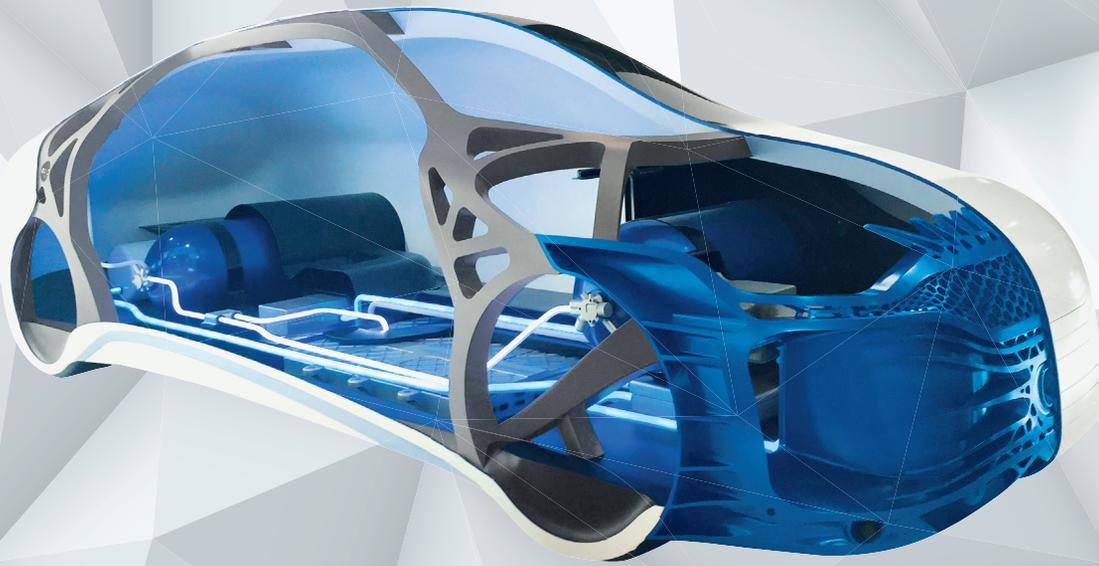


# INNOVATION AND AUDACITY





# #Innovators all

The car of the future – cleaner, safer and more connected – is being designed today. As a major partner of automakers around the world, Plastic Omnium is focusing its full attention on this endeavor and becoming a pure-play automotive supplier. Stepping up its strategy as an independent leader in technology, it is planning, innovating and investing. For Plastic Omnium, the future is nothing but opportunity.



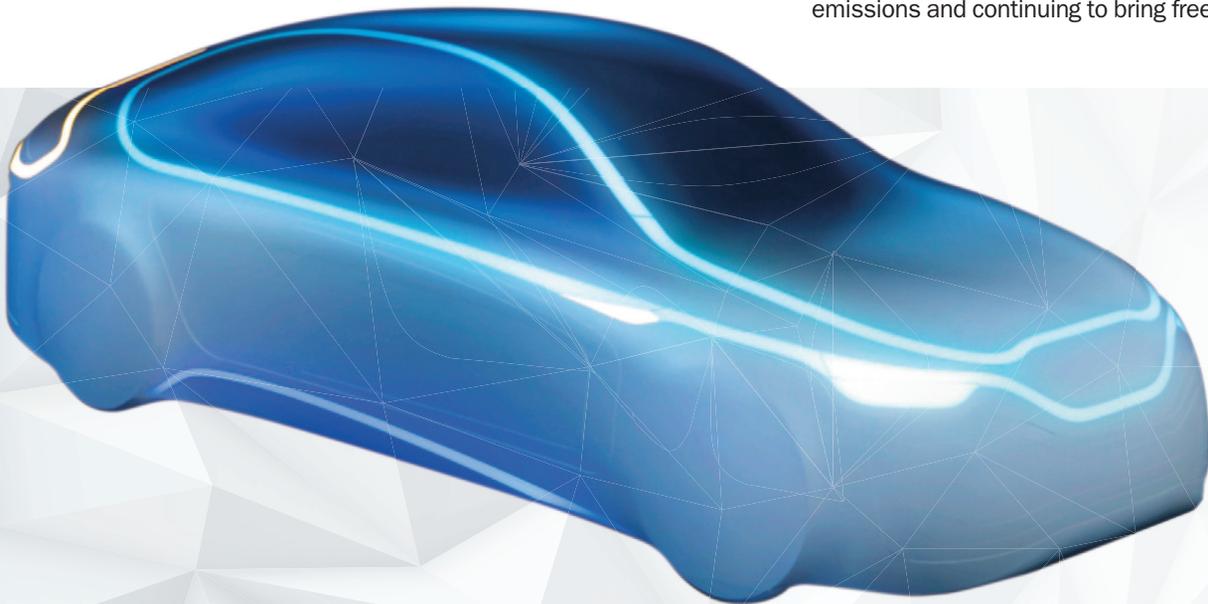
- 2 @Plastic Omnium
- 8 #innovatorsall
- 20 Product portfolio

# @PLASTIC OMNIUM INTELLIGENT EXTERIOR SYSTEMS

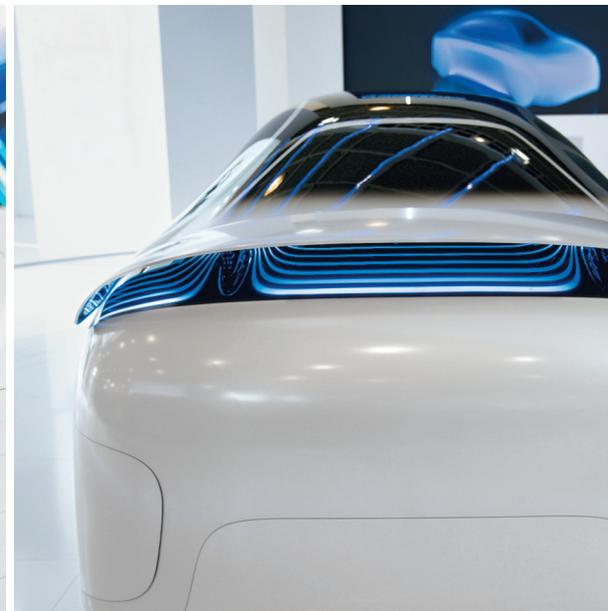
## Goal

Support  
the clean,  
connected car

The goal: to embed detection and connectivity systems in body parts while reducing their weight to cut CO<sub>2</sub> emissions and continuing to bring freedom to styling.



Technology  
embedded  
in materials



## Innovation

# Customized multimaterial solutions

Plastic Omnium is the world's leading producer of intelligent complex exterior components, including bumpers, shock-absorption systems, tailgates, spoilers, fenders and rocker panels. Plastic Omnium's **function integration** expertise, backed by the outstanding **electromagnetic transparency** performance of plastics, holds out infinite possibilities. At the front end, the Smart Bumper and its crash module integrate seven functions and cut 5 kg. In the rear, the tailgate made of new-generation materials includes interactive and aerodynamic systems that are revolutionizing driving and improving air quality.



# 1st smart bumper

tested and validated on vehicle



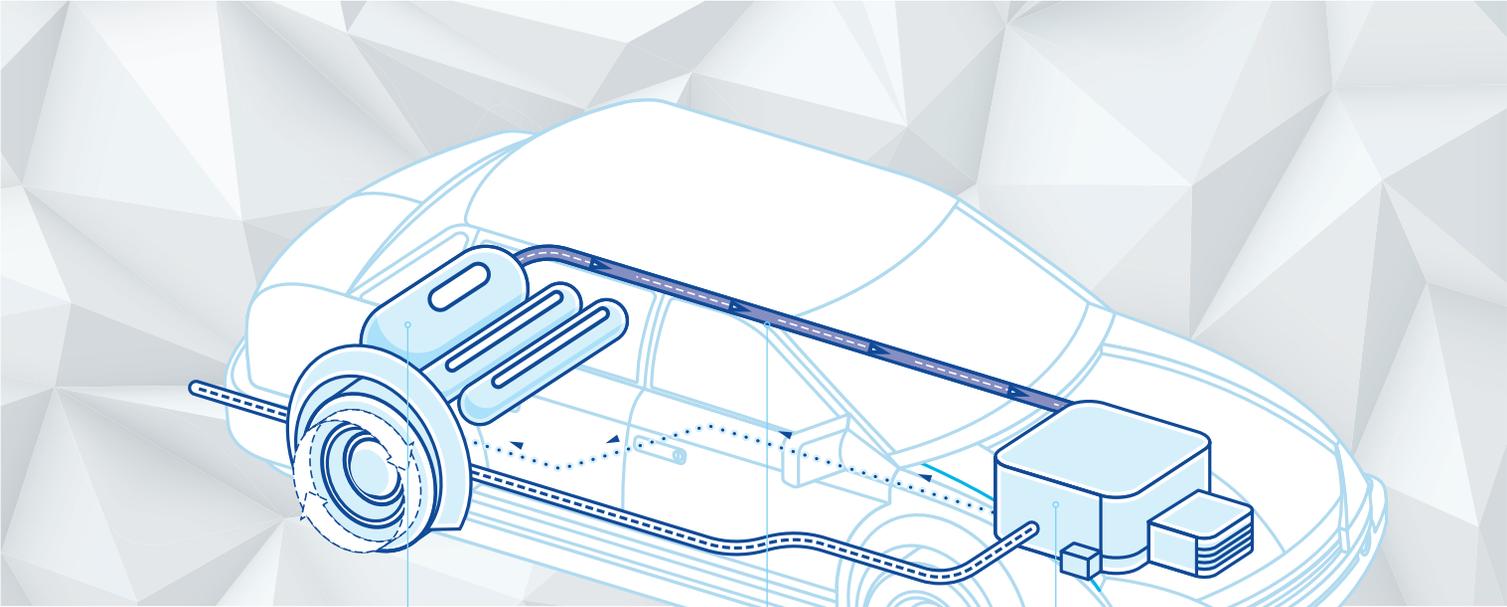
# @PLASTIC OMNIUM CLEAN ENERGY SYSTEMS

“Plastic Omnium is deploying its breakthrough innovation.”

Jean-Michel Szczerba  
Co-Chief Executive Officer

## Goal Position Plastic Omnium in electric vehicles

The most widely used fossil fuel solutions are also the most controversial. What will be the energy of the future? Electrification is being rolled out, but when will the all-electric solution be available? And what system will it use? We need to become part of the zero-emission ecosystem.



Hydrogen  
propulsion at  
three levels

Flow management

Hydrogen  
tank

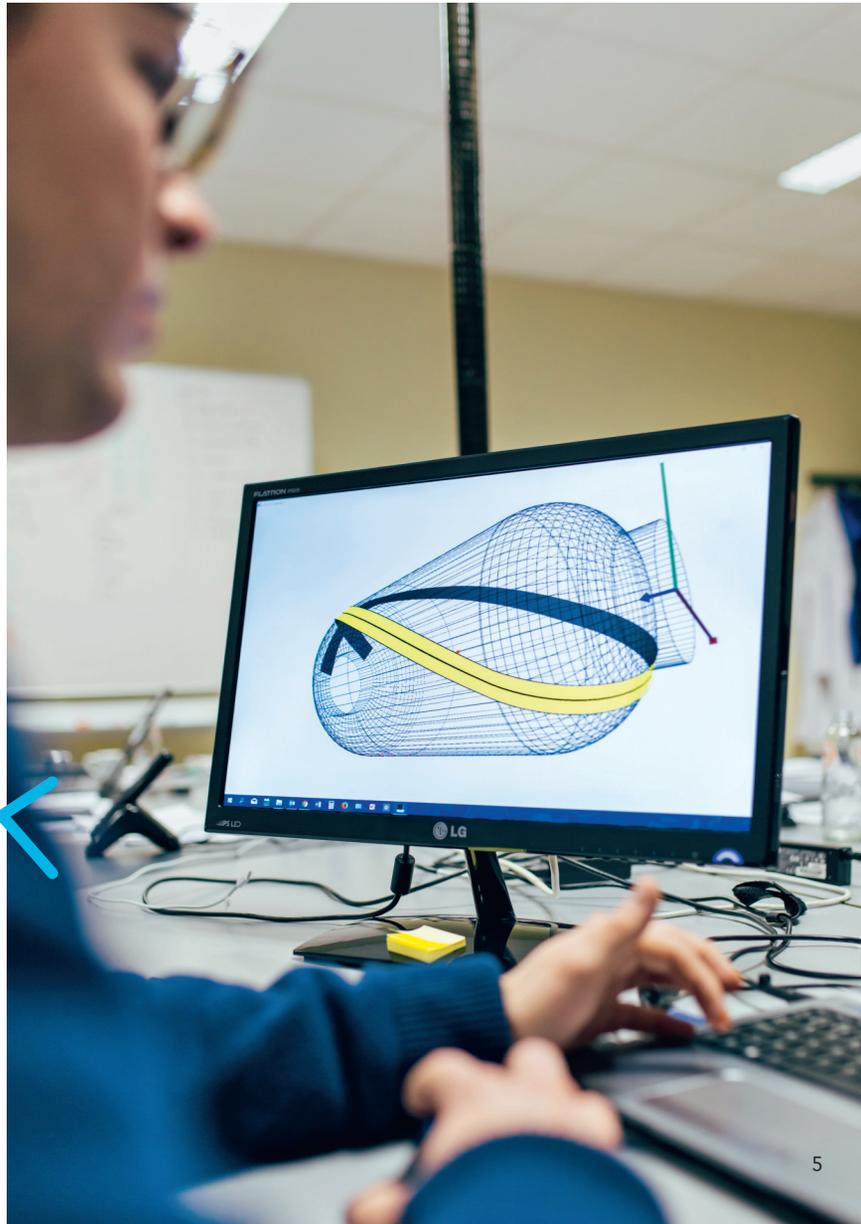
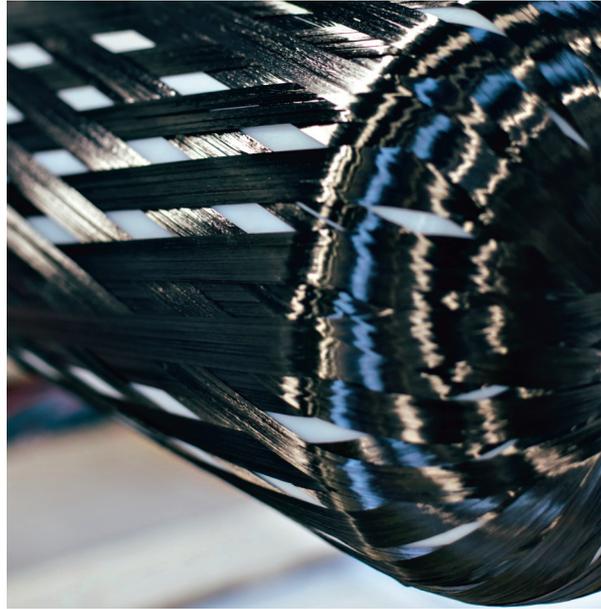
Fuel cell

## Innovation

# A proactive and productive strategy

As the world leader in clean energy storage systems, Plastic Omnium offers solutions for all types of propulsion. Its selective catalytic reduction (SCR) solution for diesel pollution complies with the most stringent diesel regulations. For gasoline vehicles, its water injection system optimizes consumption and emissions. Its new-generation systems support the growing use of plug-in hybrid vehicles. In the 2030 timeframe, automobiles will use **multipropulsion systems** in which Plastic Omnium solutions have a promising future. Beyond that horizon, the Group is preparing for a world in which fossil fuels might have entirely disappeared.

Over a five-year period of reflection, Plastic Omnium concluded that electricity is THE alternative solution, but not stored in a single battery. Instead, we are focusing on generating electricity within the vehicle via a fuel cell and **on hydrogen** as the energy source. This endeavor is now being stepped up with the creation of the New Energies business unit. Plastic Omnium has already taken positions in all three levels of hydrogen propulsion: the **tank**, with the first type approval in view and the acquisition of Optimum CPV, a specialist in pressurized hydrogen storage; the **fuel cell**, via Israeli joint venture EPO-Celltech; and **flow management**, with the acquisition of Swiss Hydrogen.

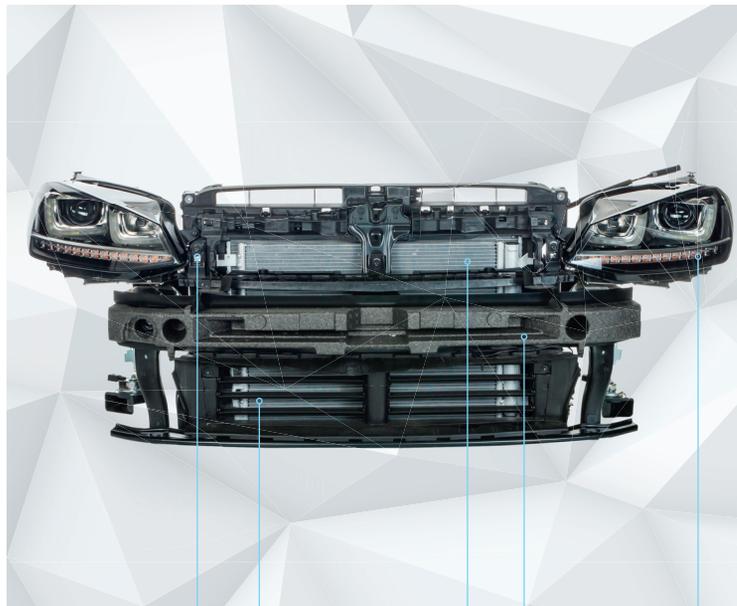


# 1st tank

currently under approval

# @PLASTIC OMNIUM COMPLEX MODULES

The all-in-one  
front-end module



Driving  
assistance  
radars and  
sensors

Engine  
cooling  
system

Controlled  
shutters

Shock-  
absorber  
beam

Lighting  
system

## Goal

# Write part of the automotive industry's future story

The car of the future will consist of just a few modules: from the front-end module, a complex assembly integrating the full range of functions, to the roof, hood and rear-end modules. The industry will move into the era of the highly customized, ready-to-assemble automobile.

## Innovation

# A decisive stake

HBPO is the **world leader** in the development, assembly and logistics of automotive front-end modules, with 18% of worldwide market share. Its assembly units located close to automaker factories provide just-in-time delivery of 6 million front-end modules per year.

After acquiring operational control of HBPO, the Group created **Plastic Omnium Modules**, an assembly business comprising 24 sites in 11 countries and offering the critical mass and technological expertise to place Plastic Omnium in the vanguard of smart modular products.



6 million

front-end modules assembled  
per year





# #innovatorsall

Innovation is the leitmotiv running through the history of Plastic Omnium and making up the DNA of its generations of engineers. We welcome the ideas and enthusiasm of those who are passionately interested in embedded technology, alternative energy and industry 4.0.



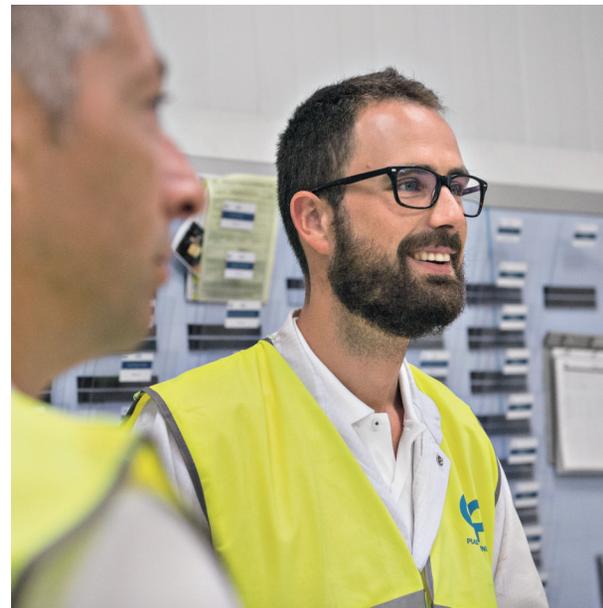
# INNOVATION: A MINDSET

## The PO culture that drives our success

With the multiple challenges facing the automotive sector – diesel crisis, stringent emission regulations, connectivity and competitiveness are just some – the industry needs to reinvent itself, make choices, take risks, invest fearlessly and move fast. This is just what Plastic Omnium has been doing for 70 years. Our ‘PO Way’ brings together our 31,000 employees, from the chairman to the operator, from Europe to China. To tackle the broad range of complex challenges facing the industry, Plastic Omnium is marshalling its ideas and initiatives and joining forces with academia and disruptive startups to co-construct tomorrow’s intuitive and responsible mobility. Plastic Omnium is placing the bar high: we want to be the technology leader of choice for automakers while remaining an independent company in which talent can come into its own.

## The first Innovation Awards

Many innovative projects emerge within the Group. Plastic Omnium therefore decided to recognize the people behind them and initiate a new competition. Starting in 2019, the Group will present awards for the best innovations in three categories: products, operational excellence, and open innovation for projects developed in partnership with laboratories, startups and/or universities. All employees across all divisions, functions and countries may take part, individually or in a team. The idea is not to create a suggestion box but rather to set up a technological innovation accelerator. Prizes will be commensurate with that goal: winners will be appointed “Innovation Ambassadors” for a period of one year and embark on the kind of learning expedition that all talented people dream of – the international Consumer Electronics Show (CES), Open Lab and other pathways to the future.





“We do our utmost to release creative energies and make the most of them.”

**Damien Degos,**  
CEO, New Energies

“Every time we build a factory we use the opportunity to fine-tune processes and flows.”

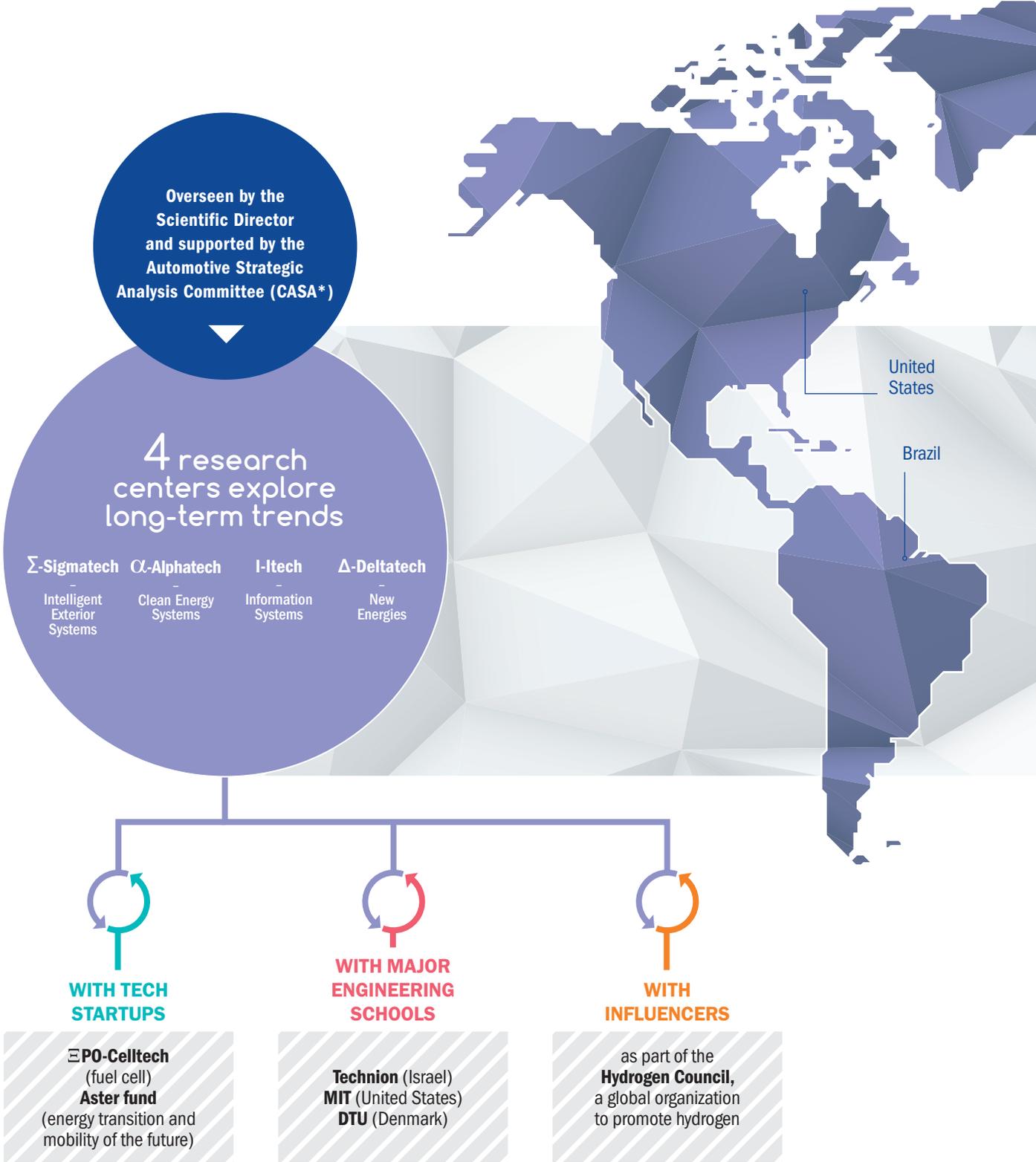
**Christian Kopp,**  
CEO Asia,  
Clean Energy Systems

“Innovation is a matter of choosing to work with each other.”

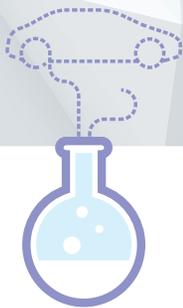
**Ronan Stephan,**  
Scientific Director  
of Plastic Omnium



# INNOVATION: AN ECOSYSTEM



\* CASA: Comité d'Analyse Stratégique Automobile.



24

R&D centers

3,500

engineers

6%

of revenue invested

AROUND

3,400

patents in the portfolio

# INNOVATION: NEW BUSINESS LINES

## Exploring plastronics and mechatronics

Plastronics, a new discipline situated halfway between plastics and electronics, makes it possible to embed sensors and antennas in body parts, expand their content and enhance their value. In doing so, plastronics is transforming the production of smart components into the design of advanced mobility solutions and holding out prospects for exciting careers.

Mechatronics is at the intersection of mechanical engineering, electronics and connected systems. This discipline makes it possible to design industrial production systems, such as pressure regulation monitoring and control, and is writing a new chapter in the industry 4.0 revolution.

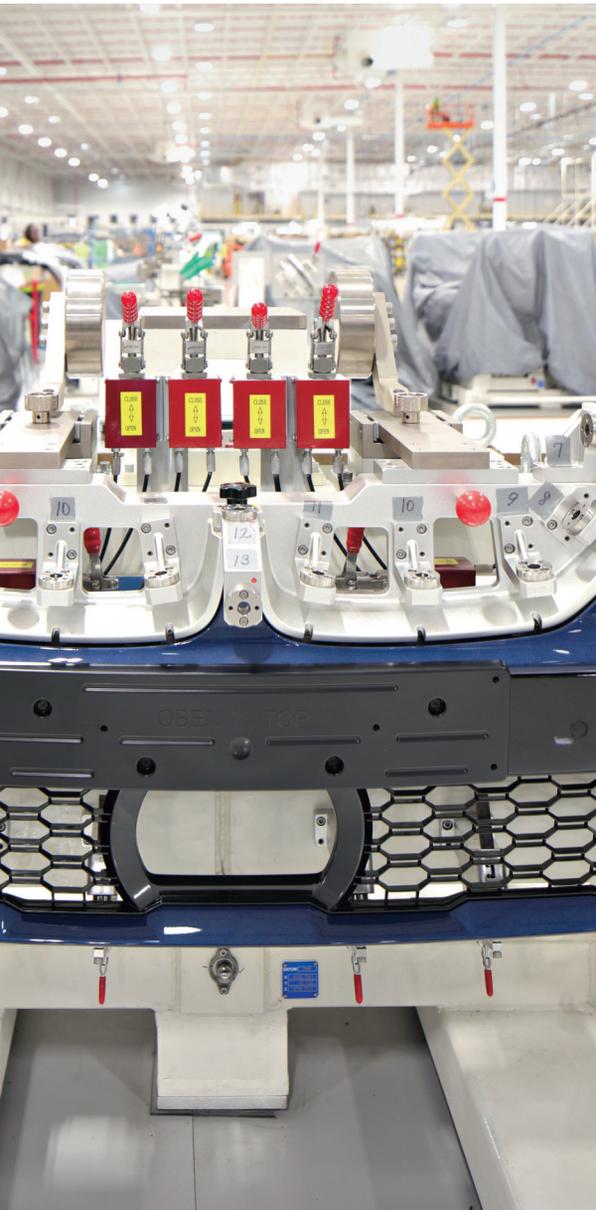
## Progress in electrochemistry

Electrochemistry, which straddles chemistry and electricity, studies phenomena relating to exchange of electrical energy. This gives the discipline a broad range of applications, from biology to energy storage and the behavior of materials. Increasing vehicle electrification has prompted the automotive industry to embrace the science. As an industry pioneer, Plastic Omnium has moved to focus on electricity, recruiting experts in electrochemistry, concentrating on fuel cell technology and stepping up research in this type of propulsion, which heralds the post-combustion era.



“Aerodynamic research is more critical than ever. It calls for multidisciplinary teams combining design, propulsion, electronics and systems engineering.”

**Julien Jacomy**, active aerodynamic product line Manager,  
Plastic Omnium Intelligent Exterior Systems



## Notice to innovators

Data analysis, software and diagnostic engineering, and digital manufacturing are new fields calling for new skills. Plastic Omnium is developing them in-house and recruiting young engineers trained in disruptive technologies to focus on development of such things as smart embedded systems and hydrogen fuel cells. Work in open teams with laboratories and universities on basic research and with technology partners on breakthrough projects make assignments exciting and accelerate discoveries.

“The clean energy adventure has only just begun. There are many challenges and Plastic Omnium gives us the resources needed to tackle them.”

**Julien Schweicher**, electrochemical research Engineer,  
Plastic Omnium Clean Energy Systems



# INNOVATION: A NEW DIMENSION

Pioneering hydrogen  
propulsion



2013

- Plastic Omnium decides to focus on hydrogen



2015

- Launch of fuel cell R&D
- €200 million invested between 2015 and 2020



2016

- Creation of the  $\Xi$ PO-Celltech (Israel) joint venture



2017

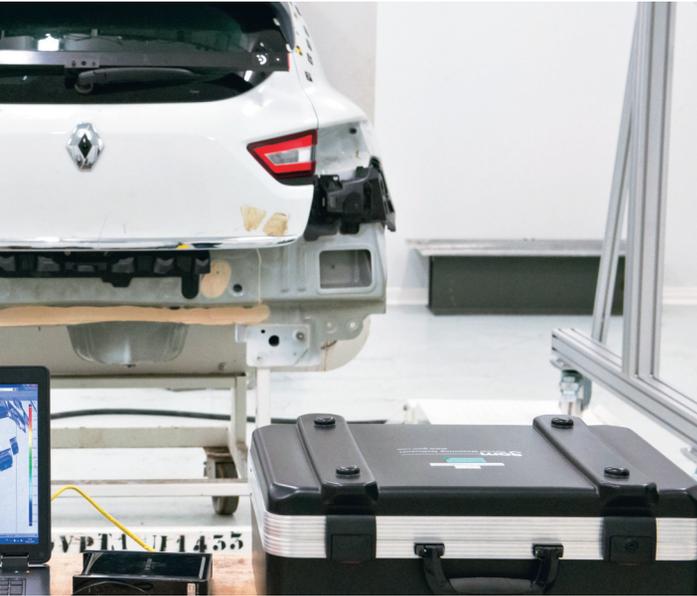
- Strategic manufacturing acquisitions:
  - Optimum CPV (pressurized tanks)
  - Swiss Hydrogen (flow management)
- Membership in the Hydrogen Council
- Investment in the Aster fund, dedicated to energy transition



## $\omega$ -Omegatech, the Plastic Omnium flagship in Asia

Wuhan is already an industrial hub for Plastic Omnium. The Group opened its first factory in China here in 2008. Ten years later, there are 3 factories with 650 employees in the area. Here, the Group is also building a **Clean Energy Systems** testing and development center for Asia,  $\omega$ -Omegatech. Starting in 2019, specific innovations for Asia will be developed here.





## The future of Intelligent Exterior Systems is being written at $\Sigma$ -Sigmatech

The international  $\Sigma$ -Sigmatech exterior systems R&D center is being expanded from 16,000 to 24,000 square meters; it will be redesigned to foster creativity and agility, and equipped with new research resources. The center will comprise pilot lines as well as design offices and a laboratory for exploring plastronics and mechatronics; it will take an Open Lab approach to work with academic and startup partners, and use collaborative tools to share discoveries throughout the worldwide network of engineering centers.



2018

- Creation of a dedicated New Energies business unit
- Type approval of the first hydrogen tank



2019

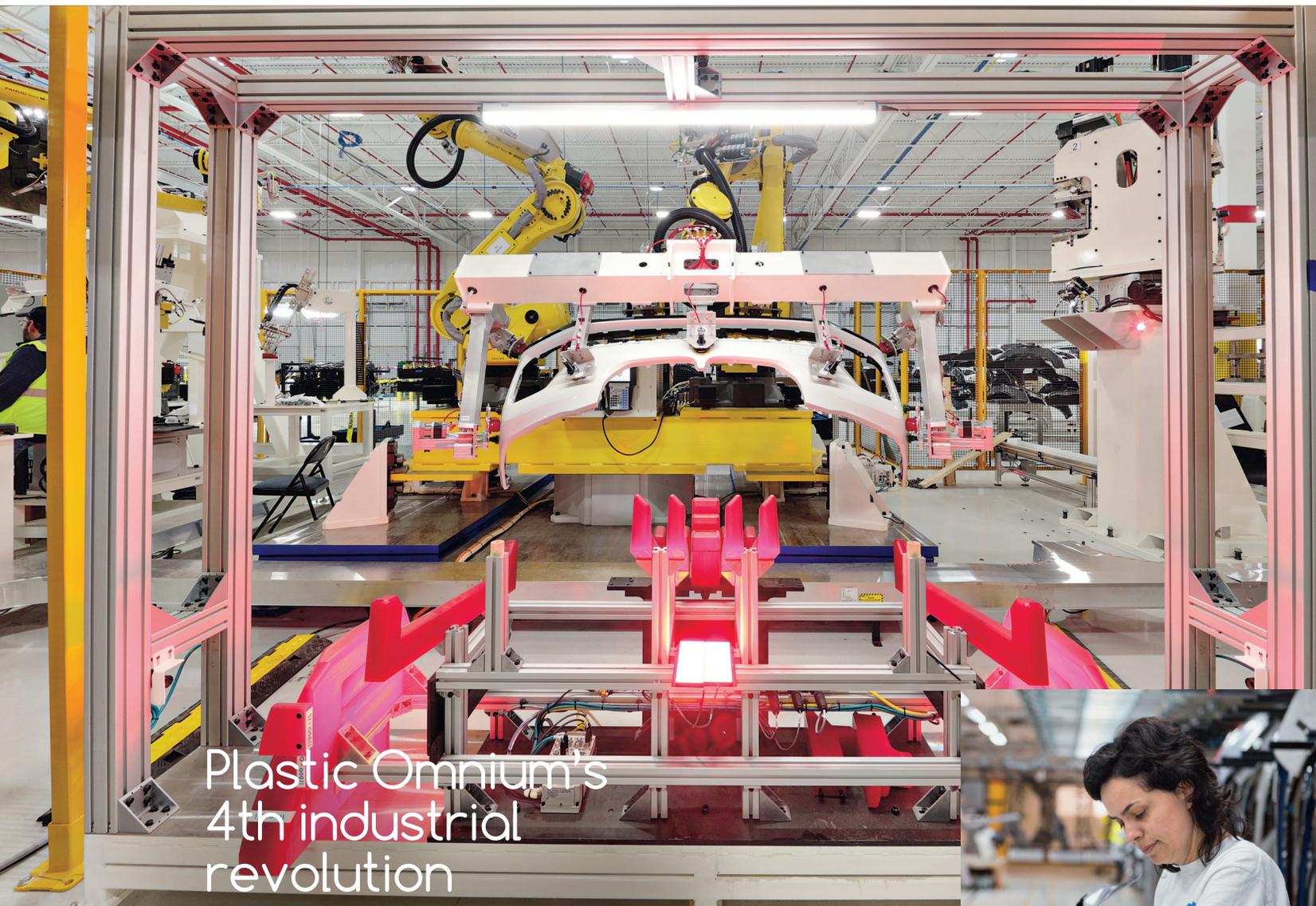
- Inauguration of the dedicated  $\Delta$ -Deltatech research center (Brussels),  $\Omega$ -Omegatech and  $\Sigma$ -Sigmatech



## $\Delta$ -Deltatech, the New Energies research center

In mid-2019, Plastic Omnium will open an advanced research center in the north of Brussels that will be dedicated to new energies. Called “ $\Delta$ -Deltatech”, this high temple of innovation will require investment of €50 million and employ 150 researchers who will make Plastic Omnium a key player in future clean energy systems.

# THE FUTURE WILL BE 4.0



## Plastic Omnium's 4th industrial revolution

The series of technologies now arriving at maturity is known as industry 4.0. It includes big data, advanced robotics, augmented reality and industrial IoT, as well as vertical (suppliers, customers) and horizontal (partners) integration, the cloud and data management. Plastic Omnium is rolling out initiatives in all these areas.

**Some 10 concepts** have been identified in the market and tested in all our factories around the world to validate the technology and partners before proceeding further.

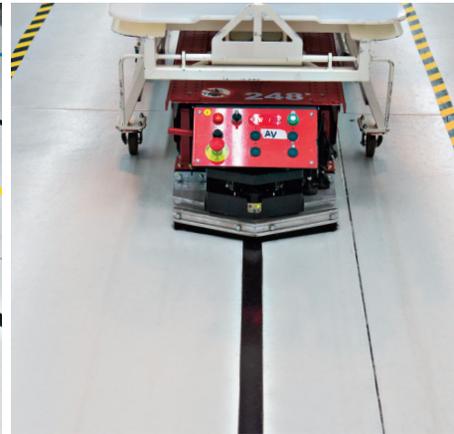
The second focus of the approach is a full **4.0 pilot plant**.

A **wave of initiatives** is accelerating the transformation around the world.



# Greer, the pilot plant

The Intelligent Exterior Systems plant in South Carolina uses industry 4.0 to prove that the whole is superior to the sum of innovations. One of the main goals is to manage behavior change across the board, from the operator to the plant manager, and for the whole team made up of 25% new employees. Starting up Greer 4.0 is a challenge observed by the entire Group around the world. A total of €150 million have been invested in Greer over the past two years to bring about cultural change and kick start a performance boost that will be applied across the entire Plastic Omnium industrial fleet within three to four years.



“Industry 4.0 boosts capabilities across the board. The operator takes control, the manager coaches the operator and the engineer focuses on innovation.”

**Pierre-Henri Desportes**, Industry Director, Intelligent Exterior Systems

## THEIR OWN CART

In keeping with the Group’s entrepreneurial culture, the move to industry 4.0 has touched off a series of spontaneous initiatives in all Plastic Omnium plants. Engineers at Greer, for example, developed a cart to move a part from operator to operator and hand it to them with an “in-house” grab. A patent is being filed for the process, which took nine months to develop.







# Product portfolio

Our automotive customers receive the best of what Plastic Omnium has to offer: patented state-of-the-art solutions and just-in-time delivery of premium-quality products that herald the clean, smart, multipropulsion car of the future.



# A RANGE OF INTELLIGENT EXTERIOR SYSTEMS

High-value-added, multimaterial solutions covered by 2,204 patents



## Bumper systems

- Styling freedom
- High-quality, diverse finishing
- Weight reduction
- Function integration and modularity
- Safety



## Spoilers and exterior components

- Styling freedom
- High-quality finishing
- Aerodynamics
- Function integration



## Tailgate systems

- Styling freedom
- High-quality finishing
- Weight reduction
- Function integration and modularity

30

million bumpers produced a year

1 in 6

1 vehicle in 6 produced worldwide is equipped with a Plastic Omnium bumper

5 kg

The weight saving with the new bumper and its shock-absorption module, reducing CO<sub>2</sub> emissions by 0.5 g/km

Embedded intelligence (Lidar, radar, ACC) helps ensure driving safety and will in future support self-driving vehicles

Integrated signature lighting system based on flexible optical fibers

Active aerodynamic system that optimizes drag coefficient and engine or battery cooling to reduce CO<sub>2</sub> emissions by 2 g/km

Front panel combining esthetic quality, electromagnetic transparency and de-icing system

Shock-absorption system in high-performance materials



## SMART BUMPER

### A bumper that communicates with its surroundings

With its hidden radars, signature light system, innovative front grille and shock-absorption system, the Plastic Omnium bumper combines stylishness, technology, safety and environmental performance to provide more autonomous, safer and cleaner driving.

## SMART TAILGATE

### A tailgate that communicates with the driver

With its touch & open system and message display panel, the Plastic Omnium tailgate combines personalization, interactive operation, safety and aerodynamics to provide a more user-friendly, smarter, safer and more efficient vehicle.

Active roof spoiler reduces CO<sub>2</sub> emissions by 1.2 g/km

Touch & open system using conductive paint

LED screen boosts safety by enabling the vehicle to interact with other drivers

Rear diffuser reduces CO<sub>2</sub> emissions by 1 g/km



# A PALETTE OF CLEAN ENERGY SYSTEMS

Solutions for all types of engines, covered by 1,190 patents



## Fuel storage systems

With its light-weighted materials, high permeability performance, embedded mechatronics and electronics and smart systems, Plastic Omnium meets the multiple needs of automotive manufacturers for different engine types, whether for conventional, hybrid or plug-in hybrid systems, and combining internal combustion and electric power. The Inwin and Tanktronic® solutions for hybrid systems are covered by 64 patents.



## Pollution reduction systems

with embedded intelligence to limit polluting emissions. Plastic Omnium's SCR system cuts NOx emissions by up to 95% and is covered by 172 patents. The water injection system for gasoline engines reduces CO<sub>2</sub> emissions by up to 15%.



## New energies

A hydrogen storage system supplies a fuel cell that generates electricity. Plastic Omnium's high-strength carbon fiber tank combined with the fuel cell delivers a driving range of 800 km with just 3 minutes charging time, and mobility with zero polluting emissions.

# 22

million fuel storage systems produced a year

# 1 in 4

1 vehicle in 4 produced worldwide is equipped with a Plastic Omnium fuel storage system

# 15%

The water injection system reduces CO<sub>2</sub> emissions by nearly 15%

Carbon fiber (95%) and glass (5%) outer case

Interior thermoplastic cylinder

Temperature and pressure valve



## HYDROPACK

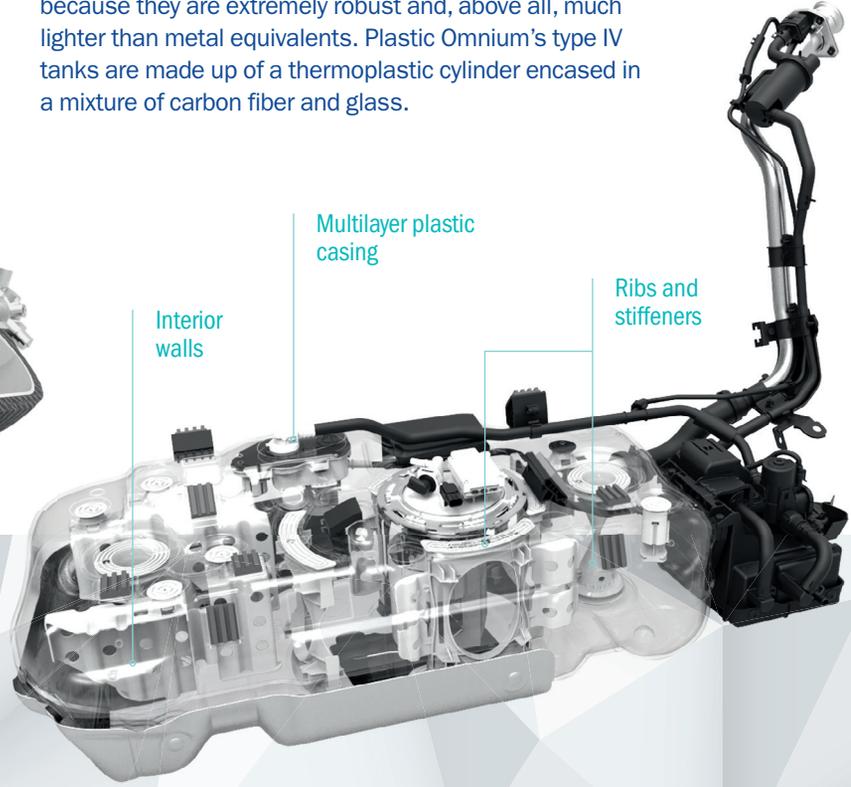
### The hydrogen tank

An outcome of space technologies, composite materials are an ideal solution for storing hydrogen in cars because they are extremely robust and, above all, much lighter than metal equivalents. Plastic Omnium's type IV tanks are made up of a thermoplastic cylinder encased in a mixture of carbon fiber and glass.

Multilayer plastic casing

Interior walls

Ribs and stiffeners



## TANKTRONIC®

### For plug-in hybrids

With its controlled valve, embedded electronics, integrated stiffeners and innovative production processes, Plastic Omnium's high-tech gasoline tank meets the specific requirements of plug-in hybrid vehicle engines.

Quality and pressure sensor

## HYDROPOWER

### To reduce gasoline emissions

Hydropower is equipped with a controlled water injection pump capable of delivering a small amount of water to the engine in order to reduce its temperature and therefore its fuel consumption. This Plastic Omnium technology also includes a heating system and a bleeding system for perfect running under all vehicle operating conditions. In addition, antibacterial treatment guarantees the purity of the stored water.



Water injection pump

Injection calculator

High-performance silicone heater

# CUSTOMIZED COMPLEX MODULES

## Complete modules for customized assembly

To meet the increasing demand for customization, automakers are seeking to reduce the complexity of their models in order to save R&D resources. Plastic Omnium meets both objectives with its front-end module expertise. As world leader via its subsidiary HBPO, it is the only front-end module supplier to deliver the full process, from design to logistics, just-in-time delivery and assembly.



### Technical front-end modules

The front-end module is a complex assembly that includes, based on the technical front panel, the shock-absorption beam, lighting and engine cooling systems, controlled grille shutters, radars and driver assistance sensors.

6

million front-end modules  
assembled every year

1 in 5

assembled front-end  
modules is an  
HBPO module

UP TO  
70

assembled parts  
in a module

UP TO  
3,000

possible assembly  
combinations for any one  
vehicle



**Cooling module**

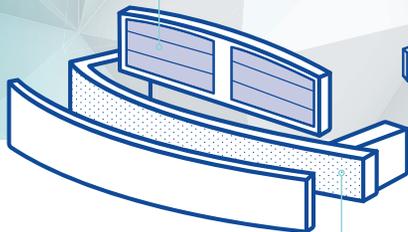
Combining performance and strength, the cooling module offers a broad diversity of integrated functions suited to every type of engine

**Optical compartment**

State-of-the-art assembly solutions to integrate and optimally align the headlights

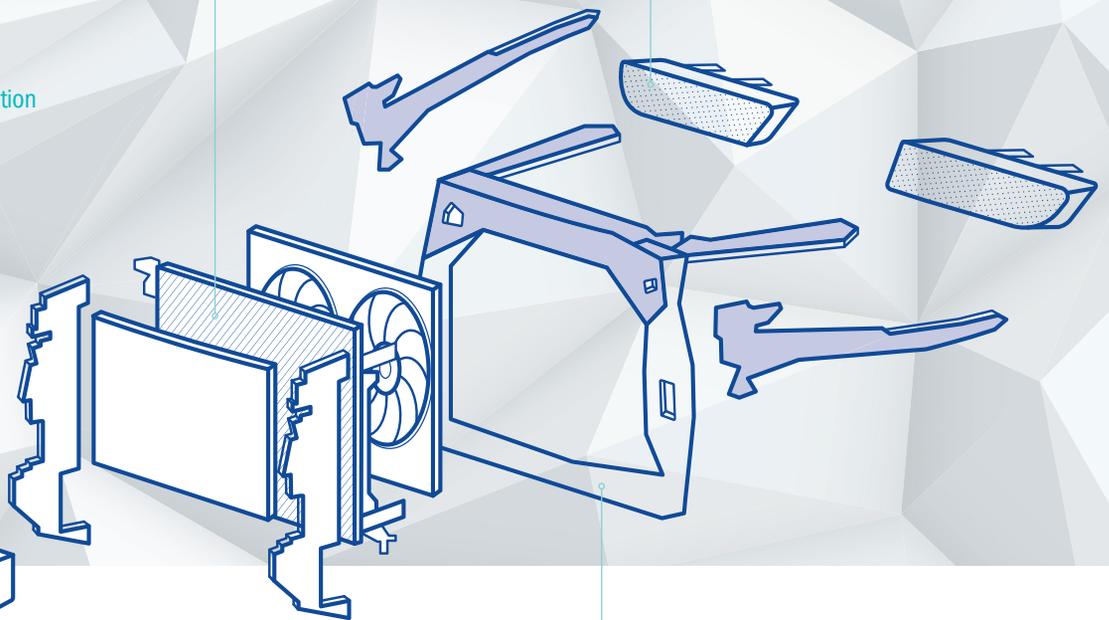
**Controlled shutters**

Aerodynamic systems optimize fuel consumption and thus reduce CO<sub>2</sub> emissions by 2 g/km



**Shock-absorption system**

Structural component designed to absorb shocks and optimize pedestrian safety



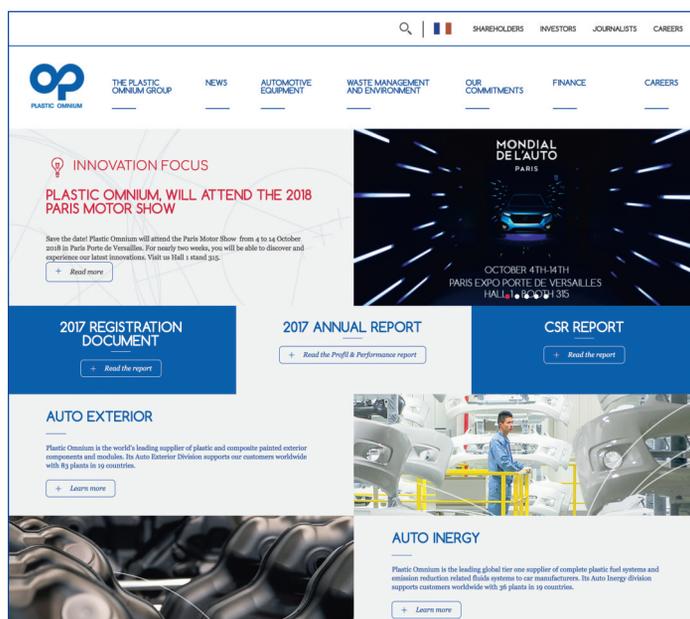
**Technical front panel**

Structural component integrating the full range of functions assembled in the front-end module, with optimized design that reduces weight by 1.5 kg

# FIND OUT MORE

## Read our latest news

[www.plasticomnium.com](http://www.plasticomnium.com)



## Follow us

 @PlasticOmnium

 [linkedin.com/company/plastic-omnium](https://www.linkedin.com/company/plastic-omnium)

## Download the app



Plastic Omnium IR is available free of charge from App Store and Play Store so you can follow our share price in real time and read our latest financial news.



1, allée Pierre-Burelle – 92593 Levallois-Perret Cedex – France  
Tel.: +33 (0)1 40 87 64 00 – Fax: +33 (0)1 47 39 78 98

[www.plasticomnium.com](http://www.plasticomnium.com)

**COMPAGNIE PLASTIC OMNIUM**

Incorporated in France with limited liability and issued capital of €8,991,966.42  
Headquarters: 19, boulevard Jules-Carteret – 69007 Lyon – France  
955 512 611 RCS Lyon – APE: 6420 Z

Plastic Omnium would like to thank everyone who contributed to this document.  
It is also available in French and on our website.

Design and production:  havas *paris*

Photo credits: Céline Clanet/Interlinks Image; Justin Jin/Interlinks Image;  
Studio Reel Video and Stills in Greer/Brian Erkans; Plastic Omnium photo library; X, all rights reserved.

September 2018.



1, allée Pierre-Burelle – 92593 Levallois-Perret Cedex – France  
Tel.: +33 (0)1 40 87 64 00 – Fax: +33 (0)1 47 39 78 98

[www.plasticomnium.com](http://www.plasticomnium.com)