

Environmental Report

All-electric Macan Turbo



PORSCHE



Sustainability at Porsche

For Porsche, economic success, ecological awareness and social responsibility are not contradictions.

On the contrary, sustainability is an Enabler within the Strategy Sportwagenschmiede '35.



Supply chain transformation

In the shift of the global economy towards greater sustainability, mobility, and with it the automotive industry, takes on a central role. Porsche is committed to actively shaping future mobility while taking into account the environment and society.



Strategic approach to sustainability

We pursue a holistic sustainability approach that integrates ecological and social aspects. Our focus lies on decarbonization and the circular economy along the vehicle value chain.



Sustainability in vehicles

Regarding the sustainability of the Macan Turbo*, decarbonisation, the circular economy and a sustainable supply chain are particularly relevant:

- In terms of decarbonisation, the aim is to reduce the global warming potential over the life cycle.
- Regarding circular economy, the aim is to use raw materials responsibly, and in a resource-conserving way, as well as to ensure that vehicles and the components used in them benefit from a long service life.
- In addition, Porsche takes its responsibility beyond its own factory gates and is therefore strategically focusing on the sustainability-oriented management of its direct supplier relationships.

* Electrical energy consumption combined: 20.7 – 18.9 kWh/100 km (WLTP), CO₂ emissions combined: 0 g/km (WLTP), CO₂ class A (see ⁵ on page 16 for details)

Porsche Macan Turbo life cycle



01 Life cycle assessment

What is a life cycle assessment and what are its results?
(p. 04-07, additional background information, p. 14-16)



02 Supply chain

What actions is Porsche taking to decarbonise its supply chain?
(p. 08-10)



03 Production

What actions is Porsche taking to decarbonise its own vehicle production?
(p. 11)



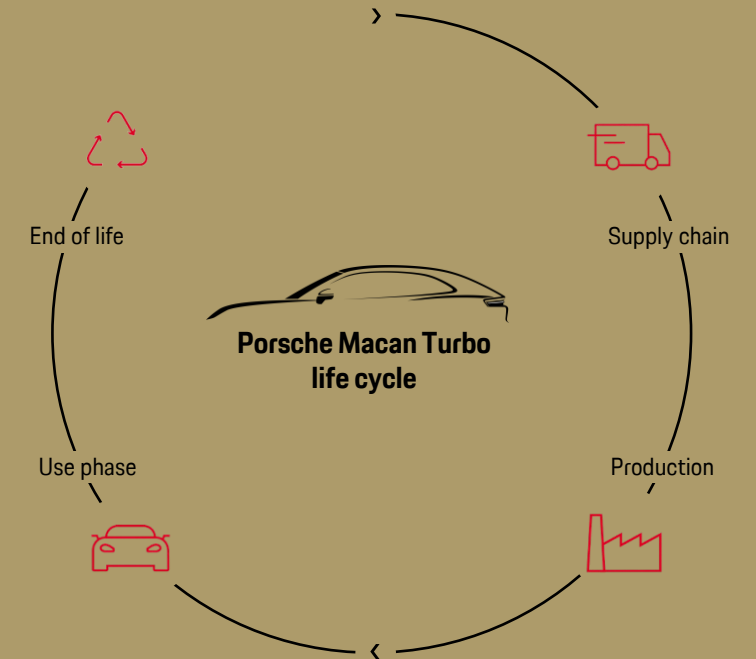
04 Use phase

What actions is Porsche taking to decarbonise the vehicle use phase?
(p. 12)



05 End of life

What actions is Porsche taking to enable the conservation of resources and to maximise the vehicle's lifespan? (p. 13)



Life cycle assessment | Study as a basis for the Environmental Report

Life cycle assessments (LCAs) aim to illustrate the potential environmental impacts along the value chain of vehicles and serve as a basis for identifying the potential for possible ecological improvements.

This LCA focuses on opportunities to reduce a vehicle's potential impact on climate change.



Principles of life cycle assessment

Experts calculate the approximate global warming potential of a vehicle by creating a life cycle assessment. Among other things, this assessment helps to minimise a vehicle's global warming potential in its production and use phases.

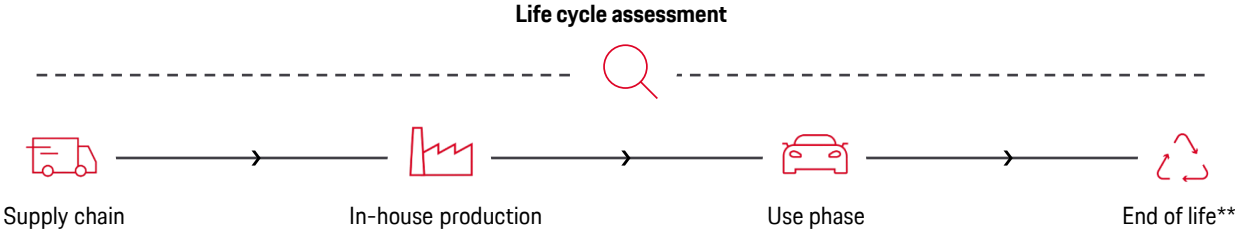
This ISO-standardised method³ comprises all individual components of the vehicle and further analyses how the vehicle affects the environment over the considered life cycle: from the extraction of raw materials and (sub-)component production in the supply chain, to the vehicle's own production and use phase, right through to dismantling*. In addition to the global warming potential, Porsche's LCA also examines other impact categories and their characterisation factors (including acidification potential, eutrophication potential and photochemical ozone formation potential). The focus of this publication is on the global warming potential. To calculate this, certain greenhouse gases (including CO₂, CH₄, N₂O, SF₆, NF₃, Hydrofluorocarbons and Perfluorocarbons) are converted into what are known as CO₂ equivalents (CO₂e). This unit of measurement is designed to make their effect on the climate comparable to CO₂ emissions. The unit CO₂e is used throughout this publication.

Measuring environmental impacts

The potential environmental impacts are determined using the 'LCA for Experts' software. Among other functionalities, the software includes a database containing information on the environmental impacts of materials and energy. For selected topics such as battery cells, the paint shop or tyres, separate modelling from the Volkswagen Group is applied.³

In addition to generic reference values, the LCAs of Porsche partly include vehicle- and company-specific information. This allows an analysis of the effects of measures to reduce the global warming potential.

It should be noted that the methodology and state-of-the-art techniques for creating life cycle assessments in the automotive industry are subject to constant development. Future calculation may therefore differ significantly from previous LCA results. A life cycle assessment should therefore always be viewed as a snapshot, taken at the time of calculation, under the respective assumptions.



³ See page 16 for details and restrictions on the preparation of LCAs according to DIN EN ISO 14040/14044 | * Without dismantling the high-voltage battery |
** Simplified representation of a product life cycle

Life cycle assessment | Information about the assessed product: Macan Turbo

The Macan: E-Performance for a new level of driving

Ten years after its market launch, the Porsche Macan has entered its second model generation as an all-electric car. With its progressive, timeless design, brand-typical performance, long range and high level of everyday usability, the new Macan – produced in Leipzig – is designed to fully meet the requirements of Porsche customers wanting an SUV.

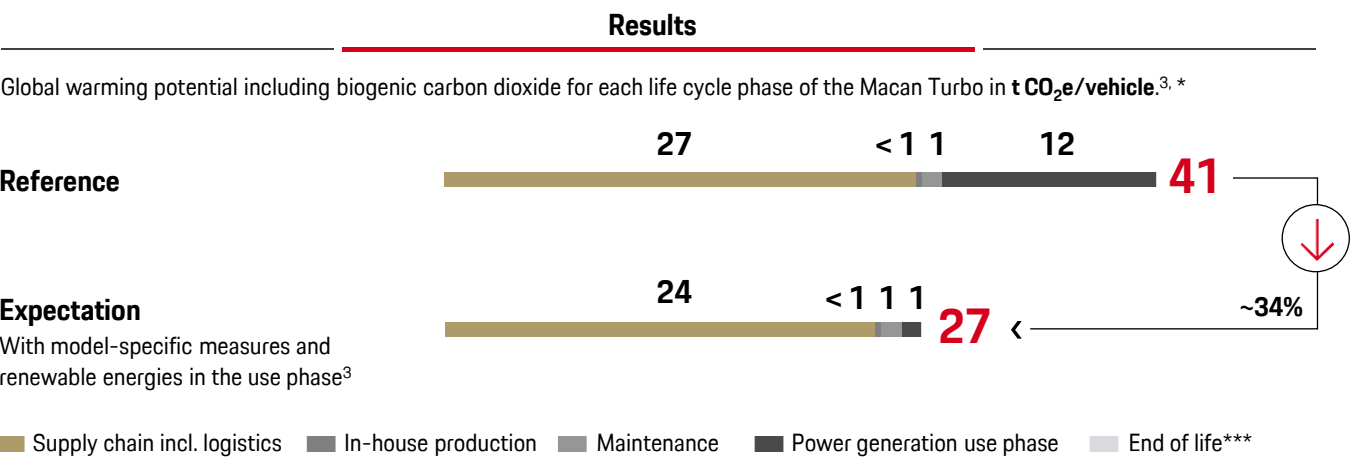
Principles of life cycle assessment	
Vehicle ¹	Macan Turbo
Configuration	Standard equipment, German market, model year 2024
Functional unit	200,000 km life cycle mileage
Unladen weight (DIN) ²	2.405 kg
Battery	100 kWh gross energy content
Consumption	According to WLTP (Worldwide Harmonised Light Vehicles Test Procedure)
Maintenance parts	Tyres, brake pads and discs, starter battery (12V), windscreen wipers, air conditioning filter, tyre sealant and brake fluid
End of life phase	Dismantling (without high-voltage battery), no credit for recovery (cut-off approach)
Third-party audit	TÜV NORD CERT GmbH, date of validation: 22.04.2025

^{1,2} See page 16 for details





Life cycle assessment | Results for the Macan Turbo



Explanation of results

To assess the global warming potential of the Macan Turbo, the following life cycle phases are considered: supply chain including logistics, in-house production, use including maintenance, and end of life.

Initially, the global warming potential of the vehicle is calculated, without taking possible reduction potentials through measures or renewable energy in the use phase into account. For this purpose, reference data such as generic data from the LCA for Experts software is applied: for example, a European electricity grid mix in the use phase.³

In addition, the LCA shows the impact on the global warming potential by evaluating reduction measures in the supply chain life cycle phase, the company's own vehicle production and by analysing a scenario for renewable energies in the use phase. Taking these measures and the scenario into account, the expectation for the remaining global warming potential with model-specific reduction measures and renewable energies in the use phase is determined approximately. To evaluate the impact of model-specific measures, Porsche compares supplier-specific data with generic reference values from a life cycle analysis database.

Porsche has entered into contractual agreements with suppliers for the model-specific ecological improvement potentials identified in the LCA. **

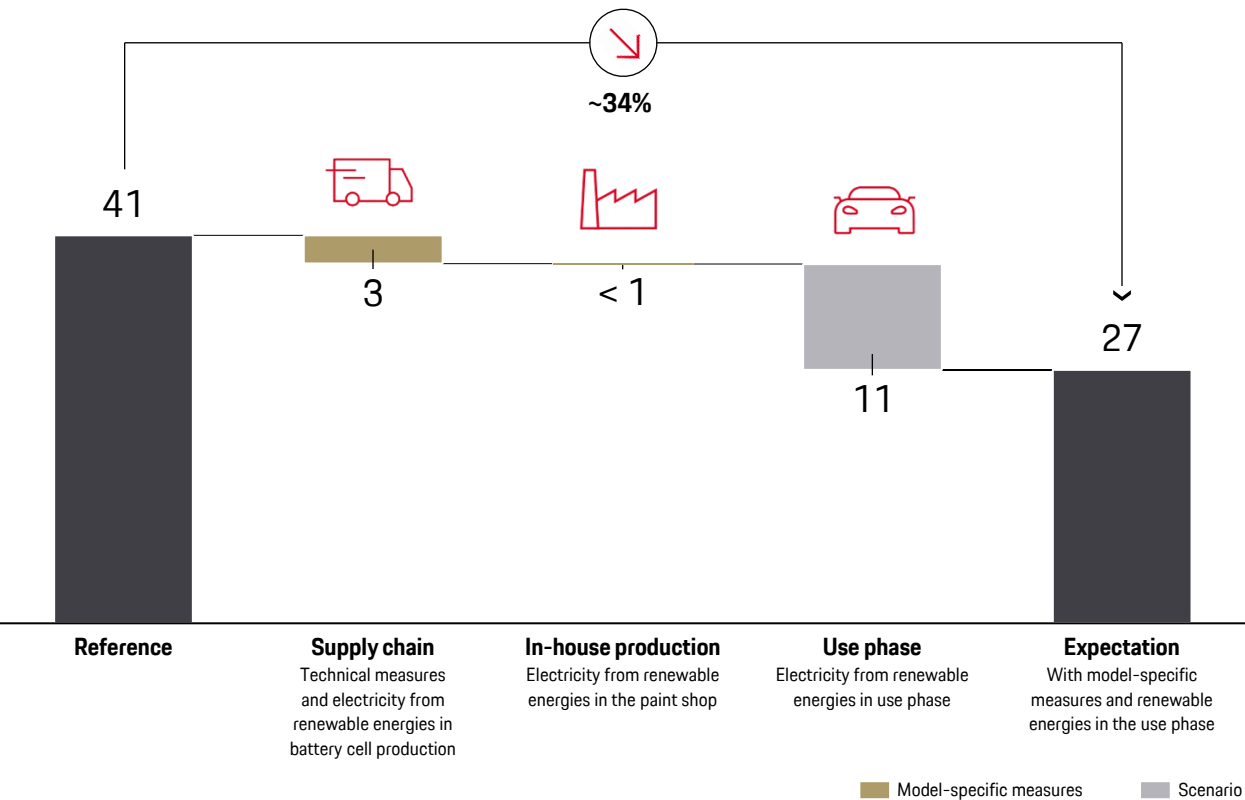
The scenario shown in the LCA considers the full use of electricity from renewable sources during the use phase. Analogous to this scenario in the LCA, Porsche supports the expansion of wind and solar energy systems to cover the expected electricity demand of the European Macan fleet (based on 200,000 km of driving performance at certified WLTP consumption)

³See page 16 for details of the calculation | * Approximation, all values rounded | ** Contractual agreements with suppliers and internal Porsche measures at the time the measures were calculated. Subsequent changes are possible (e.g. due to unforeseen events) | *** End of life < 1 t CO₂e/vehicle

Life cycle assessment | Reduction measures across the life cycle of the Macan Turbo

Impact of model-specific measures and renewable energy in the use phase

Global warming potential including biogenic carbon dioxide for the Macan Turbo measured in **t CO₂e/vehicle**.^{3,*}



³ See page 16 for calculation details | * Approximation, all values rounded | ** Expansion of renewable energies to cover the electricity requirements that the European Macan fleet is expected to need over a 200,000 km life cycle based on various models



~3 t CO₂e

The expected impact of supply chain measures on global warming potential is examined by TÜV NORD (in their 'critical review') within the context of the life cycle assessment (LCA). The measures include the use of CO₂e-reduced primary materials, secondary materials and electricity from renewable energy sources (see page 10 for details).



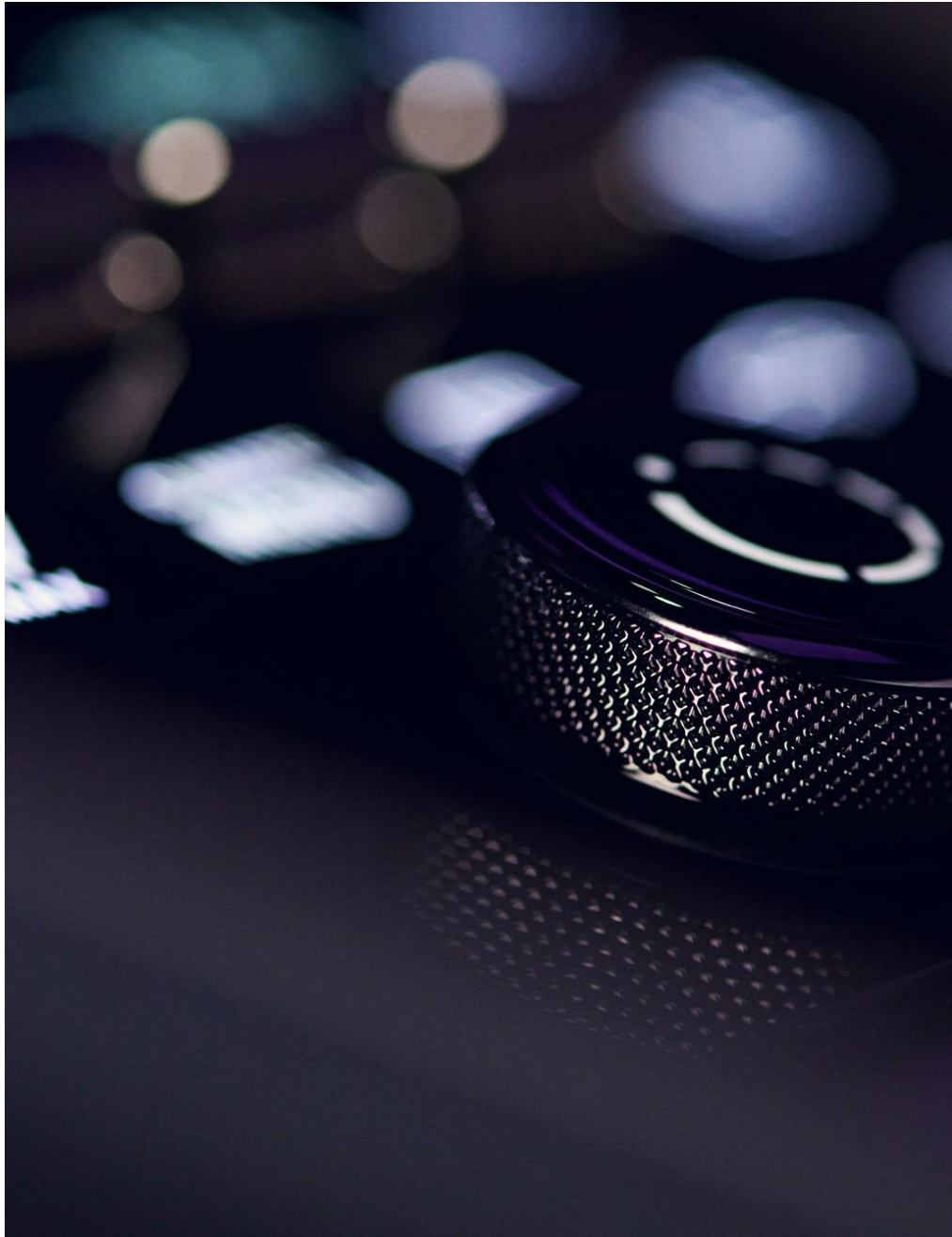
< 1 t CO₂e

The measure 'electricity from renewable energies in the paint shop' in the LCA is based on the use of 100 per cent renewables-generated electricity. Beyond the effect shown in the LCA, Porsche uses electricity from 100 per cent renewable sources at its Leipzig plant, as well as primarily biomass and balance-sheet biomethane for the generation of heat. This is validated by an independent auditor outside of the LCA (see page 11 for details).

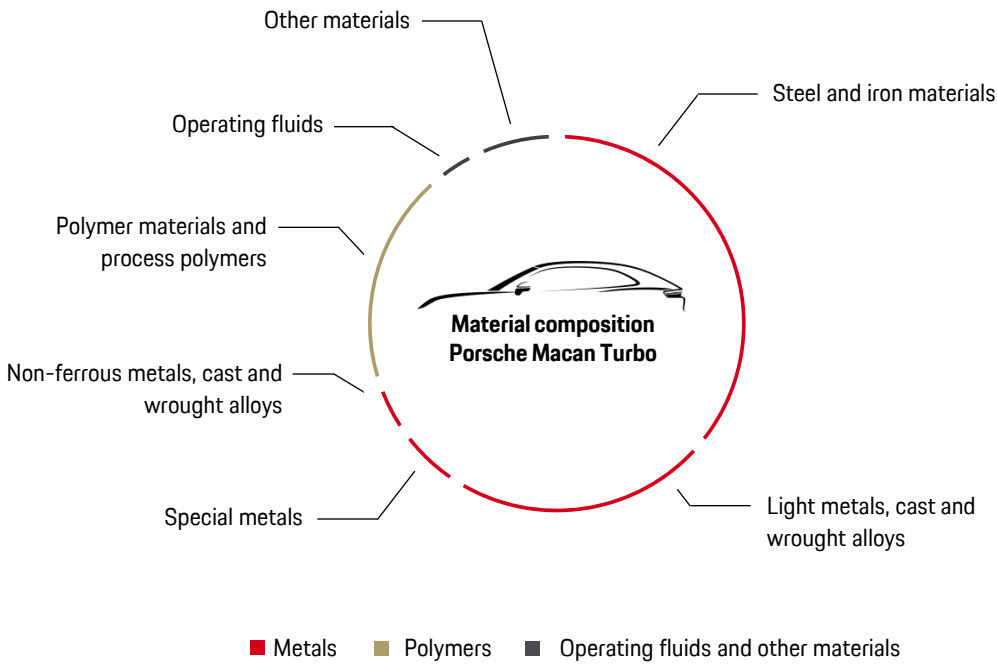


~11 t CO₂e

The 'renewable energies in the use phase' scenario of the LCA is based on the utilisation of electricity from solely renewable energies during the use phase. Analogous to this scenario, Porsche supports the expansion of wind and solar energy systems to cover the expected electricity requirements of the European Macan fleet. The influence of Porsche's commitment to the expansion of renewable energies** is validated separately by an independent auditor outside of the LCA (see page 12 for details).



Supply chain | Porsche Macan Turbo material composition



Material composition

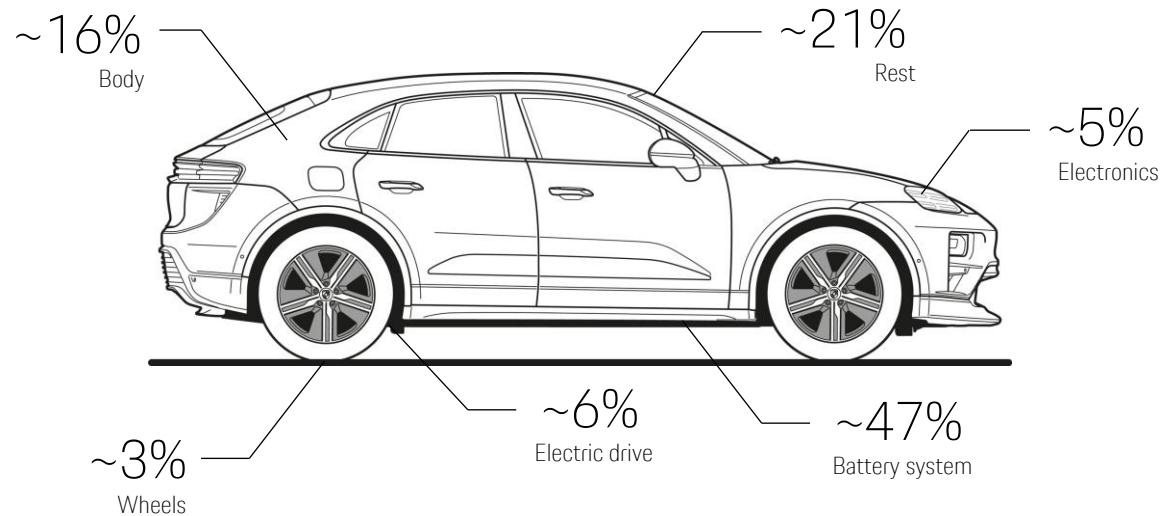
The material composition of a vehicle is a key input parameter for a life cycle assessment, since the various materials differ significantly in their global warming potential.²

The materials used for the Macan Turbo comprise metals, polymers, operating fluids and other materials. The material groups with the highest proportions by weight are steel and iron materials, light metals (cast and wrought alloys), polymer materials and process polymers.

² See page 16 for details of the calculation

Supply chain | Distribution of global warming potential by component group

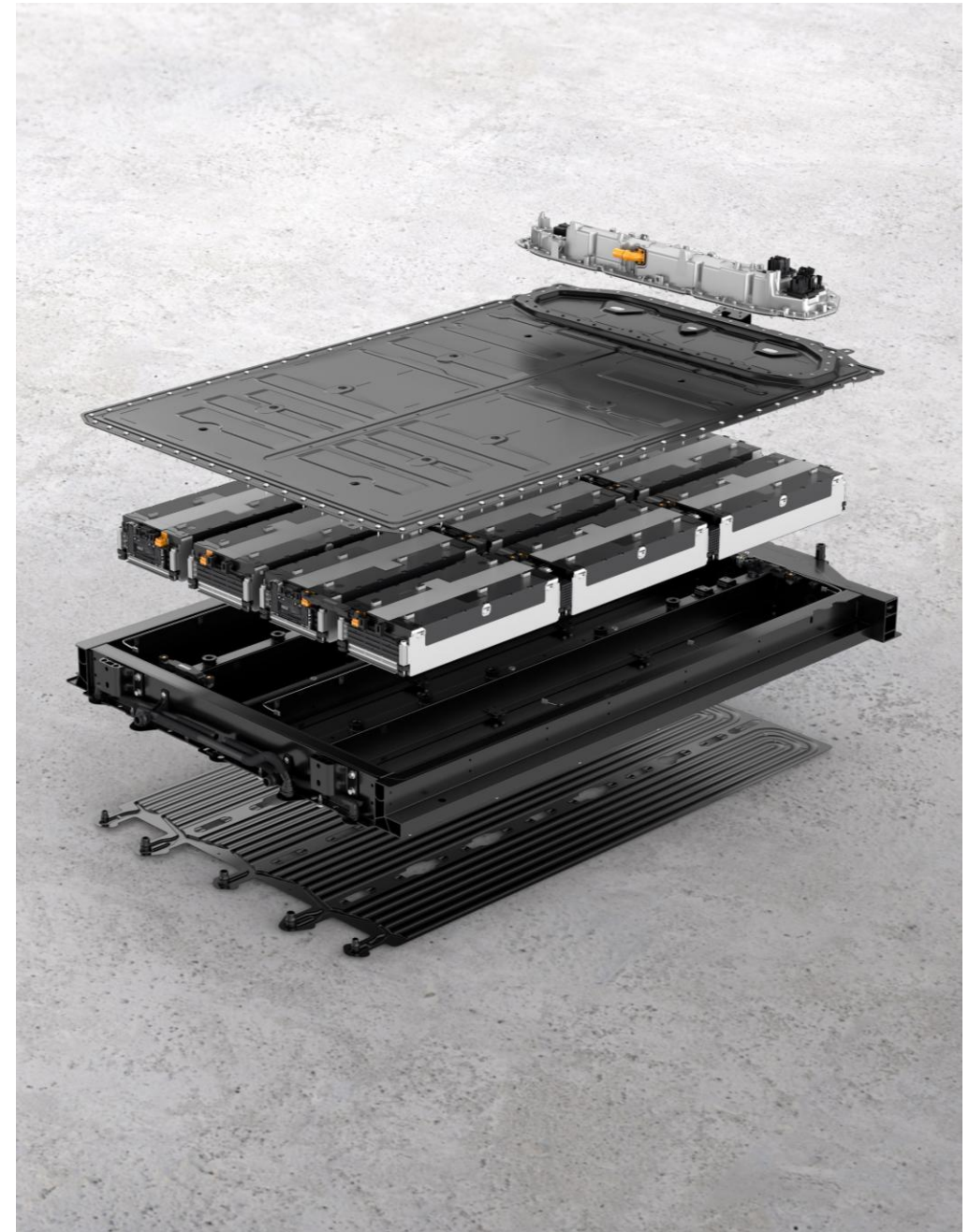
Global warming potential including biogenic carbon dioxide for the Macan Turbo measured in $\text{t CO}_2\text{e/vehicle}$.^{3,*}



The various component groups of the Macan Turbo differ in their contribution to the global warming potential in the supply chain. In total, the battery system, body and electric drive account for almost 70% of the global warming potential in the life cycle phase of the supply chain.

The battery system's contribution exceeds all other component groups at approximately ~47% of the total global warming potential in the supply chain life cycle phase. The body, electric drive, electronics and wheels together contribute ~30%.

Transparency regarding these component groups and the associated materials enables a focused approach to decarbonising the supply chain life cycle phase.³



³ See page 16 for details and calculation restrictions | * All values rounded, excluding own production ~1%



Supply chain | Reduction of global warming potential along the supply chain

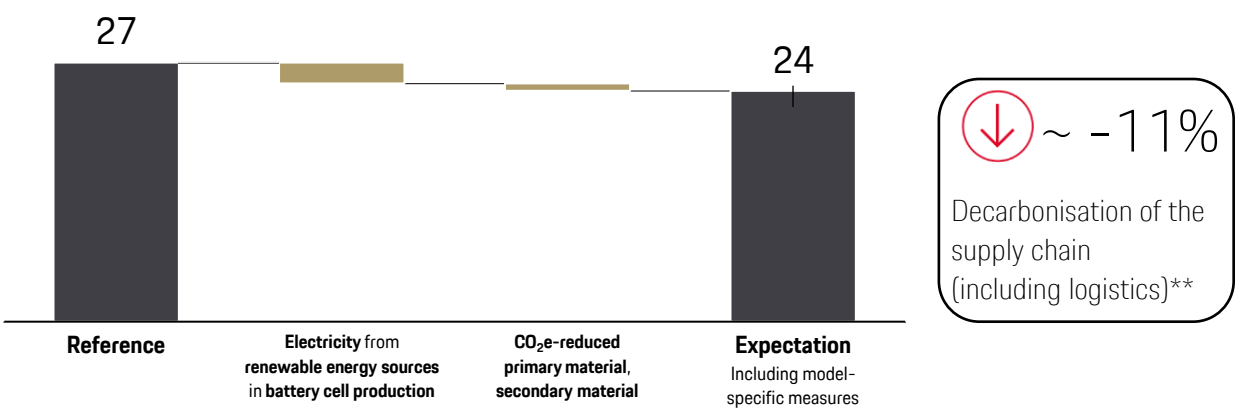
Measures along the supply chain

Porsche has taken measures to reduce the global warming potential in the supply chain during the manufacturing of vehicle components. For the Macan, Porsche requires direct suppliers of selected components to use aluminium with reduced CO₂e. When measured against unprocessed primary aluminium that is typically used in the EU, the unprocessed CO₂e-reduced aluminium used in the Macan has a lower potential impact on the climate, on a kilogram by kilogram basis. Unprocessed means aluminium that has not been processed into semi-finished products (e.g. sheets) or components.

The Macan's frame of the high-voltage battery is an example of the use of CO₂e-reduced aluminium. For the majority of the aluminium used there (more than 50 kg), the global warming potential of the component, compared to the average primary aluminium* used in Europe, was reduced by more than half to 4.0 kg CO₂e/kg aluminium. In addition, secondary aluminium (recycled aluminium) has been used for selected components.

Battery cell production is one of the processes with a particularly high electricity demand. Porsche therefore requires the direct supplier of high-voltage battery cells to use electricity from renewable sources.

Global warming potential including biogenic carbon dioxide for the supply chain (excluding in-house production, including logistics) of the Macan Turbo measured in **t CO₂e/vehicle**.^{3,**}



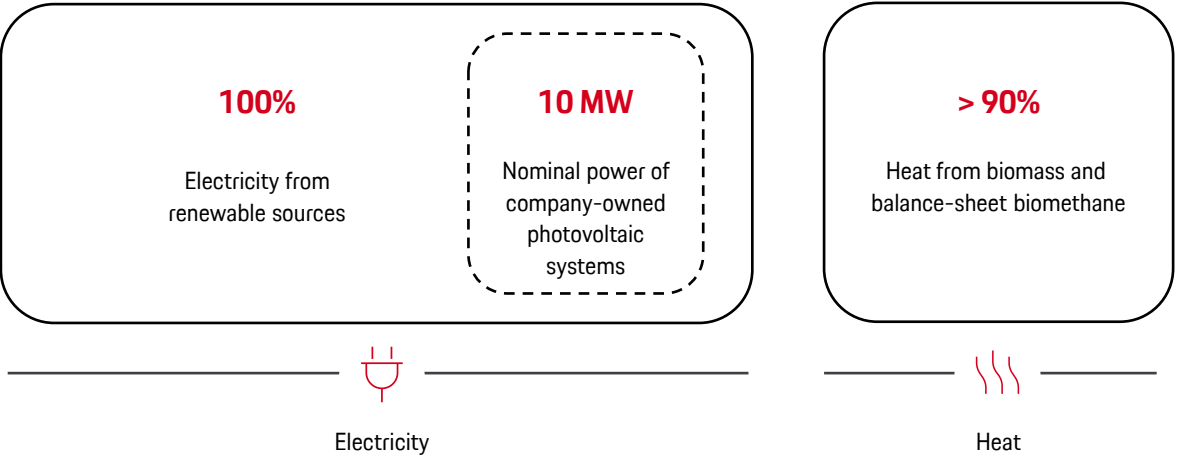
³ See page 16 for details and calculation restrictions | * The average carbon footprint of aluminium in the EU is determined, for example, by European Aluminium. According to the study 'Environmental Profile Report for the European Aluminium Industry' published by European Aluminium in November 2024, the global warming potential of the average primary aluminium used in Europe is 9.7 kg CO₂e/kg aluminium | ** Approximation, all values rounded

Production | Reducing the global warming potential of vehicle production

Activities in production

Porsche is mitigating the global warming potential of Macan production in Leipzig by using 100 per cent electricity from renewable energies and by meeting most of its heating needs with renewables.

Since 2017, only electricity from renewable sources has been used at Porsche's own production facility in Leipzig. Among other things, Porsche has been using the plant's own photovoltaic systems with a total output of almost 10 MW of nominal power since 2021. Most of the required heat is generated by biomass and balance-sheet biomethane. In 2024, this share amounted to more than 90 per cent. Balance-sheet biomethane means that a quantity of gas taken from the gas grid corresponds to a quantity of biomethane fed into the grid at another point.*



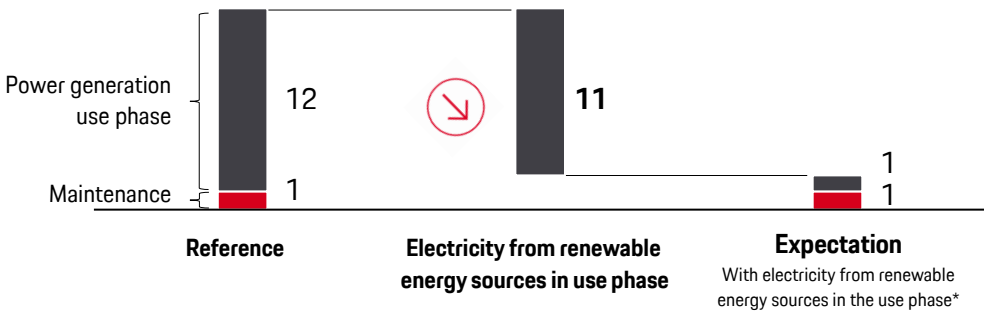
* For methodological reasons, the activities to reduce the global warming potential of production are not fully included in the life cycle assessment. The reductions shown are part of the externally validated environmental key figures reported in the Annual and Sustainability Report 2024



Use phase | Reducing the global warming potential during vehicle operation

Scenario during the use phase of a Macan Turbo

The scenario analysis describes the global warming potential, including biogenic carbon dioxide, when using electricity from renewable energy sources in the use phase, measured in **t CO₂e/vehicle** for the reporting vehicle in Europe.^{3, *}



Measures in the vehicle fleet in Europe

With every new fully electric vehicle, additional electricity requirements arise due to charging during the vehicle use phase. To meet this demand in Europe, Porsche is supporting the creation of new wind and solar capacities. The energy this generates is fed into the local power grids.

Porsche uses a model-based approach aiming to cover the increased demand for renewable energy that is expected to be triggered by the growing fully electric Macan fleet. To achieve this, the expansion of wind and solar power capacity in the European electricity supply networks is being supported – this capacity is of sufficient scale to cover the model-based energy consumption of the Macan Electric new vehicle fleet in Europe. The exact generation capacity of wind and solar energy plants depends on the weather (wind and sun radiation). Porsche uses the average expected output of the plants it supports to project the anticipated generation capacity. This indicates the amount of electricity the plant can exceed or fall short of with a likelihood of 50%. Porsche financially supports the expansion of required wind and solar capacity by entering into ten-year contracts with project partners, such as plant builders and/or operators, together with other companies within the Volkswagen Group. Under the agreements, Porsche commits to paying a fixed amount per unit of energy produced, thereby increasing the plant operator’s planning security and contributing proportionally to the financing of the new plant. In return, Porsche acquires the certificates of origin (EACs: Energy Attribute Certificates) for the electricity fed into the grid and its 'ecological properties'. Cancelling the certificates prevents double usage and double trading by third parties.⁶ The influence of Porsche’s commitment to the development** of renewable energies is validated separately by an independent auditor, outside of the life cycle analysis.

^{3, 6} See page 16 for details and calculation restrictions | * Approximation, all values rounded | ** Expansion of renewable energies to cover the electricity requirements that the Macan fleet in Europe is expected to need over a 200,000 km life cycle on a model-based approach

End of life | Promoting a circular economy

Porsche strives to ensure a responsible and sustainable use of raw materials and the long-lasting use of vehicles and the components within.



Repairability of high-voltage batteries

For the high-voltage battery in the Macan, Porsche has developed a comprehensive repair concept that is available through Porsche Centres and partner workshops worldwide. If the battery requires repair, faults can be diagnosed and defective components can be replaced. This also allows individual battery modules to be replaced. These measures enable a more resource-efficient and cost-effective battery repair. The raw materials used in the battery thereby remain in use for a longer period.



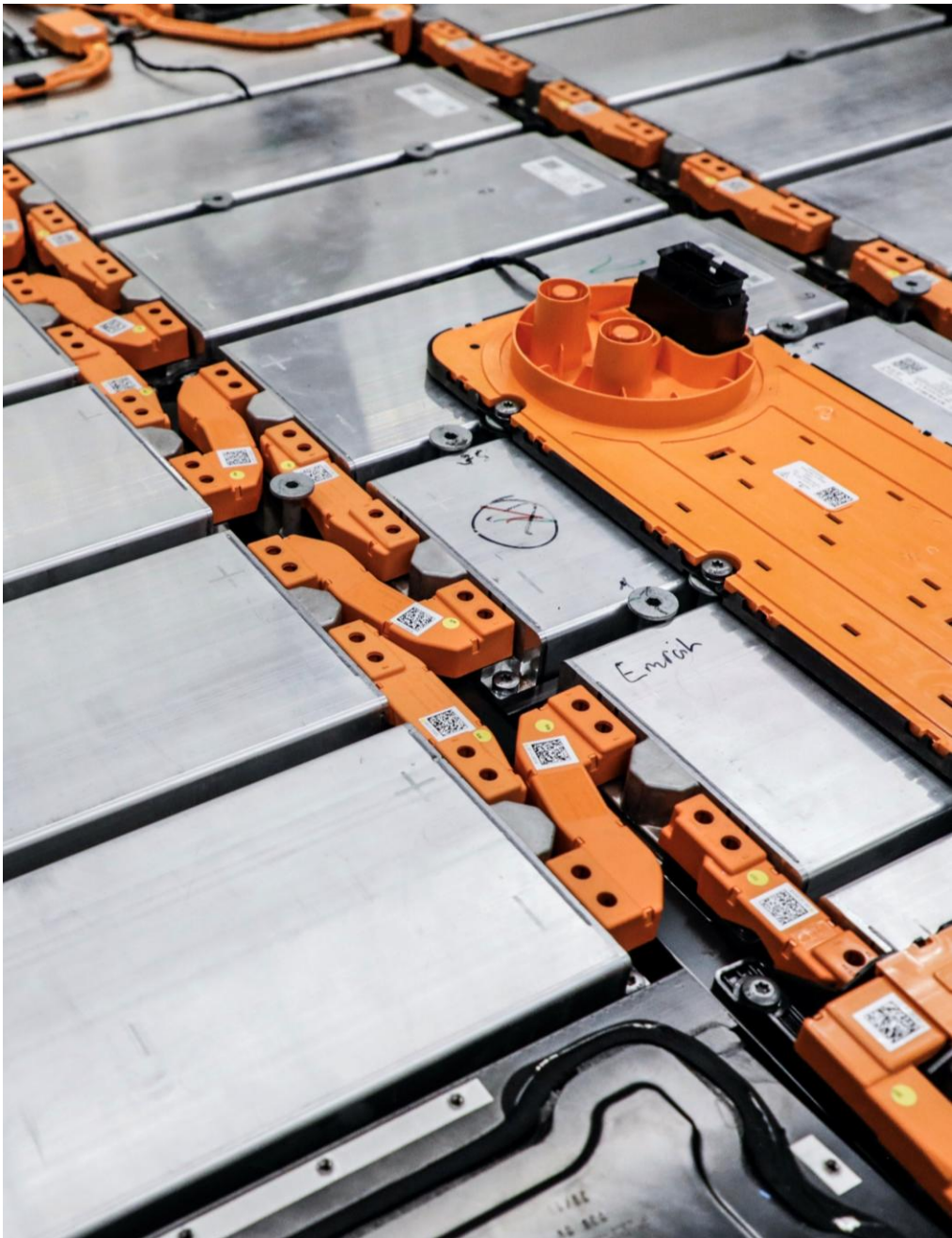
Investment in the recycling ecosystem

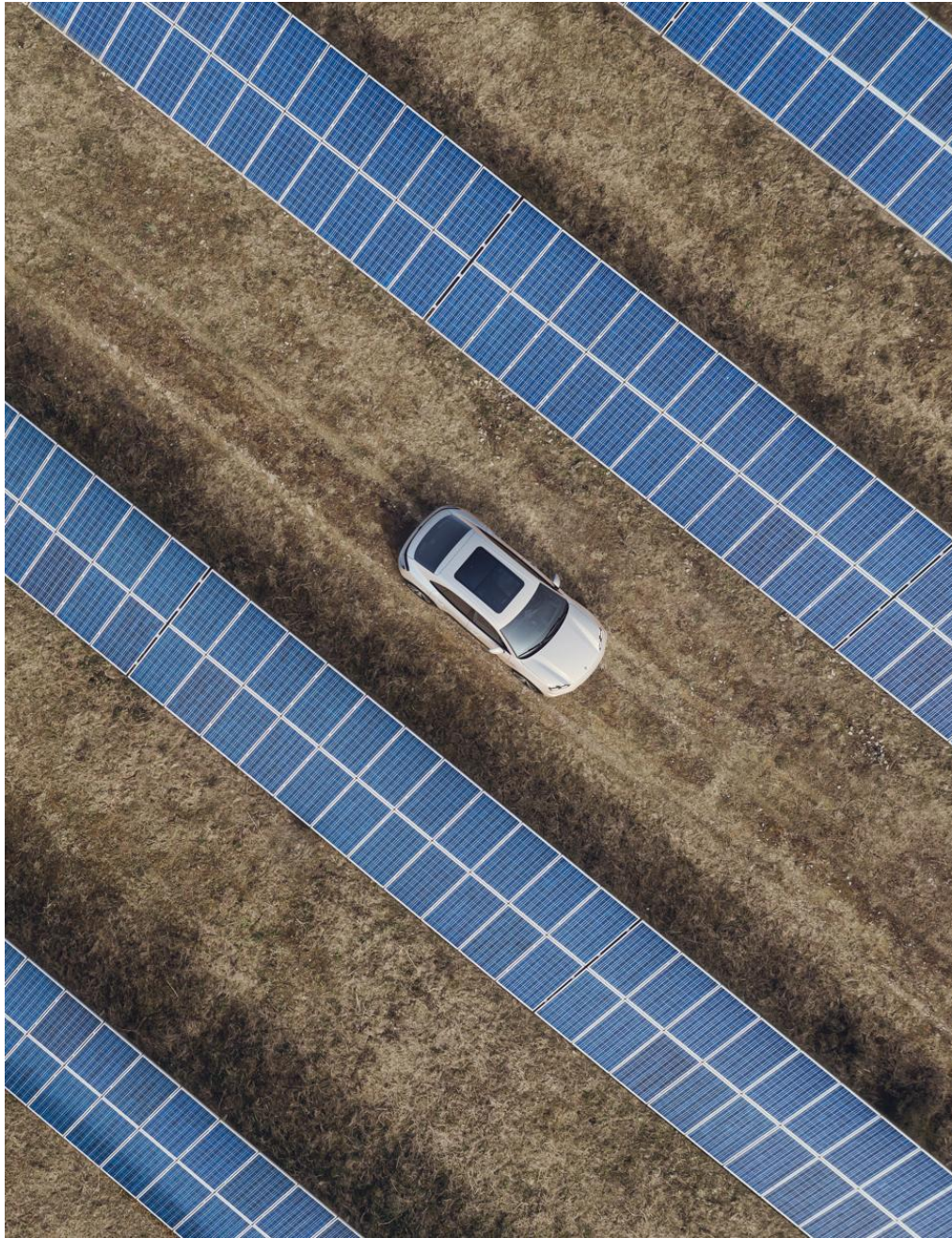
Even at the end of the battery's life, Porsche places the highest priority on responsible management of these materials. To this end, Porsche invested in the battery recycling scale-up cylib in May 2024 via the venture capital unit Porsche Ventures. The innovative process developed by cylib allows for the recovery of approximately 90% of the high-voltage battery raw materials (weighted by mass for lithium, graphite, nickel, manganese, and cobalt). In the future, cylib plans to recycle 60,000 tonnes of end-of-life batteries annually across all manufacturers at a new industrial facility.



Recyclability in the automotive development process

Recycling is also considered beyond batteries. According to the EU End of Life Vehicles Directive 2000/53/EC, vehicles must be at least 85 per cent reusable and/or recyclable and at least 95 per cent reusable and/or recoverable in relation to the vehicle weight. Compliance with these requirements is ensured by appropriate processes during the development phase.

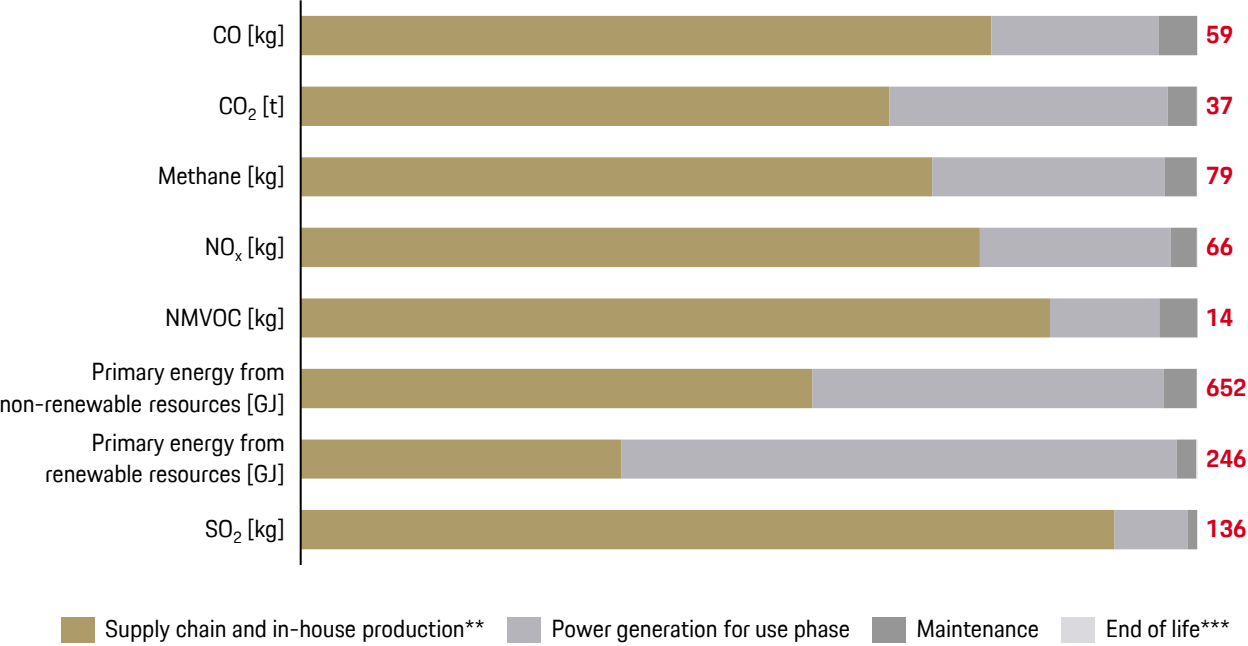




Annex | Extract from the life cycle inventory results of the life cycle assessment

Life cycle inventory results

As part of the life cycle assessment, an inventory analysis⁴ of common factors is created and analysed specifically for each life cycle phase. The following factors, among others, are considered: carbon monoxide (CO), carbon dioxide (CO₂), methane, nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC), primary energy from non-renewable resources, primary energy from renewable resources, sulphur dioxide (SO₂).*



⁴ See page 16 for calculation details and restrictions | * All values rounded | ** Excluding logistics | *** Category < 1%

Annex | Parameters for calculating the life cycle assessment

Software, database and scope of the study

Software

Sphera LCA for Experts Version 10.7.1.28.

Life cycle assessment database and data sets

Sphera LEAD database version 2023.1 with extension databases and data-on-demand data records as well as the corresponding mapping list of the VW Group.

VW Group data sets: final assembly, paint shop, press-hardening steel, tyres, window glass, printed circuit boards, high-voltage battery cells, magnets, dismantling.

Logistics values from VW group logistics system (estimated value for the specific Macan Turbo model, calculated using allocations based on vehicle numbers (Macan and Cayenne) in Leipzig with 2023 as the reference year).

Calculation methodology and guidelines

DIN EN ISO 14040/DIN EN ISO 14044, VW Group LCA Guidelines Version 2.0 and VW Group LCA Manual Version 8.0. Greenhouse potential according to CML 2001 methodology – Aug. 2016.

Scope

In accordance with the life cycle approach, the system boundaries cover the product life cycle from the supply chain and production through the use phase to end of life. The 'cut-off approach' is used. No credits are given in the life cycle assessment for secondary materials recovered from the recycling of vehicles at the end of life. Only the emissions from the dismantling processes (excluding dismantling of the high-voltage battery) are considered. Downstream process steps for recycling the high-voltage battery, such as thermal deactivation and shredding, are not taken into account.

Input variables

Supply chain and production phase

Vehicle configuration with standard equipment for the German market (model year 2024). Modelling of the supply chain and production, if possible, with a geographical reference area of Europe (not location-specific). Separate regional modelling for high-voltage battery cells to improve model accuracy. One traction battery over the life cycle. Consideration of reduction measures at the component and material level when suppliers provide contractual assurances.

Use phase

Electricity grid mix for Europe, reference year 2019 (the most recent figures available in the Sphera LEAD database at the time of preparation).

Electricity consumption: according to Worldwide Harmonised Light Vehicles Test Procedure (WLTP) over 200,000 km.

Maintenance: tyres, brake pads and discs, starter battery (12V), windscreen wipers, air conditioning filter, tyre sealant and brake fluid.

End of life

Generic vehicle segment-specific model for dismantling (without dismantling the high-voltage battery) and without credits for recovery (cut-off approach).

Critical review

Critical review by TÜV NORD CERT GmbH:
Validation report dated 22.04.2025 (Audit Report No. 3538 7612) for the LCA background report dated 17.04.2025.



Annex | Notes and further information

1 The selected reference vehicle, the Macan Turbo from the Macan model series, has the largest kerb weight and the highest consumption with standard equipment according to WLTP at the time of the life cycle assessment (LCA). The results of the Macan Turbo life cycle assessment (LCA) should therefore generally be above the expected results of LCAs for other derivatives of the Macan model series with standard equipment.

2 The LCA is calculated on the basis of IMDS data ('International Material Data System' – a globally standardised exchange and management system for material data in the automotive industry) and the weights specified there. Deviations compared to the DIN kerb weight are less than one per cent.

3 With regard to the state of the art in life cycle assessments, it should be noted that the calculation methods for LCAs in the automotive industry are subject to constant further development. Future calculations may show deviations from potential environmental impacts determined in the past. The life cycle assessments are based on assumptions that were made on the basis of the available information and were considered realistic at the time of the calculation. Assumptions are not adjusted retrospectively. The assumptions made and the associated uncertainties may lead to an over- or underestimation of the environmental impacts. Therefore, LCAs are to be understood as the status at the time of calculation (snapshot of the respective assumptions) and do not represent guaranteed product characteristics in a legal sense. Due to potentially different methodological assumptions, they are not suitable for comparison with life cycle assessments, especially those of other automobile manufacturers. The LCA has been prepared in accordance with DIN EN ISO 14040:2021/DIN EN ISO 14044:2021 and reviewed by TÜV NORD (in their 'critical review'). Scenario analyses can be part of an LCA in accordance with DIN EN ISO 14040/DIN EN ISO 14044. The study conducted examines options for action that affect environmental impacts, such as the use of electricity from renewable sources during the use phase. In line with this scenario, Porsche supports the expansion of wind and solar energy to cover the expected electricity requirements of the European Macan fleet. The influence of Porsche's commitment to the development of renewable energies is validated separately by an independent auditor outside of the life cycle assessment (see page 12). Additionally, the scenario analysis examines the impact of contractually agreed model-specific measures on global warming potential, both within the supply chain and in the company's in-house production processes. The potential reduction from using electricity sourced from renewable resources is calculated as the difference between the emissions generated when using a regional average electricity mix (as a reference) and the emissions originating when using an average dataset for electricity derived from renewable sources, which accounts for the typical renewable energy technologies employed in the region under consideration. This is evaluated within the context of a scenario analysis of the TÜV Nord-audited Life Cycle Assessment (LCA) in accordance with DIN EN ISO 14040/DIN EN ISO 14044. This approach combines and compares two different methods of electricity accounting, which introduces methodological uncertainties, and which can lead to double counting of electricity from renewable sources. Currently, this issue cannot be resolved due to a lack of data availability. An adjustment (calculation via the residual mix) would not only increase the expected global warming potential of the reference vehicle and the expected value (with model-specific measures and renewable energies in the use phase), but also the expected amounts offset by measures and scenarios.

4 On the basis of the results of the inventory analysis, impact analyses are carried out, such as for the global warming potential. This global warming potential measures the greenhouse gas emissions that can lead to increased heat absorption in the atmosphere through solar radiation and thus contribute to climate change, for example in the form of rising global average temperatures. The reference substance is carbon dioxide (CO₂). The other greenhouse gases (e.g., CH₄, N₂O, SF₆) are converted into CO₂ equivalents (CO₂e) according to their global warming potential. The so-called CML methodology (CML2001-Aug. 2016) is used for this purpose. It was developed at the Centrum voor Milieukunde Leiden (CML) of the University of Leiden in the Netherlands. The CML methodology is used to assess the potential environmental impact based on recognised scientific models.

5 Insofar as the consumption and emission values are given as ranges, they do not refer to a single, individual vehicle and are not part of the offer. They serve solely as a means of comparing the different types of vehicles and refer to the product range on the German market. Additional equipment and accessories (attachments, tyre format, etc.) can change relevant vehicle parameters such as weight, rolling resistance and aerodynamics and, in addition to weather and traffic conditions as well as individual driving behaviour, can influence fuel/power consumption, CO₂ emissions, range and driving performance values of a vehicle.

6 For vehicles in Europe (EU+3 (Iceland, Norway, UK)), the region-specific average consumption value is calculated based on an assumed mileage of 200,000 km (~124.274 mi) per vehicle over ten years. The consumption value is determined according to the legally prescribed test cycle (WLTP). The assumed mileage of 200,000 km (~124.274 mi) is based on the recommendation of VDA (German Association of the Automotive Industry) guideline 900-100. Porsche has the procedure audited annually by an independent expert.



CERTIFICATE OF VALIDITY

DIN EN ISO 14040:2021 / DIN EN ISO 14044:2021
(product-related life cycle assessment - LCA)

Evidence that the application conforms to the regulations was delivered, and is herewith certified according to the TÜV NORD CERT Prüf- und Umweltgutachtergesellschaft mbH - procedure for

Dr. Ing. h.c. F. Porsche AG
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Germany



Range of application
Life Cycle Assessment „Porsche Macan Turbo (MY 2024)“

The requirements of the above-mentioned standards were evidently fulfilled by a critical review with regard to

- the scientifically justified and technically valid methods used in carrying out the LCA;
- the appropriateness of the data used in relation to the objective of the study;
- the consideration of the objective of the LCA and the identified limitations in the interpretations.

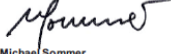
The LCA report (Ref: 35387612, Vers. 05) is transparent and self-consistent.

This declaration of validity refers exclusively to the functional unit at point in time of the LCA report.

Report No. 3538 7612



Dr. Winfried Hirtz
Environmental verifier



Hannover, 2025-04-22
Michael Sommer
Environmental expert

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Database status for LCA

August 2023, update of selected data points and
modeling April 2025

Publication

May 2025, selected updates in October 2026 (version 2)

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