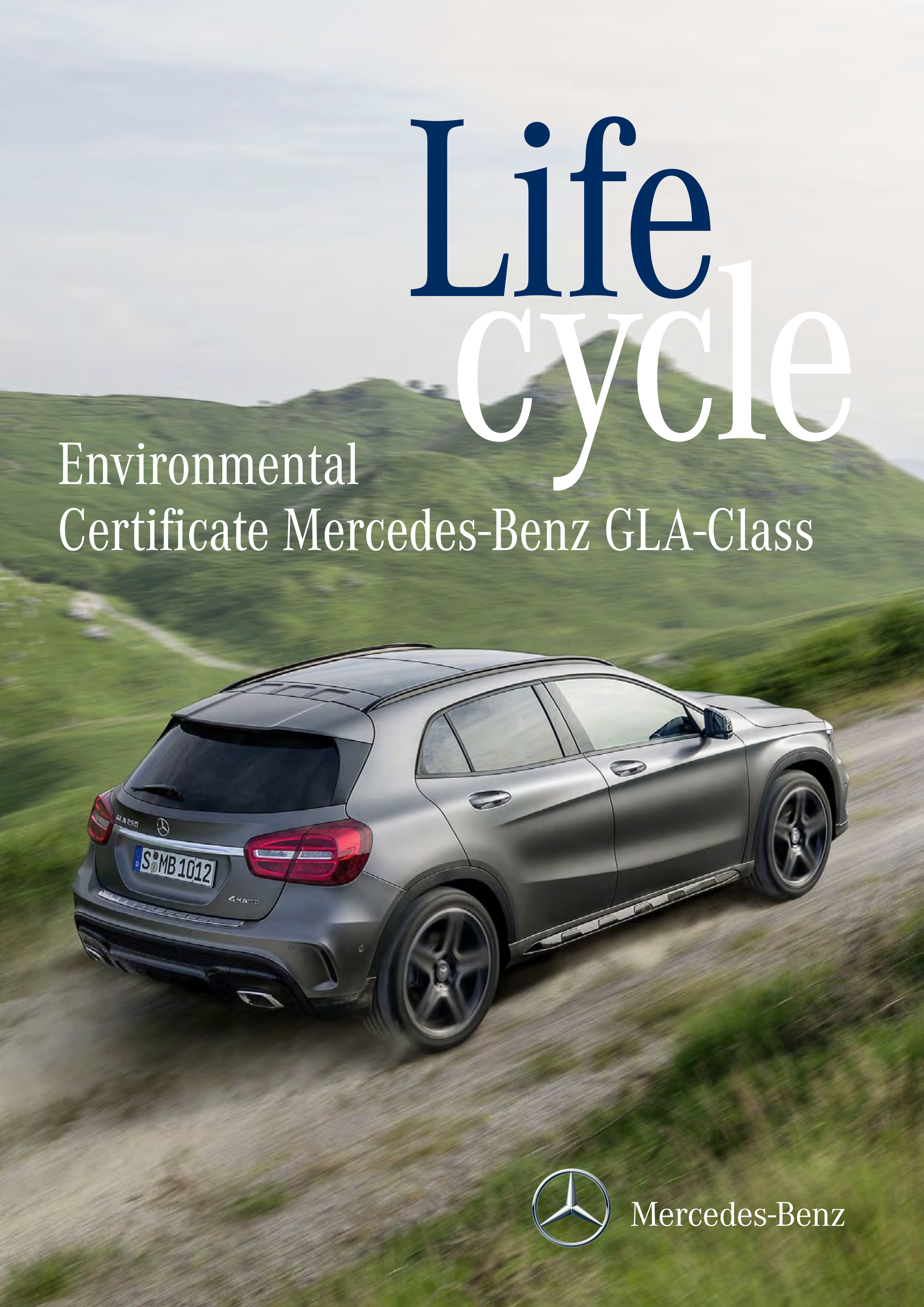
Life cycle

Environmental Certificate Mercedes-Benz GLA-Class



Mercedes-Benz

Contents

As at: December 2013

Life cycle

Since the beginning of 2009, “Life Cycle” has been presenting the Environmental Certificates for Mercedes-Benz vehicles. Above all the principal aim of this documentation series is to provide the best possible service to as many interested parties as possible: on the one hand, the wide-ranging and complex subject of the “car and the environment” needs to be communicated to the general public in a manner which is easy to understand. On the other hand, however, specialists also need to have access to detailed information. “Life Cycle” fulfils this requirement with a variable concept.

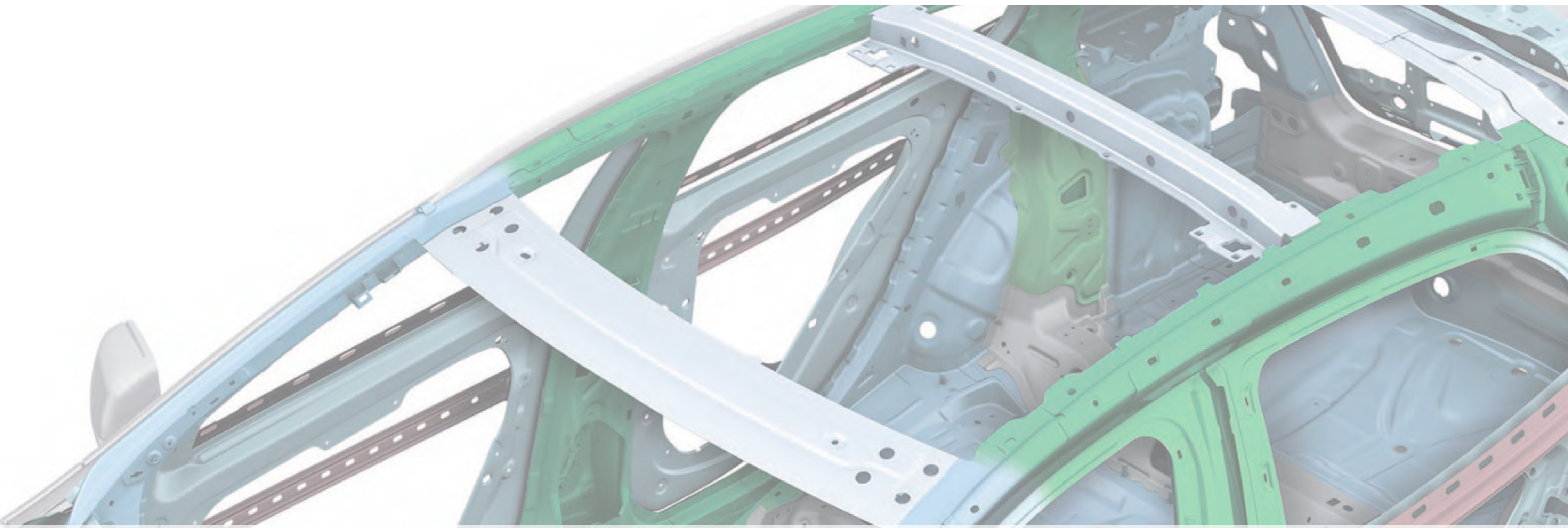
Those wanting a quick overview can concentrate on the short summaries at the beginning of the respective chapters. These summaries highlight the most important information in note form, while standardised diagrams also help to simplify orientation. If more detailed information on the environmental commitment of Daimler AG is required, clearly arranged tables, diagrams and informative text passages have also been provided. These elements describe the individual environmental aspects in meticulous detail.

With its service-oriented and attractive “Life Cycle” documentation series, Mercedes-Benz is once again demonstrating its pioneering role in this important area – just as in the past, when in 2005 the S-Class became the very first vehicle to receive the Environmental Certificate from TÜV Süd (South German Technical Inspection Authority).

Interview

“Extreme lightweight construction in detail”

Professor Dr Herbert Kohler,
Chief Environmental Officer, Daimler AG



Professor Kohler, with a Cd value of 0.29 the GLA is at the top of its segment as far as the aerodynamic properties are concerned. Which were the decisive measures for these exemplary aerodynamic characteristics?

As ever, there have been a wide range of optimisations. These include a low A-pillar step with corresponding A-pillar geometry and aerodynamically optimised exterior mirror housings. The tail end is also streamlined. The measures here include the roof spoiler lip and the aerodynamically shaped tail lights. Rear spoilers at the sides ensure that the airflow breaks off for optimal aerodynamic efficiency. Seals in the front bumper (around radiator grille including headlamps) complement the aerodynamic measures.

Where does the car have the edge in terms of the drive system‘s efficiency?

In the GLA we exclusively use state-of-the-art four-cylinder engines with turbocharging and direct injection, and the ECO start/stop function is always standard. All the engines in the GLA already meet the Euro 6 emissions standard and both diesel units are in efficiency class A.

Talking of diesel: In the GLA 200 CDI is there now also a variant of the OM 651 engine with a displacement of 2.2 litres?*

Yes, meaning that we meet the Euro 6 emissions standard and, with 4.3 litres over 100 km, achieve a very good combined consumption figure. This engine has been revised for greater efficiency. The modifications include optimisation of the belt drive, a cylinder head package with different roller bearings and additional finishing, optimisation of the vacuum pump, aluminium pistons with optimised assembly clearances and low-friction ring package, the roller bearings of the Lanchester balancer shaft and pressure-sensor combustion control in the cylinder head.

On request the new GLA-Class is available with the permanent all-wheel drive system 4MATIC. What is efficiency like in this case?

For design reasons the system weight of the new 4MATIC is as much as 25 percent lower than that of the all-wheel drive versions offered by our competitors. The outcome of these highly effective lightweight design measures is good energy efficiency.

The eco innovations are often to be found in the detail. For instance, the parcel shelf in the luggage compartment of the GLA, which has a honeycomb core made of recycled paper, has already received several awards.

The invention has scooped the MATERIALICA AWARD “Best of CO_2”. This component project is also among the winners of the “Environmental Leadership Award”, with which Daimler honours outstanding environmental projects in the Group every year. Mercedes-Benz has registered four patents in all for the innovative manufacturing process and the composition of the material used.

How does the new production process function in detail?

The eight layers of the composite material are joined, formed, laminated and cut to size in one step. This consolidation of the production steps into a single operation and the use of recycled paper in the honeycomb core reduce CO_2 emissions during the manufacture of the components by 60 percent compared with the old process. At the same time, with a weight of 1.2 kilograms the load compartment cover of the GLA has only around half the weight of a conventional component.

This extreme lightweight construction surely lowers the CO_2 emissions during the use of the vehicle?

Yes, over the entire life cycle this results in CO_2 savings of about 13 kilograms, as the company‘s experts determined in their analysis for this Environmental Certificate.

* Fuel consumption GLA 200 CDI with manual transmission (combined): 4.5-4.3 l/100km; CO_2-emissions (combined): 119-114 g/km.

Product description

Multi-talented

Progressive in design, self-assured in day-to-day motoring and with good off-road capability: A wanderer between automotive worlds, the Mercedes-Benz GLA reinterprets the compact SUV segment in impressive style.

The first Mercedes-Benz in the fast-growing compact SUV segment is highly manoeuvrable around town (length x width x height: 4417 x 1804 x 1494 millimetres), lively on country and pass roads and dynamic and efficient on the motorway (Cd figure 0.29).

The high-quality appointments, developed with a loving attention to detail, and the flexible interior clearly position the GLA as a compact premium SUV. The GLA is the first Mercedes SUV to be available with the option of the new generation of 4MATIC permanent all-wheel drive featuring fully variable torque distribution.

Information displayed on the off-road screen includes the steering angle, the selected off-road driving program, roll angle and the downhill and uphill gradients.

The highlights of the new GLA-Class

- All-rounder with the hallmark Mercedes SUV genes, youthful, sculptural and full of subtle drama.
- Attractive design features and high perceived quality in the interior.
- Excellent aerodynamics (Cd value: 0.29).
- Powerful and efficient turbo engines.
- ECO start/stop function as standard.
- Numerous driving assistance systems, including advanced COLLISION PREVENTION ASSIST.
- New-generation permanent all-wheel drive system 4MATIC (optional extra).

The side view of the GLA likewise conveys power and serenity. The “dropping line” emerges at the headlamp and extends to the rear wheel arch.

Design: Quality and self-assurance

As an SUV, the new GLA combines the key design values of progression and tradition, and is the SUV of the future. It is an all-rounder with the hallmark Mercedes-Benz SUV genes, but more youthful, sculptural and full of subtle drama.

The low greenhouse, raised vehicle body and large wheel arches give the GLA great appeal. The clearly defined surfaces are supplemented with sharp lines that provide definition and precision, varying the sensitively modelled and subtly dramatic sculptured contours of the vehicle body.

The prominent and self-assured upright front end with a central star lends a muscular and superior impression to the GLA. Powerdomes structure the bonnet as sporty features, and the twin-louvre grille accentuates the vehicle‘s width. An impressive front aspect is ensured by the headlamps and LED daytime running lamps. This iconic Mercedes-Benz design feature has been developed further using trifunctional fibre-optics, and gives the vehicle its characteristic look. The front bumper features diamond-pattern grilles in front of the cooling air intakes. A simulated underguard at the front and contrasting dark-grey cladding all-round emphasise the SUV characteristics of the GLA. This cladding extends around the bottom edge of the vehicle like a frame and provides protection against stone impact.

The side view of the GLA likewise conveys power and serenity. Following the design philosophy, the “dropping line” emerges at the headlamp and extends to the rear wheel arch. The line of the beltline trim gradually rises from the rear door to the C-pillar. Together the light-catching contour on the curvature and the counter-line to the dropping line at side-sill height create an interplay of lines that lends the car flowing dynamism and subtle drama. At the sides the cladding follows the contours of the wheel arches and side sill panels into the rear bumper. The side panel has depressions shaped like an excavator‘s teeth to accentuate the SUV character. Roof trim strips form the conclusion at the top as standard.

The muscular shoulders over the rear axle are further highlighted by the inward taper of the C-pillars. In combination with the divided tail lights, this emphasises the width of the tail end. It combines dynamic lines with an overall harmonious appearance.

This impression is heightened by the curved rear window and the sweeping chrome handle between the tail lights. Thanks to the divided tail lights, the loading hatch is pleasantly wide. The large, aerodynamically very effective roof spoiler is another eye-catching feature. It takes up the structure of the rear roof cladding and accommodates the third brake light and various aerials. In the area of the rear bumper covering there are other SUV-specific features such as a robust external load sill guard and a simulated underguard.

Interior: attractive design features and high perceived quality

The muscular and imposing appearance of the exterior is systematically continued into the interior. The interior has a particularly high feel of quality that is achieved through the design idiom and through the choice and available combinations of high-grade materials. The heavy emphasis on horizontal lines, the dynamic design and the highly attractive design features are other high-quality attributes. The same applies to the great precision of joints and gap dimensions.

The dashboard consists of an upper and lower section, allowing surface structures that are different in look and feel. Matt and glossy 3D geometries (graining) create attractive effects of light. The three-dimensional trim section of innovative membrane, aluminium or wood lends a new, modern touch to the interior.

The muscular and imposing appearance of the exterior is systematically continued into the interior. There is also a particularly high-class appeal.

Five round air vents are integrated into the dashboard. As an exclusive GLA feature, bezels are optionally available around these circular vents, whose SUV-look echoes the underguard and side member claddings. The direction of airflow can be changed through butterfly-shaped inserts. The large, free-standing display has a high-gloss display facing in piano-black and a flush-fitting surround in silver-shadow.

The wide choice of seat upholsteries in terms of material (e.g. leather, fabric, fabric/leather) and colour combinations allows plenty of scope for individualisation. Sports seats with integral head restraints are available as an optional extra. The high quality of the sports seats is emphasised by the aperture in the lower section of the head restraint. On the rear of the front seats this aperture is framed by a surround in silver-shadow, and can have ambience lighting on request.

If the optional Load Compartment package is ordered, the backrest of the rear seat unit can be moved to a steeper position, the so-called cargo position. This enlarges the load compartment capacity by 60 litres, providing more space for bulky items while still allowing the rear seats to be used by passengers.

Aerodynamics: As sleek as they come

With the GLA, yet another model series is set to become the leader in its segment with respect to aerodynamic efficiency. It has a Cd value of 0.29. At 0.66 m^2 the drag area, Cd x A, which decisively affects fuel consumption from around 60 km/h, is also outstanding.

The good air flow characteristics, which are a major contributory factor to the vehicle‘s low fuel consumption in everyday conditions, result from numerous aerodynamic optimisation measures. These include a low A-pillar step with suitable A-pillar geometry and aerodynamically optimised exterior mirror housings. The tail end is also streamlined. The measures here include the roof spoiler lip and the aerodynamically shaped tail lights. Rear spoilers at the sides ensure that the airflow breaks off for optimal aerodynamic efficiency.

The prominent and self-assured upright front end with a central star lends the GLA a powerful, effortlessly superior expression.

Extensive underbody panelling, additional panelling in the middle area of the rear axle and an aerodynamically optimised rear silencer followed by a diffuser improve the flow of air beneath the underbody.

Numerous measures have also been taken to reduce wind noise in the GLA. These include a multi-level door sealing concept, additional sealing of the joint between the tailgate and the roof and side seals on the tailgate. Particularly rigid window frames prevent the airflow from pulling on the doors at higher speeds, and reduce vibrations. External noise has also been minimised by the low A-pillar step mentioned above and by exterior mirrors connected to the body by a stem.

[1] Fuel consumption GLA 200 with manual transmission (combined): 5.9 l/100km; CO_2-emissions (combined): 139-137 g/km.
[2] Fuel consumption GLA 250 with dual clutch automatic transmission (combined): 6.1-6.0 l/100km; CO_2-emissions (combined): 143-141 g/km.
[3] Fuel consumption GLA 250 4MATIC with dual clutch automatic transmission (combined): 6.6-6.5 l/100km; CO_2-emissions (combined): 154-151 g/km.

Engines and transmissions: dynamic expression of leadership aspirations

The GLA can be driven at a fuel consumption of only 4.3 litres per 100 km, setting new standards in its segment. Modern four-cylinder engines with turbocharging and direct injection, as well as an ECO start/stop function as standard, make for superior efficiency. The new GLA-Class also takes the lead in its segment with its dynamic performance figures..

Initially the power range of the 1.6 and 2.0-litre petrol engines will extend from 115 kW (156 hp) in the GLA 200[1] to 155 kW (211 hp) in the GLA 250[2]. The GLA 250 4MATIC[3] sprints from zero to 100 km/h in only 7.1 seconds, underlining the GLA-Class‘s leadership aspirations on the dynamics front. It has a top speed of 230 km/h and a combined consumption figure of just 6.5 l/100 km (151 g CO_2/km).

The GLA is the first Mercedes SUV to be available with the option of the new generation of 4MATIC permanent all-wheel drive featuring fully variable torque distribution..

The two diesel engines excel with dynamic torque and outstanding efficiency: The GLA 200 CDI generates 100 kW (136 hp), maximum torque of 300 Nm and has a displacement of 2.2 litres. This engine has been reengineered for greater efficiency. The modifications include optimisation of the belt drive, a cylinder head package with different roller bearings and additional finishing, optimisation of the vacuum pump, aluminium pistons with optimised assembly clearances and a low-friction ring package, and the roller bearings of the Lanchester balancer shaft.
The GLA 200 CDI requires just 4.3 litres of fuel for 100 km, which equates to 114 g CO_2/km. It is rated efficiency class A. The GLA 220 CDI* with the same displacement of 2.2 litres generates 125 kW (170 hp) and 350 Nm.

* Fuel consumption GLA 220 CDI with dual clutch automatic transmission (combined): 4.6-4.4 l/100km; CO_2-emissions (combined): 119-115 g/km.

All the engines feature the ECO start/stop function as standard. The engines are combined with a six-speed manual transmission or with the 7G-DCT dual clutch automatic transmission (standard for GLA 250, GLA 220 CDI and the 4MATIC models), which unites comfort and sportiness in a very special way.

Suspension: for guaranteed recreational fun

The chassis of the GLA features a MacPherson front axle and an independent multi-link rear suspension. Three control arms and one trailing arm per wheel manage the incoming forces. This means that longitudinal and lateral dynamics are independent of one another. The wheel carriers and spring control arms are made of aluminium to reduce the unsprung masses. In all there are three chassis and suspension set-ups to choose from: the comfort suspension as standard, the dynamic handling package with suspension lowered by 15 mm and Sports Direct-Steer system, plus the off-road comfort suspension (optional). Compared to conventional systems, the electromechanical power steering provides better feedback to the driver and

makes an important contribution to the vehicle's overall efficiency, as the servo assistance only requires energy when the vehicle is actually being steered. It also allows various steering assistance functions that are initiated by the ESP® control unit.

Confident on light terrain: off-road functions

Models with 4MATIC are equipped with DSR (Downhill Speed Regulation) and an off-road transmission mode as standard. DSR is activated by a control button in the centre console, and assists the driver on demanding downhill stretches by maintaining a slow, manually selected vehicle speed within the physical limits when negotiating downhill gradients. This is done with the help of the engine and transmission control systems, and by targeted brake intervention.

When the off-road transmission mode is selected using the transmission mode switch, the shift points and accelerator characteristics are modified so that the requirements for driving on light off-road terrain, and particularly on loose surfaces, can be met. In combination with Audio 20 CD (standard) and COMAND Online (optional extra), the head unit can also be switched to an off-road display.

Smart safety: advanced assistance systems

Numerous driving assistance systems offer support in the GLA and reduce the driver's workload. Standard-fit features for the SUV include ATTENTION ASSIST drowsiness detection and radar-based COLLISION PREVENTION ASSIST with adaptive Brake Assist, which now helps to avoid collisions from a speed as low as 7 km/h.

This feature combines with DISTRONIC PLUS (optional extra) to become COLLISION PREVENTION ASSIST PLUS. This incorporates an additional function: when a danger of collision persists and the driver fails to respond, the system is able to carry out autonomous braking at speeds of up to 200 km/h, thereby reducing the severity of collisions with slower or stopping vehicles. The system also brakes in response to stationary vehicles at a speed of up to 30 km/h, and is able to prevent rear-end collisions at relative speeds of up to 20 km/h.

Established assistance systems, such as the optional Lane Tracking package with Blind Spot Assist and Lane Keeping Assist or Adaptive Highbeam Assist, are also available for the GLA. Active Parking Assist (optional) allows automatic parking in parallel and end-on parking spaces.

Validation

TÜV SÜD Management Service

Validation:

The **following report** gives a comprehensive, accurate and appropriate account on the basis of reliable and reproducible information.

Mandate and basis of verification:
The following environmental product information of Daimler AG, named as „Environmental-Certificate Mercedes-Benz GLA-Class“ with statements for the passenger vehicle types GLA 200, GLA 250, GLA 250 4MATIC, GLA 200 CDI, GLA 200 CDI 4MATIC, GLA 220 CDI and GLA 220 CDI 4MATIC was verified by TÜV SÜD Management Service GmbH. If applicable, the requirements outlined in the following directives and standards were taken into account:

- EN ISO 14040 and 14044 regarding life cycle assessment (principles and general requirements, definition of goal & scope, inventory analysis, life cycle impact assessment, interpretation, critical review)
- EN ISO 14020 (environmental labels and declarations – general principles) and EN ISO 14021 (criteria for self-declared environmental claims)
- ISO technical report ISO TR 14062 (integration of environmental aspects into product design and development

Independence and objectivity of verifier:
TÜV SÜD Group has not concluded any contracts regarding consultancy on product-related environmental aspects with Daimler AG either in the past or at present. TÜV SÜD Management Service GmbH is not economically dependent or otherwise involved in any way with the Daimler AG.

Process and depth of detail of verification:
Verification of the environmental report covered both document review and interviews with key functions and persons in charge of the design and development of the new GLA-Class.
Key statements included in the environmental information, such as weight, emissions and fuel consumption were traced back to primary measuring results or data and confirmed.
The reliability of the LCA (life cycle assessment) method applied was verified and confirmed by means of an external critical review in line with the requirements of EN ISO 14040/44.

TÜV SÜD Management Service GmbH

Munich, 2013-12-16

Dipl.-Ing. Michael Brunk

Environmental Verifier

Dipl.-Ing. Ulrich Wegner
Head of Certification Body
Environmental Verifier

Responsibilities:
Full responsibility for the contents of the following report rests with Daimler AG. TÜV SÜD Management Service GmbH had the task to review the available information for correctness and credibility and validate it provided the pertinent requirements were satisfied.

1 Product documentation

This section documents significant environmentally relevant specifications of the different variants of the GLA-Class referred to in the statements on general environmental topics (Chapter 2.1).

The detailed analysis of materials (Chapter 1.2), Life Cycle Assessment (Chapter 2.2), and the recycling concept (Chapter 2.3.1) refer to the GLA 200 with standard equipment.

1.1 Technical data

The table below shows essential technical data for the variants of the GLA-Class.
The relevant environmental aspects are explained in detail in the environmental profile in Chapter 2.

Characteristics	GLA 200	GLA 250	GLA 250 4MATIC	GLA 200 CDI	GLA 200 CDI 4MATIC	GLA 220 CDI	GLA 220 CDI 4MATIC
Engine type	Petrol engine	Petrol engine	Petrol engine	Diesel engine	Diesel engine	Diesel engine	Diesel engine
No. of cylinders	4	4	4	4	4	4	4
Displacement (effective) [cc]	1595	1991	1991	2143	2143	2143	2143
Output [kW]	115	155	155	100	100	125	125
Emissions standard (fulfilled)	EU 6	EU 6	EU 6	EU 6	EU 6	EU 6	EU 6
Weight [kg] (excluding driver and luggage)	1320**/ 1360	1380	1430	1430**/ 1460	1520	1460	1520
Exhaust emissions [g/km]							
CO_2*	139–137**/ 138–135	143–141	154–151	119–114**/ 119–114	132–129	119–115	132–129
NO_X	0.0167**/ 0.0242	0.0269	0.0269	0.0491**/ 0.056	0.056	0.056	0.056
CO	0.137**/ 0.158	0.1435	0.1435	0.3619**/ 0.2965	0.2965	0.2965	0.2965
HC (for petrol engine)	0.0315**/ 0.0334	0.0297	0.0297	–	–	–	–
NMHC (for petrol engine)	0.0275**/ 0.0293	0.0255	0.0255	–	–	–	–
$HC+NO_X$ (for diesel engine)	–	–	–	0.0905**/ 0.0851	0.0851	0.0851	0.0851
Particulate matter	0.00069**/ 0.00029	0.00025 –	0.00025 –	0.00072**/ 0.00091	0.00091	0.00091	0.00091
Particle number [1/km]	8.87 E11**/ 9.06 E11	1.6 E11	1.6 E11	1.47 E9**/ 2.49 E10	2.49 E10	2.49 E10	2.49 E10
Fuel consumption NEDC overall [l/100 km]*	5.9**/ 5.9–5.8	6.1–6.0	6.6–6.5	4.5–4.3**/ 4.5–4.4	5.1–4.9	4.6–4.4	5.1–4.9
Driving noise [dB(A)]	72**/ 71	73	73	71**/ 72	72	72	72

NEDC consumption for base variant GLA 200 with manual transmission and standard tyres: 5.9 l/100 km.
* Figures depend on tyres.
** Figures for vehicle with manual transmission.

1.2 Material composition

The weight and material data for the GLA 200 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 1-1 shows the material composition of the GLA 200 according to VDA 231-106.

Steel/ferrous materials account for slightly over half of the vehicle weight (57.5 percent) in the GLA-Class. These are followed by polymer materials at 20.5 percent and light alloys as the third-largest group (9.6 percent). Fuels and lubricants comprise around 4.4 percent. The proportions of non-ferrous metals and of other materials (first and foremost glass) are somewhat lower, at about 3.6 percent and 3.1 percent respectively. The remaining materials – process polymers, electronics, and special metals – contribute about one 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 13.9 percent. Elastomers (predominantly tyres) are the second-largest group of polymers with 4.9 percent.

The service fluids include oils, fuel, coolant, refrigerant, brake fluid and washer fluid. Only circuit boards with components are included in the electronics group. Cables and batteries are categorised according to their material composition.

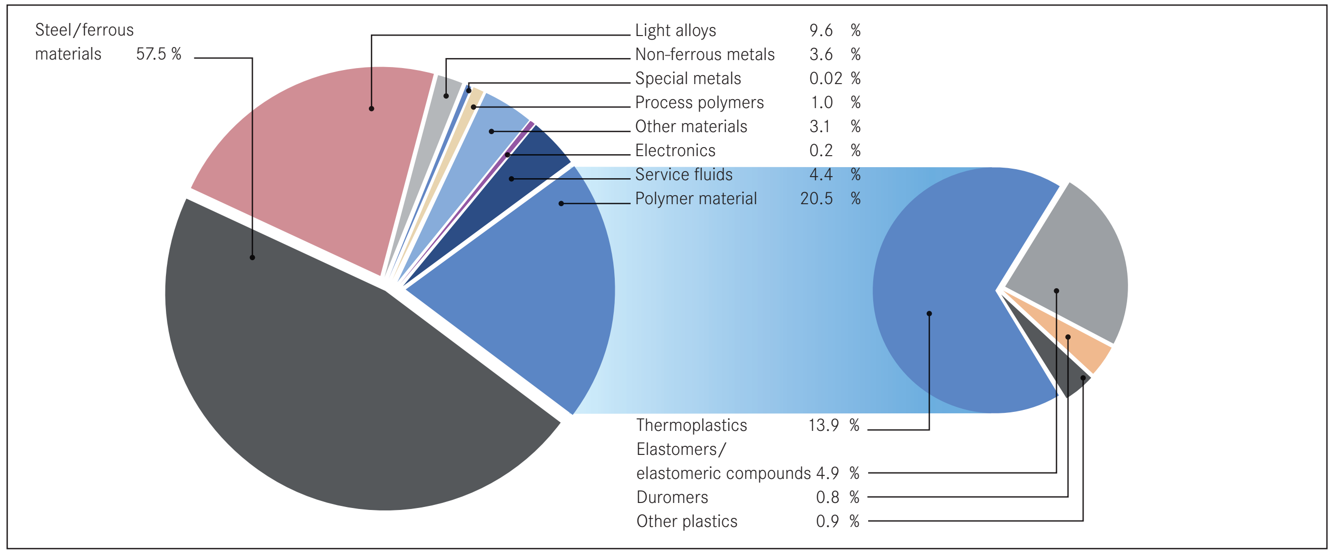


Figure 1-1: GLA 200 material composition

2 Environmental profile

The environmental profile documents general environmental features of the GLA-Class with regard to such matters as fuel consumption and exhaust gas emissions. It also presents specific analyses of environmental performance, such as the Life Cycle Assessment, the recycling concept and the use of secondary and renewable raw materials.

2.1 General environmental issues

The GLA-Class range currently comprises two petrol models with highly precise piezo injection and two diesel variants. In the GLA 200 base variant investigated, the latest-generation 4-cylinder petrol engine (M270) is used. Its consumption in this model is a favourable 5.9 l/100 km.

When it comes to the diesel variants a high level of efficiency is also ensured. The GLA 200 CDI posts fuel consumption of 4.5 – 4.3 l/100 km, which corresponds to CO_2 emissions of 119 resp. 114 g/km. The GLA 220 CDI posts 4.6 – 4.4 l/100 km, also putting it at this very favourable level.

The high efficiency is ensured by an intelligent package of measures. These extend to optimisation measures in the drive system, energy management and aerodynamics, as well as to tyres with optimised rolling resistance, weight reduction through lightweight construction techniques and driver information to encourage an energy-saving driving style.

Modules for excellent environmental performance

- Downsizing strategy for the engines.
- Fuel consumption shown on the display.
- Special “eco driver training” from Mercedes-Benz.
- Certified environmental management system at the Rastatt plant.
- Efficient drive system with start/stop system for all available engines.
- Aerodynamic optimisation.
- Use of renewable raw materials and plastic secondary raw materials.

Figure 2-1: Consumption-reducing measures for the new GLA-Class

The most important measures include:

- For all petrol and diesel drive systems: Friction-optimised engines with turbocharging, direct injection and thermal management; petrol engines with Camtronic (GLA 200).
- Friction-optimised 6-speed manual transmission and 7-speed dual clutch automatic transmission, both featuring high-geared configurations.
- The ECO start/stop system fitted as standard on all available engines.
- The aerodynamic optimisation through optimised diffuser, optimised underbody and rear axle panelling, rear side spoiler and roof spoiler with Cd-optimised seals, radiator shutter and aero wheel trim.
- Use of tyres with optimised rolling resistance.
- Wheel bearings with substantially reduced friction.
- Weight optimisation through the use of lightweight materials.
- Closed-loop fuel and oil pump can adjust the pump output according to the required load.
- The intelligent alternator management in conjunction with an efficient alternator ensures that consumers are powered from the battery during acceleration, while during braking part of the resulting energy is recuperated and fed back into the battery.
- Highly efficient refrigerant compressor with optimised oil management, reduced displacement and magnetic clutch which avoids friction losses.
- Optimised belt drive with decoupler.

Initially the power range of the 1.6 and 2.0-litre petrol engines will extend from 115 kW (156 hp) in the GLA 200 to 155 kW (211 hp) in the GLA 250.

The two diesel engines excel with dynamic torque and outstanding efficiency: The GLA 200 CDI develops 100 kW (136 hp), has a displacement of 2.2 litres and generates a maximum torque of 300 Nm. The GLA 220 CDI also has a displacement of 2.2 litres, and develops 125 kW (170 hp) and 350 Nm.

In addition to the improvements to the vehicle, the driver also has a decisive influence on fuel consumption. For this reason, a display in the middle of the instrument cluster shows the current fuel consumption level. This easy-to-read bar indicator reacts spontaneously as soon as the driver takes their foot off the accelerator and uses the engine‘s overrun cut-off, for example. The GLA-Class 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 show that adopting an efficient and energy-conscious style of driving can help to reduce the fuel consumption of a car by up to 15 percent.

The GLA-Class is also fit for the future when it comes to its fuels. The EU‘s plans make provision for an increasing proportion of biofuels to be used. It goes without saying that the GLA-Class will meet these requirements: in the case of petrol engines, a bioethanol content of 10% (E 10) is permitted. A 10% biofuel component is also permitted for diesel engines in the form of 7% biodiesel (B 7 FAME) and 3% high-quality, hydrogenated vegetable oil.

High efficiency is achieved in terms of exhaust gas emissions, too. All new engines already meet the requirements of the Euro 6 emissions standard which comes into force in 2015. The petrol engines even undercut the much more stringent diesel particulate limit in the Euro 6 standard with no additional exhaust aftertreatment. The GLA 220 CDI is equipped with a multi-path exhaust gas recirculation system which reduces nitrogen oxide emission levels.

The GLA-Class is manufactured at the Mercedes-Benz plant in Rastatt. For many years this production facility has had an environmental management system certified to EU eco-audit regulations and ISO Standard 14001. The paint technology used for the GLA-Class, for example, is not only state of the art but also stands out by virtue of its high levels of environmental friendliness, efficiency and quality, which are achieved thanks to consistent use of water-based paints with solvent levels of less than 10 percent. This painting process enables a low input of solvents, while electrostatic application reduces the amount of paint used by 20 percent.

Substantial successes have also been achieved in Rastatt in the area of energy saving. The in-house combined heat and

The new bodyshell shop at the Rastatt plant is equipped with a geothermal plant which takes care of the heating in winter and cooling in summer and of the cooling of the welding line. For this purpose groundwater is sourced from five extraction wells and fed back via six infiltration wells..

power plant (CHP) generates electricity and heating energy from clean natural gas at a high level of efficiency. Equally significant are what are known as the heat wheels. Such rotary heat exchangers are deployed wherever large volumes of air are exchanged – in ventilating the production shops and the painting booths, for example. Heat wheels make use of the heat recuperation potential of air extracted from the production area and generated by the processes. The effect: as an annual average more than a third of the heating energy is saved. The latent heat of condensation from the heating furnaces‘ flue gases is also used. Additional reductions in CO_2 emissions are achieved through the use of a solar system to heat service water. A geothermal plant has been installed for the new body-in-white shop for the purposes of heating in the

winter and cooling in the summer and to cool the welding equipment. For this purpose groundwater is sourced from five extraction wells and fed back via six infiltration wells. No fossil fuels are required. Through all the energy saving measures together approximately 14,300 tonnes of CO_2 emissions are avoided annually. An environmental information circuit has been set up at the Rastatt plant to provide visitors and employees with an insight into daily environmental protection practice. The individual environmental protection measures in the production process and around the plant are explained here directly on site.
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.

The take-back system introduced in 1993 also means that Mercedes-Benz is a model for the automotive industry where workshop waste disposal and recycling are concerned. 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 recycled via a network operating throughout Germany. Classic components include bumpers, side panels, electronic scrap, glass and tyres. The reuse of 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 a new, innovative procedure for the rapid disposal of vehicles in an environmentally friendly manner and free of charge. For convenient disposal, a comprehensive network of collection points and dismantling facilities is available to Mercedes customers.

Owners of used cars can find out free of charge all the important details relating to the return of their vehicles via the phone number 00800 1 777 7777.

2.2 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 life cycle (cf. Figure 2-2).

The standardised tool for evaluating a vehicle‘s environmental compatibility is the Life Cycle Assessment. 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.

Down to the smallest detail

- With the Life Cycle Assessment, Mercedes-Benz registers all the effects of a vehicle on the environment – from development via production and operation through to disposal.
- For a comprehensive assessment, all environmental inputs are accounted for within each phase of the life cycle.
- Many emissions arise not so much during driving, but in the course of fuel production – for example non-methane hydrocarbon (NMVOC)* and sulphur dioxide emissions.
- The detailed analyses also include the consumption and processing of bauxite (aluminium production), iron and copper ore.

* NMVOC (non-methane volatile organic compounds)

In the development of Mercedes-Benz passenger cars, Life Cycle Assessments are used in 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.

Figure 2-2: Overview of the Life Cycle Assessment

2.2.1 Data basis

The ECE base variant is analysed in the Life Cycle Assessment. The GLA 200 with manual transmission (115 kW) served as the base variant for the new GLA-Class. The main parameters of the LCA are shown in the table below.

Project objective	
Project objective	• LCA over the life cycle of the new GLA-Class as the ECE base variant with GLA 200 engine. • Verification of attainment of the objective "environmental compatibility" and communication.
Project scope	
Functional equivalent	• GLA-Class passenger car (base variant; weight in acc. with DIN 70020)
System boundaries	• Life Cycle Assessment for car production, use and recycling. The scope of assessment is only to be extended in the case of elementary flows (resources, emissions, non-recyclable materials).
Data basis	• Weight data of car: MB parts list (date of revision: 09/2013). • 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 (also see Chapter 2.3.1) • Material production, energy supply, manufacturing processes and transport: GaBi database as at SP22 (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.

Table 2-1: LCA basic conditions

The fuel has a sulphur content taken to be 10 ppm. Combustion of one kilogram of fuel thus yields 0.02 grams of sulphur dioxide emissions. The use phase is calculated on the basis of a distance covered of 160,000 kilometres.

The LCA includes the environmental impact of the recovery phase on the basis of the standard processes of the removal of service fluids, shredding, and recovery of energy from the light shredder fraction (LSF). Environmental credits are not granted.

Project scope	(continued)
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 life cycle 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 model. • Vehicle maintenance and care are not relevant to the comparison.
Assessment	• Life cycle, in conformity with ISO 14040 and 14044 (LCA).
Analysis parameters	• Material composition according to VDA 231-106 • Life cycle 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 useful results. • Interpretation: sensitivity analyses of car module structure; dominance analysis over life cycle
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 6 (http://www.pe-international.com/gabi).
Evaluation	• Analysis of life cycle results according to phases (dominance). The manufacturing phase is evaluated based on the underlying car module structure. Contributions of relevance to the results will be discussed.
Documentation	• Final report with all basic conditions

2.2.2 LCA results for the GLA 200

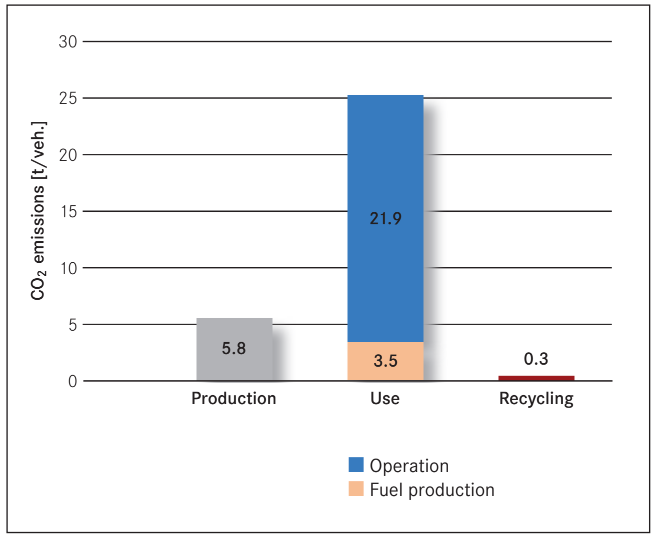


Figure 2-3: Overall carbon dioxide (CO_2) emissions in tonnes

Over the entire life cycle of the GLA 200, the life cycle inventory analysis yields for example a primary energy demand of 470 gigajoules (corresponding to the energy content of around 14,600 litres of petrol), an environmental input of approx. 32 tonnes of carbon dioxide (CO_2), around 13 kilograms of non-methane volatile organic compounds (NMVOC), around 21 kilograms of nitrogen oxides (NO_X) and 29 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 life cycle is investigated.

The relevance of the respective life cycle phases depends on the particular environmental impact under consideration. For CO_2 emissions, and likewise for primary energy demand, the use phase dominates with a share of 81 and 78 percent respectively (see Figure 2-3/2-4). 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 and NO_X emissions (see Figure 2-4). The production phase must therefore be included in the analysis of ecological compatibility.

During vehicle use today a large number of emissions arise less through driving itself than through fuel production, as for example in the case of the NO_X and SO_2 emissions and the environmental effects closely associated with them such as the eutrophication potential (EP) and acidification potential (AP).

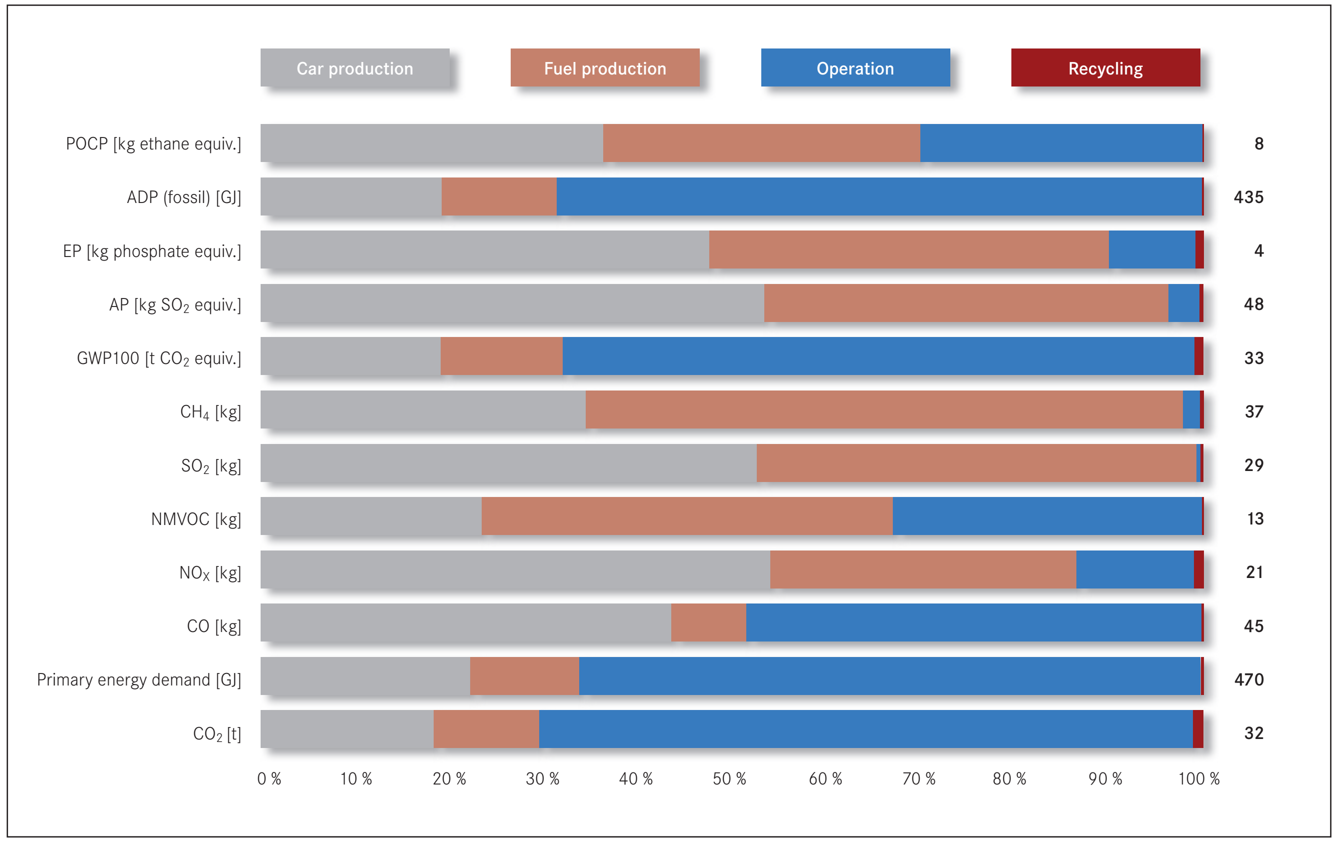


Figure 2-4: Share of life cycle phases for selected parameters

For a comprehensive and therefore sustainable improvement of the environmental effects associated with a vehicle the end-of-life phase must also be taken into account. In terms of energy, the use or initiation of recycling cycles is worthwhile. For a complete assessment, all environmental inputs within each life cycle phase are taken into consideration.

In addition to the results presented above it has also been determined, for example, that municipal waste and tailings (first and foremost ore processing residues and overburden) arise primarily from the production phase, while special and hazardous waste is caused for the most part by fuel production during the use phase.

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 to organic substances, measured through the factors AOX, BOD and COD.

To enable an assessment of the relevance of the respective environmental impacts, the impact categories fossil abiotic depletion potential (ADP), eutrophication potential (EP), photochemical ozone creation potential (summer smog, POCP), global warming potential (GWP) and acidification potential (AP) are presented in normalised form for the life cycle of the GLA 200.

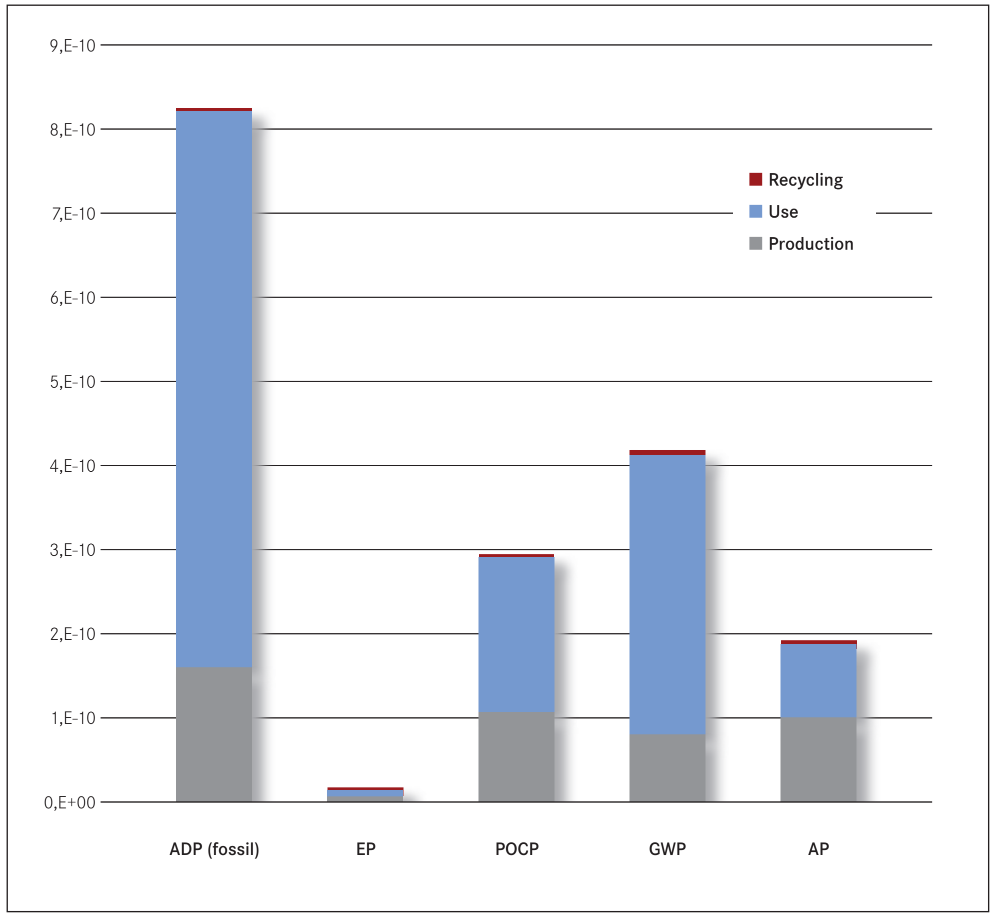


Figure 2-5: Normalised life cycle [–/passenger car]

Normalisation involves assessing the LCA results in relation to a higher-level reference system in order to obtain a better understanding of the significance of each indicator value. Europe served as the reference system here. The total annual values for Europe (EU 25+3) were employed for the purposes of normalisation, breaking down the life cycle of the GLA 200 over one year. In relation to the annual European values, the GLA 200 reveals the greatest proportion for fossil ADP, followed by GWP (cf. Figure 2-5). The relevance of these two impact categories on the basis of EU 25+3 is therefore greater than that of the remaining impact categories examined. The proportion is the lowest in eutrophication.

In addition to the analysis of overall results, the distribution of selected environmental impacts on the production of individual modules is investigated. Figure 2-6 shows by way of example the percentage distribution of carbon dioxide and sulphur dioxide emissions for different modules.

While bodyshell manufacturing features predominantly in terms of carbon dioxide emissions, due to the mass share, when it comes to sulphur dioxide it is modules with precious and non-ferrous metals and glass that are of greater relevance, since these give rise to high emissions of sulphur dioxide in material production.

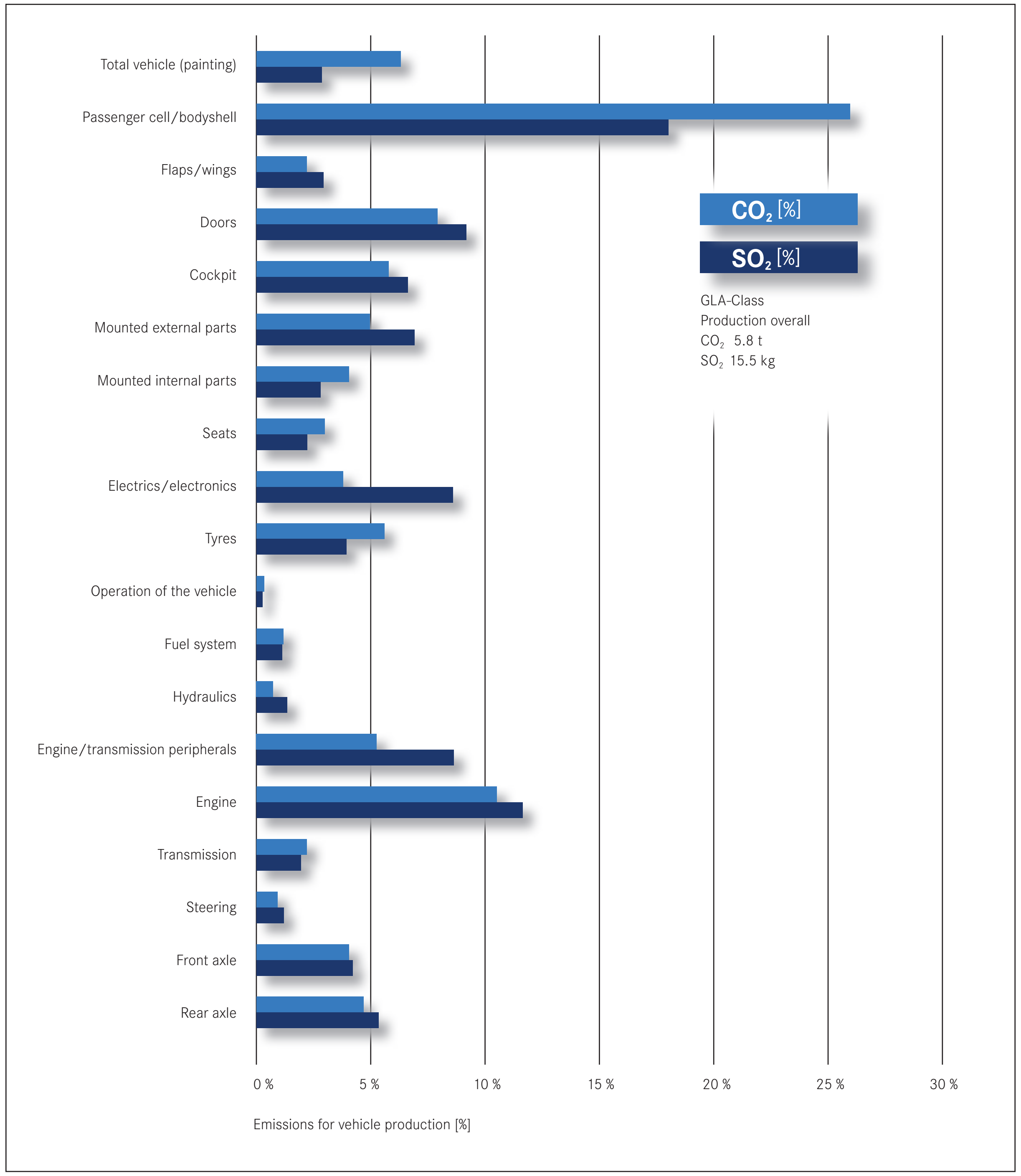


Figure 2-6: Distribution of selected parameters (CO_2 and SO_2) to modules

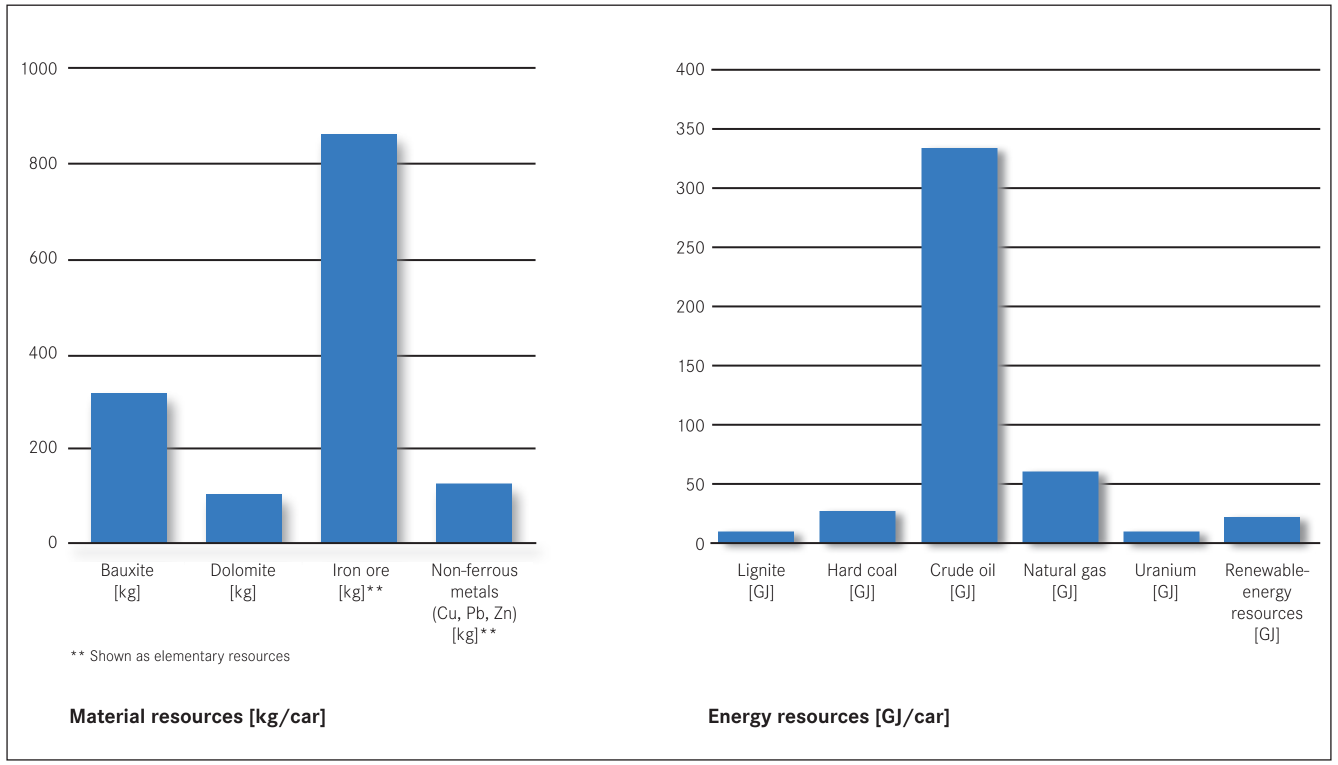


Figure 2-7: Consumption of selected material and energy resources [unit/car]

Figure 2-7 shows the consumption of relevant material and energy resources. When it comes to the demand for material resources, such as iron ore and bauxite, car production dominates. However, energy resources (particularly crude oil) are consumed predominantly in the use phase.

Tables 2-2 and 2-3 present an overview of further LCA parameters. The lines with grey shading indicate superordinate impact categories; they group together emissions with the same effects and quantify their contribution to the respective impacts over a characterisation factor, e.g. contribution to global warming potential in kilograms of CO_2 equivalent.

Input parameters

Resources, ores	GLA-Class	Comment
Bauxite [kg]	313	Aluminium production.
Dolomite [kg]	102	Magnesium production.
Iron [kg]**	862	Steel production.
Precious metal ore/Rare earths ore [kg] **	172	esp. engine/transmission peripherals (catalytic converter charging).
Non-ferrous metals (Cu, Pb, Zn) [kg] **	122	esp. electrics (cable harnesses/battery) and zinc.

Energy carrier	GLA-Class	Comment
ADP fossil* [GJ]	435	esp. fuel consumption.
Primary energy [GJ]	470	approx. 78 % due to use.
Proportionately		
Lignite [GJ]	10	approx. 83 % due to car production.
Natural gas [GJ]	61	approx. 51 % due to use.
Crude oil [GJ]	334	approx. 95 % due to use.
Hard coal [GJ]	29	approx. 94 % due to car production.
Uranium [GJ]	12	approx. 85 % due to car production.
Renewable energy resources [GJ]	23	approx. 44 % due to car production.

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

Output parameters

Emissions to air	GLA-Class	Comment
GWP* [t CO_2 equiv.]	33	esp. due to CO_2 emissions.
AP* [kg SO_2 equiv.]	48	esp. due to SO_2 emissions.
EP* [kg phosphate equiv.]	4	esp. due to NO_x emissions.
POCP* [kg ethene equiv.]	8	esp. due to NMVOC emissions.
CO_2 [t]	32	esp. due to driving operation.
CO [kg]	45	around 56 % due to use, of which approx. 86% driving operation.
NMVOC [kg]	13	around 77 % due to use, of which approx. 43% driving operation.
CH_4 [kg]	37	around 35 % due to car production. The rest is mainly from fuel production. Driving operation accounts for only around 2 %.
NO_X [kg]	21	around 45 % due to car production. The remainder due to car use. Driving operation accounts for only around 13 % of the nitrogen oxide emissions.
SO_2 [kg]	29	approx. 53 % due to car production. The remainder due to fuel provision.

Emissions to water	GLA-Class	Comment
BSB [kg]	0.1	approx. 61 % due to car production.
Hydrocarbons [kg]	0.4	approx. 52 % due to use.
NO_3^- [g]	3548	approx. 91 % due to use.
PO_4^{3-} [g]	70	approx. 70 % due to use.
SO_4^{2-} [kg]	13	approx. 65 % due to production.

* CML 2001, date of revision: November 2010

** as an elementary resource

Table 2-3: Overview of LCA parameters (II)

2.3 Design for recovery

With the adoption of the European ELV Directive (2000/53/EC) on 18 September 2000, 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. This results in the following requirements on the automotive industry:

- 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 by 1 January 2015 at the latest.
- Evidence of compliance with the recycling rate as part of type approval for new passenger cars as of December 2008.
- Take-back of all ELVs free of charge from January 2007
- 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.

The GLA-Class already meets the recoverability rate of 95 percent by weight, effective 01.01.2015.

- End-of-life vehicles have been taken back by Mercedes-Benz free of charge since January 2007.
- Heavy metals such as lead, hexavalent chromium, mercury or cadmium have been eliminated in accordance with the requirements of the ELV Directive.
- Mercedes-Benz already currently has a highly efficient take-back and recycling network.
- By reselling certified used parts, the Mercedes Used Parts Center makes an important contribution to the recycling concept.
- As early as the development phase of the GLA-Class, attention was paid to separation and ease of dismantling of relevant thermoplastic components.
- Detailed dismantling information is available to all ELV recyclers in electronic form via the "International Dismantling Information System" (IDIS).

2.3.1 GLA-Class recycling concept

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. Pre-treatment (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 GLA-Class 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. Overall, with the process chain described below, a 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 new GLA-Class as part of the vehicle type approval process (see Figure 2-8).

At the ELV recycler‘s premises, the fluids, battery, oil filter, tyres, and catalytic converters are removed as part of the pre-treatment process. The airbags are triggered with a device that is standardised among 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 GLA-Class, these components were specifically prepared for subsequent recycling. In addition to material purity, 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.

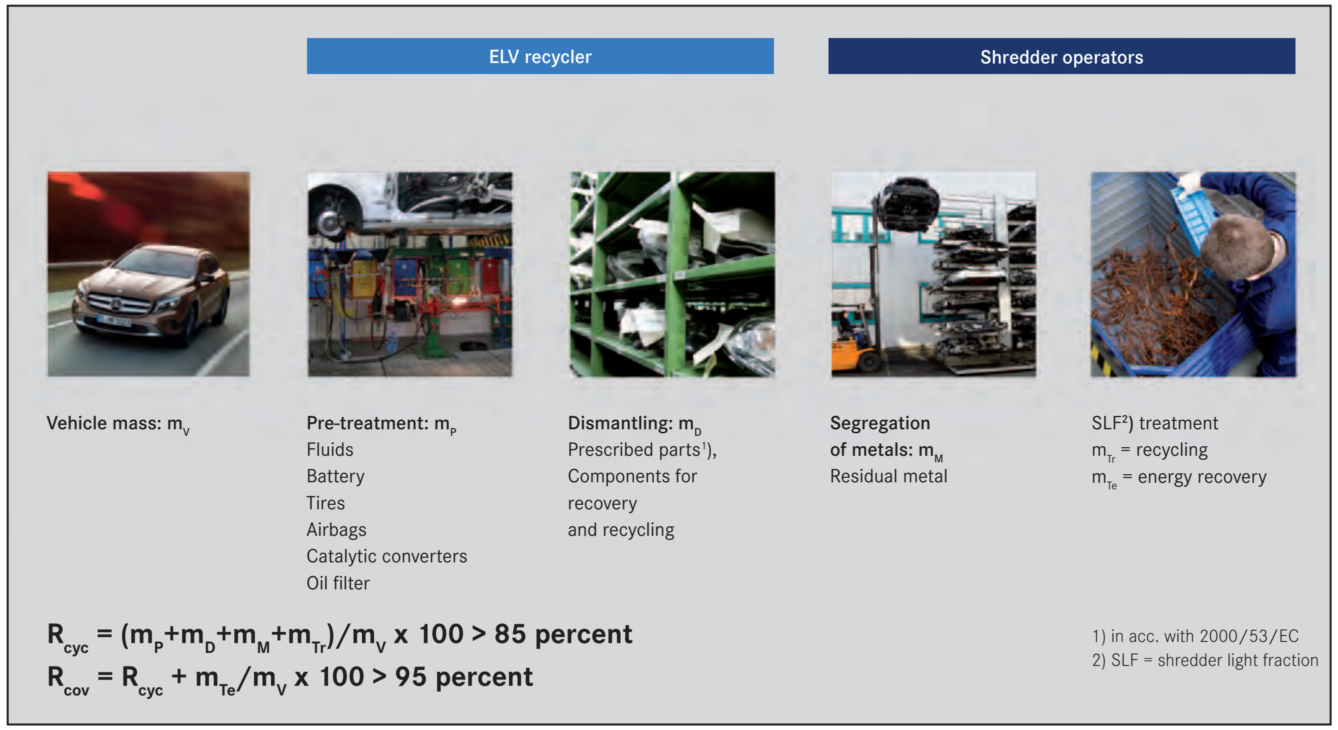


Figure 2-8: Material flows in the GLA-Class recycling concept

2.3.2 Dismantling information

Dismantling information plays an important role for
ELV recyclers when it comes to implementing the recycling concept.

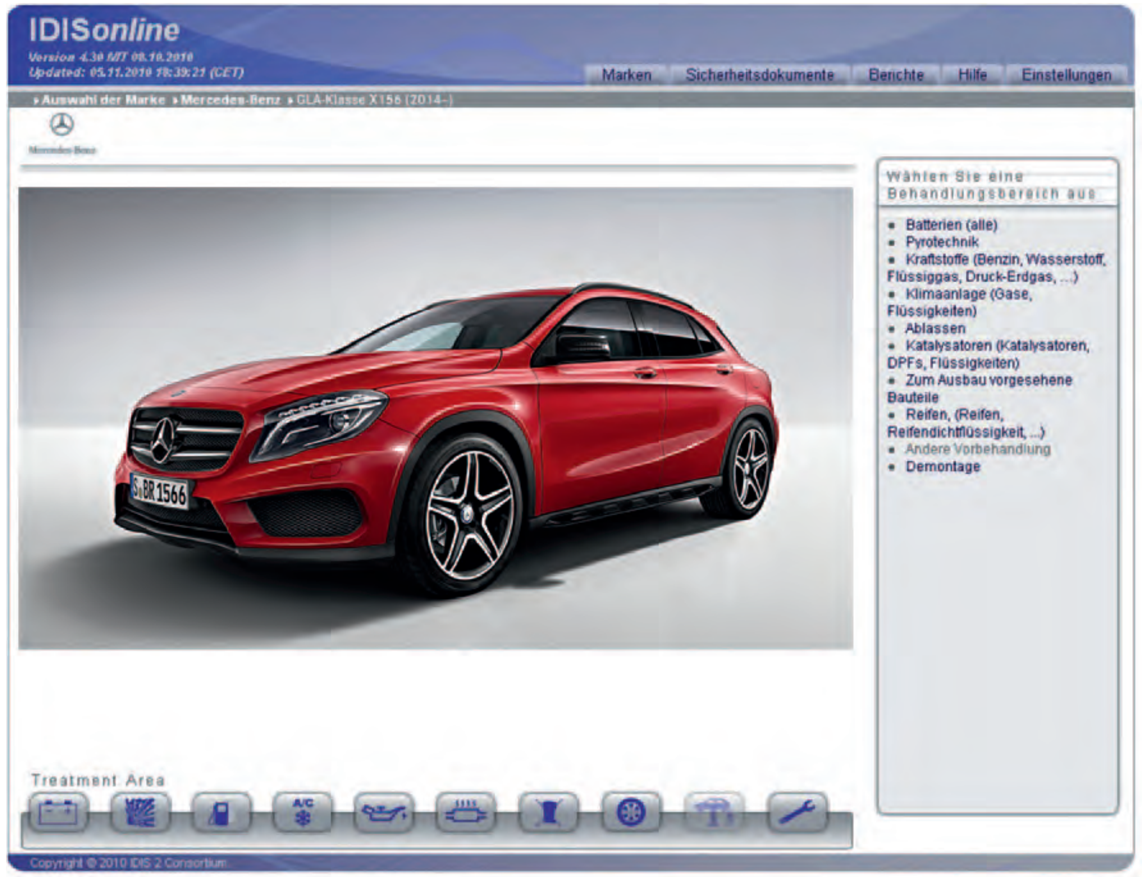


Figure 2-9: Screenshot of the IDIS software

For the GLA-Class 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 pre-treatment and recycling techniques at the end of their operating lives.

The system presents model-specific data both graphically and in text form. In pre-treatment, specific information is provided on service fluids and pyrotechnic components. In the other areas, material-specific information is provided for the identification of non-metallic components.

The current version (November 2013) covers 1847 different models and variants from 71 car brands. The IDIS data are made available to ELV recyclers and incorporated into the software six months after the respective market launch.

2.3.3 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.

The continual reduction of interior emissions is a key aspect of the development of components and materials for 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 our internal standard (DBL 8585) since 1996. 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.

The heavy metals lead, cadmium, mercury, and hexavalent chromium, which are prohibited by the ELV Directive of the EU, are also included here. To ensure compliance with the ban on heavy metals in accordance with the legal requirements, Mercedes-Benz has modified and adapted numerous processes and requirements both internally and with suppliers. For example, lead-free elastomers are used in the drive system, along with lead-free pyrotechnic initiators, cadmium-free thick film pastes, and surfaces free of hexavalent chromium in the interior, exterior, and assemblies.

Materials used for components in the passenger compartment and boot are also subject to emission limits that are likewise laid down in the DBL 8585 standard as well as in delivery conditions for the various components. The continual reduction of interior emissions is a key aspect of the development of components and materials for Mercedes-Benz vehicles.

2.4 Use of secondary raw materials

In the GLA-Class, 41 components with an overall weight of 35.9 kilograms can be manufactured party from high-quality recycled plastics.

- These include wheel arch linings and underbody panelling.
- Wherever possible, secondary raw materials are derived from vehicle-related waste streams; The wheel arch linings are made out of reprocessed starter batteries and bumper coverings.

Component weight	GLA-Class
in kg	35.9

In addition to the requirements for attainment of recycling rates, manufacturers are obliged by Article 4, Paragraph 1 (c) of the European ELV Directive 2000/53/EC to make increased use of recycled materials in vehicle production and thereby to establish or extend the markets for recycled materials. To comply with these stipulations, the specifications books for new Mercedes models prescribe continuous increases in the share of the secondary raw materials used in car models.

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. Accordingly, details of the use of secondary raw materials in passenger cars are only documented for thermoplastic components, as only this aspect can be influenced during development.

The quality and functionality requirements placed on a component must be met both with secondary raw materials and with comparable new materials. 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.

Figure 2-10: Use of secondary raw materials in the new GLA-Class

In the new GLA-Class, 41 components with an overall weight of 35.9 kilograms can be manufactured partly from high-quality recycled plastics. Typical areas of use are wheel arch linings and underbody panels, which consist for the most part of polypropylene. Figure 2-10 shows the components for which the use of secondary raw materials is approved.

A further objective is to obtain secondary raw materials wherever possible from vehicle-related waste flows, so as to achieve closed cycles. To this end, established processes are applied for the GLA-Class: a secondary raw material comprised of reprocessed starter batteries and bumper panelling is used for the wheel arch linings, for example.

Use of secondary raw materials, taking the wheel arch lining as an example (as here in the current B-Class)

2.5 Use of renewable raw materials

Component weight	GLA-Class
in kg	21.0

In automotive production, the use of renewable raw materials is concentrated primarily in the vehicle interior. Established natural materials such as coconut, cellulose and wood fibres, wool and natural rubber are also employed, of course, in series production of the GLA-Class. The use of these natural materials gives rise to a whole range of advantages in automotive production:

- Compared with glass fibres, the use of natural fibres usually results in 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.

The types of renewable raw materials and their applications are listed in Table 2-4. All in all 46 components in the new GLA-Class with a total weight of 21 kilograms are made using natural materials. Figure 2-11 shows the components in the new GLA-Class which are produced using renewable raw materials.

Raw material	Use
Cotton, wool	Insulating materials
Biopolyamide	Engine cover (M270 petrol engine)
Wood	Activated charcoal filter
Coconut fibres, wool	Padding for driver's and front passenger's backrest
Natural rubber	Vibration dampers and bearing parts
Paper (cellulose)	Parcel shelf
Wool	Textiles for upholstery fabrics

Table 2-4 : Application fields for renewable raw materials

For the production of the parcel shelf for the GLA-Class, Mercedes-Benz developed a new process which can be used to build up a composite material around a honeycomb core made of recycled paper. The eight layers of the composite material are joined, formed, laminated and cut to size in a single step. The uniting of these process steps in one overall procedure, together with the use of recycled paper in the paper honeycomb core, reduces the CO_2 emissions during manufacture of a component by 60% compared with the previous process.

Figure 2-11: Components in the new GLA-Class which are produced using renewable raw materials.

Figure 2-12 (bottom):
This honeycomb structure comprised of recycled paper forms the core of the composite component.

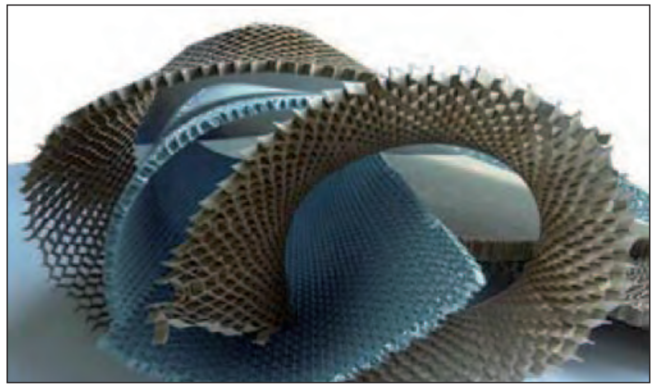
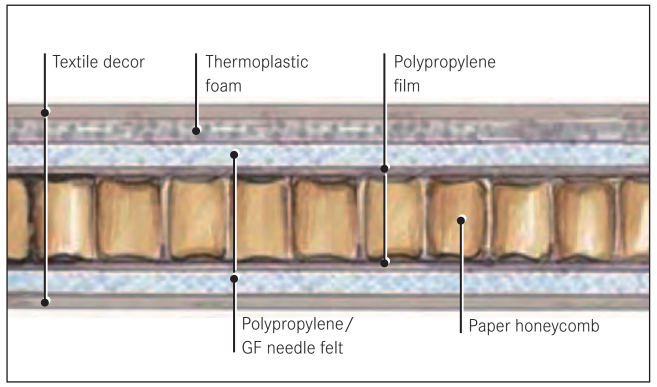


Figure 2-13 (bottom):
Composition of the sandwich structure.



At the same time the parcel shelf of the GLA has only around half the weight of a comparable conventional component. This extreme lightweight design lowers the CO_2 emissions during the use of the vehicle. Over the life cycle of a parcel shelf this results in CO_2 savings of around 13 kg. A total of four patents have been applied for the innovative production process of this component, which underlines the exceptional nature of the development work undertaken here.

The work put in was recognised in the form of the 2012 MATERIALICA AWARD "Best of CO_2".

This component project is also among the winners of the "Environmental Leadership Award", with which Daimler honours outstanding environmental projects in the Group every year.

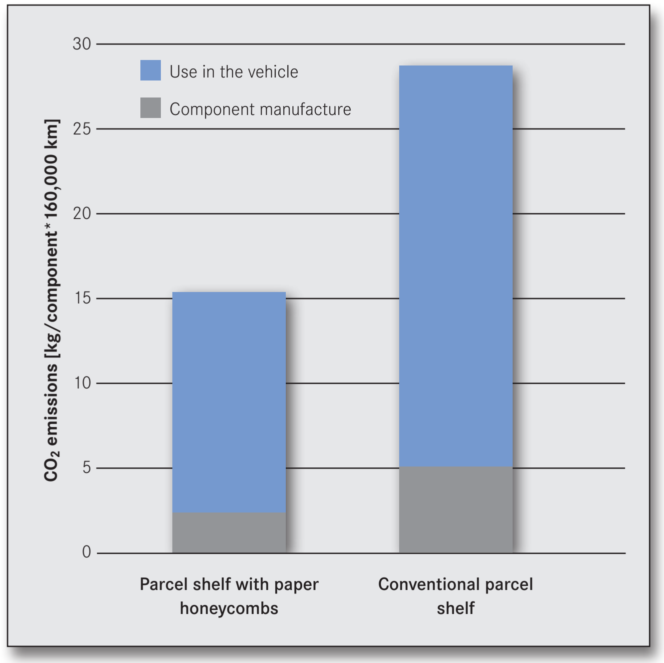


Figure 2-14: Carbon dioxide emissions for the manufacture and use of a GLA parcel shelf (paper honeycomb core compared with the conventional structure).

3 Process documentation

Reducing the environmental impact of a vehicle's emissions and resource consumption throughout its life cycle 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 sustainable product development ("Design for Environment") is integrated into the development process, the greater the benefits in terms of minimised 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 acceptable product development. Comprehensive vehicle concepts are devised in accordance with the "Design for Environment" (DfE) principle. 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 GLA-Class. Under the overall level of project management, employees are appointed with responsibility for development, production, purchasing, sales, and further fields of activity. There are development teams according to the most important assemblies and functions of a car (for example bodyshell, drive system, interior equipment and appointments etc.).

Focus on "Design for Environment"

- In the case of the GLA-Class, sustainable product-development ("Design for Environment, DfE") was integrated into the development process right from the outset. This minimises environmental burden and costs.
- During development, a "DfE" team ensures compliance with the secured environmental objectives.
- The "DfE" team comprises specialists from a wide range of fields, for example from LCA, dismantling and recycling planning, materials and process engineering, and design and production.
- The integration of the "DfE" team into the development project ensured that environmental aspects were taken into account at all stages of development.

During development, a “DfE” team ensures compliance with the secured environmental objectives.

One such cross-functional group is known as the DfE team. It consists of experts from the fields of LCA, dismantling and recycling planning, materials and process engineering, and design and production. Members of the DfE team are also incorporated 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.

The integration of Design for Environment into the operational structure of the development project for the GLA-Class ensured that environmental aspects were not sought only at the time of launch, but were included in 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 GLA-Class 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 already meets the requirements of the new 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 GmbH) in 2012.

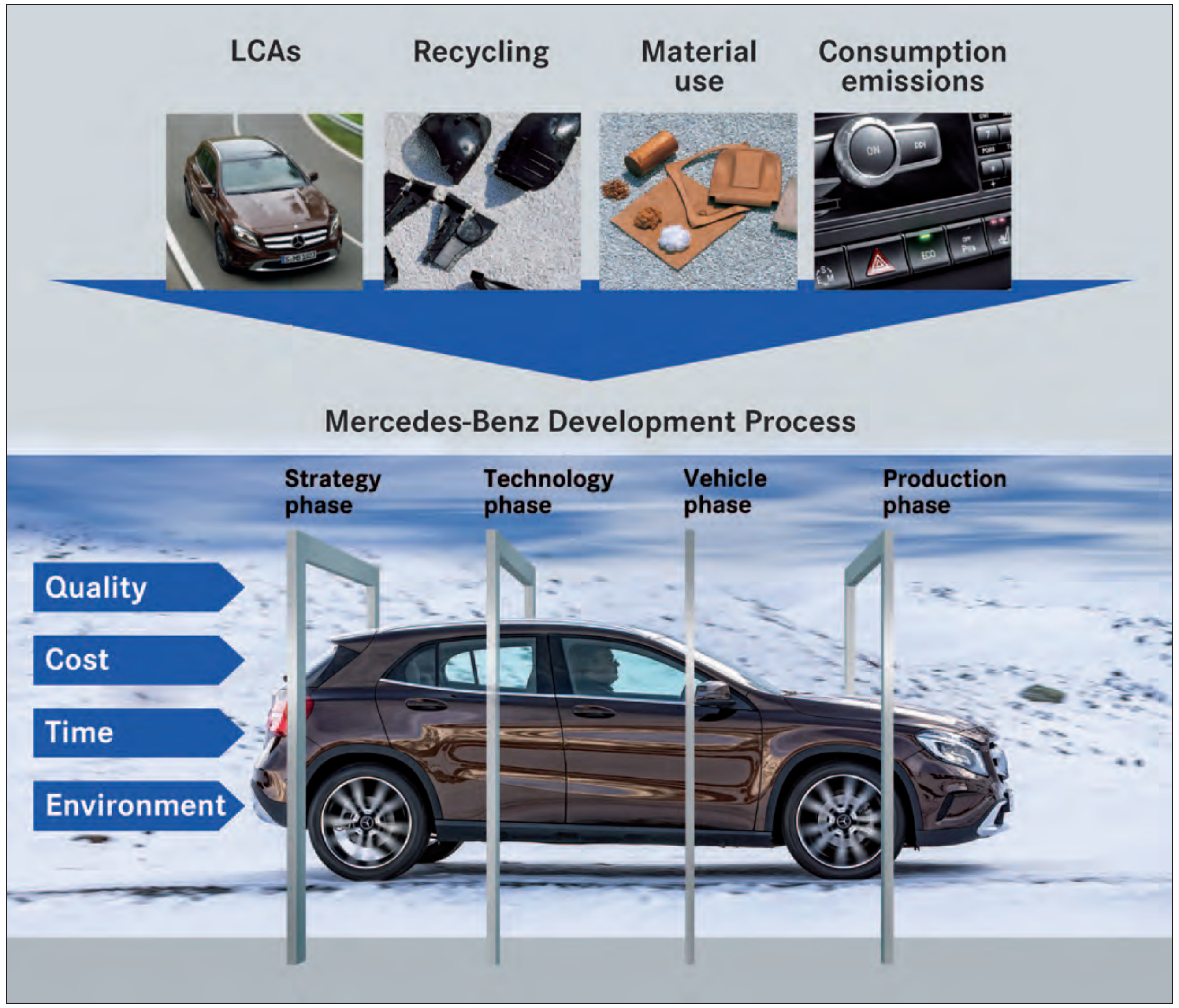


Figure 3-1: “Design for Environment” activities at Mercedes-Benz

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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
Group Research & Mercedes-Benz Cars Development
D-71059 Sindelfingen

for the scope

Development of Passenger Vehicles

has implemented and applies an Environmental Management System with particular focus on ecodesign.

Evidence of compliance to

ISO 14001:2004
with ISO 14006:2011 and ISO/TR 14062:2002

was provided in an audit, report No. **70014947,** demonstrating that the entire product life cycle is considered in a multidisciplinary approach when integrating environmental aspects in product design and development.

Results are verified by means of Life Cycle Assessments.

The certificate is valid until **2015-12-06,** Registration-No. **12 770 13407 TMS**

with reference to the certificate ISO 14001:2004 of Daimler AG, Mercedes-Benz Werk Sindelfingen (Registration-No. **12 104 13407 TMS).**

Munich, 2012-12-07

TÜV SÜD Management Service GmbH • Zertifizierungsstelle • Ridlerstraße 65 • 80339 München • Germany

5 Conclusion

The new Mercedes-Benz GLA-Class not only meets the highest demands in terms of safety, comfort, agility, and design, but also fulfils all current requirements regarding environmental compatibility.

Mercedes-Benz is the world's first automotive manufacturer to have held Environmental Certificates in accordance with the ISO TR 14062 standard since 2005. Over and above this, since 2012 the requirements of the new ISO 14006 standard relating to the integration of environmentally acceptable product development into the higher-level environmental and quality management systems have been met, as also confirmed by TÜV SÜD Management GmbH.

The Environmental Certificate documents the results for evaluating the environmental compatibility of the new GLA-Class. Both the process of environmentally compatible product development and the product information contained herein have been certified by independent experts in accordance with internationally recognised standards. Mercedes-Benz GLA-Class customers benefit from low fuel consumption, low emissions and a comprehensive recycling concept, among other things. Furthermore, a high percentage of the materials used are high-quality recycled materials and renewable raw materials. The GLA-Class therefore boasts an exemplary Life Cycle Assessment.

6 Glossary

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 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 (such as global warming, acidification, etc.) are grouped together.
ISO	International Organisation for Standardisation
KBA	German Federal Motor Transport Authority
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; 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, underbody protection.
SLF	Shredder light fraction; non-metallic residual substances occurring following crushing and through a separation and purification procedure during vehicle recycling.

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to the Mercedes-Benz international model range.
Differences relating to standard and optional equipment, engine options,
technical specifications and performance data are possible in other countries.

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