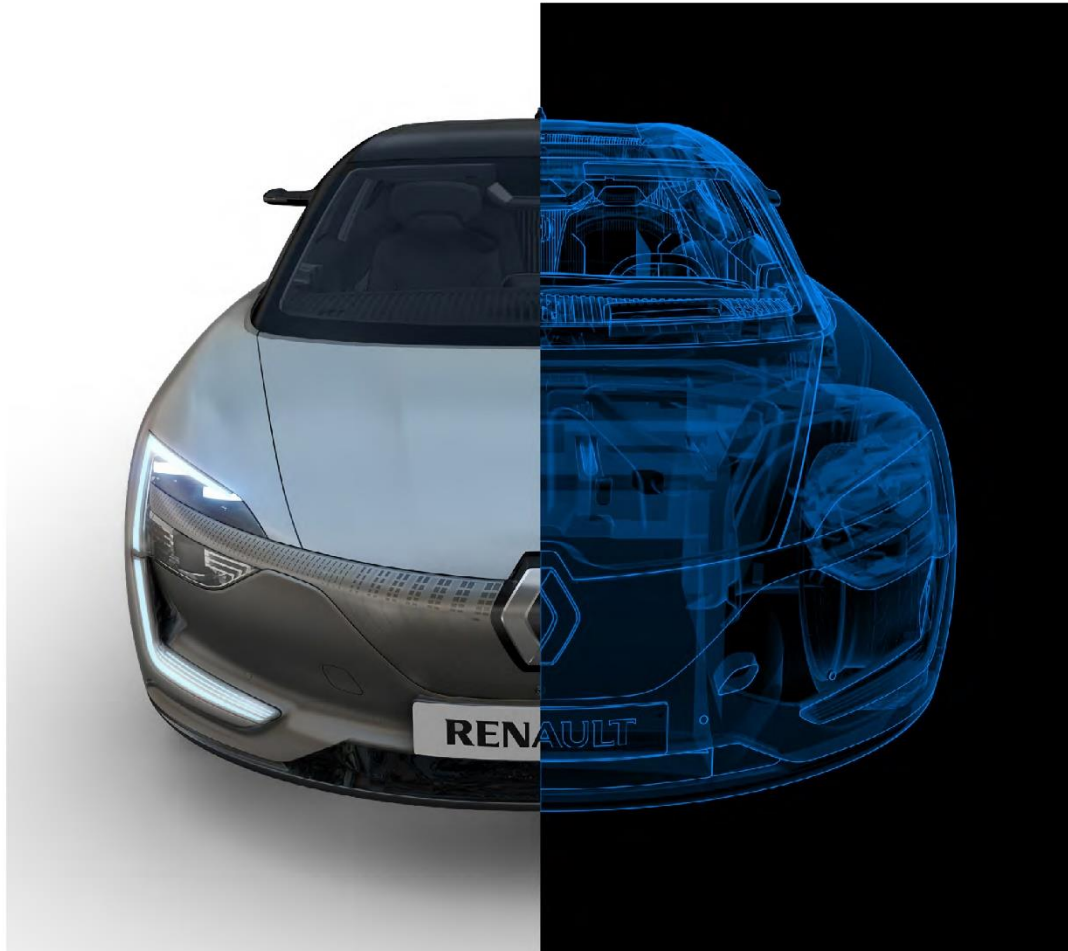


# RENAULT SYMBIOZ DEMO CAR



**GROUPE** RENAULT



## Renault SYMBIOZ: Experience tomorrow today – autonomous, electric and connected

- We are on the cusp of making history. Imagine you set out on a journey to work or for leisure, strapped inside a bullet – that accelerates as fast as a sports car, but quietly –allowing you to take your mind off the road ahead. You're surrounded by concert-quality sound and cinema-quality screens. You arrive relaxed. Caught up. Entertained. Is this the future? Renault thinks so. But we're providing a taste of it today with the SYMBIOZ demo car.
- After unveiling a vision for 2030 with the concept car and house SYMBIOZ at the Frankfurt Motor Show in September 2017, Renault is now giving journalists the chance to climb on board SYMBIOZ demo car, the first rolling prototype built to be autonomous from the ground up and to give us a more near-term experience to 2023.
- The SYMBIOZ demo car road tests provide Renault with the opportunity to demonstrate in real-life conditions a car that is autonomous, electric and connected. The result is a whole new life-on-board experience and as much pleasure while driving as with hands off the steering wheel. In SYMBIOZ, the driver can automate driving and use travel time for other activities. We believe car travel will become a multi-sensory, personalised experience, with a cabin reconfigured differently for each driving mode. The car becomes part of the personal ecosystem for both driver and passenger.

*"You cannot re-imagine the future of mobility until you've been in the SYMBIOZ demo car. Our engineering and design teams have pushed into the next decade with an autonomous car that lets you experience a new kind of mobility. Electric and connected, this working concept car is designed from the outset to challenge old paradigms about getting from place to place. We're excited to show the world our vision – and to let them sample the future of Renault."*

**Gaspar Gascon Abellan** – Executive Vice President, Product Engineering, Groupe Renault

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# Renault SYMBIOZ demo car: The Car

*“Technological advances in autonomous driving open up new opportunities for ways of using cars, especially new travelling experiences. The SYMBIOZ demo car is the first vehicle that has been designed for mind-off automation from the start. On authorised highways, the driver can fully delegate driving and concentrate on other things. This exploratory exercise has helped us to envisage what the future will look like for car occupants. As such, it’s been a really important and inspiring learning experience for our engineering and design teams.”*

**Mathieu Lips** – Director, SYMBIOZ demo car project

## Advanced, Level 4 autonomous driving for additional free time

Autonomous cars use technology that is new to the industry. One of the goals of the SYMBIOZ demo car is to enable Renault to make the transition from theory to practice, to allow its engineers and designers to address the many challenges and opportunities presented by autonomous driving.

- From base level driving assistance like cruise control to full driving automation in any roads, SAE International\* has defined five levels of autonomous driving. The SYMBIOZ demo car is capable of reaching Level 4, also known as ‘mind-off’.
- Level 4 frees the driver from all dynamic driving tasks when the car’s automated driving system is switched on. It is no longer necessary for the driver to concentrate on the road ahead. The car is capable of moving into a safe position if it cannot deal with an unexpected incident ahead.
- On authorized highways or dual roads with a median strip, a Level 4 autonomous car like SYMBIOZ demo car can adjust the vehicle’s speed in accordance with the car in front, stay in its lane even when cornering, change lanes (i.e. to overtake another car or exit the highway) and function alone in traffic jams.

Level 4 driving automation is currently not permitted under French road rules. However, France’s road authorities (and similar organisations in other countries) allow trials to take place if someone is travelling in the car and can supervise the autonomous drive mode. This person needs to be able to take back control of the vehicle at any time. The SYMBIOZ demo car road tests will be conducted under these provisions.

*\*US-based international organization specialized in standardization in transport industry*

## All the enjoyment of a Zero Emissions vehicle

The SYMBIOZ demo car is powered by all-electric motors, as you would expect from Renault, the pioneer of mass-market electric vehicles in Europe and Europe’s number one seller of electric vehicles.

- The two electric motors powering the SYMBIOZ demo car are located on the rear axle, with each motor driving one wheel. This rear-wheel drive system ensures that power is fed to the road more efficiently to enhance driving pleasure.
- Driving sensations are also improved with the 4CONTROL all-wheel steering system, which brings outstanding roadholding.
- SYMBIOZ demo car delivers maximum power of 500kW and 660Nm peak torque (360kW and 550Nm continuous).
- The car provides acceleration from standstill to 100kph in 6 seconds.
- The 700V power supply enables a greater ramp-up in power.
- SYMBIOZ demo car comes with a 72kWh battery pack. The vehicle architecture can accommodate batteries with a capacity of up to 100kWh.
- The car’s batteries are charged via a cable plugged into a fast-charging point with a continuous current power supply.
- During the road tests, the SYMBIOZ demo car will be charged at a charging point reaching 150kW at certain times.
- The batteries can then be charged to 80 percent of their capacity in less than half an hour.

*Zero CO<sub>2</sub> emissions and zero emissions of regulated pollutants during road use, in compliance with NEDC, excluding wear parts.*

## Innovative, people-focused design

An offshoot of the SYMBIOZ concept car unveiled at the Frankfurt Motor Show, the SYMBIOZ demo car is a new kind of vehicle redefining the concept of space in the cabin. The autonomous functions of the car and the activities they allow on board are the starting point for design considerations.

- The innovative exterior design perfectly matches Renault 'French Design' styling: it is sensual and warm with fluid lines and a dynamic stance.
- The design is accentuated by the 'Champagne' body colour and pearlescent finish.
- As a low-slung, one-box car with sporty looks, SYMBIOZ demo car is:
  - 4.92 metres long
  - 1.92 metres wide
  - 1.44 metres high
  - mounted on a wheelbase of 3.07 metres
- The car's steeply raked windshield accommodates new interior features such as a horizontal layout and storage areas on the dashboard.
- The car's upper section boasts a vast glazed surface to let ample light into the cabin and optimise outside visibility without detracting from the impression of robust strength.
  - The floating glass roof takes on an iridescent appearance.
  - It features a system to adjust the opacity of the glass and the LED lighting that can be accessed from the Renault MULTI-SENSE 3.0 system interface.
- To improve the car's efficiency, the SYMBIOZ demo car is fitted with a range of all-new aerodynamic features:
  - Vertical air intakes in front of the front wheels and extractor vents behind them to reduce drag and turbulence.
  - Side wind deflectors channel airflow as close as possible to the car body.
  - Roof spoiler deploys automatically in the Dynamic mode.
  - The side wind deflectors house sensors that can unlock and open the rear doors and a third brake light is built into the wind deflector located on the roof.
- The SYMBIOZ demo car's exterior styling incorporates various sensors for autonomous driving:
  - Lidars concealed in the front head lights and rear bumper
  - Radars and ultrasound sensors positioned behind the bodywork
  - Front camera in the upper part of the windshield; rear camera built into the Renault diamond logo
  - Lateral cameras hidden in the door handles
- The model's exterior lighting signature includes C-shaped lights both front and rear, carrying this hallmark Renault design into the future.
- To assert its personality, the SYMBIOZ demo car lights up in blue when autonomous drive mode is activated, also making it easy for surrounding cars to know it is operating in this mode.

The exterior lines of the SYMBIOZ demo car were also designed to showcase the interior, with its many design features devoted to travelling comfort.

- The cabin layout has been flexibly designed to accommodate the car's different driving modes and Level 4 'mind-off' automation, allowing the driver to stop paying attention to the road and do something else. For example:
  - There is no centre console.
  - The air vent system has been redesigned to achieve a flat floor all the way through to under the dashboard.
  - The storage areas in the dashboard have been moved to free up space on the sides.
  - The door panels have been optimised with built-in lighting.

- The SYMBIOZ demo car boasts a living-room-style cabin with a focus on safety and comfort in the individual seats for each passenger.
  - The front seats offer a degree of modularity never previously seen in a car: the RELAX layout features a 'zero gravity' seat position and in LOUNGE layout the front armrests automatically drop down and the seats turn 10 degrees towards the inside.
  - The rear of the cabin has been designed as an alcove, with a concealed rear window for greater privacy.
- The cabin layout of the SYMBIOZ demo car changes automatically according to the driving mode selected.
  - In the *AD* mode, the steering wheel and dashboard move back 12 centimetres to free up space in front of the driver.
  - In the *Dynamic* mode, the driver's seat features additional lateral support for a bucket seat feel.
- The L-shaped digital display developed by LG saves cabin space while also providing new features.
  - It comprises three customizable OLED screens, which display information in real time about driving, navigation, and cabin comfort.
  - This display offers a unique user experience especially for onboard entertainment: you can watch a high-definition movie or discover the activities proposed at the next rest area on your journey.
- The car also features a large windshield-mounted head-up display to provide the driver with data from the autonomous drive system.

# Renault SYMBIOZ demo car: The Experience

## Three driving modes and three journey experiences

Courtesy of the Renault MULTI-SENSE 3.0 system, an upgraded version of the current MULTI-SENSE system, the SYMBIOZ demo car features three driving modes:

- The *Classic* mode is the standard mode. Occupants are at one with the car and feel at home. The driving position is conventional and the car's settings are focused on comfort.
- The *Dynamic* mode boosts driving sensations. Driving is more active and the driver's seat features additional lateral support for a bucket seat feel. The engine response, steering and chassis settings are all geared towards a dynamic driving style.
- The *AD* mode optimises the space available in front of the driver to permit a variety of hands-off activities. When the *AD* mode is switched on, the steering wheel and dashboard – which comes with a unique L-shaped display developed by LG – automatically move back 12 centimetres.

The driving mode is selected by pushing the Renault logo, which is lit up like a hologram in the middle of the steering wheel.

In *AD* mode the driver can choose from three layouts adapted to different free-time moods and desires.

- The *Alone@Home* layout frees up space by retracting the steering wheel and dashboard and taking advantage of the extra legroom provided by the vehicle platform, which has been optimised for autonomous driving and to house the electric motor (no centre console or transmission tunnel).
- The *Relax* layout enables the driver to sit back and cruise with their seat in 'zero gravity' position. The driver can also be at the heart of a virtual reality of a few minutes, developed by Ubisoft.
- The *Lounge* layout lets the driver move closer to the person in the front passenger seat. The front armrests lower automatically and the seats turn 10 degrees towards each other to facilitate conversations between the driver and front-seat passenger.

## A glimpse into the future of entertained travel

The SYMBIOZ demo car is packed with technology, but at the heart of the matter are people and what sort of experience they can enjoy. In this respect, the car is very much part of the people-centric 'Easy Life' approach core to Renault's DNA. SYMBIOZ demo car truly allows the driver and passengers to 'engage the senses' during journeys.

The journey starts at home. In our scenario, the passenger's personal agenda is displayed on the home TV, updated via smartphone, tablet or PC and shared between the car and the home.

- Fifteen minutes prior to departure, trip information is displayed on the home TV and the tablet inside the house. This will include the destination, hotel booking, and an option to update Facebook, among other information options.
- Five minutes prior to departure, information about the car (charge level, driving range of batteries) and the journey (traffic and weather) can be displayed instead.
- The driver can call the SYMBIOZ demo car on their smartwatch (connected to their smartphone). The car then picks up the driver and passengers – this is the 'valet parking' feature associated with the car's autonomous drive mode. The driver can watch the car approach from outside, courtesy of a bird's-eye view camera.

Onboard SYMBIOZ demo car, the Renault MULTI-SENSE 3.0 system, an advanced version of the current MULTI-SENSE system, reinforces the sensory experience delivered according to the driving mode selected. Three sensory experiences will be available with different lighting environments, acoustic ambiances, and in-car fragrances.

- Lights on! SYMBIOZ demo car surrounds its passengers with selected colours to enhance the feeling of well-being on board. The lighting environment varies according to the situation and driving mode.
  - When getting into the car, the driver is welcomed by a wave of light running along a belt of LEDs positioned mid-height on the doors and dashboard.



- Versatile light displays are featured in each driving mode:
  - In the *Dynamic* mode, for example, a red light runs from the back to the front of the vehicle.
  - In contrast, selecting the *AD* mode bathes the cabin in a gentle gold ambient light.
- A “wow effect” is also guaranteed with the sound environment. Courtesy of a partnership with Devialet, SYMBIOZ demo car unleashes the full emotional impact of sound, helping to redefine automotive travel experience through audio, with three major innovations:
  - Audio modules are miniaturized versions of Devialet’s Phantom speakers.
  - They are built into the car’s centre pillars, the middle of the dashboard and between the rear seats.
  - These modules are accompanied by revolutionary wave guides, the “diffusers”, distributed in all the hollow spaces of the cabin. They form a network of virtual speakers and offer an incredibly wide sound stage with very few speakers.
  - This architecture is driven by a spatialization technology offering a totally immersive sound reproduction. It takes into account the resonance of the interior materials was taken and optimise sound dynamics in the cabin.

To illustrate an extreme of ‘mind-off’ driving, the virtual reality experience designed by our partner Ubisoft is another way to enjoy the whole new experience proposed while travelling in autonomous mode with SYMBIOZ demo car. Immersive and contemplative, the experience allows the driver to sit back and relax while the vehicle is in autonomous drive mode.

- Put the helmet and change your vision! A virtual reality headset can be worn to enable the driver or its passengers to go on a virtual journey. It begins with a realistic, real-time representation of the car and the road before departing to an urban setting with a sci-fi atmosphere and finish on a natural and surreal landscape.
- This system is connected to the vehicle and uses its data. The speed, trajectory, position on the road as well as surrounding vehicles detected AD sensors, are reproduced in real-time within this experience of virtual reality.
  - This allows for a correlation between what the driver sees in the virtual reality headset and what his body feels, ensuring a comfortable experience.
  - It also reinforces the immersion and the sensation of escape while making the experience unique to each journey and the vehicles encountered.
- Passengers will also enjoy a specially scented environment. Three fragrances – one for each driving mode available: *Classic*, *Dynamic* and *AD* – have been developed for SYMBIOZ demo car.
  - The identity fragrance (in *Classic* mode) is inspired by the essences of materials found in the cockpit. The selected scents (including ginger, cedar, birch, and vetiver) provide a sweet, welcoming, and warm identity. The *Classic* identity fragrance provides the basis from which the *Dynamic* and *AD* mode fragrances are derived.
  - In the *Dynamic* mode the fragrance is more stimulating and energetic, thanks to the highlighting of ginger, cardamom and bergamot.
  - In the *AD* mode the fragrance opens the space to more airy and fresh horizons, thanks to caraway, sandalwood musk, and saffron powder.



# Renault SYMBIOZ demo car: The Ecosystem

The dividing line that has long separated the car from the home and the workplace is becoming increasingly blurred. Connectivity and constant data sharing between the different parts of the device ecosystem promise to better maintain a continuous link between all aspects of the customer's life.

## Always connected

The SYMBIOZ demo car's onboard connectivity system allows the driver and passengers to access their digital lives and enjoy a wide range of services. In harmony with personal smartphones, the users' link to their media and data is never cut.

- Occupants are identified by their smartphone regardless of where they are sitting. The smartphone interacts with the car's human-machine interface (HMI) to determine personal seat settings, air-conditioning settings and music preferences, among other functions.
- Thanks to a full suite of connectivity features (GPS, 4G, Wi-Fi), occupants can access their digital environment, media and services just like at home or in the office.
- The L-shaped dashboard display, which is the car's primary HMI, lets users interact remotely with the outside world, including road infrastructures or the home.
  - Users can check what happens within their house thanks to a 360-degree camera view on the screen of the dashboard.
  - They can also adjust the heating settings or access refrigerators and other domestic appliances.

## In connection with infrastructures

More and more, local, regional and national governments are exploring investments in the internet of things, smart cities, and ways to enable better communication between people, vehicles and infrastructure. Renault works closely with governments, NGOs, and private sector partners as part of these worldwide efforts to help advance sustainable mobility for all.

With SYMBIOZ, the journey is made more leisurely thanks to SYMBIOZ demo car's connection to road infrastructure from Sanef's network. Sanef is a subsidiary of the Albertis group, the world's leading highway operator and one of Renault's partners on this project. This vehicle-to-infrastructure (V2X) trial uses communication protocols defined under [the EU's SCOOP project](#). Some examples of public-private partnership opportunities:

- Driving will be safer and more relaxing because the car can be warned in advance of any hazards up ahead, including roadworks, accidents, poor weather and congestion. This means the car is able to 'see' further than its own sensors.
- This V2X connectivity notifies the SYMBIOZ demo car of which toll lanes operate as electronic toll collection (ETC) lanes so it can pass through tollgates in autonomous drive mode on approved highways like A13 during the test-drive.
- The connection with road infrastructure also brings new types of data to the occupants of the car. Information about nearby tourist attractions is displayed on the L-Shape screen of the dashboard.

## A home at one with the car

On its stage at the Frankfurt Motor Show, Renault presented the SYMBIOZ concept car alongside a connected home to allow visitors to experience the way cars may be interacting with the domestic environment in the future. When parked inside the home, the SYMBIOZ concept car showed how cars could play an even more important role in our everyday lives.

This connected home will also be on display during the SYMBIOZ demo car road tests.

- The house is 21 metres long, 7 metres high, and 8 metres wide.
  - It was designed for Renault by Marchi Architectes, the 2008 winners of the Nouveaux Albums des Jeunes Architectes Paysagistes (NAJAP) Award from the French Ministry of Culture and Communication.

- As one of France's up-and-coming architecture firms, Marchi Architectes share the warm, people-focused approach central to Renault's own design DNA.
- Inspired by the world of home design, 80 percent of the rectangular-shaped ground floor's glazed surfaces use clear glass, letting in as much light as possible.
- The house has no interior pillars or walls, making it easier to move around inside and providing a special area for the SYMBIOZ demo car to pick up occupants.
- Once inside the car is still visible from the outside of the house, thanks to the transparency of nearly all the ground-floor walls.
- The first floor of the house is cylinder-like and features a warm copper colour.
  - This 'night-time area' includes the bedroom and the corridor to the rooftop terrace.
  - Unlike the ground floor, the walls on the first floor are opaque for greater privacy.
  - Three light wells at the top of the cylinder let light flood in to the ground floor.
- Some of the concept home's furniture and hardware elements were designed by promising French designers who share Renault's drive for innovation and authenticity. These include Ionna Vautrin (lights, worktops), Constance Guisset (mirrors, poufs), Iratzoki Lizaso (table, chairs), Guillaume Delvigne (marble objects, crystal glasses), Samuel Accoceberry (mirror, rug), Cléo Joffre and Cardew Bonniot (dinnerware).

# Renault SYMBIOZ demo car: The Development

The SYMBIOZ demo car was developed simultaneously alongside the SYMBIOZ concept car at the 'Garage', a dedicated collaborative workspace at the Technocentre in Guyancourt, France. This project comprised cross-functional teams from engineering and design. It also included extended teams bringing partner technology and creative industry leaders together in an 'open innovation' approach. Groupe Renault highly values this form of collaborative working. More about Open Innovation can be found on our website [here](#)

## Six 'open innovative' partners

The six core partners involved alongside Renault's teams in the development of SYMBIOZ demo car provided input in their specific areas of expertise:

- LG has been involved in the development of the human-machine interfaces.
- Ubisoft has provided onboard virtual reality experience for autonomous driving mode.
- Devialet has developed a new user experience through an advanced sound system.
- Sanef has worked on the way the car communicates with road network infrastructure.
- TomTom has contributed with its geo-positioning expertise.
- IAV has provided autonomous driving engineering expertise.

## How did we develop this platform? A mule story!

The Renault SYMBIOZ demo car was designed on a special EV platform. How did our engineers develop this platform? In fact, [it all starts with a mule...](#)

- The chassis was developed on a test mule named Road Runner, which was one of the three test mules used for the prototype. The many hours of testing allowed the engineers to ensure a high level of comfort, handling, and reliability before other components were fitted to the SYMBIOZ demo car.
- Since the vehicle platform was conceived from the outset to accommodate an electric drivetrain, the position of the motors and batteries was optimised in order to deliver:
  - A maximum cabin space with no transmission tunnel. The rear-wheel drive system also enabled the front seats to be brought forward.
  - A dynamic drive thanks to a lower centre of gravity and optimum weight distribution, including the battery.
  - Safety, in order to minimise roll and limit the onset of understeer while driving.

Renault SYMBIOZ demo car shows what will be possible tomorrow by offering an experience now. Alongside some interior and exterior styling elements, the technologies featured in this vehicle are an example of what could also appear in the Renault range over the next few months and years.

- Autonomous drive features will be progressively deployed in Renault's range under the name '[Renault EASY DRIVE](#)'.
  - The first model to come out in 2019 will offer Level 2 driving automation with assisted 'eyes-on' driving on motorways and in peri-urban areas.
  - Cars with Level 4 'mind-off' driving automation will appear starting in 2022, pending government regulatory approvals.

- Some examples of connected services and new-generation motoring will be rolled out cross the range under the name '[Renault EASY CONNECT](#)' and in conjunction with the new [MY Renault](#) smartphone app.

On October 6<sup>th</sup>, Groupe Renault announced [Drive The Future](#), its new 6-year plan aligned with its vision of sustainable mobility for all, today and tomorrow. By 2022, Groupe Renault will offer:

- 8 purely electric vehicles and 12 electrified models to continue to lead in electric vehicles
- 15 AD models benefiting from the Renault-Nissan-Mitsubishi scale effect and technologies
- 100% connected vehicles in key markets.