

Life Cycle Assessment

Methods and independent verification

Life Cycle Assessment (LCA) based on DIN EN ISO 14040 and DIN EN ISO 14044

We are currently particularly observing the global warming potential as impact category that converts certain environmental impacts into CO₂ equivalents. Volkswagen AG commissioned TÜV NORD CERT Prüf- und Umweltgutachtergesellschaft mbH as an independent external body to carry out the critical review of this LCA study in accordance with the applicable standards DIN EN ISO 14040 and DIN EN ISO 14044. In accordance with the standard, the manufacturing phase from raw material extraction, the use phase comprising passenger transportation over 200,000 km in the WLTP driving cycle and the dismantling for recycling (without battery system) were used as framework. The environmental impacts were assessed via a special software including a database with average upstream chain values. For selected parts like the battery cells separate analyses were carried out.

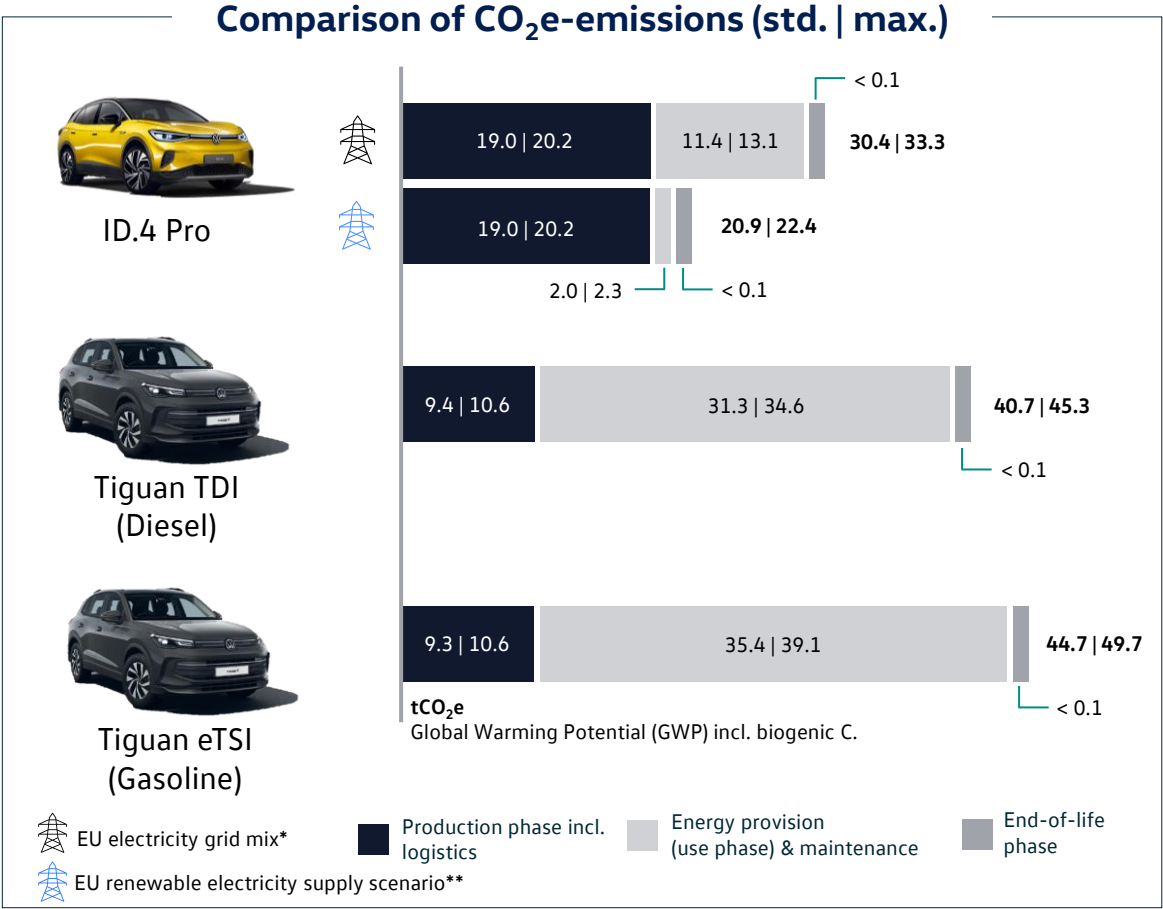


With regard to the state of the art of LCAs, it should be noted that the calculation methods for LCAs in the automotive industry are subject to constant further development. Amongst others generic data and assumptions are increasingly being replaced by vehicle- and company-specific data, thus future calculations may lead to significant deviations from previous LCA values. The presented LCA results reflect the methodology, datasets and assumptions available at the time of calculation and may be updated in the future accordingly. Therefore, LCAs are to be understood as a status at the time of execution (snapshot of the respective assumptions), do not represent a guaranteed product property in a legal sense and are not suitable for comparisons with LCAs from other car manufacturers. Respective harmonizing EU standards are announced.



Life Cycle Assessment Comparison: ID.4 Pro vs. Tiguan

Overview LCA ID.4 Pro & Tiguan			
	ID.4 Pro 210 kW 82 kWh ³	Tiguan 2.0 TDI 110 kW ⁴ DSG	Tiguan 1.5 eTSI 110 kW ⁵ DSG
Configurations ¹	standard (std.) maximum (max.), market Germany, MY 24		
Functional unit	200,000 km passenger transportation in WLTP test cycle		
System boundaries	production in Europe (not site-specific)		
	avg. logistics Zwickau & Emden	avg. logistics Wolfsburg	
WLTP energy / fuel consumption ²	16.0 18.4 kWh per 100 km	5.3 5.8 liter per 100 km	6.2 6.8 liter per 100 km
Maintenance	tires, brake pads and disks, starter batteries, wiper blades, additionally for Tiguan engine oil and AdBlue in case of TDI		
End-of-life phase	dismantling (without battery), no credits for recovery (cut-off)		
Critical Review	TÜV NORD CERT, Audit Report No. 3535 7825		



All figures shown in the report are rounded, minor discrepancies may arise from addition of these amounts. Vehicles were selected as representative examples of comparable vehicle segments.

¹standard configuration: standard equipment in representative line | maximum configuration: one feasible parameter set for additional equipment for maximum weight ²values rounded to first decimal place

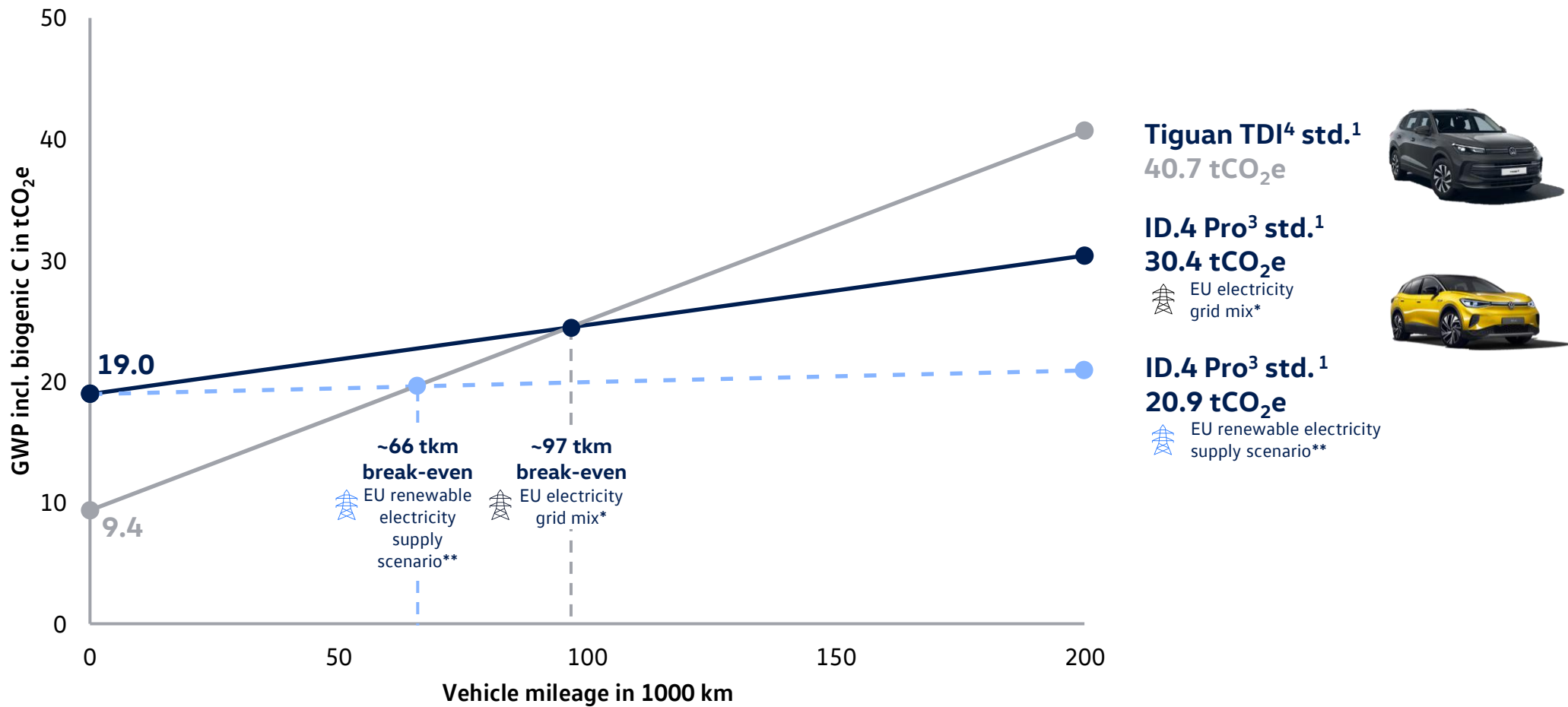
Information in accordance with 1999/94/EC for the German market as of September 2026: ³energy consumption combined 17.6 - 15.4 kWh/100 km; CO₂ emissions combined 0 g/km; CO₂ class: A; ⁴fuel consumption combined 5.9 - 5.3 l/100 km; CO₂ emissions combined 155 - 139 g/km; CO₂ class: E; ⁵fuel consumption combined 6.7 - 6.0 l/100 km; CO₂ emissions combined 153 - 137 g/km; CO₂ class: E; specific models from model year 2024 with different consumption value spans used in the LCA calculation are no longer available for sale

* EU electricity grid mix: LCA model of the European average electricity consumption mix for final consumers based on annual average production data

** EU renewable electricity supply scenario: LCA model of a European renewable electricity supply mix (100% renewable energy sources) for final consumers based on annual average production data, hypothetical modelling scenario for LCA purposes



Life Cycle Assessment Comparison: ID.4 Pro vs. Tiguan



All figures shown in the report are rounded, minor discrepancies may arise from addition of these amounts. Vehicles were selected as representative examples of comparable vehicle segments. Illustrative LCA result under stated modelling assumptions.

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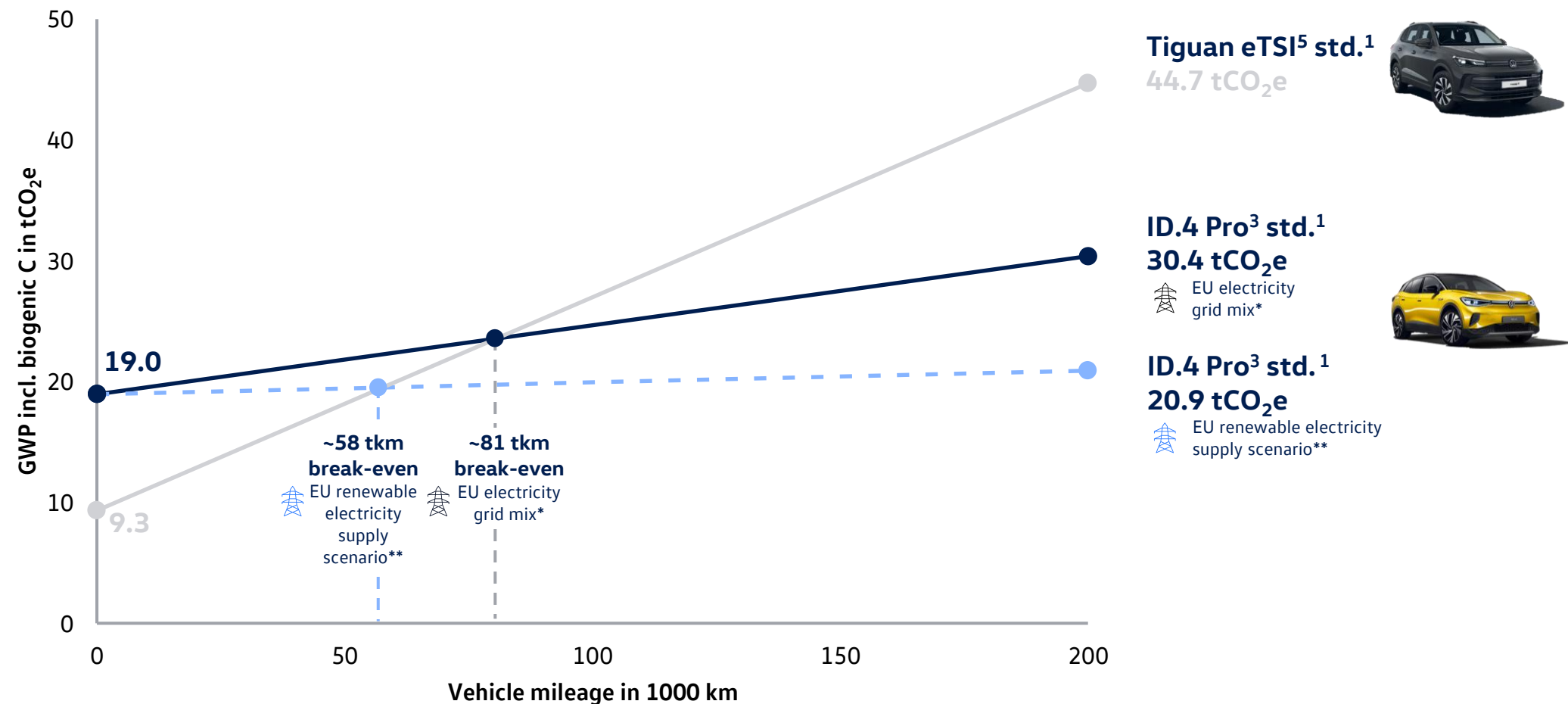
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Life Cycle Assessment Comparison: ID.4 Pro vs. Tiguan



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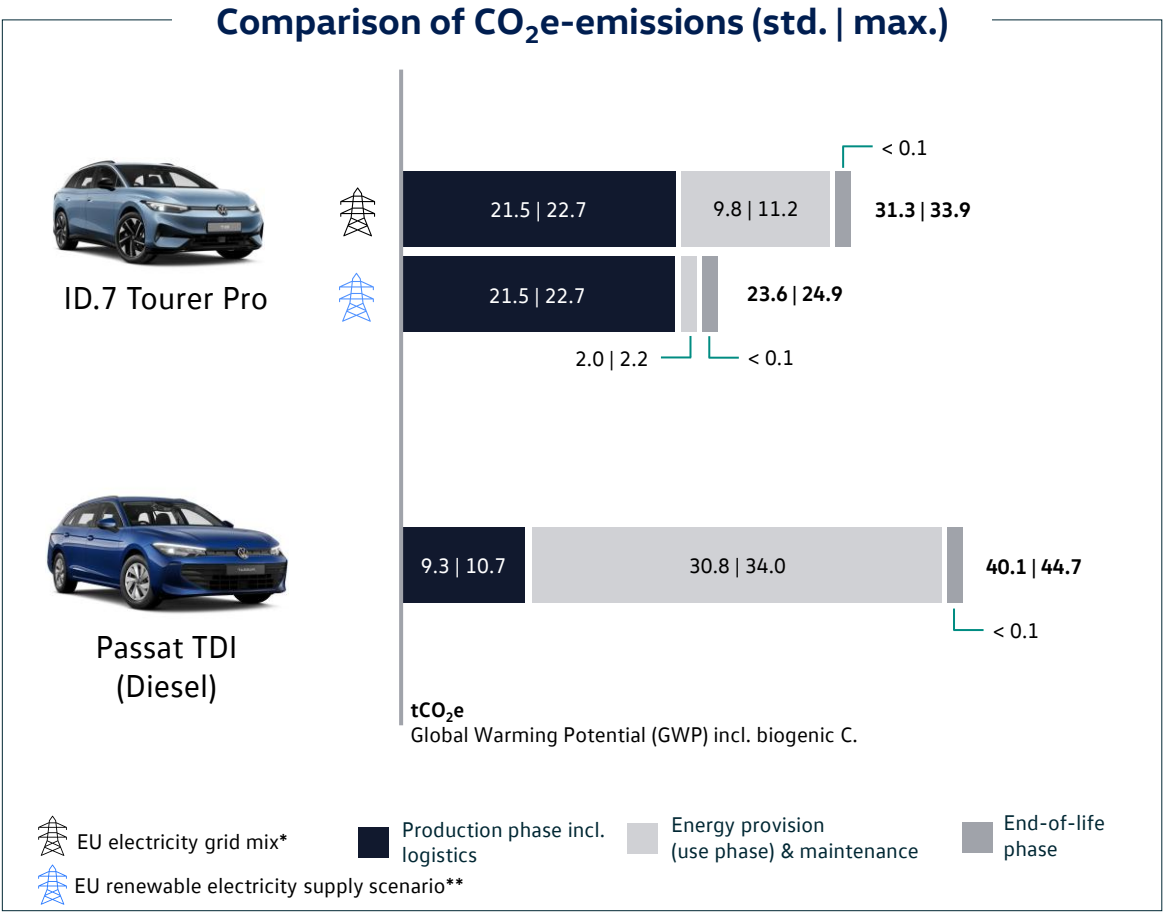
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Life Cycle Assessment Comparison: ID.7 Tourer Pro vs. Passat

Overview LCA ID.7 Tourer Pro & Passat		
	ID.7 Tourer Pro 210 kW 82 kWh ³	Passat 2.0 TDI 110 kW ⁴ DSG
Configurations ¹	standard (std.) maximum (max.), market Germany, MY 24	
Functional unit	200,000 km passenger transportation in WLTP test cycle	
System boundaries	production in Europe (not site-specific)	
	avg. logistics Emden	avg. logistics Bratislava
WLTP energy / fuel consumption ²	14.5 16.8 kWh per 100 km	4.9 5.4 liter per 100 km
Maintenance	tires, brake pads and disks, starter batteries, wiper blades, additionally for Passat engine oil and AdBlue	
End-of-life phase	dismantling (without battery), no credits for recovery (cut-off)	
Critical Review	TÜV NORD CERT, Audit Report No. 3539 8485	



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Information in accordance with 1999/94/EC for the German market as of September 2026 : ³energy consumption combined 17.6 - 15.0 kWh/100 km; CO₂ emissions combined 0 g/km; CO₂ class: A; ⁴fuel consumption combined 5.5 - 5.0 l/100 km; CO₂ emissions combined 144 - 130 g/km; CO₂ class: D; specific models from model year 2024 with different consumption value spans used in the LCA calculation are no longer available for sale

* EU electricity grid mix: LCA model of the European average electricity consumption mix for final consumers based on annual average production data
** EU renewable electricity supply scenario: LCA model of a European renewable electricity supply mix (100% renewable energy sources) for final consumers based on annual average production data, hypothetical modelling scenario for LCA purposes



Life Cycle Assessment ID.4 and Tiguan Methodology



Software, Data Basis and Scope

Software

- Sphera LCA for Experts version 10.7.1.28

LCA database and data sets

- Sphera LEAD database content version 2023.2 with extension databases and data-on-demand datasets, respective VW Group mapping list
- VW Group datasets: final assembly, paint shop, press-quenched steel, tires, vehicle windows, recovery, printed circuit boards, high-voltage battery cell
- Logistics via VW logistic system (only GWP)

Calculation Rules

- DIN EN ISO 14040/44
- VW Group LCA Guidelines version 2.0 and VW Group LCA Manual version 8.0

Scope

- According to the life cycle approach the system boundaries comprise the entire product life span (from production to use phase and end-of-life). Emissions from further scope 3 categories like business travel, employee commuting, franchises etc. as defined in the greenhouse gas protocol are not covered and are considered for the calculation of the VW group KPI “Decarbonization Index”.



Input variables

Production phase

- Vehicle configurations in dominant market with standard equipment in representative line and with one feasible parameter set for additional equipment for maximum weight
- Supply chain and in-house production in Europe (not site-specific)
- Battery: one traction battery (if applicable) covering the functional unit
- If applicable inclusion of reduction measures on part level confirmed by respective validation reports and validity statements

Use Phase

- Energy and fuel provision: European electricity, gasoline and diesel datasets of 2019 (the most current data available in the applied Sphera LEAD database)
- Energy and fuel consumption: Worldwide Harmonized Light Vehicles Test Procedure (WLTP) for 200,000 km
- Maintenance: tires, brake pads and disks, starter batteries, wiper blades, if applicable engine oil and AdBlue

End-of-life

- Generic vehicle segment specific model for dismantling without battery system and without credits for recovery (cut-off approach)



Verification

- Critical Review by TÜV NORD CERT: validity statement from Audit Report No. 3535 7825



With regard to the state of the art of LCAs, it should be noted that the calculation methods for LCAs in the automotive industry are subject to constant further development. Amongst others generic data and assumptions are increasingly being replaced by vehicle- and company-specific data, thus future calculations may lead to significant deviations from previous LCA values. The presented LCA results reflect the methodology, datasets and assumptions available at the time of calculation and may be updated in the future accordingly. Therefore, LCAs are to be understood as a status at the time of execution (snapshot of the respective assumptions), do not represent a guaranteed product property in a legal sense and are not suitable for comparisons with LCAs from other car manufacturers. Respective harmonizing EU standards are announced.



Life Cycle Assessment ID.7 and Passat Methodology



Software, Data Basis and Scope

Software

- Sphera LCA for Experts version 10.8.0.14

LCA database and data sets

- Sphera LEAD database content version 2024.1 with extension databases and data-on-demand datasets, respective VW Group mapping list
- VW Group datasets: final assembly, paint shop, press-quenched steel, tires, vehicle windows, recovery, printed circuit boards, high-voltage battery cell
- Logistics via VW logistic system (only GWP)

Calculation Rules

- DIN EN ISO 14040/44
- VW Group LCA Guidelines version 3.0 and VW Group LCA Manual version 9.0

Scope

- According to the life cycle approach the system boundaries comprise the entire product life span (from production to use phase and end-of-life). Emissions from further scope 3 categories like business travel, employee commuting, franchises etc. as defined in the greenhouse gas protocol are not covered and are considered for the calculation of the VW group KPI “Decarbonization Index”.



Input variables

Production phase

- Vehicle configurations in dominant market with standard equipment in representative line and with one feasible parameter set for additional equipment for maximum weight
- Supply chain and in-house production in Europe (not site-specific)
- Battery: one traction battery (if applicable) covering the functional unit
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Use Phase

- Energy and fuel provision: European electricity, gasoline and diesel datasets of 2020 (the most current data available in the applied Sphera LEAD database)
- Energy and fuel consumption: Worldwide Harmonized Light Vehicles Test Procedure (WLTP) for 200,000 km
- Maintenance: tires, brake pads and disks, starter batteries, wiper blades, if applicable engine oil and AdBlue

End-of-life

- Generic vehicle segment specific model for dismantling without battery system and without credits for recovery (cut-off approach)



Verification

- Critical Review by TÜV NORD CERT: validity statement from Audit Report No. 3539 8485



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Life Cycle Assessment ID.4, ID.7, Tiguan and Passat

Methodology - glossary

CML methodology and IPCC methodology

The Life Cycle Impact Assessment (LCIA) and the characterization model for the ID.4 and the Tiguan LCA are based on the CML methodology as of August 2016. For the ID.7 and the Passat LCA the more recent IPCC AR 6 methodology is applied. The IPCC AR6 is the sixth major climate assessment report, developed over several years by scientists worldwide and released between 2021 and 2023. The respective methodology and its characterization model for the assessment of environmental impact potentials thus incorporates current insights into atmospheric chemistry, radiative forcing, and climate feedbacks.

Critical Review

Process described in ISO 14044 intended to ensure consistency between a life cycle assessment and the principles and requirements of the International Standards on life cycle assessment as described in ISO 14040, carried out by independent experts.

Cut-off approach

For the secondary materials emerging from vehicle recovery processes at the end of life, no credits are issued within the life cycle assessment. Only the expenditures and emissions of the recovery processes are considered. For vehicles with a high-voltage battery, the end of life of the battery including thermal deactivation and shredding is not assessed.

Global Warming Potential (GWP)

The global warming potential describes the emission of greenhouse gases, which lead to an increase of the heat absorption of solar radiation within the atmosphere and thus can contribute to climate change, e.g. an increase of global average temperatures. The reference substance for the global warming potential is carbon dioxide. All other greenhouse gases (e. g. CH₄, N₂O, SF₆) are projected to carbon dioxide in terms of their impact on global warming (CO₂ equivalents or CO₂e). GWP values including biogenic carbon (biogenic C) basically consider the uptake of greenhouse gases from the atmosphere by respective processes.

Greenhouse Gas Protocol (GHG Protocol)

A partnership between the World Resources Institute and the World Business Council for Sustainable Development providing accounting and reporting standards, sector guidance and calculation tools for emissions reporting. It establishes a comprehensive, global, standardized framework for measuring and managing emissions and divides emissions into three scopes: scope 1 - direct GHG emissions (of company), scope 2 - energy related indirect GHG emissions, scope 3 - other indirect GHG emissions

ISO 14040/44

ISO 14040 and ISO 14044 define the standard for an ISO-compliant Life Cycle Assessment (LCA) and respective comparative LCAs. ISO 14040 provides the 'principles and framework' of the standard, while ISO 14044 provides an outline of the 'requirements and guidelines'.

Life Cycle Assessment (LCA)

LCA addresses the environmental aspects and potential environmental impacts (e.g. use of resources and environmental consequences of releases) throughout a product's life cycle from raw material acquisition through production, use and end-of-life treatment (i.e. cradle-to-grave). An LCA study consists of the phases (1) goal and scope definition, (2) inventory analysis, (3) impact assessment and (4) interpretation.

Sphera LCA for Experts

The software LCA for Experts (common name: GaBi, "Ganzheitliche Bilanzierung") from Sphera is a LCA modelling and reporting application. The content databases include many raw materials and processes in every phase from extraction to end-of-life across the supply chain.

Worldwide Harmonized Light Vehicles Test Procedure (WLTP)

The WLTP is a globally harmonized standard for determining the levels of pollutants, CO₂ emissions and fuel consumption of traditional and hybrid cars, as well as the range of fully electric vehicles.

Information in accordance with 1999/94/EC:

The figures for fuel consumption, power consumption, CO₂ emissions and electric range were determined in accordance with the legally required "Worldwide Harmonized Light Vehicles Test Procedure" (WLTP) in accordance with Regulation (EC) 715/2007. Additional equipment and accessories (add-on parts, tyre format, etc.) can change relevant vehicle parameters, such as weight, rolling resistance and aerodynamics, and influence a vehicle's fuel consumption, power consumption, CO₂ emissions, electric range and mileage values in addition to weather and traffic conditions as well as individual driving behaviour.

