360° Environmental Check Mercedes-Benz CLA

Mercedes-Benz
The best or nothing.

Contents

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As of: August 2019

Overview 360° Environmental Check Mercedes-Benz CLA

The new CLA relies on the four-cylinder petrol and diesel engines which were completely updated to relaunch the compact model series. In comparison to the previous generation, they are characterised by significantly increased power, improved efficiency and emissions. Good fuel efficiency requires not only an efficient drive but also good aerodynamic qualities. All variants of the new CLA Coupé offer very good aerodynamic drag (c_d value from 0.23). Despite the wider track, the frontal area remained the same size as on the predecessor model (2.21 m^2). When it comes to the assistance systems, the new CLA also sets a new benchmark. Improved camera and radar systems allow it to see up to 500 metres ahead. The CLA also uses map and navigation data for assistance functions. For example, Active Distance Assist DISTRONIC as part of the optional Driving Assistance Package is able to provide route-based support to the driver in numerous situations, and to predictively and conveniently adjust the speed, e.g. when approaching bends, junctions or roundabouts.

The improvement of the environmental compatibility at Mercedes-Benz means much more than fuel consumption. Because the earlier this “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 from the TÜV Süd inspection authority. This is how the 360° environmental check is created.

In this brochure, we present you the results of the lifecycle assessment in detailed form.

By the way: this brochure is like all previously published LifeCycle brochures available for download from http://www.mercedes-benz.com.

Validation

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

"360° Environmental Check Mercedes-Benz CLA"

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

- DIN EN ISO 14040:2009 / DIN EN ISO 14044:2018 (Principles and general requirements, definition of objective and scope of the LCA, life cycle inventory analysis, life cycle impact assessment, interpretation, critical review)
- ISO/TS 14071:2014 Environmental management - Life cycle assessment - Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006
- Technical Report DIN ISO/TR 14062:2002 (Integration of environmental aspects into product design and development)
- DIN EN ISO 14020:2002 (Environmental labels and declarations. General principles) and EN ISO 14021 (Self-declared environmental claims)

Result:

1. The environmental declaration includes a comprehensive and appropriate presentation or interpretation of the results based on reliable and traceable information.
2. The LCA study on which the environmental declaration is based is in compliance with DIN EN ISO 14040:2009 and DIN EN ISO 14044:2018. 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.
3. 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 on 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 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 fuel consumption and CO_2-emissions had been investigated by Daimler AG according to a procedure under surveillance of the German KBA 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, 2019-09-17

Alexandra Koller
Head of Product Compliance Management / Certification body

Michael Brunk
Lead auditor

1. General environmental issues

1.1 Product information

The new CLA relies on the four-cylinder petrol and diesel engines which were completely updated to relaunch the compact model series. In comparison to the previous generation, they are characterised by significantly increased power, improved efficiency and emissions. As previously in the A-Class and B-Class, the two-litre diesel engine (OM 654q) in the CLA 200 d with 8G DCT dual-clutch transmission (combined fuel consumption 4.4 - 4.1 l/100 km, combined CO_2 emissions 117-109 g/km)[1]/CLA 220 d with 8G DCT dual-clutch transmission (combined fuel consumption 4.4 - 4.3 l/100 km, combined CO_2 emissions 117 - 114 g/km)[1] fulfils the Euro 6d standard, which is only obligatory for new models from 1.1.2020.

The M 282 with a displacement of 1.33 litres forms the point of entry to the range of petrol engines in the CLA 180 (with manual transmission fuel consumption combined 5.6 - 5.3 l/100 km, CO_2 emissions combined 127 - 121 g/km)[1] and CLA 200 (with manual transmission fuel consumption combined 5.7 - 5.4 l/100 km, CO_2 emissions combined 131 - 124 g/km)[1]. The engine excels with very compact dimensions and low weight. For efficient partial-load operation, this engine initially in combination with the 7G-DCT transmission also has cylinder shutoff. The new compact four cylinder engine comes with a particulate filter as standard. The more powerful petrol-engine variants CLA 220 and CLA 250 (with 7G DCT dual-clutch transmission fuel consumption combined 6.2 – 6.0 l/100 km, CO_2 emissions combined 141 - 138 g/km)[1] use the M 260 two-litre engine. The CAMTRONIC variable valve timing system allows two-stage adjustment of the valve lift on the intake side. In the partial-load range with a smaller valve lift it reduces the load quantity and thus lowers gas cycle losses. In higher load ranges the system switches to the higher valve lift to achieve the engine's full power delivery. The direct injection uses the latest-generation piezo injection valves. Their installation position and control are meant to avoid raw emissions especially of particles. A particulate filter is also standard with the M 260.

In contrast to the predecessor model, the new CLA underwent a much longer phase of aerodynamic optimisation on the computer before the first models were examined in the wind tunnel. The result also sets standards: a c_d value from 0.23. Despite the significantly increased width and wider track, the frontal area of 2.21 m^2 corresponds exactly to that of the predecessor model. This was achieved by a slightly lower vehicle height and improvements to the underbody. The optimisation work took place in close cooperation with the designers. There was much fine tuning involved, in particular with the rear apron and the diffuser, the radiator grille and the fog lamp recesses. The relief-like diamond-shaped pattern of the fog lamp recesses was reduced to the edge on the CLA for aerodynamic reasons. Totally new are the front wheel spoilers with their fins in the longitudinal direction; they help air to flow around the wheels and the wheel well with minimal losses.

The CLA has the very latest driving assistance systems with cooperative driver support. To do this, it keeps a close eye on the traffic situation. Improved camera and radar systems allow it to see up to 500 metres ahead. The CLA also uses map and navigation data for assistance functions. For example, Active Distance Assist DISTRONIC as part of the optional Driving Assistance Package is able to provide route-based support to the driver in numerous situations, and to predictively and conveniently adjust the speed, e.g. when approaching bends, junctions or roundabouts.

In addition to the improvements to the vehicle, the driver also has a decisive influence on fuel consumption. So that the driver can check his driving style for efficiency and adapt it if necessary, the ECO display shows situation-specific an evaluation of his driving style in the instrument cluster highlighted icons. Thanks to the new ECO display, the driver can learn to immediately implement the highest level of efficient driving and thus drive more efficiently. The CLA owner's manual also includes additional tips for an economical and environmentally friendly driving style. Furthermore, Mercedes-Benz offers its customers "Eco Driver Training". The results of this training course have shown that adopting an efficient and energy-conscious style of driving can help to further reduce a car's fuel consumption.

[1] The values given are the "NEFZ CO_2" values generally employed by Article 2 (1) of the Implementing Regulation (EU) 2017/1153. Fuel consumption values were calculated on the basis of these values. As a tax base for vehicle tax, a higher value may be decisive. Further information about the official fuel consumption and the official specific CO_2 emissions for new passenger cars can be found in the publication "Leitfaden über den Kraftstoffverbrauch und die CO_2-Emissionen neuer Personenkraftwagen" ["Guidelines concerning the fuel consumption and the CO_2 emissions of new passenger cars"], available free of charge from all showrooms and from the Deutsche Automobil Treuhand GmbH (at www.dat.de).

1.2 Production

The new CLA is produced exclusively at the Mercedes-Benz plant in Kecskemét, Hungary. Right from the start, this production facility has had an environmental management system certified to EU eco-audit regulations and ISO Standard 14001. The painting techniques used for the CLA, for example, are not only technologically advanced, but also stand out by virtue of their high levels of environmental friendliness, efficiency and quality, achieved through the consistent use of water-based paints. Environmentally friendly technologies are also used to generate energy at the Kecskemét plant. The plant's two combined heat and power units (CHP) generate electricity and heating from natural gas in a highly efficient manner. One of the key aims is to increase the energy efficiency of the plant, to which end considerable effort is being devoted to the further development of energy supplies and to the optimisation of energy consumption. As just one step in the process, the ISO 50001 energy management system was introduced in the Kecskemét plant in 2015.

The plant in Kecskemét is an important part of the worlwide integrated production network for compact cars. This network also includes the lead plant in Rastatt, Germany, the Chinese production location BBAC in Beijing, the contractor Valmet Automotive in Uusikaupunki, Finland, and the joint venture COMPAS in Aguascalientes, Mexico. The first model to roll off the line in Kecskemét was the Mercedes-Benz B-Class in 2012. It was followed by the compact four-door CLA Coupé in 2013 and by the CLA Shooting Brake in 2015. Both of these models are produced exclusively in Kecskemét for the world market. Since May 2018, the new A-Class has also been part of the product range at the Hungarian production location.

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 00800 1 777 7777.


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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.

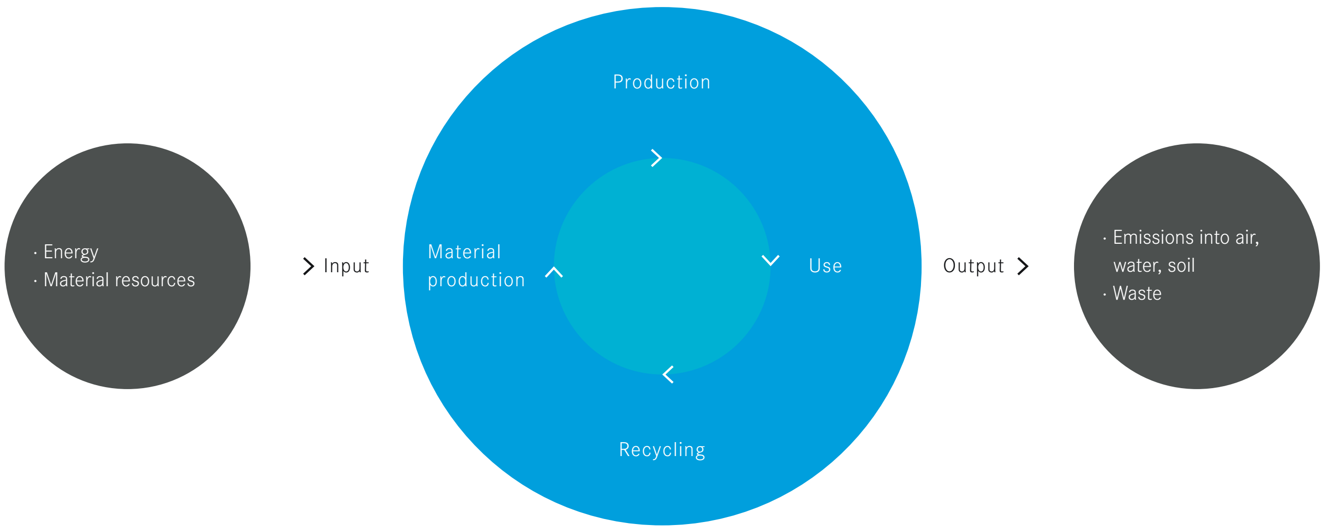
Life Cycle Assessments are used by the Mercedes-Benz passenger car development division for the evaluation and comparison of different vehicles, components, and technologies. The DIN EN ISO 14040 and DIN EN ISO 14044 standards prescribe the procedure and the required elements.

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 CLA are shown in the following chapters. The main parameters of the LCA are documented in the glossary. The operation phase is calculated on the basis of a mileage of 160,000 kilometres.

Figure 2-1: Overview of the Life Cycle Assessment



2.1 Material composition

The weight and material data for the new CLA 180 with 7G-DCT dual clutch transmission (fuel consumption combined 5.7 - 5.4 l/100 km, CO_2 emissions combined 130 - 123 g/km)[1] 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 of the new CLA 180 in accordance with VDA 231-106.

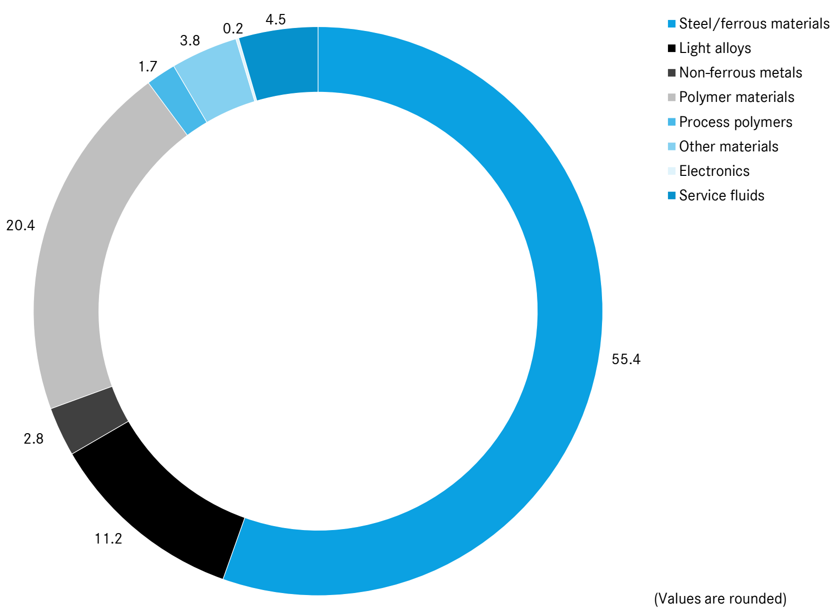
Steel/ferrous materials account for slightly the half of the vehicle weight (55.4 percent) in the new CLA 180. These are followed by polymer materials at 20.4 percent and light alloys as third-largest group with 11.2 percent. Service fluids comprise around 4.5 percent. The proportions of other materials (e. g. glass) and non-ferrous metals are somewhat lower, at about 3.8 and 2.8 percent respectively.

The remaining materials – process polymers and electronics – contribute about 1.9 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 13.5 percent. Elastomers (predominantly tyres) are the second-largest group of polymers with 4.9 percent.

The service fluids include oils, fuels, 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.

[1] The values given are the "NEFZ CO_2 values" generally employed by Article 2 (1) of the Implementing Regulation (EU) 2017/1153. Fuel consumption values were calculated on the basis of these values. As a tax base for vehicle tax, a higher value may be decisive.

Figure 2-2: Material composition CLA 180 [%]



2.2 LCA results

Over the entire lifecycle of the new CLA 180, the lifecycle inventory analysis yields e.g. a primary energy consumption of 443 gigajoules (corresponding to the energy content of around 13,760 litres of gasoline), an environmental input of approx. 29 tonnes of carbon dioxide (CO_2), around 26 kilograms of non-methane volatile organic compounds (NMVOC), around 40 kilograms of nitrogen oxides (NO_x) and 22 kilograms of sulphur dioxide (SO_2). In addition to the analysis of the overall results, the distribution of individual environmental impacts over the various phases of the lifecycle is investigated. The relevance of the respective lifecycle phases depends on the particular environmental impact under consideration. For CO_2 emissions, and likewise for primary energy demand, the use phase (fuel production and operation) dominates with a share of 80 and 76 percent respectively (see Figure 2-3).

However, it is not the use of the vehicle alone which determines its environmental compatibility. Some environmentally relevant emissions are caused principally by manufacturing, for example SO_2 emissions (cf. Figure 2-5). The production phase must therefore be included in the analysis of ecological compatibility.

For the new CLA, the driving emissions (CO, HC and NO_x) as part of the life cycle assessment were modelled based on limits; while for nitrogen oxides the RDE limits (Real Driving Emissions) applicable in normal driving were used. Compared to earlier studies, the proportion of these emissions in driving therefore increases over the entire lifecycle.

During the use phase of the vehicle, many of the emissions are dominated less by the actual operation of the vehicle and far more by the production of fuel, as for example in the case of the SO_2 emissions and CH_4 emissions.

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

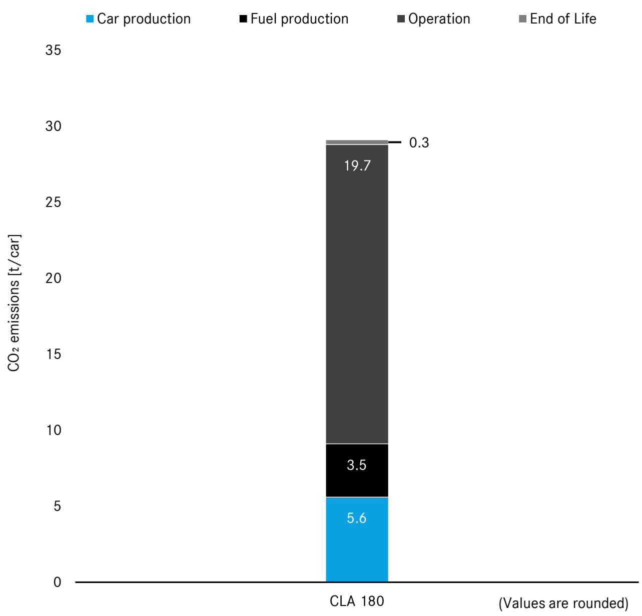
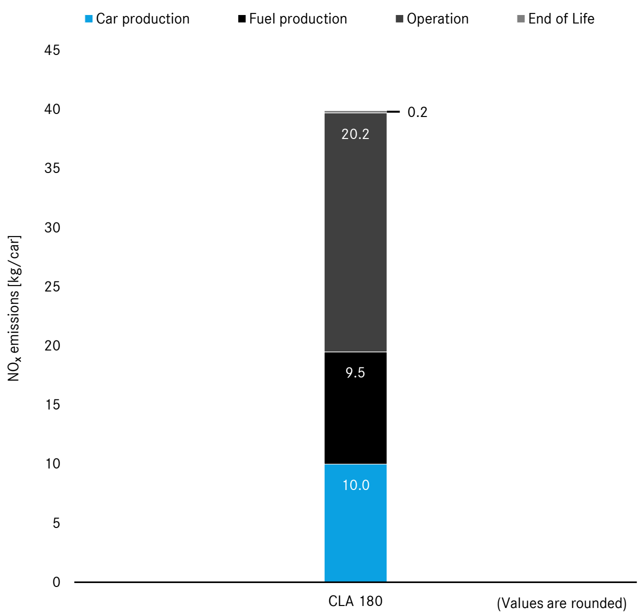


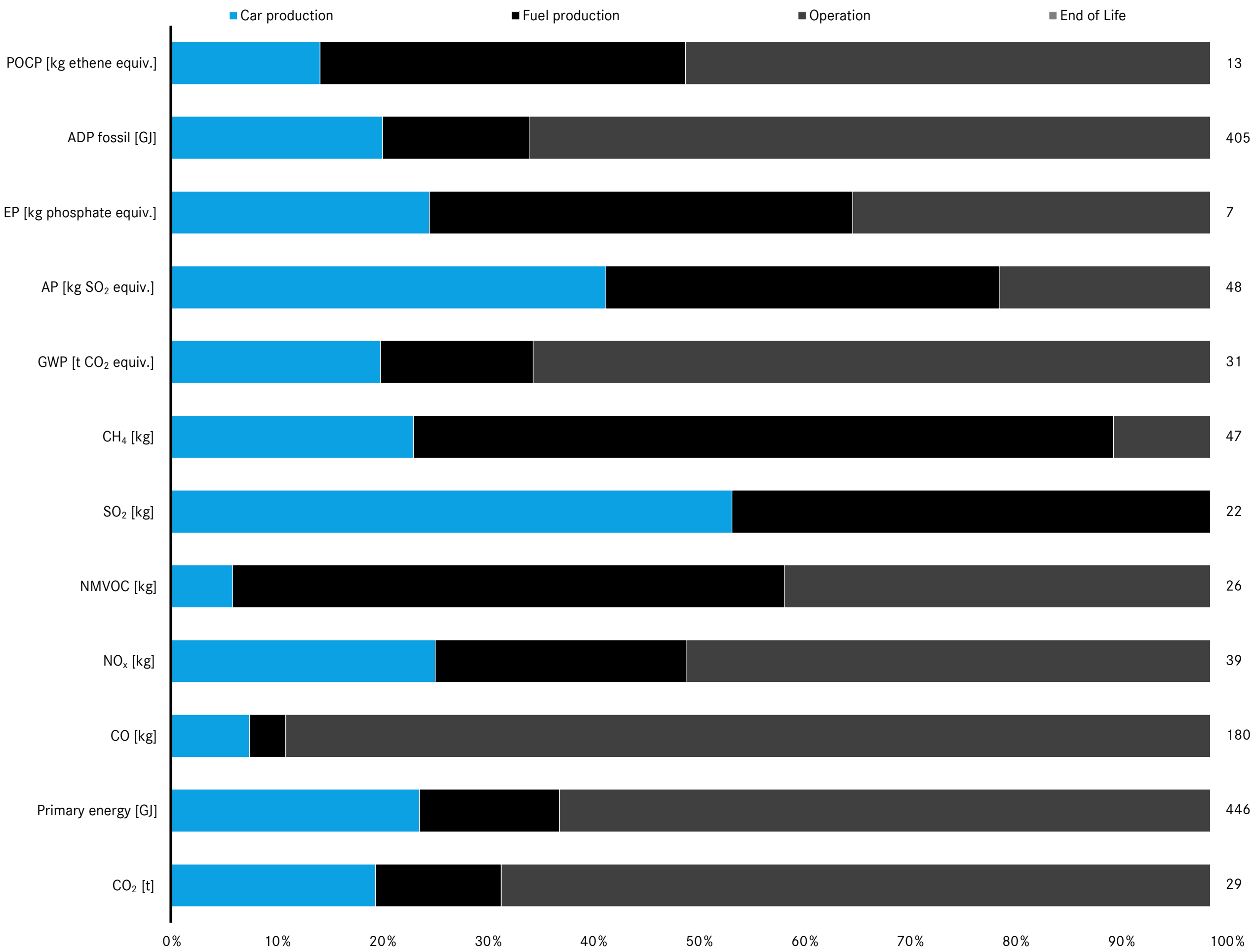
Figure 2-4: Overall Nitrogen oxides emissions (NO_x) in kilograms



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, 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 in the form of emissions into water result from vehicle manufacturing, in particular 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.

Figure 2-5: Share of lifecycle phases for selected parameters



(Values are rounded)

2.3 Comparison with the predecessor

In parallel with the analyses of the new CLA an assessment of the comparable predecessor was made (CLA 180 with dual clutch transmission: 1,355 kilograms DIN weight). The parameters on which this was based are comparable to the modelling of the new CLA 180. The production process was represented on the basis of extracts from the current list of parts. The operation phase was calculated using the valid certification values. The same state-of-the-art model was used for recovery and recycling.

As Figure 2-6 shows, the production of the new CLA 180 already results in a slightly lower quantity of carbon dioxide emissions than its predecessor. This is due to the lower weight compared to its predecessor and a similar mix of materials. Due to the significantly improved efficiency in the use phase compared to the predecessor, there are clear advantages for the new CLA over the entire lifecycle.

At the beginning of the lifecycle, production of the new CLA 180 causes a slightly lower amount of CO_2 emissions (5.6 tonnes) than its predecessor. In the subsequent operation phase, the new CLA 180 emits 23.1 tons of CO_2. In total, the production, use and recycling result in 29.1 tonnes of CO_2.

Production of the predecessor gives rise to 5.9 tons of CO_2. During use, it emits 26.5 tons of CO_2, the contribution of the recycling is 0.3 tons of CO_2. All in all, this results in 32.7 tons of CO_2 emissions.

Taking the entire lifecycle into consideration, namely production, operation over 160,000 kilometers and recycling/disposal, the new CLA 180 causes around 11 percent lower CO_2 emissions than its predecessor.

Figure 2-6: Comparison of CO_2 emissions [t/car]

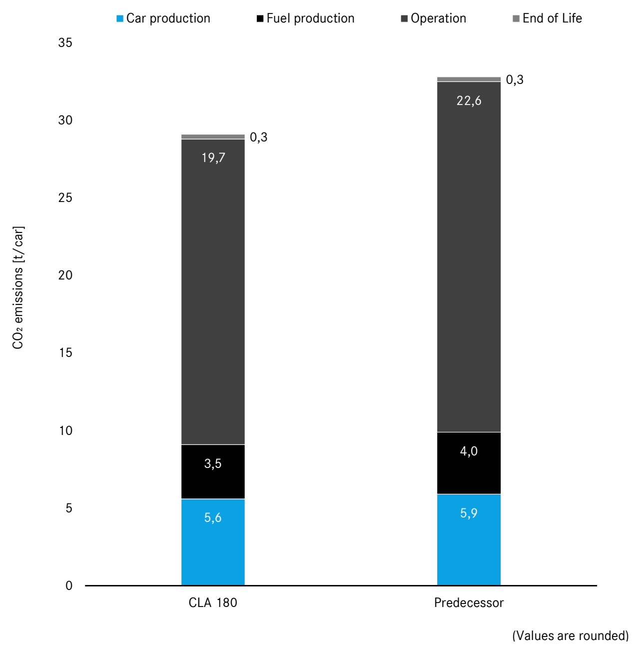


Figure 2-7: Comparison of NO_x emissions [kg/car]

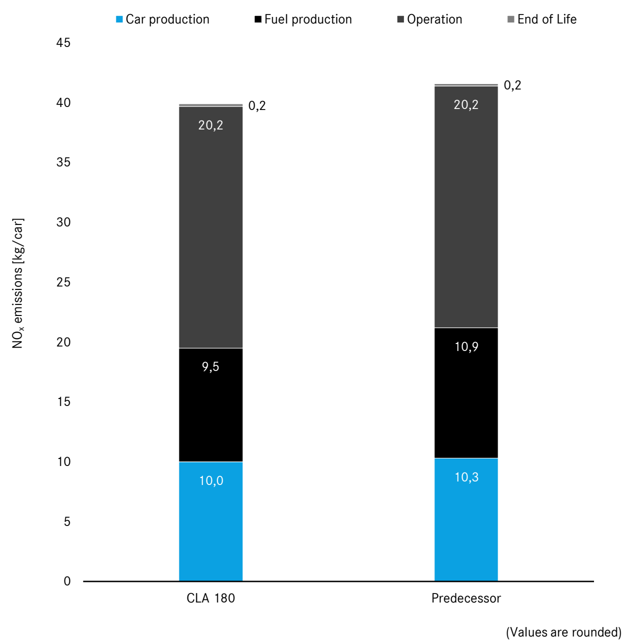


Figure 2-8 shows the examined impact categories in comparison over the various lifecycle phases. Over the entire lifecycle the new CLA shows clear advantages towards the previous model in terms of global warming potential (GWP100), summer smog (POCP), acidification potential (AP) and eutrophication (EP).

Regarding the energetic resources there are also changes compared to the previous model (cf. Figure 2-9). The consumption of crude oil could be reduced notably by 12 percent. Other energetic resources hard coal and uranium, which are mainly used for the car production, could be reduced by 5 percent each. Overall the fossil abiotic depletion potential (ADP fossil) could be reduced clearly by 11 percent.

Figure 2-8: Selected result parameters for the new CLA 180 in comparison to the predecessor [unit/car]

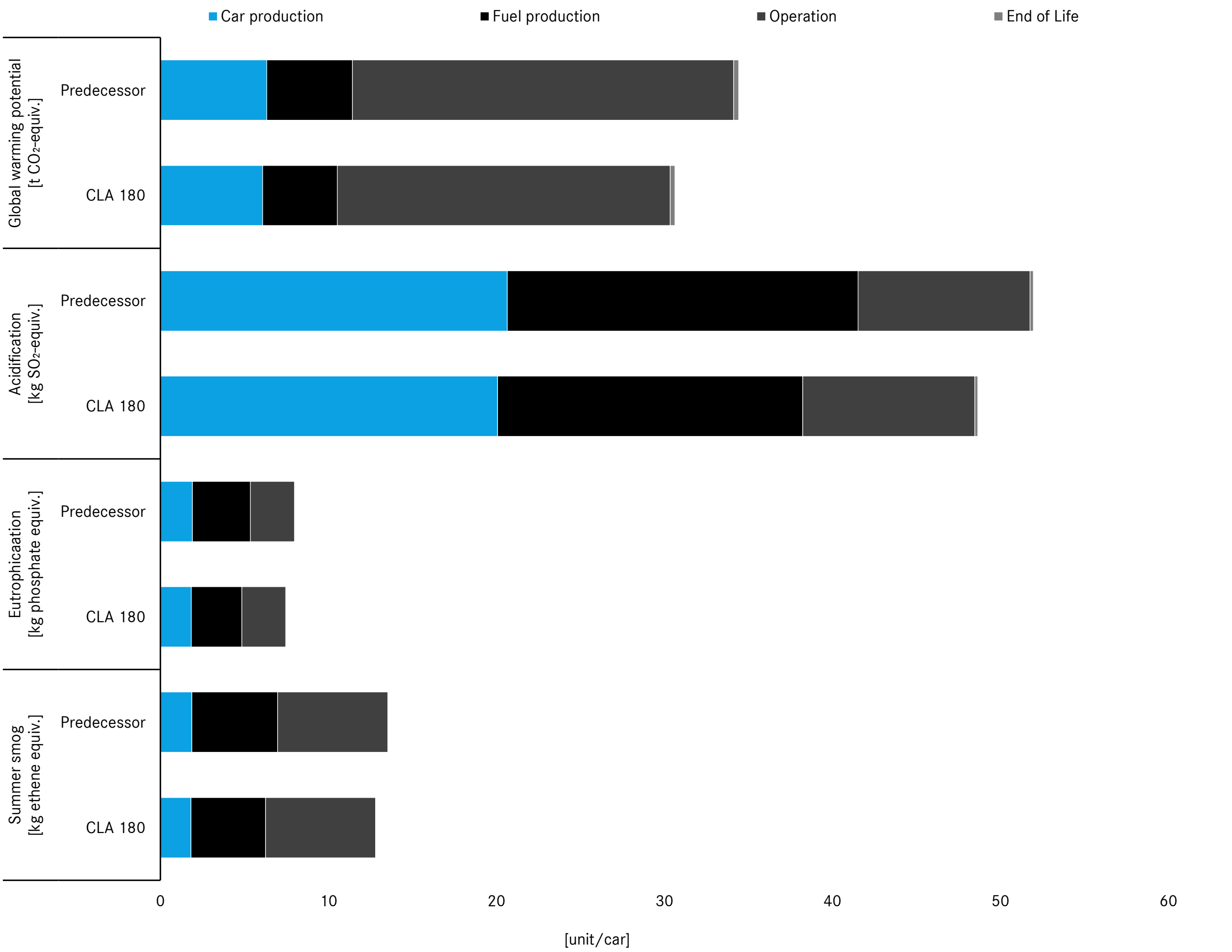
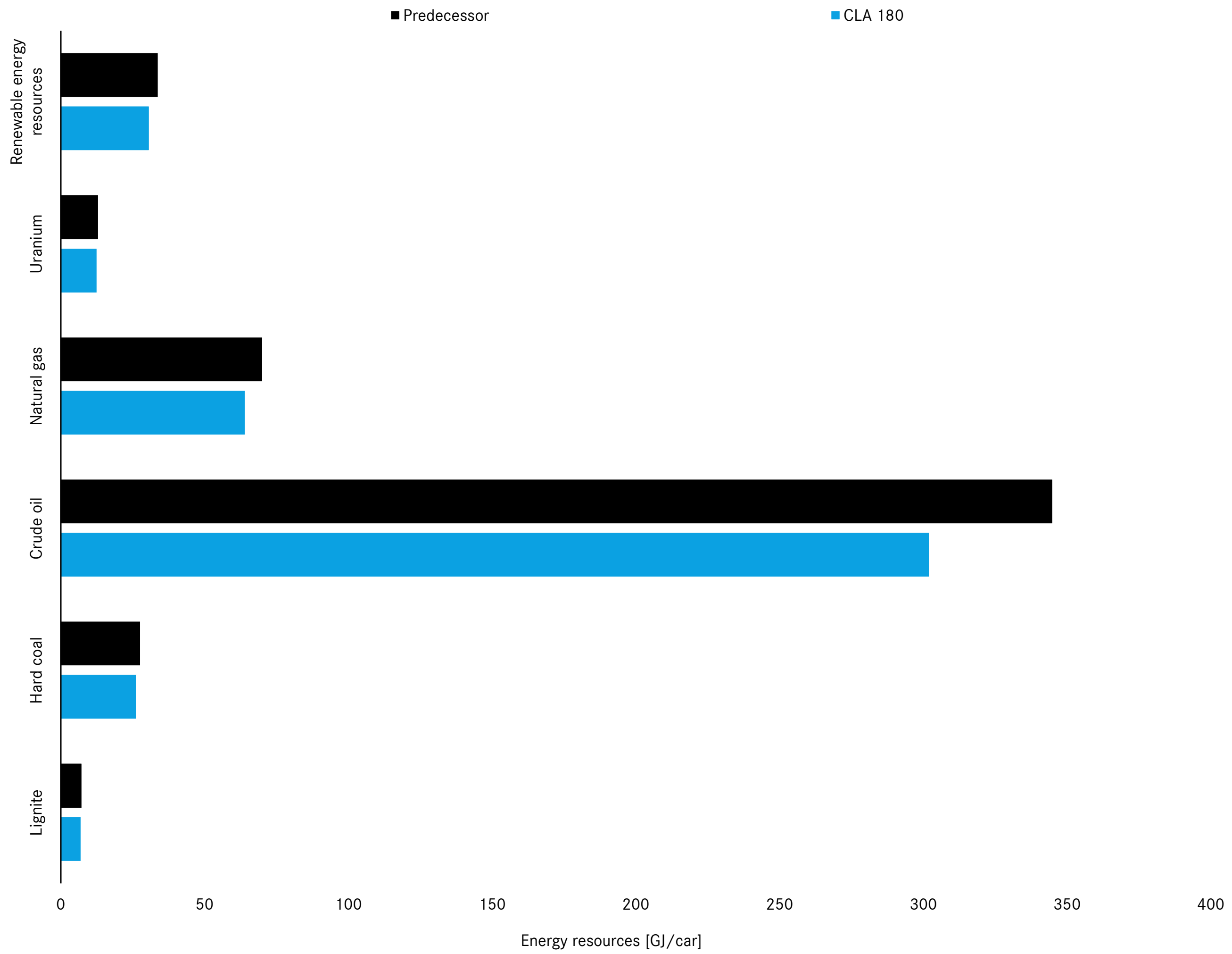


Figure 2-9: Selected energy resources new CLA 180 in comparison to the predecessor [GJ/car]



In order to comprehensively assess the use of resources in products, various aspects must also be considered in addition to pure raw material consumption. Questions pertaining to safeguarding the supply of raw materials in the medium and long term in particular as well as maintaining social and environmental standards along the supply chain play a key role. As part of the research project ESSENZ, funded by the Federal Ministry of Education and with the involvement of Daimler AG, a holistic approach was developed that brings together the different perspectives.

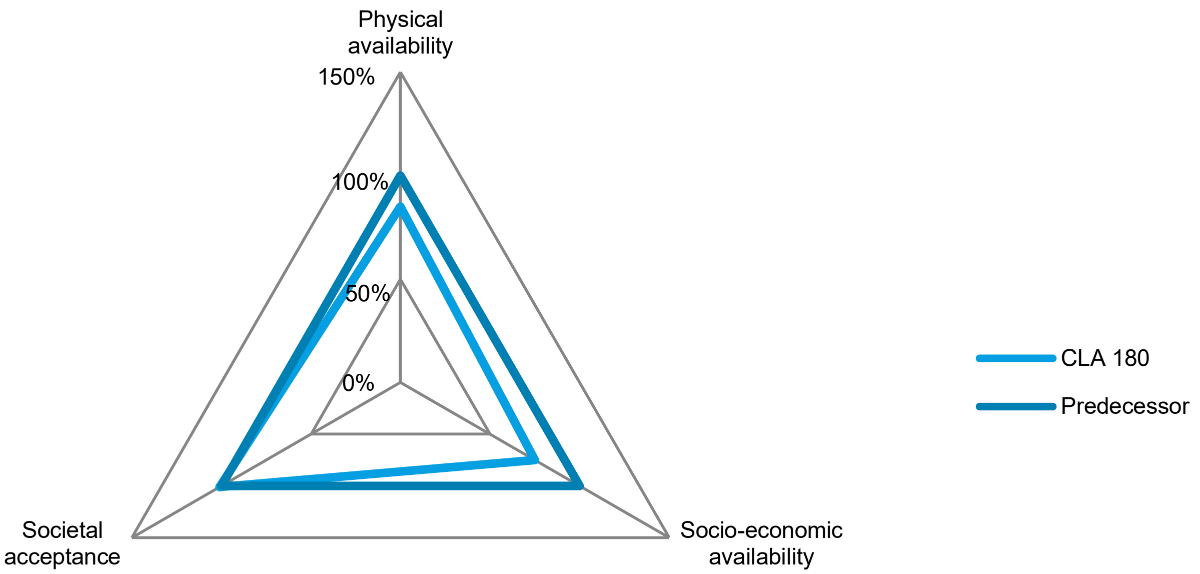
As an indicator of long-term supply security, the geological availability of resources is taken as an underlying basis with respect to changing needs. Medium-term effects on supply security are determined by leveraging socio-economic indicators such as country/company concentration, political stability of growing countries and price developments as well as growth in demand.

Maintaining environmental and social standards are bundled in the dimension of social acceptance and provides indication of possible risks when extracting resources at the national level. In the process, indicators of working conditions and effects on the local ecosystem are taken into account.

The comparison of the new CLA 180 to the predecessor shows only a slightly different overall picture due to the similar composition of materials. In socio-economic availability, metals used in electronic components mainly influence the result. Due to the assessment factors deposited with ESSENZ, small quantities are already visible here. The lower fuel consumption of the new CLA 180, in particular the lower oil consumption, has an impact on the physical availability dimension.

Tables 2-1 and 2-2 show further LCA result parameters as an overview. The goal of bringing about improved environmental performance in the new CLA over its predecessor was achieved overall. Over the entire lifecycle, the new CLA shows notable advantages in the impact categories global warming potential (GWP100), eutrophication (EP), acidification (AP), fossil abiotic depletion potential (ADP fossil) and summer smog (POCP) compared to the predecessor.

Figure 2-10: Summary of resource efficiency dimensions of the ESSENZ method – new CLA 180 compared with the preceding model



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

Input parameters	CLA 180	Predecessor	Delta to predecessor	Comments
Material resources				
Bauxite [kg]	557	581	-4 %	Aluminium production.
Dolomite [kg]	114	104	9 %	Mainly magnesium production.
Iron [kg]*	610	657	-7 %	Steel production.
Non-ferrous metals (Cu, Pb, Zn) [kg]*	96.0	99	-3 %	Mainly electric (wiring harness/battery) and zinc.
*as elementary resources				
Energy resources				
ADP fossil** [GJ]	399	450	-11 %	80 % (CLA 180) resp. 81 % (predecessor) from use phase.
Primary energy [GJ]	443	497	-11 %	
Proportionately				
Lignite [GJ]	7.0	7.3	-4 %	83 % resp. 82 % from car production.
Natural gas [GJ]	64.1	70.1	-9 %	48 % resp. 45 % from car production.
Crude oil [GJ]	302	345	-12 %	Each 94 % from use phase.
Hard coal [GJ]	26.3	27.7	-5 %	94 % resp. 93 % from car production.
Uranium [GJ]	12.5	13.1	-5 %	81 % resp. 80 % from car production.
Renewable energy resources [GJ]	30.8	33.8	-9 %	53 % resp. 55 % from use phase.
**CML 2001, as of January 2016				

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

Output parameters	CLA 180	Predecessor	Delta to predecessor	Comments
Emissions in air				
GWP** [t CO_2-equiv.]	30.6	34.4	-11 %	Mainly due to CO_2 emissions.
AP** [kg SO_2-equiv.]	48.7	52.0	-6 %	Mainly due to SO_2 emissions.
EP** [kg phosphate-equiv.]	7.5	8.0	-6 %	Mainly due to NO_x emissions.
POCP** [kg ethene-equiv.]	12.8	13.6	-5 %	Mainly due to NMVOC and CO emissions.
CO_2 [t]	29.1	32.7	-11 %	19 % (CLA 180) resp. 18 % (predecessor) from car production.
CO [kg]	180	182	-1 %	7 % resp. 8 % from car production.
NMVOC [kg]	26.0	28.1	-7 %	Each 94 % from use phase.
CH_4 [kg]	49.1	54.8	-10 %	77 % resp. 78 % from use phase.
NO_x [kg]	39.8	41.5	-4 %	Each 75 % from use phase.
SO_2 [kg]	22.4	24.2	-7 %	53 % resp. 50 % from car production.
Emissions in water				
BOD [kg]	0.12	0.13	-7 %	55 % resp. 52 % from car production.
Hydrocarbons [kg]	1.2	1.3	-11 %	70 % resp. 71 % from use phase.
NO_3^- [kg]	6.5	7.4	-13 %	97 % resp. 98 % from use phase.
PO_4^{3-} [kg]	0.36	0.40	-10 %	71 % resp. 73 % from use phase.
SO_4^{2-} [kg]	16.2	17.8	-9 %	52 % resp. 50 % from car production.

**CML 2001, as of January 2016


CLA 250
S CA 5224


09:29
626.1
2127
LIVETRAFFIC
Parzivalplatz
VOL
AUTO
PASSENGER AIR BAG
A/C
SYNC

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 CLA too was developed in accordance with the requirements of the quality seal of the European Centre for Allergy Research Foundation (ECARF) and a seal has been applied for. 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 in the CLA 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 CLA a total of 183 components including small parts such as push buttons, plastic nuts and cable fasteners with a total weight of 58.8 kilogrammes can be produced partially from less resource consuming materials. Figure 3-2 shows the approved components.

The consistent use of less resource consuming materials takes place for identical parts and for parts with the same function over all models of the new compact car family.

To this end, established processes are applied in the CLA: 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.

Furthermore, cable ducts of the CLA are already made nearly entirely from recycled material.

With the Dinamica® material, high-quality secondary raw material is also now used in the interior of the CLA. Dinamica® is a microfiber made of recycled polyester and water-borne polyurethane. The recycled polyester contained in Dinamica® derives e.g. from textiles remnants and PET bottles. Dinamica® has a suede leather optic and haptic and is used in the interior as seat cover.

Figure 3-2: Use of less resource consuming materials in the new CLA


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 CLA

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 and catalytic converters, 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).

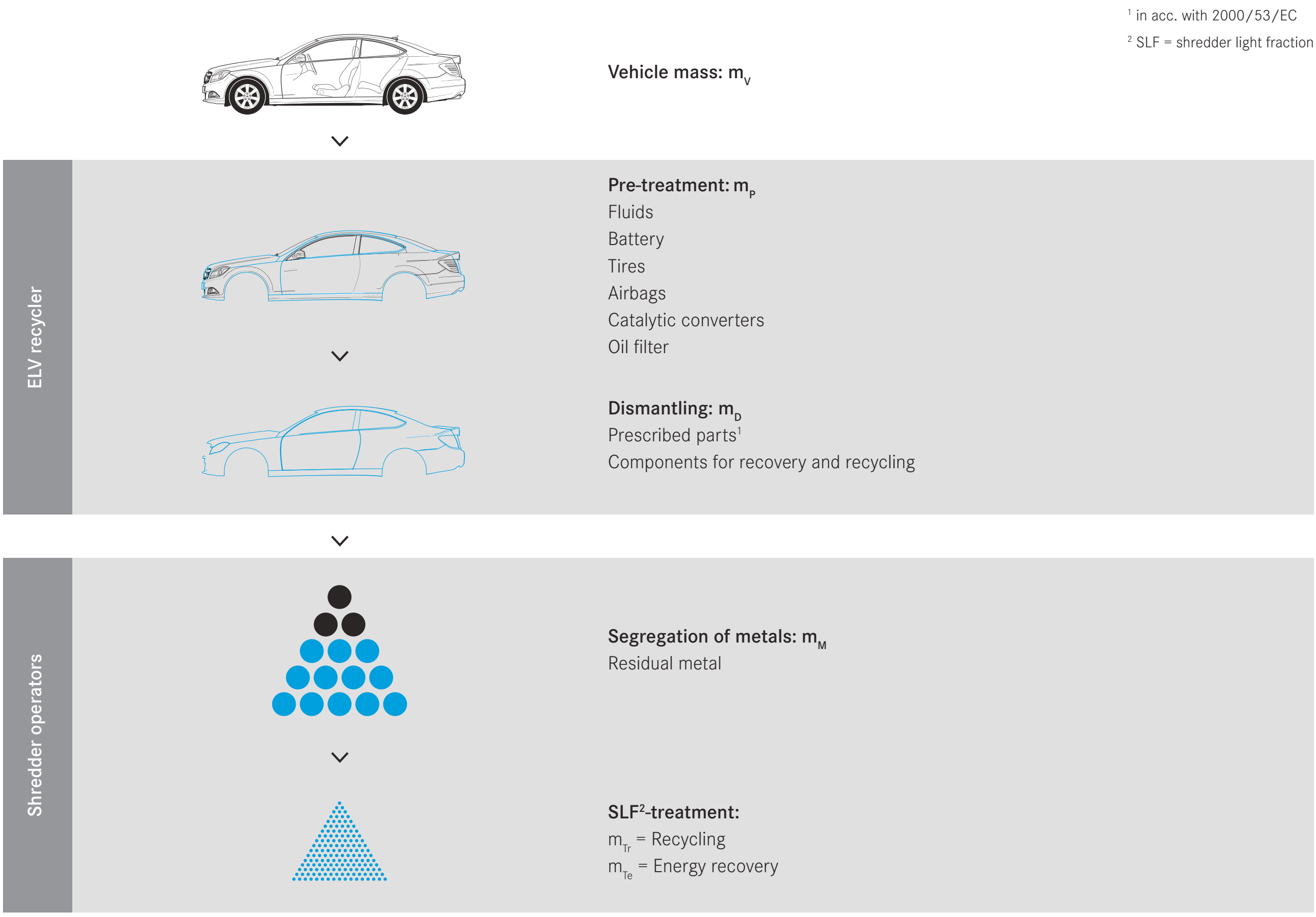
The recycling concept for the CLA was devised in parallel with development of the vehicle; the individual components and materials were analysed for each stage of the process. The volume flow rates established for each stage together yield the recycling and recovery rates for the entire vehicle. With the process chain described below, an overall material recyclability rate of 85 percent and a recoverability rate of 95 percent were verified on the basis of the ISO 22628 calculation model for the CLA 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 CLA, 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



$R_{cyc} = (m_P + m_D + m_M + m_{Tr}) / m_V * 100 > 85$ percent

$R_{cov} = R_{cyc} + m_{Te} / m_V * 100 > 95$ percent

4.2 Dismantling information

Dismantling information plays an important role for ELV recyclers when it comes to implementing the recycling concept. For the CLA 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 CLA. 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 crossfunctional teams (e. g. quality management, project management etc.) are appointed in accordance with the most important automotive components and functions.

One such crossfunctional 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 CLA 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.

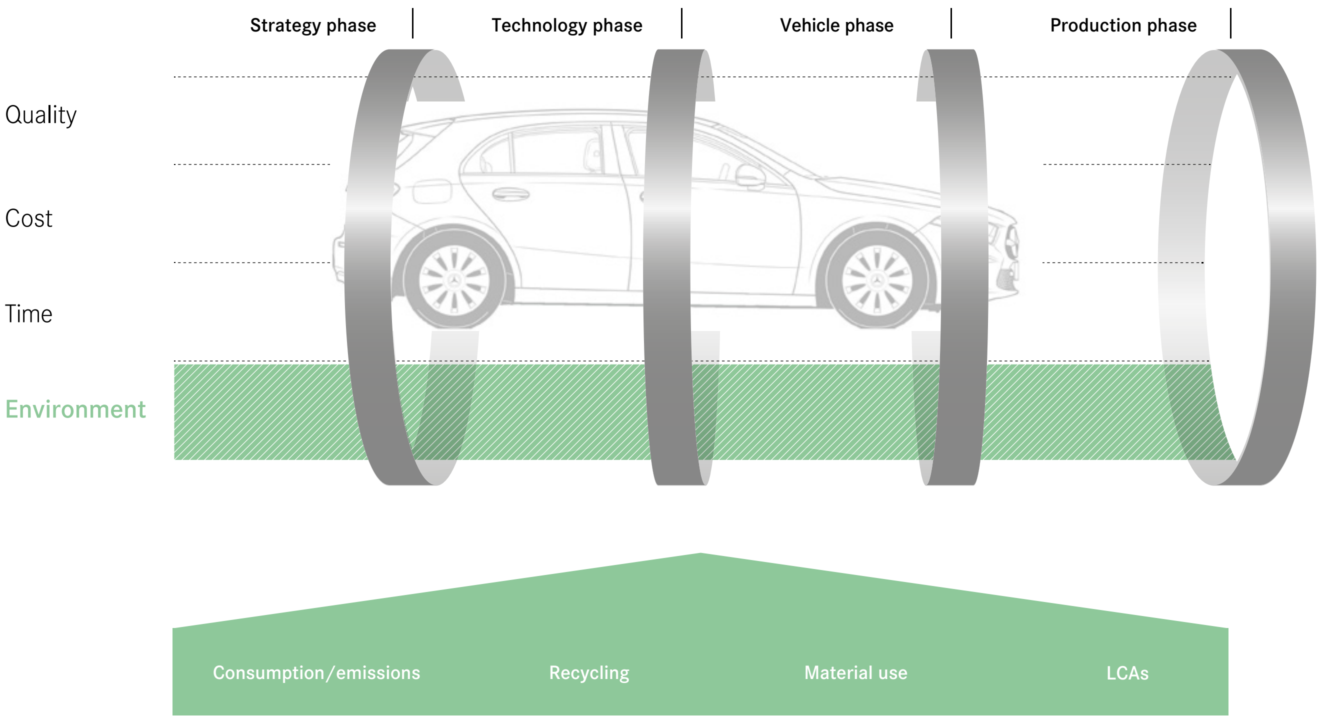
The process carried out for the CLA meets all the criteria for the integration of environmental aspects into product development, which are described in ISO standard TR 14062.

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

TÜV SÜD
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

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6. Conclusion

The new Mercedes-Benz CLA not only meets the highest demands in terms of safety, comfort, agility, and design, but also shows significant improvements with regard to environmental impacts over the entire lifecycle compared to its predecessor. This is documented comprehensively 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.

With the new CLA, Mercedes-Benz customers benefit across the range from new, efficient engines, which are geared to the stricter emissions provisions for measurements in real driving operations (Real Driving Emissions, RDE). The new diesel engine generation with Euro 6d-TEMP resp. Euro 6d (OM 654q) emissions standard complies also with the strict NO_x RDE limits for real driving. In addition, it employs a great proportion of high-quality secondary and renewable raw materials.

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.

Appendix

A: Product documentation

Technical data	CLA 180 DCT
Engine type	Petrol engine
Number of cylinders	4
Displacement (effective) [cm^3]	1,332
Output [kW]	100
Emission standard (fulfilled)	Euro 6d-TEMP
Weight (without driver and luggage) [kg]	1,335
Fuel consumption [l/100 km][1]	5.7 – 5.4[2]
CO_2 [g/km] [1]	130 – 123[2]

[1] The stated figures are the “measured NEDC CO_2 figures” in conformance with Art. 2 No. 1 implementing order (EU) 2017/1153. The fuel consumption figures were calculated on the basis of these values. Energy consumption was determined on the basis of Regulation (EC) No. 692/2008. A higher figure may be relevant as the assessment basis for the motor vehicle tax. The figures vary depending on the selected optional extras.
[2] The life cycle assessment was calculated for the base variant (lowest consumption figures).

The table below shows the limits Euro 6d-TEMP (WLTC/RDE).

Emissions	Petrol engine
CO [g/km]	1/-
($HC+NO_x$) [g/km]	-/-
HC (NMHC) [g/km]	0.1 (0.068)/-
NO_x [g/km]	0.060/0.126
PM [g/km]	0.0045/-
PN [1/km]	6E11/9E11

Project objective	
Project objective	LCA over the lifecycle of the CLA 180, as ECE base version, with 7G-DCT dual clutch transmission in comparison to the predecessor CLA 180 with dual clutch transmission.
	Verification of attainment of the objective "environmental compatibility" and communication.

Project scope	
Functional equivalent	CLA passenger car (base variant, weight in acc. with DIN 70020).
Technology/product comparability	With two generations of a car type, products are generally able to be compared. Due to the product comparability, the progress in development and the changing market requirements, the new CLA provides additional scope especially in the area of the active and passive safety. If the additional scope takes relevant influence on the balance sheet result it will get commented in the course of the evaluation.
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 as of 6/2019.
	Materials information for model-relevant, vehicle-specific parts: MB parts list, MB internal documentation systems, IMDS, technical literature.
	Vehicle-specific model parameters (bodyshell, paintwork, catalytic converter etc.): MB specialist departments.
	Location-specific energy supply: MB database.
	Materials information for standard components: MB database.
	Use (fuel consumption, emissions): type approval/certification data.
	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 SP39 (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. Major sources of particulate matter (mainly tyre and brake abrasion) are not dependent on vehicle type and consequently of no relevance to the result of the vehicle comparison.
	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, NO_x, 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). These impact assessment parameters are based on internationally accepted methods. They are modelled on categories selected by the European automotive industry, with the participation of numerous stakeholders, in an EU project under the name LIRECAR. The mapping of impact potentials for human toxicity and ecotoxicity does not yet have sufficient scientific backing today, and therefore will not deliver meaningful results.
	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 9 (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).
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	Federal Motor Transport Authority (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
NEFZ	New European Driving Cycle; cycle used to establish the emissions and consumption of motor vehicles since 1996 in Europe; prescribed by law.
NE-Metall	Non-ferrous metal (aluminium, lead, copper, magnesium, nickel, zinc etc.).
NMVOC	Non-methane volatile organic compounds (NMHC Non-methane hydro-carbons).
POCP	Photochemical ozone creation potential, (summer smog); impact category that describes the formation of photo-oxidants (summer smog).
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.
RDE	Real Driving Emissions.
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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