materials can significantly contribute to reducing the weight of vehicles and CO₂ emissions (13kg less weight brings a reduction of 1 g of CO₂/km), as well as offering a range of technical functionality and design characteristics.

Faurecia is expanding the use of composite materials for a range of structural and semi-structural parts, as well as components for the interior and seats, for all types of powertrain – internal combustion engines, hybrids and electric and fuel cell vehicles. This will involve working further upstream with automotive manufacturers to integrate a mix of composite and metal components in the body-in-white manufacturing phase for more cost-effective design, assembly and function integration. Components made in composite materials will increasingly feature in key areas of the vehicle, including structural elements of the body-in-white (compliant with car manufacturers' production lines). ■



NOTES

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