



PORSCHE

Next level E-Performance

Press Kit

Contents

Introduction.....	4
At a glance: e-mobility at Porsche	4
New model year brings substantial updates	7
Latest Taycan model gets fine tuning of driver assistance systems	7
Overview of the three body versions	8
From IAA concept study to all-electric test vehicle on the racetrack	10
The Porsche GT4 e-Performance is the vision of an all-electric racing car.....	10
The GT4 e-Performance Tour #race2zero	11
Facts & Figures	12
Corporate Insight: challenges for the company	13
Vision of the Zero Impact Factory: significantly reducing the ecological footprint	13
PPE Insights: new platform is an important step towards the electrification of the product portfolio	15
Porsche fine-tunes E-Performance for future series models	15
Powertrain: system output up to around 450 kW and torque of over 1,000 Nm.....	16
Battery: From five to 80 percent charged in less than 25 minutes.....	16
Chassis: quintessential brand driving dynamics and characteristic steering	17
Insight Formula E: the new Gen3 era	20
The new Porsche 99X Gen3	20
The new Porsche 99X Electric	20
Racing and design.....	22
The TAG HEUER Porsche Formula E team.....	22

Fuel consumption and emissions

Taycan sports sedan models

NEDC: Power consumption combined: 27.0 – 25.4 kWh/100 km; CO₂ emissions combined: 0 g/km

WLTP: Power consumption combined: 24.1 – 19.6 kWh/100 km; CO₂ emissions combined: 0 g/km

Electric range: 370 – 512 km; Electric range city: 440 – 630 km

Taycan Cross Turismo models

NEDC: Power consumption combined: 28.1 – 26.2 kWh/100 km; CO₂ emissions combined: 0 g/km

WLTP: Power consumption combined: 26.4 – 21.2 kWh/100 km; CO₂ emissions combined: 0 g/km

Electric range: 389 – 490 km; Electric range city: 463 – 616 km

Taycan Sport Turismo models

NEDC: Power consumption combined: 27.4 – 25.7 kWh/100 km; CO₂ emissions combined: 0 g/km

WLTP: Power consumption combined: 24.7 – 20.2 kWh/100 km; CO₂ emissions combined: 0 g/km

Electric range: 358 – 497 km; Electric range city: 433 – 619 km

All data refers to the EU model (Germany).

As all new cars offered by Porsche are type approved in accordance with the WLTP, the NEDC values are therefore derived from the WLTP values. Further information on the official fuel consumption and official, specific CO₂ emissions of new passenger cars is available in the “Guidelines on fuel consumption, CO₂ emissions and power consumption of new passenger cars” [Leitfaden über den Kraftstoffverbrauch, die CO₂-Emissionen und den Stromverbrauch neuer Personenkraftwagen], available free of charge from all sales outlets and from Deutsche Automobil Treuhand GmbH (DAT), Hellmuth-Hirth-Str. 1, 73760 Ostfildern, Germany.

At a glance: e-mobility at Porsche

Porsche is seen as a pioneer of sustainable mobility. And now, as it enters the era of electromobility, the sports car brand is moving up another gear. In 2025, the company aims to deliver more than half of its new cars with an electric powertrain – either fully electric or as a plug-in hybrid. And its goal for 2030 is for more than 80 per cent of its new deliveries to be BEV models.

These goals are based on the brand's high level of innovation. Take the Taycan: in 2020, the experts at the Center of Automotive Management (CAM) named the first all-electric Porsche as the most important innovator on the global automotive market. Among its exemplary innovations is the 800-volt architecture of the electric powertrain system. Today it is the quality standard for high-performance electric cars across the industry.

Premium Platform Electric (PPE) gives Porsche the opportunity to also bring high-volume electric models, made to the highest technical standards, to the market in a profitable way in the future. This will enable even more of the product portfolio to be electrified – in particular in the SUV segment. The 718 series is also to be fully electrified in the middle of the decade. In the medium term, the company also plans to add a new all-electric SUV model to the luxury segment of its model range. This car will be manufactured at the Leipzig factory.

With these steps, Porsche is continuing with its commitment to sustainable mobility. The strategic targets of the company are ambitious: Porsche aims to play a leading role among the traditional car manufacturers when it comes to sustainability, electromobility and technology. To this end, the future projects of the company are being consistently pushed forward.

Porsche aims to achieve a CO₂-neutral value chain by 2030. At the main plant in Stuttgart-Zuffenhausen, it has already been manufacturing on a CO₂-neutral basis since 2020. The Leipzig production site and the Weissach Development Centre followed at the start of 2021. With the start of production for the next model generation of the Macan, the Porsche plant in Leipzig is even on the way to becoming a “zero-impact factory” whose operations leave no ecological footprint. Porsche is also keeping an eye on the processes upstream from

production in its efforts to increase sustainability. For example, the company demands that its system suppliers use green energy when manufacturing components for Porsche new car projects.

The progressive electrification of the Porsche product range is also accompanied by major work in the field of battery cell technology. With its Cellforce joint venture, the company is investing in the development of new high-performance cells. Porsche Werkzeugbau is driving forward the efficient production of state-of-the-art, powerful battery modules. At the same time, Porsche is also committed to extending charging infrastructure – for example, in setting up a European network of own-brand fast-charging stations exclusively for Porsche customers.

Electromobility is firmly rooted in the brand DNA of Porsche. Even the back-story of the manufacturer of luxury and sports cars began electrically. In 1898, the 23-year-old car designer Ferdinand Porsche played a leading role in the development of the Egger-Lohner C2 Phaeton. This car was powered by an electric ‘octagon’ motor. Two years later came the Lohner-Porsche Electromobile powered by two wheel-hub electric motors. It was with this development that Ferdinand Porsche caused a sensation at the 1900 World Exhibition in Paris. That same year, he supplemented each wheel-hub motor with a combustion engine that generated electrical energy. Based on this powertrain design the Lohner-Porsche Semper Vivus was built. This car is seen as the world’s first functioning full hybrid vehicle. In 1901, the further developed production version was launched as the Lohner-Porsche Mixte.

A good hundred years later the now world-famous sports car brand revived this historical idea. In 2010, Porsche presented the Cayenne S Hybrid, its first modern series hybrid car. That same year, the 918 Spyder super sports car appeared as a concept study with a powerful hybrid powertrain. In spring 2013, Porsche launched the world’s first plug-in hybrid in the luxury class. The new Panamera S E-Hybrid had a system output of 306 kW, of which 70 kW was generated electrically.

In 2014, Porsche entered a hybrid racing car in the LMP1 class at the 24 Hours of Le Mans for the first time. Between 2015 and 2017, the Porsche 919 Hybrid took overall victory in the FIA World Endurance Championship – three times in a row. Also in 2014, the company

presented the first plug-in hybrid in the premium SUV segment. With the Cayenne S E-Hybrid, Porsche was the only premium manufacturer thus far to offer powerful plug-in hybrid series models in three different market segments.

Porsche intends to continue to live up to its pioneer role in the field of electromobility, with the brand's electrically driven cars remaining the embodiment of sporty performance and driving dynamics into the future. It is an ambition that Porsche is aiming to prove worthy of, not only today with the Taycan, but with its future-oriented motorsport projects as well.

For example, the third-generation Porsche racing cars that will be entered in Formula E are among the fastest electric sports cars ever built: light, strong and, thanks to their high energy recuperation, particularly efficient. Then there is the GT4 e-Performance. This innovative test vehicle embodies the vision of an all-electric GT racing car for the customer motorsport of the future. In qualification mode the car has a maximum output of up to 800 kW. And with its 900-volt architecture, the car's batteries can be charged from five to 80 per cent in just 15 minutes at full charging capacity.

These examples show that Porsche is consistently pursuing its chosen path. And as has always been the case throughout its almost 75-year history, the innovations that prove themselves on the racetrack will soon make their way into the development of series-production road cars. Porsche remains Porsche – in the long term, and with no exceptions.

New model year brings substantial updates

Latest Taycan model gets fine tuning of driver assistance systems

In November 2022, the 100,000th Taycan rolled off the production line at the Porsche headquarters in Zuffenhausen. The milestone car left the assembly line around three years after production first started in September 2019. Three months earlier, in August 2022, production for the 2023 model year had already commenced, with a whole range of improvements for the Taycan sports sedan, Taycan Cross Turismo and Taycan Sport Turismo. A number of driver assistance systems, such as Lane Change Assistant, can provide the driver with support in even more situations in future. The ParkAssist sensors now operate with a greater range. The search for available parking spaces has been improved as well, so that now even smaller spaces are offered to the driver as an option. Porsche has also extended the system limits of the optional Remote ParkAssist. There are now even more situations in which the latest Taycan model can be piloted into parking spaces remotely using a smartphone.

Functions on Demand (FOD) allows Taycan drivers to add what were previously different comfort and assistance systems following purchase and original configuration. One new FoD option is the keyless opening function (Porsche Entry) for the doors and tailgate. More Over-the-Air (OTA) software updates are also available.

Technical optimisations have already increased the range of the electric sports car for everyday use. For the 'Normal' and 'Range' driving modes in the all-wheel-drive models, the front electric motor is almost completely disconnected and de-energised in the partial load range. There is no drive torque on either of the axles when coasting and at a standstill. This reduces resistance in the drivetrain and power consumption, leaving more energy in the battery for additional kilometres of range per charge.

Due to a re-homologation, the increase in efficiency of the drivetrain is now also reflected by the WLTP consumption values. With a range of 513 kilometres in accordance with WLTP, the Taycan 4S is once again the version with the longest range in the series.

The Taycan Turbo S has set another benchmark: clocking a time of 7:33 minutes on the Nordschleife of the Nürburgring, it holds the record for the fastest series electric car.

Overview of the three body versions

The Taycan sports sedan was launched as the first representative of the model series at the end of 2019. With its purist design, it signals the start of a new era. At the same time, it retains the unmistakable Porsche design DNA. From the front, the electric sports car looks particularly broad and flat, with highly contoured wings. The silhouette is dominated by the sporty roof line sloping downwards to the rear, and the side section with its heavily sculptured appearance features the characteristic Porsche look. The cockpit also heralds this new era with its clear structure and a completely new architecture. The free-standing and curved instrument cluster forms the highest point on the dashboard. With Taycan, Taycan 4S, Taycan GTS, Taycan Turbo and Taycan Turbo S, there are now five different motor versions to choose from for the sports sedan. What's more, the first two variants are also available with the Performance Battery and the Performance Battery Plus as optional extras, and the last four come with all-wheel drive.

The Taycan Cross Turismo features all the strengths that characterise the Taycan, such as a superior performance and long range. Added to this are additional headroom for rear-seat passengers and the maximum luggage compartment capacity of more than 1,200 litres behind the large tailgate. The standard all-wheel-drive chassis, with its air suspension, features height adjustment. The off-road design elements include wheel arch covers, distinctive lower sections at the front and rear, and side skirts. In combination with the Offroad Design package, special flaps are fitted at the corners of the front and rear bumpers and at the ends of the door sills of the Cross Turismo. These make for a striking exterior while also providing protection from stone impacts. The Taycan Cross Turismo was launched in summer 2021, with the programme encompassing four different motor versions from the Taycan 4 to the Taycan Turbo S.

The Taycan Sport Turismo is the latest body variant, and has been available since February 2022. This derivative is aimed at people who wish to combine the suitability of the Taycan

Cross Turismo for everyday use with the on-road dynamics of the sports sedan. The Taycan Sport Turismo shares the sporty silhouette, rearward-sloping roof line and functional design of the Taycan Cross Turismo. In contrast to its sibling model, the Taycan Sport Turismo foregoes any off-road design elements. It is also available with rear-wheel drive. This means that there are five different motor versions to choose from for the Sport Turismo – Taycan, Taycan 4S, Taycan GTS, Taycan Turbo and Taycan Turbo S.

The Porsche GT4 e-Performance is the vision of an all-electric racing car

The all-electric GT4 e-Performance can deliver up to 800 kW (1,088 PS). Porsche is aiming to use this test vehicle to show how sustainable customer motorsport can work in the future – and win many fans. Lap times can already match those of the current 911 GT3 Cup over the distance of a Carrera Cup race.

Porsche is using the all-electric GT4 e-Performance to show how sustainable customer motorsport can work – and win many fans in the future. This test vehicle deploys the technological components of the Mission R concept study, with which the sports car manufacturer presented its vision of an all-electric GT racing car at the IAA MOBILITY 2021 in Munich. The chassis of both cars are based on the familiar 718 Cayman GT4 Clubsport. The electric motor and battery technology of the GT4 e-Performance are from Mission R. In qualifying mode it can generate up to 800 kW (1,088 PS). In simulated racing mode 450 kW (612 PS) is continuously available for 30 minutes – the duration of a Carrera Cup race. In terms of lap time performance and top speed, the GT4 e-Performance is a match for the current 992-generation 911 GT3 Cup.

In June 2022, the GT4 e-Performance revealed to the public for the first time what it is capable of at the Goodwood Festival of Speed. The famous 1.9 kilometres or so of hill-climb track on Lord March's Goodwood estate also marked the start of the GT4 e-Performance world tour. Over the next two years, it will take the innovative test vehicle to locations around Germany and beyond. The goal is to display the potential of this progressive vehicle concept and the opportunities for related racing formats to motorsport customer teams, partners and decision-makers from the racing world.

“With Mission R we have shown how Porsche can visualise the sustainable customer motorsport of the future,” says Matthias Scholz, Director GT Racecars. “The GT4 e-Performance is now proving that this vision works on the racetrack and is also very popular. We are very excited about the feedback, because a one-make series with electric racing cars could be an important addition to our existing customer sport programme.”

As with Mission R, the all-electric powertrain of the GT4 e-Performance is based on one permanently excited synchronous motor on each of the front and rear axles. Together they can produce up to 800 kW (1,088 PS) and transform the vehicle into an all-wheel driveracer. The oil direct cooling of the electric motors and the battery pack developed by Porsche counteract thermally induced derating. Thanks to 900-volt technology, the battery can be charged from five to 80 per cent SoC (State of Charge) in around 15 minutes.

“The integration of the oil cooling significantly influenced the vehicle concept,” explains Björn Förster, GT4 e-Performance Project Manager. “The whole development team, comprising aerodynamics and thermodynamics experts, high-voltage experts and body specialists created an architecture that enabled us to tap into the full potential of the battery cells for the first time because no thermal derating occurred. This means that in racing mode the full power is available for the desired period of half an hour.”

The lines of the GT4 e-Performance were developed by a Porsche Style team led by designer Grant Larson. The racing car is 14 centimetres wider than a 718 Cayman GT4 Clubsport. Porsche redesigned around 6,000 parts for the car. The body includes natural fibre composite materials, the production of which would generate fewer emissions than comparable synthetic materials. The use of recycled carbon fibres is also being tested. Wider wings compared to the 718 Cayman GT4 Clubsport create room for even wider 18-inch racing tyres from Michelin. They contain a particularly high proportion of renewable materials.

The GT4 e-Performance Tour #race2zero

Following its world premiere at the Goodwood Festival of Speed, the GT4 e-Performance is headed to further international stops, every one of which has its own unique character. At the world-famous car festival in the south of England, it was all about the motorsport tradition of Porsche. On 20 August 2022, it was the turn of the Porsche factory in Leipzig. The factory is celebrating its 20th birthday this year and has a 3.7-kilometre track that is based on famous sections of world-renowned circuits. Further destinations in Europe, North America and Asia up to 2024 are planned. In harmony with the sustainability strategy of the entire ‘race2zero’ project, the logistically optimised transportation is exclusively by ship, rail and HGV.

“The GT4 e-Performance is setting the course for Porsche customer sport with electrically powered racing cars. In the first step we are presenting this concept to our partners around the world,” says Oliver Schwab, Project Manager Sales for the GT4 e-Performance. “Working together with drivers, teams, event organisers, authorities and other interested parties, we will be gathering ideas for possible future racing formats from Porsche.”

Facts & Figures

800 kW (1,088 PS)	Maximum power
450 kW (612 PS)	Consistent performance
Around 30 minutes	Maximum racing time
6,000 parts	Redesigned by Porsche for the GT4 e-Performance
14 cm	The additional width of the GT4 e-Performance compared to a 718 Cayman GT4 Clubsport, on which it is based
900 volt	Voltage of the E-drive architecture
15 minutes	Charging time from five to 80 per cent SoC (State of Charge) at full charging capacity
45.50 seconds	Lap time of the GT4 e-Performance on the 1.9 km (approx.) hill-climb track at the Goodwood Festival of Speed, where it took second place in the overall standings
Up to 53 per cent	Proportion of bio-based and recycled materials in the Michelin racing tyres of the GT4 e-Performance

Vision of the Zero Impact Factory: significantly reducing the ecological footprint

Porsche has a clear commitment to the aims of the Paris Agreement. The sports car manufacturer is working towards a CO₂-neutral balance sheet across the entire value chain by 2030. Porsche is implementing a consistent electrification strategy, setting ambitious targets for decarbonisation. This also applies in comparison with the rest of the sector. The CO₂ emissions of the company and its products are being reduced along the entire life cycle. An important sub-section of the sports car manufacturer's decarbonisation strategy is the production and the vision of a Zero Impact Factory.

Porsche has a holistic view on sustainability – economically, ecologically and socially. It is founded upon six fields of activity. Alongside decarbonisation, these also include diversity and transparent supply chains. An important component is the vision of a Zero Impact Factory – a factory that significantly reduces the ecological footprint. The vision of the Zero Impact Factory in the field of climate protection relates to scope 1 and scope 2 emissions.

So-called environmental impact points enable the targets to be measured. Based on starting year 2018, Porsche aims to reduce the environmental impact points by 95 percent by 2030 in the factories in Stuttgart-Zuffenhausen and Leipzig. To make this vision a reality, Porsche has also defined specific fields of activity here that include resource, materials and energy efficiency, as well as efficient water use. Areas such as technology and processes, as well as logistics, also affect the use of resources at the company.

Porsche has already set down the first milestones on its way towards a Zero Impact Factory. In Zuffenhausen and Leipzig, car production is now completely CO₂-neutral. The factory was a trailblazer with the all-electric Taycan in 2019. This was followed by the entire production output in Zuffenhausen in 2020, and the factory in Leipzig and the Weissach Development Centre in 2021.

Since 2014, Porsche has reduced balance sheet CO₂ emissions in its own production by 90 percent for each car. This required a lot of attention to detail. For example, 100 per cent of the electricity used by the company comes from renewable energy, The rail transport for

new cars between Zuffenhausen and Bremerhaven is for the most part powered by regenerative green electricity. In the Zuffenhausen factory, the sports car manufacturer generates heat with its own combined heat and power plants that are operated CO₂-neutrally with biomethane.

Porsche is convinced that the conservative use of natural resources has a positive effect on the environment while simultaneously lowering costs. This is why the company is continually optimising its processes. For example, changing the technical procedures in the paint shop enabled the use of chemicals in the body pre-treatment and the water consumption in the waste water treatment to be further reduced. Porsche also lowered the use of structural adhesives in the assembly and body construction areas. This was achieved by shortening the preparation times, which also cut down the amount of waste produced. Information technology enabled the identification and implementation of potential in the media monitoring for powering off drive and ventilation systems according to demand. At the Zuffenhausen factory alone, this saves more than 400,000 kWh of electrical energy per year.

Porsche fine-tunes E-Performance for future series models

Porsche is picking up speed on electromobility. Thanks to a clearly defined roadmap, by 2025 more than half of all new Porsche cars sold are expected to be electrified – either fully or as plug-in hybrids. By 2030, the Stuttgart sports car manufacturer's target is for more than 80 per cent of its new car deliveries to be fully electric models. Premium Platform Electric (PPE) is just one of the tools the company is deploying to fulfil this ambition. This platform will give Porsche the opportunity to profitably market high-volume models to high technical standards and thereby electrify a further important part of the portfolio.

With PPE, Porsche and Audi have together developed an architecture for all-electric cars. with which the benefits of a purely electric platform can be enjoyed in many ways – in terms of package and spaciousness, for example. At the same time, the architecture offers so much room for manoeuvre in the wheelbase, track width and ground clearance that it can be used to realise a variety of models – including in different segments. which simultaneously allows the flexibility for Porsche models to retain their strong, independent character.

The first Porsche based on the PPE will be the all-electric Macan. With its 800-volt architecture, the powerful electric motor of the latest generation, and state-of-the-art battery and charge management, this model offers the E-Performance that is characteristic of Porsche. The successor to the successful compact SUV will be the sportiest model in its segment. Along with reproducible best-in-class performance values, the development targets include long-range capability and high-performance fast charging.

For the top variants, the engineers are creating a dynamic, sporty driving experience with fully variable electronically controlled rear differential and a so-called 'Performance rear axle'. Added to this is a powerful electric motor positioned behind the rear axle. This enables a rear-dominant all-wheel application across a wide spectrum. In combination with the dynamic torque distribution in the all-wheel drive, it also supports high agility when accelerating out of corners.

Powertrain: system output up to around 450 kW and torque of over 1,000 Nm

The PPE enables a wide range of models with rear- and all-wheel drive and various performance levels. The system output will initially go up to around 450 kW, with a maximum torque of more than 1,000 Nm.

As with the Taycan, Porsche is deploying the 800-volt technology for the next Macan generation. This ensures consistent high performance, significantly reduces the charging time, and lowers the weight of the high-voltage cables and the space required for them. A further common feature are the permanently excited synchronous electric motors (PSM) with hairpin winding used by Porsche. In this design, the rotor of the AC motor is fitted with permanent magnets that generate a permanent magnetic field in the motor. In comparison to asynchronous motors (ASM), PSMs offer higher power and torque densities, greater efficiency and better reproducibility of the power output.

In the all-electric Macan only the latest-generation PSM is to be used. To maximise the power density, the water jacket cooling was optimised in comparison to the Taycan. An example of the further comprehensive optimisations in the PSMs is what is known as the double V lamination – the arrangement of the magnets within the rotors.

The development of the power electronics has also taken a big step forward: to optimise the effectiveness, silicon carbide (SiC) is used instead of silicon as the semiconductor material in the pulse inverter (PWR) on the rear axle. This significantly reduces switching losses in the PWR and enables higher switching frequencies.

Battery: From five to 80 percent charged in less than 25 minutes

All electric Macan models have a lithium-ion battery in the underbody with a total capacity of around 100 kWh. This sizing is based on the Porsche philosophy. When looking at how to balance range, performance and sustainability, the company focuses on travel time. High-performance battery and charging technology is key here.

The battery in the future all-electric compact SUV from Porsche consists of twelve modules with prismatic cells. The mixing ratio of nickel, cobalt and manganese is 8:1:1, and the battery achieves a higher energy density. Thanks to 800-volt technology, the first PPE model series from Porsche is to be charged with an even higher charging capacity than the 270 kW

of the Taycan. At a suitably powerful fast-charging station the battery charge level can be increased from five to 80 percent in less than 25 minutes

If the station is using 400-volt technology, the all-electric Macan uses 'bank charging' for the first time, whereby corresponding high-voltage switches (gates) are automatically switched in the battery before the actual charging process begins. This effectively splits the 800-volt battery into two batteries with a nominal voltage of 400 volts each that can be charged in parallel on one 400-volt charging station without an additional HV booster. If necessary, the states of charge of the two battery halves are first aligned before they are charged together.

The way the electronic components are packaged is also innovative: Porsche has applied for a patent for its Integrated Power Box which, in addition to the cables required and the weight, has also reduced the costs. The box saves space by combining three components – the on-board AC charger, the high-voltage heater and the DC/DC converter.

Even before the first Macan prototypes were built, the entire electric drive system, including the actual battery, was comprehensively tested on the high-voltage system test bench. This test bench is located in the drive test building in the Weissach Development System, opened in summer 2019, in which charging strategies and technology can be tested for different markets.

Chassis: quintessential brand driving dynamics and characteristic steering

Porsche will always be Porsche. This goes for the performance of the future PPE models and their expected driving dynamics. In the future compact SUV, depending on the model Porsche will be deploying a 'Performance rear axle'. Here the electric motor is positioned particularly far back, resulting in a slightly rear-focused weight balance with the ratio of 48 to 52 per cent. In combination with the dynamic torque distribution of the all-wheel drive and the rear-axle steering, the powerful electric motors on the rear axle ensure agility when accelerating out of a bend.

The all-electric Macan will have a completely revised double wishbone axle with detached strut level at the front. Its kinematics and elastokinematics enable improved responsiveness, steering precision and straight-line driving. The multi-link axle at the rear is connected to the body via an elastically mounted sub-frame, while the rear electric drive unit is fastened

directly to the structure at four points – a special feature of the Performance styling at the rear. This has a positive effect on the driving dynamics with precise wheel guidance and high transverse rigidity, and on the NVH behaviour (NVH = Noise, Vibration, Harshness).

The top versions will have Porsche Torque Vectoring Plus as standard: an electronically controlled differential lock on the rear axle. This control strategy is independent of the respective driving situation and ensures greater traction, driving stability and transverse dynamics. The steering behaviour and precision are supported by targeted dynamic braking interventions on the rear axle.

Porsche Traction Management (PTM) makes use of the conceptual advantages of the all-electric powertrain. Like the Taycan, the all-electric Macan will have an all-wheel concept with one electric motor per axle. The two electric motors enable fast, precise all-wheel control and a fully variable and – depending on the driving programme selected and the respective driving situation – demand-based torque distribution between the front and rear axles. This is beneficial to the steerability and the directional control of the front axle on the one hand, and on the other to the traction as the basis for the characteristic Porsche handling with high agility. Even away from paved roads, the Macan benefits from the optimised all-wheel distribution of the electronically controlled all-wheel drive.

At the same time, this packaging also enables the first rear-axle steering in a Macan. It resolves an old conflict of objectives and combines agility in urban traffic with stability and driving precision on the motorway.

At speeds of up to around 80 km/h, the rear wheels steer in the opposite direction to the front wheels, with a steering angle at the rear axle of up to five degrees. This virtual shortening of the wheelbase results in a more dynamic steering response when cornering. At the same time, manoeuvring is easier as the turning circle is reduced by around one metre. At speeds above approximately 80 km/h, the rear wheels steer in the same direction as the front axle. As a result, the wheelbase is virtually lengthened, further increasing the driving stability, for example when changing lanes on the motorway.

With rear-axle steering comes a 15 per cent more direct steering ratio to the front axle. Even in the basic version the front-axle steering already adheres to the uncompromising Porsche

design, offering the highest precision for all steering manoeuvres. Combined with high actuator dynamics this results in optimum modulation. The power steering support developed in-house identifies and amplifies important steering information for the driver, such as the surface characteristics of the road and the grip capability of the tyres. Disruptive vibrations and bumps, on the other hand, are eliminated and not transferred to the steering wheel. The driver thus enjoys the clear, completely transparent steering experience characteristic of Porsche.

The electronic Porsche Active Suspension Management (PASM) is combined with the air suspension in the all-electric Macan, but may also be combined with the steel suspension. The system reacts to the condition of the road but also to the speed, longitudinal and lateral acceleration, accelerator pedal modulation, steering behaviour, and the position level of the car.

The two-valve shock absorbers will be a new feature in the PASM of the future Macan. On the one hand, they offer improved performance due to a significantly greater damper characteristic spread. On the other, two-valve shock absorbers can be adjusted independently of each other, providing an appreciable increase in comfort. This versatility makes the differences between the driving programmes even more tangible, putting each individual driving programme in the future Macan on its own distinct level. Additionally, depending on the speed, the body can be lowered in combination with the air suspension, and this improves the aerodynamics for increased range.

The wheel and tyre scenario in the future all-electric Macan is also typical of Porsche, especially when it comes to the mixed tyres, which will be even more pronounced than in the current model. The wheel widths on the front and rear axles will differ even more significantly in order to accommodate the rear-focused weight distribution – for more grip and driving dynamics. The wheel sizes of up to 22 inches will provide further performance potential.

The new Porsche 99X Gen3

The third-generation Formula E cars represent a new technological milestone and will be competing in the all-electric racing series from the 2023 season. The Gen3 racing cars introduce new technical standards such as a significant power increase of 100 kW (136 PS) to a maximum of 350 kW (476 PS) in qualifying mode. The energy recovery can even enable up to 600 kW (816 PS), which is 2.4 times higher than for Gen2. These increased outputs also lead to significantly greater acceleration and maximum speed, which are achieved by means of a new powertrain and revised aerodynamics. The racers are also lighter and more agile than the previous cars.

The Fédération Internationale de l'Automobile (FIA) and Formula E are aiming to launch a racing car that will set new standards in motorsport for performance, efficiency and sustainability. At the end of April 2022, the new Gen3 car was presented to the world in Monaco.

Porsche developed the Gen3 version of the new Porsche 99X Electric at the Porsche Development Centre in Weissach. The new car will be on the starting grid at the ABB FIA Formula E World Championship in 2023.

The new Porsche 99X Electric

Sustainability

- **Battery:** According to component manufacturer data, the third generation of the Formula E cars contains cells that are in part made of sustainably obtained minerals. At the end of each racing season, the battery cells will be reused or recycled. More than 40 per cent of the energy used to drive the cars will be recovered by means of regenerative braking.
- **Carbon fibre body:** According to manufacturer data, recycled carbon fibre from the previous-generation cars will be used to build the racer. Carbon fibre waste will be recycled for new applications using an aviation industry procedure.

- Tyres: According to the manufacturer, natural rubber and recycled fibres make up more than a quarter of the new Gen3 tyres. Like other components, the tyres will also be recycled after every race.
- CO2: According to Formula E data, the CO2 footprint of the new car was measured from the start of the design phase onwards in order to determine all the measures that could help reduce the racing car's environmental impact. All unavoidable emissions will be offset as part of Formula E's obligation to net zero CO2.
- Suppliers: Gen3 suppliers will work together to comply with international ISO standards so that the environmental impact of production can be reduced during the manufacturing process.

Performance

- Speed: The cars of the new generation show potential for significantly higher maximum speeds.
- Energy: More than 40 per cent of the energy used will come from recuperative energy that results from braking.
- Energy efficiency: The output of the new Gen3 cars has increased to 350 kW (476 PS). The energy efficiency of the drivetrain is around 95 per cent compared to approximately 40 per cent for the best combustion engines.
- Powertrain: For the first time, the car has one powertrain at the front and one at the rear – an innovation for formula cars. The maximum driving power is split between 250 kW of recuperative energy on the front axle and 350 kW on the rear axle.
- Charging capability: The ultra-high-speed charging capability of the Gen3 cars will provide 600 kW of additional energy during races. This would make the chargers of the new Formula E cars almost twice as powerful as the current most advanced commercial chargers. The fast-charging technology will also ensure constantly high battery power.

Racing and design

The higher performance values are accompanied by a shorter wheelbase, narrower track width and an overall weight reduction of more than 50 kilograms from the previous 903 kg. This improves the overall performance and agility of the cars during races.

The design of the new car was also revised, as can be seen in new aerodynamic elements that manage airflow, or the omission of the wheel covers seen on the previous car. All of this in combination gives the new car a significantly different look.

The TAG HEUER Porsche Formula E team

The TAG Heuer Porsche Formula E team is committed to supporting the targets of the FIA and the ABB FIA Formula E World Championship. Innovative technology in the field of electromobility is part of the current Porsche strategy. Motorsport with electrically driven racing cars is laying the foundation for future mobility solutions, while Porsche is expecting its commitment to Formula E to yield technological synergies and concepts for future series production models.

We are convinced that the new generation of racing cars –which of course also includes the new Porsche 99X Electric – is a further step forward for consistent developments in Formula E, in motorsport, and on our shared path to a sustainable future. The TAG Heuer Porsche Formula E team sees itself as part of this, and will make its own contribution in terms of sport and technology.