360° Environmental Check Mercedes-Benz EQS

Mercedes-Benz
The best or nothing.

Contents

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As of: October 2021

Overview 360° Environmental Check Mercedes-Benz EQS

The EQS is the first all-electric luxury saloon from Mercedes-EQ. With the EQS, Mercedes-EQ wants to redefine this vehicle segment. The EQS is also the first model to be based on the modular architecture for luxury and executive-class electric vehicles. Fusing technology, design, functionality and connectivity, the EQS delights both drivers and passengers.

The first models to come onto the market are the EQS 450+ (NEDC combined electrical consumption: 18.9-16.2 kWh/100 km; CO_2 emissions: 0 g/km)[1] plus the EQS 580 4MATIC (NEDC combined electrical consumption: 19.6-17.6 kWh/100 km; CO_2 emissions: 0 g/km)[1]. Fuel consumption acc. to WLTP[2]: EQS 450+ combined electrical consumption 19.8-15.6 kWh/100 km, CO_2 emissions 0 g/km; EQS 580 4MATIC combined electrical consumption 21.4-18.3 kWh/100 km, CO_2 emissions 0 g/km. With ranges up to 785 kilometres (WLTP)[2] and an output of up to 385 kW, the drive of the EQS also meets every expectation of a progressive saloon in the S-Class segment.

The EQS also marks the launch of a new generation of batteries with significantly higher energy density. The innovative battery management software, developed in-house, allows updates over the air (OTA). The energy management of the EQS is therefore kept up to date throughout the lifecycle. In terms of the cell chemistry, the cobalt content of the cathodes has been reduced to ten percent.

The improvement of the environmental compatibility at Mercedes-Benz means much more than energy consumption. Because the earlier the “Design for Environment” approach is integrated into the development process, the greater are the benefits in terms of minimized environmental impacts and costs. It is likewise crucial to reduce the environmental impact caused by emissions and consumption of resources during the entire lifecycle. This comprehensive and exhaustive Life Cycle Assessment (LCA) we call “360° environmental check”. It scrutinizes all environmentally relevant aspects of a car’s life: from manufacture of the raw materials to production, vehicle operation and then recycling at the end of the vehicle‘s life – a long way off in the case of a new Mercedes-Benz.

As well as documenting every last detail of this LCA in-house throughout the entire lifecycle, we have the results checked and confirmed by independent assessors. This is how the 360° environmental check is created.

This brochure presents the results of the Life-Cycle Assessment in detail.

[1] Electricity consumption [and range] was [were] determined on the basis of Regulation 692/2008/EC. The values depend on the vehicle configuration. Further information on the official fuel consumption and the official specific CO_2 emissions of new passenger cars can be found in the publication “Leitfaden uber den Kraftstoffverbrauch, die CO_2-Emissionen und den Stromverbrauch neuer Personenkraftwagen” [Guide to fuel consumption, CO_2 emissions and electrical consumption of new passenger cars] which is available free of charge at all sales outlets and from Deutsche Automobil Treuhand GmbH at www.dat.de.
[2] Electricity consumption [and range] was [were] determined on the basis of Regulation 2017/1151/EC. The values depend on the vehicle configuration.

Validation

Management Service

TÜV SÜD Management Service GmbH verified the following environmental declaration of **Daimler AG, Mercedesstraße 137, 70327 Stuttgart**

„360° Environmental Check Mercedes-Benz EQS“

Verification was based on the requirements of the following standards and guidance documents as far as applicable:

- DIN EN ISO 14040:2021 / DIN EN ISO 14044:2021 (Environmental management - Life cycle assessment - Principles and framework / Requirements and guidelines)
- ISO/TS 14071:2014 (Environmental management - Life cycle assessment - Critical review processes and reviewer competencies
- Technical Report DIN ISO/TR 14062:2002 (Integrating environmental aspects into product design and development, 5.4 Communication strategy)
- DIN EN ISO 14020:2002 (Environmental labels and declarations - General principles) and EN ISO 14021:2016 (Environmental labels and declarations - Self-declared environmental claims)

Result:

- The environmental declaration includes a comprehensive and appropriate presentation or interpretation of the results based on reliable and traceable information.
- The LCA study on which the environmental declaration is based is in compliance with DIN EN ISO 14040:2021 and DIN EN ISO 14044:2021. The methods used and the detailed modelling of the product system are of high quality. They are suitable for fulfilling the goals stated in the LCA study. The report is comprehensive and transparently describes the survey-scope of the study.
- The assessed samples of data and environmental information included in the environmental declaration were traceable and plausible. Verification did not reveal any issues within the defined scope that compromised the validation in any way.

Verification process:
Verification of the LCA study on which the environmental declaration is based included a critical review supported by an external expert and – where relevant for the environmental declaration – a data-oriented audit of the LCA results and their interpretation in the form of interviews, inspections of technical documents and selective checks of the data entered in the LCA database (GaBi). LCA input data (e.g. weights, materials and possibly emissions) and other statements included in the environmental declaration (such as use of less resource consuming materials, recycling concept) were traced back on random sample basis where possible to documents including official type approval documents, parts lists, supplier information, measurement results etc.
The input data for energy consumption had been investigated by Daimler AG according to a procedure under surveillance of the German Kraftfahrt-Bundesamt and were not included in the data verification.

Independence of verifier:
Daimler AG has not placed any contracts for consultancy concerning product-related environmental aspects with TÜV SÜD, either in the past or at present. There are no areas of financial dependence or conflicts of interest between TÜV SÜD Management Service GmbH and Daimler AG.

Responsibilities:
Sole liability for the content of the environmental declaration rests with Daimler AG. TÜV SÜD Management Service GmbH was commissioned to review said LCA study for compliance with the methodical requirements, and to verify and validate the correctness and credibility of the information included therein.

TÜV SÜD Management Service GmbH

Munich, 2021-10-27

Dipl.-Ing. (FH) Fred Wenke
Head of Certification Body

Dipl.-Ing. Ulrich Wegner
Lead auditor

1. General environmental issues

1.1 Product information

The EQS is the first all-electric luxury saloon from Mercedes-EQ. The EQS will allow customers in the luxury segment to benefit fully from all the advantages of an all-electric architecture with respect to space and design. The first models to come onto the market are the EQS 450+ plus the EQS 580 4MATIC.

The new generation of electric vehicles in the luxury and executive segment is based on a custom-developed architecture, which is scalable in every aspect and can be used across model series. The wheelbase and track as well as all other system components, especially the batteries, are variable thanks to the modular design. The vehicle concept is thus optimised to meet every requirement of a future-oriented, battery-electric model family.

All EQS models have an electric powertrain (eATS) at the rear axle, while the versions with 4MATIC also have an eATS at the front axle. With ranges up to 785 kilometres (WLTP)[1] and an output of up to 385 kW, the drive of the EQS also meets every expectation of a progressive saloon in the S-Class segment.

With a lot of meticulous detail work and on the basis of the purpose design, the aerodynamicists in close cooperation with the designers were able to achieve an excellent Cd value of 0.20[2]. The purpose design with smooth underbody and mostly closed radiator shutter as well as the favourable basic shape were a good starting point for the flow optimisation. This benefits the range in particular, but also the noise comfort: The very low wind noise level contributes significantly to this. For further enhanced quiet running, the standard Acoustic Comfort Package has been developed. This includes additional insulation measures in the interior.

In terms of recuperation, too, the EQS is excellent: of the maximum deceleration in the D^{Auto} recuperation program of 5 m/s^2, up to 3 m/s^2 is achieved by recuperation (2 m/s^2 by the service brakes). This allows deceleration to a standstill without using the brake pedal, while at the same time the range benefits from this recuperation strategy and the high recuperation power. Deceleration is also applied to detected vehicles ahead until they come to a standstill, for example at traffic lights. Intelligent recuperation is situation-optimised with the aid of ECO Assist and acts with foresight, taking into account traffic conditions or topography, among other things.

The EQS marks the launch of a new generation of batteries with significantly higher energy density. The innovative battery management software, developed in-house, allows updates over the air (OTA). The energy management of the EQS is therefore kept up to date throughout the lifecycle. In terms of the cell chemistry, the cobalt content of the cathodes has been reduced to ten percent, and the optimised active material consists of nickel, cobalt and manganese in a ratio of 8:1:1.

The EQS can be charged with up to 200 kW at fast charging stations with direct current. Power for up to another 300 kilometres (WLTP) is recharged in just 15 minutes[3]. At home or at public charging stations, the EQS can be conveniently charged with up to 22 kW with AC using the on-board charger.

[1] On the Mercedes-Benz.de Homepage the EQS range can be simulated individually, taking into account driving profiles, temperature and climate control
[2] EQS 450+ with 19-inch AMG wheel/tyre combination and AMG Line exterior (available in the EU from the end of 2021) in the SPORT drive program
[3] Charging speed at DC fast charching stations with 500 amps

With Mercedes me, Mercedes-EQ provides comprehensive services for the electric mobility of today and tomorrow. Via Mercedes me Charge, drivers of a Mercedes-EQ or plug-in hybrid model with the latest MBUX (Mercedes-Benz User Experience) infotainment generation have the possibility to get access to one of the world's largest charging networks. It currently has more than 500,000 AC and DC charging points in 31 countries, including over 200,000 in Europe.

The new function Plug & Charge makes it even easier to charge the EQS at suitable public charging stations: charging starts as soon as the charging cable is plugged in; no further authentication on the part of the customer is required. The vehicle and the charging station communicate directly via the charging cable. What's more, Mercedes me Charge customers continue to benefit from the integrated payment function with automatic payment.

To give customers special support when switching over to the age of electric mobility, Mercedes-Benz has developed an intelligent, digital personal trainer: the Mercedes me Eco Coach. This is the latest member in the eco-system of Mercedes-Benz me apps. In an entertaining manner, the Eco Coach familiarizes drivers of electrified Mercedes-Benz models with the electric capabilities of their vehicles. Customers who follow the recommendations and hints in the app not only get to know their car with alternative drive better – they also improve their driving style and can better protect the environment.

Figure 1-1: Mercedes-Benz EQS 580 4MATIC

1.2 Production

The new EQS models are produced at the Sindelfingen plant. As early as 1994, the Sindelfingen plant implemented an environmental management system and one year later voluntarily had it audited in accordance with the European Eco-Management and Audit Scheme EMAS. This has created the prerequisite for continuous and effective improvement of the company's environmental performance. It is the centre of competence for vehicles in the luxury class and the lead plant for the production of the S-Class and E-Class model series.

In 2015, the Sindelfingen site celebrated its 100th anniversary. In the same year, the Board of Daimler AG decided to make the plant fit for the future with the "Future Vision 2020+" programme.

This becomes evident in a multitude of construction measures. The new „Factory 56" building with its 220,000 m² has already been put into operation. On the roof is a photovoltaic system with around 12,000 PV modules and an output of approx. 5000 kWp (kilowatt peak), which supplies self-generated green electricity for the building. Furthermore, Factory 56 is completely paperless: thanks to digital tracking of each vehicle on the line via a tracking system, the data of a respective vehicle on the line relevant for the employees is displayed on terminals and screens in real time. All in all, this will save around 10 tonnes of paper each year. In addition to the CO_2 and energy balance considerations, Mercedes-Benz's sustainability approach also includes other ecological aspects. About 43,000 m² of the roof area (38 % of the greenable area) will be greened.

Figure 1-2: Factory 56 at the Sindelfingen plant


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1.3 After Sales

High environmental standards are also firmly established in the environmental management systems in the sales and after-sales sectors at Mercedes-Benz. At dealer level, Mercedes-Benz meets its product responsibility with the MeRSy recycling system for workshop waste, used parts and warranty parts and packaging materials. This exemplary service by an automotive manufacturer is implemented right down to customer level. The waste materials produced in our outlets during servicing and repairs are collected, reprocessed and recovered via a network operating throughout Germany. Classic components include bumpers, side panels, electronic scrap, glass and tyres.

The reuse of used parts also has a long tradition at Mercedes-Benz. The Mercedes-Benz Used Parts Center (GTC) was established back in 1996. With its quality-tested used parts, the GTC is an integral part of the service and parts operations for the Mercedes-Benz brand and makes an important contribution to the appropriately priced repair of Mercedes-Benz vehicles.

Although the reuse of Mercedes passenger cars lies in the distant future in view of their long service life, Mercedes-Benz offers an innovative procedure for the rapid disposal of vehicles in an environmentally friendly manner and free of charge. For convenient recycling, a comprehensive network of collection points and dismantling facilities is available to Mercedes customers. Owners of used cars can find out Europe-wide all the important details relating to the return of their vehicles via the free phone number +49800 1 777 7777.

Figure 1-3: Mercedes-Benz Used Parts Center (GTC)


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2. Life Cycle Assessment (LCA)

The environmental compatibility of a vehicle is determined by the environmental burden caused by emissions and the consumption of resources throughout the vehicle's lifecycle (cf. Figure 2-1). The standardised tool for evaluating a vehicle's environmental compatibility is the LCA. It comprises the total environmental impact of a vehicle from the cradle to the grave, in other words from raw material extraction through production and use up to recycling.

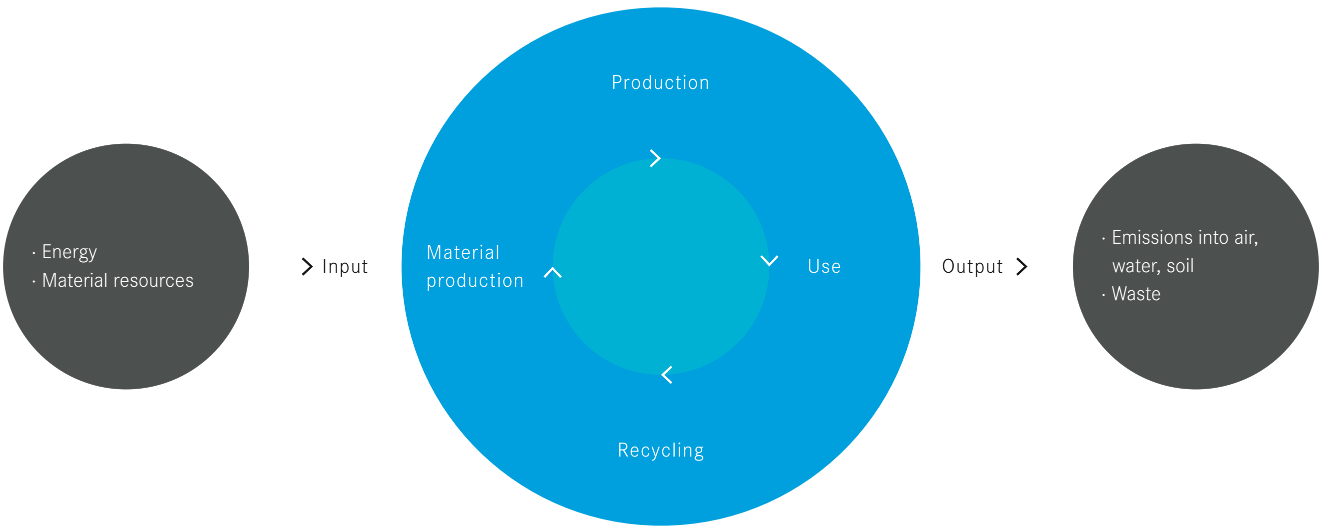
Life Cycle Assessments are used by the Mercedes-Benz passenger car development division for the evaluation and comparison of different vehicles, components, and technologies. The DIN EN ISO 14040 and DIN EN ISO 14044 standards prescribe the procedure and the required elements.

The elements of a Life Cycle Assessment are:

1. Goal and scope definition: define the objective and scope of an LCA.
2. Inventory analysis: encompasses the material and energy flows throughout all stages of a vehicle's life: how many kilograms of raw material are used, how much energy is consumed, what wastes and emissions are produced etc.
3. Impact assessment: gauges the potential effects of the product on the environment, such as global warming potential, summer smog potential, acidification potential, and eutrophication potential.
4. Interpretation: draws conclusions and makes recommendations.

The LCA results of the new EQS 450+ are shown in the following chapters. The main parameters of the LCA are documented in the appendix. The operation phase is calculated on the basis of a mileage of 300,000 kilometres.

Figure2-1: Overview of the Life Cycle Assessment



2.1 Material composition

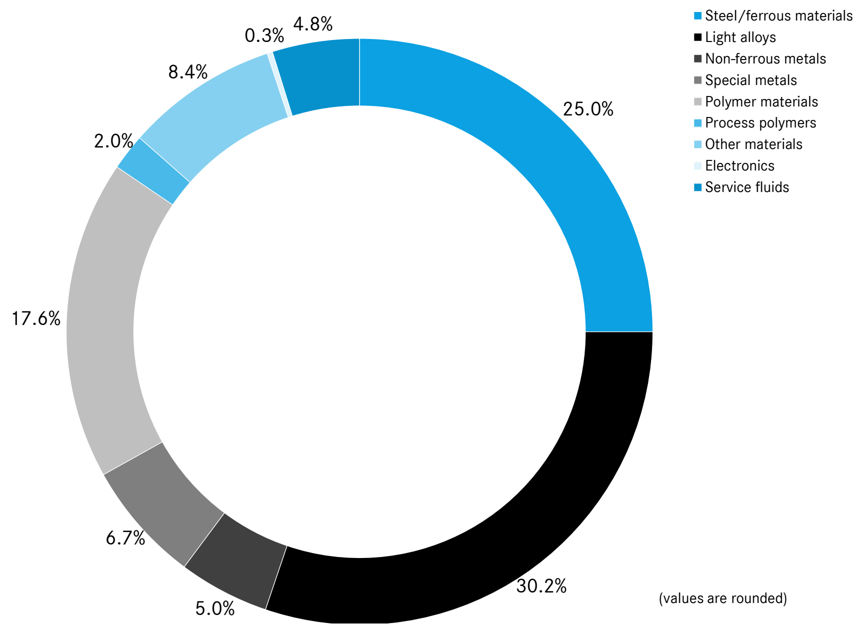
The weight and material data for the new EQS 450+ were determined on the basis of internal documentation of the components used in the vehicle (parts list, drawings). The “kerb weight according to DIN” (without driver and luggage, fuel tank 90 percent full) served as a basis for the recycling rate and LCA. Figure 2-2 shows the material composition in accordance with VDA 231-106.

Light alloys account for about 30.2 percent of the vehicle weight in the EQS 450+. This is followed by Steel/ferrous materials with 25.0 percent and the polymer materials with 17.6 percent. Other materials (esp. graphite, glass) and special metals have a share of about 8.4 and 6.7 percent respectively. The shares of non-ferrous metals and service fuels are somewhat lower at around 5.0 and 4.8 percent respectively. The remaining materials – process polymers and electronics – contribute about 2.3 percent to the weight of the vehicle. In this study, the material class of process polymers largely comprises materials for the paint finish.

The polymers are divided into thermoplastics, elastomers, duromers and non-specific plastics, with the thermoplastics accounting for the largest proportion at 11.9 percent. Elastomers (pre-dominantly tyres) are the second-largest group of polymers with 3.5 percent.

The service fluids include oils, coolants, refrigerants, brake fluid, and washer fluid. The electronics group only comprises circuit boards and their components. Cables and batteries have been allocated according to their material composition in each particular case.

Figure 2-2: Material composition EQS 450+ [%]



2.2 LCA results

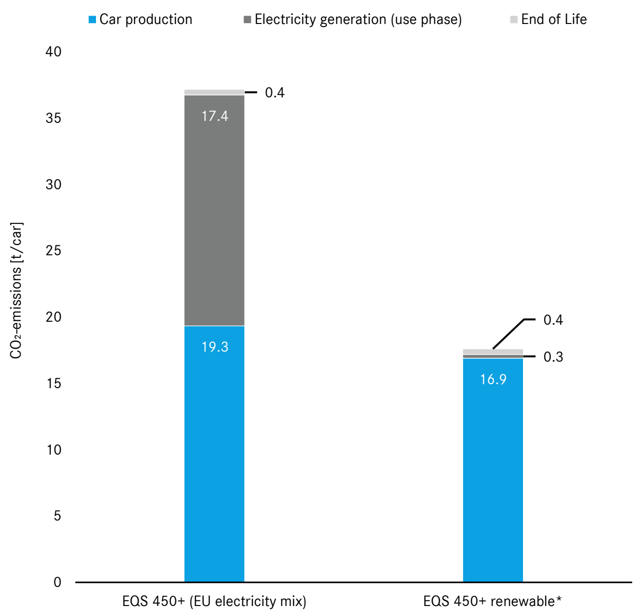
With the increasing electrification of vehicles, two factors are coming more into focus: the production of the high-voltage battery and the generation of the electricity to charge the battery externally. To take this into account, the LCA examines two scenarios. In the "EU electricity mix" scenario, the European electricity mix is used for charging the high-voltage battery. In the renewable scenario, renewable energy is used both for the production of the battery cells (electricity from hydropower and heat from biomass) and for charging (electricity from hydropower).

Over the entire life cycle of the new EQS 450+, the life cycle inventory calculations in the EU electricity mix scenario, for example, result in a primary energy consumption of 853 gigajoules and an environmental impact of 37.2 tonnes of carbon dioxide, 7.9 kg of non-methane volatile organic compounds (NMVOC), 56.8 kg of nitrogen oxides (NO_x) and 89.5 kg of sulphur dioxide (SO_2). If renewable energy is used for high-voltage battery cell production and charging power generation (renewable scenario), this results in a primary energy consumption of 555 gigajoules, 17.6 tonnes of carbon dioxide, 5.3 kg of non-methane volatile organic compounds (NMVOC), 31.9 kg of nitrogen oxides (NO_x) and 70.2 kg of sulphur dioxide (SO_2).

In addition to analysing the overall results, the distribution of individual environmental impacts over the various life cycle phases is examined. Compared to vehicles powered by internal combustion engines, the relevance of the car manufacturing phase tends to increase for electric vehicles and the relevance of the use phase tends to decrease. The high relevance of car production is also reflected in the CO_2 emissions of the EQS life cycle shown below (Figure 2-3): in the scenario with the EU electricity mix, car production already slightly dominates the life cycle with 19.3 t CO_2, while the generation of traction current causes 17.4 t CO_2. In the renewable scenario, the contribution of car manufacturing is only 16.9 t CO_2; manufacturing the high-voltage battery cells with renewably generated energy saves around 2.4 t CO_2. In this scenario, the life cycle is clearly dominated by car production, as the generation of traction current from hydropower only requires a very small amount, 0.3 t, of CO_2. The share of the end-of-life phase is 0.4 t CO_2 in each case.

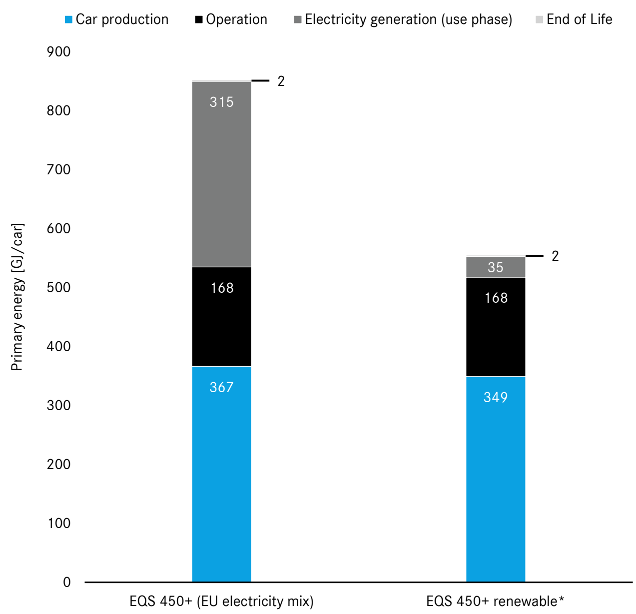
Figure 2-4 shows the LC phases for primary energy demand. For this result parameter, the use phase, consisting of electricity generation and driving operation, dominates the life cycle with 484 GJ if the EU electricity mix is used for charging. Here, too, the use phase share in the regenerative scenario decreases significantly, but at 204 GJ it still remains in a relevant order of magnitude.

Figure 2-3: Overall carbon dioxide emissions (CO_2)



* renewably generated energy for cell production and charging current (values are rounded)

Figure 2-4: Overall primary energy consumption



* renewably generated energy for cell production and charging current (values are rounded)

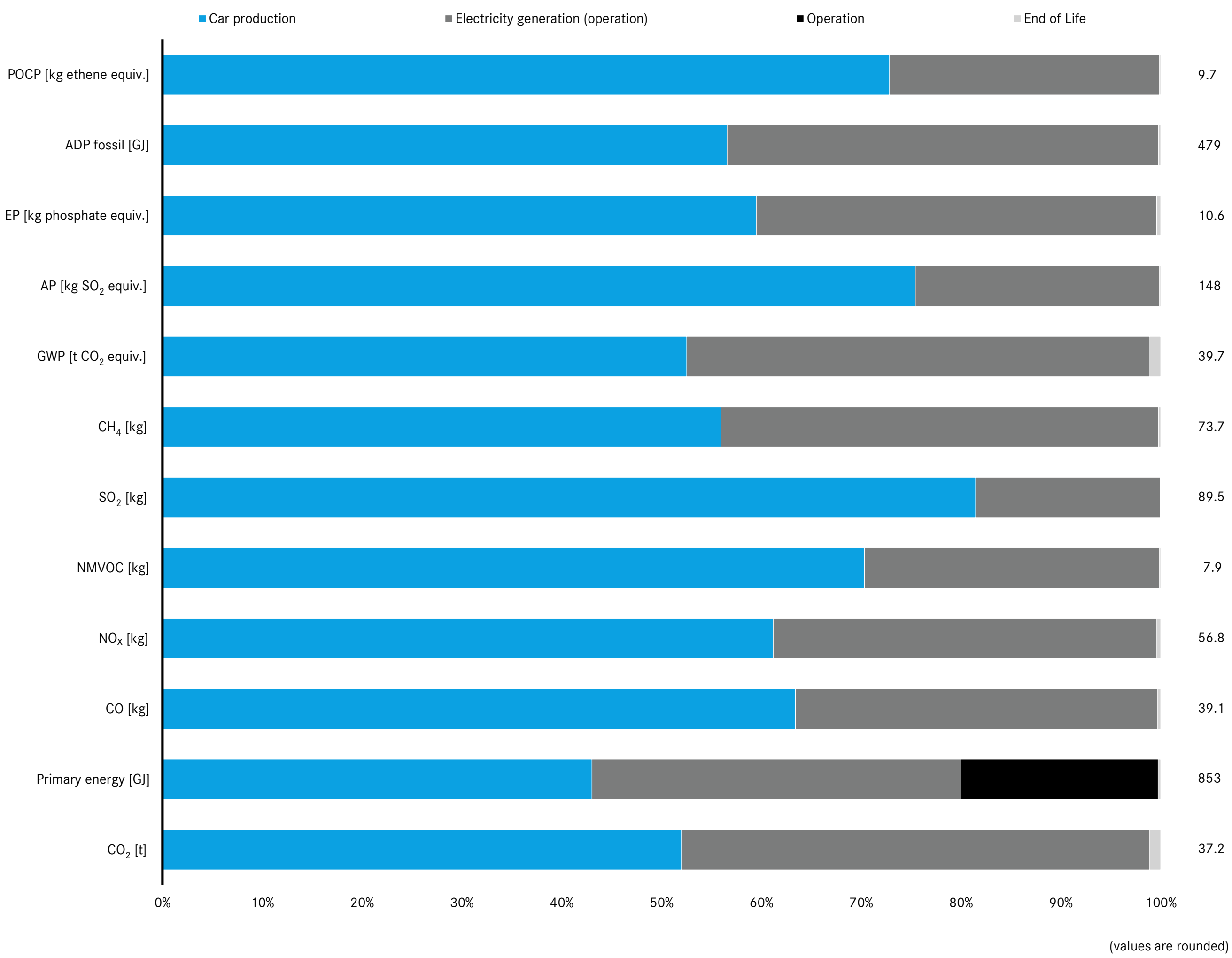
Figure 2-5 shows the EQS 450+ life cycle phases for selected environmental impacts in the scenario with the EU electricity mix. Most of the result parameters are dominated by car production. But the use phase also has a decisive influence on the ecological performance of an electric vehicle, because the use of renewably generated traction current can again significantly reduce the contribution compared to the European electricity mix. In the renewable scenario, the results are almost exclusively determined by the manufacturing phase.

For comprehensive and thus sustainable improvement of the environmental impacts associated with a vehicle, it is essential that the end-of-life phase is also considered.

In terms of energy and resource preservation, the use or initiation of recycling cycles is worthwhile. For a complete assessment, all environmental inputs within each lifecycle phase are taken into consideration. Environmental burdens, for example, in the form of emissions into water result from vehicle lifecycle owing to the output of inorganic substances (heavy metals, NO_3^-- and SO_4^{2-}- ions) as well as organic substances, measured according to the factors AOX, BOD and COD.

In Table 2-1 and 2-2, some further result parameters are compared together with the life cycle assessment results discussed so far in the overview for the two scenarios examined.

Figure 2-5: Share of lifecycle phases for selected parameters (scenario EU electricity mix)



(values are rounded)

Table 2-1: Overview of LCA parameters (I)

Input parameters	EQS 450+ (EU electricity mix)	EQS 450+ renewable*	Delta to EQS 450+ (EU electricity mix)
Material resources			
Bauxite [kg]	3,800	3,794	-0.2 %
Dolomite [kg]	210	203	-3 %
Iron [kg]**	529	519	-2 %
Non-ferrous metals (Cu, Pb, Zn) [kg]**	790	788	0 %
** as elementary resources			
Energy resources			
ADP fossil* [GJ]**	**479**	**243**	**-49 %**
Primary energy [GJ]	853	555	-35 %
Proportionately			
Lignite [GJ]	67.0	15.2	-77 %
Natural gas [GJ]	201	108	-47 %
Crude oil [GJ]	68.2	54.7	-20 %
Hard coal [GJ]	142	65.5	-54 %
Uranium [GJ]	154	28.9	-81 %
Renewable energy resources [GJ]	219	283	29 %

* renewably generated energy for cell production (electricity from hydropower, heat from biomass) and charging (electricity from hydropower.).
*** CML 2001, as of August 2016

Tables 2-2: Overview of LCA parameters (II)

Output parameters	**EQS 450+ (EU electricity mix)**	**EQS 450+ renewable***	**Delta to EQS 450+ (EU electricity mix)**
Emissions to air			
GWP [t CO_2-equiv.]**	**39.7**	**18.9**	**-52 %**
AP [kg SO_2-equiv.]**	**148**	**108**	**-27 %**
EP [kg phosphate-equiv.]**	**10.6**	**6.2**	**-42 %**
POCP [kg ethene-equiv.]**	**9.7**	**6.6**	**-32 %**
CO_2 [t]	37.2	17.6	-53 %
CO [kg]	39.1	27.2	-30 %
NMVOC [kg]	7.9	5.3	-33 %
CH_4 [kg]	73.7	34.4	-53 %
NO_x [kg]	56.8	31.9	-44 %
SO_2 [kg]	89.5	70.2	-22 %
Emissions in water			
BOD [kg]	0.17	0.16	-7 %
Hydrocarbons [kg]	1.5	1.4	-7 %
NO_3^- [kg]	4.9	2.4	-50 %
PO_4^{3-} [kg]	0.3	0.2	-32 %
SO_4^{2-} [kg]	59.3	23.9	-60 %

* renewably generated energy for cell production (electricity from hydropower, heat from biomass) and charging (electricity from hydropower.).
** CML 2001, as of August 2016

Navigation
EQ
300km Range
Radio
FM/DAB
AUTO
Climate Menu
AUTO

3. Material selection

3.1 Avoidance of potentially hazardous materials

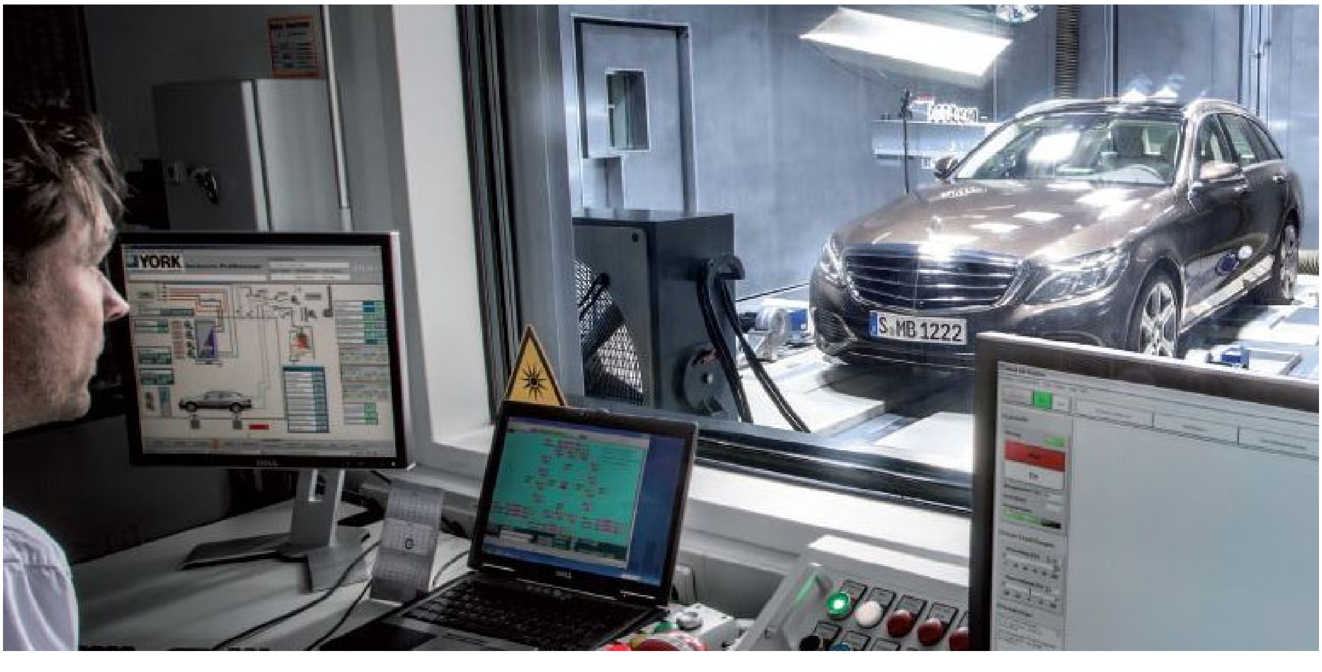
The avoidance of hazardous substances is a matter of top priority in the development, manufacturing, use and recycling of Mercedes-Benz vehicles. For the protection of humans and the environment, substances and substance classes whose presence is not permitted in materials or components of Mercedes-Benz passenger cars have been listed in the internal standard (DBL 8585). This standard is already made available to the designers and materials experts at the advanced development stage for both the selection of materials and the definition of manufacturing processes.

Materials used for components with contact to air of the passenger compartment are also subject to emission limits that are laid down in the vehicle specifications book and in part specific supplier specification DBL 5430. The reduction of interior emissions is a key aspect in the development of components and materials for Mercedes-Benz vehicles.

3.2 Allergy tested car cabin

The new EQS was developed in accordance with the requirements of the quality seal of the European Centre for Allergy Research Foundation (ECARF) and will receive a seal. The ECARF Seal of Quality is used by ECARF to designate products that have been scientifically tested and proven to be suitable for allergy sufferers. The conditions involved are extensive: numerous components from each equipment variant of a vehicle have to be tested for inhaled allergens, for example. Furthermore, the function of the pollen filter must be tested in both new and used condition. In addition, tests are undertaken with human “guinea pigs”. Driving tests are conducted with people suffering from severe asthma, for example, with lung function tests providing information about the impact on the bronchial system. In addition, all materials that might come in contact with the skin are dermatologically tested. So-called epicutaneous skin tests were undertaken with test subjects suffering from contact allergies in order to test the tolerance levels for known contact allergens. To this end, substances from the interior are adhered to the skin as potential allergens, using plasters. The air-conditioning filters also have to meet the stringent criteria of the ECARF Seal in both new and used condition: amongst other things the tests measure their retention efficiency with regard to dust and pollen.

Figure 3-1: Test chamber to measure car cabin emissions



3.3 Use of less resource consuming materials

Manufacturing vehicles requires a high degree of material usage. For this reason there is a developmental focus on further reducing the use of resources and the environmental impacts of the materials deployed. To this end, renewable raw materials and recycled plastic materials (recovered plastic) are used. Apart from the economical use of resources, reconditioning components and recycling the raw materials used also play an important role.

Recycling plastic waste and using recycled plastic materials in new products means that primary raw materials are spared and in contrast to production using crude oil, energy and CO_2 emissions are cut down on. Directive 2000/53/EC of the European Parliament on end-of-life vehicles also calls for the increased use of recycled material to thus build up and expand the markets for secondary raw material.

The use of these renewable raw materials gives rise to a whole range of advantages in automotive production:

- Compared with glass fibre, natural fibres normally result in a reduced component weight.
- Renewable raw materials help to reduce the consumption of fossil resources such as coal, natural gas and crude oil.
- They can be processed by means of conventional technologies. The resulting products are generally readily recyclable.
- If recycled in the form of energy they have an almost neutral CO_2 balance, as only as much CO_2 is released as the plant absorbed during its growth.

At Mercedes-Benz passenger car development, the amount of less resource consuming materials is defined from the very beginning in the requirement specifications for new models. The safety, quality and functionality technical requirements placed on a component must be met both with less resource consuming materials and with comparable new materials.

The studies relating to the use of recycled material, which accompany the development process, focus on thermoplastics. In contrast to steel and ferrous materials, to which secondary materials are already added at the raw material stage, recycled plastics must be subjected to a separate testing and approval process for the relevant component. To ensure passenger car production is maintained even when shortages are encountered on the recycled materials market, new materials may also be used as an alternative.

For established and already implemented components new solutions also have to be developed time and again because the use of secondary raw material and/or natural fibre in construction is often faced with additional technical requirements, such as new safety requirements (crash relevance), further reduction in fuel consumption (lightweight construction) or a new interior concept (surface area).

In the new EQS, a total of 186 components plus small parts such as push buttons, plastic nuts and cable fasteners with a total weight of 82.4 kilogrammes can be produced partially from less resource consuming materials. Figure 3-2 shows the parts with less resource consuming materials.

The consistent use of less resource consuming materials takes place for identical parts and for parts with the same function over all model series.

To this end, established processes are applied in the EQS: a secondary raw material comprised of reprocessed starter batteries and bumper panelling is used for the wheel arch linings, for example. The proven concept of the cardboard honeycomb structure in the boot floor is also used here. In floor coverings, a switch was made to a recycled yarn in tuft velour. This yarn with the brand name ECONYL® consists of regenerated nylon. It is manufactured by recovering nylon waste destined for the landfill, for example old fishing nets and fabric remnants from mills and carpets. These are collected and transformed into a new yarn having the same properties as nylon from new raw materials. The recycling process saves CO_2 compared to a virgin product. It also enables Mercedes-Benz to close material cycles.

With the EQS, however, new processes are used in addition to the established processes. For example, the load compartment recess is produced by an innovative injection moulding process ("SpriForm"). In this process, a thermoplastic, plate-shaped and continuous glass fibre reinforced semifinished product is given a very high 3-dimensional forming or draping in the injection mould and is directly overmoulded in the closed mould with rib and functional geometry. For this process, a recyclate made of glass fibre reinforced polypropylene PP GF50 (REC60) has now been qualified for large-scale production for the first time at the Hamburg plant.

Figure 3 2: Parts with less resource consuming materials in the EQS


Feld
2

4. Design for recovery

With the adoption of the European ELV Directive (2000/53/EC), the conditions for recovery of end-of-life vehicles were revised. The aims of this directive are to avoid vehicle-related waste and encourage the take-back, reuse and recycling of vehicles and their components. The resulting requirements for the automotive industry are as follows:

- Establishment of systems for collection of end-of-life vehicles (ELVs) and used parts from repairs.
- Achievement of an overall recovery rate of 95 percent by weight.
- Evidence of compliance with the recycling rate as part of type approval.
- Take-back of all ELVs free of charge.
- Provision of dismantling information to ELV recyclers within six months of market launch
- Prohibition of lead, hexavalent chromium, mercury and cadmium, taking into account the exceptions in Annex II.

4.1 Recycling concept for the EQS

The calculation procedure is regulated in ISO standard 22628, "Road vehicles – Recyclability and recoverability – Calculation method." The calculation model reflects the real ELV recycling process and is divided into four stages.

1. Pretreatment (removal of all service fluids, tyres, the battery, ignition of airbags).
2. Dismantling (removal of replacement parts and/or components for material recycling).
3. Separation of metals in the shredder process.
4. Treatment of non-metallic residual fraction (shredder light fraction – SLF).

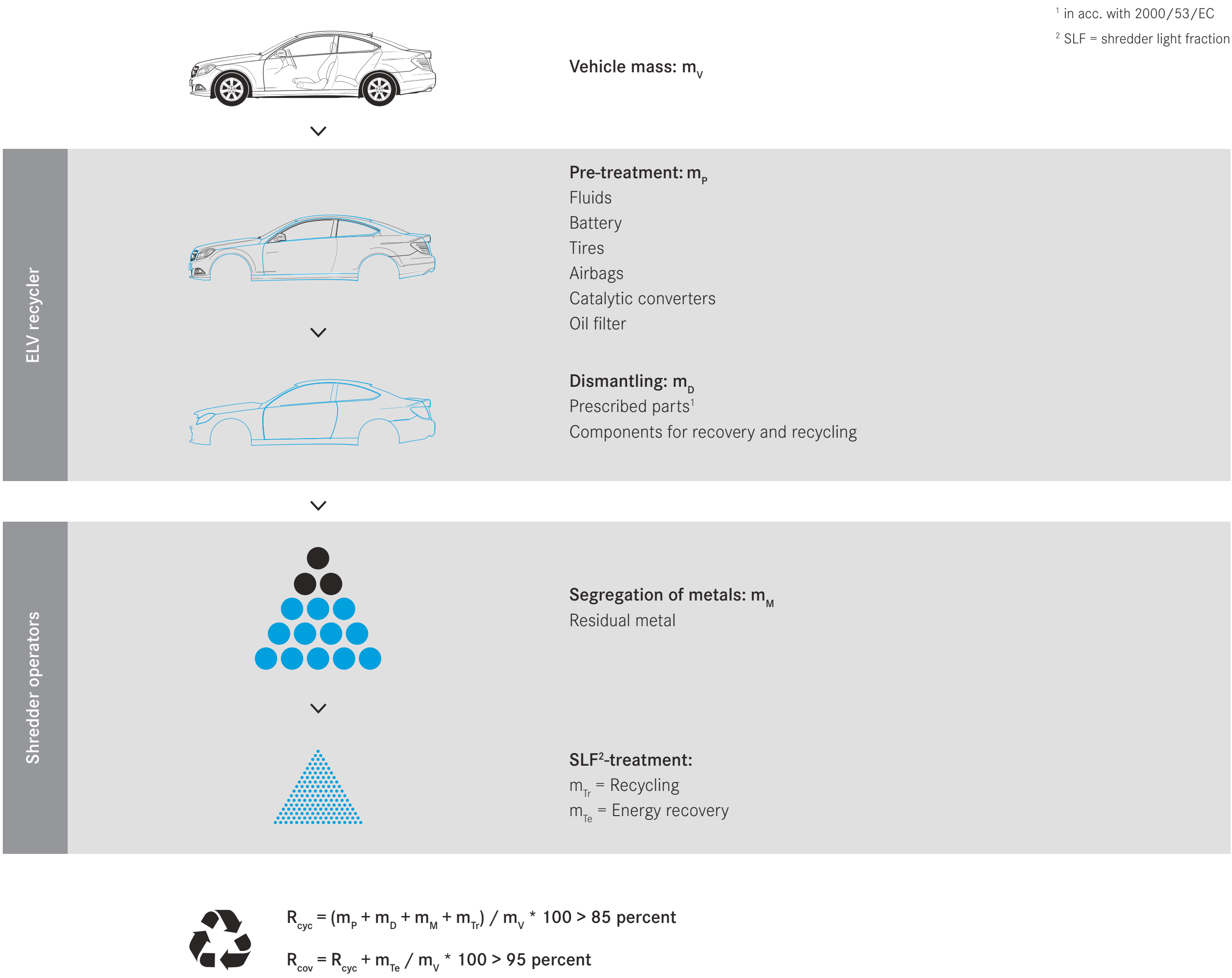
The recycling concept for the EQS was devised in parallel with development of the vehicle; the individual components and materials were analysed for each stage of the process. The volume flow rates established for each stage together yield the recycling and recovery rates for the entire vehicle. With the process chain described below, an overall material recyclability rate of at least 85 percent and a recoverability rate of at least 95 percent were verified on the basis of the ISO 22628 calculation model for the EQS as part of the vehicle type approval process (see Figure 4-1).

At the ELV recycler's premises, the fluids, battery, oil filter, tyres, and catalytic converters are removed as part of the pretreatment process. The airbags are able to get triggered with a device that is standardized amongst all European car manufacturers. During dismantling, the prescribed parts are first removed according to the European ELV Directive. To improve recycling, numerous components and assemblies are then removed and are sold directly as used spare parts or serve as a basis for the manufacturing of replacement parts. In addition to used parts, materials that can be recycled using economically appropriate procedures are selectively removed in the vehicle dismantling process. These include components of aluminium and copper as well as selected large plastic components.

During the development of the EQS, these components were specifically prepared with a view to their subsequent recycling. Along with the segregated separation of materials, attention was also paid to ease of dismantling of relevant thermoplastic components such as bumpers, wheel arch linings, outer sills, underfloor panelling and engine compartment coverings. In addition, all plastic parts are marked in accordance with international nomenclature.

In the subsequent shredding of the residual body, the metals are first separated for reuse in the raw material production processes. The largely organic remaining portion is separated into different fractions for environment-friendly reuse in raw material or energy recovery processes.

Figure 4-1: Material flows in the recycling concept



4.2 Dismantling information

Dismantling information plays an important role for ELV recyclers when it comes to implementing the recycling concept. For the EQS too, all necessary information is provided in electronic form via the International Dismantling Information System (IDIS). This IDIS software provides vehicle information for ELV recyclers, on the basis of which vehicles can be subjected to environmentally friendly pretreatment and recycling techniques at the end of their operating lives.

The IDIS data are made available to ELV recyclers and incorporated into the software six months after the respective market launch.

Figure 4-2: Screenshot of the IDIS-Software

5. Process - Design for Environment

Reducing the environmental impact of a vehicle's emissions and resource consumption throughout its lifecycle is crucial to improving its environmental performance. The environmental burden of a product is already largely determined in the early development phase; subsequent corrections to product design can only be implemented at great expense. The earlier environmentally compatible product development ("Design for Environment") is integrated into the development process, the greater the benefits in terms of reduced environmental impact and cost. Process and product-integrated environmental protection must be realised in the development phase of a product. The environmental burden can often only be reduced at a later date by means of downstream "end of pipe" measures.

We strive to develop products that are highly responsible to the environment in their respective market segments – this is the second Environmental Guideline of the Daimler Group. Its realisation requires incorporating environmental protection into products from the very start. Ensuring that this happens is the task of environmentally compatible product development. It follows the principle "Design for Environment" (DfE) to develop comprehensive vehicle concepts. The aim is to improve environmental performance in objectively measurable terms and, at the same time, to meet the demands of the growing number of customers with an eye for environmental issues such as fuel economy and reduced emissions or the use of environmentally friendly materials.

In organisational terms, responsibility for improving environmental performance was an integral part of the development project for the EQS. Under the overall level of project management, employees are appointed with responsibility for development, production, purchasing, sales, and further fields of activity. Development teams (e. g. body, drive system, interior etc.) and cross-functional teams (e. g. quality management, project management etc.) are appointed in accordance with the most important automotive components and functions.

One such cross-functional group is known as the DfE team. It consists of experts from the fields of life cycle assessment, dismantling and recycling planning, materials and process engineering, and design and production. Members of the DfE team are also represented in a development team, in which they are responsible for all environmental issues and tasks. This ensures complete integration of the DfE process into the vehicle development project. The members have the task of defining and monitoring the environmental objectives in the technical specifications for the various vehicle modules at an early stage, and of deriving improvement measures where necessary.

Integration of Design for Environment into the operational structure of the development project for the EQS ensured that environmental aspects were not sought only at the time of launch, but were given consideration from the earliest stages of development. The targets were coordinated in good time and reviewed in the development process in accordance with the quality gates. Requirements for further action up to the next quality gate are determined by the interim results, and the measures are implemented in the development team.

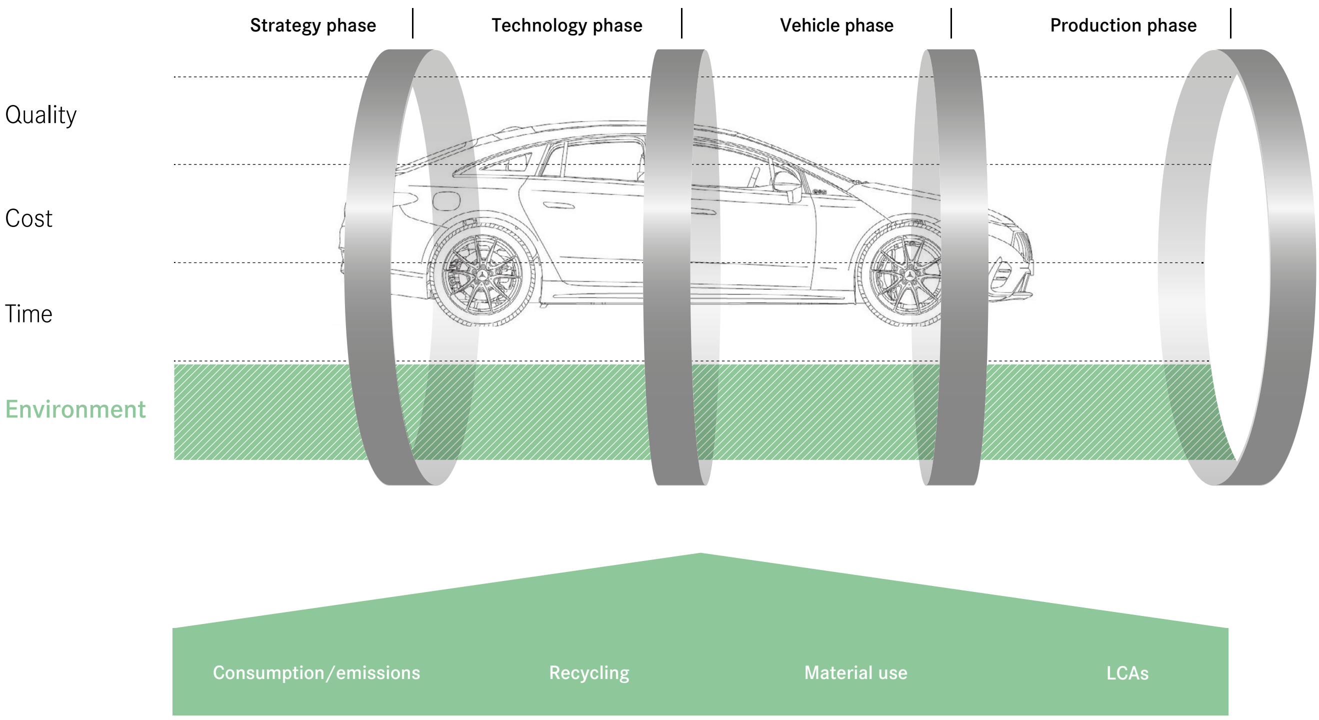
The process carried out for the EQS meets all the criteria for the integration of environmental aspects into product development, which are described in ISO standard TR 14062.

Over and above this, in order to implement environmentally compatible product development in a systematic and controllable manner, integration into the higher-level ISO 14001 and ISO 9001 environmental and quality management systems is also necessary.

The international ISO 14006 standard published in 2011 describes the prerequisite processes and correlations.

Mercedes-Benz meets the requirements of the ISO 14006 in full. This was confirmed for the first time by the independent appraisers from the South German Technical Inspection Authority (TÜV SÜD Management Service GmbH) in 2012.

Figure 5-1 : „Design for Environment“ activities at Mercedes-Benz



ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Management Service

CERTIFICATE

The Certification Body
of TÜV SÜD Management Service GmbH

certifies that

Daimler AG
Mercedes-Benz Sindelfingen
Béla-Barényi-Straße 1
71063 Sindelfingen
Germany

has established and applies
an Environmental Management System
with particular focus on eco design for

Development of passenger vehicles.

A specific audit, Order No. **70014947**,
revealed, that the entire product life cycle is considered
in a multidisciplinary approach when integrating environmental aspects
in product design and development
and that the results are verified by means of Life Cycle Assessments.

Thereby the requirements according to

ISO 14006:2011
ISO/TR 14062:2002

are fulfilled.

This certificate is valid only in combination with the
ISO 14001 certificate, registration no.: 12 104 13407 TMS
from **2018-12-27** until **2021-12-06**.

Certificate Registration No.: **12 771 13407 TMS**.

Product Compliance Management
Munich, 2019-01-02

MS/01-03/2018

TÜV SÜD Management Service GmbH • Zertifizierungsstelle • Ridlerstrasse 65 • 80339 München • Germany
www.tuev-sued.de/certificate-validity-check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6. Conclusion

The new Mercedes-Benz EQS not only meets the highest demands in terms of safety, comfort, agility, and design, and was also analysed comprehensively in terms of its environmental impact over the entire lifecycle. This is documented in the underlying life cycle assessment report and was examined in an appropriate way in the context of advanced sensitivity analyses. The result was verified by environmental experts of TÜV SÜD.

In the new all-electric EQS, Mercedes-Benz customers benefit from a highly efficient powertrain, outstanding aerodynamics and a new generation of batteries with significantly higher energy density, which together enable an electric range of up to 785 km (WLTP). To conserve natural resources, a high proportion of high-quality recycled materials and renewable raw materials is also used.

Mercedes-Benz publishes since 2005 environmental product information as a result of the process of environmentally compatible product development in accordance with the ISO TR 14062 and ISO 14040/14044. Over and above this, since 2012 the requirements of the ISO 14006 standard relating to the integration of environmentally compatible product development into the higher-level environmental and quality management systems have been met, as also confirmed by TÜV SÜD Management Service GmbH.


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Appendix

A: Product documentation

Technical data	EQS 450+
Engine type	synchronous electric motor
Weight (without driver and luggage) [kg]	2,405
CO_2 combined [g/km][1]	0
Combined consumption [kWh/100 km][1]	19.8 - 15.6[2]
Max. range (WLTP) [km][1]	631 - 785

[1] Electricity consumption [and range] was [were] determined on the basis of Regulation 2017/1151/EC. The values depend on the vehicle configuration.
[2] The life cycle assessment was calculated for the base version (lowest consumption figure).

B: LCA basic conditions

Project objective	LCA over the lifecycle of the EQS 450+ (model series V297), as ECE base variant.
	Verification of attainment of the objective “environmental compatibility” and communication.
Project scope	
Functional equivalent	EQS passenger car (base variant, weight in acc. with DIN 70020).
System boundaries	LCA for car production, use and recycling. The LCA limits must only be exceeded in the case of elementary flows (resources, emissions, non-recyclable materials).
Data basis	Weight data of car: MB parts list (EQS 450+ as of 2/2021).
	Materials information for model-relevant, vehicle-specific parts: MB parts list, MB internal documentation systems, IMDS, technical literature.
	Vehicle-specific model parameters (bodyshell, paintwork etc.): MB specialist departments.
	Location-specific energy supply: MB database.
	Materials information for standard components: MB database.
	Use (fuel consumption, emissions): certification data / limits.
	Use (mileage): MB specification.
	Recycling model: state of the art (see also Chapter 4.1).
	Material production, energy supply, manufacturing processes and transport: LCA database as of SP2021.2 (http://documentation.gabi-software.com); MB database.
Allocations	For material production, energy supply, manufacturing processes and transport, reference is made to GaBi databases and the allocation methods which they employ.
	No further specific allocations.
Cut-off criteria	For material production, energy supply, manufacturing processes and transport, reference is made to GaBi databases and the cut-off criteria they employ.
	No explicit cut-off criteria. All available weight information is processed.
	Noise and land use are currently not available as lifecycle inventory data and are therefore not taken into account.
	“Fine dust” or particulate emissions are not analysed. They do not have relevant influence on the considered impact categories.
	Vehicle maintenance and care are not relevant to the result.
Assessment	Lifecycle, in conformity with ISO 14040 and 14044 (LCA).
Analysis parameters	Material composition according to VDA 231-106.
	Lifecycle inventory: consumption of resources as primary energy, emissions such as CO_2, CO, NOx, SO_2, NMVOC, CH_4 etc.
	Impact assessment: abiotic depletion potential (ADP), global warming potential (GWP), photochemical ozone creation potential (POCP), eutrophication potential (EP), acidification potential (AP).
	Interpretation: sensitivity analyses of car module structure; dominance analysis over lifecycle.
Software support	MB DfE tool. This tool models a car with its typical structure and typical components, including their manufacture, and is adapted with vehicle-specific data on materials and weights. It is based on the LCA software GaBi 10 (http://www.gabi-software.com).
Evaluation	Analysis of lifecycle results according to phases (dominance). The manufacturing phase is evaluated based on the underlying car module structure. Contributions of relevance to the results are discussed.
Documentation	Final report with all basic conditions.

Term	Explanation
ADP	Abiotic depletion potential (abiotic = non-living); impact category describing the reduction of the global stock of raw materials resulting from the extraction of non-renewable resources.
Allocation	Distribution of material and energy flows in processes with several inputs and outputs, and assignment of the input and output flows of a process to the investigated product system.
AOX	Adsorbable organic halogens; sum parameter used in chemical analysis mainly to assess water and sewage sludge. Used to determine the sum of the organic halogens which can be adsorbed by activated charcoal; these include chlorine, bromine and iodine compounds.
AP	Acidification potential; impact category expressing the potential for milieu changes in ecosystems due to the input of acids.
Base variant	Base vehicle model without optional extras and with a small engine.
BOD	Biological oxygen demand; taken as measure of the pollution of waste water, waters with organic substances (to assess water quality).
CML	Centrum voor Milieukunde Leiden.
COD	Chemical oxygen demand; used in the assessment of water quality as a measure of the pollution of waste water and waters with organic substances.
DIN	German Institute for Standardisation (Deutsches Institut für Normung e.V.).
ECE	Economic Commission for Europe; the UN organisation in which standardised technical regulations are developed.
EP	Eutrophication potential (overfertilisation potential); impact category expressing the potential for oversaturation of a biological system with essential nutrients.
GWP100	Global warming potential, time horizon 100 years; impact category that describes potential contribution to the anthropogenic greenhouse effect (caused by mankind).
HC	Hydrocarbons
IDIS	International Dismantling Information System.
IMDS	International Material Data System.
Impact categories	Classes of effects on the environment in which resource consumptions and various emissions with the same environmental effect are grouped together (e. g. global warming, acidification etc.).
ISO	International Organisation for Standardisation.
KBA	Kraftfahrtbundesamt
LCA	Life Cycle Assessment Compilation and assessment of the input and output flows and the potential environmental impacts of a product in the course of its life.
MB	Mercedes-Benz
NEDC	New European Driving Cycle; cycle used to establish the emissions and consumption of motor vehicles since 1996 in Europe; prescribed by law.
NF-metal	Non-ferrous metal (aluminium, lead, copper, magnesium, nickel, zinc etc.).
NMVOC	Non-methane volatile organic compounds (NMHC Non-methane hydrocarbons).
POCP	Photochemical ozone creation potential (summer smog); impact category that describes the formation of photooxidants.
Primary energy	Energy not yet subjected to anthropogenic conversion.
Process polymers	Term from the VDA materials data sheet 231-106; the material group “process polymers” comprises paints, adhesives, sealants, protective undercoats.
SLF	Shredder Light Fraction; non-metallic substances remaining after shredding as part of a process of separation and cleaning.
WLTC	Worldwide Harmonized Light Vehicles Test Cycle; a cycle prescribed by law used to determine the emission and consumption figures of motor vehicles in Europe since 09/2017.
WLTP	Worldwide Harmonized Light Vehicles Test Procedure; a procedure prescribed by law used to determine the emission and consumption figures of motor vehicles in Europe since 09/2017.

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